REPORT

PFAS Tyrifjorden 2018

ENVIRONMENTAL MONITORING OF PFAS IN BIOTIC AND ABIOTIC MEDIA

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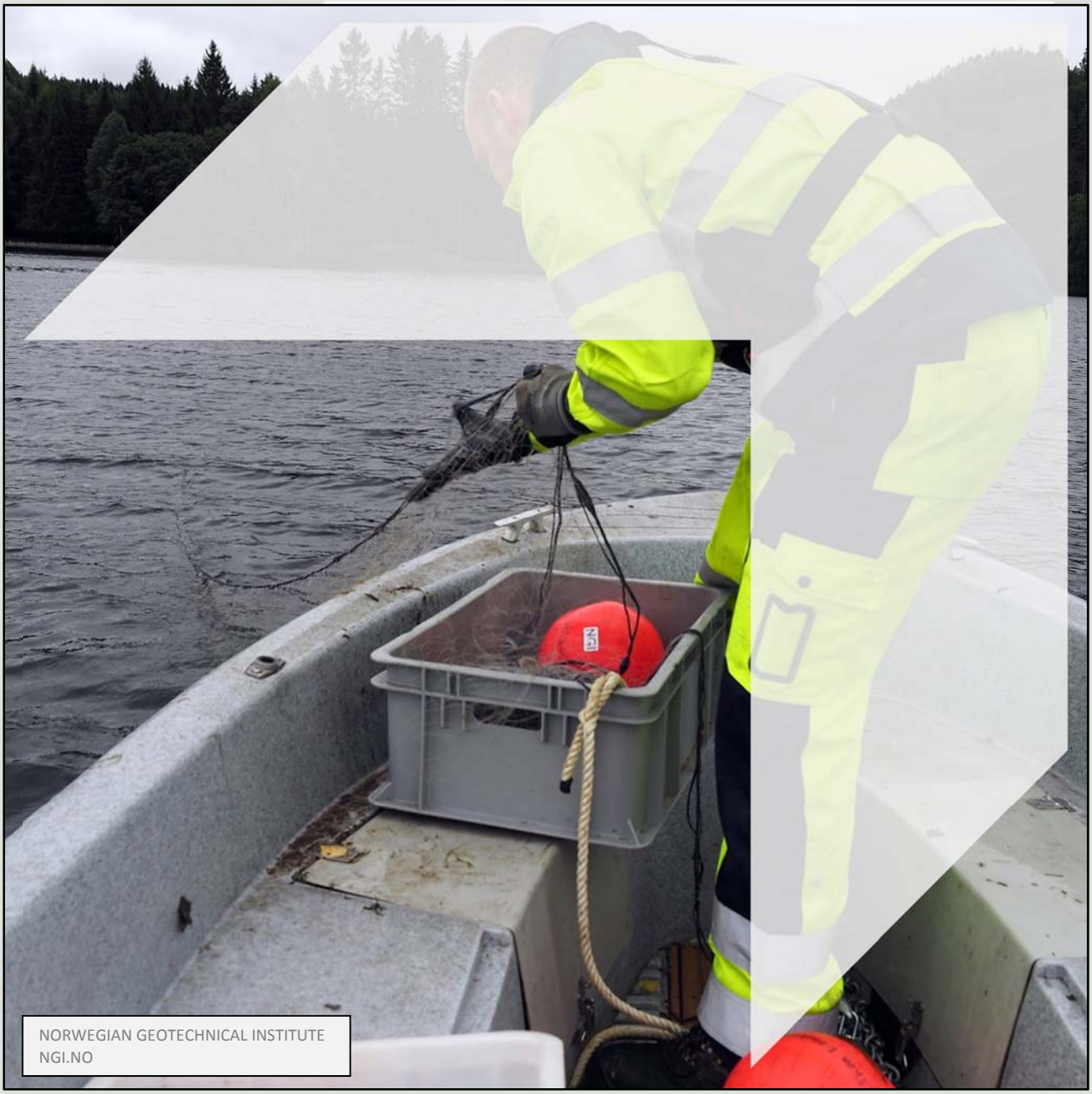

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Abstract

The Norwegian Geotechnical Institute (NGI) and the Norwegian Institute for Water Research (NIVA) have conducted an environmental survey of per- and polyfluoroalkyl substances (PFAS) contamination in water, sediment and biota in the Tyrifjorden lake and its receiving rivers, on behalf of the Norwegian Environment Agency. The survey is a follow up of a source tracking investigation for perfluorooctane sulfonic acid (PFOS) in the Tyrifjorden lake, performed in 2017, which identified possible sources of PFAS contamination to the Tyrifjorden area. The investigation identified two major sources of PFAS contamination and high concentrations in sediments and liver from perch *(Perca fluviatilis)* were detected. A follow up survey was recommended and this is reported here.

PFAS are a group of anthropogenic chemicals that have been widely used by industry and in consumer products since the 1950s. The chemicals are amphiphilic (i.e. have both hydrophobic and hydrophilic moieties) and are used in products that need reduced surface tension, low surface energy or water and oil repellent properties, i.e. aqueous film forming foam (AFFF), food packaging, outdoor clothing and pan coatings. Due to the diverse use of these chemicals, the sources of emissions are numerous. Since PFAS are persistent under natural conditions, a targeted effort is necessary to remove these substances from the environment. Their stability, toxicity and potential for bioaccumulation and biomagnification, render them a cause of concern.

53 different non-polymer PFAS were analysed in this investigation. Non-polymer PFAS can be divided into sub-groups based on the common molecular structure within each group. PFAS from four different sub-groups were detected in the samples:

- Perfluoroalkyl carboxylic acids (PFCA): substances with a fully fluorinated carbon backbone of varying length and a carboxylic acid (-COOH) "tail"
- Perfluoroalkyl sulfonic acids (PFSA): substances with a fully fluorinated carbon backbone of varying length and a sulfonic acid ($-SO_2H$) "tail"
- Perfluorooctane sulfonamido substances (preFOS): substances that are known precursors to PFOS and will be referred to as "preFOS" herein
- Fluorotelomer sulfonic acids (FTSA): polyfluorinated substances with a carbon backbone of varying length and a sulfonic acid ($-SO_2H$) "tail"

Concentrations detected in the water phase were compared to Environmental Quality Standards (EQS). These EQS values are given in the Water Framework Directive (EU Directive 2000/60/EC) and are implemented in Norway through the Vannforskrift. EQS values are hazard based determined using available toxicological data and represent a threshold below which adverse effects are not expected. The concentration of PFOS in the water from Tyrifjord did not exceed the Annual Average Environmental Quality Standard (AA-EQS value) of 0.65 ng/L. No other PFAS were detected in the free phase water in Tyrifjorden.

The concentrations of PFAS detected in the Tyrifjorden sediments are high and the highest concentrations were found in the area at the outlet from the Storelva river and in the deeper sedimentation areas downstream this area (areas called Nordfjorden and Storfjorden). The concentrations of long chain FTSA (particularly 10:2 and 12:2 FTS) are especially high and dominate the PFAS distribution in the sediment samples. In addition, PFOS precursors (preFOS) were found in high concentrations. Sediment pore water concentrations are also high, particularly in the samples from the delta outside Storelva. For these samples, the more mobile PFCA dominate the PFAS distribution.

A sediment core sample taken from Nordfjorden was dated and the same samples were analysed for PFAS. The dating information shows that the emission of preFOS were highest in the mid-1980s and then steadily declined. FTSAs subsequently became the dominate PFAS group, their concentration peaking in 2006, and declining thereafter. The dating information for preFOS is concurrent with the widespread use of perfluorooctanesulfonyl fluoride (POSF) based chemicals before their phase-out in 2002. The decline of FTSAs concentration is correlated with the closure of a paper factory at Viul in 2013. The top of the core from 2017, shows lower concentrations of PFAS. This correlates with the PFAS concentrations found in the sediment traps deployed in Tyrifjorde and shows that there is less PFAS in the material that settles today. The sediment traps indicate that contaminated particulate material from Storelva has the potential to spread throughout the Tyrifjorden system, as the PFAS distribution was similar in the trap outside the Storelva outlet and the trap placed in the bay towards Vikersund. Estimates based on detected concentrations show a yearly sedimentation of just over 1.5 kg PFAS in Tyrifjorden. At the river delta outside Storelva, about 50 % of the deposited PFAS is FTSA, while for Tyrifjorden as a whole, 40 % of the deposited PFAS is PFCA.

Biota samples of perch *(Perca fluviatilis)*, pike *(Esox lucius)*, whitefish *(Coregonus lavaretus)*, roach *(Rutilus rutilus)*, bream *(Abramis brama)*, brown trout *(Salmo trutta)* arctic char *(Salvelinus alpinus)*), crayfish *(Astacus astacus)*, zooplankton and benthic organisms were analysed for PFAS. In general, the highest concentrations were detected in perch liver. Except for one individual of perch from Storøya, the highest concentrations of PFAS (Σ_{53} PFAS) in biota was found in perch caught outside the former paper industry site at Viul. In biota from the other areas, the detected concentrations of PFAS are comparable. The biota generally contain large proportions of PFOS, with concentrations exceeding EQS_{biota} in 23 of 63 fish muscle samples, 70 of 72 fish liver samples and in both zooplankton samples. Concentrations of PFOS compared to other detected PFAS vary between species probably due to differences in diet and/or differences in the organisms capacity of elimination and biotransformation. Concentrations of PFOA were not detected above the QS_{biota} in any samples.

Currently (E)QS values are currently only stipulated for PFOS and PFOA. However, the combination of high PFOS concentrations with relatively high concentrations of other PFAS may result in an increased risk of adverse effects on the ecosystem, when compared to the effects of PFOS alone.

Based on existing literature PFOS is known to disturb immune systems, development and reproduction (endocrine disruption) of organisms and influence lipid metabolism. Based on the $EQS_{BIOTA, SECPOIS}$ for PFOS, observed biomagnification of PFOS and long chain PFCA, existing literature on oviparous transfer, toxicity, and uncertainties associated with cocktail effects, the levels of PFOS reported here are concluded to pose an unacceptable risk to the local ecosystem. Emissions of PFAS were highest in the mid 1980's and it is likely that concentrations in biota were higher then than they are now. Thus, the combination of higher emission levels and long term exposure of wildlife at higher trophic levels may have increased the likelihood of negative effects especially to highly exposed organisms.

Ratios of stable carbon and nitrogen isotopes, $\delta^{13}C$ and $\delta^{15}N$, were used to calculate relative trophic level and to assess the association with the benthic food web. Trophic magnification is assumed to occur if the calculated trophic magnification factor (TMF) is greater than 1. TMF calculated for long chain PFCA in fish liver (TMF_{liver}) varied between 3.2 and 16.1 depending on the sampled area. For PFOS, TMF_{liver} in the whole lake was 1.9. In crayfish and fish pooled from the whole lake and from Steinsfjorden, TMF_{muscle} was 2.0 and 9.3, respectively.

The results from stabile carbon isotopes ($\delta^{13}C$) indicate that uptake of long chain PFCA, preFOS, and long chain FTSA occurs in the benthic food web. PFOS is relatively water soluble (in contrast to its precursors), thus, PFOS which is "produced" from precursors in sediments will be dissolved in water to a greater extent. The low concentrations of PFAS in lake water combined with the clear relationship with the benthic food web indicate that the lake sediments are a major source of continuous input of PFAS to the lake food web (partly via release from sediments to the water column).

Analysis of branched PFOS (br-PFOS) in pore water and perch liver show that the fraction of linear PFOS decreases significantly with distance from Viul. Biotransformation of preFOS have previously been shown to be faster for branched compared to corresponding linear isomers. Thus, increased concentrations of br-PFOS is expected to be indicative of a major contribution from ongoing degradation of preFOS. However, br-PFOS is also reported to be more water soluble, and to have lower elimination half-life in organisms than the linear isomer. Thus, over time (and further from point-sources) the combination of br-PFOS higher mobility and faster elimination in organisms results in an increased proportion of linear PFOS relative to br-PFOS. The results indicate a higher contribution from ongoing preFOS degradation closer to Viul. The same trend was observed for FTSA compared to Σ_{53} PFAS in perch liver (decreasing proportions with increasing distance from Viul), which might indicate a more complete FTSA degradation further from the source.

Additional sources of PFAS contamination were investigated and only a few were found. A landfill used for paper industry waste from the factory at Viul and the fire station at Hønefoss are relevant to the PFAS loads in Tyrifjorden. For the paper landfill, the contamination profile observed is quite similar to that at the former paper industry site at Viul. Based on low concentrations of long chain FTSA, the fire station was not

concluded to be a major source of the PFAS contamination. The fire station is still a source of PFOS and other PFAS related to firefighting foam, though these are considered minor when assessing the amounts that are released to the environment yearly.

The contribution of the sources found in this study and the survey from 2017 was estimated as yearly PFAS release from each source. There are large uncertainties to these calculations, however they show that the fire station and the paper deposit site contribute 0.55 kg PFAS/yr and 1.6 kg PFAS/yr. to the water phase.

The largest source of PFAS in the Tyrifjorden area is in the sediments, both in Tyrifjorden itself, downstream the former industry site at Viul, and likely in sedimentation areas in the Randselva-Storelva water course. The magnitude of these loads is uncertain. Estimations based on detected concentrations show that 30 kg PFAS could be present in the sediments downstream the factory area, while the total amount in Tyrifjorden is estimated to be 150 kg. Note that the estimation in Tyrifjorden is based on the upper 2 cm of the sediments, while the contamination can be bioavailable down to 10 cm in the sediments.

The former industrial site at Viul is, in this survey, identified as the main source for the high sediment PFAS concentrations seen in Tyrifjorden. The importance of this source is determined by the following factors (elaborated in chapter 8.4):

- The distribution of PFAS in the sediments
- Information from the dated sediment core sample
- Analysis of a disposable paper plate from Viul
- The fingerprint of the PFAS contamination from the unregulated waste paper landfill site
- Higher concentrations of PFAS, but similar profiles, in fish caught directly downstream the factory area compared to fish from the lake
- Investigation of a similar paper production facility at Geithus

The sediments originating from Viul are probably also the main source of the detected PFAS concentrations in the water phase in Tyrifjorden and in the sampled biotic media. Based on all results, an assessment of possible remediation measures for the sediments in the Randselva-Storelva water course and in Tyrifjorden itself should be carried out.

Sammendrag

På vegne av Miljødirektoratet har Norges Geotekniske Institutt (NGI) og Norsk Institutt for Vannforskning (NIVA) gjennomført en miljøundersøkelse av forurensningen av perfluorerte stoffer (PFAS) i vann, sediment og biota fra Tyrifjorden og dens tilførselselver. Undersøkelsen ble gjort som en oppfølging til kildesporingsundersøkelsen gjennomført i 2017, med mål om å finne kilder til perfluoroktylsulfonat (PFOS) i Tyrifjorden-området. Kildesporingen i 2017 avdekket to store og flere mindre kilder til PFAS, og det ble også funnet høye konsentrasjoner i sedimenter i Tyrifjorden og lever fra abbor (*Perca fluviatilis)* fanget i Tyrifjorden. Det ble anbefalt å gjennomføre en grundigere undersøkelse av PFAS blant annet i sedimenter og mer biota fra Tyrifjorden (denne rapporten).

PFAS er en gruppe med antropogene kjemikalier som har blitt brukt i stor skala siden 1950-tallet, både i industrien og i forbrukerartikler. Kjemikaliene er amfifile (de har både en hydrofob og hydrofil del), og er derfor blitt brukt i produkter der det er behov for reduksjon av overflatespenning, lav overflateenergi eller vann- og fettavstøtende egenskaper. Dette gjør at kjemikaliene blir brukt for eksempel i brannskum, matemballasje, ytterbekledning og i belegg i stekepanner. Siden kjemikaliene har et vidt bruksområde, er også kildene til utslipp tallrike. PFAS brytes ikke ned under naturlige forhold, og det er derfor behov for målrettede tiltak for å fjerne kjemikaliene fra naturen. Grunnet kjemikalienes stabilitet, toksisitet og potensiale for bioakkumulering og -magnifisering gir utslipp av disse til naturen grunn til bekymring.

53 ulike PFAS har blitt analysert i denne undersøkelsen, alle er ikke-polymerer. Disse ikke-polymere PFAS kan bli delt inn i undergrupper basert på felles molekylstruktur innad i gruppene. PFAS-forbindelser fra fire ulike undergrupper har blitt detektert i denne undersøkelsen:

- Perfluorerte karboksylsyrer (PFCA): forbindelser med fullstendig fluorerte karbonkjeder (perfluorerte) av ulik lengde, og med hale av karboksylsyre (-COOH)
- Perfluorerte sulfonsyrer (PFSA): forbindelser med fullstendig fluorerte karbonkjeder (perfluorerte) av ulik lengde, og med hale av sulfonsyre (-SO_2H)
- Perfluorooktan sulfonamidforbindelser (preFOS): forbindelser som alle er kjente forløpere til PFOS, og blir derfor kalt "preFOS" i denne rapporten
- Fluortelomer sulfonsyrer (FTSA): forbindelser med delvis fluorerte karbonkjeder (polyfluorerte) av ulik lengde, og med hale av sulfonsyre (-SO_2H)

Konsentrasjonene som ble påvist i vannfasen ble sammenliknet med Environmental Quality Standards (EQS). Disse EQS-verdiene er gitt i Water Framework Directive (EU Directive 2000/60/EC) og er implementert i Norge gjennom vannforskriften. EQS-verdier er bestemt basert på toksisitetsdata og representerer grenseverdier der det ved konsentrasjoner under disse grenseverdiene ikke forventes alvorlige effekter. For vannet i Tyrifjorden er kun PFOS detektert i lave konsentrasjoner (ingen som overskrider Annual Average Environmental Quality standards (AA-EQS) for PFOS på 0,65 ng/L). Ingen andre PFAS-forbindelser ble påvist i de frie vannmassene i Tyrifjorden. De

påviste sedimentkonsentrasjonene i Tyrifjorden er høye, og høyest i forbindelse med utløpet av Storelva og i de dypere sedimentasjonsområdene nedstrøms (områdene kalt Nordfjorden og Storfjorden). De påviste konsentrasjonene av de langkjedede FTSA-forbindelsene (spesielt 10:2 og 12:2 FTS) er spesielt høye, og dominerer PFAS-sammensetningen i sedimentprøvene. Det er også funnet forløpere til PFOS (preFOS-forbindelser) i høye konsentrasjoner i noen områder. Det påvises også til dels høye konsentrasjoner i porevannet i sedimentene, men her er det de mer mobile PFCA-forbindelsene som dominerer.

Det har blitt utført datering av en sedimentkjerne fra Nordfjorden, og de samme prøvene er analysert for PFAS. Informasjonen fra dateringen viser at utslippene av preFOS-forbindelser var høyest på 1980-tallet, men har etter den tid vært avtagende. FTSA-forbindelsene tar da over som de dominerende PFAS-forbindelsene, med høyeste detekterte konsentrasjoner i 2006. Etter dette har det vært en nedgang i konsentrasjoner. Dateringsinformasjonen og PFAS-konsentrasjonene passer godt sammen med det vi vet om bruken av PFAS. Høye konsentrasjoner av preFOS-forbindelser passer godt med bruk av produkter med innhold av disse, men slike produkter ble faset ut i 2002. Nedgangen i FTSA-forbindelser passer godt med at en papirfabrikk ved Viul ble nedlagt i 2013. De øverste prøvene i kjerna passer også godt sammen med detekterte PFAS-konsentrasjoner i sedimentfella utenfor utløpet til Storelva. Sedimentene i sedimentfella er renere enn det som er påvist i innsjøsedimentene tidligere. Resultatene fra sedimentfellene viser videre at partikulært materiale fra Storelva har potensiale for å spre seg over store deler av Tyrifjorden, siden fordelingen av PFAS-forbindelser var tilsvarende i fella ved utløpet til Storelva som det som ble funnet i sedimentfella nærmere utløpet til Tyrifjorden (mot Vikersund). Pågående, årlig spredning av PFAS-forurensede partikler til Tyrifjorden estimeres til å være 1,5 kg. På elvedeltaet ved utløpet til Storelva er ca. 50 % av PFAS som sedimentere FTSA-forbindelser, mens for Tyrifjorden som helhet er ca. 40 % PFCA-forbindelser.

Prøver av fisk (abbor *(Perca fluviatilis)*, gjedde *(Esox lucius)*, sik *(Coregonus lavaretus)*, mort *(Rutilus rutilus)*, brasme *(Abramis brama)*, ørret *(Salmo trutta)* og røye *(Salvelinus alpinus)*), kreps *(Astacus astacus)*, dyreplankton og bunndyr ble analysert for PFAS. Generelt i biota er de høyeste konsentrasjonene av PFAS funnet i abborlever. Sett bort i fra ett individ fra Storøya, ble de høyeste konsentrasjonene av PFAS (Σ_{53} PFAS) funnet i abbor fanget i nærheten av den nedlagte papirfabrikken på Viul. Biota fanget i de øvrige områdene i prosjektet, har sammenlignbare konsentrasjonsnivåer av PFAS. I biota er det generelt høye konsentrasjoner av PFOS, hvorav konsentrasjonene overskrider EQS_{biota} i 23 av 63 muskelprøver av fisk, 70 av 72 leverprøver av fisk, og i begge prøvene av dyreplankton. Det er ikke påvist PFOA i konsentrasjoner som overskrider QS_{biota} i noen av de biotiske prøvene.

De PFAS-forbindelsene som er påvist i høyest konsentrasjoner i biota fra Tyrifjorden er PFOS, langkjedede PFCA-forbindelser, langkjedede FTSA-forbindelser og preFOS-forbindelser (PFOSA, et-FOSAA og FOSAA). PFOS er generelt den dominerende forbindelsen, men PFAS-fordelingen varierer mellom de ulike artene. Forskjell mellom

artene kommer sannsynligvis av forskjeller i diett og/eller artsforskjeller i utskillelse og biotransformasjon av PFAS-forbindelser.

Miljøkvalitetsstandarder (QS-verdier) er kun utviklet for PFOS og PFOA, men kombinasjonen av PFOS med de relativt høye konsentrasjonene av andre PFAS-forbindelser som er påvist kan medføre en økt risiko for alvorlige effekter på økosystemet, sammenliknet med forventede effekter av høye konsentrasjoner av PFOS alene.

I toksisitetsstudier har PFAS vist seg å ha negative effekter på immunsystemet, utvikling og reproduksjon (endokrine forstyrrelser) og påvirke lipidmetabolismen (nedbryting av fett) hos ulike organismer. Basert på $QS_{BIOTA, SECPOIS}$ for PFOS, påvist biomagnifisering av PFOS og langkjedede PFCA, eksisterende litteratur om overføring og toksisitet, samt de store usikkerhetene knyttet til blandinger av forskjellige PFAS og effekter av disse, konkluderes det med at PFAS-nivåene som er rapportert her utgjør en uakseptabel risiko for det lokale økosystemet. Når man ser på PFAS-konsentrasjoner påvist i sedimenter datert til midten av 1980-tallet, da utslippene var høyest, antas det at nivåene av PFAS i biota også var høyere da. Både de høye nivåene og den langsiktige eksponeringen av biota/dyreliv på høyere trofiske nivåer kan ha hatt en negativ påvirkning på sårbare eller spesielt eksponerte organismer i økosystemet i/ved Tyrifjorden.

Forholdet mellom stabile karbon- og nitrogenisotoper ($\delta^{13}C$ og $\delta^{15}N$) ble benyttet for å regne ut relativt trofisk nivå og for å vurdere tilknytning til det bentiske næringsnettet. Det antas at trofisk magnifisering skjer dersom utregnet trofisk magnifiseringsfaktor (TMF) er større enn 1. TMF beregnet for langkjedede PFCA-forbindelser i lever (TMF_{lever}) varierte mellom 3,2-16,1 avhengig av område. For PFOS er beregnet TMF_{lever} 1,9 for hele Tyrifjorden. TMF_{muskel} for edelkreps og fisk er beregnet til 2,0 for hele Tyrifjorden og 9,3 for Steinsfjorden.

Resultatene av stabile karbonisotoper ($\delta^{13}C$) indikerer at opptak av langkjedede PFCA-forbindelser, preFOS-forbindelser og langkjedede FTSA-forbindelser er forbundet med det bentiske næringsnettet. Det er vist at PFOS er relativt vannløselig (når en sammenligner med PFOS-forløpere). PFOS som blir "produsert" fra nedbryting av forløpere i sedimentene vil i stor grad bli løst i vann. De lave konsentrasjonene av PFAS i vannet i Tyrifjorden kombinert med tilknytningen til det bentiske næringsnettet indikerer at sedimentene er en stor kilde til PFAS i næringsnettet i Tyrifjorden (delvis gjennom frigjøring fra sedimentene til vannfasen).

Analyse av forgrenede PFOS (br-PFOS) i porevann og abborlever viser at fraksjonen av lineær PFOS avtar signifikant med avstand fra Viul. Biotransformasjon av preFOS er vist å gå raskere for forgreina isomerer enn deres lineære motpart. Høyere konsentrasjoner av br-PFOS indikerer derfor at det pågår nedbryting av preFOS. br-PFOS er også vist å være mer vannløselig, og bli raskere utskilt fra organismer. Derfor vil andelen lineær PFOS relativt til br-PFOS, øke over tid og med avstand fra punktkilder for preFOS. Resultatene indikerer et større bidrag fra pågående preFOS-nedbryting nærmere kildeområdet på Viul. Den samme trenden ble observert for FTSA-forbindelser

sammenlignet med Σ_{53} PFAS i abborlever (minkende andel FTSA med avstand til kildeområdet), som kan indikerer en mer fullstendig degradering av FTSA-forbindelsene med større avstand til kildeområdet.

Som et supplement til kildesporingsundersøkelsen for PFAS i Tyrifjorden i 2017, ble det undersøkt flere mulige kilder til PFAS-forurensning i Tyrifjorden. Det ble bare identifisert noen få kilder, der en villfylling for avfall fra papirfabrikken på Viul og brannstasjonen var de eneste kildene av en viss størrelse. PFAS-forurensningen fra villfyllingen av papiravfall ble vurdert til å være lignende i PFAS-sammensetning som observert fra fabrikkområdet på Viul. Hønefoss brannstasjon ble også identifisert som en vesentlig kilde i forrige undersøkelse. I prosjektet i 2018 ble det undersøkt om brannskum fra brannstasjonen også kunne være en kilde til langkjedede FTSA-forbindelser. Det ble funnet lave konsentrasjoner av disse forbindelsene, og det er derfor ikke sannsynlig at brannstasjonen er opphavet til denne forurensningen i sedimentene i Tyrifjorden. Brannstasjonen er likevel en kilde til PFOS og andre PFAS som relateres til brannskum, men den ansees som en liten kilde sammenlignet med de mengdene PFAS som finnes i vannmassene i Tyrifjorden.

Det årlige bidraget fra kildene er blitt beregnet, både fra denne undersøkelsen og undersøkelsen i 2017. Det er store knyttet store usikkerheter til beregningsgrunnlaget. Beregningene viser at brannstasjonen og villfyllingen på Haga bidrar til PFAS-forurensning av vannfasen, henholdsvis med 0,55 kg/år og 1,6 kg/år.

Den største kilden til PFAS i Tyrifjorden ligger i sedimentene, både i Tyrifjorden, nedstrøms papirfabrikkområdet på Viul, og sannsynligvis også i områder med sedimentasjon i elveløpet mellom Viul og Tyrifjorden. Det er knyttet stor usikkerhet til størrelsen på kildeområdene. Estimater basert på de detekterte konsentrasjonene viser at det er i størrelsesorden 30 kg PFAS i sedimentene nedstrøms Viul, mens det i Tyrifjorden er estimert å være ca. 150 kg. Merk at estimatet fra Tyrifjorden er basert på de øverste 2 cm av sedimentene, og at en derfor underestimerer hvor mye PFAS som er biotilgjengelig i sedimentene (det antas at forurensningen er biotilgjengelig ned til 10 cm dybde i sedimentene).

Det nedlagte papirfabrikkområdet på Viul er i denne undersøkelsen identifisert som hovedkilden til de høye PFAS-konsentrasjonene som detekteres i Tyrifjorden. Konklusjonen er basert på følgende funn i undersøkelsen (utdypes i kap. 8.4):

- PFAS-fordelingen i sedimentene
- Informasjonen fra den daterte sedimentkjerneprøven
- Analyse av en forbrukerartikkel (engangs papptallerken) fra fabrikken på Viul
- Villfyllingen med papirmasser fra Viul, som viser lignende PFAS-sammensetning som nedstrøms fabrikkområdet og i sedimentene i Tyrifjorden
- Høyere PFAS-konsentrasjoner i fisk som er fanget rett utenfor fabrikkområdet. Fisk i de øvrige områdene har likevel lignende PFAS-profiler som de fiskene som er fanget ved Viul
- Undersøkelser ved en lignende papirfabrikk på Geithus

Sedimentene fra Viul er sannsynligvis også hovedkilden til detekterte vannkonsentrasjoner og biotakonsentrasjoner i Tyrifjorden. Det konkluderes derfor med at det bør gjøres vurdering av tiltak rettet mot sedimenter i Randselva-Storelva og i Tyrifjorden.

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1 Introduction

On behalf of the Norwegian Environment Agency, the Norwegian Geotechnical Institute (NGI) and the Norwegian Institute for Water Research (NIVA) have conducted an environmental survey of PFAS contamination in water, sediment and biota in Tyrifjorden lake and its receiving rivers. The project started in the spring of 2018, and the environmental sampling was performed during the following field season.

The main objectives of the environmental survey, as stated by the Norwegian Environment Agency, are summarized below:

- Identify sources of PFAS contamination
- Investigate the levels of PFAS contamination in the different parts of the ecosystem and collect data so that the risk of human consumption of biota from the ecosystem can be evaluated
- Investigate distribution pathways to Tyrifjorden and the ecosystem, including the importance of trophic level and lake sediments for PFAS levels in biota
- Assess the impact of the reported PFAS contamination to the ecosystem
- Assess the contribution of the major PFAS sources
- Date the PFAS release to the lake
- Consider the need for remedial action to improve the situation

1.1 Site description

Tyrifjorden is the fifth largest freshwater lake in Norway, with a surface area of 137.38 km^2. It stretches into the following municipalities; Ringerike, Modum, Hole and Lier in Buskerud county.

The precipitation in the area is estimated to be 670 mm/yr (Norsk Klimaservicesenter, 2017). The precipitation catchment covers an area of 9808 km^2, and the average water discharge from Tyrifjorden (into the Drammen river) is 170 m^3/sec. The theoretical residence time for water in the lake is 2.6 years (NIVA, 1977), although it varies within the lake. Specifically, the part of the lake called Steinsfjorden has a longer water residence time (4.6 years).

Tyrifjorden can be divided into several different areas:

- Storfjorden: The main part of the lake which includes the relatively shallow parts of the lake, and covers the areas from Nakkerud to Vikersund, and the width extension in this interval
- Holsfjorden: Holsfjorden stretches from Storfjorden to the municipality Sylling in the southeast, covering the deepest part of the lake, with a maximum depth of 288 m.

- Nordfjorden: The northwest part of the lake, where the largest rivers, Storelva and Sogna, feeds water into the lake. This part of the lake is shallow, especially the river deltas from the two river outlets.
- Steinsfjorden: The northeast part of Tyrifjorden. This part of the lake is separated from the rest of Tyrifjorden with a narrow strait. Steinsfjorden is shallow, and the renewal of water is lower here than the rest of Tyrifjorden (4.6 years).

Figure 1. Map of Tyrifjorden and the main rivers feeding water into Tyrifjorden (Map: Statens Kartverk)

Water to Tyrifjorden is primarily fed through the river systems which have outlets in the northwest of the lake, although there are also smaller rivers all around the lake. Storelva is the largest river outlet, feeding on average 150 m^3/s into Tyrifjorden. Further upstream the rivers Ådalselva and Randselva merge into Storelva, with waterflows of 90 m^3/s and 60 m^3/s respectively. The river Sogna has a waterflow of 10 m^3/s (http://nevina.nve.no/).

The rivers have variable water flow through their courses, and include areas with waterfalls that have been exploited for production of electricity, to parts dominated by meander migration. The rivers can, especially during flood situations, carry a lot of sediments that are deposited in the deltas in Tyrifjorden.

1.2 Per- and Polyfluoroalkyl Substances (PFAS)

Per- and polyfluoroalkyl substances (PFAS) are a group of anthropogenic chemicals that have been widely used in industry and as a part of consumer products since the 1950s. The chemicals are amphiphilic (i.e. have both hydrophobic and hydrophilic moieties), and are widely used in products to reduce surface tension, lower surface energy or provide water and oil repellent properties, i.e. aqueous film forming foam (AFFF), food packaging, outdoor clothing, coating in pans. Due to the chemicals' diverse use, the sources of emissions are numerous. Since PFAS are persistent under natural conditions, a targeted effort is necessary to remove these substances from nature. Their stability, toxicity and potential for bioaccumulation and biomagnification, have given rise for concern.

The Organisation for Economic Co-operation and Development (OECD) recently published a list of PFAS registered with CAS-numbers. A total of 4730 PFAS related substances have been identified and categorised. PFAS can be divided into polymers or non-polymers. All the analysed PFAS in this project are non-polymers. As shown in Figure 2, non-polymer PFAS can be divided into sub-groups, based on the common molecular structure within each group.

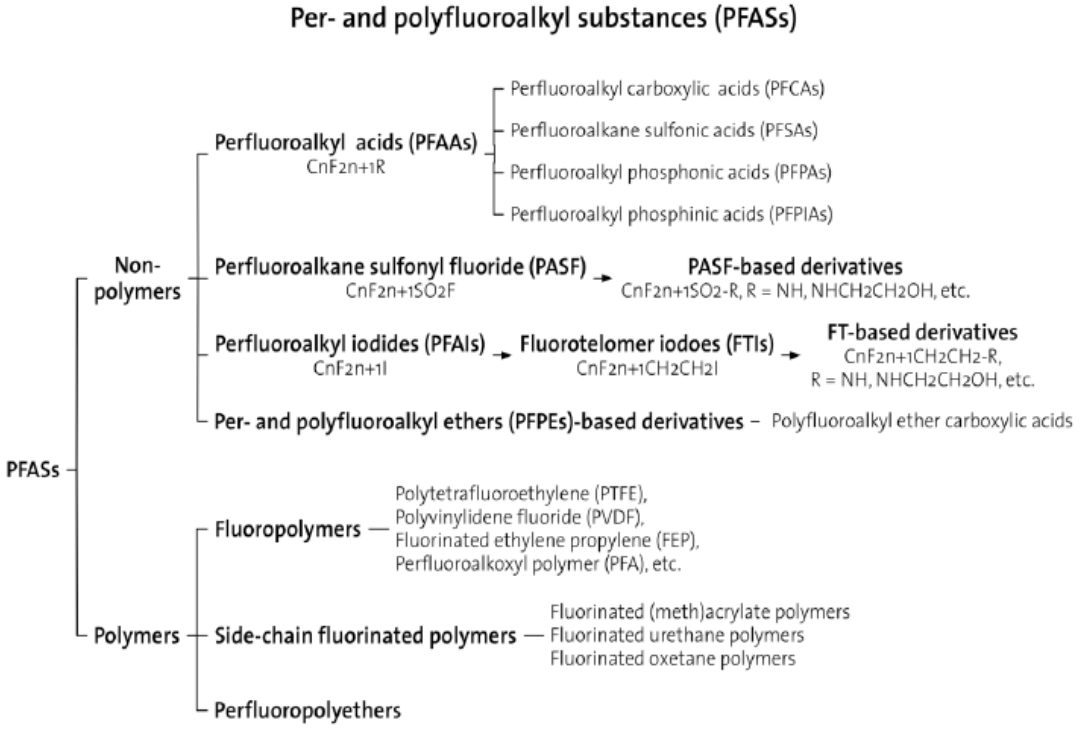

Figure 2. Classification of per- and polyfluoroalkyl substances (PFAS) (OECD, 2013).

In the following chapters a brief introduction of the groups, their common structure and the main applications, as well as an overview of analysed and quantified substances within each group in this project is given. A complete overview of the PFAS, including both full name and abbreviations, CAS-number and molecular structure, can be found in appendix F. Limits of quantification (LOQ) for the chemicals in the analysed matrixes are found in appendix G.

1.2.1 Perfluoroalkyl carboxylic acids (PFCA)

Perfluoroalkyl carboxyl acids (PFCA) are a class of substances with a fully fluorinated carbon backbone of varying length, and a carboxylic acid (-COOH)"tail". The most studied of these substances is perfluorooctanoic acid (PFOA) with a backbone of eight carbon atoms. There is evidence that PFOA can lead to adverse effects in humans and the environment. Studies indicate reproductive toxicity and it is classified as a possible human carcinogen. PFOA has been restricted in production and use in the western world (included as a candidate of substance of very high concern (SVHC) by the European Chemical Agency (ECHA) and is also on the recommended listed under review for the Stockholm convention. ECHA has recently recommended that the EU Commission also restricts use of PFCA with longer chain lengths than PFOA (C9-C14).

The following PFAS in the in the PFCA group were analysed: PFPA (C5), PFHxA (C6), PFHpA (C7), PFOA (C8), PFNA (C9), PFDA (C10), PFUdA (C11), PFDoDA (C12), PFTrDA (C13), PFTeDA (C14), PFPeDA (C15) and PFHxDA (C16).

1.2.2 Perfluoroalkyl sulfonic acids (PFSA)

Perfluoroalkyl sulfonic acids (PFSA) are a class of substances with fully fluorinated carbon backbone of varying length, and a sulfonic acid (-SO_2H)"tail". The most studied chemical is perfluorooctane sulphonic acid (PFOS), with eight carbon atoms. PFOS has been listed under annex B in the Stockholm convention since 2009, due to its adverse environmental effects. The production and use of this substance is therefore restricted. Perfluorohexane sulphonic acid (PFHxS), with a six carbon backbone, has recently been given more attention, and was listed as a candidate as a SVHC by ECHA and is being reviewed for listing under the Stockholm convention. The Norwegian Environment Agency will submit a proposal for REACH-restrictions of PFHxS in April 2019.

The Norwegian Environment Agency has begun work to identify perfluorobutane sulphonic acid (PFBS) as a SVHC. PFBS is less likely to bioaccumulate than its long-chain analogues but is very mobile and as persistent as other PFAS. A literature study of 80 articles performed by NGI for the Norwegian Environmental Agency showed that PFBS is found in 88 % of all water samples reported in these articles (NGI, 2018).

The following PFAS in the PFSA group were analysed: PFBS (C4), PFPeS (C5), PFHxS (C6), PFHpS (C7), PFOS (C8), PFNS (C9), PFDS (C10), PFUdS (C11), PFDoS (C12), PFTrS (C13) and PFTeS (C14).

Many PFAS can occur as both linear and branched isomers. In this project, concentrations of both linear and branched PFOS (br-PFOS) are quantified for most samples. The results are presented in separate figures, and when concentrations of "PFOS" are reported, this is for the linear isomer only. The quantification of isomers has only been done for PFOS as this is the only PFAS found in all matrixes.

1.2.3 Perfluorooctane sulfonamido substances (preFOS)

Perfluorooctane sulfonamido substances are all known precursors to PFOS and will in this report be referred to as "preFOS". They can be categorised into different groups according to whether they contain an ethanol group or a carboxylic group connected to the sulfonamido "tail".

These chemicals were produced by the electrochemical fluorination (ECF) method developed and used by 3M since the 1940s. Perfluoro-1-octane sulfonylfluoride (POSF) is the start-up chemical, while the molecules et-PFOSE and me-PFOSE are intermediate products, and the primary building blocks for the perfluorochemistry of 3M (Cheremisinoff, 2017).

Many of the substances in this group have been used in water and oil repellent coatings for textile and paper products.

The following PFAS in the in the preFOS group were analysed: PFOSA, me-PFOSA, et-PFOSA, me-PFOSE, et-PFOSE, FOSAA, me-FOSAA and et-FOSAA (all substances are based on a chain of eight carbon atoms)

Another group of PFAS which can degrade to preFOS, are perfluoroalkane sulfonylamidoethanols phosphate esters (SAmPAP). This group of surfactants were introduced by 3M in 1974, for use in food contact paper and packaging (Begley, 2007). SAmPAP diester was analysed in a few samples in this project, as it was not included in the original scope of the project.

1.2.4 Fluorotelomer sulfonic acids (n:2 FTSA)

Fluorotelomer sulfonic acids (n:2 structure, shortened to FTSA in this report) are a class of polyfluorinated carbon backbone of varying length, and a sulfonic acid (-SO_2H) "tail". The production method (telomerisation) results in only linear chained PFAS.

Fluortelomers generally includes more classes with different functional groups. Telomers are commonly used for surface treatment of e.g. carpets, textiles, paper, stone and leather (Cheremisinoff, 2017).

The following PFAS in the in the FTSA group were analysed: 4:2 FTS, 6:2 FTS, 8:2 FTS, 10:2 FTS, 12:2 FTS and 14:2 FTS (the last two are quantified using the standard for 10:2 FTS, and therefore there is some added uncertainty to these results). The first number denotes the number of fluorinated carbon atoms, while the other two are not fluorinated.

1.2.5 Other analysed PFAS

16 other PFAS were analysed in addition to the ones already mentioned. These are generally more novel PFAS that are commonly not investigated. The PFAS mentioned below were not detected in any matrixes in this project, and have probably not been used in the Tyrifjorden area.

Other analysed PFAS: 8Cl-PFOS, 4:2 F53B, 8:2 F53B, 7:3 FTAC, PFBSA, meFBSA, etFBSA, PFPeSA, meFPeSA, etFPeSA, PFHxSA, meFHxSA, etFHxSA, PFHpSA, meFHpSA and etFHpSA.

1.3 Identified sources of PFAS contamination in 2017

On behalf of the Norwegian Environment Agency, the Norwegian Geotechnical Institute (NGI) carried out a survey tracking the sources of PFAS contamination in the Tyrifjorden area in 2017. A brief summary is given in the following.

PFAS sources within the following categories were investigated:

- Industrial sites
- Waste water treatment plants
- Landfills
- Locations with known use of aqueous film forming foam (AFFF)

The sampling locations for the PFAS screening are shown in Figure 3.

Two of the sources were identified as major contributors of PFAS to the environment; the former paper industry site at Viul and the municipal fire station at Hønefoss. The other sources investigated were also identified to contribute to the PFAS contamination, but to a much lesser extent than the two major sources. These additional sources were not focused on further due to their minor contribution. They are therefore not considered a first priority in follow up work. For more details, see Miljødirektoratet (2017) (in Norwegian).

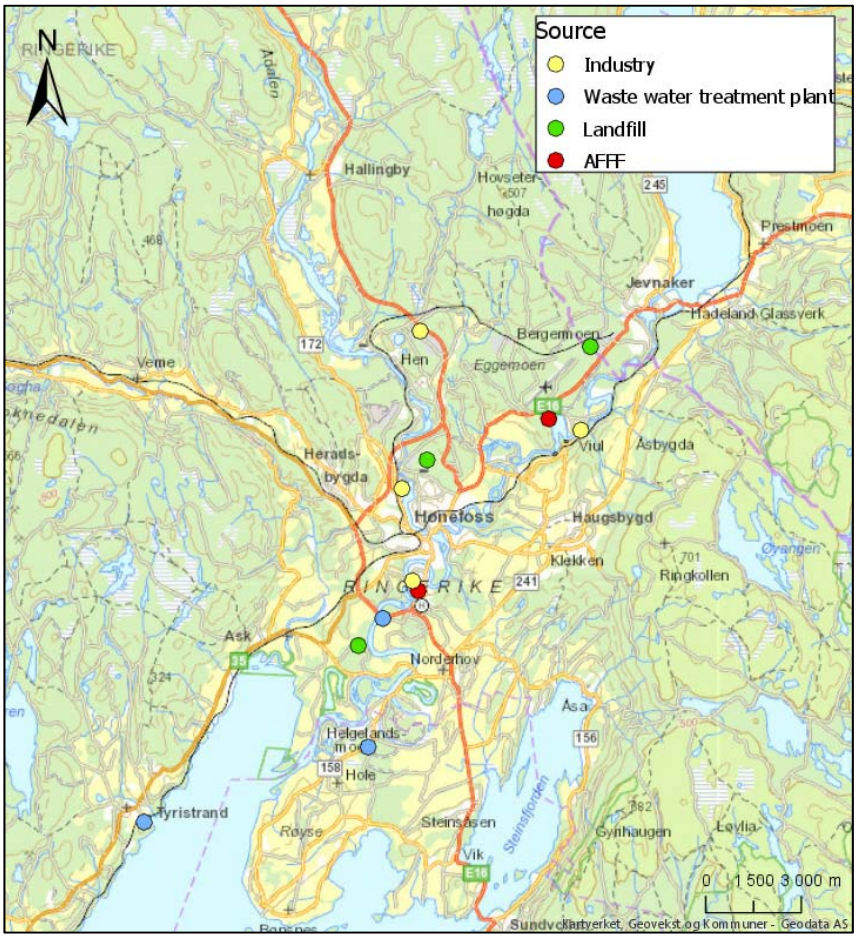

Figure 3. Sampling stations in the survey in 2017 (Map: Statens Kartverk)

2 Sampling stations

2.1 Possible contaminant distribution pattern

The ecological conditions in the main basin of Tyrifjorden (Storfjorden and Holsfjorden) are largely controlled by the movements of water bodies throughout the year. After the ice thaw in early spring, there is a short period when the whole lake circulates from bottom to surface, because all water reaches the same temperature (+4°C) and thus the same density. This spring circulation causes the deep water to be replaced with fresh oxygen-rich water from the surface, and the upper water layer is supplied with nutrient salts from the deeper parts. In spring, a more effective photosynthesis increases the amount of phytoplankton in the surface layer, and the surface nutrients are gradually consumed. Simultaneously, the surface water is heated up and creates a lid over the denser and colder benthic water. During the stagnation of the water masses in the summer, the surface layer is kept separated from the deeper water, creating a so-called thermocline where the temperature drops quickly over the span of a few meters. This stratification also prevents the phytoplankton population in the surface layer from getting additional nutrients from the deeper water in the summer. When the surface layer gradually gets colder in the autumn, stratification becomes weaker, and finally there is a new full circulation and upwelling before the ice settles, usually in late October.

Shallower parts of Tyrifjorden, such as areas around Storøya, Vikersund, and Steinsfjorden, will have a less stable stratification and a weaker thermocline especially after periods of cool weather and wind. Wind tends to cause movements and turbulence also in deeper water layers. For Steinsfjorden, the stratification changes from one year to the next. For example, in 2014 the stratification was apparent, causing only a very limited mixture of surface layer with the bottom water. In the following year, dominated by colder weather conditions, the stratification was much weaker. Nutrients from the bottom could then be mixed with surface water.

The dispersion of PFAS to Tyrifjorden will mainly occur through the supply from discharging rivers, such as Storelva (90 %) and Sogna (5 %) in addition to potentially contaminated local runoff. PFAS contamination will spread from the local sources either freely dissolved in the water phase or adsorbed to particulate matter. This will potentially lead to PFAS contamination of the entire pathway from sources upstream and to the accumulation basins of Tyrifjorden. The known sources of PFAS contamination in the area are mainly found along the Ådalselva-Randselva-Storelva river system (Figure 3), which is also the river contributing with most of the water (90 %) flowing into Tyrifjorden (NIVA, 1980).

Further spreading of PFAS contamination in Tyrifjorden will follow the streams that are present in the lake system at the time when the contamination comes into the lake. The distribution pattern of water and particles in Tyrifjorden have been studied by NIVA on several occasions, mainly to establish the pattern due to planned efforts to increase the exploitation of water from Holsfjorden for drinking water, and further to secure that

future efforts do not affect other user interests in the area. Studies of the distribution pattern have been done using mathematical simulation (NIVA, 1980; 1982; 2000), calibrating the model with field registrations (NIVA, 1980), tracking of radioactive bromine (^{82}Br) (NIVA, 1982) and with measured concentrations of coliforms in the lake (NIVA, 2000).

During the ice-free time of the year, wind is the main factor controlling the currents in Tyrifjorden (NIVA, 2000). During the period from 2008 to 2017, the winds were predominantly northerly or southerly (80 % of the time). NIVA (1980) shows that since wind coming from the north is the predominant direction, the predominant water current runs from Nordfjorden towards Holsfjorden in the south. This indicates that if the main contribution of PFAS is expected to come from the Storelva-outlet, this contribution can potentially contaminate large parts of the Tyrifjorden area.

Table 1. Relative frequency of wind direction and velocity at the Høyby station (source: Metereologisk Institutt)

Wind direction		**North**			**East**			**South**			**West**		
Wind direction (degrees)		315° - 344°	345° - 14°	15° - 44°	45° - 74°	75° - 104°	105° - 134°	135° - 164°	165° - 194°	195° - 224°	225° - 254°	255° - 284°	285° - 314°
Relative frequency of measured direction and velocity	0.3 - 5.2 (m/s)	18.7%	16.7%	7.7%	2.4%	1.6%	2.7%	13.6%	14.5%	5.5%	2.8%	3.3%	3.4%
	5.3 - 10.2 (m/s)	0.7%	0.8%	0.1%	0%	0%	0%	0.3%	0.2%	0.1%	0.1%	0.1%	0.1%
	> 10.3 (m/s)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sum[1]		**44.7 %**			**6.7 %**			**34.2 %**			**9.8 %**		

[1] App. 5 % of the time the observed wind velocity was below 0.3 m/s, which is calm winds and wind direction was not decided

Through modelling results of wave activity and calculation of erosion, transport and accumulation due to the bathymetric conditions in Tyrifjorden, NIVA (1982) presents a map of potential zones in Tyrifjorden representing these factors. Sedimentation of fine-grained particles (silt and clay) may occur in accumulation basins or zones, see Figure 4. PFAS present in the water masses from Storelva are most likely freely dissolved in the water masses, which means that they may be transported over large distances with the water itself, or potentially adsorbed to fine-grained particles. The sediment concentration of PFAS in Tyrifjorden is therefore likely to be largest in the areas where it is expected that the fine-grained particles accumulate.

The exception is Steinsfjorden, which is connected to Tyrifjorden only through a narrow straight called Kroksund. Water exchange between Tyrifjorden and Steinsfjorden is mainly driven by changes in the water level in Tyrifjorden caused by seasonal floods, active water level regulation or manipulation downstream near the outlet in the Vikersund area (FRE-16, 2018). This means that the water exchange between Tyrifjorden and Steinsfjorden is not exclusively driven by wind as for the other areas of Tyrifjorden (NIVA, 1999; FRE-16, 2018). Steinsfjorden is a shallow, nutrient rich,

mesotrophic, lake and may receive water with more oxygene from Tyrifjorden in periods of rising water level, but the effect is quite low because the same water will tend to flow back and forth. In the long term, the total water exchange between Tyrifjorden and Steinsfjorden is very low.

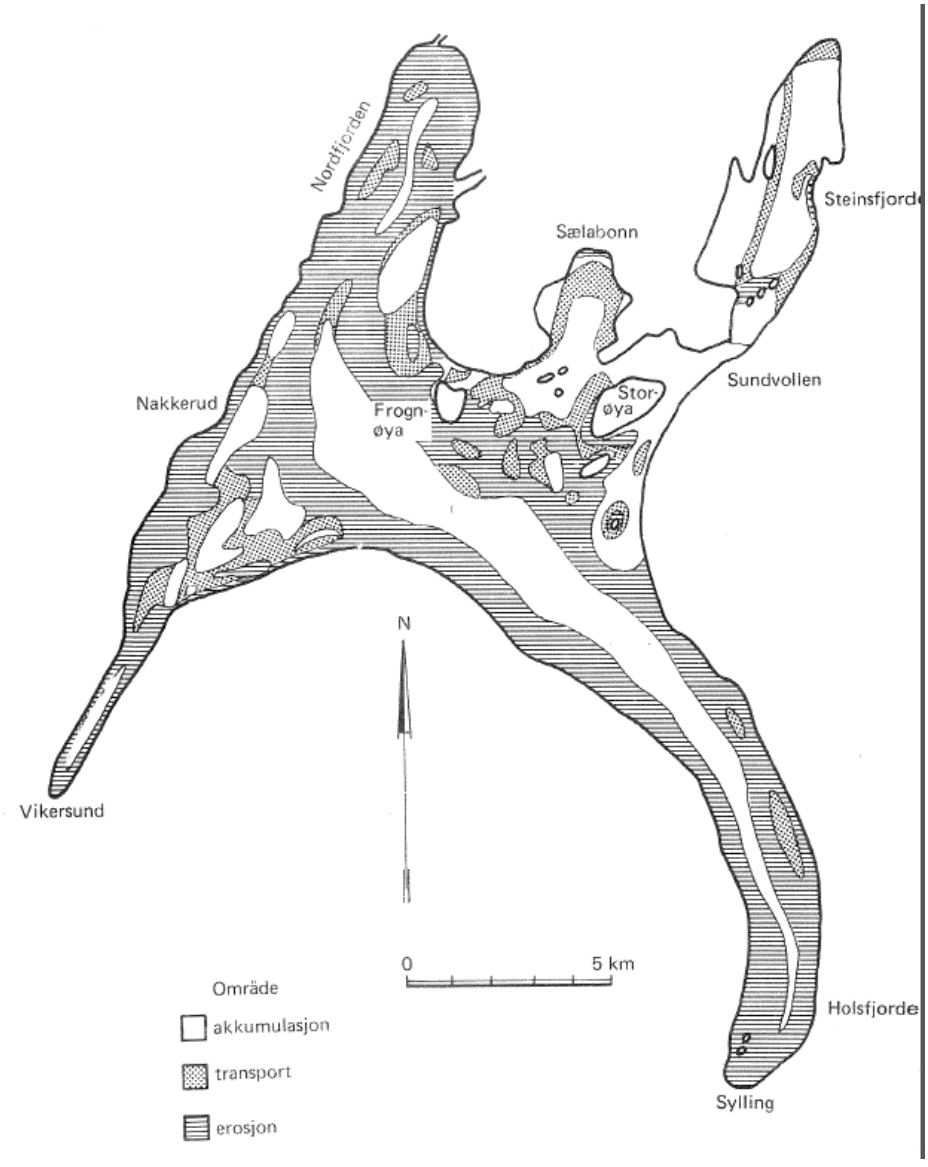

Figure 4. Expected areas for accumulation (sedimentation), transport and erosion in Tyrifjorden (NIVA, 1982)

2.2 The biotic environment

Tyrifjorden contains a rich diversity of fish species, such as brown trout (*Salmo trutta*), pike (*Esox lucius*), perch (*Perca fluviatilis*), whitefish (*Coregonus lavaretus*), roach (*Rutilus rutilus*), bream (*Abramis brama*) and arctic char (*Salvelinus alpinus*) all of which were caught in this project. Tyrifjorden also contains populations of smelt (*Osmerus eperlanus*), which is an important prey for large brown trout. Smelt were not caught in this project.

There are two populations of brown trout in Tyrifjorden, one in the north which will spawn in Storelva/Randselva, and one in the south near Vikersund in the upper part of Drammenselva. It is known that the brown trout population of Tyrifjorden is very vulnerable to being caught in nets in the spring when hunting for its favourable prey smelt (*Osmerus eperlanus*), and in the autumn migrating to their preferred rivers for spawning.

Whitefish in Tyrifjorden are divided in two main populations, one preying mostly on benthic organisms, and one on a more pelagic population.

Steinsfjorden holds one of the most important populations of crayfish (*Astacus astacus*) in Norway, and the population has been monitored since the 1970s. Since this is one of the few viable populations of crayfish in Europe, measures for upholding the population include trial fishing before and after the catch season and a strict regulation of minimum catch size. The catch season is limited to 8 days in August each year. Crayfish prey mostly on decaying organisms and smaller organisms such as snails, insects and worms (NINA, 2017). Pike and perch are the two most important predators preying on crayfish in Steinsfjorden and Tyrifjorden.

For fish samples there remains an uncertainty related to whether they are mostly stationary or migrating. For perch, migration in and out of their preferred areas will occur continuously, and they will also alternate between the littoral zone, benthic or pelagic habitats depending on access to prey species, thus being opportunistic in their behaviour similar to pike. This may introduce some variation of PFAS pattern between areas.

2.3 Sampling stations and sampled media

The determination of sampling stations was based on previous knowledge of the earlier identified PFAS contamination sources (Miljødirektoratet, 2017), the assumed distribution pathways for PFAS contamination in the system and information about the ecosystem and the consummation of crayfish and fish from Tyrifjorden and the rivers.

103 sediment samples are scattered throughout the entire Tyrifjorden, since modelling of the streams show that water from Storelva river might reach all main parts of the lake system. The exception is Steinsfjorden, but sampling of sediments in Steinsfjorden is important because it is a popular area for fishing and catching crayfish.

The sediment samples are mainly placed in the sedimentation areas of the lake system, as these areas are assumed to have the highest concentrations of PFAS since the contaminants are known to adsorb to silt and clay. Figure 5 shows the sediment sampling stations in Tyrifjorden and area names used in this project. Sampling of water and sediment for pore water analysis were also done in triplicates within the same areas in Tyrifjorden.

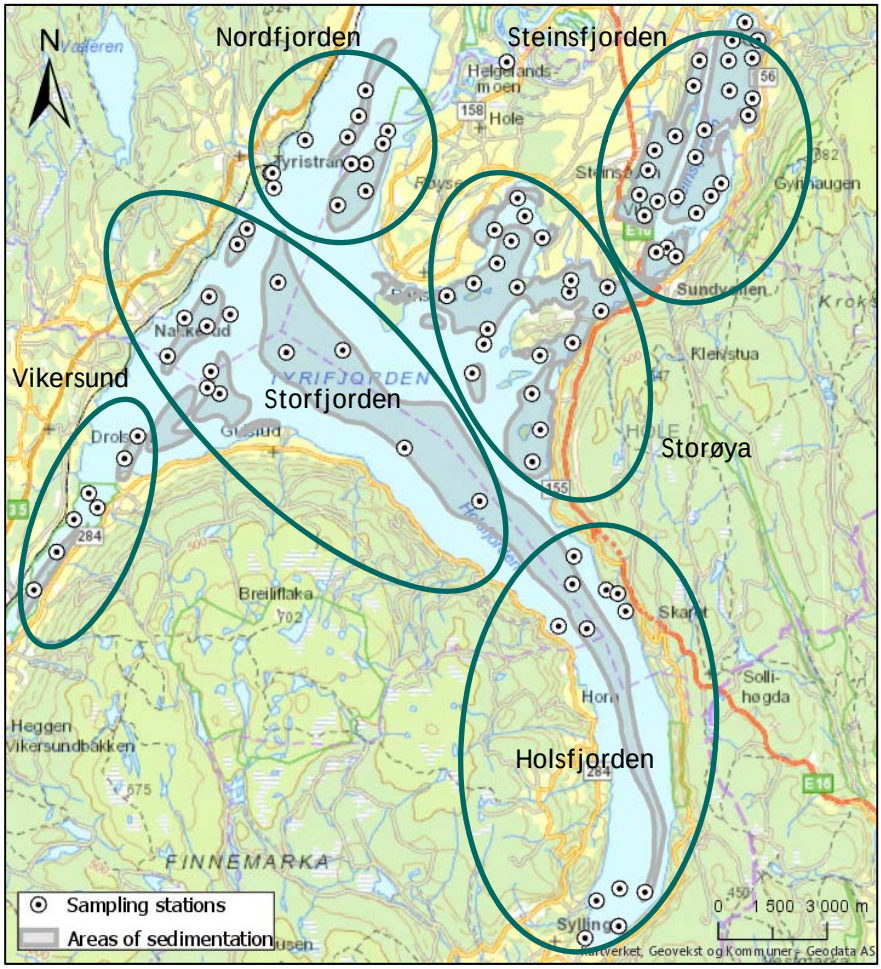

Figure 5. Sediment sampling stations in Tyrifjorden, with area names used in this project (Map: Statens Kartverk).

A total of 151 individual fish (42 perch *(Perca fluviatilis)*, 14 pike *(Esox Lucius),* 46 whitefish *(Coregonus lavaretus),* 40 roach *(Rutilus rutilus),* six trout *(Salmo trutta),* two bream *(Abramis brama)* and one char *(Salvelinus alpinus),* and 20 individuals of crayfish *(Astacus astacus))* were sampled from the areas around Viul (former paper industry site), downstream Hønefoss fire station, Nordfjorden, Storøya, Vikersund and Steinsfjorden. In addition, two zooplankton samples were collected south of the island Utøya (in Storfjorden) and one sample of benthic organisms was collected in the area around Storøya.

The choice of species and location is based on the occurrence of the different species and on information of relevant areas for fish and crayfish consumption. Areas have also been chosen to enable the investigation of differences between concentrations in sediments, water and in the food chain.

3 Method

3.1 Fieldwork

3.1.1 Water sampling

Water samples were collected from the five selected areas of Tyrifjorden and Steinsfjorden, shown in Figure 5. Plastic HD-PE bottles (1 L) were used to collect surface water (0-1 m) as the vessel moved slightly forwards in order to avoid contamination from the vessel itself. Triplicate 1 L water samples were collected at the sites in Nordfjorden, Holsfjorden, Vikersund, Storøya and Steinsfjorden. However only samples from Holsfjorden and Steinsfjorden were analysed due to laboratory challenges.

3.1.2 Sediment sampling

Sediment sampling in Tyrifjorden and Steinsfjorden were performed following the same procedure. At each location (Figure 5) a Kajak-Brinkhurst sediment corer with an acid-proof test tube (Ø 8.5 cm), was deployed from the stern of the vessel. Using a high resolution sounder, the corer was gently lowered into the bottom substrate. On contact with the sediment a closing mechanism was automatically triggered, keeping the sediment core of approx. 30 cm within the tube. Each core was retrieved to the stern deck by help of an electric hauling mechanism. Once on deck, the weight on top of the corer was removed, and a pressing device was used to gently push the sediment core out from the bottom of the corer making the top layer available at the top. Sections of 0-2 cm were sliced carefully and transferred to a burnt glass jar.

In some of the locations, high water content, larger grain sizes or large depth made it difficult to retrieve suitable cores from the substrate. In those cases, a van Veen grab had to be used. This was also due to challenges in getting the corer to enter the substrate vertically. At these locations the grab was cautiously lowered to the sediment, again monitored by the sounder, to limit impact on the top layer sediment. This approach secured an undisturbed sample substrate down to 10 – 15 cm depth within the grab. Samples were collected by opening the top lid of the grab once aboard the vessel. A steel spoon was used to transfer a sample of 0-2 cm into the glass jars.

In each of the main sampling areas of Tyrifjorden and Steinsfjorden, a designated sediment core was collected for historical samples and corresponding dating of layers. From each core, slices of 1 cm were cut out and transferred to individual glass jars. Two of the cores were selected for PFAS determination, and one of these were also sent to a collaborating laboratory in Denmark for dating (see chapter 3.2.3).

Sampling at Viul and in Storelva was done using a smaller van Veen grab from a smaller boat. In these areas, the samples represent the top 10 cm of the sediments.

Triplicates were collected in each area of Tyrifjorden for pore water extraction and analysis (see map in Figure 6). For the stations in Storelva, only one sample was taken per station.

Figure 6. Stations for sampling sediments for pore water extraction and analysis.

Sediment traps were placed in the rivers (four traps) and in Tyrifjorden (two traps) to gather settling particles in different parts of the Tyrifjorden system. The location of the sediment traps are shown in Figure 7. The traps were placed in areas of expected sedimentation, based on information from maps and observations in the field.

Figure 7. Placement of the sediment traps in the project.

The sediment traps were collected after a deployment of approximately two months. The material gathered in the traps was dried, weighed and analysed for PFAS.

Table 2. The placement and deployment time for the traps in the project.

Name	Placement	Deployment (days)
Trap 1	Upstream Viul	56
Trap 2	Downstream Viul	56
Trap 3	Storelva, by Busund	61
Trap 4	Storelva, by Helgelandsmoen	61
Trap 5a	Outlet Storelva, parallell A	56
Trap 5b	Outlet Storelva, parallell B	56
Trap 6	Bay towards Vikersund	56

3.1.3 Biota sampling

Fish and crayfish were sampled in areas used for recreational fishing by the local community, for assessment of food safety (by the food safety authorities). In addition, biota at different trophic levels were sampled close to the suspected major sources and in Tyrifjorden, for assessment of the distribution of PFAS and transport into and within the biotic environment. For whitefish, both pelagic and benthic populations were caught in this project using littoral nets in shallow parts of the lake, and floating nets in the main basin, respectively.

The procedure for catching fish is given in appendix E.

Zooplankton were collected in August when the zooplankton population normally is fully developed. Samples was collected using a small plankton net (95 µm mesh) in the circulating surface water (epilimnion), in the surface 0-2 meters. The sampling areas were in the main basin of Tyrifjorden south and southwest of Utøya (see Figure 1). The plankton net was a nylon mesh equipped with a collecting cup with a sieve (both in brass). Clogging of nets by diatoms (algae) that may form jelly-like aggregates on the net may lower the efficiency of zooplankton sampling, challenging the sampling procedure to provide enough material. Consequently, only two full samples of zooplankton were collected within the project. After sampling, zooplankton samples were transferred to the same type of analytical glass in the field, and into laboratory test tubes upon analysis.

It was not possible to collect enough benthic organisms from the lake bottom sediment to carry out chemical analysis, but one sample of diverse benthic organisms was collected with a kick-sample approach. This was carried out in the shallow parts north of Storøya in Tyrifjorden using waders and a fine-meshed net to collect enough material for an analysis. This sample further received the same treatment as the zooplankton samples.

Table 3. Overview of sampled and analysed material from different locations. Analysis are performed by NIVA laboratory.

Sampled species	N	Liver/muscle	Analysed	Area
Perch *(Perca fluviatilis)*	5	5/5	5 liver, 5 muscle	Viul
	2	2/2	2 liver, 2 muscle	Fire station
	10	5/5	5 liver, 5 muscle	Nordfjorden
	10	5/5	5 liver, 5 muscle	Storøya
	5	5/5	5 liver, 5 muscle	Vikersund
	10	5/10	5 liver, 10 muscle	Steinsfjorden
Total	42	27/42	27 liver and 42 muscle	
Pike *(Esox Lucius)*	4	4/4	4 liver, 4 muscle	Viul
	2	2/2	2 liver, 2 muscle	Nordfjorden
	3	3/3	3 liver, 3 muscle	Storøya
	5	5/5	5 liver, 5 muscle	Steinsfjorden
Total	14	14/14	14 liver and 14 muscle	
Whitefish *(Coregonus lavaretus)*	5	1/0	1 liver	Fire station
	15	3/0	3 liver	Nordfjorden
	12	3/0	3 liver	Storøya
	12	3/0	3 liver	Vikersund
	12	3/0	3 liver	Steinsfjorden
Total	46	13/0	13 liver	
Roach *(Rutilus rutilus)*	5	1/0	1 liver	Nordfjorden
	15	3/0	3 liver	Storøya
	15	3/0	3 liver	Vikersund
	5	1/0	1 liver	Steinsfjorden
Total	40	8/0	8 liver	
Trout *(Salmo trutta)*	1	1/1	1 liver and 1 muscle	Storøya
	5	5/5	5 liver, 5 muscle	Tyrifjorden
Total	6	6/6	6 liver and 6 muscle	
Bream *(Abramis brama)*	2	2/0	2 liver	Steinsfjorden
Char *(Salvelinus alpinus)*	1	1/1	1 liver and 1 muscle	Storøya
Crayfish *(Astacus astacus)*	10	0/10	10 muscle	Storøya
	10	0/10	10 muscle	Steinsfjorden
Total	20	0/20	20 muscle	
Zooplankton	2		2	Storfjorden, south of Utøya
Benthos	1		1	Storøya

3.2 Laboratory

3.2.1 PFAS analysis of water, biota and sediments

Per- and polyfluoroalkyl substances (PFAS) for all matrixes were analysed by NIVA. All matrixes were analysed for 53 individual PFAS.

Extraction
Prior to extraction, a mixture of isotope labelled PFAS was added for quantification purposes. Sediment and biota samples were extracted with organic solvents and use of buffers for pH control. The extracts were cleaned using solid phase extraction (SPE) and active coal if needed (the latter for lipid rich biota samples).

Water samples were concentrated and cleaned up using an SPE column. All samples were concentrated under nitrogen flow.

Analysis
PFAS were analysed using LC-qTOF-MS.

Limits of Detection
The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method; three times the signal/noise ratio (s/n) and 9 times s/n, respectively.

Quality assurance and accreditation
NIVA's laboratory is accredited by Norwegian Accreditation for ISO/IEC 17025. NIVA is not accredited for these particular chemicals, but to the extent possible, documentation, preparation, analysis and calculations are performed in accordance with accredited methods.

Samples were analysed in groups with at least one additive standard sample and a blank control. To ensure repeatability, a random sample from each matrix was selected for duplicate analysis.

Extraction of pore water
Pore water was extracted from triplicate sediment samples from each of the five main areas in Tyrifjorden in addition to riverbed sediments from two locations in Storelva. About 30-35 g of sediment was weighed out and transferred to centrifuge tubes (485 mL). The tubes were placed so that equal masses (+/- 0.1 g) stood opposite each other. Samples were centrifuged at a rotor speed of about 8000 rpm or 11 000 G for 45 minutes. After centrifugation pore water was poured into PE bottles and the remaining sediment was transferred to a PE test tube upon extraction and analysis.

3.2.2 Analytical method for stable isotopes of N ($\delta^{15}N$) and C ($\delta^{13}C$)

The ratio between the stable nitrogen isotopes ^{14}N and ^{15}N ($\delta^{15}N$), and the carbon isotopes ^{12}C and ^{13}C ($\delta^{13}C$) were determined by IFE (Institute for Energy Technology), based on Vander Zanden and Rasmussen (2001). Analyses were performed according to standard protocols without removing lipids nor carbonates prior to analysis. Important steps of the method include combustion in an element analyzer, reduction of NO_x in a Cu-oven, separation of N_2 and CO_2 on a GC-column followed by determination of ^{15}N and ^{13}C on an Isotope Ratio Mass Spectrometer (IRMS).

3.2.3 Sediment dating

The 15 samples of sediment slices from Nordfjorden were analyzed for the activity of ^{210}Pb, ^{226}Ra and ^{137}Cs via gamma spectrometry at the Gamma Dating Center, Institute of Geography, University of Copenhagen, Denmark. The measurements were carried out on a Canberra ultralow-background Ge-detector. ^{210}Pb was measured via its gamma-peak at 46.5 keV, ^{226}Ra via the granddaughter ^{214}Pb (peaks at 295 and 352 keV) and ^{137}Cs via its peak at 661 keV, based on Andersen (2017) and Appleby (2001).

3.2.4 Total extractable organic fluorine (ToF)

Total organfluorine in the samples were analyzed using a combustion ion chromatography (CIC). The CIC consists of a combustion module (Analytikjena, Germany), a 920 absorbent module and a 930 Compact IC flex (Metrohm, Switzerland). Separation of anions was performed on an ion exchange column (Metrosep A Supp5 – 150/4) using carbonate buffer (64 mM sodium carbonate and 20 mM sodium bicarbonate) as eluent in isocratic elution.

In brief, the sample extract (0.1 mL) was set on a quartz boat and placed into the furnace at 1000-1050°C for combustion, during which, all organofluorine was converted into hydrogen fluoride (HF); the HF is then absorbed into Milli-Q water. The concentration of F- in the solution was analyzed using ion chromatography.

The analysis of ToF was conducted by Örebro University.

3.2.5 Total organic carbon content and grain size in sediments

The total organic carbon (TOC) content and grain size were determined by the accredited laboratory ALS Laboratory Group AS. Documentation of the results from the laboratory is shown in appendix I.

TOC-content was determined using IR, down to a LOD of 0.1 %.

The grain size ranging between 2 and 63 µm was determined from sieving and laser diffraction. The LOD for each of the fractions were 0.1 %.

3.3 Calculations

3.3.1 Environmental Quality Standards (EQS values)

Environmental Quality Standards (EQS) are limit values defined through the EUs Water Framework Directive to assess the chemical status of water bodies. There are EQS values for 45 different compounds in water, and for some of them also in sediment and/or biota. The EQS values for biota cannot be used to evaluate the risk of consumption of biota. These evaluations are done separately by the Norwegian Food Safety Authority (www.mattilsynet.no).

For PFAS, EQS values are only established for PFOS and PFOA. EQS values for these substances are set based on systems for environmental standards and risk assessment of chemicals in the EU (Miljødirektoratet, 2014).

For PFOA and PFOS, yearly average environmental quality standard EQS (AA-EQS) and maximum EQS (MAC-EQS) exist for water bodies. Corresponding values are then determined for sediments and biota, using the water EQS values and partitioning behaviour between the media. From AA-EQS there is a corresponding QS_{sed} and QS_{biota}, establishing the level of the chemicals where long-time exposure can have chronic adverse effects. A corresponding value for MAC-EQS exists only for sediment ($QS_{sed\ acute}$), where short time exposure can lead to acute effects. For details regarding the calculations of the quality standards, see the guidelines from the Norwegian Environmental Agency (Miljødirektoratet 2014; 2016a).

Table 4. Environmental quality standards (EQS) for PFOA and PFOS (Miljødirektoratet, 2016).

Matrix	**Substance**	**AA-EQS (water) QS_{sed} (E)QS_{biota}**	**MAC-EQS (water) $QS_{sed,\ acute}$**
Fresh water	PFOA	9100 ng/L	
	PFOS	0.65 ng/L	36000 ng/L
Sea water	PFOA	9100 ng/L	
	PFOS	0.13 ng/L	7200 ng/L
Sediment, fresh water	PFOA	713 µg/kg	
	PFOS	2.3 µg/kg	360 µg/kg
Sediment, sea water	PFOA	71 µg/kg	
	PFOS	0.23 µg/kg	72 µg/kg
Biota	PFOA	91.3 µg/kg ww	
	PFOS	9.1 µg/kg ww	

For PFOS, an EQS value for biota has been established, listed in appendix VIII in the Norwegian Water Management Regulation (Norwegian: Vannforskriften). The Norwegian regulation is based on the European Water Framework Directive (WFD) (Directive 2013/39/EU, 2013).

Values for QS_{biota} in the WFD are based on the "critical quality standard (QS)" (i.e. the lowest of either QS for human health [QS_{hh}] or QS for secondary poisoning [$QS_{BIOTA, SECPOIS}$]).

In December 2018, the European Food Safety Authority (EFSA) proposed new tolerable intake levels of PFOS and PFOA of 13 and 6 ng/kg body weight per week, respectively (Knutsen et al., 2018). However, the PFOS QS_{hh}, is based on the existing value for daily intake (TDI, 150 ng/kg body weight per day) combined with a body weight of 70 kg, an intake of 0.115 kg per day, and a limit of max 10 % of TDI (European Commission, 2011), shown in the equation below:

$$QS_{hh} = \frac{0.150\ \mu g/kg\ \times 70.0\ kg\ \times 0.1}{0.115\ kg} = 9.1\ \mu g/kg$$

The $QS_{BIOTA, SECPOIS}$ is 33 µg/kg wet weight (w.w.), thus the critical QS for PFOS is QS_{hh}, and the EQS for PFOS and its derivatives is 9.1 µg/kg w.w (European Commission, 2011).

The WFD states that the EQS is for fish: "Unless otherwise indicated, the biota EQS relate to fish. An alternative biota taxon, or another matrix, may be monitored instead, as long as the EQS applied provides an equivalent level of protection…" (Directive 2013/39/EU, 2013). The WFD does not state specific species, size, or what matrix to analyse (e.g. fillet or whole fish homogenate).

In this study, human health was considered the major protection goal. Thus, fish muscle tissue (fillet) was chosen as the target tissue in order to collect good quality data for comparison to the QS_{biota}-value (9.1 µg/kg for PFOS), and for assessment of food safety (done by the food safety authorities). Liver concentrations were chosen for source tracking (due to the higher PFAS accumulation in the liver), and for comparison to exposure experiments.

3.3.2 Partitioning coefficients

From measured concentrations in sediments and pore water, a distribution coefficient (K_d-value) can be calculated. The K_d-value is a measure of the affinity the given substance has to the sediment or the water phase in the conditions present in the sample. The value is calculated using the following equation:

$$K_d = \frac{C_{sed}}{C_{pw}}$$

Where C_{sed} and C_{pw} is the measured concentration in the sediment and the pore water respectively. In this study, a K_d values were calculated for all detected PFAS in sediment and the pore water.

The content TOC was determined for sediments in the different areas. Thus, a partitioning coefficient adjusted for the fraction of TOC (f_{OC}) was calculated using the following equation:

$$K_{OC} = \frac{K_d}{f_{oc}}$$

Where for instance 1 % TOC in the sediments is equivalent to a $f_{oc} = 0.01$

3.3.3 Determination of trophic level and carbon sources

Sampling of biota from different habitats at various trophic levels was carried out to evaluate relationships between PFAS loads and trophic level and/or food sources. In order to quantify trophic level and food sources, analysis of stable carbon and nitrogen isotopes, $\delta^{13}C$ and $\delta^{15}N$, were performed.

The $\delta^{15}N$ of a consumer is enriched relative to its diet, thus the $\delta^{15}N$ can be used to estimate the trophic level of an organism. Trophic fractionation of $\delta^{15}N$ is reported to be 3.4 ‰ (Post, David, 2002), thus relative trophic levels were calculated by dividing $\delta^{15}N$ by a factor of 3.4. Trophic magnification factors (TMF) were calculated using linear regression on relative trophic levels and log-transformed (natural logarithm) PFAS concentrations, as described in Miljødirektoratet (2016b).

The use of $\delta^{13}C$ for evaluating the ultimate sources of carbon (i.e. dominating primary producers in the food web) is previously described by Post, D. (2002). In lakes, the $\delta^{13}C$ can be used to differentiate between production in the benthic-littoral zone and pelagic production, because the $\delta^{13}C$ tends to be enriched in benthic-littoral food webs (France, 1995). Thus, an increased (i.e. less negative) $\delta^{13}C$ is associated with increased proportions of benthic organisms as food sources. The $\delta^{13}C$ is often assumed to be unaffected by trophic level; enrichment with increasing trophic level is reported, however due to large variations it is difficult to distinguish this fractionation from zero (Post, D. 2002). For simplicity, in this report the $\delta^{13}C$ is treated as an indicator of association to the benthic food web, unaffected by trophic level.

3.3.4 PFOS in whole fish

In this study, muscle (fillet) concentrations were chosen for comparison with QS_{biota} values. This was done to properly address the major protection goal. However, as there are established QS values for secondary poisoning, $QS_{BIOTA,\ SECPOIS}$ (33 µg/kg for PFOS), the whole fish body burden is interesting (assuming most prey fish are eaten whole). Equations have been developed to convert concentrations of PFOS from fillet to whole fish. These are shown suitable for PFOS in selected species (Fliedner et al., 2018). For perch, the conversion equation shown in the equation below is reported to be statistically significant (Fliedner *et al.*, 2018). Perch is one of the species with highest concentrations of PFAS, and it is caught in the greatest number at all stations. Therefore,

concentrations in whole perch were calculated for comparison to $QS_{BIOTA,\ SECPOIS}$ using the following equation:

$$C_{whole\ fish} = 2.8459 \times C_{fillet} - 0.4636$$

3.3.5 Mass balance analysis of organofluorine

An analysis of total extractable organic fluorine (ToF) was conducted to establish how much of the PFAS present in the samples that was actually detected in the target analysis (for 53 individual substances) (see ch. 3.2.4). To compare the concentrations in the ToF-analysis to the target analysis of PFAS, the detected concentrations of PFAS (ng/g) are converted into corresponding fluoride concentrations (C_F in ng F/g) using the following equation:

$$C_F = n_F \cdot \frac{MW_F}{MW_{PFAS}} \cdot C_{PFAS}$$

Where
n_F: number of fluorine in PFAS
MW_F: molecular weight of fluorine (in g/mol)
MW_{PFAS}: molecular weight of PFAS (in g/mol)
C_{PFAS}: detected concentration of PFAS (in ng/g)

3.3.6 Statistics and data treatment

Details about statistical analysis and data treatment are given in appendix D.

3.4 Analysed PFAS and symbology

Throughout this report, each individual PFAS is shown with a specific colour, related to the earlier defined PFAS groups, listed in Table 5 (e.g. *Figure 12*).

Table 5. Grouping of PFAS into colours in the figures later presented.

Group	PFCA	PFSA	preFOS	FTSA
Analysed PFAS	PFPA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUdA, PFDoDA, PFTrDA, PFTeDA, PFPeDA, PFHxDA	PFBS, PFPeS, PFHxS, PFHpS, PFOS, PFNS, PFDS, PFUdS, PFDoS, PFTrS and PFTeS	PFOSA, me-PFOSA, et-PFOSA, me-PFOSE, et-PFOSE, FOSAA, me-FOSAA, et-FOSAA	4:2 FTS, 6:2 FTS, 8:2 FTS, 10:2 FTS, 12:2 FTS, 14:2 FTS
Symbology colours	Blue, brown	Green	Yellow, light blue	Red

For the other analysed PFAS no colour is defined, as they are not detected in any analysed matrix.

4 PFAS results in the abiotic environment

4.1 Surface water concentrations

Lake and river water samples were collected from all locations as described in chapter 3.1.1. Unfortunately, only six samples (three from Holsfjorden and three from Steinsfjorden) were analysed due to laboratory challenges. In the water, only PFOS and branched PFOS (br-PFOS) were detected above the detection limit in the six water samples that were analysed. PFOS concentrations are higher in the water samples in Steinsfjorden than in Holsfjorden (Figure 8).

The water concentrations of PFAS were lower in 2018 than in the 2017 survey (PFOS concentrations between 0.42 and 0.71 ng/L). In 2017 more PFAS was detected in the water in Tyrifjorden, though in low concentrations (**Steinsfjorden:** PFBA, PFPA, PFHxA, PFHpA, PFOA, PFNA; **Storøya:** PFHpA, PFOA; **Holsfjorden:** PFHpA, PFOA; **Nordfjorden:** PFHpA, PFOA, **Vikersund:** PFHpA, PFOA) (Miljødirektoratet, 2017).

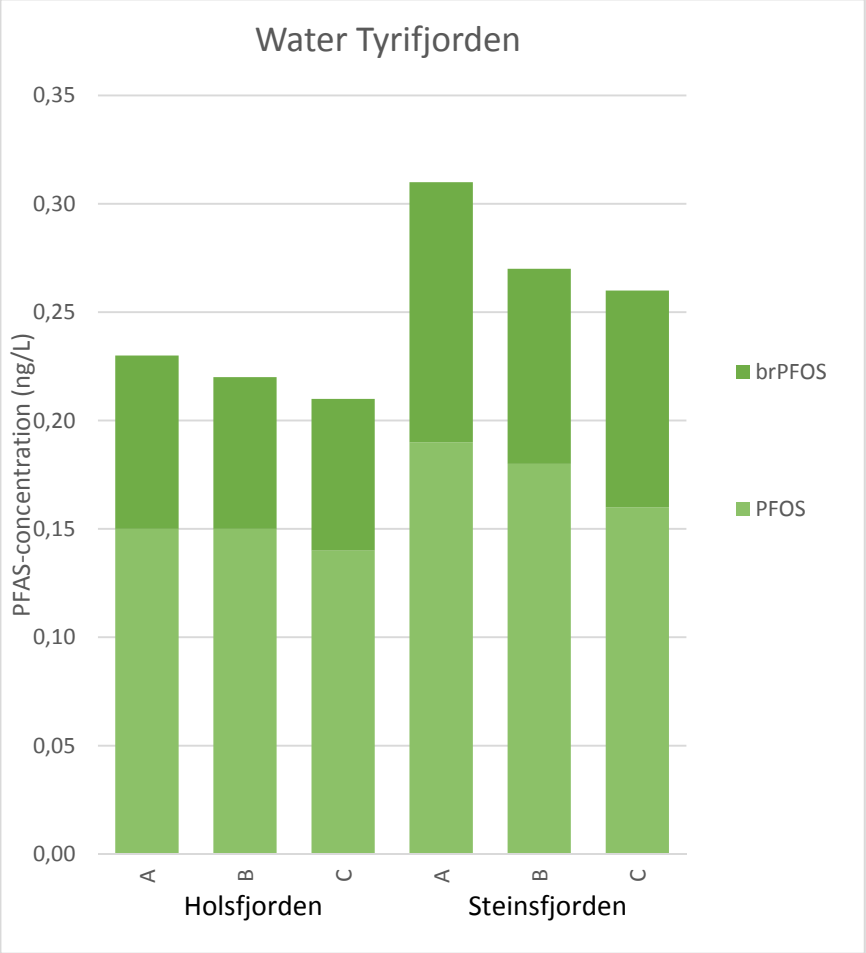

Figure 8. Detected PFAS concentrations in water samples from Holsfjorden and Steinsfjorden.

The proportions of br-PFOS compared to the total amount of PFOS detected (PFOS + br-PFOS) were between 32 and 39 % for the samples, and no differences were observed in the two areas. Average fractions of linear PFOS are shown in Figure 9.

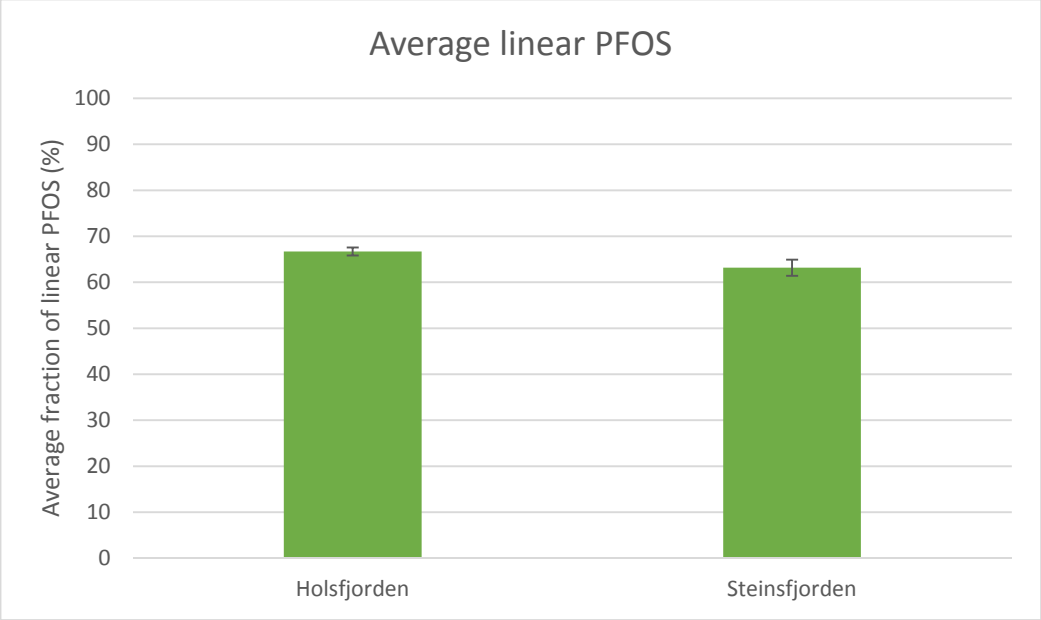

Figure 9. PFOS concentrations in water samples from Holsfjorden and Steinsfjorden shown as average fractions of linear PFOS.

4.1.1 Comparison to quality standards

The concentrations of PFOS did not exceeded the environmental quality standard (AA-EQS) for PFOS of 0.65 ng/L, not even when including br-PFOS.

4.2 Sediment concentrations

Sampling of sediments in Tyrifjorden has been conducted as described in chapter 3.1.2. In addition, sediments downstream the two major sources identified in the 2017 survey were sampled (Miljødirektoratet, 2017). Individual concentrations of all samples and all PFAS are reported in appendix H. All concentrations are given in dry weight (dw).

4.2.1 Comparison to quality standards

PFOA was not detected above the limit of quantification in the sediment samples in Tyrifjorden. PFOA was detected in two sediment samples (1 and 2) outside the former paper industry site at Viul, and in the sediment traps in Tyrifjorden. None of the detected concentrations exceeded environmental quality standard (QS_{sed}) for PFOA in sediment (713 µg/kg).

The detected PFOS concentration in each of the sampling stations are shown in Figure 10 (Tyrifjorden) and Figure 11 (Viul), where the concentrations are shown as under or above the QS_{sed} value for PFOS of 2.3 µg/kg dw. For stations in Storelva, PFAS was not detected in the sediment samples.

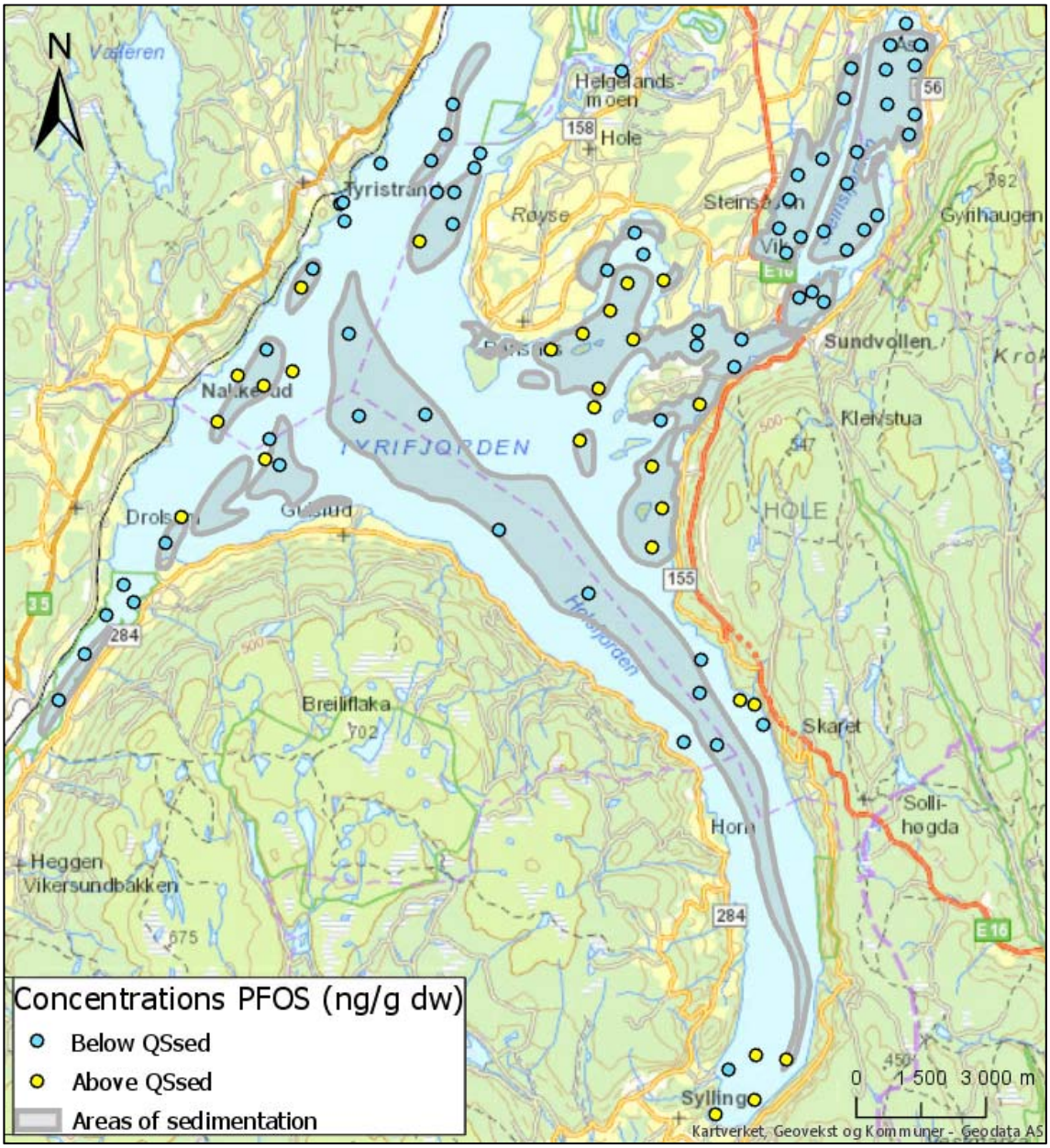

Figure 10. Sediment stations in Tyrifjorden shown as under or over the PFOS QS_{sed} value (2.3 µg/kg).

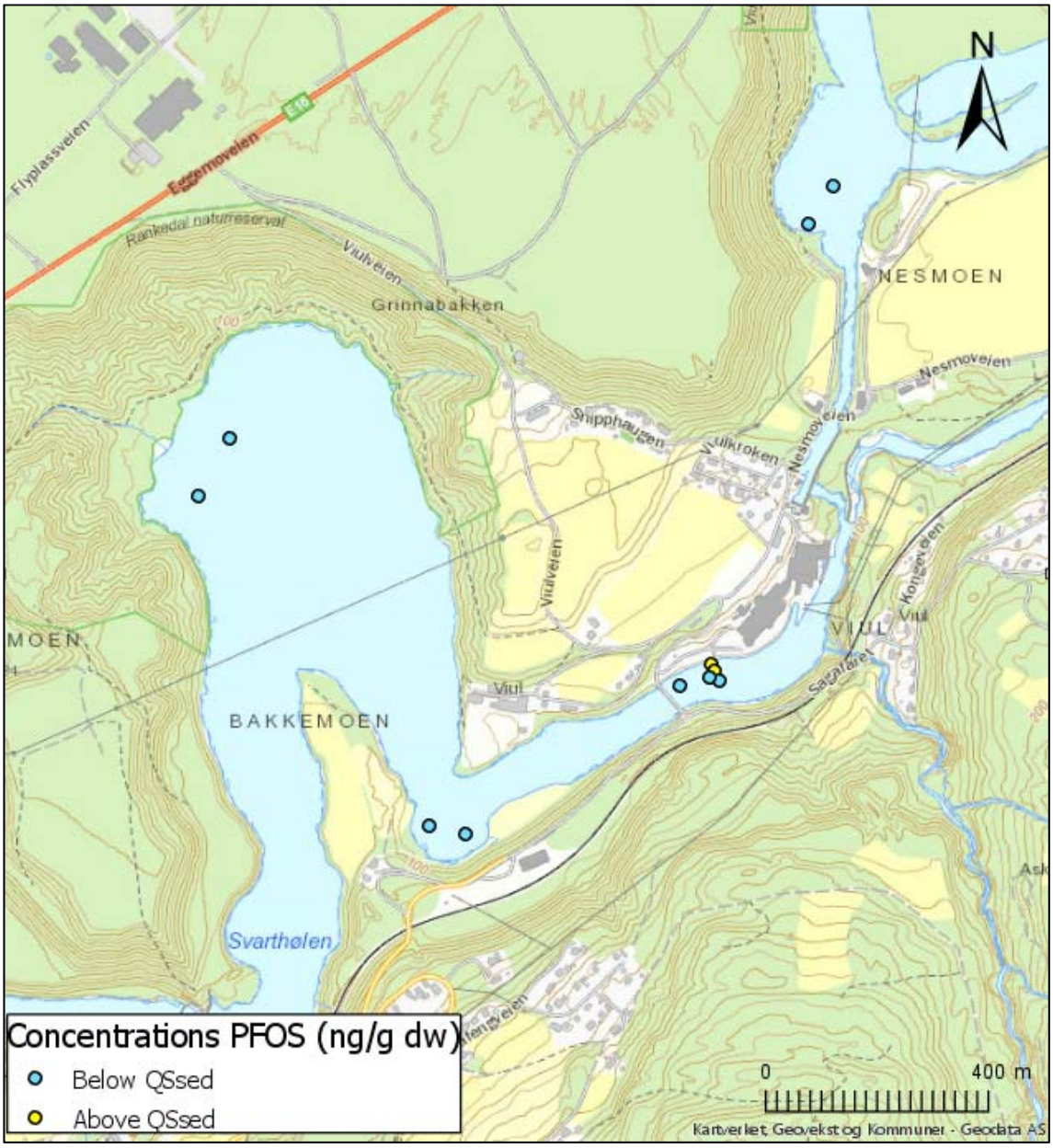

Figure 11. Sediment stations at Viul shown as under or over the PFOS QS_{sed}-value (2.3 µg/kg).

The concentrations of PFOS are further statistically summarized in Table 6. The concentrations are compared to the QS_{sed} value for PFOS of 2.3 µg/kg dw, and number of samples exceeding the QS value is shown. The PFOS concentrations exceeded the QS value in a few areas (Storfjorden, Storøya, Holsfjorden, Viul and Haga (only one sample)).

Table 6. Statistical summary of the detected concentrations of PFOS in sediments in the different areas. Concentrations are given in µg/kg dw. Red indicates concentrations exceeding QS_{sed} for PFOS (2.3 µg/kg dw).

Area	n	Average	Min	Max	Std.dev.	n above EQS
Upstream Viul	2	<0.1	<0.1	<0.1	0	0
Viul	9	298	<0.1	1780	663	2
Storelva	9	<0.1	<0.1	<0.1	0	0
Sediment traps	7	1.5	<0.1	2.4	0.8	2
Nordfjorden	14	1.1	<0.1	3.7	1.0	3
Storfjorden	15	4.9	<0.1	17.8	4.5	10
Storøya	21	8.4	0.1	24.2	7.1	14
Vikersund	7	1.8	<0.1	4.0	1.6	3
Steinsfjorden	25	<0.1	<0.1	0.5	0.1	0
Holsfjorden	12	6.7	0.2	22.3	6.8	7
Skjærdalen Bruk	1	<0.1	<0.1	<0.1	0	0
Haga	1	5.2				1

4.2.2 Concentration levels in different areas of Tyrifjorden

In Figure 12 and Figure 13, averaged concentrations of individual PFAS are shown, divided into areas of origin (substances are coloured according to groups, shown in Table 5). Figure 12 clearly show that there is a much higher concentration of PFAS detected in the samples downstream Viul than in any of the other investigated areas.

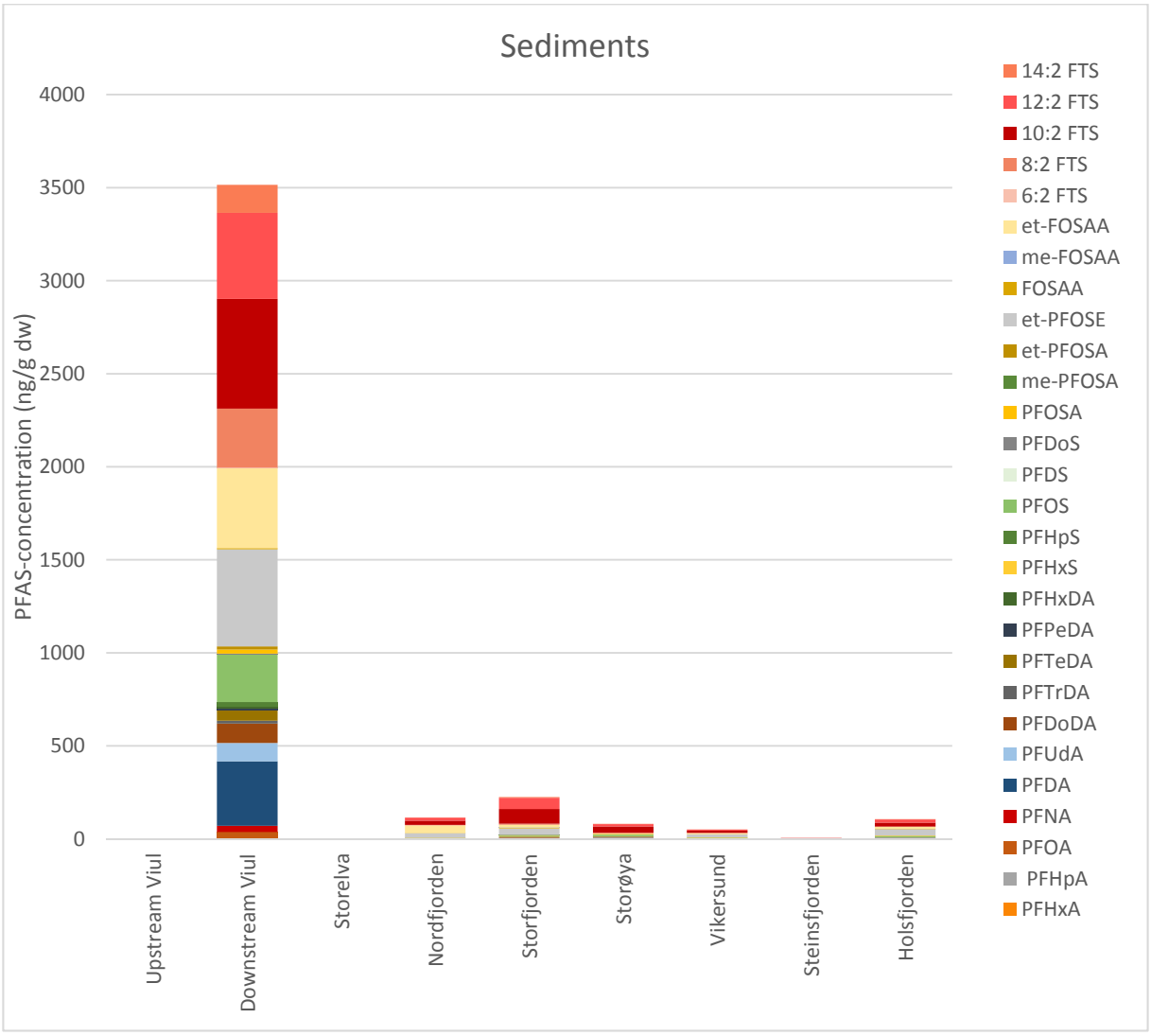

Figure 12. Concentrations of all analysed PFAS averaged for each substance.

Figure 13 shows the average PFAS concentrations by area in Tyrifjorden. The concentrations of PFAS outside the former paper industry site at Viul are further discussed in chapter 4.2.4. The figure shows that the highest concentrations are detected in Storfjorden.

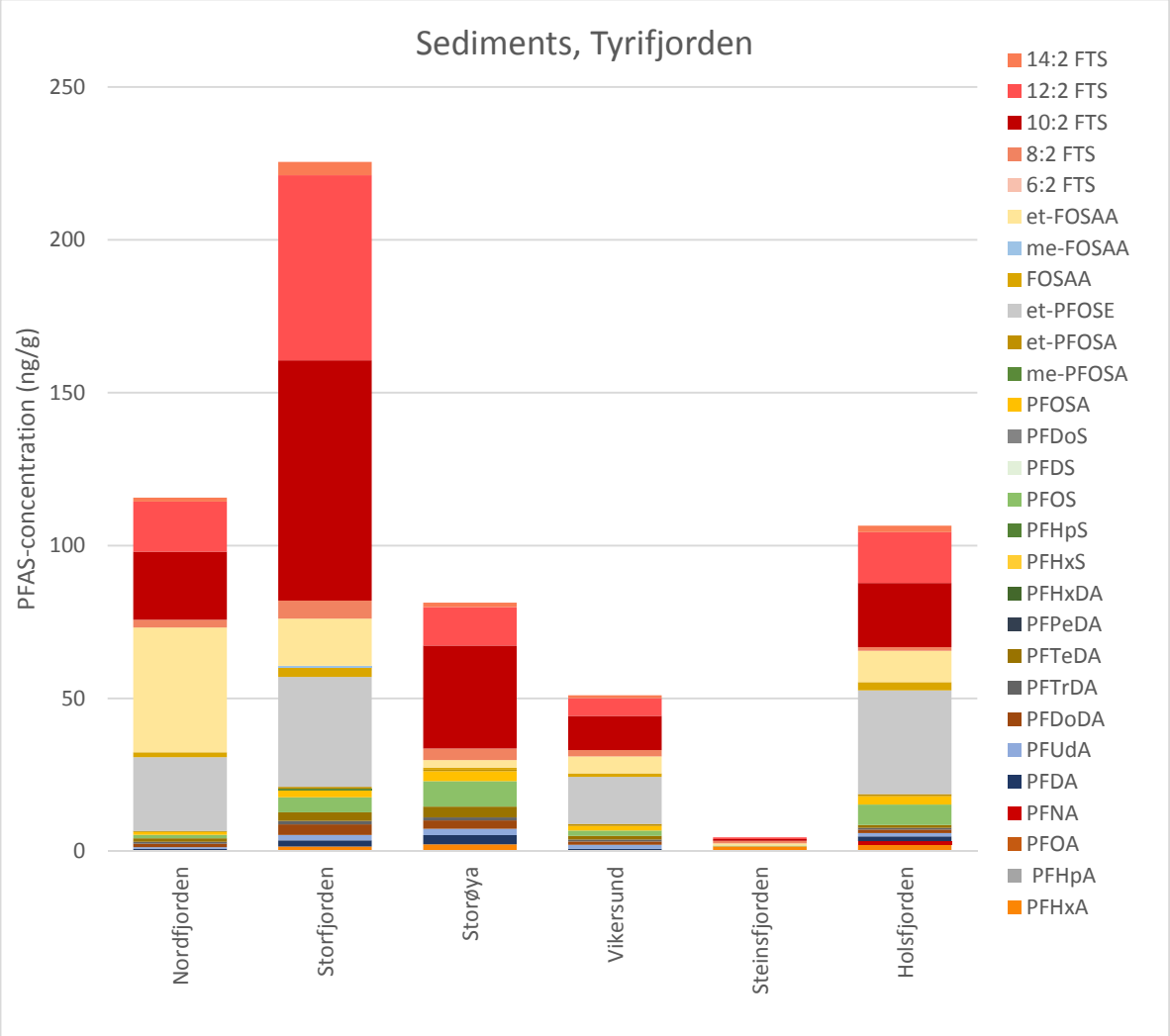

Figure 13. Concentrations of all analysed PFAS averaged for each substance. Results are shown for the areas of Tyrifjorden.

The following figures show PFAS concentration levels detected in each of the individual samples in the different areas of Tyrifjorden. Note that the y-axis on the figures differ because of large variations in detected PFAS concentrations. The sampling stations are shown in map segments from the different areas in Tyrifjorden. In order to understand the naming in the maps, see the list below where X is the number of the samples shown in the resulting figures:

Nordfjorden = Nord X (X: samples 1 to 14)
Storfjorden = Storf X (X: samples 1 to 15)
Storøya = Storø X (X: samples 1 to 21)
Vikersund = Vik X (X: samples 1 to 7)
Steinsfjorden = Stein X (X: samples 1 to 25)
Holsfjorden = Hol X (X: samples 1 to 12)

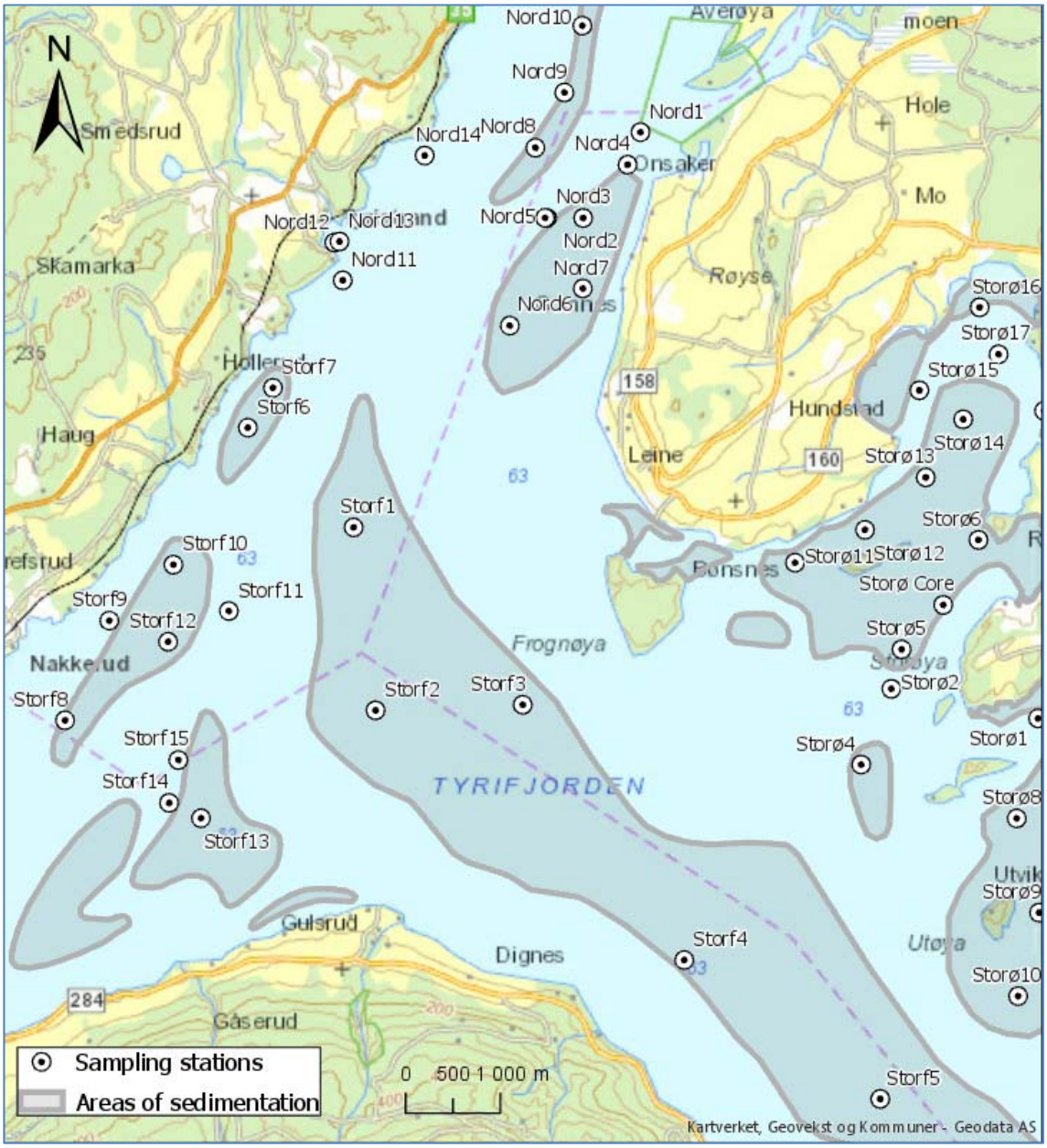

Figure 14. Sampling stations for sediments in Nordfjorden and Storfjorden.

The results from Nordfjorden and Storfjorden (Figure 15) show that there are relatively high PFAS concentrations in many of the sediment stations, although the concentrations vary. The varying concentrations are probably due to different sedimentation conditions within each area. The highest concentrations are found in the Storfjorden area, where stations 1, 2, 3 and 14 are the highest, indicating that there is a lot of sedimentation of PFAS contaminated particles in these areas.

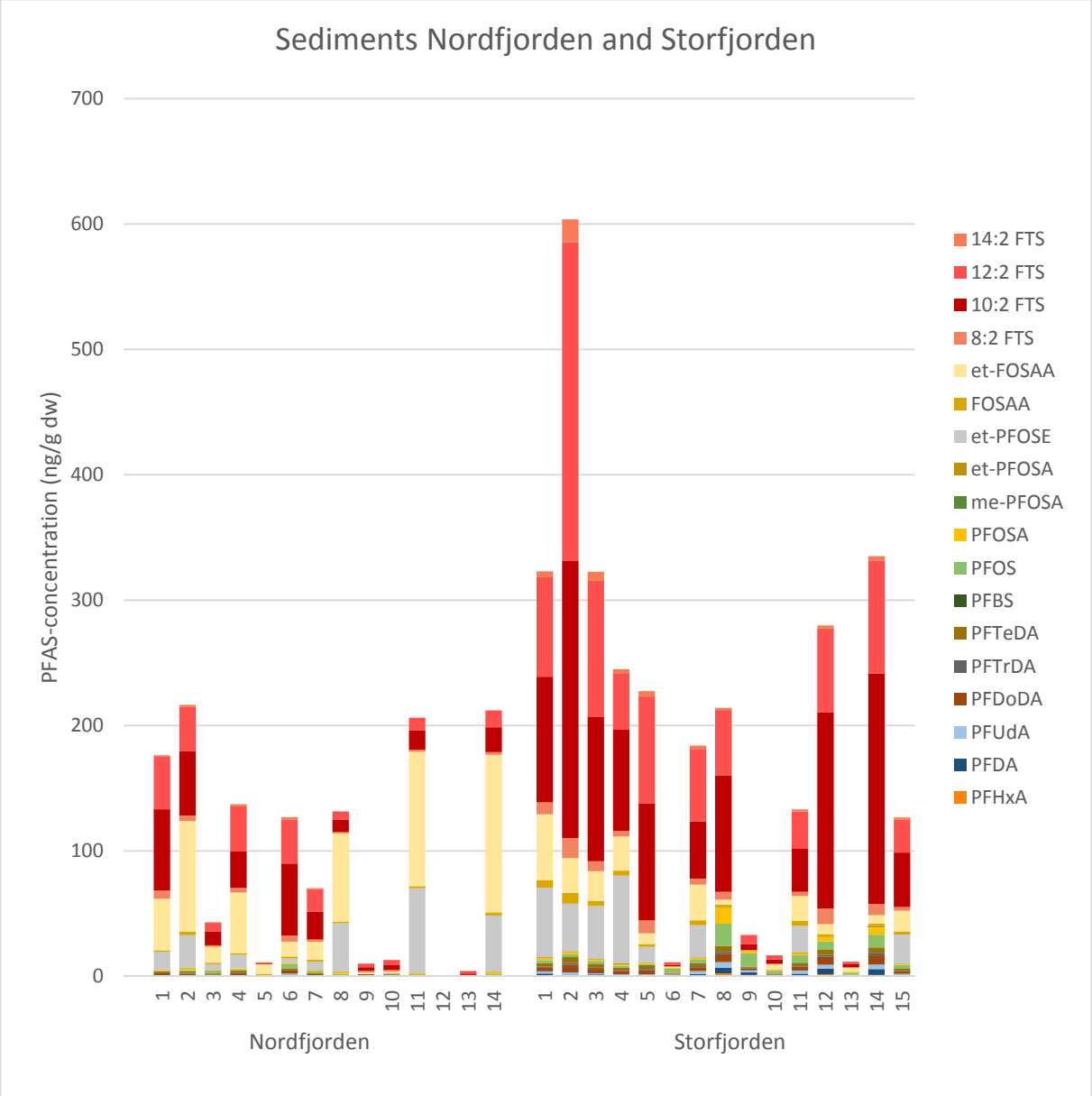

Figure 15. PFAS concentrations in the sampling stations in Nordfjorden and Storfjorden.

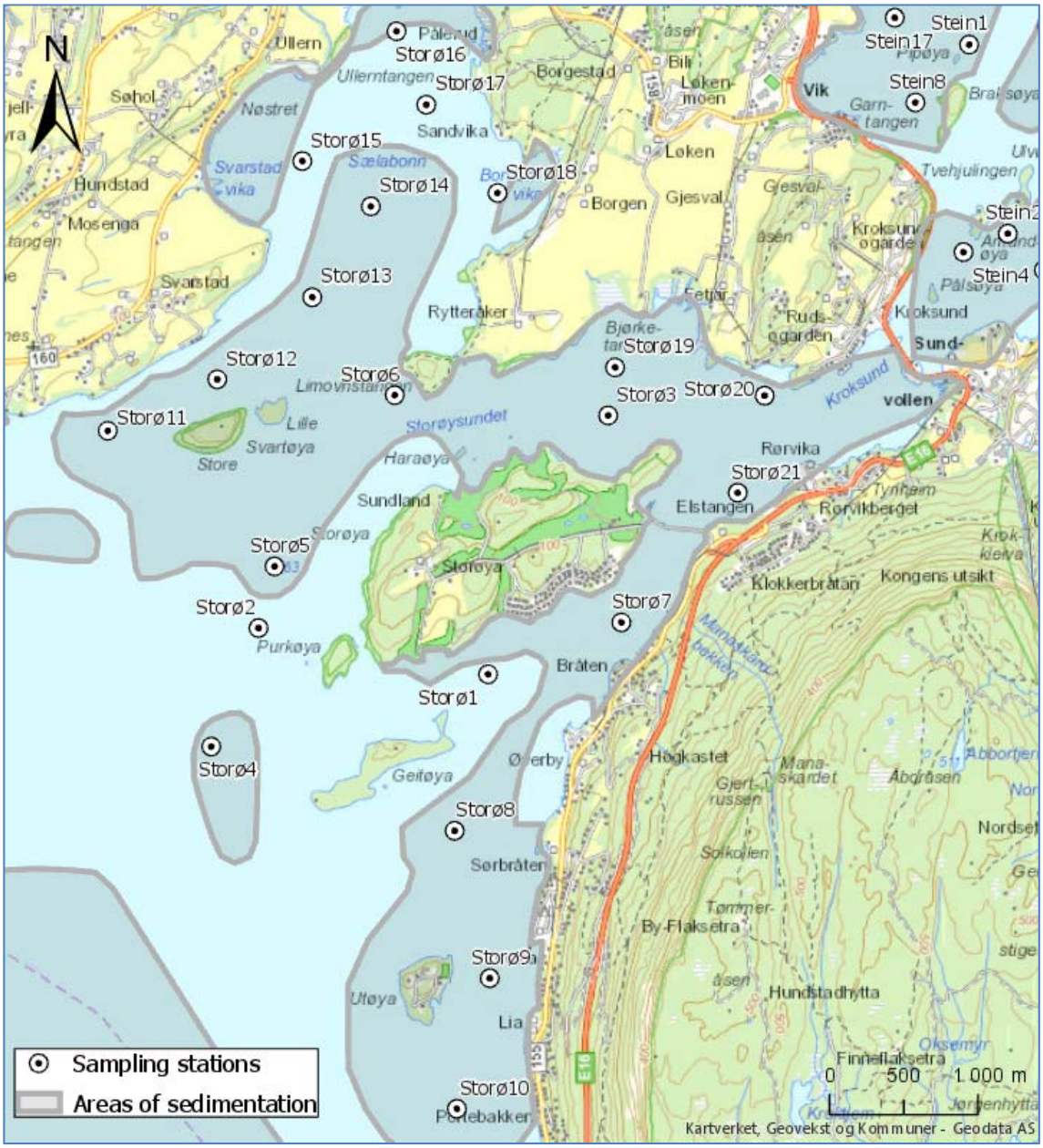

Figure 16. Sampling stations for sediments around Storøya.

The sediment sampling stations around Storøya are shown in Figure 16, and the detected concentrations in Figure 17. There is no clear pattern related to where the highest concentrations are found, but they can probably be linked to the areas where the sedimentation rate is highest. The highest detected PFAS concentrations are found in stations 9, 13 and 11. It seems that the stations with lower concentrations of detected PFAS have more PFOS relative to the detected concentration of PFAS (see for instance stations 7 and 15). This can be due to more favourable conditions for transformation of PFOS precursors into PFOS in areas with less sedimentation.

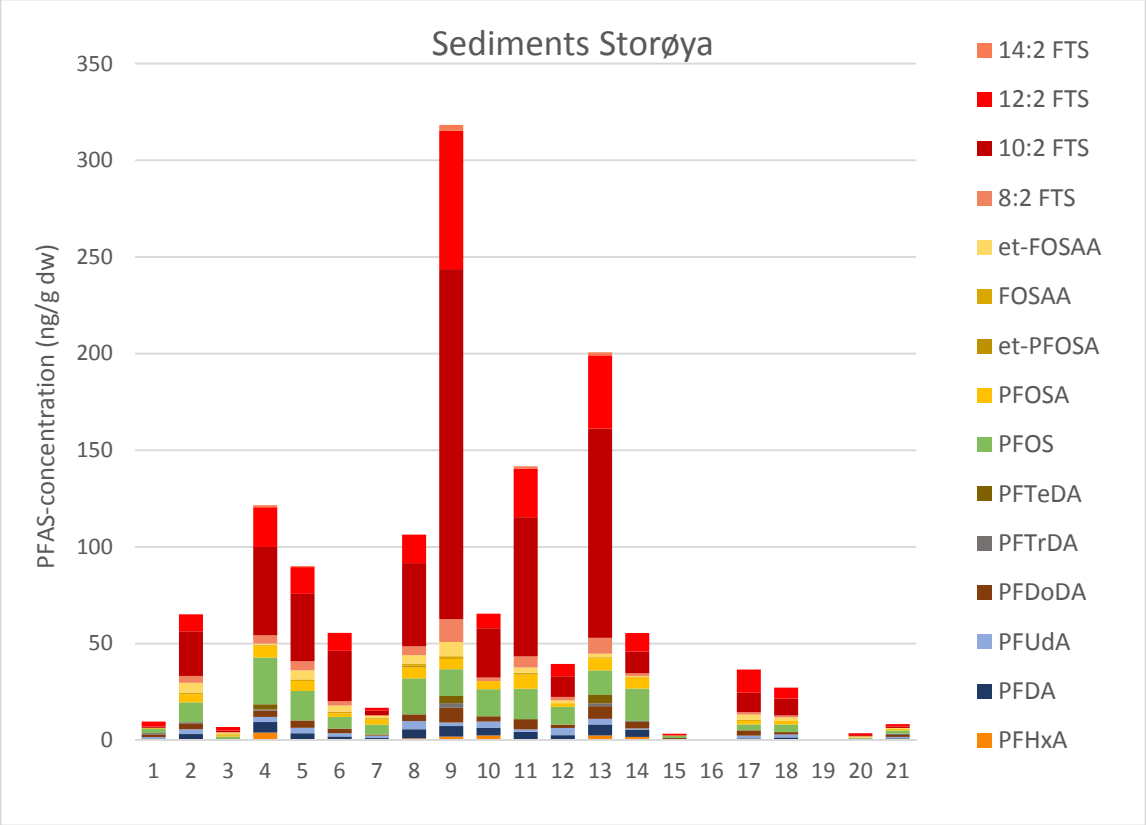

Figure 17. PFAS concentrations in the sampling stations around Storøya.

The sediment sampling stations in the bay towards Vikersund municipality are shown in Figure 18.

Figure 18. Sampling stations for sediments in the bay towards Vikersund municipality.

The highest PFAS concentrations are found in the areas with the probable highest sedimentation of particles (stations 7, 6 and 5), and lower PFAS concentrations are found in the stations in between.

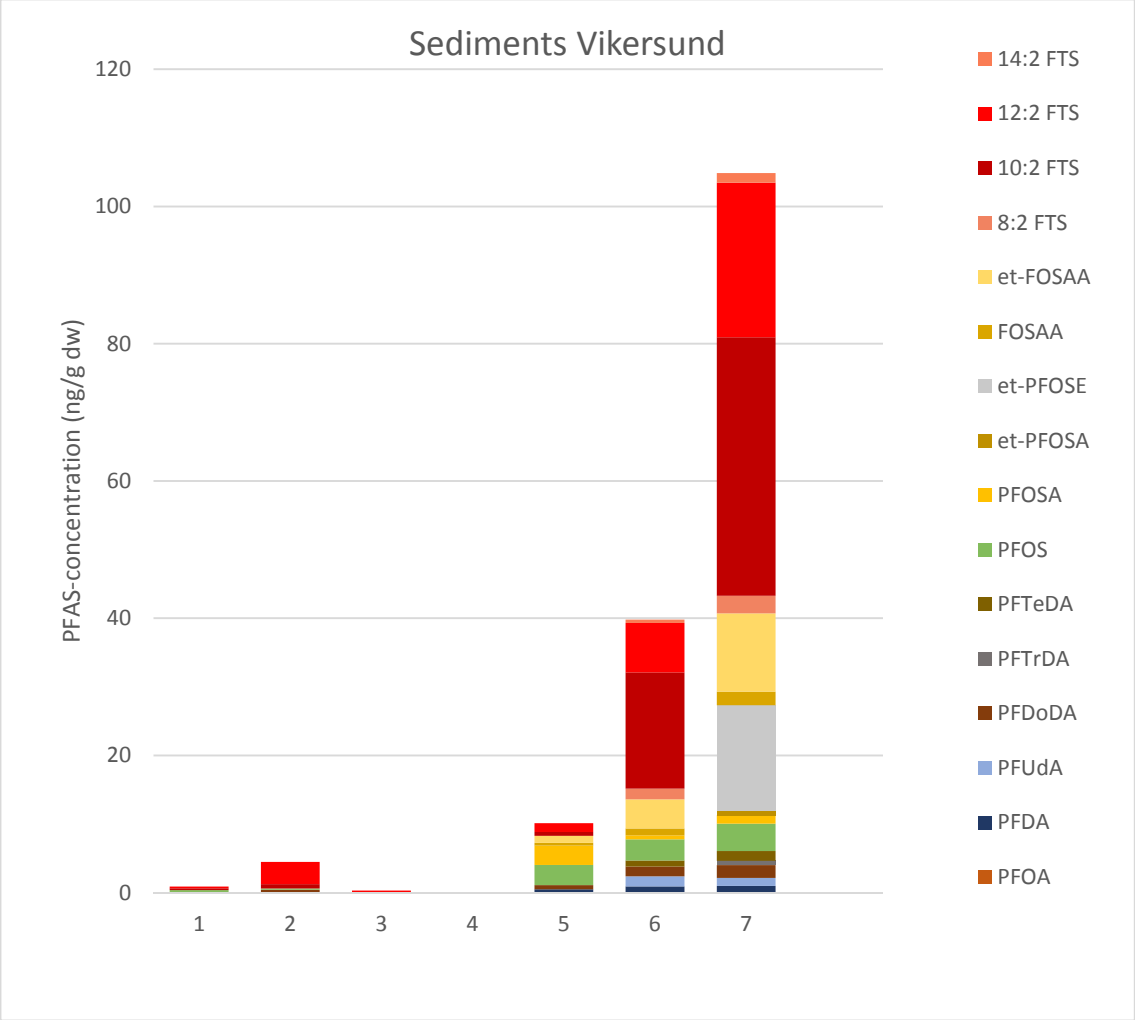

Figure 19. PFAS concentrations in the sampling stations in the bay towards Vikersund.

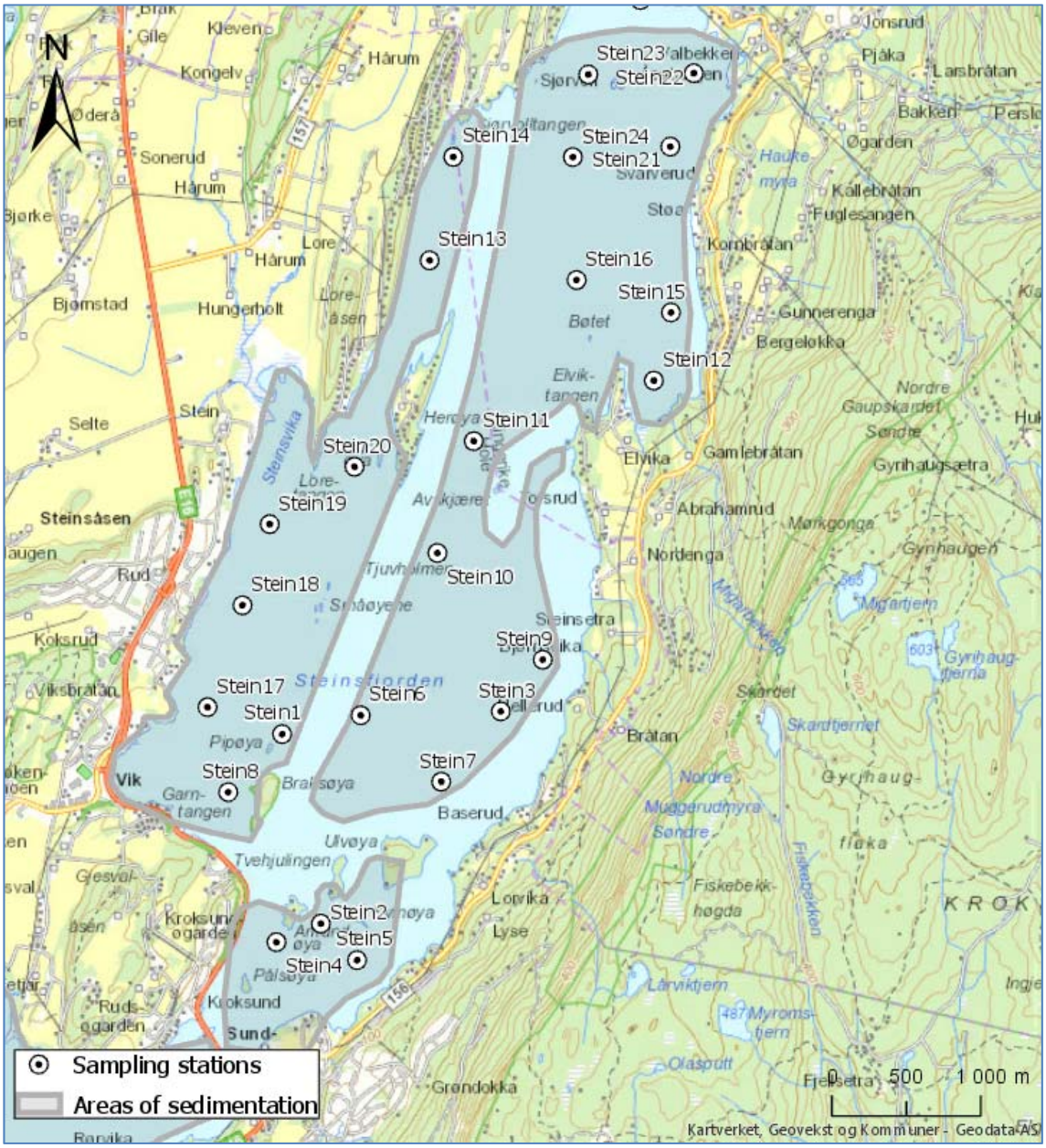

Figure 20. Sampling stations for sediments in Steinsfjorden.

The sediment sampling stations in Steinsfjorden are shown in Figure 20. The concentrations of PFAS in Steinsfjorden are much lower than those found in the other areas in Tyrifjorden, probably due to the limited water transport through the straight separating Steinfjorden from the rest of the lake system. The sampled sediment stations have a very low concentration of PFOS (average 0.3 ng/kg ± 0.095). This indicates that there might not be any distinct point sources of PFOS contamination in the area, rather diffusive sources that are present all around Steinsfjorden (e.g. many small waste water treatment plants or use of biosolids in agriculture). Alternatively the PFAS can come

from spreading with the water masses from Tyrifjorden. Some stations also have detectable concentrations of other PFAS, but there is not a clear pattern to be seen.

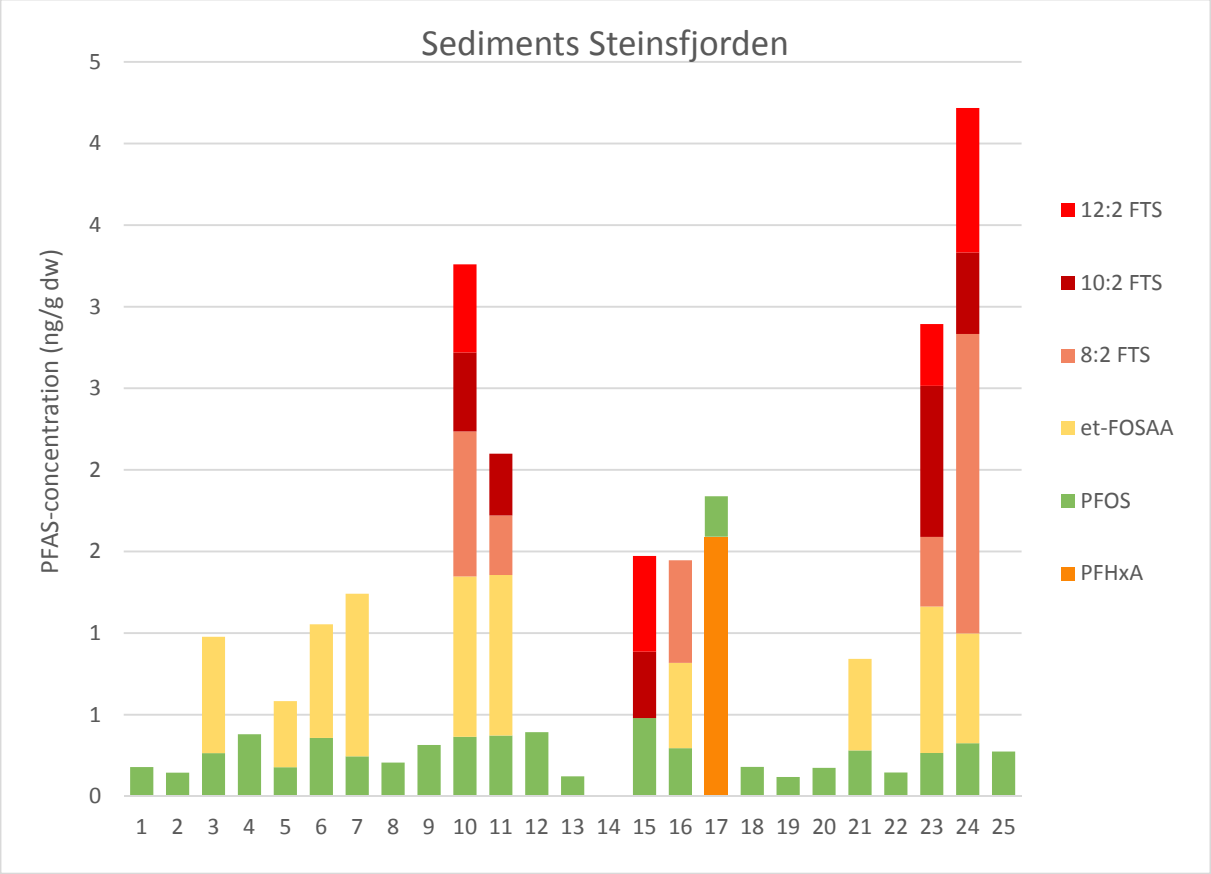

Figure 21. PFAS concentrations in the sampling stations from Steinsfjorden.

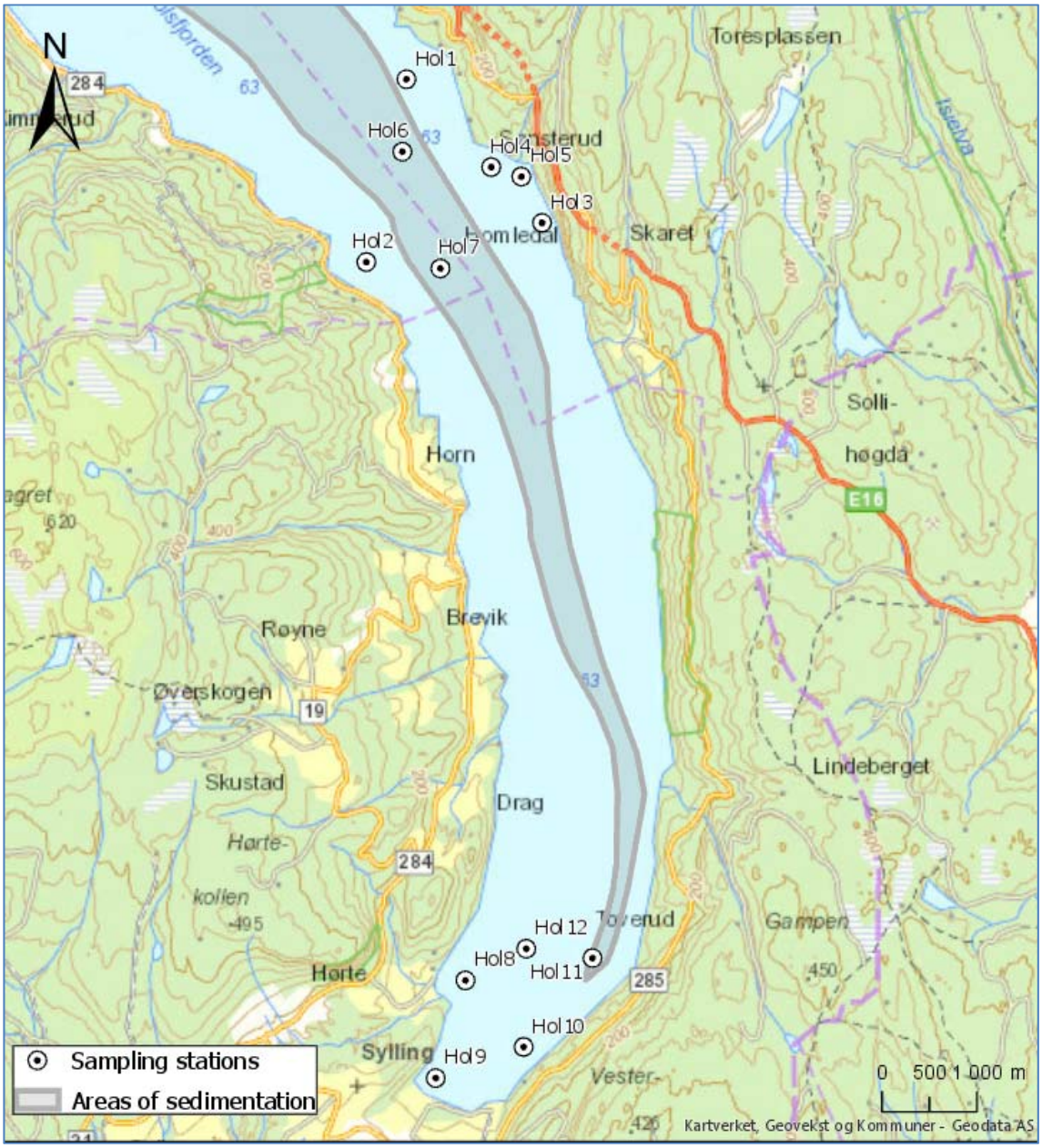

Figure 22. Sampling stations for sediments in Holsfjorden.

Figure 22 shows a map of the sediment stations in Holsfjorden. The highest PFAS concentration is found in sampling station 7, located in the middle of the sedimentation area in Holsfjorden. Closest to the municipality Sylling, the concentration is highest in station 11, also located in the assumed sedimentation area of the fjord. The distribution of PFAS is similar in Holsfjorden to what is observed in Nordfjorden/Storfjorden. It is likely that local PFAS sources (e.g. waste water treatment plants or use of biosolids in agriculture) also contribute to the detected concentrations and distribution.

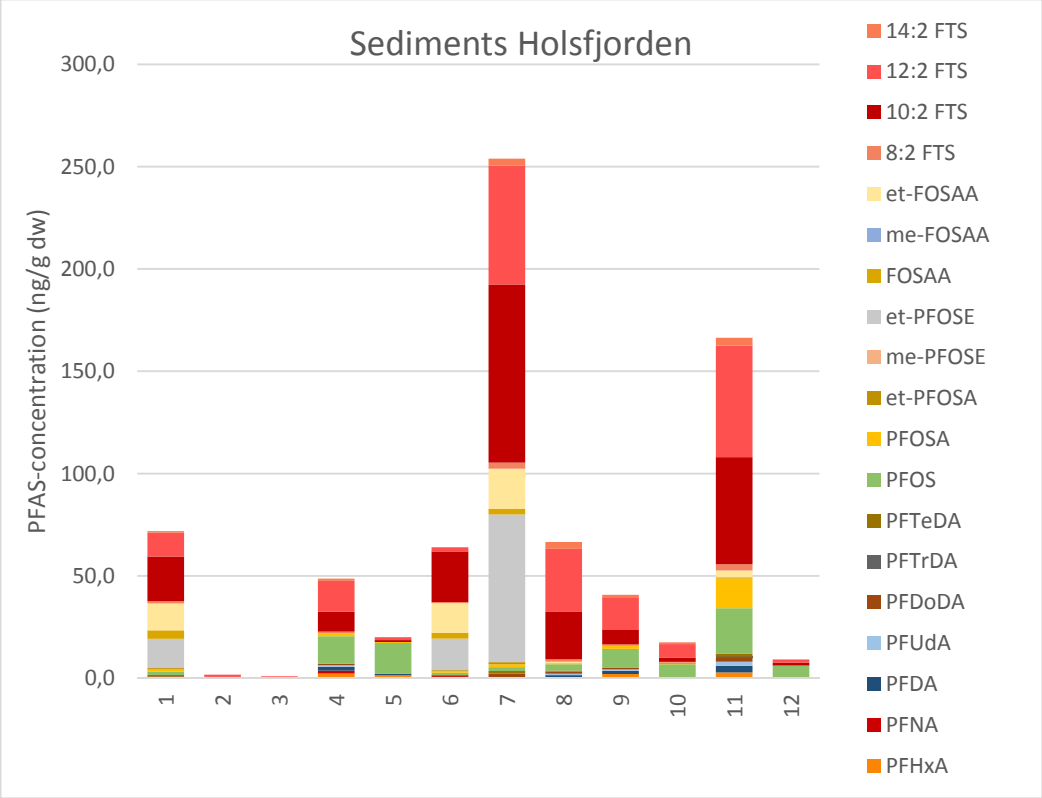

Figure 23. PFAS concentrations in the sampling stations from Holsfjorden.

Br-PFOS is analysed in all the sediments samples in the project. Figure 24 shows the average fraction of linear PFOS (in %) within each area. The results show that most of the detected PFOS in the sediments are linear PFOS, indicating that the more mobile br-PFOS has leaked to the pore water and to the overlaying water body. In many samples, the concentration of PFOS and/or br-PFOS are under the LOQ, which complicates interpretation of the results as well as statistical calculations.

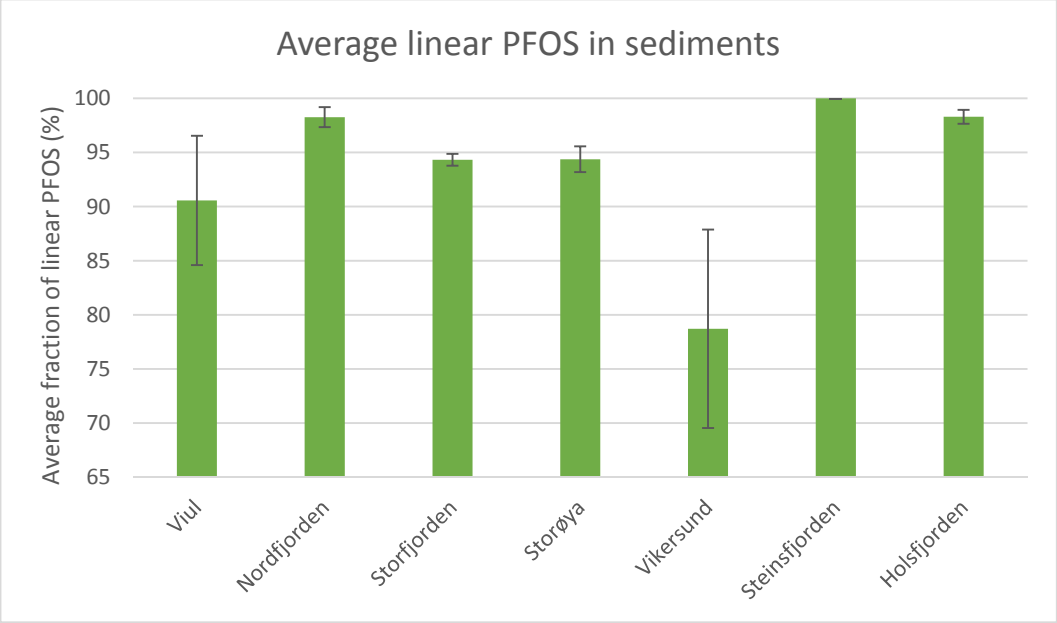

Figure 24. Fraction linear PFOS in sediments, showed as percent linear out of total PFOS (sum of branched and linear PFOS isomers). Error bars show ± standard error of mean (SEM).

4.2.3 Distribution in Tyrifjorden

The concentrations of PFOS in the sediment samples from Tyrifjorden are generally low, and of the other analysed PFSA, only PFBS is detected above the LOQ in one station (in Storfjorden) at a low concentration (0.19 ng/g dw). The areas which can be expected to affect detected PFOS concentrations are those around Storøya and in Holsfjorden (both the inlet and in the bay by Sylling). The concentration levels of PFSA in sediments are shown in Figure 25.

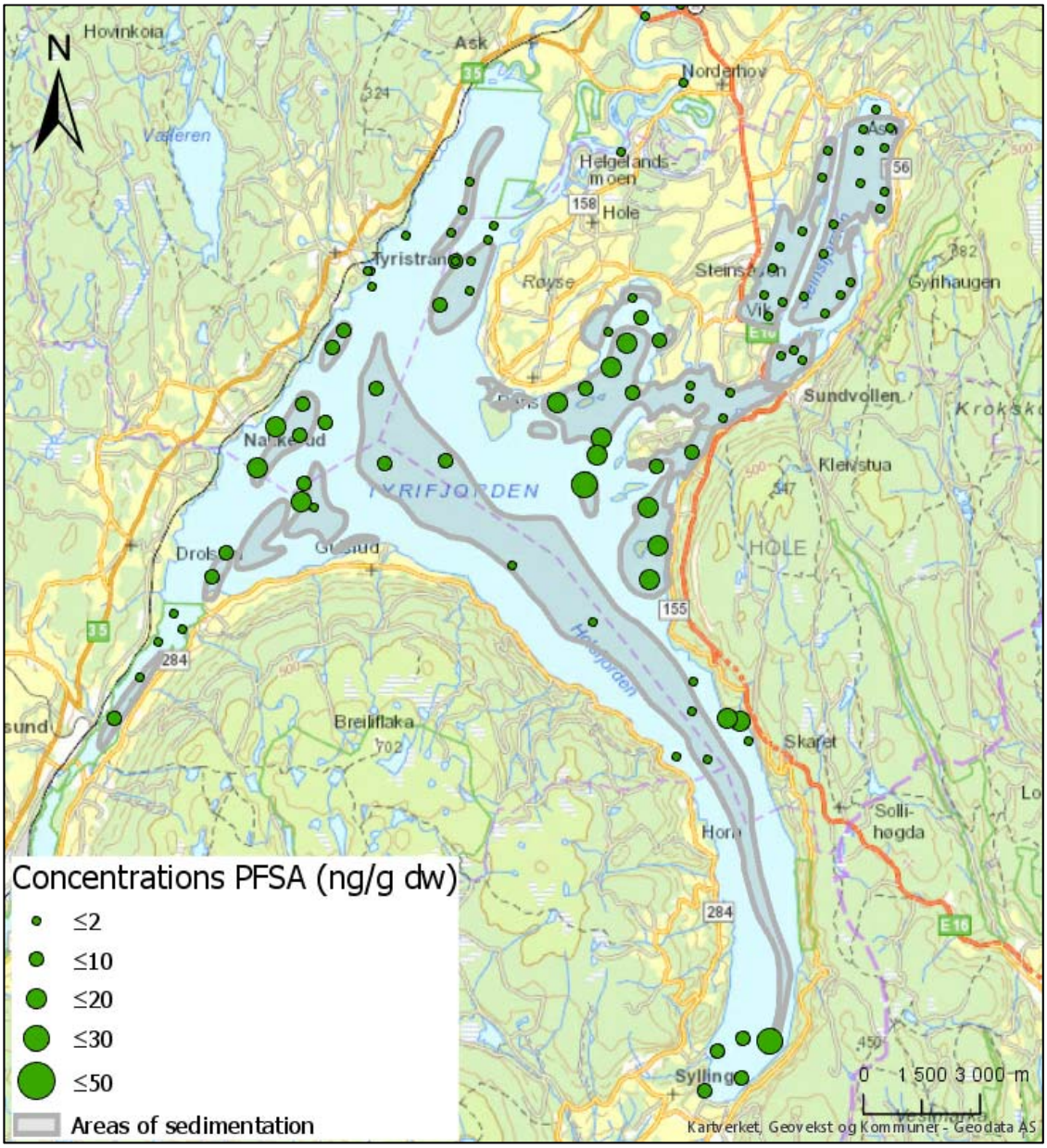

Figure 25. Concentrations of PFSA in Tyrifjorden. Symbology shows increasing concentrations with increasing size, as shown in the legend.

Detected concentrations of PFCA are shown in Figure 26. There are generally low concentrations of this PFAS group, but with slightly higher concentrations around Storøya and in Storfjorden towards the outlet by Vikersund (up to 50 ng/g dw in some of the sediment stations).

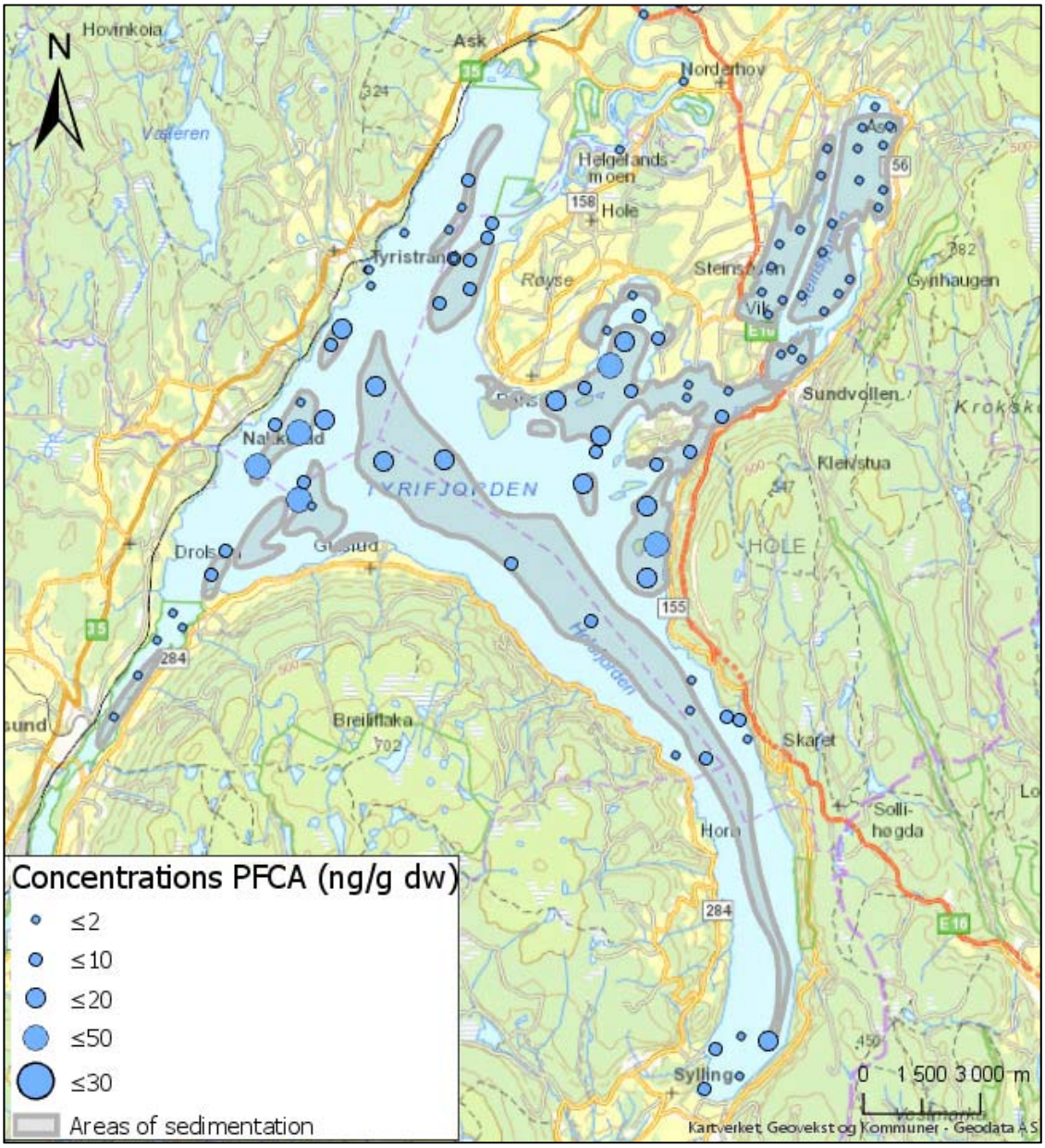

Figure 26. Detected concentration of PFCA in Tyrifjorden. Symbology shows increasing concentrations with increasing size, as shown in the legend.

The concentrations of preFOS are shown in Figure 27. Detected sediment concentrations show that these substances are spread from Storelva and into the lake. Relatively high concentrations are found in the sedimentation area in Storfjorden, indicating that these substances follow the expected main distribution pattern in the lake.

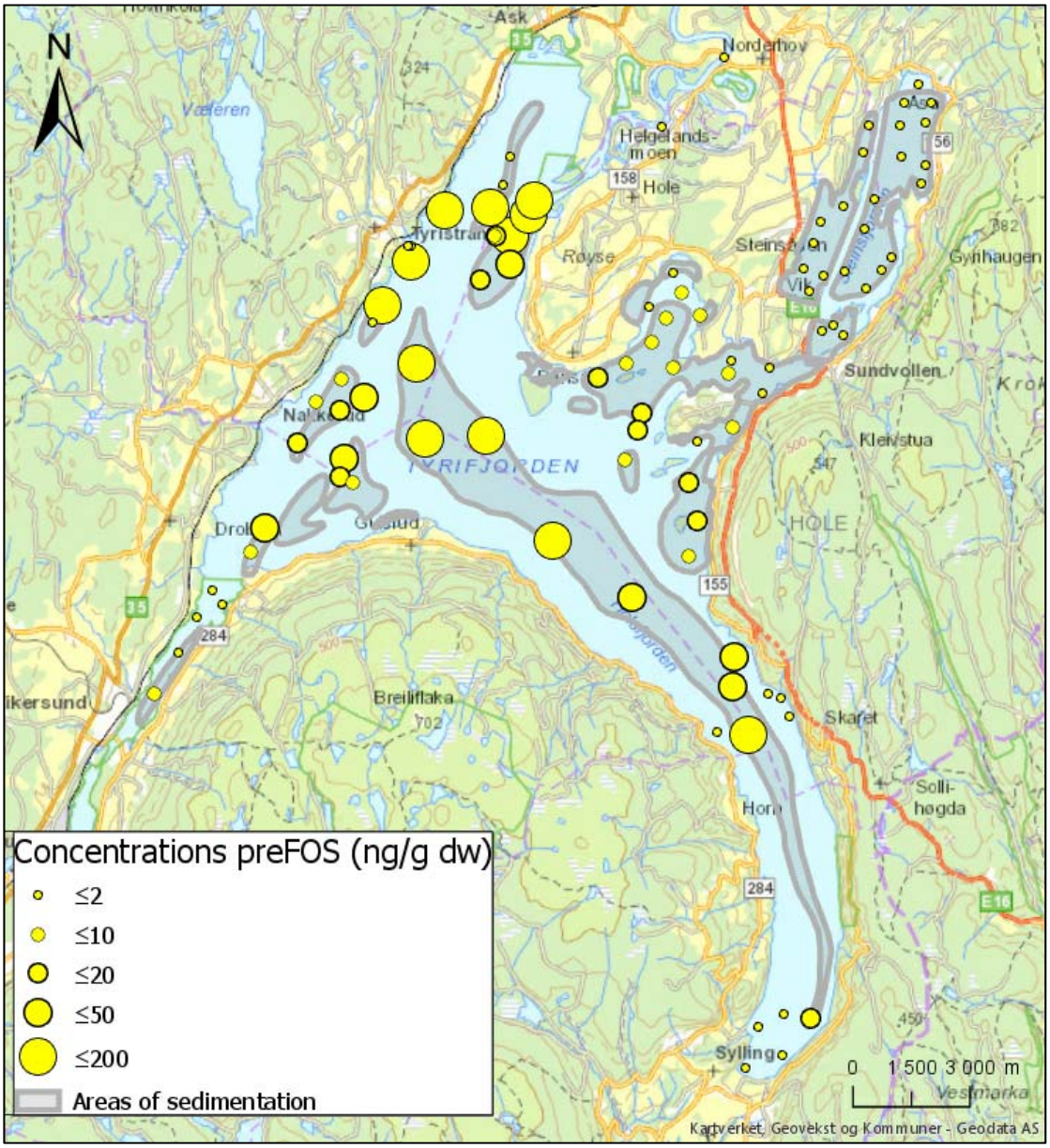

Figure 27. Concentrations of preFOS in Tyrifjorden. Symbology shows increasing concentrations with increasing size, as shown in the legend.

Concentrations of FTSA are shown in Figure 28. This group, and especially the long-chain constituents (10:2 FTS and 12:2 FTS) dominate the distribution of PFAS. The concentrations are especially high near the outlet of Storelva, and in the sedimentation areas in Storfjorden.

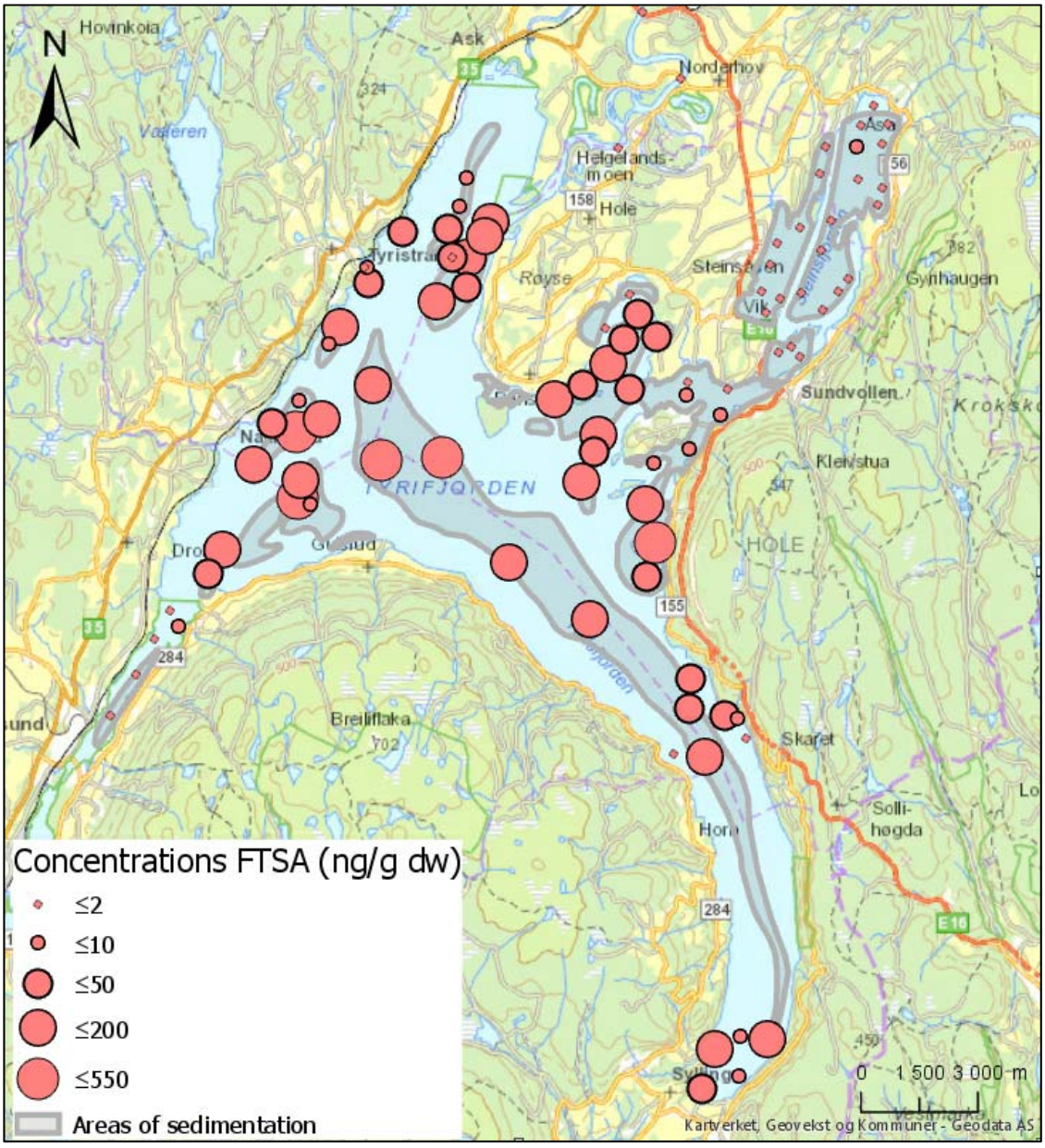

Figure 28. Concentrations of FTSA in Tyrifjorden. Symbology shows increasing concentrations with increasing size, as shown in the legend.

4.2.4 Concentrations levels at Viul

The sampling stations for sediments that represent the area considered as the output from the former paper industry site at Viul are shown in Figure 29, and in in Figure 30 a blow up of the sampling area right outside the factory is shown.

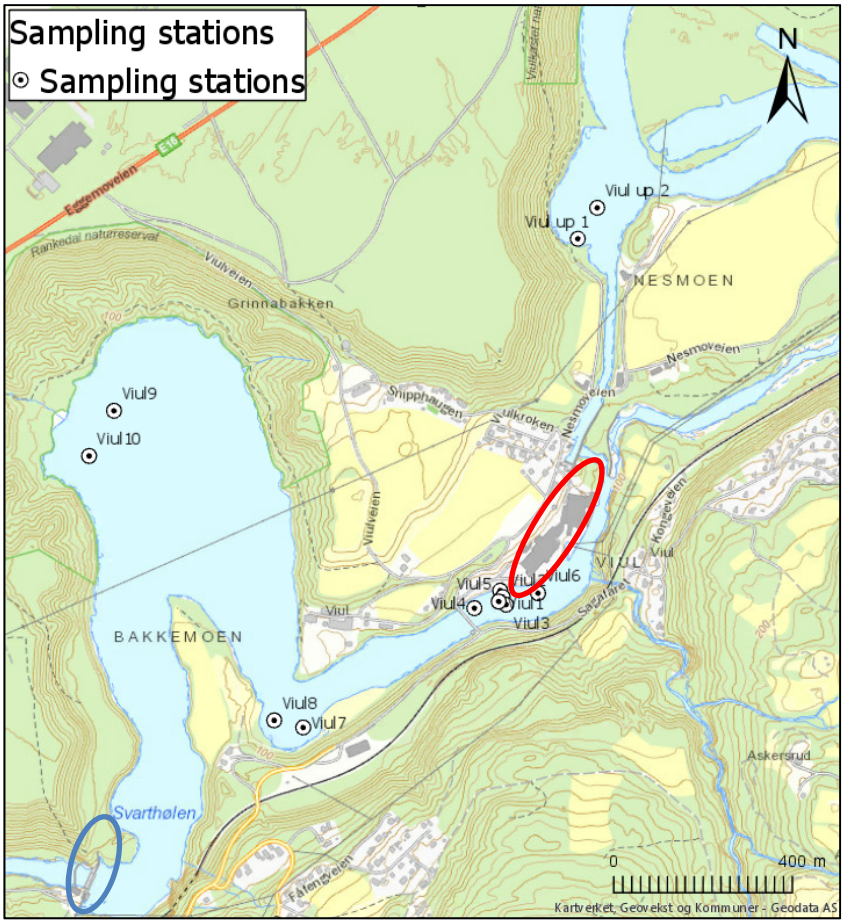

Figure 29. Sediment samples in connection to the former paper industry site at Viul. The factory is shown with a red outline, and the Viul dam with a blue outline.

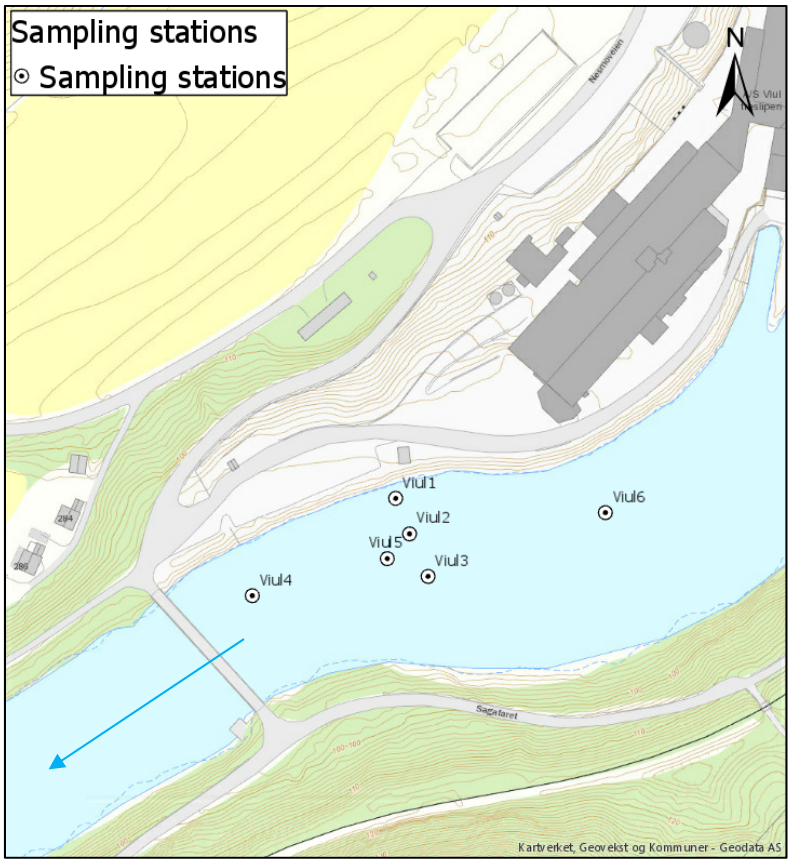

Figure 30. Sampling stations right outside the industry area. The blue arrow indicates the direction of the water in the river.

The results show that the sample named Viul 2 contained the highest concentration of PFAS, with a Σ_{53} PFAS of almost 14 000 ng/g dw. Samples Viul 1 and Viul 10 also had high concentrations of PFAS, while the other sampling stations showed lower concentrations (Figure 31).

In the upstream samples, only a very low concentration of PFHxS was detected.

The results indicate that the high concentrations of PFAS seen in the sediments right outside the industrial area most likely limited to a relatively small area. Since the PFAS concentration in Viul 10 was high, it is very likely that the contamination has migrated downstream, carried by the river water. The extent of this downstream contamination is not known and should be further investigated. The investigation should include a study of the sedimentation pattern in the meandering river course, and sampling and PFAS analysis in the areas identified as sedimentation areas. It is probable that a lot of the particulate material is collected before the Viul dam (see Figure 29).

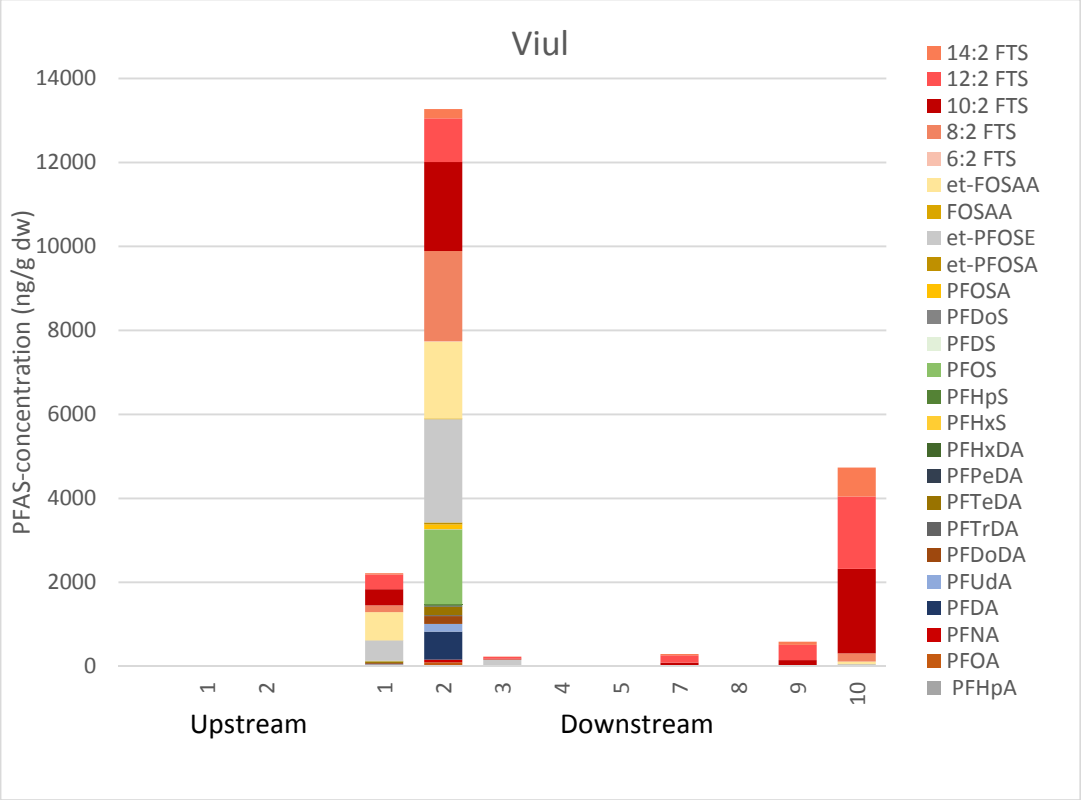

Figure 31. Concentrations of PFAS in the sediments upstream and downstream the former industry site at Viul. Det er analysert for de samme forbindelsene i alle prøvene som er vist i figuren. Forskjellene representerer sannsynligvis at det er stor forskjell mellom ulike steder rett nedstrøms Viul. Oppstrøms Viul (Upstream 1 og 2) er det kun påvist PFHxS; 1,49 og 2,17 ng/g. I stasjon 4 er det påvist 0.14 ng/g lineær PFOS, 0.1 ng/g PFOSA, 0.3 ng/g 8:2 FTS, 1.2 ng/g 10:2 FTS, 2.0 ng/g 12:2 FTS. I stasjon 5 er det ikke påvist noe over LOQ. I stasjon 8 er det påvist 1.37 ng/g PFHxS, 0.3 ng/g 8:2 FTS, 0.7 ng/g 10:2 FTS, 1.4 ng/g 12:2 FTS, 0.4 ng/g 14:2 FTS.

4.2.5 Total organic carbon (TOC) and grain size

Some sediment samples from each area were analysed for the content of total organic carbon. Figure 32 shows the TOC content of the analysed sediment samples, where the samples from Nordfjorden and Storfjorden had the highest TOC content. This can be linked to the nature of the contamination from the paper industry upstream, where it is probable and was also observed by local people in the area that the industry periodically discharged paper mass into the rivers. The paper mass will have a high carbon content due to its chemical nature. These are also the areas where the highest PFAS concentrations in Tyrifjorden were detected.

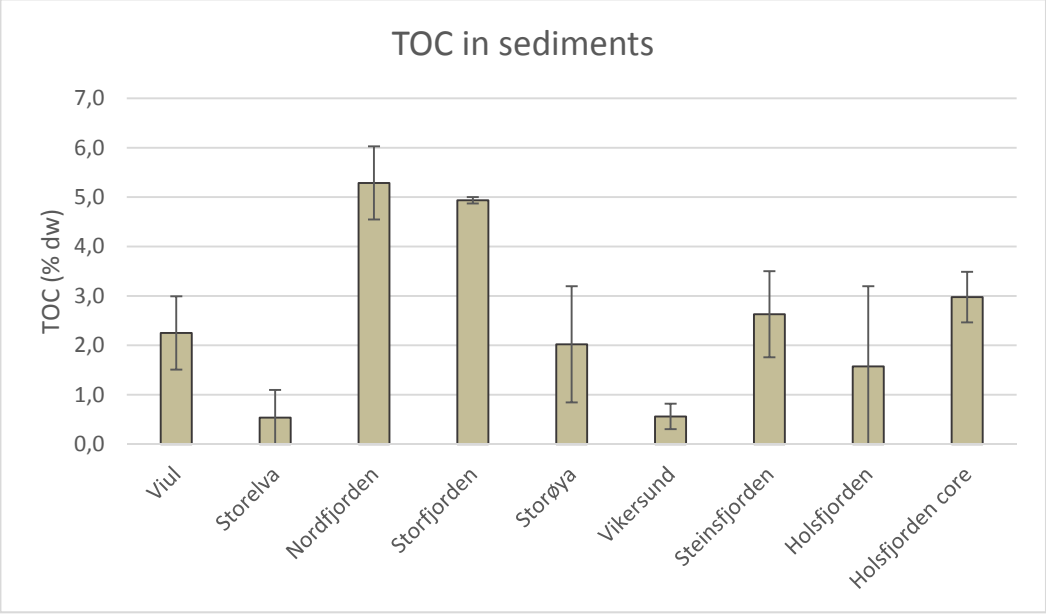

Figure 32. TOC content of sediments from different areas of the rivers and Tyrifjorden.

The grain size distribution for the same sediments are shown in Figure 33. The results are shown as percent of the whole sample, where it is assumed that sand (>63 µm) and silt/clay (<63 µm) are the main constituents of the sediment samples, as the sum of these fractions was 100 %.

Figure 33 shows that the river sediments and the sediments in the bay towards Vikersund and Storøya have a higher sand content than fine grained material (silt and clay). For some areas, the grain size distribution can be linked to the concentration of PFAS. For example, PFAS is not detected in the sediment samples from Storelva, and these sediments are mostly sand. This is however not the case for the sediments at Viul. At Viul, an important driving factor for PFAS sorption and thus observed PFAS concentrations may be the oil contamination at the site (see Miljødirektoratet, 2017 for details). Oil represents an additional adsorption phase for PFAS which results in high concentrations despite the low content of fine grained material.

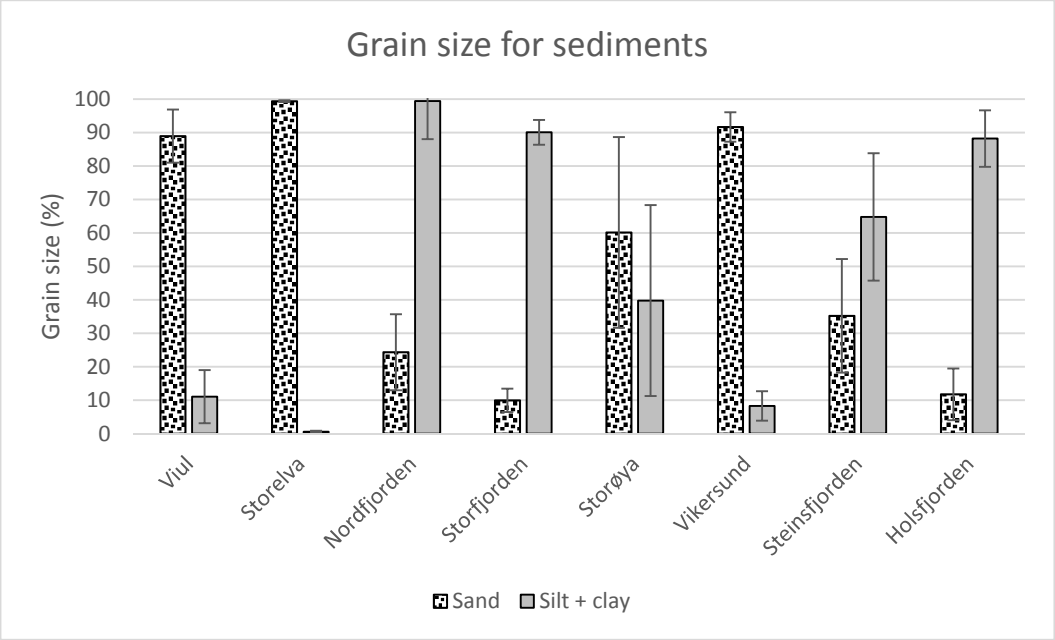

Figure 33. Grain size distribution for sediments from the river system and different areas of Tyrifjorden.

4.3 Sediment dating

One sediment core from outside Storelva was dated using the occurrence of the natural Pb-210 isotope. This is the area in Tyrifjorden where the sedimentation rate is expected to be highest, and this is also the area where the highest concentrations of PFAS are expected due to the sources upstream.

Pb-210 is present in the sediments because uranium in the earth's crust produces radon gas, which further decays to Pb-210 in the atmosphere. Pb-210 follows precipitation back to the ground, is adsorbed to particulate matter, transported to water and becomes part of the sediments. The Pb-210 isotope has a half-life of 22 years, and by analysing the remaining isotope in the sampled sediment, the year of sediment deposition can be determined.

The sediment core was divided into 15 slices (1 cm slices, each data point in the figures represent 1 cm), and the same slices were both dated using the Pb-210 content and analysed for PFAS. The results are shown in Figure 34.

The results show that preFOS and FTSA dominate the PFAS distribution, but at different times. While the preFOS concentrations peaked in the middle of the 1980s, the concentrations of FTSA were highest in 2006. After 2006, there is a decline in PFAS concentrations. The shift from preFOS to FTSA is probably linked to the phase-out of PFOS and related substances, initiated by 3M in 2002 (Benskin et. al, 2013). Cheremisinoff (2017) report that when PFOS or preFOS was phased out of containing

products (for instance Scotchguard, Baygard and Zonyl), the producers switched to the use of fluorotelomers (e.g. FTSA) instead. This can be seen in a sample of a paper plate obtained from the paper factory at Viul, dated to 2007, where FTSA and PFCA are both detected (Figure 56). The decline of FTSA is likely linked to the closure of the paper factory at Viul in 2013.

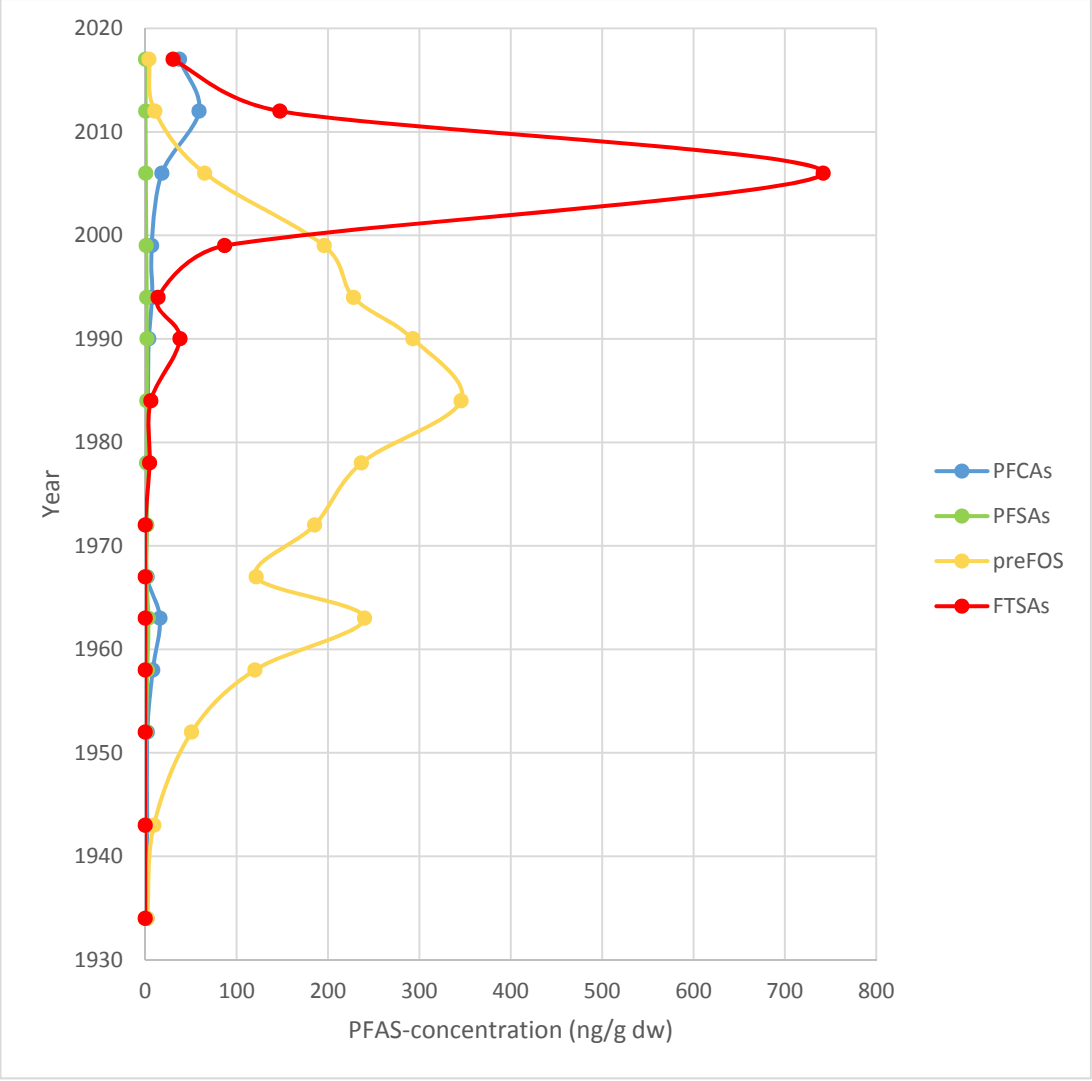

Figure 34. PFAS concentrations in relation to the year of deposition of the sediment in the sediment core from Nordfjorden.

Figure 35 shows the concentrations of all detected PFAS in the sediment core. The results show the same picture as the previous figure; when the amounts of preFOS decreased, the amount of FTSA increased. The total concentration of PFAS was observed to decreased after its peak in 2006.

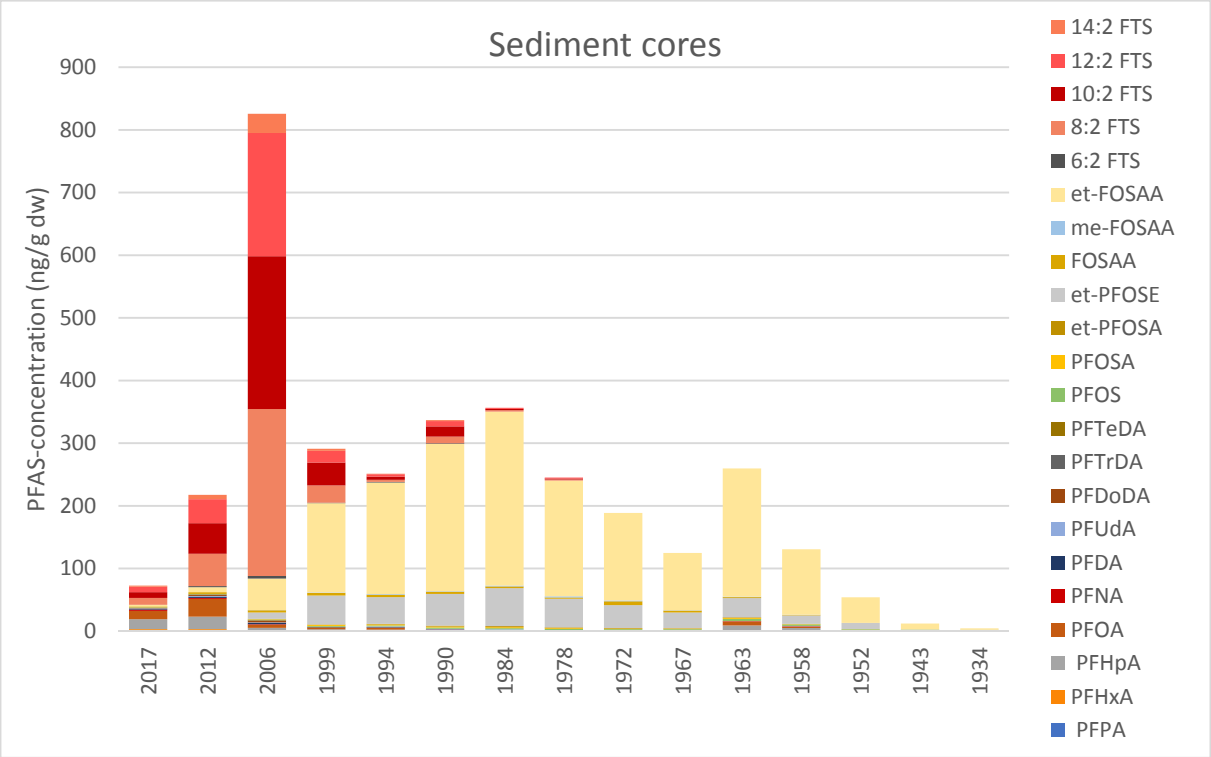

Figure 35. Detected PFAS concentrations in the core from Nordfjorden shown by year of deposition.

The PFAS SAmPAP diester (SAmPAP), was also analysed in the sediment core samples. During the project, there was increasing suspicion towards the contribution of this chemical to overall PFAS burdens, since it was widely used in paper industry and is known to degrade to preFOS and further to PFOS (Benskin et al, 2013). Only a few sediment samples in the project were analysed for this substance, as it was not a part of the initial scope of analysis. As no standard was available for the laboratory at the time of analysis, SAmPAP was quantified against PFOS and is therefore probably an underestimation of real concentrations. Despite this, the results of the analysis indicate that this substance follows the same pattern as preFOS. The highest concentration was detected in the middle of the 1980s, after which it declined. The results from the analysis can be found in appendix H.

A sediment core sample from Holsfjorden was also analysed for PFAS, but was not dated. As the sedimentation rate is probably different in Holsfjorden compared to outside the Storelva outlet, the dating information from the Nordfjorden core cannot be used for Holsfjorden. The concentration levels of PFAS are therefore shown at the sampling depths. The vertical distribution of PFAS in Holsfjorden was different from the distribution in Nordfjorden (shown in Figure 36). In Holsfjorden, concentrations increased towards the top of the core. In addition, PFCA were the dominating PFAS group in the top slice. This can be due to a time effect of spreading from Storelva. If that is the case, there is a possibility that the sediment concentrations in Tyrifjorden (except

in Nordfjorden) will continue to increase before cleaner particulate material reaches the outer parts of the lake. The dominance of PFCA may however also be due to other and more local sources of PFAS contamination.

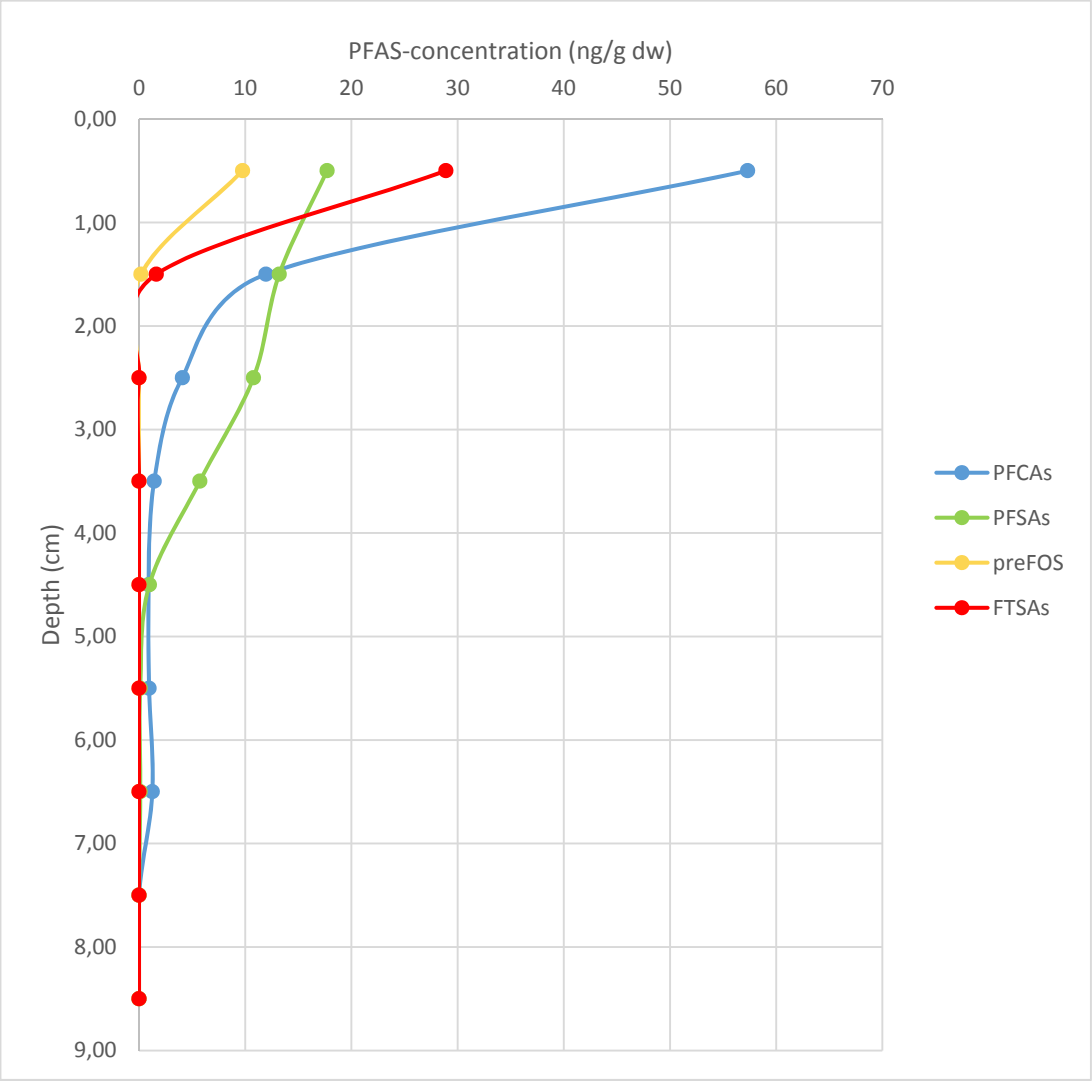

Figure 36. PFAS concentrations in relation to sampling depth in the sediment core from Holsfjorden.

4.4 Sediment traps

The sedimentation rate in the area of deployment was calculated using the deployment time and the area of the sediment trap, and using a sediment specific weight of 1.4 g/cm^3. Sedimentation rates are shown in Table 7. As shown in the table, very small amounts of material were deposited in the traps. There is a higher uncertainty when analysing small samples compared to larger samples, because of the uncertainty of the representativeness of the material present.

Table 7. Sedimentation rate for each of the sediment traps.

Name	Sampling site	Dry material (g)	Deployment (days)	Sedimentation rate (kg/m²·yr)	Sedimentation (cm/yr)
Trap 1	Upstream Viul	1.88	56	1.6	0.11
Trap 2	Downstream Viul	0.23	56	0.19	0.014
Trap 3	Storelva, by Busund	1.13	61	0.86	0.062
Trap 4	Storelva, by Helgelandsmoen	0.96	61	0.73	0.052
Trap 5a	Outlet Storelva, parallell A	0.62	56	0.51	0.037
Trap 5b	Outlet Storelva, parallell B	1.97	56	1.6	0.12
Trap 6	Bay towards Vikersund	0.31	56	0.26	0.018

The results from the two sediment traps outside Storelva show sedimentation rates within the same range as the sedimentation rates calculated from the dated core (Core: 0.18 ± 0.04 cm/yr; Trap 5b: 0.12 cm/yr). The difference can be ascribed to the following; variation in local sedimentation rates, variation in sedimentation with water flow and variation in water flow with season. The yearly variation is relevant since sedimentation in the sediment trap is limited to the deployment time (5th of July to 30th of august 2018, and the summer of 2018 was unusually dry, probably leading to less transport of sediments in the rivers), while the sediment core takes in to account sedimentation that occurred from 1934.

The concentrations of PFAS in the settling particles are shown in Figure 37, where the traps are shown from upstream to downstream (left to right). The trap nearby Viul exhibits the lowest concentrations, possibly due to the low amount of dry material in this trap, indicating that the deployment site was not that of highest sedimentation.

There is some indication of sedimentation of PFAS contaminated particles through the Storelva river, since both trap 3 by Busund and trap 4 by Helgelandsmoen contain sediments that are contaminated. The results further indicate that the main deposition of contaminated sediments occurs outside the outlet of Storelva (trap 5a and 5b).

Interestingly the distribution of PFAS is also similar in trap 6 (in a bay towards Vikersund), indicating that the material and therefore also the PFAS profile in the trap originates from Storelva. This shows that the assumed main distribution area probably carries the PFAS contaminated sediments from Storelva to the rest of the Tyrifjorden area, though the highest concentrations are found closest to the outlet. This is also in accordance with the results from the sediment samples, where the samples from

Nordfjorden and Storfjorden contain higher concentrations of PFAS than those found in the other areas in Tyrifjorden.

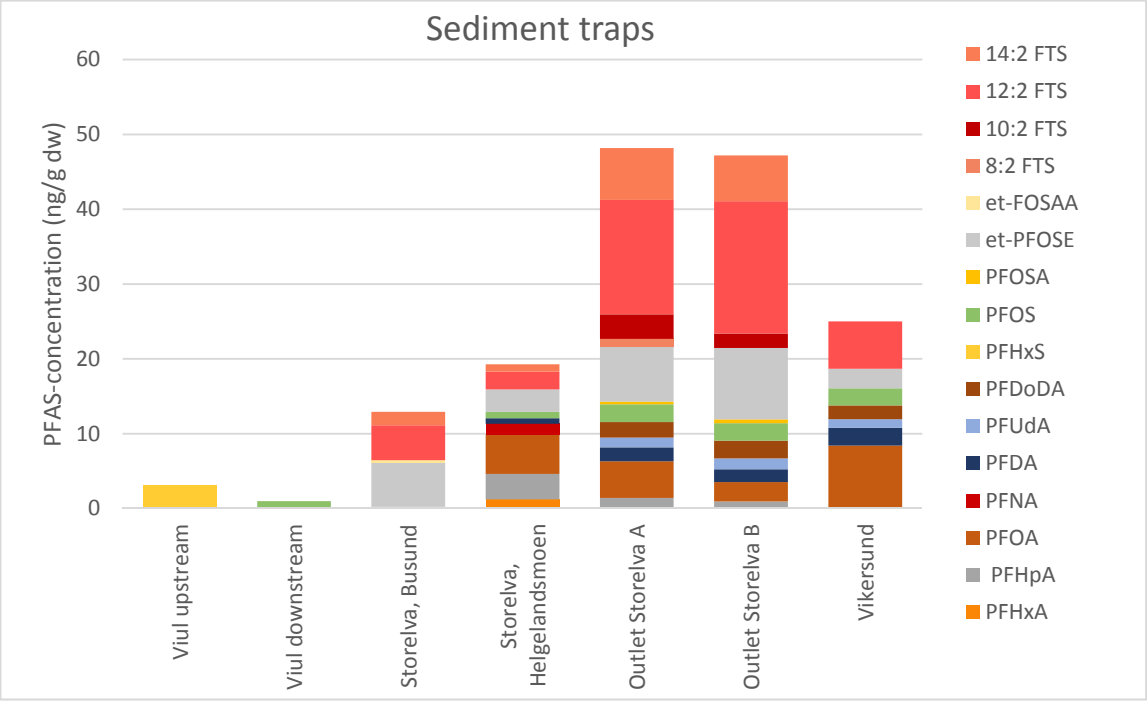

Figure 37. Detected concentrations of PFAS in the sediment traps.

Figure 38 shows a comparison of the PFAS concentrations found in the trap outside Storelva (Trap Storelva A and B), the top two slices of the core sample (Core sample 1 cm and 2 cm) and the sediment sample closest to the core sample (sediment sample 2 cm, Nordfjorden 1 in Figure 15). The distribution of PFAS in the samples is similar and likely reflects the probable distribution and concentration level of the "new" sediment on the surface in the area.

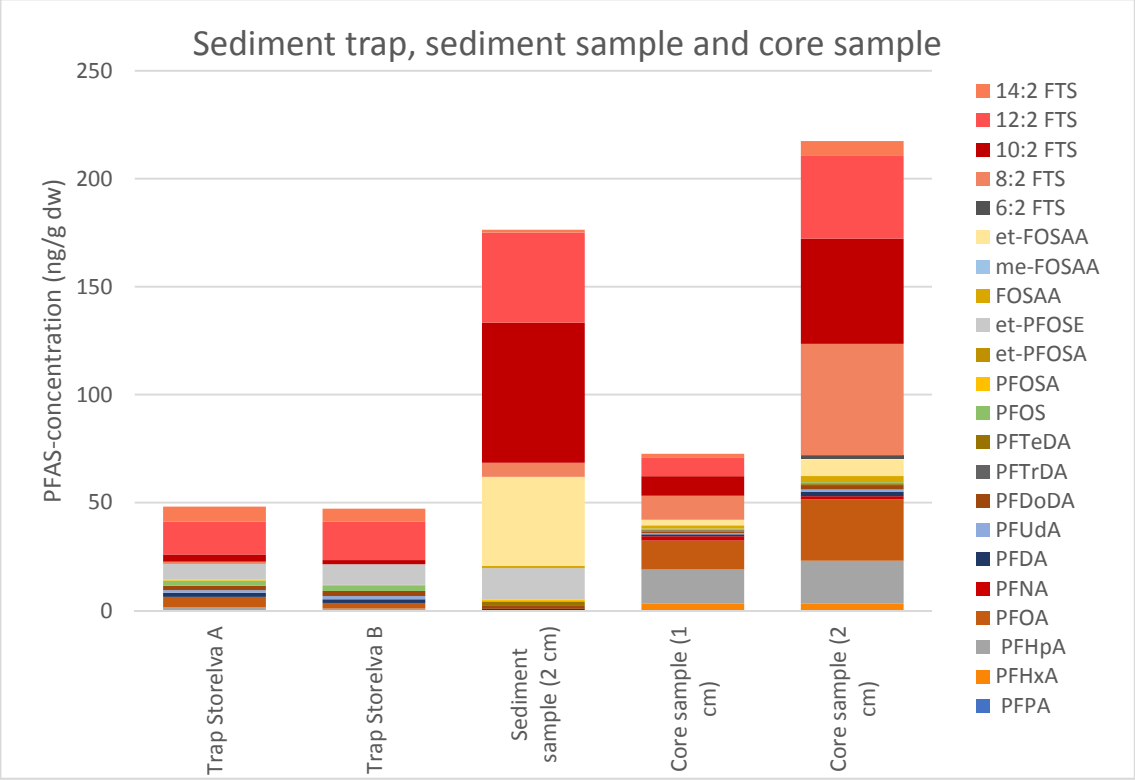

Figure 38. Comparison of the detected PFAS concentrations in the trap in Storelva, the sediment sample (Nord 1) closest to the core and the top two slices of the sediment core.

To be able to estimate the PFAS load to Tyrifjorden per year, the settling particles gathered outside Storelva were used representative for the delta area (6 km^2), while the particles gathered at Vikersund were deemed to be representative for the rest of the Tyrifjorden area. The main currents in Tyrifjorden are assumed to go either towards Holsfjorden or towards Vikersund. Sedimentation is assumed to be the same in all parts of Tyrifjorden. However, this will not be the case in reality and this introduces a source of error into the calculations. For more accurate estimates, sediment traps should be placed in different parts of the fjord system for a longer period of time and emptied regularly (for instance every two months) to look at seasonal variations. Dating of more sediment cores from different areas in Tyrifjorden will give similar information.

The results of the calculations (Table 8) show that a little over 1.5 kg PFAS/yr is deposited in the Tyrifjorden area. At the river delta outside Storelva, about 50 % of the deposited PFAS is FTSA, while for Tyrifjorden as a whole 40 % of the deposited PFAS is PFCA. This could be due to degradation of the FTSA to PFCA (as reported for 6:2 FTS by Wang et al., 2011) due to the distance from the source area, or be an effect of the higher mobility of the PFCA compared to the FTSA.

Table 8. Calculated amount of yearly sedimentation of PFAS (g/yr).

Parameter	Delta outside Storelva	Tyrifjorden (except delta outside Storelva)
Area (m^2)	6 000 000	131 380 000
Sedimentation rate ($kg/m^2 \cdot yr$)	1.1	0.26
PFOA	24	285
PFOS	15	77
PFCA	67	466
PFSA	15	77
preFOS	57	88
FTSA	169	215
$\sum_{53}$ PFAS (kg/yr)	**0.85**	**0.31**

4.5 Pore water concentrations

Three samples of sediment were extracted for pore water in the different areas of Tyrifjorden, in addition to one sample from three different locations in Storelva (see map in Figure 6). Unfortunately, the samples from Steinsfjorden and one sample from Nordfjorden could not be analysed for PFAS due to their high content of dissolved organic matter.

The results show relatively high concentrations of PFAS in the pore water in the sediments, especially in the two samples from Nordfjorden (Figure 39). The distribution profile of PFAS is similar to that detected in the pore water samples, and substances within the PFCA group largely contribute to the distribution of PFAS. This is as expected theoretically, since these are more mobile than their counterparts within other PFAS groups. In Holsfjorden, Vikersund and Storøya, PFOS contributes significantly to the observed pore water concentrations.

preFOS are only detected in pore water in Nordfjorden, while FTSA are detected in Nordfjorden and in one of the samples in Holsfjorden. The low detection rates of these substances in pore water is probably due to their high affinity to the sediment phase.

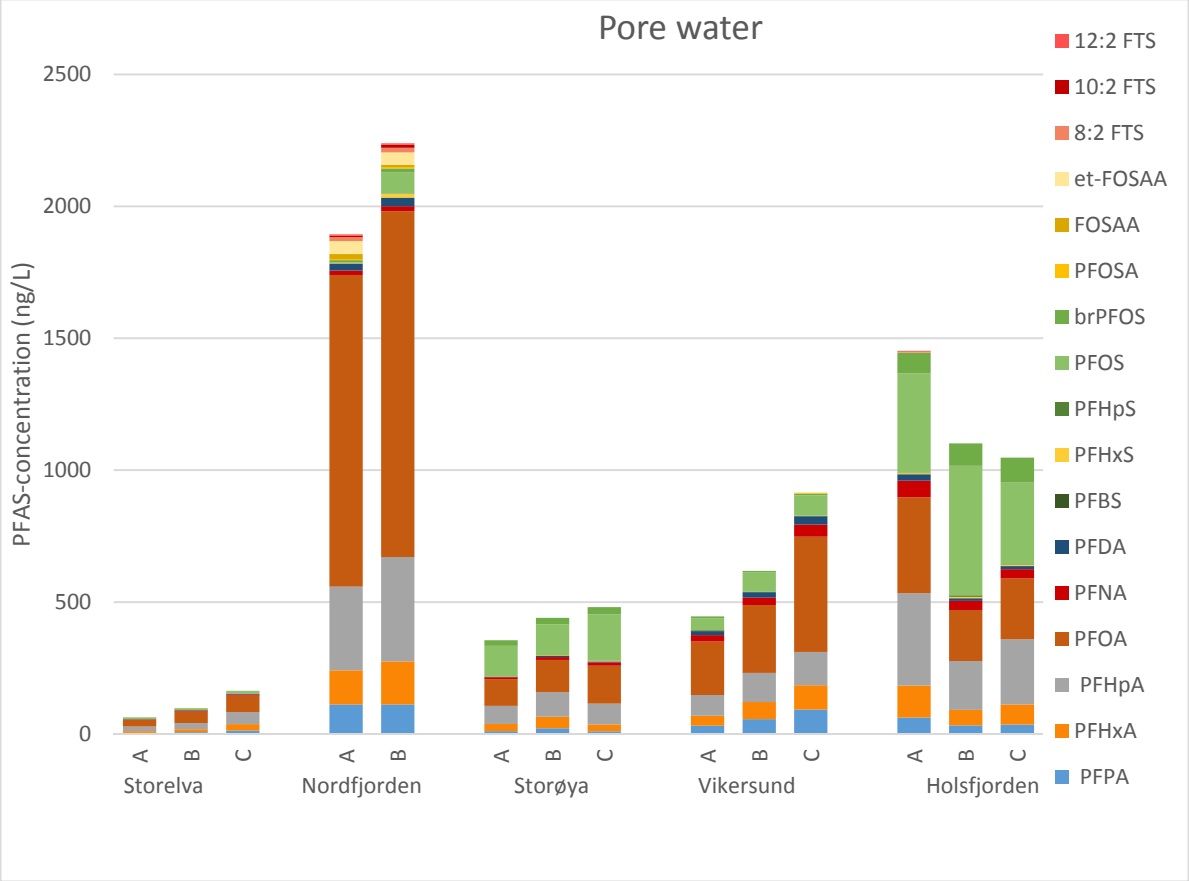

Figure 39. PFAS concentrations in the pore water from different areas in the Tyrifjorden system.

The pore water samples were also analysed for br-PFOS. The fraction of linear PFOS in pore water samples is shown as percent linear PFOS compared to total PFOS (sum of branched and linear PFOS isomers) in Figure 40. The figure shows that the percentage of br-PFOS decreases significantly with distance from Storelva. Due to the higher mobility of the br-PFOS compared to linear PFOS, more of the br-PFOS is expected to be found in the free water masses with increasing distance from the source area. For more details and reference to relevant articles, see chapter 8.2.

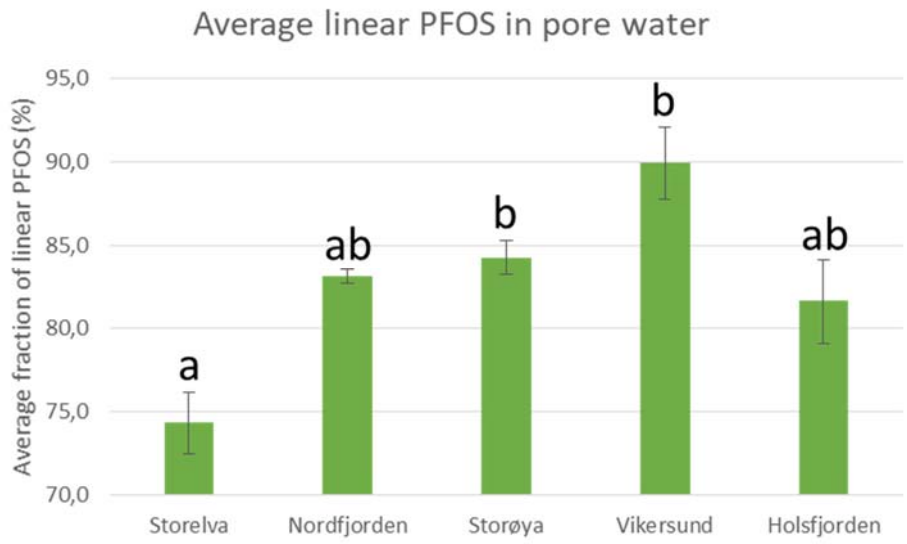

Figure 40. Fraction linear PFOS in pore water, showed as percent linear out of total PFOS (sum of branched and linear PFOS isomers). Error bars show ± standard error of mean (SEM). Different letters denote significant differences (One way ANOVA and Tukey's HSD, p<0.05).

The sediments remaining after the pore water extraction were also analysed. The results of the analysis are shown in Figure 41. The sediments from Nordfjorden have comparable concentrations and PFAS distributions compared to the sediment samples from the same area (Figure 15). In contrast, the other samples contained concentrations that were lower than what is seen in the sediments. Again this might be because PFAS concentrations can vary greatly within a relatively small area.

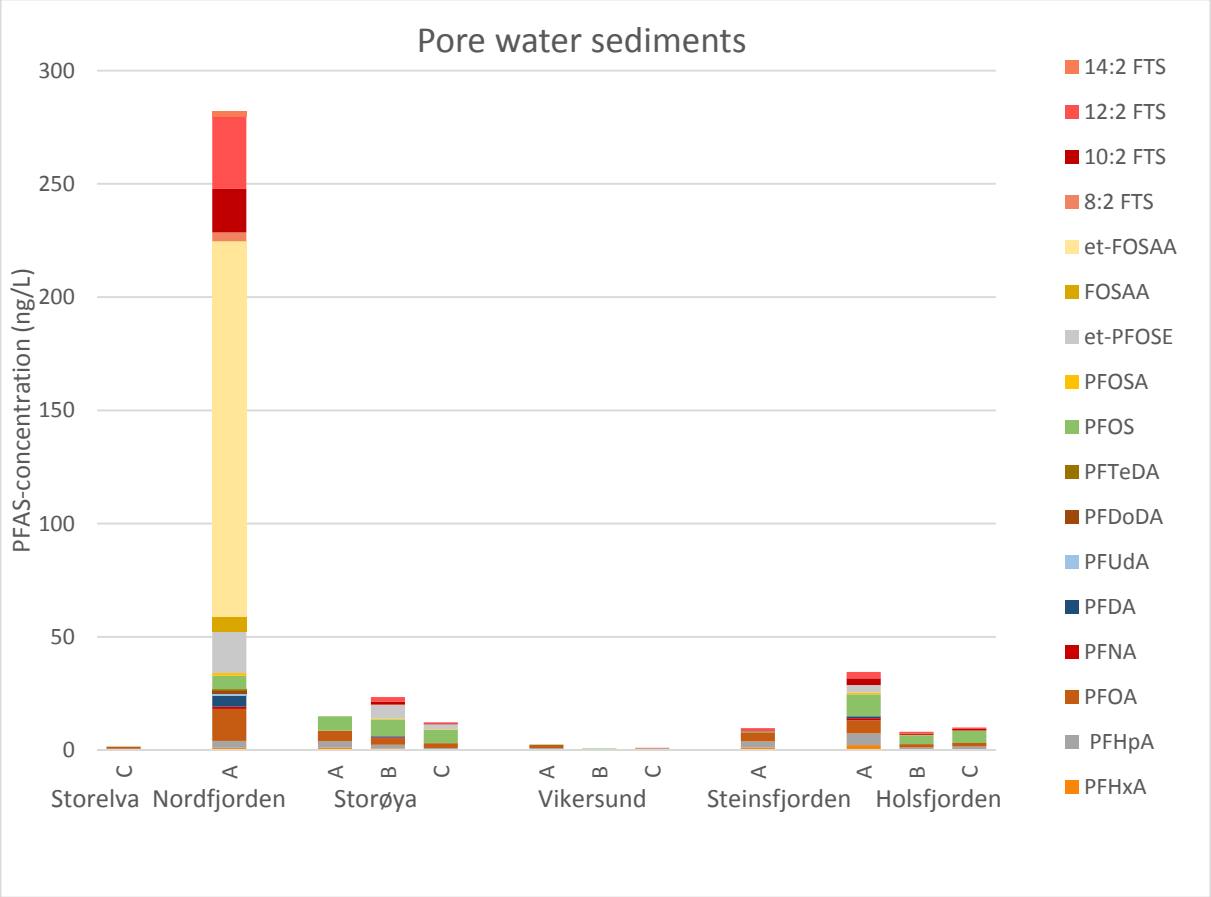

Figure 41. Detected concentrations of PFAS in the pore water sediments.

The fractions of linear PFOS compared to total PFOS (linear + br-PFOS) in pore water sediments are shown in Figure 42. The results show that most of the PFOS in the sediments are linear PFOS, as also seen in Figure 24. The exception is the sample from Steinsfjorden, but since this is only based on one sample, concrete conclusions can not be drawn.

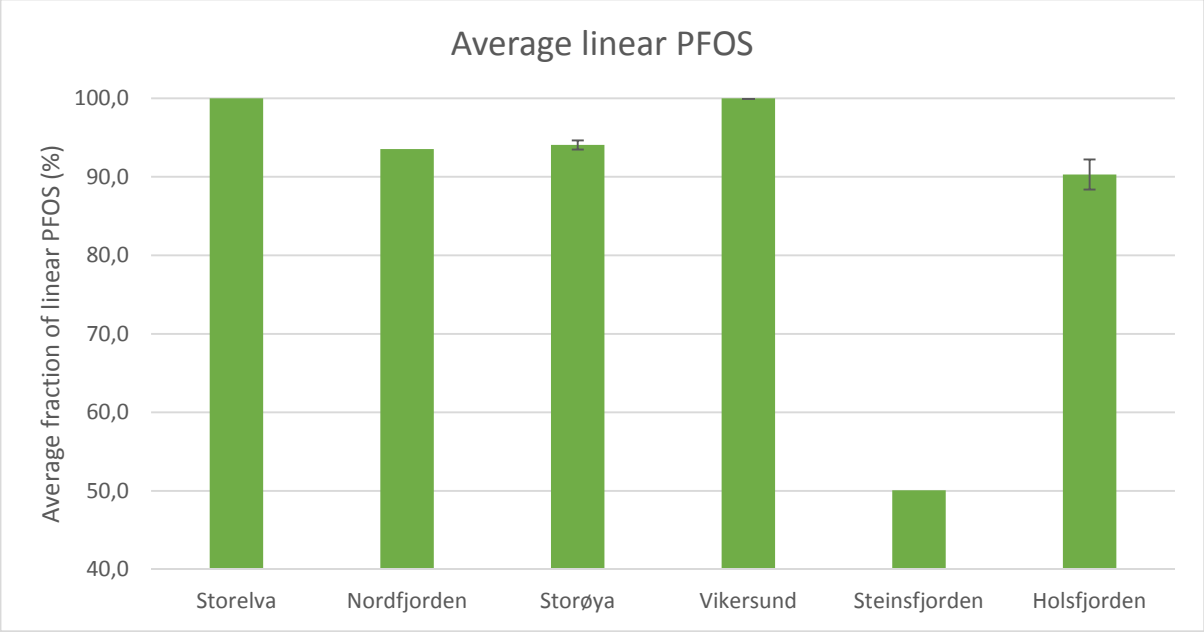

Figure 42. Fraction linear PFOS in pore water sediments, showed as percent linear out of total PFOS (sum of branched and linear PFOS isomers). Error bars show ± standard error of mean (SEM).

4.6 Partitioning coefficients

Partitioning coefficients provide a measure of the affinity a compound has for water and sediment. The higher the K_d value, the greater the affinity the compound has for the sediment phase. For PFAS, binding to the sediment phase increases with increasing carbon chain length, as is also shown in Figure 43, where K_d values are calculated for the station in Nordfjorden. Here, it can be seen that the K_d value is higher for the PFSA than for PFCA with same carbon chain length showing that functional group also plays a role in sorption affinity to sediment. Partitioning behaviour can be dependent on a wide range of factors, where sediment characteristics are shown to be important (Ahrens et al., 2011).

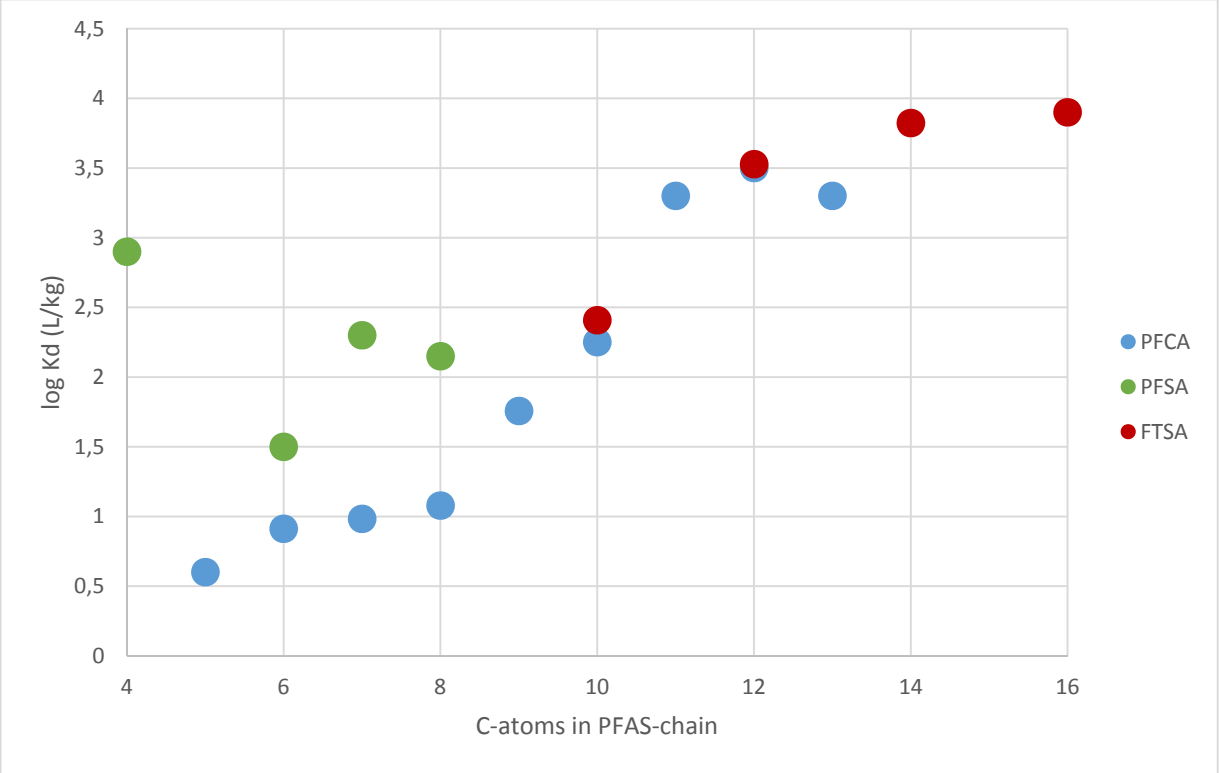

Figure 43. Calculated Kd-values for the different PFAS detected both in the sample from Nordfjorden. Note that some of the PFAS are only detected in pore water (PFPA, PFBS, PFHxS and PFHpS), while some others are only detected in the pore water sediments (PFUdA, PFDoDA, PFTeDA and 14:2 FTS).

K_d values are not shown for preFOS in Figure 43, however calculations show that K_d values are higher for these substances, indicating that their structure provides additional sediment sorption affinty (results from Nordfjorden, log K_d: PFOSA = 2.5, FOSAA = 2.5, et-FOSAA = 3.5).

Figure 44 shows calculated log K_d values for PFOA and PFOS in the sampled areas. The results show a difference between the areas, probably connected to differences in the physicochemical properties of the sampled sediments. The sediment in Storelva contained more sand than the sediments in Nordfjorden (Figure 33), but had a lower content of TOC (Figure 32). In Nordfjorden the calculated log K_d for PFOS was higher than in any other area (however this is based on one sample).

For all calculated K_d values, see appendix B.

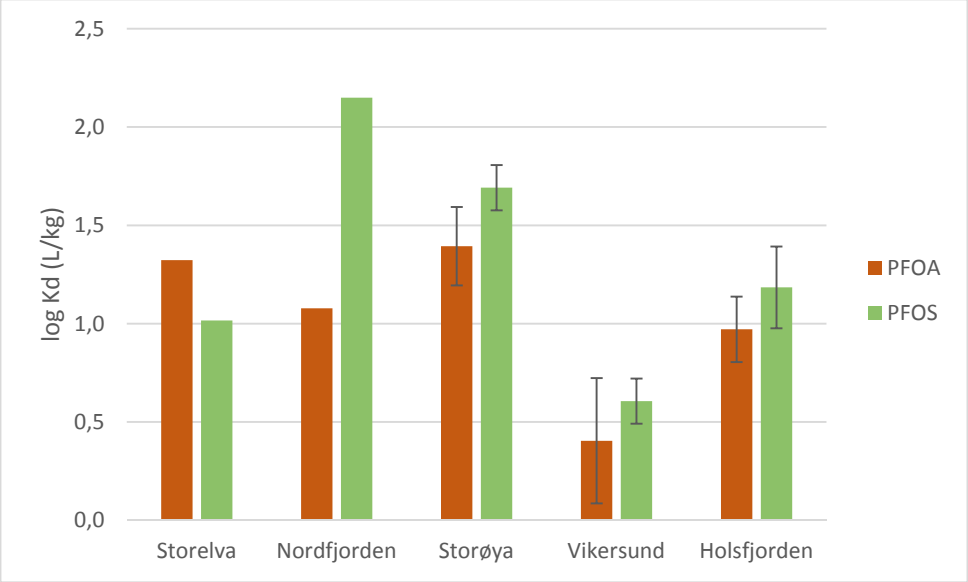

Figure 44. Calculated K_d values for PFOA and PFOS from the different areas. For the areas given an error bar, the calculated log Kd is an average of three values.

K_{OC} was also calculated by utilising the measured TOC in the sediments. There is some uncertainty related to these results, as the measured TOC was not in exactly the same sediment samples. The results from the calculations are shown for the sampled areas in Figure 45. The results show that when correcting for the content of TOC, the calculated K_{OC} values for PFOS are more similar than the K_d values, again implying that increasing TOC content will increase PFOS affinity to the sediments.

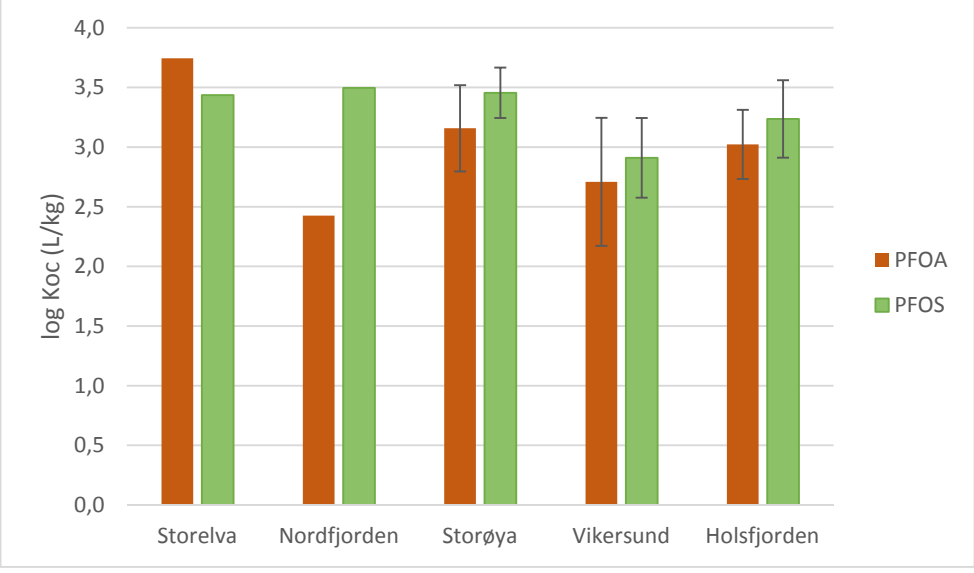

Figure 45. Calculated K_{OC} values for PFOA and PFOS from the different areas. For the areas given an error bar, the calculated log K_{OC} is an average of three values.

4.7 Other possible sources of PFAS

The main objective of the survey conducted for Miljødirektoratet in the Tyrifjorden area in 2017 (Miljødirektoratet, 2017), was to identify sources of PFAS contamination to the lake system. The survey is briefly discussed in chapter 1.3. To supplement the survey in 2017, one of the aims of this work was to identify further possible sources of PFAS to Tyrifjorden. As such a new PFAS source tracking campaign was conducted. The details of the source tracking are provided in appendix A, and briefly summarized in the following.

Only a few additional significant sources of PFAS were found and the waste disposal site at Haga and the fire station at Hønefoss are the only ones of relevance for the PFAS contamination in Tyrifjorden. For the waste disposal site at Haga, the PFAS fingerprint is quite similar to that found in connection with the former paper industry site at Viul (chapter 4.2.4). For the fire station, samples were analysed for the same PFAS as the other samples in this project, and the long-chain FTSA were considered especially relevant. Low concentrations of these substances were found and as such the fire station is not assumed to be the origin of the long-chain FTSA in the sediments in Tyrifjorden. The fire station is however a source of PFOS and other PFAS contained in firefighting foam, though their contribution to overall loads is considered minor when the amounts released to the environment yearly are assessed (see chapter 8.3 for calculations).

Table 9. The possible sources of PFAS investigated in this project.

Type of source	Name	Short description	Significant source?	Main PFAS detected	
				Water	Sediment/sludge
Landfill	Vikersund landfill	Closed down landfill for municipal waste	No	PFOA, PFHpA, PFHxA	Not detected
Landfill	Haga waste disposal site	Waste from the paper factory at Viul	Yes	PFOA, PFOS, et-FOSAA	8:2FTS, 10:2FTS, 12:2 FTS, et-FOSAA
Paper industry	Nordic Paper Geithus	Closed down paper factory, investigated as a comparable site to the former paper industry site at Viul	Yes, but not to Tyrifjorden (downstream the outlet)	et-FOSAA, PFOSA, PFOS, PFOA	et-PFOSE, et-FOSAA
Paper industry	Skjærdalen bruk	Closed down paper factory, making mostly silk paper	No	PFOA, PFHpA, PFHxA	Not detected
Firefighting foam	Fire station	Material sampled from fire station to analyse the same PFAS scope as this study	Yes	PFHxA, PFPA, PFOS, PFOA, PFHpA, PFHxS	PFOS, PFHxS, PFOSA
Firefighting training area	Schjongs-lunden	Training area for the local fire brigade	No	PFOA, PFHpA, PFHxA (water affected by upstream sources)	Not detected in sediments. Soil: PFOS
Military camp	Hvalsmoen	Closed down military camp where the engeneering troop had their own fire brigade	No	PFOA, PFHpA, PFHxA	PFOS

5 PFAS results in the biotic environment

5.1 Biota concentrations

The distributions and concentrations of PFAS in selected biota samples are shown in the figures in the following chapter. The distribution of PFAS in all biological samples are given in appendix C, while individual concentrations of PFAS in all samples are reported in appendix H. All concentrations are given in wet weight (ww).

5.1.1 Comparison to quality standards

In order to evaluate the level of contamination of PFOS and PFOA, the concentrations found in fish and crayfish muscle were compared to E()QS_{biota} values (PFOS: 9.1 and PFOA: 91.3 µg/kg).

Concentrations of PFOA were not detected above the QS_{biota} in any samples. PFOA was detected above the LOQ in a total of 23 samples: in 14 out of 71 fish liver samples, 7 out of 63 fish muscle samples and in both samples of zooplankton. In muscle, the highest concentration of PFOA in fish liver detected was in one individual perch from Viul, with 3.1 µg/kg. PFOA was detected at the highest concentration in zooplankton with 27.7 µg/kg measured. No concentrations above the LOQ were detected in crayfish muscle.

The concentrations of PFOS in samples from fish and crayfish muscle and zooplankton and benthic organisms are summarized Table 10. The concentrations are compared to the EQS value for PFOS in biota. Concentrations above the EQS_{biota} are marked in red.

In fish muscle, concentrations of PFOS above the EQS_{biota} (9.1 µg/kg w.w.) were detected in 23 of 63 samples. PFOS concentrations above the EQS_{biota} were detected in 6 of 9 muscle samples from Viul, 2 of 2 muscle samples from Hønefoss fire station, 4 of 12 muscle samples from Nordfjorden, 4 of 14 muscle samples from Storøya, 1 of 5 muscle samples from Vikersund, and 6 of 15 muscle samples from Steinsfjorden. Concentrations above the EQS_{biota} for PFOS were not detected in crayfish.

In fish liver, concentrations of PFOS are generally high (concentrations exceeded the EQS_{biota} in 70 of 71 liver samples). The highest concentration was in whitefish liver from the two individuals (pooled in to one sample) caught downstream Hønefoss fire station, with 651 µg/kg PFOS. The highest concentration of PFOA in fish liver was detected in the liver of one perch caught at Storøya with 18.5 µg/kg.

In zooplankton, the concentrations in both samples exceed the EQS_{biota} for PFOS. The PFOS concentration in benthic organisms do not exceed the EQS_{biota} value.

Table 10. Statistical summary of the detected concentrations of PFOS in biota muscle tissue in the different areas. Concentrations are given in µg/kg w.w. Red indicates samples with concentrations above the EQS_{biota} value for PFOS (9.1 µg/kg w.w.)

Species	Area	N	Average	Min	Max	Std.dev.	n above QS_{biota}
Perch *(Perca fluviatilis)*	Viul	5	25.19	9.97	37.6	11.95	5
	Fire station	2	10.4	9.49	11.3	0.91	2
	Nordfjorden	10	11.4	4.33	29.4	8.50	4
	Storøya	10	11.41	4.65	38.1	9.56	3
	Vikersund	5	7.07	3.21	10.1	2.58	1
	Steinsfjorden	10	10.45	6.50	20.8	3.94	6
Pike *(Esox lucius)*	Viul	4	5.7	1.3	13.4	4.93	1
	Nordfjorden	2	2.4	1.6	3.26	0.82	0
	Storøya	3	3.4	1.1	6.06	2.04	0
	Steinsfjorden	5	3.3	2.5	4.08	0.56	0
Brown trout *(Salmo trutta)*	Tyrifjorden	6	3.07	0.6	7.0	2.08	0
Arctic Char *(Salvelinus alpinus)*	Tyrifjorden	1	3.38	3.38	3.38	0	0
Crayfish *(Astacus astacus)*	Storøya	10	1.5	0.7	2.9	0.7	0
	Steinsfjorden	10	0.6	0.3	0.97	0.22	0
Zooplankton	Storfjorden	2	17.5	14.9	20.1	2.6	2
Benthic organisms	Storøya	1	0.13	0.13	0.13	0.13	0

5.1.2 Concentration levels in different areas

The highest concentration of Σ_{53} PFAS in biota was detected in the liver of one perch caught at Storøya (1484.7 µg/kg). Apart from this sample, the highest concentrations were detected in the liver of perch from Viul (354.2 - 896.3 µg/kg). Due to physical barriers downstream the former paper industry site at Viul, pike and perch are expected to be stationary in the area close to the factory. In pike, the two highest concentrations of Σ_{53} PFAS were detected in liver samples from fish caught at Viul, with 264.8 and 244.5 µg/kg, respectively. Only pike and perch could be sampled at Viul. The highest concentration in whitefish were detected in liver samples from Hønefoss fire station, with 723 µg/kg (pooled sample of two individuals). For both roach liver and crayfish muscle, the highest concentrations were detected in samples from Storøya with respectively 242.1 (pooled sample of five individuals) and 69.2 µg/kg. For trout and char the highest concentrations were detected in Tyrifjorden and Storøya, with 464.6 and

234.8 µg/kg in liver, respectively. The highest detected concentration in bream (only two individuals from Steinsfjorden) was 186.3 µg/kg in liver.

In general, the highest concentrations of Σ_{53} PFAS in biota were detected at Viul. Levels of Σ_{53} PFAS in the remaining stations were comparable to each other. Perch was the most abundant species caught at the sampling stations, and the only species caught at all stations. Concentrations of Σ_{53} PFAS in perch liver from the different areas are shown in Figure 46.

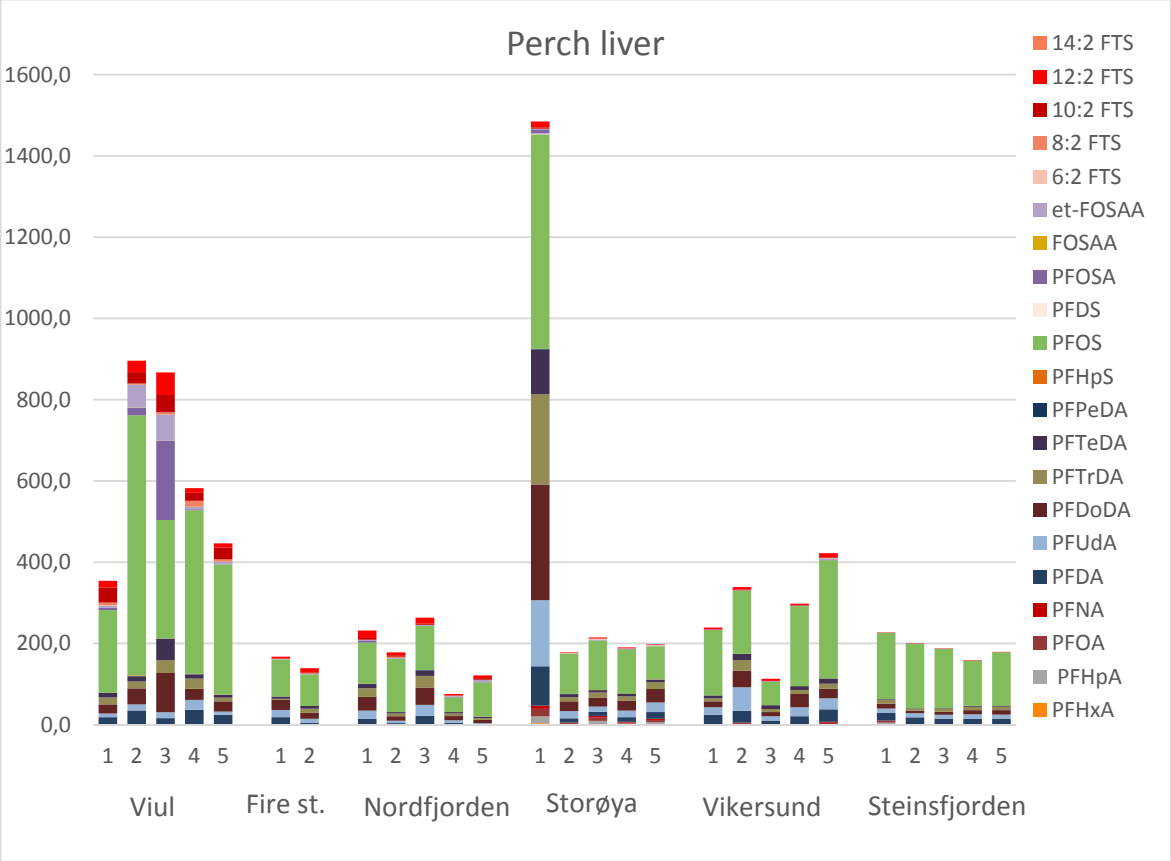

Figure 46. Variations in Σ_{53} PFAS across sampling locations for perch. Concentrations are given in µg/kg.

Differences in Σ_{53} PFAS between species may be due to differences in diet and/or differences in capability of elimination and biotransformation. When comparing average concentrations in different species within the same areas, the highest concentrations of PFAS are generally found in perch. The exception is downstream the fire station, where concentrations of Σ_{53} PFAS in one liver sample from whitefish is higher than in perch. A statistical summary of the concentrations of Σ_{53} PFAS in biota samples (fish liver, zooplankton and benthic organisms) from the different areas is given in Table 11.

Table 11. Statistical summary of the detected concentrations of Σ_{53} PFAS in biota (fish liver, zooplankton and benthic organisms) from the different areas. Concentrations are given in µg/kg w.w.

Species	Area	n	Average	Min	Max	St.dev.
Perch *(Perca fluviatilis)*	Viul	5	629.45	354.2	896.3	219.0
	Fire station	2	153.4	139.4	167.5	14.0
	Nordfjorden	10	175.5	75.6	263.9	69.2
	Storøya	10	453.1	177.9	1484.7	515.9
	Vikersund	5	282.3	113.2	422.6	103.5
	Steinsfjorden	10	190.6	158.7	227.0	22.7
Pike *(Esox lucius)*	Viul	4	178.4	101.7	264.8	76.6
	Nordfjorden	2	142.7	141.9	143.6	0.8
	Storøya	3	76.8	54.7	104.3	20.6
	Steinsfjorden	5	103.2	68.7	189.7	45.2
Whitefish *(Coregonus lavaretus)*	Fire station	1	723	723	723	0
	Nordfjorden	15[1] (3)	116.5	90.0	148.0	23.9
	Storøya	12[1] (3)	323.9	254.3	406.5	62.8
	Vikersund	15[1] (3)	118.7	77.7	160.8	33.9
	Steinsfjorden	12[1] (3)	43.2	36.0	50.7	6.0
Roach *(Rutilus rutilus)*	Nordfjorden	5	68.1	68.1	68.1	0
	Storøya	15[1] (3)	161.9	46.5	242.1	83.7
	Vikersund	15[1] (3)	84.4	57.3	108.7	21.1
	Steinsfjorden	1	30.9	30.9	30.9	0
Bream *(Abramis brama)*	Steinsfjorden	2	173.8	161.2	186.3	12.5
Brown trout *(Salmo trutta)*	Tyrifjorden	6	246.1	65.2	464.6	134.9
Arctic Char *(Salvelinus alpinus)*	Tyrifjorden	1	234.8	234.8	234.8	0
Crayfish *(Astacus astacus)*	Storøya	10	30.7	10.4	69.2	18.0
	Steinsfjorden	10	7.9	4.5	14.3	3.3
Zooplankton	Storfjorden	2	191.8	191.2	192.6	0.71
Benthic organisms	Storøya	1	0.13	0.13	0.13	0

[1] Mixed samples of 3-5 individuals. Number of samples are shown in parenthesis.

Storøya is the area where the largest number of different species were sampled. Thus, concentrations of Σ_{53} PFAS in individuals sampled at Storøya is shown in Figure 47.

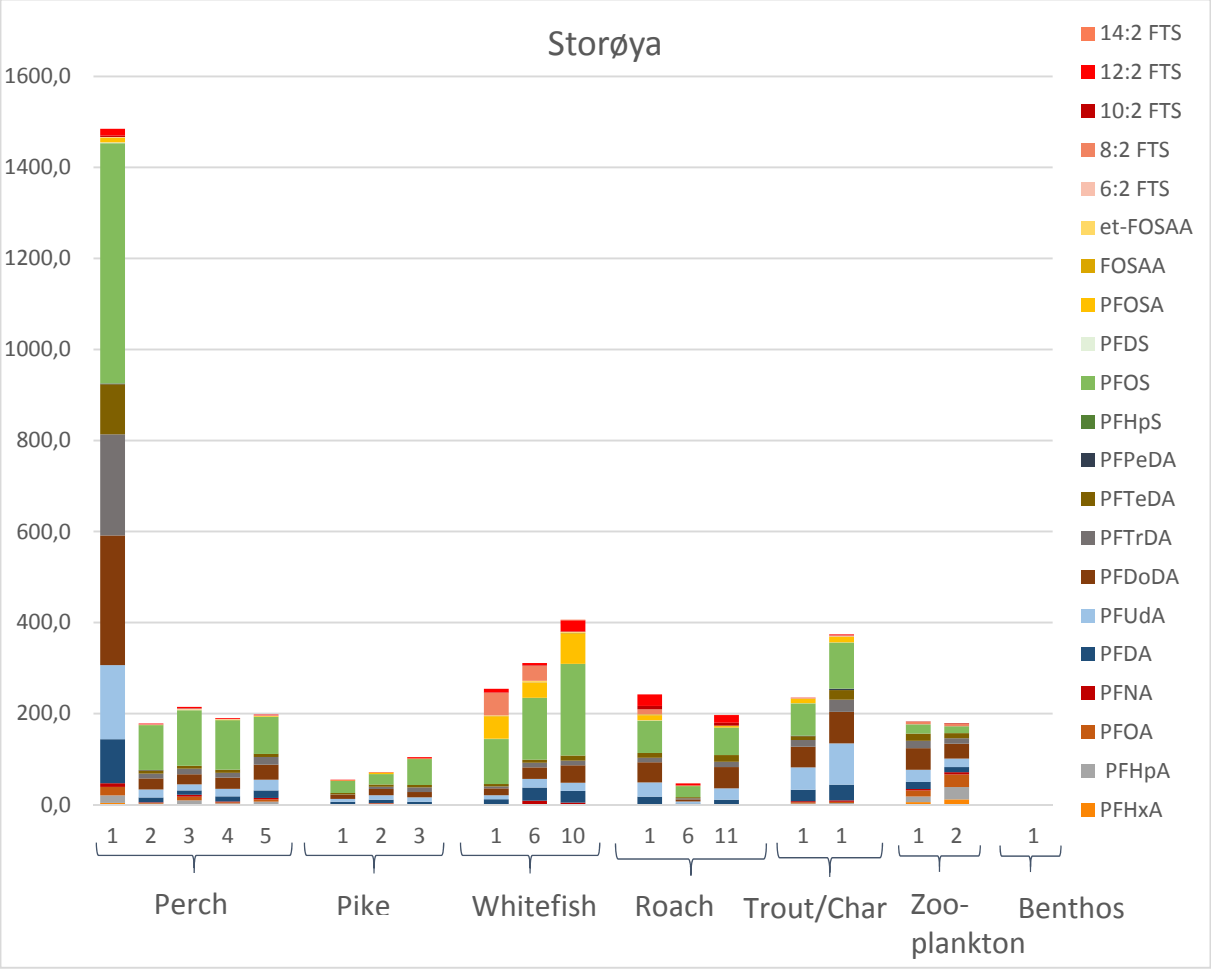

Figure 47. Variations in Σ_{53} PFAS across fish species (liver) and benthic organisms caught around Storøya. Zooplankton were sampled in the Storfjorden area. Concentrations are given in µg/kg ww.

5.1.3 Distribution of different PFAS

The distribution of the different PFAS is relatively similar in liver and muscle samples from fish. A comparison between distribution of PFAS in muscle and liver in species where both tissues are analysed (perch, pike and trout) are shown in appendix C.

Generally, PFOS constituted the largest percentage of Σ_{53} PFAS, followed by PFOSA, PFDoDA and PFUdA. However, in pike from Viul and Nordfjorden, PFOSA and long-chain carboxylic acids had the highest concentrations. In whitefish from Nordfjorden, higher concentrations of PFOSA (than PFOS) were detected. In trout and char (muscle)

from Storøya and in trout (liver) from Tyrifjorden, long-chain PFCA were detected at the highest concentrations.

There are some variations in the distribution of PFAS between species which may be due to differences in diet and/or differences in capability of PFAS elimination and biotransformation. In general, whitefish and roach had a higher proportion of FTSA than the other species. In addition, whitefish had a higher proportion of preFOS (PFOSA) than the other species. Pike contained more PFOSA than perch, especially at Viul.

Zooplankton (results based on 2 samples) had a higher proportion of the more water soluble short chain PFCA compared to fish. In addition, a higher proportion of the long chain PFCA PFDoDA (17-24% of Σ_{53} PFAS) than of PFOS (7-10% of Σ_{53} PFAS) were detected. Higher levels of PFUdA than PFOS were also detected in one sample of zooplankton. In benthic organisms only PFOS was detected above the LOQ.

In crayfish, higher concentrations of long chain PFCAs (PFDoDA, PFTrDA, PFTeDA) than PFOS were detected in all individuals from both Steinsfjorden and Storøya. For the crayfish caught around Storøya, the detected concentrations of 12:2 FTS were higher (1.74-3.15 µg/kg) than concentrations of PFOS (0.72-2.9 µg/kg) in all but one individual.

As the highest concentrations of Σ_{53} PFAS were detected in perch liver, the percentage distribution of the various substances is shown for perch liver from the different areas in Figure 48. In general, the percentage of FTSA and preFOS is greater in individuals from Viul, downstream the fire station, and in Nordfjorden compared to Storøya, Vikersund and Steinsfjorden. To be able to compare the distribution of the various PFAS in liver and muscle samples, the distribution of PFAS in perch muscle is also shown in Figure 49.

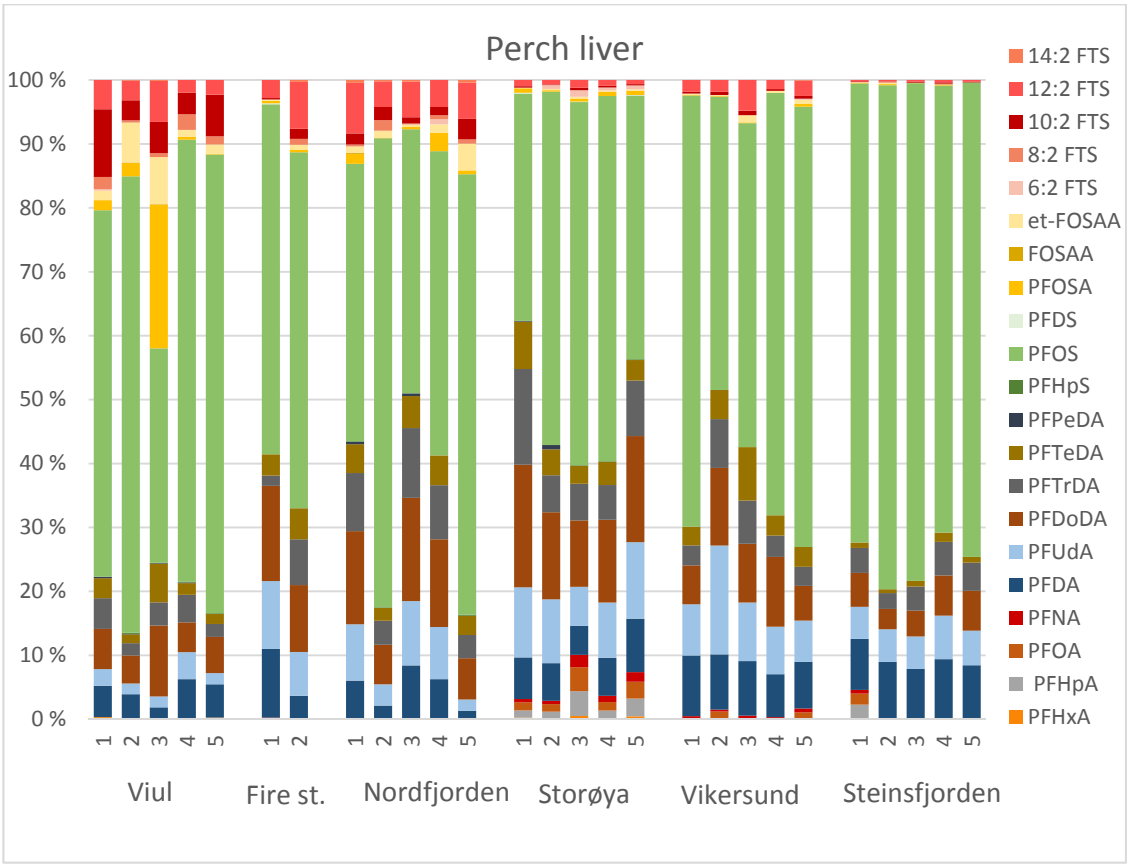

Figure 48. Distribution of PFAS across sampling locations for perch liver. Distribution is shown as percent relative to the total concentration detected within each sample.

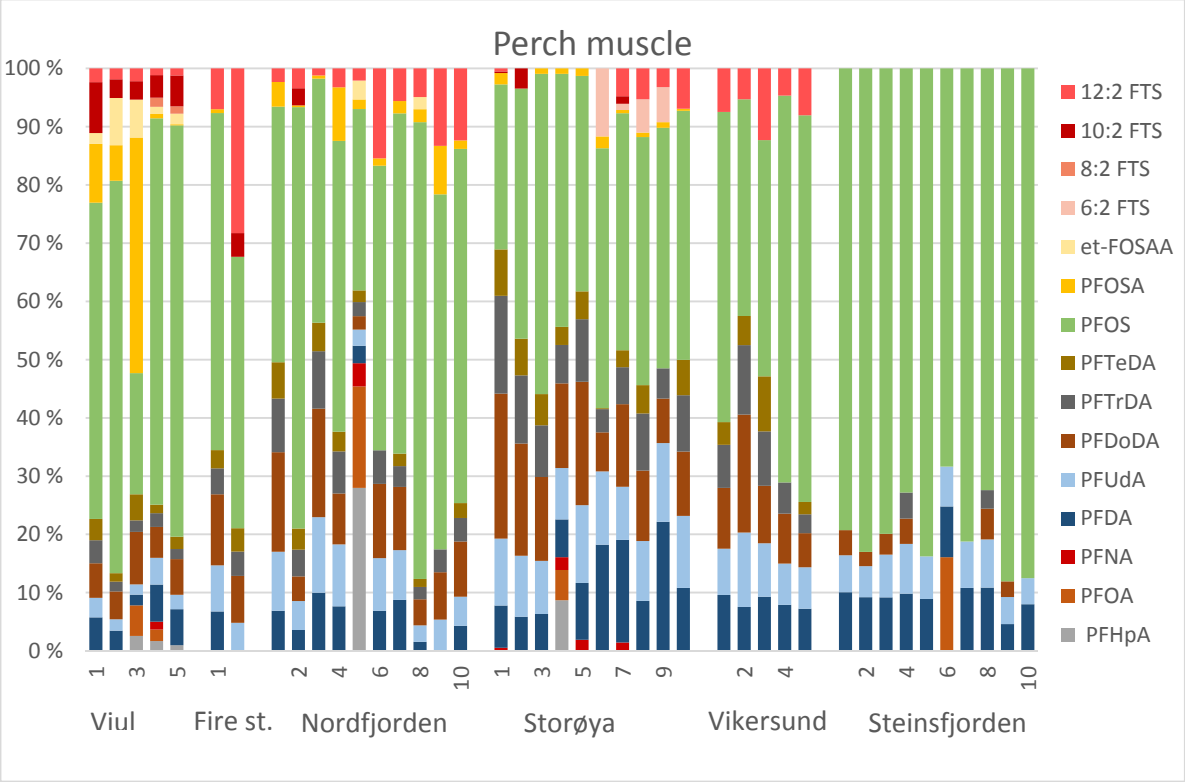

Figure 49. Distribution of PFAS across sampling locations for perch muscle. Distribution is shown as percent relative to the total concentration detected within each sample.

The percentage distribution of the various PFAS in the different organisms caught around Storøya is shown in Figure 50 and in Figure 51. PFOS was the compound detected at the highest concentration, followed by the long-chain PFCAs (PFDoDA, PFUdA, PFDA, PFTrDA and PFTeDA). In whitefish and roach (Figure 50) there is a higher proportion of FTSA and preFOS compared to the other species. The figures that show the percentage distribution of PFAS detected at the other areas are shown in appendix C.

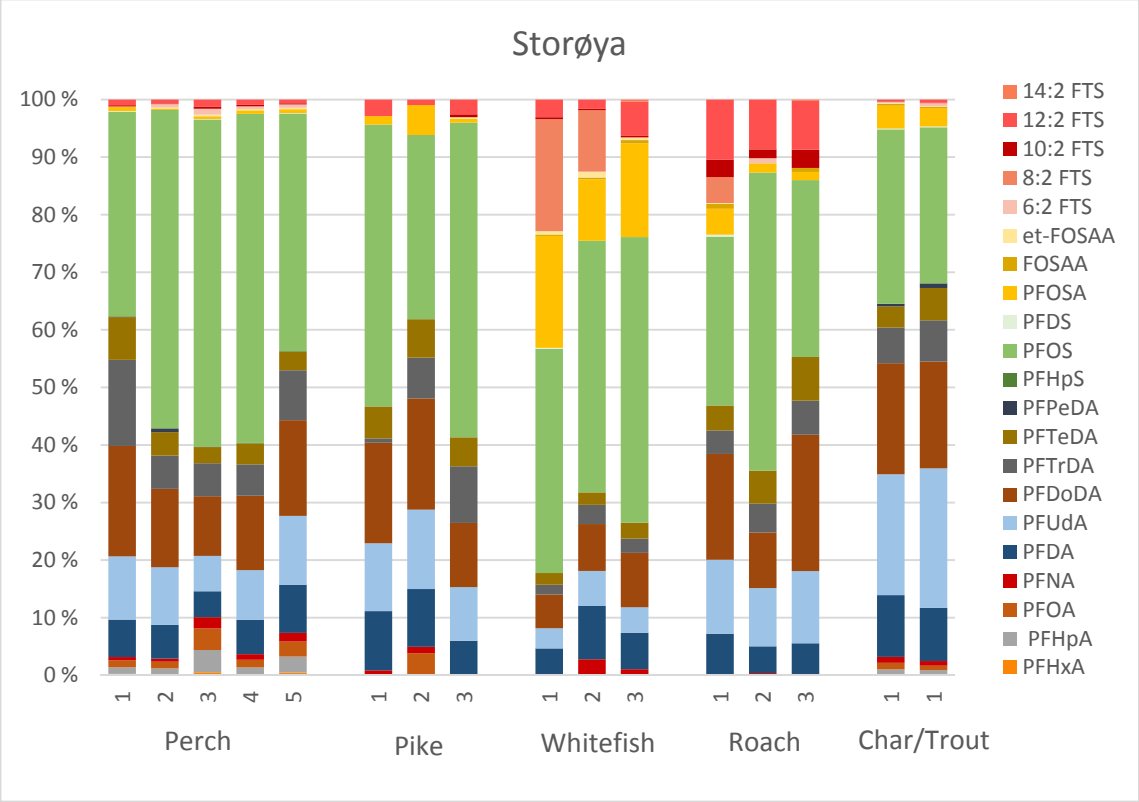

Figure 50. Percentage distribution of the various PFAS in samples of fish liver at Storøya. Distribution is shown as percent relative to the total concentration detected within each sample.

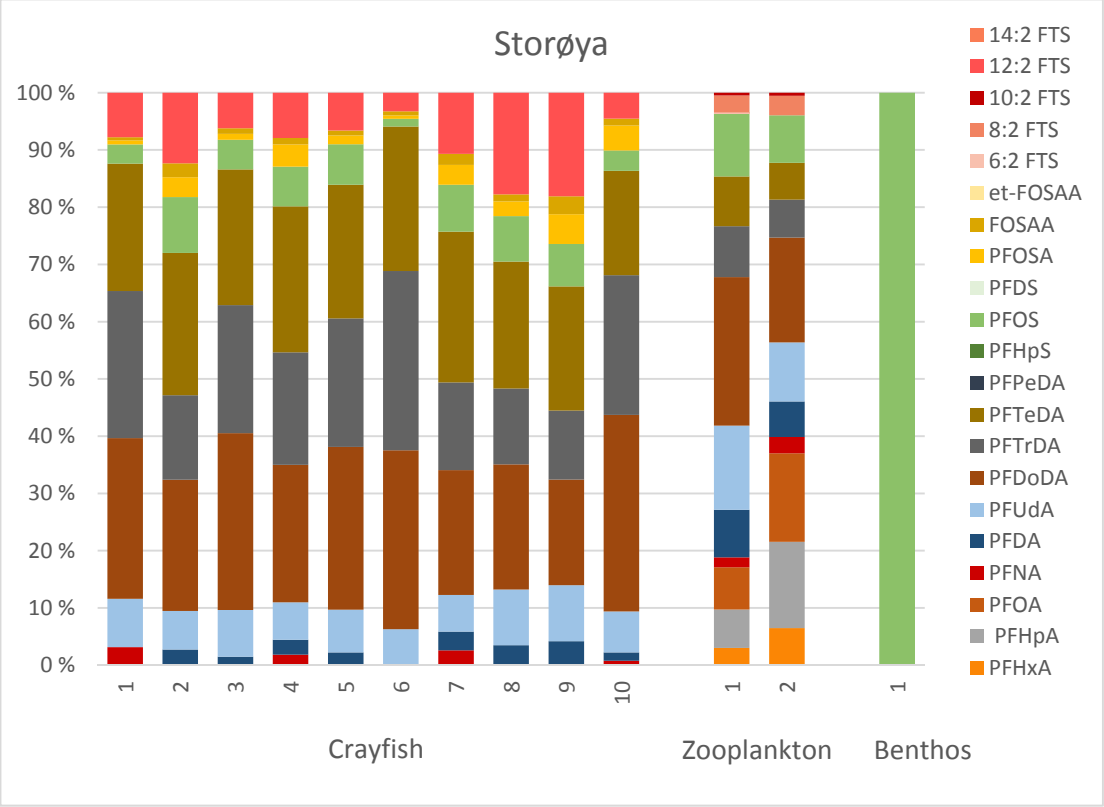

Figure 51. Percentage distribution of the various PFAS in samples of crayfish, zooplankton and benthic organisms at Storøya/Storfjorden.

The biota samples were also analysed for br-PFOS. The fraction of linear PFOS in perch liver samples from the sampled areas are showed as the percent linear PFOS compared to the total PFOS (sum of branched and linear PFOS isomers) in Figure 52. The figure shows that the percentage of br-PFOS decreases significantly with distance from Viul. Due to the higher mobility of the br-PFOS compared to linear PFOS, more of the br-PFOS is expected to be in the free water masses with increasing distance from the source area. For more details and reference to relevant articles, see chapter 8.2.

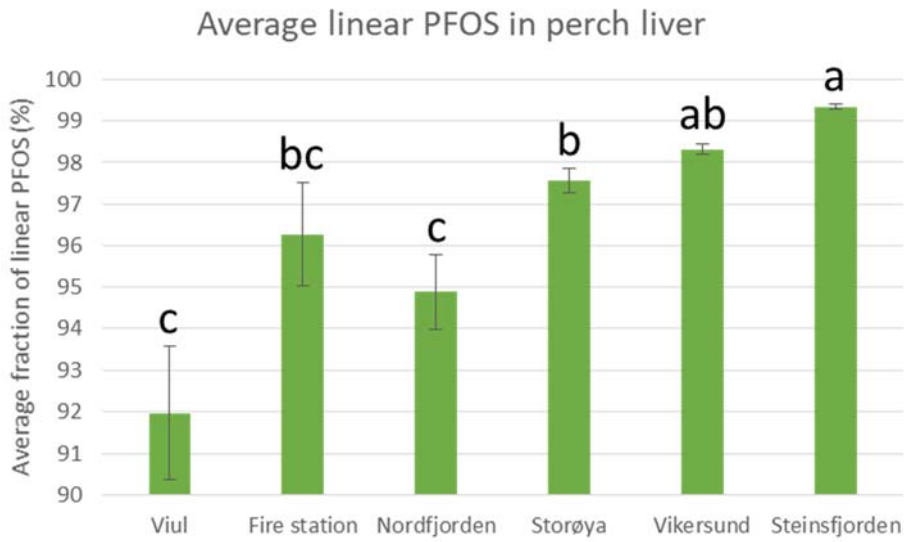

Figure 52. Fraction linear PFOS in perch liver from the examined areas, showed as percent linear out of total PFOS (sum of branched and linear PFOS isomers). Error bars show ± standard error of mean (SEM). Different letters denote significant differences (Kruskal-Wallis and Bonferroni correction, p<0.05).

5.1.4 Relationships between levels of PFAS and biometric variables

Negative relationships ($p \leq 0.05$) were observed between preFOS and perch length in samples from Storøya and with pike weight in samples from Steinsfjorden. A positive relationship was observed between the sum of detected PFAS and crayfish length in samples from Storøya ($p = 0.05$). No other significant relationships were observed.

Negative correlations were observed ($p<0.05$) between Fulton's condition factor K (weight to length ratio, (Fultons K)) and both PFOS and sum PFAS in the liver of pike and perch from Steinsfjorden. In addition a negative relationship was observed between Fultons K and PFOS in pike muscle ($p = 0.04$), but not perch muscle, in Steinsfjorden. No significant relationships were observed between PFAS load and Fultons K in other areas.

Overall, there were very few relationships between levels of PFAS and biota weight or length observed. This is consistent with existing literature, showing no clear relationships between fish length or weight, and levels of PFAS.

6 Uptake and transfer in the food chain

As described in chapter 3.3.3 stable carbon and nitrogen isotopes, $\delta^{13}C$ and $\delta^{15}N$, were used to evaluate the relationships between PFAS loads and trophic level and/or food sources. The biota from Steinsfjorden was estimated to have a higher trophic level compared to the same species from the other locations, and therefore results from Steinsfjorden were not compared directly to the remaining part of the lake.

6.1 Pathway from abiotic to biotic media

Correlations between $\delta^{13}C$ and PFAS levels in biota were tested using Spearmans rho as described in appendix D. Only significant relationships ($p \leq 0.05$) are reported here. Positive relationships were found between $\delta^{13}C$ and sum preFOS in fish liver at Nordfjorden. The same were shown for sum long chain FTSA in fish liver at Storøya and the whole Tyrifjorden lake (not including Steinsfjorden). Positive relationships were found between $\delta^{13}C$ and the sum of long chain PFCA in crayfish and fish muscle at stations at Storøya and the whole lake. Positive relationships were also found between $\delta^{13}C$ and preFOS in crayfish and fish muscle at Nordfjorden. The same was shown for the sum of long chain FTSA in crayfish and fish muscle at stations at Storøya and the whole lake.

The observed relationships indicate that uptake of long chain PFCA, preFOS, and long chain FTSA are associated with uptake from the benthic food web and thus sorption from sediments. The observed associations with the benthic food web are consistent with K_d values reported in chapter 4.6 and appendix B. preFOS and (long chain) FTSA have K_d values that show these compounds are bound to sediments. The same applies to PFCA with carbon chain length >11, while the K_d value for PFOS is lower (Figure 43).

SAmPAP has previously been reported to be strongly associated to sediments (Benskin et al., 2012), as well as being resistant to microbial degradation in sediments (> 380 days half-life at 25°C, and >3400 at 4 °C in marine sediments) (Benskin et al., 2013). However, the degradation is reported to be more efficient if the substance is taken up by fish (Gaillard et al., 2017, Peng et al., 2014). Juvenile perch exposed to SAmPAP through their diet, have been reported to biodegrade SAmPAP into the smaller preFOS (Gaillard et al., 2017). The smaller preFOS are reported to be more easily degraded in sediments and the half life of et-PFOSE was reported to be 160 ± 17 days in marine sediments (Benskin et al., 2013). The relatively low K_d value for PFOS (0.5 – 2.1 L/kg) indicate that PFOS which is "produced" from precursors in sediments to a large extent will be dissolved in water (in contrast to its precursors) and only partition to sediment minimally. The reported concentrations of preFOS (and SAmPAP) in sediments from Tyrifjorden indicate that the lake sediments are a source for continuous input of PFOS to water and the lake food web.

The positive relationship between $\delta^{13}C$ and the sum of long chain PFCA in muscle at Storøya indicates a direct input of PFCA from the sediments. Previously, the shorter chain FTSA, 6:2 FTS, has been reported to degrade to PFCA with a carbon chain length

≤ 6 (Wang et al., 2011). Assuming that the longer FTSA follow the same degradation pattern, they will be transformed to PFCA with longer chain lengths. Thus, transformation of long chain FTSA might be an alternative transfer route from sediments (positive relationships are shown between $\delta^{13}C$ and long-chain FTSA).

Given the relatively short half-live of PFOS in fish (12 days have been reported in blood of rainbow trout (*Oncorhyncus mykiss*) (Martin et al., 2003)) and the reported water retention time in the lake (2.6 -4.6 years), water-solved PFOS would be expected to be relatively quickly removed from the lake system. The low concentrations in lake water combined with the clear relationships in the benthic food web indicate that the lake sediments are a major source of continuous input of PFAS to the Tyrifjorden food web (partly via release from sediments to the water column). High concentrations in plankton (PFOS: 14.9-20.1, PFCA: 118.6-138.4 ng/g) sampled at Storfjorden show that there is still some uptake of PFAS from the water column.

6.2 The significance of trophic level

Significant positive relationships ($p<0.05$) were found between relative trophic level and long chain PFCA concentration in fish liver at stations Nordfjorden, Storøya, and Vikersund, as well as in the whole Tyrifjorden lake (not including Steinsfjorden), shown in Figure 53. The same was shown for PFOS concentrations in fish liver at Storøya, Vikersund, and the whole lake, and for preFOS concentrations in fish liver at Storøya. Positive relationships ($p<0.05$) were also found between relative trophic level and PFOS concentrations in crayfish and fish muscle at stations Storøya, Steinsfjorden, and the whole lake.

Trophic magnification factors (TMF) were calculated as described in chapter 3.3.3. Trophic magnification is assumed to occur if the calculated TMF is greater than 1. TMF_{liver} for long chain PFCA were 3.2, 5.5, 16.1, and 4.2 in fish from Nordfjorden, Storøya, Vikersund, and the whole lake, respectively. No significant relationships were shown between trophic level and long chain PFCA in fish and crayfish muscle.

In the whole lake, TMF_{liver} for PFOS in fish was 1.9, and in crayfish and fish TMF_{muscle} was 2.0. In Steinsfjorden, TMF_{muscle} in crayfish and fish was 9.3 (while no increasing concentrations were shown for fish liver concentrations). The relatively high TMF_{liver} for long chain PFCA at Vikersund may be due to the low number of species caught at the station; only 3 different species on relatively similar trophic level were sampled. Thus, species specific differences (other than trophic level), or random variation might affect the calculated TMF more in this station compared to other stations.

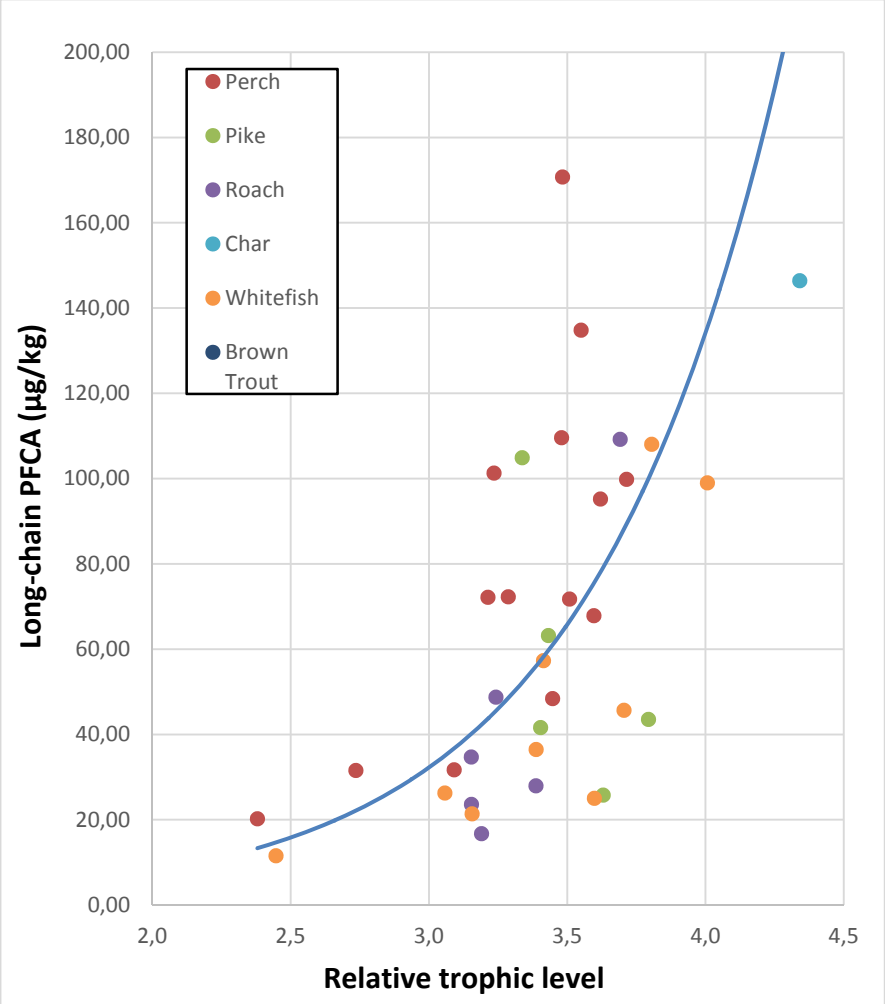

Figure 53. Sum long-chain PFCA (µg/kg) in fish liver from the whole lake plotted versus relative trophic level.

7 Ecosystem effects

The Norwegian Environmental Agency has set a guideline value for the acceptable concentration of PFOS in soils of 100 µg/kg (0.1 mg/kg) (Miljødirektoratet, 2008). Based on this, a freshwater sediment direct toxicity benchmark of 220 µg/kg was determined as a screening value for risk assessment purposes. No chronic effects to sediment dwelling aquatic organisms were observed below this value. In sediments from Viul, where the highest levels of PFOS were detected, the average concentration of PFOS was 298 µg/kg, with a maximum concentration of 1780 µg/kg.

The EQS values given in the Water Framework Directive include both annual average standards (AA-EQS) and maximum allowable concentrations (MAC-EQS). Maximum allowable concentrations of PFOS are 36 µg/L for inland waters and 7.2 µg/L for other

waters. The directive also established a biota threshold for PFOS at 9.1 µg/kg w.w and for PFOA at 91.3 µg/kg w.w.

As described in chapter 3.3.1 a QS value for secondary poisoning, $QS_{BIOTA, SECPOIS}$ (33 µg/kg for PFOS) has been determined. Assuming most prey fish are eaten whole, investigating the whole fish body burden provides interesting information. Calculated concentrations (as shown in chapter 3.3.4) in whole perch exceed the $QS_{BIOTA, SECPOIS}$ at Viul. All other stations show average concentrations below (but close to) $QS_{BIOTA, SECPOIS}$. Individual concentrations above $QS_{BIOTA, SECPOIS}$ are shown at stations Nordfjorden, Storøya, and Steinsfjorden. Calculated PFOS concentrations in whole perch are shown in Table 12.

Table 12. Calculated PFOS concentrations in whole perch and number of individuals exceeding the $QS_{BIOTA, SECPOIS}$ (33 µg/kg). Conversion equation is from (Fliedner et al., 2018),

Area	Concentrations in whole fish (µg/kg) ± SEM	Number above $QS_{BIOTA, SECPOIS}$ [sampled individuals]
Viul	71.2 ± 12.2	4 [5]
Fire station	29.1 ± 2.6	0 [2]
Nordfjorden	27.7 ± 8.7	3 [10]
Storøya	32.0 ± 9.1	4 [10]
Vikersund	19.7 ± 3.7	0 [5]
Steinsfjorden	29.3 ± 3.7	2 [10]

The QS values listed above only applies to PFOS and PFOA. In addition, the water (E)QS values are not based on ecological risk, but on toxicological effects of PFAS in food (Seacat et. al, 2002, European Commission (2011)). Bioaccumulation can increase the risk of compounds in the ecosystem. Potential of bioaccumulation of PFAS tends to increase with increasing chain length (Martin et al., 2004). In Tyrifjorden, very low concentrations of PFAS were detected in water, but calculated TMF values show that bioaccumulation and biomagnification results in biota concentrations close to $QS_{BIOTA, SECPOIS}$. As expected, it is the long-chain PFAS that tends to accumulate and amplify; analysis show increasing concentrations of PFOS and long-chain PFCA with trophic level.

The dominating PFAS in biotic samples in Tyrifjorden are PFOS, long chain PFCA, long chain FTSA, and preFOS (PFOSA, et-FOSAA and FOSAA). FTSA are suspected to be degraded to PFCA (as discussed in chapter 6.1) and preFOS are a source of PFOS. Thus, these substances might constitute an indirect environmental hazard, in addition to the potential hazard of the substances themselves.

Several studies have indicated that a high body burden of PFOS in fish, relative to total body weight, may have long term effects on physiological functions of fish. For example, a previous study has shown that PFOS can be taken up by developing embryos in zebrafish (*Danio rerio*) (Sharpe et al., 2010), and high concentrations of PFOS detected in fish eggs in lake whitefish (*Coregonus clupeaformis*) also suggest oviparous transfer (Kannan et al., 2005).

Chronic exposure to PFOS can have a negative effect on reproduction, embryonic growth, and subsequently offspring development in zebrafish (Wang et al., 2011b; Du et al., 2009). In addition, PFOS induced toxicity has been observed in gills in European bullhead (*Cottus gobio*) (Dorts et al., 2011) and in gonads and liver of zebrafish (Du et al., 2009).

Commonly, components in a PFAS mixture are evaluated independently from each other in risk assessments. However, in drinking water, the US EPA and the state of Vermont consider additive effects of PFOA and PFOS (US EPA, 2016a, b; Vermont ANR, 2016). A study by Wei et al. (2009) investigated the combined effect of several PFAS (PFOA, PFNA, PFDA, PFDoA, PFOS, 8:2 FTOH) on biota. The study showed that certain genes were regulated by the mixture, though unaffected by the individual substances. The effected genes are those involved in fatty acid metabolism and transport, in xenobiotic metabolism, in the immune response, and in the emergence of oxidative stress (Wei et. al 2009).

In another study, exposure to a mixture of PFOS and PFOA induced and expedited cell apoptosis ("cell death") more effectively than exposure to the individual substances (Hu et. al, 2009). In the concurrent exposure only 53 compounds were analysed and exposure most likely occurs to up to thousands of PFAS overlooked in this analysis. Due to a lack of knowledge about identity, individual hazards, total load, mechanisms of action and cocktail effects, there is great uncertainty associated with estimating the associated risks for the entire group of PFAS (Wang et. al 2017). The combination of PFOS and the relatively high concentrations of other PFAS reported here, might increase the risk compared to exposure of PFOS alone.

Predators (e.g. mammals or birds) that feed nearly exclusively on fish will mostly not separate tissues and eat the whole fish. Thus, they will be exposed to higher concentrations of PFOS compared to humans, who largely eat the muscle. Therefore, organisms at higher trophic levels might be at risk of exposure due to biomagnification, despite the fact that the fish themselves have apparent good health. For example, high levels of PFAS have been shown in Scandinavian otters, and increasing concentrations were observed in the period 1972-2011, with up to 16000 ng/g fresh weight (Roos et al., 2013). Persson et al. 2013 compared levels of perfluoroalkyl acids (PFAA) in mink liver from different areas in Sweden, and reported that the levels found in mink from Märsta, near Stockholm Arlanda airport were 4 to 20 times higher compared to levels in mink sampled from the other regions.

It is not possible to definitively conclude what kind of effects the detected concentrations of PFAS will have on biota in Tyrifjorden. However, it is clear that the levels of PFAS reported here pose an unacceptable risk to the local ecosystem. This is based on the $QS_{BIOTA, SECPOIS}$ for PFOS, observed biomagnification of PFOS and long chain PFCA, existing literature on oviparous transfer, toxicity, and the great uncertainties associated with possible cocktail effects of PFAS. Long term exposure of wildlife at higher trophic levels may lead to adverse effects including liver toxicity, immune response, effect on reproduction, embryonic growth, and subsequent offspring development.

8 Contribution from sources

8.1 Suspect screening

Total extractable organic fluorine (ToF) was analysed in 16 samples to determine the fraction that the 53 individual PFAS determined within this project contribute to the total fluorine. The analysis was carried out on seven sediment samples and nine biotic samples, from different areas and from different species. These samples were chosen for ToF analysis before the PFAS chemical analysis was completed due to time restrictions. The selection was based on assumed concentrations in the different areas and the different biota. The detected PFAS concentrations (in ng/g) were converted into corresponding fluoride concentrations, using the equation shown in ch. 3.3.5.

The results from the analysis for the biotic samples are shown in Table 13 and Figure 54. For one sample of perch from Steinsfjorden, the results show that the amount of detected 53 individual PFAS exceeds the total extractable fluorine in the sample. This is due to laboratory uncertainties and the result should be discarded.

The biotic samples from Viul, Nordfjorden and Storøya contain a large fraction of non-targeted PFAS since the contribution of the Σ_{53} PFAS only corresponds to 37-55 % of the ToF analysis in perch and 8-9 % in pike. The targeted analysis (Σ_{53} PFAS) corresponds more closely with the ToF-analysis in the samples of perch from Steinsfjorden, where the targeted Σ_{53} PFAS contributed most of the total flourine in this area. However, pike from Steinsfjorden had a different pattern where only approximately 25 % of the detected ToF could be explained by the targeted Σ_{53} PFAS.

Table 13. Detected concentrations of ToF and $\sum_{53}$ PFAS (in ng F/g) in biotic samples from different areas.

Area	Specie	ToF (ng F/g)	$\sum_{53}$ PFAS (ng F/g)
Viul	Perch	649	313
	Pike	726	55
Nordfjorden	Perch	219	122
	Pike	664	58
Storøya	Perch	1348	496
	Trout	374	124
	Char	331	75
Steinsfjorden	Perch	86	93
	Pike	102	30

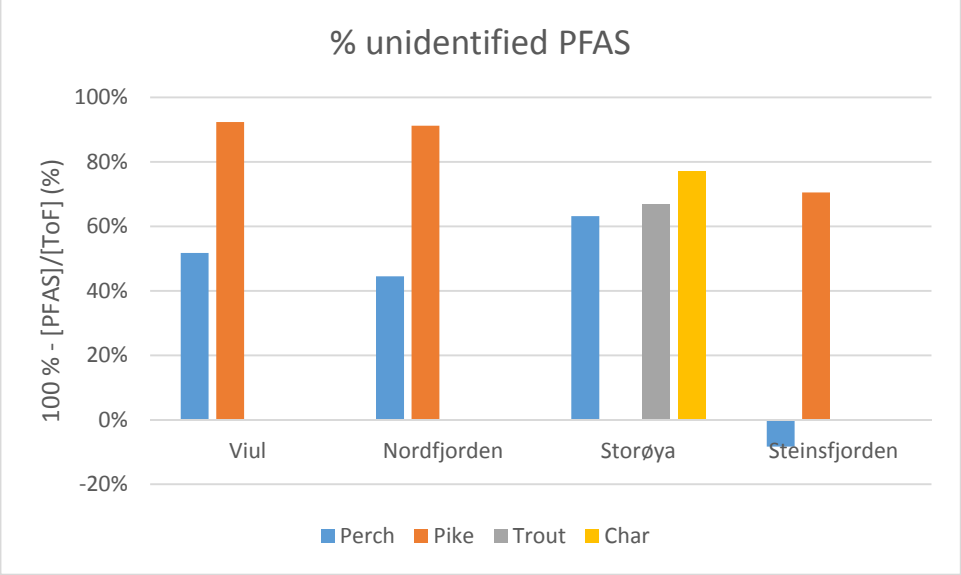

Figure 54. Fraction of unidentified PFAS for biota from different areas.

For the sediment samples, the results of the ToF are shown in Table 14. ToF was only detected above the LOD in the sample from Nordfjorden. In this sample, $\sum_{53}$ PFAS constitutes 6 % of the total detected extractable organic fluorine, leaving 94% unexplained. When these results are taken with the biota ones, it appears that the majority of these substances are not that bioavailable.

Table 14. Detected concentrations of ToF and $\sum_{53}$ PFAS (in ng F/g) in sediment samples from different areas.

Area	ToF (ng F/g)	$\sum_{53}$ PFAS (ng F/g)
Viul	*<65.3*	0.20
Storelva	*<38.7*	n.d.
Nordfjorden	963.7	62
Storøya	*<84.2*	1.3
Vikersund	*<53.8*	n.d.
Steinsfjorden	*<133.0*	0.29
Holsfjorden	*<106.7*	3.1

The target analysis also identified SAmPaP diester in the sample that was analysed for ToF, although the quantification can not be certain due to the lack of analytical standards. It is clear that SAmPaP diester contributes to the ToF in the sample. There are also other known variants of this chemical that have been used in paper factories, e.g. the smaller monoPAP and the larger triPAP, that both were constituents of the pre-2002 3M Scotchguard product (Nordic Councils of Ministers, 2017). In addition N,N-Et2FOSA was known to be used in the production of food packaging, and can therefore be assumed to be part of the total load of PFAS in the system (Nordic Councils of Ministers, 2017).

8.2 Isomeric patterns of PFOS and degradation of precursors

Two different production methods have historically been used to produce PFAS; electrochemical fluorination (ECF) and telomerization. These production methods are very different and for source tracking the most important difference is that ECF produces a mixture of branched and linear PFAS isomers, while telomerization only produces linear isomers. Quantifying the presence of branched and linear PFAS and looking at the relative distribution between them in the samples can therefore give an indication of the production method, and in some cases, also the source of the contamination.

For most samples, both linear and branched PFOS (br-PFOS) were quantified. For PFOS, the most common manufacturing method used has been ECF, consequently all historical sources of PFOS will have both linear and branched PFOS. From PFOS and PFOS precursors produced by 3M, br-PFOS is expected to be constitute approximately 30 % of the total PFOS concentration (Benskin et al, 2010). However as the mobility of the isomers differs with br-PFOS being more water soluble and therefore more mobile than its linear counterpart, it is not given that the distribution between linear and branched PFOS at any given contaminated area is 30:70.

Biotransformation of preFOS (and SAmPAP) have shown to be faster for branched compared to corresponding linear isomers (Ross et al., 2012; Peng et al., 2014), and enrichment of br-PFOS have previously been shown in fish exposed to SAmPAP (Peng et al., 2014). Thus, increased concentrations of br-PFOS are expected to be indicative of a major contribution of current degradation of SAmPAP and/or preFOS. However, br-PFOS is also reported to have lower elimination half-lives in organisms (Benskin et al., 2009; Zhang et al., 2013) than its linear counterpart. Thus, over time (and further from the point source of release) the combination of br-PFOS higher mobility and faster elimination in organisms are expected to increase the fraction of linear PFOS relative to br-PFOS.

The higher water solubility of br-PFOS is illustrated by the higher share of br-PFOS in water samples compared to sediments samples. In the lake water, the contribution of br-PFOS to the total is close to 30 %, indicating that the sources of contamination are PFAS produced using ECF. This does not however provide an answer to the question of whether the contamination itself is caused by the use of AFFF or products used by the paper industry as ECF was used in both cases. Nonetheless, increasing fractions of linear PFOS were observed with distance from Viul in pore water and in perch liver (Figure 40 and Figure 52, respectively), indicating a higher contribution from ongoing preFOS degradation closer to Viul. The same trend was observed for FTSA compared to Σ_{53} PFAS in perch liver (decreasing proportions with increasing distance from Viul), which might indicate a more complete FTSA degradation further from the source (as discussed in chapter 6.1).

8.3 Estimated amounts of PFAS from sources

An estimation of the contribution from different, possible PFAS sources has been carried out and the results are given here. Both the sources found in the 2017 survey (Miljødirektoratet, 2017) and those identified here are included. It is important to note that there is a difference in the number of PFAS that were analysed in the 217 work and the work here (2017: 23 PFAS in water and biota, 30 in sediments; 2018: 53 PFAS in water, biota and sediments), and that the estimated amounts of PFAS are therefore not directly comparable.

All the calculations of amounts of PFAS present or released, are estimates and are therefore associated with a large degree of uncertainty. This is due to assumptions and simplifications in contaminated areas and average concentrations of PFAS that are subsequently used. This can lead to both underestimations or overestimations of the calculated amounts.

For the identified PFAS sources where water samples were collected in this work, the calculated amounts of PFAS are given in Table 15. The amount of PFOA, PFOS and the earlier defined PFAS groups are calculated. The yearly amounts of water are also given in the table. For Hvalsmoen Military camp and the fire station, the yearly amount of water is based on a yearly precipitation (670 mm/year), and the area that is assumed to

drain to the sampled pipes. For the other sources, the database NEVINA (www.nevina.nve.no) is used to find the water flow in the sampled river.

Table 15. Calculated amounts of PFAS released yearly from the PFAS sources investigated in 2018. Amounts are given in g/yr.

Parameter	Hvalsmoen	Fire station	Haga	Skjærdalen bruk	Vikersund
Water (L/yr)	67 000	16 616	61 495	19 936 113	4 172 213
PFOA	0.74	54	473	225	53
PFOS	0.16	62	214	14	5.7
PFCA	1.7	328	695	225	10
PFSA	0.35	212	358	19	10
preFOS	0	2.6	532	0	0
FTSA	0	2.5	9.7	0	0
$\sum_{53}$ PFAS (kg/yr)	**0.0021**	**0.55**	**1.6**	**0.24**	**0.021**

For the sources investigated in 2017, some industrial sites are not included in the overview, since their effluents go directly to a waste water treatment plant (WWTP), and therefore will be a part of the PFAS load calculated for the WWTP. The WWTPs are considered as the three plants that were investigated in the survey, but it is also assumed that the concentrations found at the two smaller investigated plants represent all the other WWTPs in the area. The amounts of water are calculated based on the registered number of person equivalent that use each of the plants.

For the landfills, the amount of precipitation over the landfill area is used as an estimation of water runoff from the area, given that 50 % of the precipitation evaporates. For the areas with PFAS contamination related to use of AFFF (the fire station and in connection to Eggemoen airport), the yearly precipitation for the area is used as an estimate.

Table 16. Calculated amounts of PFAS released yearly from the PFAS sources investigated in 2017. Amounts are given in g/yr.

Parameter	WWTPs	Landfills	Fire station	Other AFFF
Water (m^3/yr)	569	79 730	16 616	134 000
PFOA	20	8.8	3	7
PFOS	15	1.0	166	0
PFCA	37	25	31	14
PFSA	17	14	185	0
preFOS	0	0.05	0.47	0.00
FTSA	11	1.5	108	0
$\sum_{23}$ PFAS (kg/yr)	**0.065**	**0.040**	**0.33**	**0.015**

For the water samples analysed in this and in the previous project, the landfill at Haga discharges the highest yearly amount of PFAS to the water phase. The fire station was identified as a major source in 2017, but calculations now show that it is not a significant contribution of PFAS to the water phase. Using the concentrations of PFAS found in water from Tyrifjorden itself (chapter 4.1), the total amount of detected PFAS in the water is about 3.5 kg (only PFOS and br-PFOS are detected). Here, the calculation is done using the area of Tyrifjorden (137.21 km^2) and the average depth (93 m) of the lake. This calculation shows that the PFAS point sources released to the water are diluted in the water masses, and further that the primary source of PFAS in the water probably comes from precursor degradation that occurs in the sediments.

For sediments, detectable PFAS concentrations were only found in the river downstream the landfill at Haga and in the area downstream Viul. The amount of PFAS that is present in the sediments was calculated for these areas. For Haga, calculations are based on the assumption that the creek downstream is 80 m long, 1 m wide and contains an average of 2 cm sediment throughout its extent.

For the sediments downstream Viul, the PFAS contamination is assumed to have collected in the sediments at four locations downstream the factory area, as shown in the map in Figure 55. The amount of PFAS in the top 10 cm of sediments from these areas was determined using an equation slightly different to the ones used to determine loads in the sediments in Tyrifjorden due to different sampling depths (see chapter 3.1.2). Further sampling is recommended in the source area in order to determine the extent of the hot spot concentrations and determine how far the PFAS has spread downstream the factory area. The average concentration found within each area is used in the calculation. For source area 4, no samples were taken, and thus the same average PFAS concentration as source area 3 is used.

A sediment density of 0.455 kg/L is used in calculations based on guidelines for risk assessment of sediments stating that wet sediment has a density of 1.3 kg/L and the fraction of dry matter is 0.35 (the concentrations are given in dry weight) (Miljødirektoratet, 2015a).

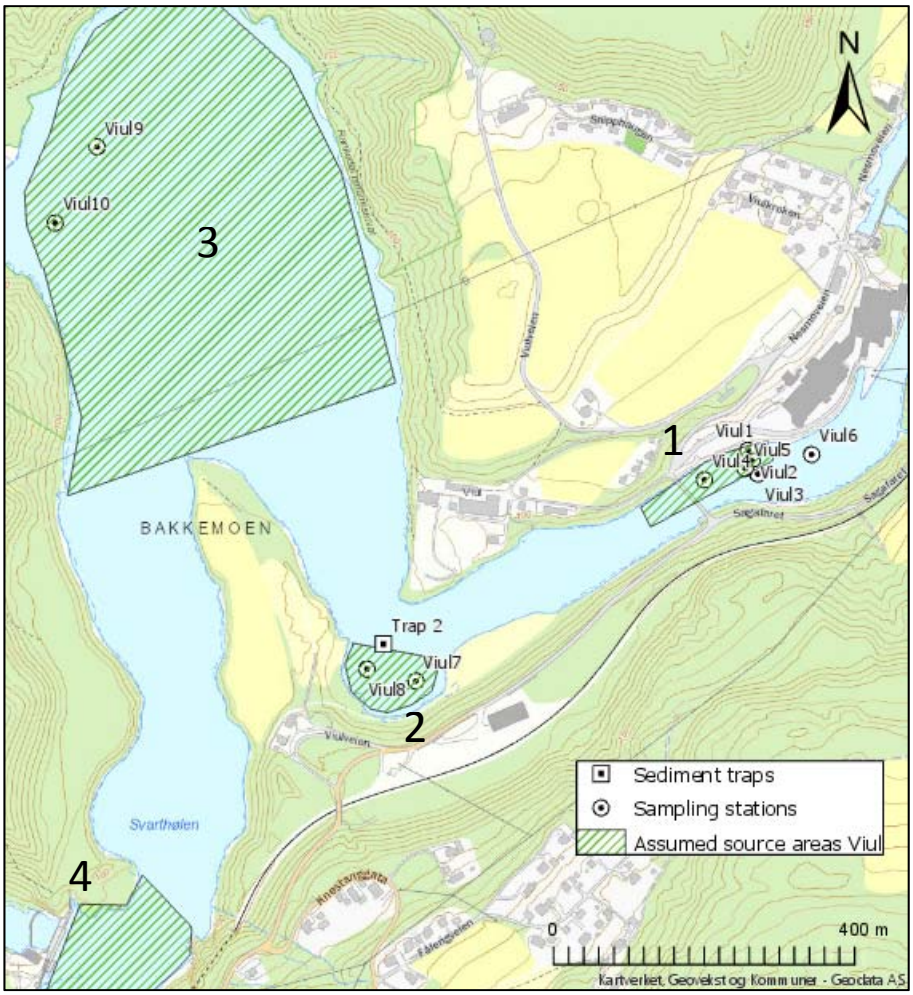

Figure 55. Assumed source areas downstream Viul, also showing the sampling stations in the area.

Table 17. PFAS amounts (in g) in the sediments in the river downstream Haga and in the the top 10 cm of the sediments in the assumed source areas downstream the closed down factory area at Viul.

Parameter	Haga	Downstream the closed down factory area at Viul			
		Source area 1	Source area 2	Source area 3	Source area 4
Area (m^2)	80	6700	8100	218000	20500
PFOA	0	14	0	25	2.4
PFOS	0.0038	136	0	7.6	0.71
PFCA	0	96	0.30	51	4.8
PFSA	0.0038	152	0.53	7.6	0.71
preFOS	0.038	353	3	608	57
FTSA	0.38	399	51	25712	2418
$\sum_{53}$ PFAS (kg)	**0.00043**	**1**	**0.055**	**26**	**2.5**

There are small amounts of PFAS in the sediments downstream the landfill at Haga. Downstream Viul, the largest amounts of PFAS is seemingly gathered right outside the factory area, but there is also deposition of eroded PFAS contaminated sediments downstream. This shows that sediments have spread from area outside Viul and downstream following the river system. A relatively large amount of PFAS is accumulated in sediments in source area 3 (estimated to 26 kg) according to the calculations.

To calculate the amounts PFAS present in the sediments, Tyrifjorden is divided into different areas (as earlier) and the area of each is determined using a mapping tool. The total area of each subarea is dictated by the samples taken within each area (see map in Figure 5).

The average concentrations within each PFAS group, as well as for PFOA and PFOS, from the samples (2 cm depth) are used to calculate the PFAS load. It is important to note that this will underestimate the actual theoretically bioavailable amount of PFAS (assumed to be the present contamination in the top 10 cm of the sediments; Miljødirektoratet, 2015a). The core samples from Nordfjorden show high concentrations of PFAS in the bioavailable layer, while in Holsfjorden, PFAS are detected down to approximately 4.5 cm depth. Thus, using average concentrations across whole areas results in a high degree of uncertainty.

Table 18. PFAS amounts (in g) of the top 2 cm of the sediments in different areas of Tyrifjorden.

Parameter	Nord-fjorden	Stor-fjorden	Storøya	Vikersund	Steins-fjorden	Hols-fjorden	Tyrifjorden (kg)
Area (km^2)	16	56	25	0.009	15	22	
PFOA	0	0	0	0	0	0	**0**
PFOS	161	2 538	1 904	0.15	35	1 342	**6,0**
PFCA	313	5 523	1 814	0.14	9	612	**8,3**
PFSA	161	2 544	1 904	0.15	35	1 342	**6,0**
preFOS	8 054	20 672	1 212	0.48	40	3 143	**33**
FTSA	6 187	76 686	11 715	1.1	265	8 193	**103**
$\sum_{53}$ PFAS (kg)	**15**	**105**	**17**	**0.0019**	**0.3**	**13**	**150**

Table 18 shows that the highest estimated amount of PFAS is found within the Storfjorden area, which is the largest area and also where the highest concentrations of PFAS are detected (see Figure 14). Here, a total of 105 kg $\sum_{53}$ PFAS is estimated to be in the top 2 cm of the sediments, while the total amount of $\sum_{53}$ PFAS in the whole of Tyrifjorden is 150 kg.

8.4 Importance of contamination from paper industry

There are indications that the former paper industry site at Viul is the main source contributing to the PFAS contamination in Tyrifjorden, based on the following observations:

- The PFAS distribution in the sediments

The sediments appeared to be the major source of PFAS input to the lake food web (as discussed in chapter 4.4). Sampling of sediments outside the industrial site show that the distribution is largely dominated by long chain FTSA and preFOS. These substances also dominate the sediments outside the outlet of Storelva river. Long chain FTSA and preFOS are not found in significant concentrations in samples from the fire station, which in the 2017 survey was defined as the other main source of PFAS contamination to the Tyrifjorden system.

- Information from the dated core sample

The dated sediment core sample from Nordfjorden also indicates that the industrial area can be the source of the contamination. The dating, combined with the PFAS concentrations, are descriptive of the legislative history, with the phase out of PFOS and its precursors (including SAmPAP where this was targeted) occurring before a

replacement with long chain FTSA took place. The decline in concentrations of FTSA observed after 2013 correspond with the closure of the paper factory.

- Analysis of a paper plate from Viul

A sample of a paper plate from the former paper industry at Viul was analysed for PFAS. The plate was given to the Norwegian Environmental Agency in 2007. The result of the analysis is shown in Figure 56. The results show that there are high concentrations of PFCA and FTSA in the plate. Since the paper plate was produced in 2007, POSF based PFAS was not used at that time in the factory. No PFSA or preFOS were detected in the sample. The results show that in 2007 the factory switched to other PFAS, most likely a FTSA based product that also contained PFCA of various chain lengths. The results show that the long chain FTSA were a part of the surfactant product in 2007 and thus are probably also part of the discharge from the factory until its closure in 2013.

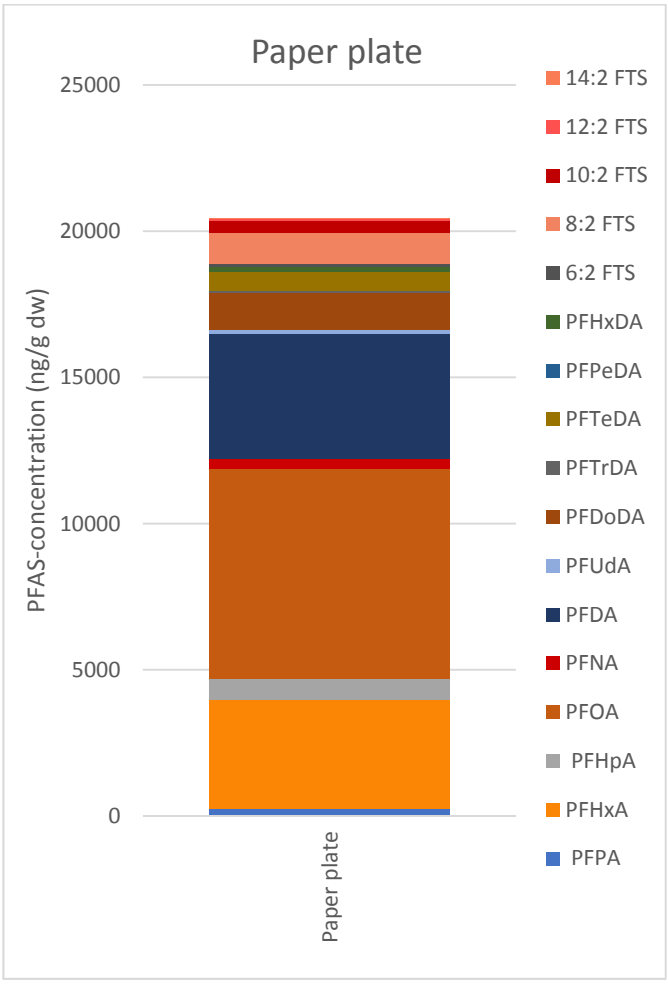

Figure 56. Detected PFAS concentrations in a paper plate from the former paper factory at Viul.

- The landfill at Haga shows release of similar PFAS profiles to that found in the sediments outside the factory area and in Tyrifjorden

Comparing the results in the sediments downstream Viul (Figure 31) and the landfill at Haga (Appendix A, Figure 6) there are similarities in the detected PFAS profile in the sediments, especially the high concentrations of long chain FTSA and some preFOS (especially et-FOSAA and et-PFOSE). At the landfill at Haga, the PFAS originates from the deposited waste that comes from the paper factory at Viul. The similar contamination patterns in both places, strongly indicates that the factory at Viul is a source of long chain FTSA and preFOS to the areas downstream Viul.

- Similar profiles, but higher concentrations of PFAS in fish caught directly downstream the factory area compared to fish caught in the lake

Except for a few individuals, the concentration levels of PFAS found in biota are generally higher directly downstream the factory area at Viul when compared to Tyrifjorden lake. As for sediments, the PFAS fingerprint in biota is similar in samples taken directly downstream Viul and from the lake. Biotic samples are dominated by PFOS, long chain PFCA, long chain FTSA and preFOS (PFOSA, et-FOSAA and FOSAA). Decreasing proportions of both br-PFOS and FTSA with increasing distance from Viul is in accordance with expected biotransformation, and mobility of more water soluble substances, given that Viul is the major source of PFAS.

- Investigation of similar production facilities

The investigation of Nordic Paper at Geithus (appendix A, chapter A1.2.1) shows that former paper industry can be a source of PFAS to the environment, even decades after closure.

9 Possible remediation measures

A remediation measure must be undertaken in order to meet an environmental goal for the area or region. In the water framework directive, environmental quality goals for every water body within the EU/EEA region are defined. These waterbodies should have "good status". Good status is defined according to a list of ecological and chemical quality criteria. Based on these criteria, Tyrifjorden can be defined as having good status when it comes to the ecological quality elements, however Tyrifjorden has a poor chemical status. The chemical status is not poor due to of the occurrence of PFAS in the system, but rather because of lead and mercury found in the water and in muscle in biota, respectively. The contamination of PFAS is listed as unknown (www.vann-nett.no, assessed in 2015).

Results from this work show that the sediments are the major source of PFAS to the water and the biota in Tyrifjorden and Randselva-Storelva. Potential remediation measures should be assessed that have the goal of reducing the environmental risk associated with the sediments in different parts of the lake system, as well as in the Randselva-Storelva water course.

The most important condition for a successful remediation in sediments is to control any sources of contaminants to the sediment. It is therefore necessary to consider remediation of sediments in light of the remedial actions planned in the source area. A natural overall remediation sequence could therefore be:

1. Emission control from upstream sources
    a. Reducing discharges
    b. Cleaning storm water systems
2. Sediment remediation at hot spots close to the source
3. Sediment remediation of other hot spots
4. Sediment remediation of moderately contaminated areas
    a. If all the above actions were successfully implemented it is likely that monitored natural recovery will be sufficient for reaching environmental goals on a long term scale

9.1 Remediation possibilities for sediments

The possible remediation measures for sediments are listed in the following (from the Norwegian Environmental Agency's *Guidelines for handling of sediments;* Miljødirektoratet, 2015b*),* also extended with pros and cons related to this specific project. An assessment of costs for the different measures is not included.

9.1.1 Capping

Capping with clean material, in thin or thick layers, to reduce leaching of contaminants to the water above and further contact with biota.

Pros:

- Capping will reduce the bioavailability of PFAS in the top sediments
- There will be very little spreading of contaminants during the remediation action

Cons:

- Capping of sediments in river systems is difficult due to the continuous flow of water
- An extensive assessment of possible erosion of the cap must be included in the planning phase, including future flood episodes
- Clean fine particles originating from the capping material can be spread by the currents, possibly affecting the biota in the water course
- Capping will temporarily destroy the ecosystem in the capping area
- Capping of the sediments does not remove the contamination from the system

9.1.2 Dredging

Removal of contaminated sediments. The contaminated material is safely disposed in a landfill.

Pros:

- Dredging will remove the contamination from the system

Cons:

- There will be an increase of the particle bound spreading of PFAS during the remediation actions, since the contaminated sediments will be disturbed
- Dredging will temporarily destroy the ecosystem in the area
- Experience show that after dredging there will still be some PFAS contamination left in the area
- After dredging, the contaminated material must be moved to a suitable landfill or contained disposal site where the PFAS contaminated masses can safely be stored long term
- After sediment dredging, treatment of PFAS contaminated pore water may be needed

9.1.3 Monitored natural restoration

Monitoring of an expected or ongoing improvement in parameters defining environmental status in the sediments.

Pros:

- The spreading of particle bound PFAS will continue to decrease, steadily improving the environmental status of the sediments
- Source control measures and remediation of upstream sediments are likely to improve the quality of sediment transported downstream and therefore increase the rate of natural restoration

Cons:

- The natural restoration of the sediments will be time consuming, due to low and probably varying sedimentation throughout the system
- If the remediation implemented upstream is insufficient, the upstream source areas can continue to contaminate the sediments downstream

9.2 Suggestions for further investigation

In order to recommend remediation measures, the scope and sequence of such remedial measured, further investigation of sediment transport and environmental risk associated with PFAS both in Tyrifjorden and in the Randselva-Storelva water course, are needed.

The steps commonly followed when assessing and planning sediment remediation are:

1. Environmental impact assessment (this report is part of this work)
2. Conceptual remediation plan
3. Detailed design of remediation actions at the different selected sites for this remediation

With each of these steps authorities and industry (or other potential responsible parties) must evaluate the need and cost benefit for the relevant remediation actions.

Recommendations for further investigations as a part of phases 1) and 2) are given below:

- Sample sediment in the Randselva and Storelva rivers and analyse for other paper production related PFAS

Sediment concentrations downstream the former paper industry site at Viul show that PFAS contaminated particles have been carried from right outside the factory area and deposited downstream. It is possible that the PFAS fingerprint can be seen throughout the river course, to the outlet of the river. If this is the case, there could be many source

areas that continue to feed Tyrifjorden with PFAS contaminated particles, especially at times of large sediment transport (flood episodes).

A detailed survey of the sedimentation pattern in the meanders in Randselva and Storelva should be carried out, both at the desk and field scale. The investigation should start in the area immediately downstream the factory area, and preferably be a combination of hydrological modelling, investigations to ensure the quality of the modelling and sampling to determine PFAS contamination levels. Interesting information will also be provided by analysing for total flour in more samples.

The investigation should draw conclusions related to which areas of the river course have the greatest need for remediation. The conclusion of the work should also be based on an evaluation of the cost/benefit effect for each of the identified source areas.

Samples should be analysed for other PFAS that are known to have been used in paper production. It is most likely these compounds that contribute to the PFAS contamination.

- Further study of sedimentation in different parts of Tyrifjorden

To investigate the possibility for monitored natural restoration of the sediments in Tyrifjorden, it is important to investigate the sedimentation in different parts of Tyrifjorden. The area outside Storelva is probably one of the areas in Tyrifjorden where the sedimentation rate is highest, but there is no detailed information on the sedimentation in other parts of Tyrifjorden. Sedimentation can be studied either by dating more sediment core samples from different parts of the lake, or by deploying sediment traps.

In addition, the concentration of PFAS in the settling sediment material is relevant. The core sample in Holsfjorden indicates an increasing concentration of PFAS in the top sediments, and investigating the possible origin of this material and the time frame of this sedimentation will provide valuable information. If the sediments are carried by the streams from Storelva, it is likely that the settling particles will continue to be PFAS contaminated for a considerable amount of time. This could be investigated by sampling settling particles in sediment traps or in water samples.

- Documentation

The outcome of further investigations should result in the preparation of a conceptual remediation plan for the sediments in the river system and in Tyrifjorden. The plan should be based on the future use of the area, where an overall evaluation of all stakeholder interest in the Tyrifjorden area (e.g. recreational purposes, fishing, agriculture, industry) should be assessed and included. The evaluation should also include a risk assessment for the different contaminated areas in the rivers and Tyrifjorden and a cost benefit analysis of different remedial strategies.

The assessment of remediation possibilities must also include an evaluation of the cost/effect linked to each of the remediation possibilities. The action that has the best cost/effect, satisfies the ambition level for the clean-up and that can be carried out within an accepted time frame, should be chosen.

9.3 Evaluation of the possible remediation possibilities

From the sediment traps and the core sample, it appears that the concentration of PFAS in the particles that are currently settling in the area outside the outlet of Storelva is declining. Therefore, an improvement in the environmental quality in relation to PFAS contamination can be expected, even without any remediation actions being taken upstream. Monitored natural restoration can therefore be an alternative in the Tyrifjorden area, albeit with some disadvantages listed below.

1) The core sample and the sediment trap results indicate a sedimentation rate below 0.2 cm/year. Given this sedimentation rate, it will take more than 50 years for a 10 cm layer of cleaner sediments to build up (10 cm is defined as the biotic active layer in the sediments; Miljødirektoratet, 2015a). For sediments deeper than 10 cm, there is little exposure of PFAS to benthic fauna or release of PFAS from the sediment pore water into the overlaying water body.

2) Given that there are known active sources of PFAS release upstream, the monitored natural restoration will be less effective than it could have been if these were not present. Particles coming from the rivers will be contaminated with PFAS, reducing the efficiency of the remediation. The core samples show that the sediments are cleaner now than some years ago. There is an uncertainty connected to continuous spread of PFAS from the source areas in the river systems.

Based on a more detailed evaluation of possible remediation options, it is likely that a combination of different remediation measures is favourable. When carrying out remediation, the best approach is to carry out one clean up measure, evaluate the effect downstream before assessing the need for further action.

Based on results here, remediation is needed in the sediments right outside the former paper industry site at Viul, but that the extent of the area in need of remediation is unknown. The amount of PFAS in the sediments in the area should also be compared to possible hot-spots downstream, and a cost-effect analysis should determine which of the source areas that are to be prioritized. Further investigations should be carried out in the sediments downstream to establish the need and scope for remediation of possible source areas in the river systems, and also the expected time frame for monitored natural restoration of Tyrifjorden.

A stepwise approach is suggested for remediation:

1. Establish the amount and prevalence of PFAS in the source area in the sediment in Randselva outside the former paper industry site at Viul

2. Investigate the river system downstream the industry site, from the dam downstream to the outlet of Storelva. The investigations should start with an assessment of the sedimentation pattern in the meandering rivers
3. Assess the need for remediation of the sediments directly downstream Viul and the possible "hot-spots" detected towards the outlet in Tyrifjorden, including which remediation alternative is most viable
4. Closely assess the sedimentation pattern and the settling particles in Tyrifjorden. Assess the possibility of monitored natural restoration as an option for remediation in Tyrifjorden
5. Assess the need for other remediation measures (capping or dredging) for the sediments in Tyrifjorden
6. Monitor water, sediments and biota in Tyrifjorden to assess the improvement after remediation measures are put in place

10 Summary

In this project an extensive environmental survey of the PFAS contamination in water, sediment and biota in Tyrifjorden lake and the Randselva-Storelva water body has been carried out. The survey was a follow up of a source tracking investigation for PFOS performed in 2017, identifying possible sources of PFAS to the Tyrifjorden area. The 2017 investigation identified two major sources of PFAS contamination, and high concentrations in sediments and liver from perch *(Perca fluviatilis)* were detected.

Field work was carried out here to sample sediments (grab samples, core samples and sediment traps), water, and pore water which were analysed for 53 individual PFAS. Biota samples of fish (perch (*Perca fluviatilis*), pike (Esox lucius), whitefish (*Coregonus lavaretus*), roach (*Rutilus rutilus*), bream (*Abramis brama*), brown trout (*Salmo trutta*) and arctic char (*Salvelinus alpinus*), crayfish (*Astacus astacus*)), zooplankton and benthic organisms were analysed for PFAS. PFAS analyses show that:

- Only PFOS was detected in the free water masses of Tyrifjorden, and in low concentrations (below Annual Average Environmental Quality Standard (AA-EQS value) for PFOS of 0.65 ng/L)
- The PFAS concentrations in sediments are high, especially long chain FTSA and preFOS
- Pore water concentrations are high, particularly in the samples from the delta outside Storelva. In the pore water samples, the more mobile PFCA dominate the PFAS distribution
- For biotic media in general, the highest concentrations were detected in perch liver. Except for one individual of perch from Storøya, the highest PFAS concentrations (Σ53 PFAS) in biota was found in perch caught outside the former paper industry site at Viul. In biota from the other areas, the detected PFAS concentrations are comparable
- The biota generally contains large proportions of PFOS, with concentrations exceeding EQS_{biota} in 23 of 63 fish muscle samples, 70 of 72 fish liver samples and in both zooplankton samples
- PFOS concentration compared to other detected PFAS varies between different biota species
- The results from stabile carbon isotopes ($\delta^{13}C$) indicate that uptake of long chain PFCA, preFOS, and long chain FTSA are associated to the benthic food web
- The low concentrations of PFAS in lake water combined with the clear relationships to the benthic food web indicate that the lake sediments are a major source for continuous input of PFAS to the lake food web (partly via release from sediments to the water column)

It is not possible to conclude what kind of effects the detected concentrations of PFAS will have on biota in Tyrifjorden. However, the levels of PFAS reported here pose an unacceptable risk to the local ecosystem. This is based on the $QS_{BIOTA, SECPOIS}$ for PFOS, observed biomagnification of PFOS and long chain PFCA, existing literature on oviparous transfer, toxicity, and the great uncertainties associated with possible effects of a mixture of different PFAS. Long term exposure of wildlife at higher trophic levels may lead to adverse effects.

The contribution of the sources found in this study and the survey from 2017 was estimated as yearly release of PFAS from each of the sources. There are large uncertainties in these calculations. The calculations show that the fire station and the paper waste disposal site contribute 0.55 kg PFAS/yr and 1.6 kg PFAS/yr to the water phase, respectively. Due to a high dilution in Tyrifjorden, this will have little effect on the total load of PFAS in the system (estimated to be around 3.5 kg for detected PFAS in the water phase).

The largest source of PFAS in the Tyrifjorden area is in the sediments, both in Tyrifjorden itself, downstream the former paper industry site at Viul, and probably also in sedimentation areas in the Randselva-Storelva water course. However, how large the source areas are is very uncertain. Estimates based on the detected concentrations show that 30 kg PFAS possibly could be present in the sediments downstream the factory area, while the total amounts in Tyrifjorden is estimated to be 150 kg. Note that the estimation in Tyrifjorden is based on the upper 2 cm of the sediments, while the contamination can be bioavailable down to 10 cm in the sediments.

The former paper industry site at Viul is the main source giving the high sediment PFAS concentrations seen in Tyrifjorden. This conclusion is based on the following:

- The distribution of PFAS in the sediments
- Information from the dated sediment core sample
- Analysis of a sample of an article (disposable paper plate) from Viul
- The unregulated waste paper disposal site show release of similar PFAS to what is found in the sediments outside the factory area and in the sediments in Tyrifjorden
- Higher concentrations of PFAS, but similar profiles, in fish caught directly downstream the factory area compared to fish from the lake
- Investigation of a similar paper production facility at Geithus

The sediments originating from Viul are probably also the main source of the detected PFAS concentrations in the water phase in Tyrifjorden and in the sampled biotic media. An assessment of possible remediation measured for the sediments in the Randselva-Storelva water course and in Tyrifjorden itself should be carried out.

A stepwise approach is suggested for remediation:

1. Establish the amount and prevalence of PFAS in the source area in the sediment in Randselva outside the former paper industry site at Viul
2. Investigate the river system downstream the industry site, from the dam downstream to the outlet of Storelva. The investigations should start with an assessment of the sedimentation pattern in the meandering rivers
3. Assess the need for remediation of the sediments directly downstream Viul and the possible "hot-spots" detected towards the outlet in Tyrifjorden, including which remediation alternative is most viable
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5. Assess the need for other remediation measures (capping or dredging) for the sediments in Tyrifjorden
6. Monitor water, sediments and biota in Tyrifjorden to assess the improvement after remediation measures are put in place

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Appendix A

OTHER POSSIBLE SOURCES OF PFAS

Contents

A1 Other possible sources of PFAS

A1.1 Landfills

A1.1.1 Vikersund landfill

Close to the municipality Vikersund in Modum County, there is a closed down landfill. Information about the landfill is scarce and the dates of when the landfill was active are unknown.

Aerial photos from 1966 shows that waste was still deposited in the area at that time, and it is therefore probable that waste containing PFAS is present. NGI does not have any information related to the closure of the landfill.

Figure 1. Aerial photo from 1966. An area where the photo indicate presence of a landfill is marked with red.

The area is now partly a sports field with two different football fields, and partly a non-habited park area. In 1995-96, the gravel pitch in the area was extended, and at the same time a brook through the areas was also closed. The brook was associated with contaminated and foul-smelling water, and the users in the area wanted to divert it into pipes.

Sampling was carried out in the brook in the area after the pipes (sampling stations 1 and 2), as well as in a connecting brook (sampling station 3), and in Tyrifjorden (sampling station TYR) itself. Comparing the map in the aerial photo from 1966 to the sampling map from 2018, it is apparent that the landscape has changed and that the northern part of the sports field is probably established on the landfill. Sampling station 3 was included to investigate if this brook also is affected by the landfill.

Figure 2. Sampling sites nearby the Vikersund landfill

Figure 3 shows PFAS concentrations and distribution found in the water samples from the brook. The results show that PFAS is detected in the brook, but in relatively low concentrations compared to that found in water samples from landfill sites in the Tyrifjorden area earlier (Miljødirektoratet, 2018). Samples 3 contains the lowest detected concentrations, probably due to dilution with clean water that is not affected by the landfill site. PFCA is the dominate PFAS in the water.

PFAS is not detected in the sediment samples around the Vikersund landfill.

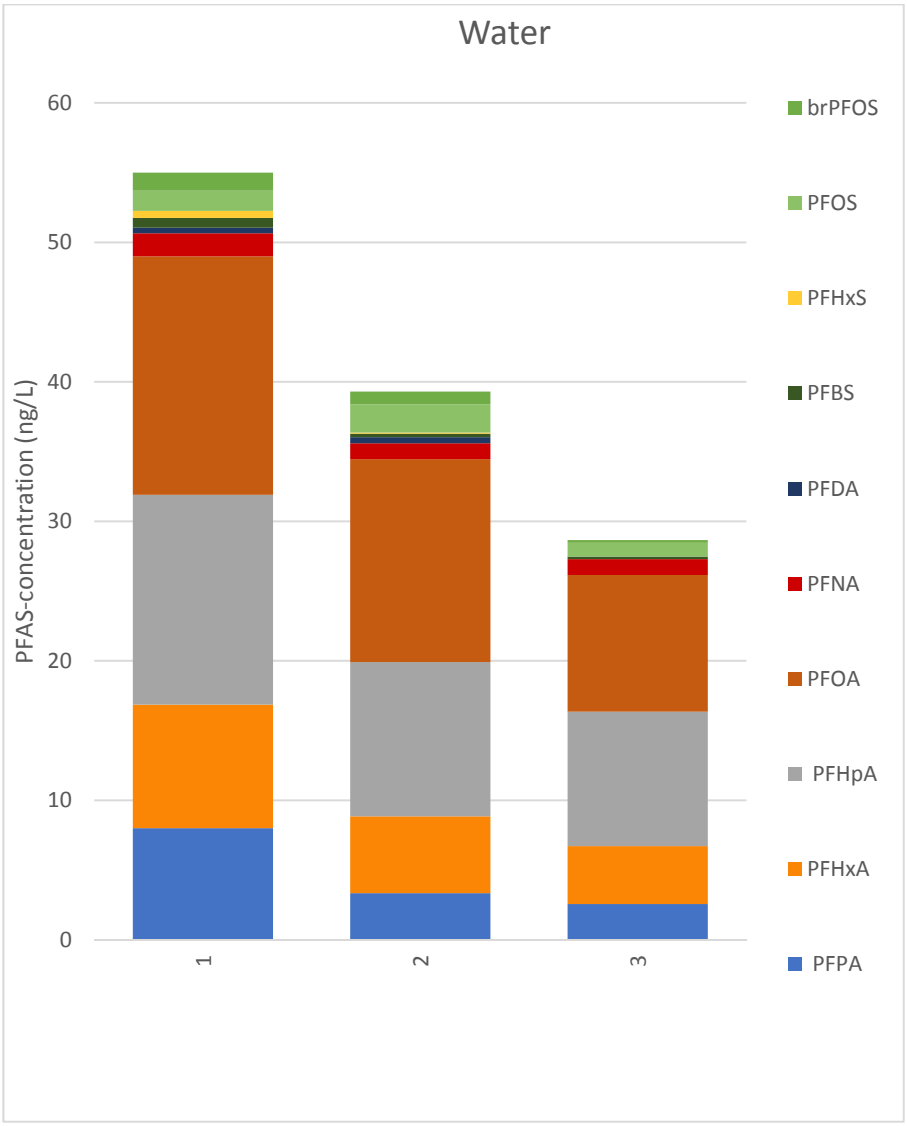


Figure 3. PFAS concentrations in the water samples outside Vikersund landfill.

A1.1.2 Deposit Haga

At Haga, along the west side of Tyrifjorden, a farmer received waste from paper production for 11 years (from sometime in the 80s to the 90s). The waste was mainly residual plastic material following the recycling of paper products, but also some cellulose. The waste was held together in bundles with steel wire.

The farmer used the waste in order to level the land masses. The affected area is thought to be between 3000 and 5000 m^2, and an average of 3 m waste was filled over this area, resulting in a total volume of 9000 to 15 000 m^3. In the 90s, the area was covered with soil (6-7 meters), to make the area cultivable.

Sampling was carried out upstream in a manhole and downstream in a small creek with an outlet in Tyrifjorden. The creek is clearly affected by run-off from the waste, as metal precipitation can be observed in the sediments in the creek.

Figure 4. Sampling station in connection to the Haga deposit. The red marking shows approximately where the deposit is located.

The results from the water samples are shown in Figure 5. They show that there is an increase in PFAS concentration from the upstream sample to the downstream sample in the creek. Many PFAS are detected downstream, and in a relatively high concentration, showing that the water in the creek is affected by the landfill.

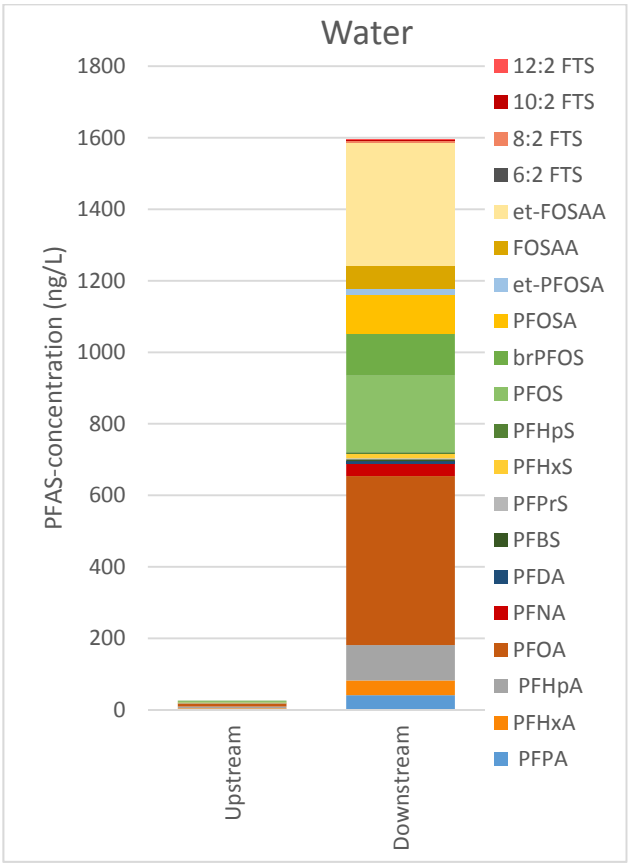


Figure 5. PFAS concentrations in the water samples in connection to the Haga deposit

The results from the sampled sediments from the landfill area are shown in Figure 6. As for water, there is a relatively high concentration of PFAS found in the downstream sample, but the distribution of PFAS is somewhat different to the water samples. This is probably due to the different partitioning behaviour of the PFAS, where the FTSA has a tendency to partition to sediments and not water.

In the upstream sediment sample, only PFOS is found at a very low concentration (0.74 ng/g dw). In the downstream sediments, relatively high concentrations are detected in the sediments, especially of 8:2 FTS and 10:2 FTS, showing that there is particulate spreading of PFAS from the landfill to the creek.

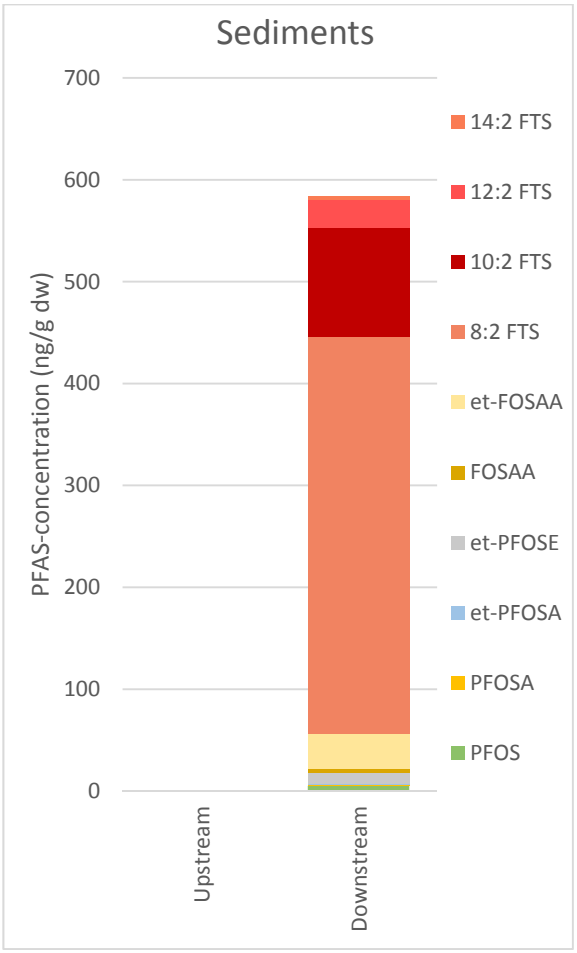


Figure 6. PFAS concentrations in the sediment samples in connection to the Haga deposit.

A1.2 Paper industry

The source tracking around Tyrifjorden, shows that the disused industrial site at Viul was a major source of PFAS contamination in the area. Paper production was carried out at the site from the late 1800s, and in the 1960s, production was focused on food packaging, including disposable cups and bowls. The Norwegian Environment Agency wanted to investigate a comparable site to see if other similar paper factories are sources of PFAS to the environment.

A1.2.1 Nordic Paper Geithus

In 1876, a paper producing factory was started at Geithus in Modum county. The production was primarily paper for food packaging. A previous employee at the site confirmed that fluoro surfactants were used in the production to make the paper water and fat repellent. The employee confirms the use of products with brand names Scotchban (3M), Zonyl (DuPont) and Cartafluor (Clariant) for coating.

Since the fluoro surfactant products were expensive, there was regular testing of the functionality of the coating to ensure that the correct amount of surfactants were added in the production. In the production line, the paper was finished and dried before application of the fluoro surfactants. The paper was then put in a bath containing water, starch and the fluoro surfactant. After the application, the paper was ready for packing and distribution. This was considered the most efficient way of applying the chemical for this use, the alternative being to add the chemical to the wet paper mass. Using this method lead to a greater volume of fluoro chemicals being used. The application in wet paper mass was likely a more common way of application when making disposable paper products for food (f.i bowls and cups).

The concentration of perfluorinated surfactants in the products are not known, as the composition is protected by trademarks. Generally though, UNEP (2010) reported that a 1-1.5 % concentration of fluorochemicals based on the dry weight of the fibres is needed for protection of paper.

Based on increasing environmental concern connected to the fluoro surfactants, Nordic Paper decided to stop the application of these surfactants in their production around 2005. In UNEP (2010) Nordic Paper was mentioned as a pioneer of production of greaseproof paper through mechanical processes making extra dense paper that stops leakage through the paper.

Production at Geithus ceased in 2007 due to recession in the marked for paper products. The area is now used for various industrial and commercial companies, among others a paper factory called Norwegian Paper. This factory has limited production, and is mainly based on distribution of paper for further production. To our knowledge, no fluorinated chemicals are used in this factory.

During a visit to the factory, a guided tour was given and water was sampled. The sampling spots were limited to the water effluent from factory (effluent), water in the river (River) and water and sludge in an old gutter in the basement of the factory (Basement). The gutter is probably the closest spot to where the fluorochemicals were used in the production baths. The effluent from the factory area gathers all water from inside the factory. The river passing by the factory area has a high current, and the deposition of sediments outside the factory area is scarce. The sampling points are shown in Figure 7.

Figure 7. Sampling points at the closed down Nordic Paper factory at Geithus.

Figure 8 shows PFAS concentration in the water samples taken from the disused Nordic Paper factory at Geithus. The samples show relatively high concentrations, both in the basement and in the effluent point leading the water into the river system. In the river, the concentrations are diluted by the river water. The distribution shows a similar pattern to the detected PFAS, but there are more substances detected in the basement than in the water in the effluent point. The river water also shows a similar distribution, but the samples water partially also originate from Tyrifjorden.

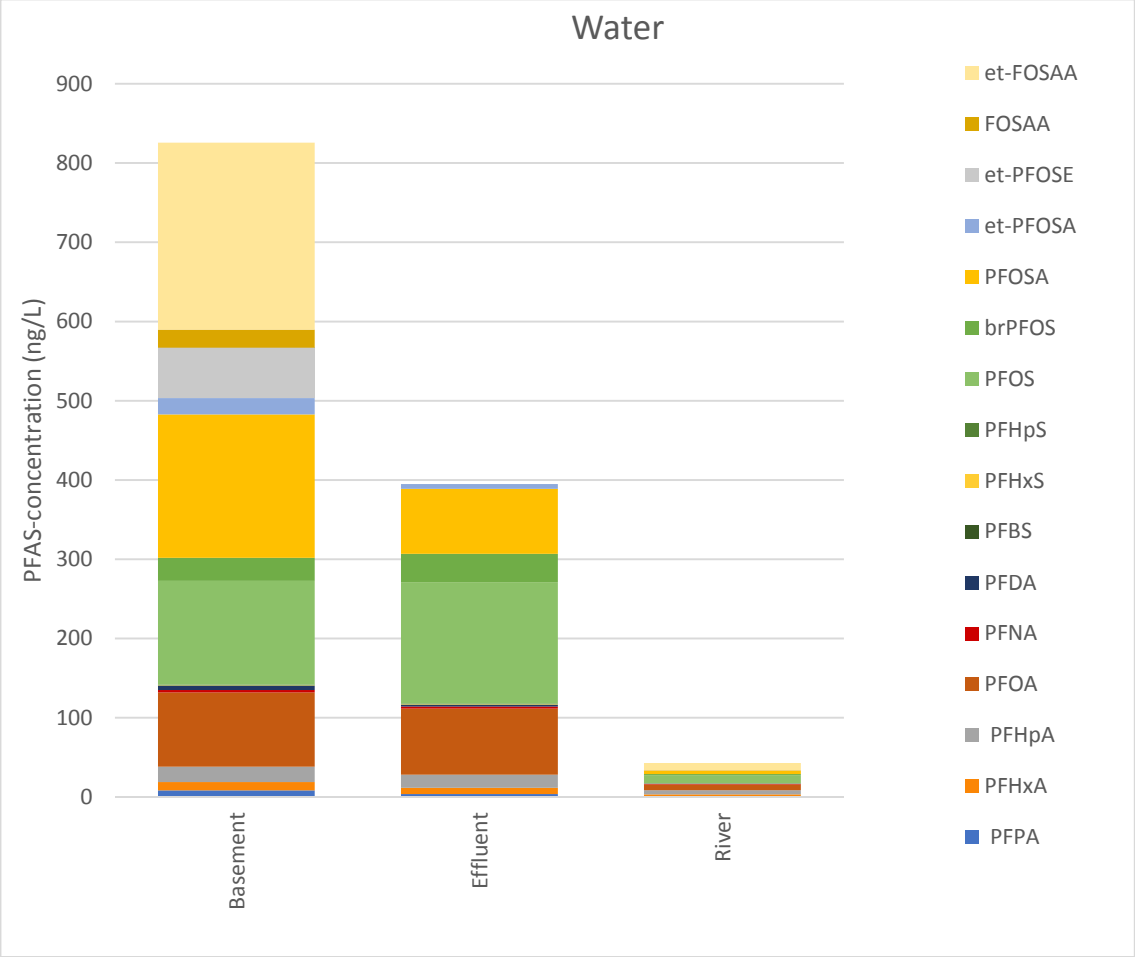


Figure 8. PFAS concentrations in the water samples in connection to the closed down Nordic Paper factory.

The PFAS concentration in the sludge sample from the basement is shown in Figure 9. A high concentration of PFAS is detected, which is dominated by et-PFOSE and et-FOSAA, both chemicals that are associated with paper industry. There is no long-chain FTSA detected in the samples, probably because the factory stopped using PFAS approximately at the same time that 3M phased out POSF-based products. The amount of sludge in the basement is very small, and the sludge itself is therefore assumed to be a small source of PFAS contamination.

The detected concentrations show that there is an ongoing emission of PFAS from the factory area. PFAS is known to adsorb to concrete.

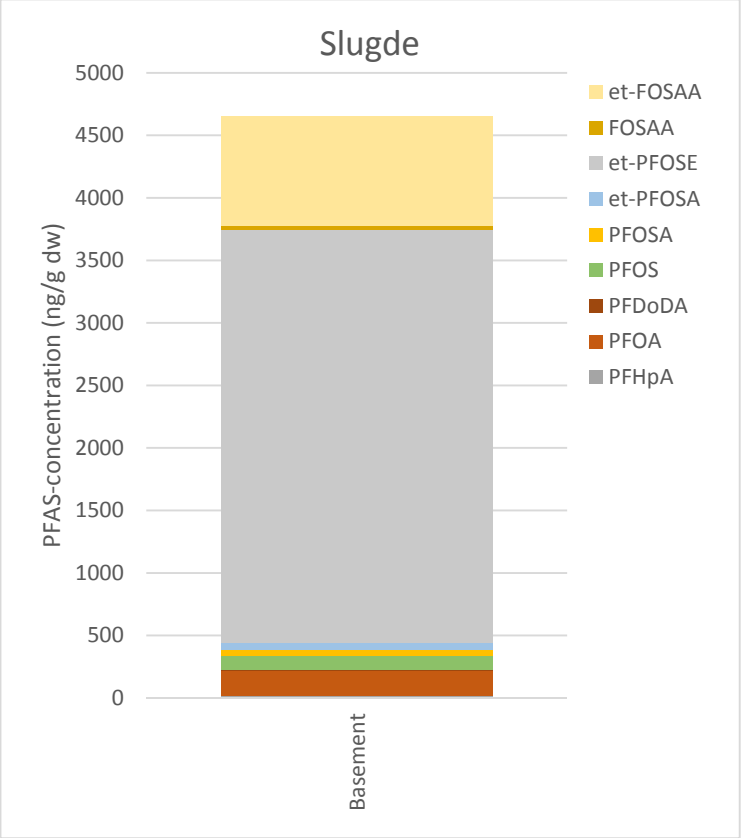


Figure 9. PFAS concentration in the sample of slugde from the basement in the closed down Nordic paper factory at Geithus.

The sampling of the disused Nordic Paper factory at Geithus shows that the contamination around the former industry site at Viul is not an isolated incident, and that there is probably PFAS contamination around most paper factories that have used perfluorinated chemicals in their production methods. The surroundings around the paper factory at Geithus differ from Viul, since there is no sedimentation just outside Geithus, but instead a spreading with the river to possible downstream sedimentation of PFAS contaminated particles.

A1.2.2 Skjærdalen bruk

In the municipality of Tyristrand along the west side of Tyrifjorden, there is an old factory area where the paper factory Skjærdalen bruk was located from the late 1800s until its closure in 2007. In the latest years of production, the factory processed paper to produce tissue paper. The area is now used for storage, and is owned by Skjærdalen Eiendom AS. Our contact person at the site had no information related to the use of perfluorinated chemicals at the factory.

Sampling was carried out in the main basin for water that originates from the factory area (manhole, water and sludge) and in the river passing by the factory (creek only

water due to no sedimentation). Today, the water in the basin is only water from the roofs of the buildings in the factory area.

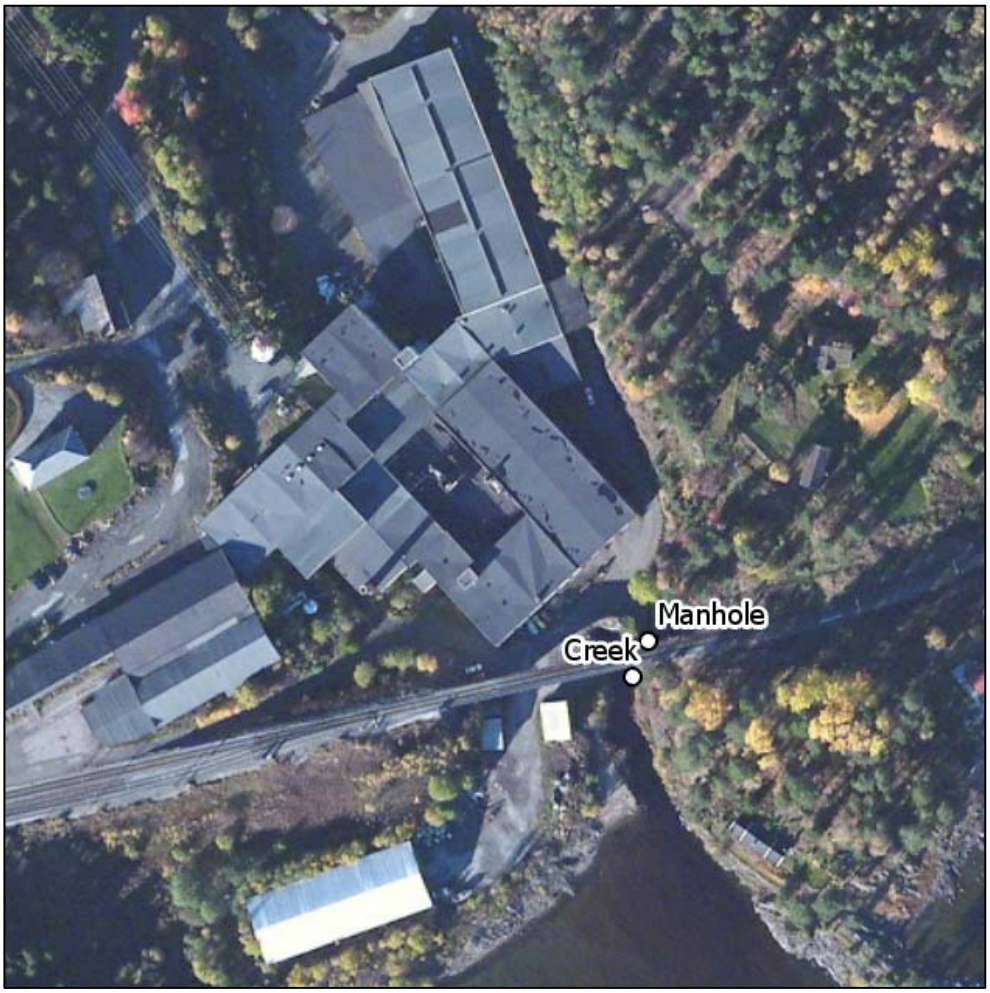


Figure 10. Sampling points at the closed down factory Skjærdalen bruk at Tyristrand.

Detected PFAS concentrations in the water samples are shown in Figure 11. PFAS is not detected in the sludge sample from the manhole. The concentrations in the sampling points are relatively low, showing that Skjærdalen bruk is a minor source of PFAS contamination to Tyrifjorden. Only PFSA and PFCA are detected in the water samples, and it is therefore unlikely that the factory used the same impregnating products as were used at Nordic Paper at Geithus and probably also at the factory at Viul.

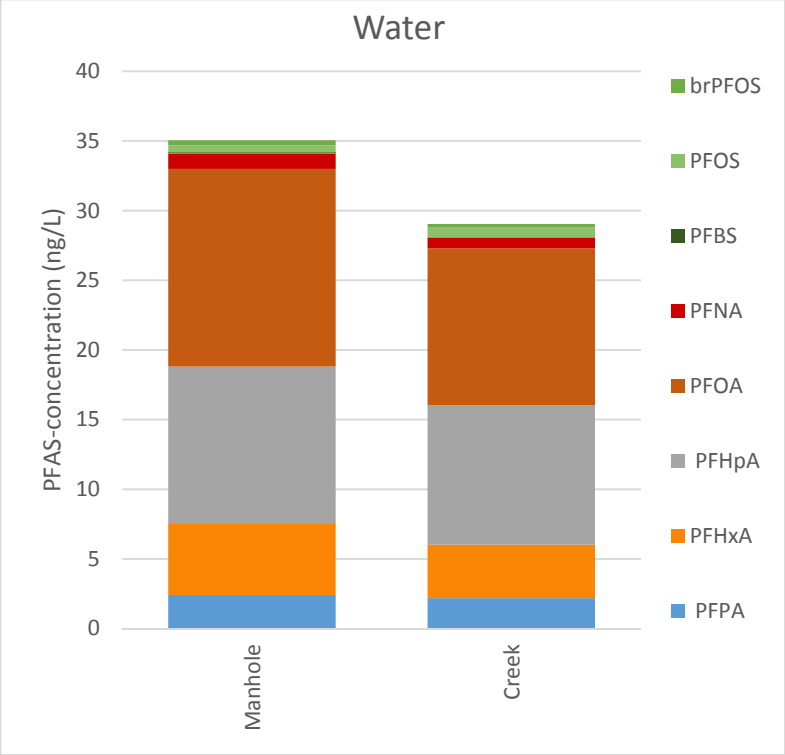


Figure 11. PFAS concentrations at the sampling points at Skjærdalen bruk.

A1.3 Other sources

A1.3.1 Fire station, Hønefoss

The fire station in Hønefoss was thoroughly sampled in 2017, and found to be a major source of PFAS contamination (Miljødirektoratet, 2018). In this survey a wider variety of PFAS were analysed and it has become clear that 10:2 FTS and 12:2 FTS were major contributors to the overall contamination load. Additional analysis was carried out on samples from the fire station to check whether 10:2 FTS and 12:2 FTS were included in the fingerprint of contamination. These substances are not known to be constituents of AFFF.

Following the request of the Norwegian Environment Agency, remediation and clean up has started at the site. The manholes and infrastructure have partly been emptied for PFAS waste and cleaned in order to decrease the ongoing source of PFAS release. AT present, the sludge from the manholes had not been disposed of. Therefore, sampling of the slugde and the water was done during the cleaning period.

The result show high concentrations, both in the water and the sludge (Figure 12). There is a difference between the two samples, this is probably due to the water and sludge originating from different times in the cleaning process, and based on the fact that there were some manholes that were much more contaminated than others (Miljødirektoratet, 2018).

In the sludge, the main constituent to the PFAS contamination is PFOS, while the water contains a much more diverse set of PFAS with PFHxA dominating.

Both the water and the sludge have low concentrations of the PFAS that have been identified to be associated with the former paper industry site at Viul (especially 10:2 FTS, 12:2 FTS, et-PFOSE and et-FOSAA). It is therefore very unlikely that the fire station is the origin of the high concentrations found of these substances in the sediments in Tyrifjorden.

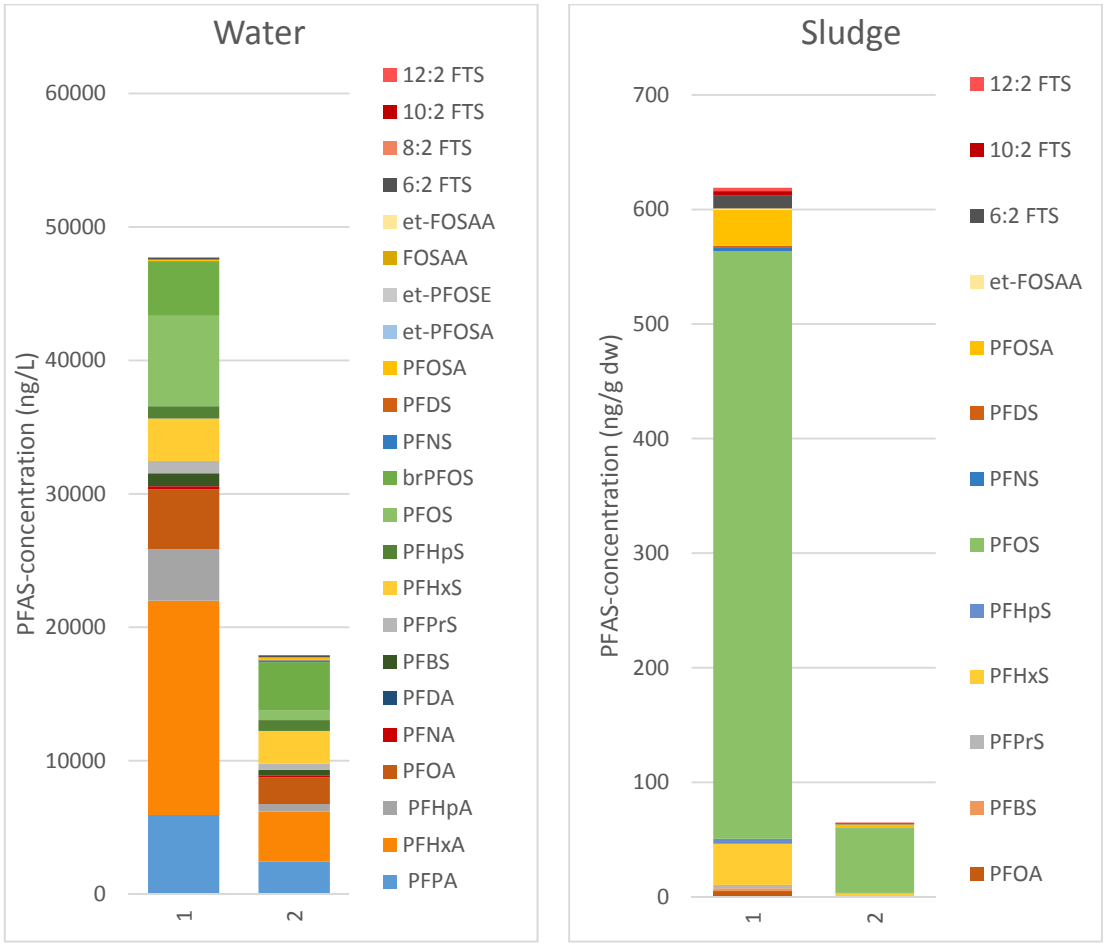


Figure 12. PFAS concentrations in water (left) and sludge (left) from the cleaning of manholes and pipes outside the fire station at Hønefoss.

A1.3.2 Schjongslunden

Schjongslunden is the name of a peninsula of the Storelva river, downstream the city of Hønefoss. The area is used for recreation by the population of Hønefoss. For about 20 years (from the 1980s), the area was also used by the local fire department for firefighting training. The practice was carried out once a year in several shifts where

each shift used about 20-25 L of foam concentrate. During the practice the firefighting foam was released directly to the river. After the practice, the equipment was washed at the fire station, where the remaining foam was released to the infrastructure around the fire station (a little downstream the river from Schjongslunden).

There is no information on product names or types of firefighting foam used during these exercises, but was likely an AFFF, containing fluoro surfactants as active ingredients, probably mainly PFOS as this was most commonly used in AFFF from that time (prohibited as the main ingredient in AFFF in Norway in 2007). To place a value on likely release from this source assumptions must be made. The concentration of PFOS in a firefighting foam analysed in a masters thesis carried out at NGI was found to be 100 000 000 ng/L in a 1:100 dilution. This dilution factor is commonly used for firefighting foam. This foam was produced by 3M and assuming the same was used here a rough estimate shows that 10 g PFOS are released directly in to the river per year.

Samples were taken both from the river water (three samples, stations 1, 2 and 3), the sediment both in the middle of the river (three samples, stations 1, 2 and 3) and nearby the shore (three samples, stations 4, 5 and 6), and from the sand on the beach (three samples, stations 7, 8 and 9). One sample was also included to analyse the pore water concentration of PFAS (from station 1).

Figure 13. Sampling points at Schjongslunden. The blue arrow indicates the direction of the water in the river.

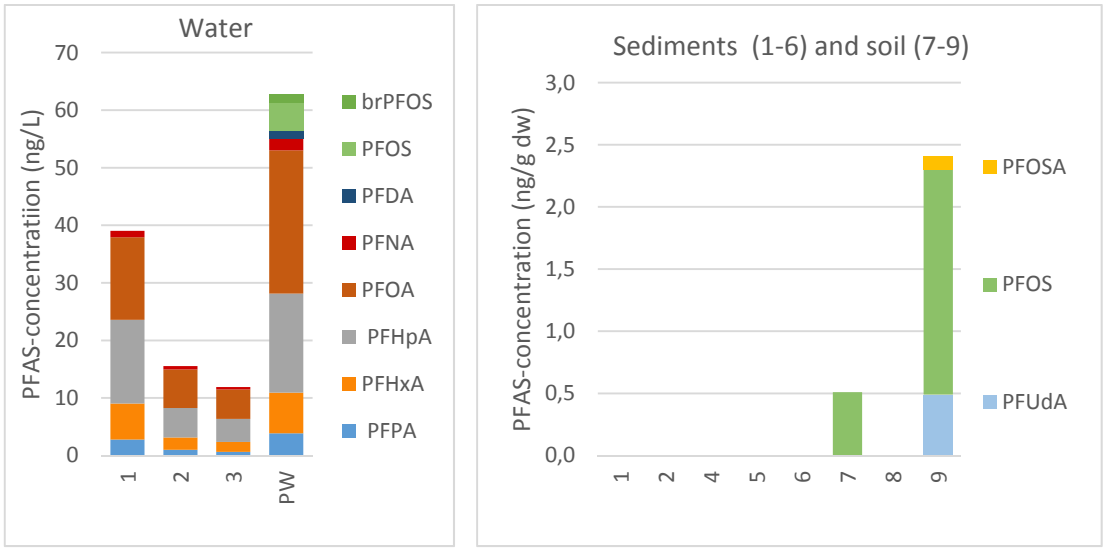


Figure 14. PFAS concentrations in water and pore water (PW) (left) and sediments/soil (right) at the sampling stations in Schjongslunden.

As shown in Figure 14, PFAS was not detected in the sediments. Low concentrations of PFOS, PFOSA and PFUdA were detected in the soil on the river bench. There is no indication that the area was contaminated by the use as a training area for the local fire brigade.

The water sampled in the area show surprisingly high concentrations of PFAS compared to the concentrations found in the river water in the survey done in 2017 (Miljødirektoratet, 2018), where only PFOA was detected in Storelva and in low concentrations (0,33 ng/L). The results are comparable to what is found in river water nearby Viul. It is likely that the detected PFAS is a part of the contamination spreading with the river, and not due to a local source at Schjongslunden.

A1.3.3 Military camps

There are three former military camps in the area (Eggemoen, Hvalsmoen and Helgelandsmoen), all situated relatively nearby the river.

Hvalsmoen housed the engineering division of the military, and therefore had its own fire brigade and is considered the most likely contamination source.

Figure 15. Former military camps in the area (Map: Statens kartverk).

The groundwater downstream Eggemoen military camp, which also has an airstrip, was thoroughly sampled in the 2017-survey, and the area was concluded to be a relatively small source of PFAS contamination (Miljødirektoratet, 2018).

Hvalsmoen was closed in 2001, and now the area is used for various purposes, though primarily as a reception centre for asylum seekers. There are plans to develop the area into a new residential area.

The drainage system in the area was investigated to see if there was any leaching of PFAS contamination from the area. There is probably little ongoing maintenance of the pipes and manholes, as many of the manholes were impossible to open due to growth or other blockages. Owing to this, only one manhole was sampled (KS-HVA-K1, water and sediment) and one outlet into the river (KS-HVA-UT, water and sediment).

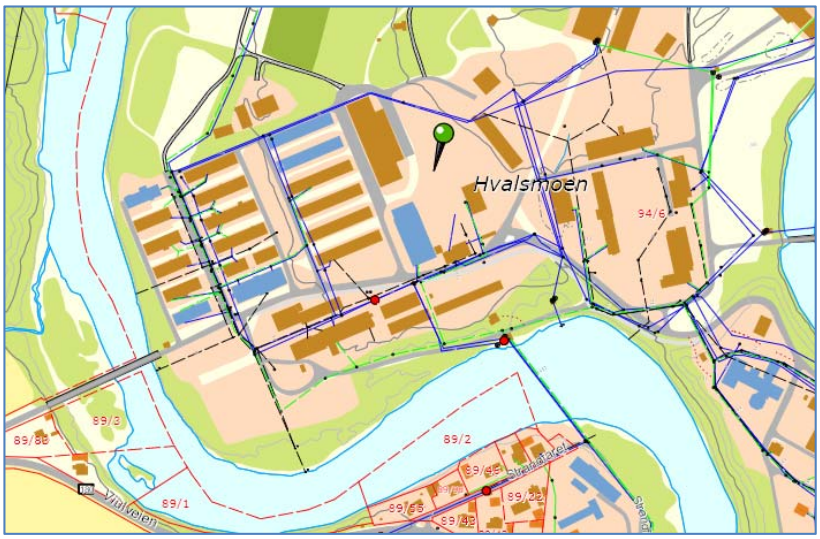


Figure 16. Drainage system at the former Hvalsmoen military camp (Map: Ringerike kommune).

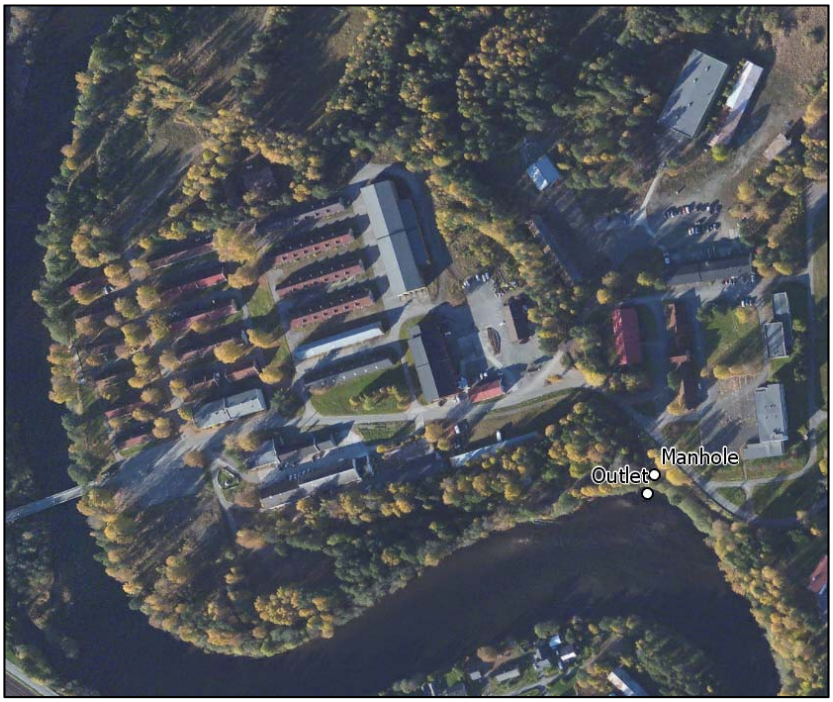


Figure 17. Samples from Hvalsmoen Military camp.

Results from the analysis are shown in Figure 18. The analysis show that there are very low concentrations of PFOS detected in the manhole, and nothing in sediments from outlet into the river. Relatively low concentrations of PFAS are detected in the water.

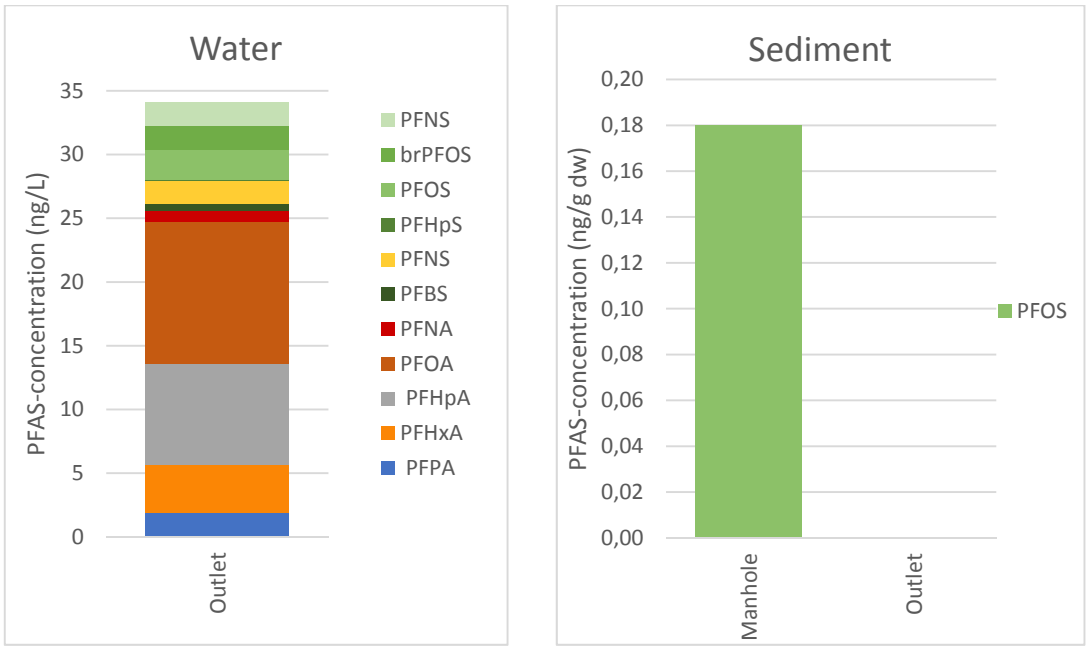


Figure 18. PFAS concentrations in water sample (left) and sediment samples (right) from Hvalsmoen.

Appendix B

CALCULATED LOG KD VALUES

Table 1. Calculated log Kd values (L/kg) for PFCA.

Station	PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTeDA
Vik A	<1,2	<1,1	1.1	0.8	<1,2	<1,4			
Vik B	<0,9	<0,9	<0,7	0.3	<1,2	<1,3			
Vik C	<0,7	<0,7	<0,6	0.1	<0,9	<1,1			
Stor A	<1,7	1.7	1.6	1.7	<1,8	<2,4			
Stor B	<1,4	1.3	1.2	1.4	1.7	2.1			
Stor C	<1,7	<1,3	1.1	1.2	<1,5	<2,2			
Hol A	<0,9	1.3	1.2	1.2	1.2	1.6			
Hol B	<1,2	<8	0.8	0.9	<1,1	<1,6			
Hol C	<1,1	0.8	0.7	0.8	<1,1	<1,5			
Nord A	<0,6	0.9	1.0	1.1	1.8	2.3	>3,3	>3,5	>3,3
Brann 3	<1,9	1.7	1.5	1.3	<2,0	<2,4			

Table 2. Calculated log Kd values (L/kg) for PFSA.

Station	PFBS	PFHxS	PFHpS	PFOS
Vik A	<1,5	<2,5	<2,9	0.8
Vik B	<1,8	<2,9	<2,9	0.6
Vik C	<1,8	<2,4		0.5
Stor A	<2,5	<2,1	<2,1	1.7
Stor B	<2,3	<1,9	<2,0	1.8
Stor C	<2,3	<1,8	<1,9	1.5
Hol A	<1,8	<1,5	<1,6	1.4
Hol B	<2,2	<1,3	<1,2	0.9
Hol C	<2,0	<1,5	<1,6	1.2
Nord A	<2,9	<1,5	<2,3	2.1
Brann 3	<2,4	<2,7		1.0

Table 3. Calculated log Kd values (L/kg) for preFOS and FTSA.

Station	PFOSA	et-PFOSE	FOSAA	et-FOSAA	8:2 FTS	10:2 FTS	12:2 FTS	14:2 FTS
Vik A								
Vik B								
Vik C	<1,5						>3,0	
Stor A								
Stor B	>3,7	>3,1			>3,0	>3,6	>3,8	
Stor C	>3,3	>2,6				>3,1	>3,2	
Hol A	>3,1	>2,8			<1,8	3.4	>4,0	
Hol B	>3,1					>3,3	>3,4	
Hol C	>3,2					>3,4	>3,3	
Nord A	2.5	>3,6	2.5	3.5	2.4	3.5	3.8	>3,9
Brann 3	<2,8							

Appendix C

ADDITIONAL FIGURES FOR BIOTIC SAMPLES

Contents

C1 Figures showing percentage distribution of detected PFAS in biotic samples

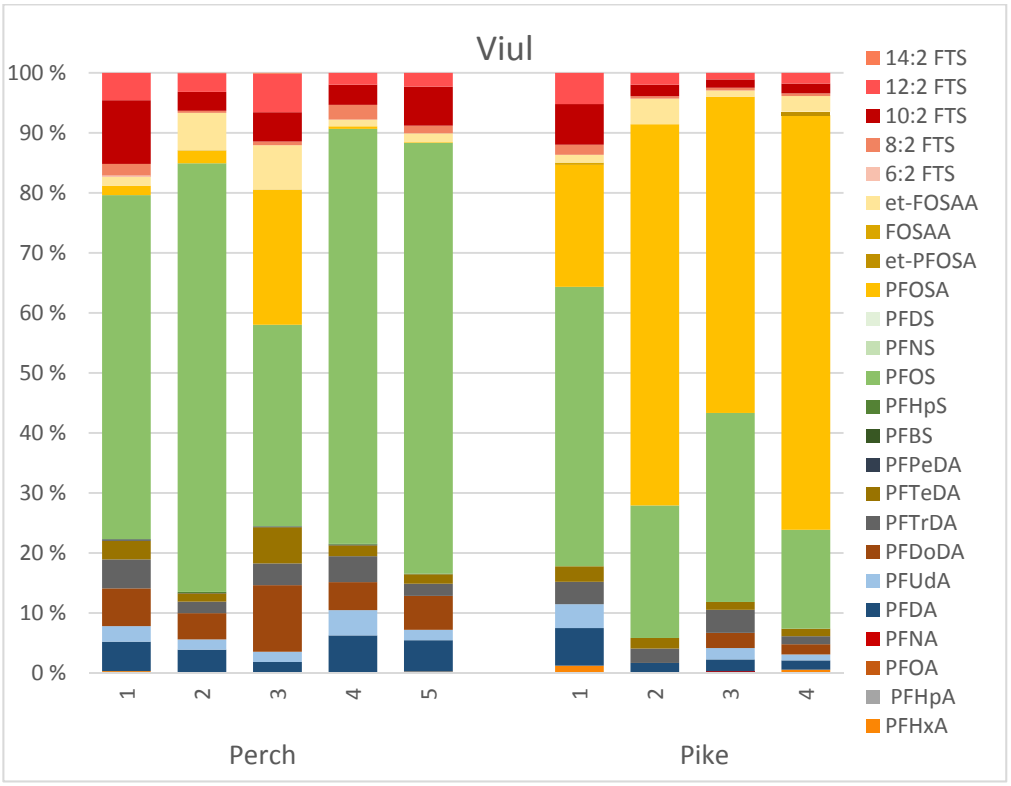


Figure 1. Percentage distribution of the various compounds in samples of fish liver at Viul.

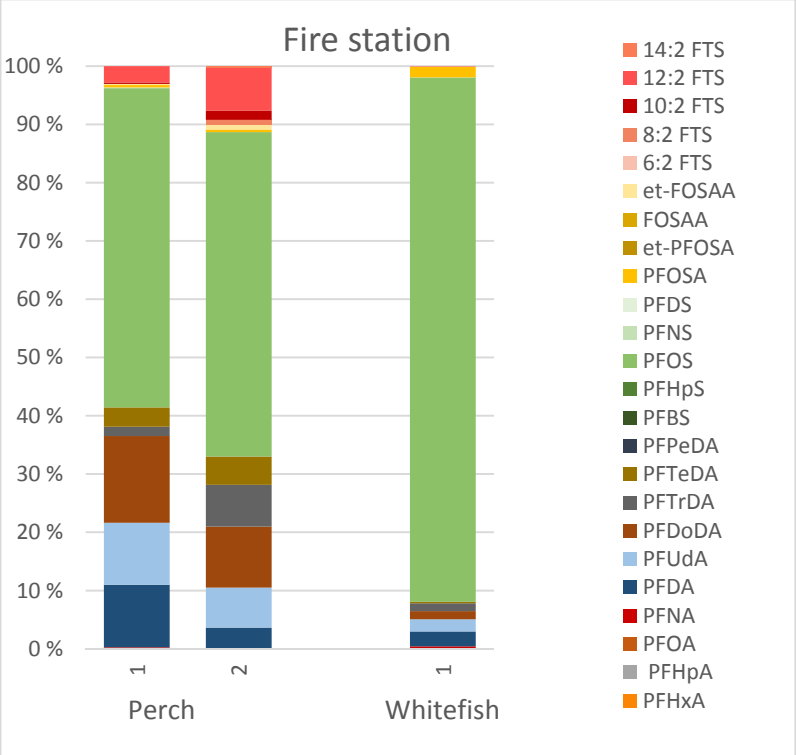


Figure 2. Percentage distribution of the various compounds in samples of fish liver downstream Hønefoss fire station.

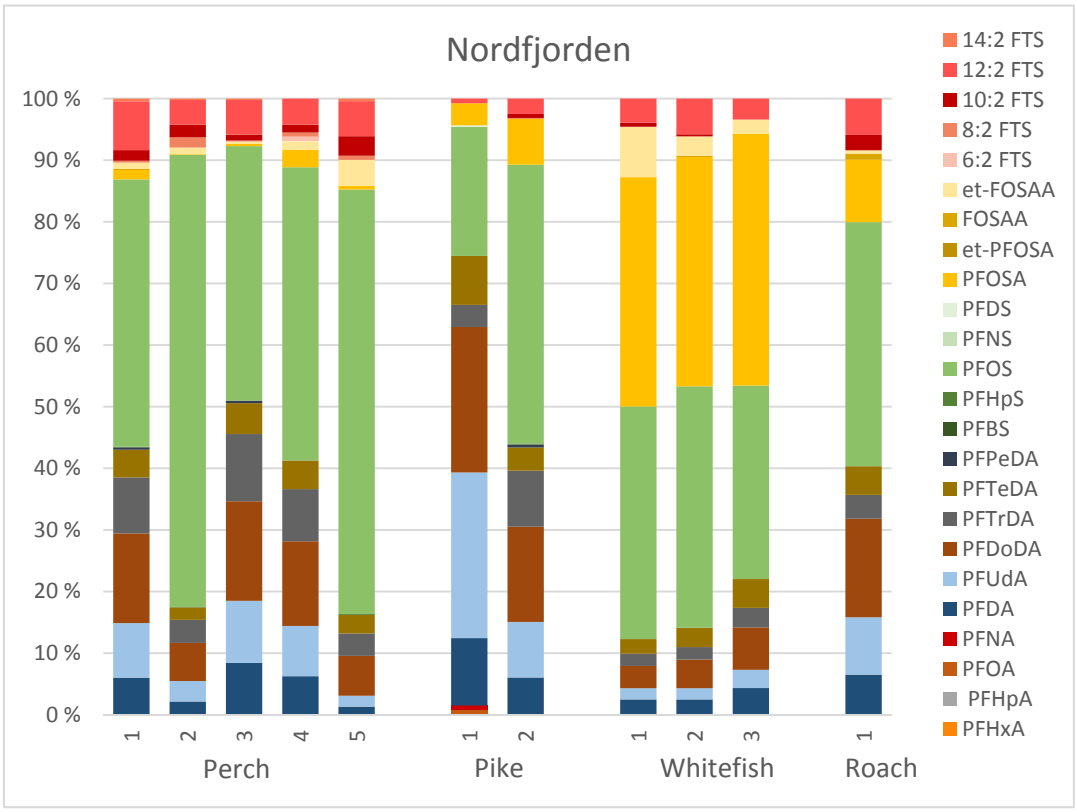


Figure 3. Percentage distribution of the various compounds in samples of fish liver at Nordfjorden

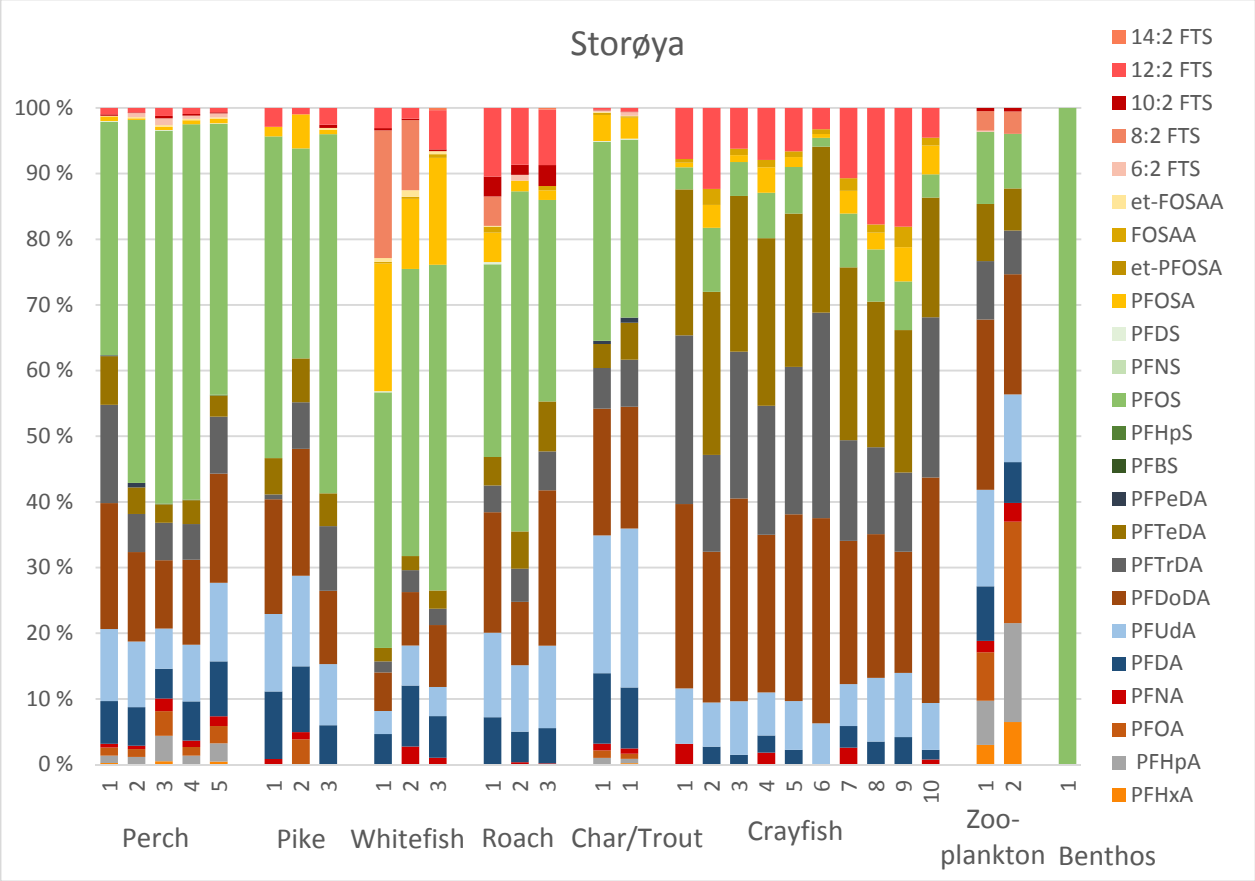


Figure 4. Percentage distribution of the various compounds in samples of fish liver, crayfish muscle, samples of zooplankton (Storfjorden) and benthic organisms sampled at Storøya.

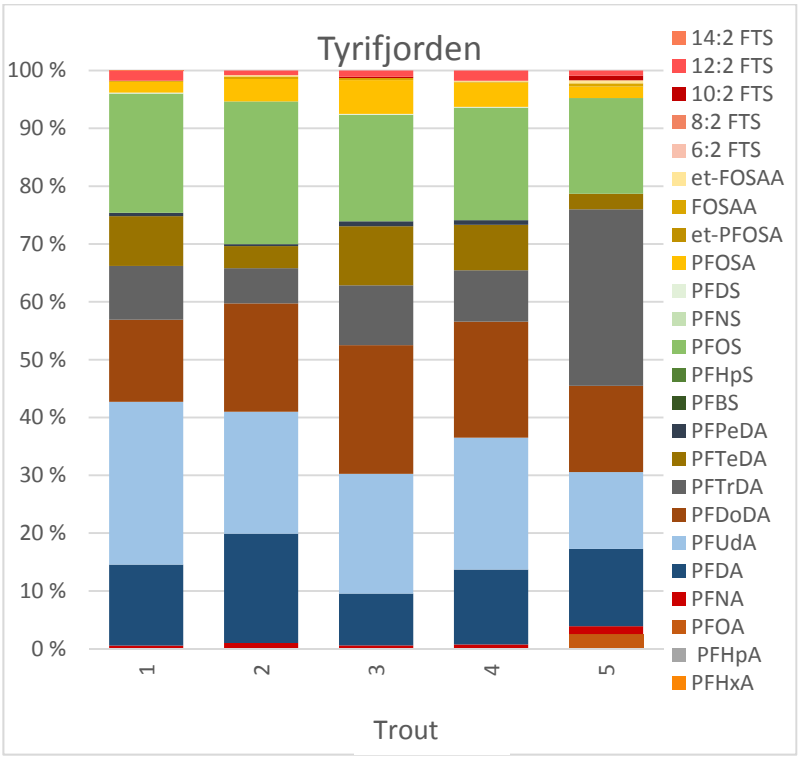


Figure 5. Percentage distribution of the various compounds in samples of trout liver at Tyrifjorden.

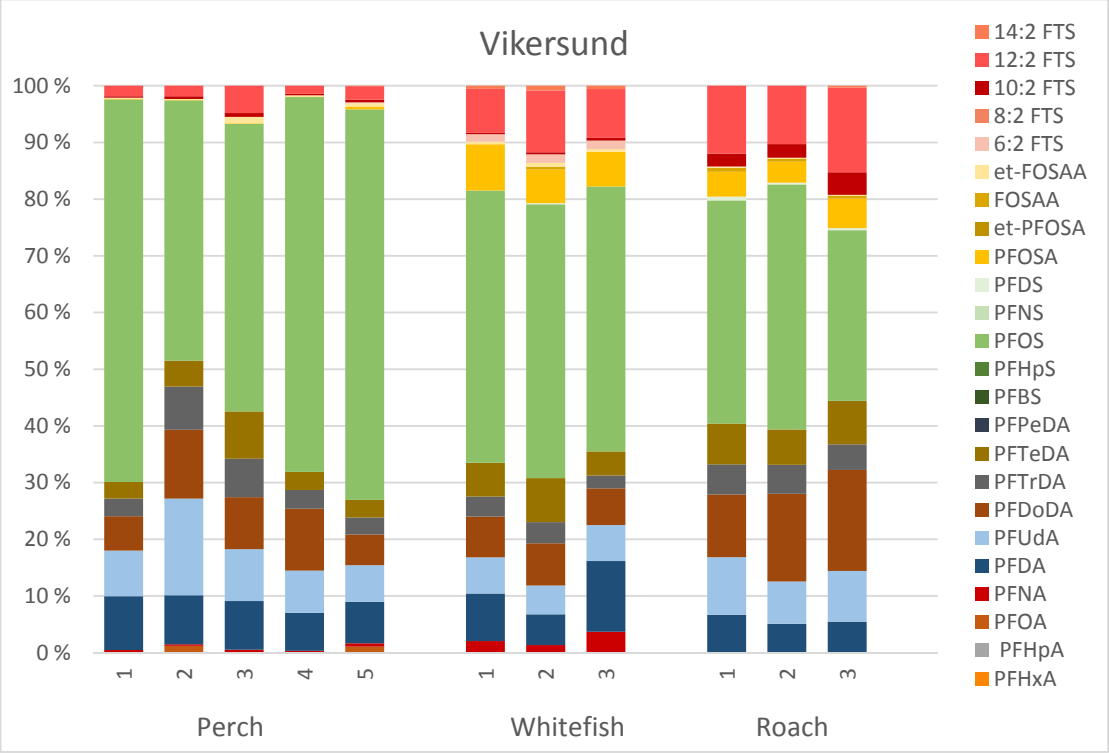


Figure 6. Percentage distribution of the various compounds in samples of fish liver at Vikersund.

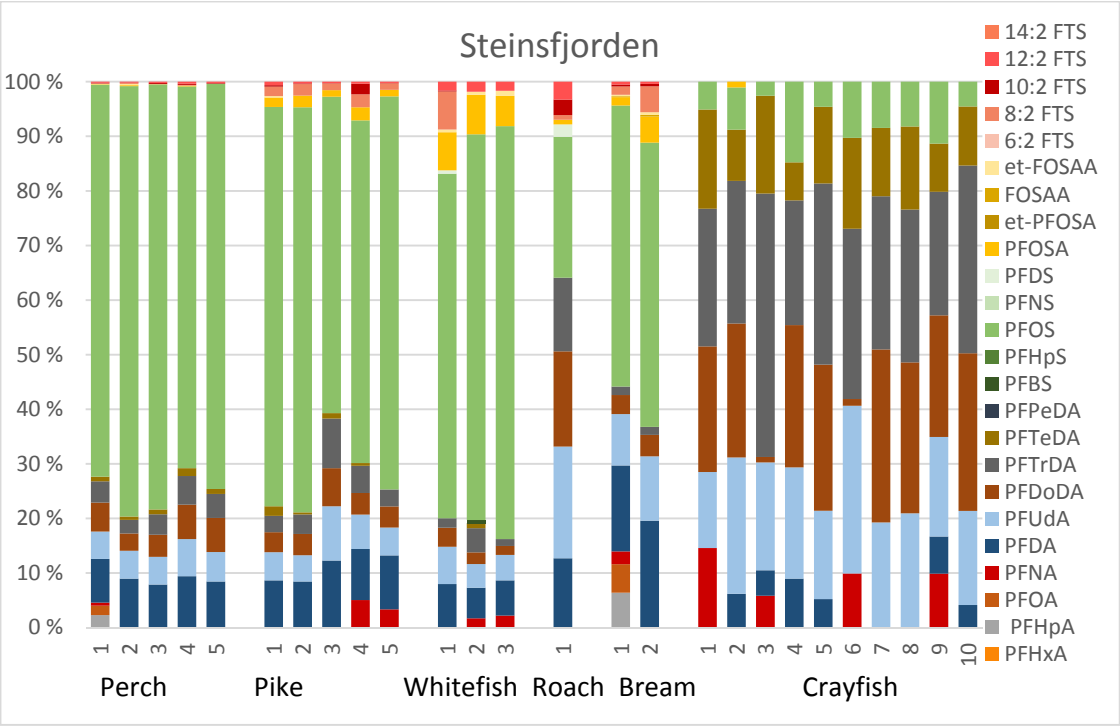


Figure 7. Percentage distribution of the various compounds in samples of fish liver and crayfish muscle at Steinsfjorden

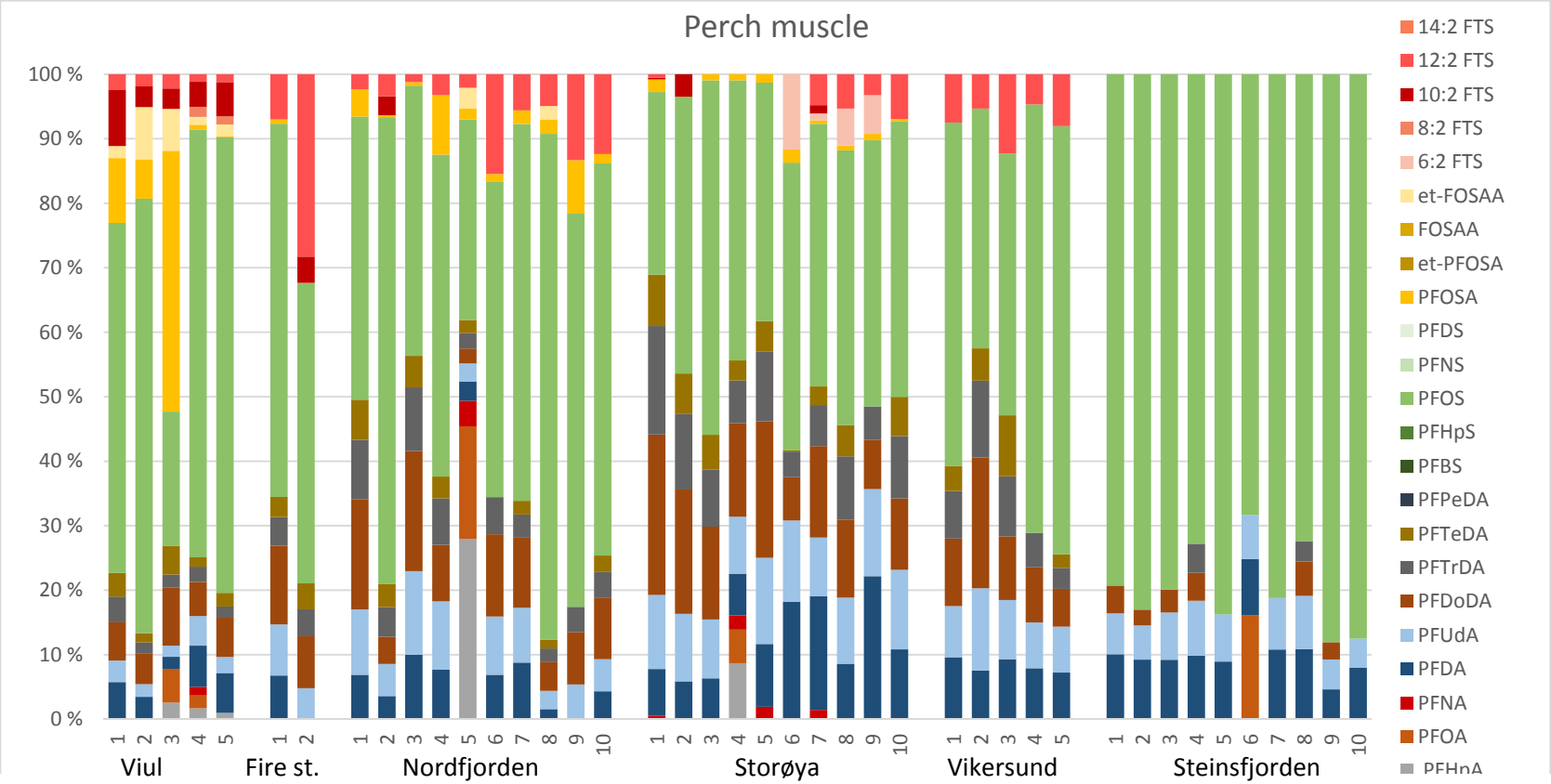


Figure 8. Percentage distribution of the various compounds in samples of perch muscle across the sampled areas.

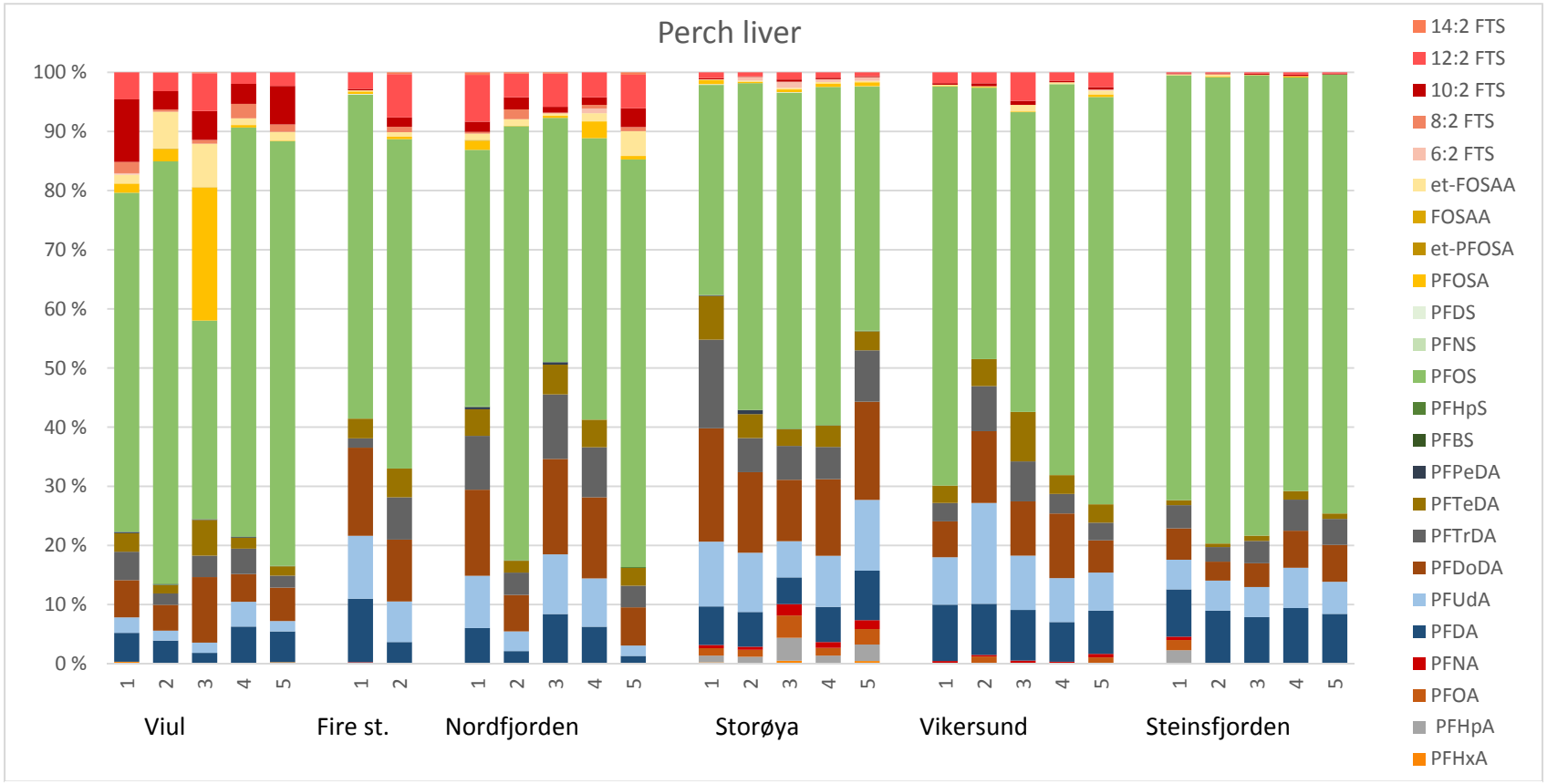


Figure 9. Percentage distribution of the various compounds in samples of perch liver across the sampled areas.

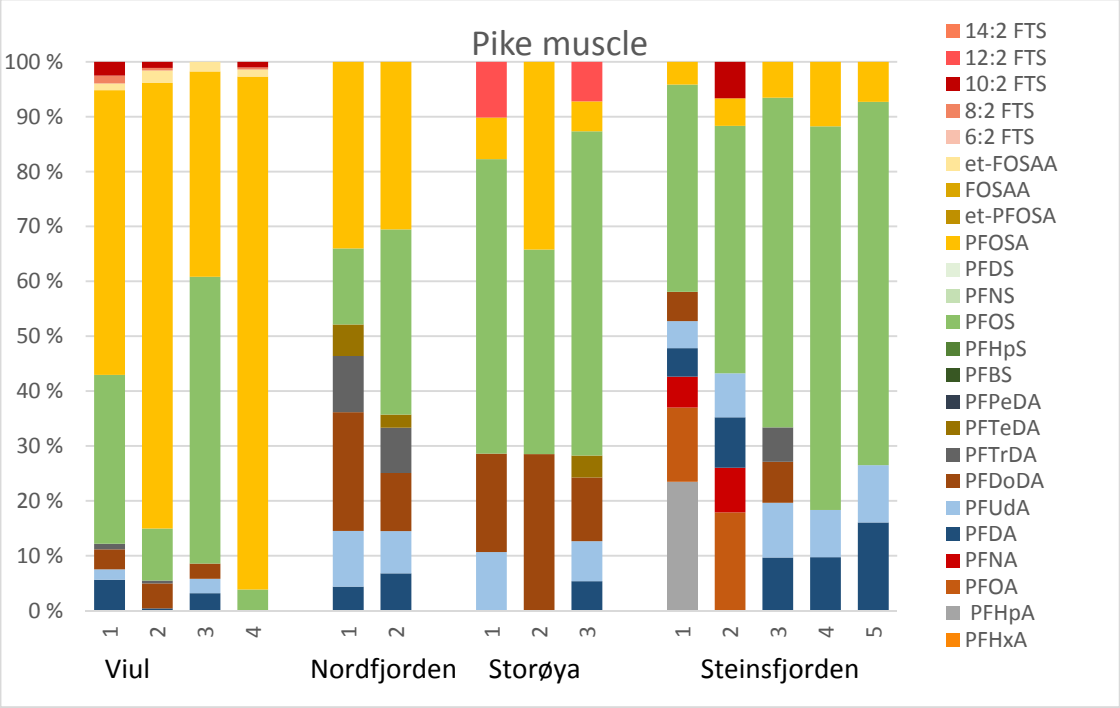


Figure 10. Percentage distribution of the various compounds in samples of pike muscle across the sampled areas.

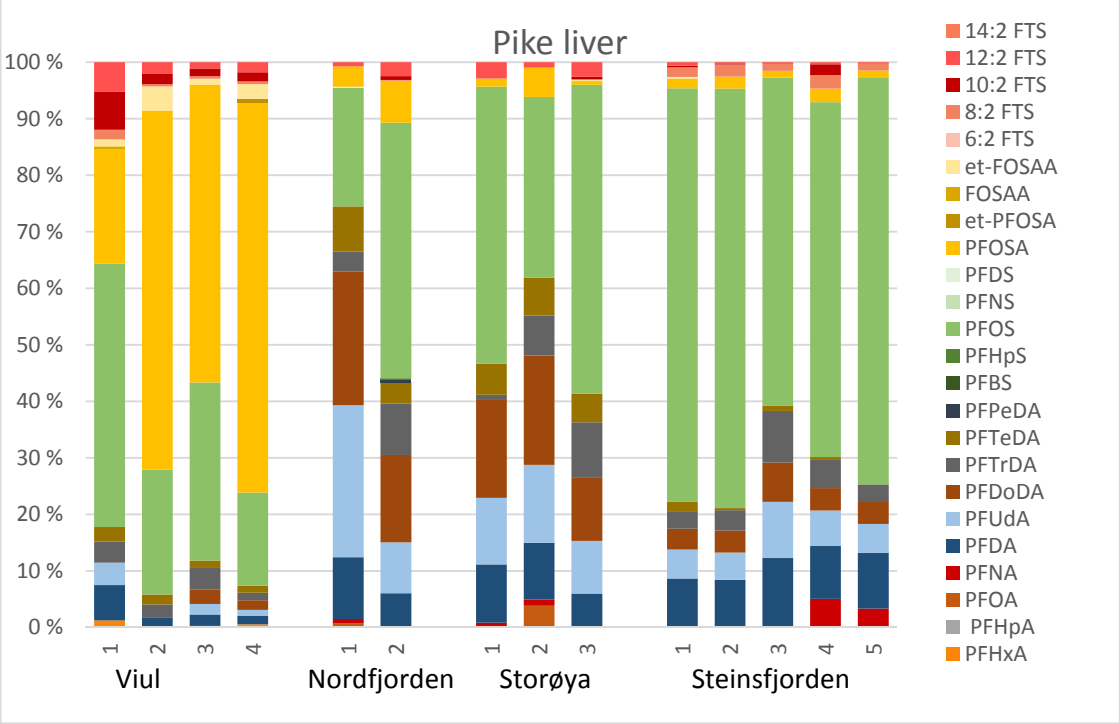


Figure 11. Percentage distribution of the various compounds in samples of pike liver across the sampled areas.

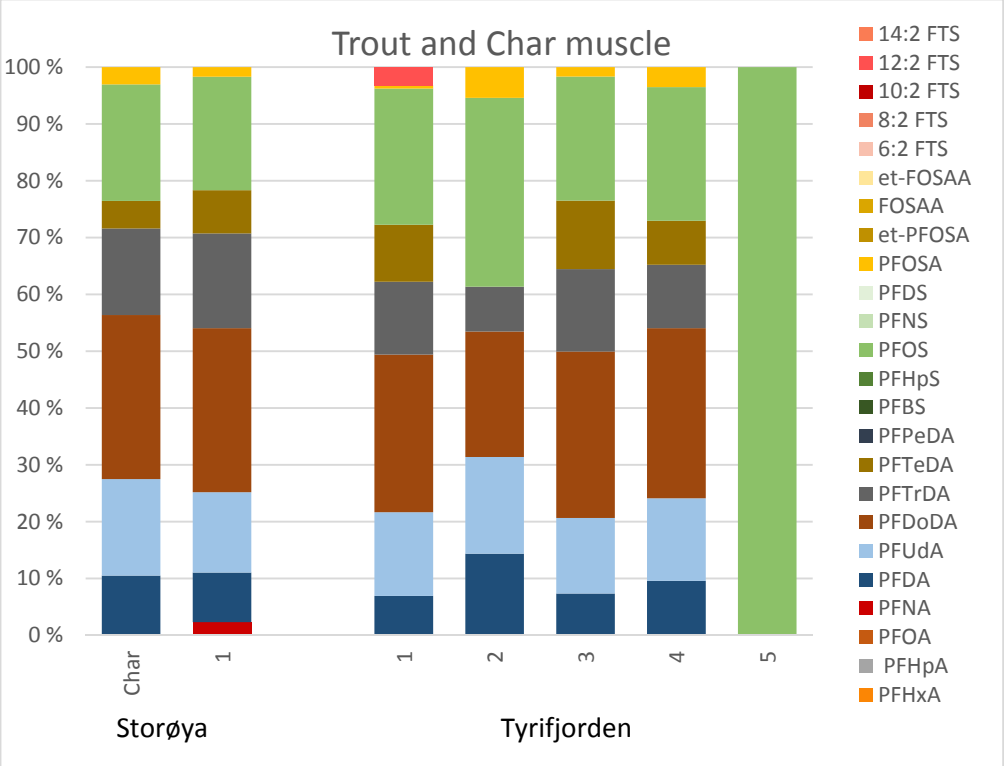


Figure 12. Percentage distribution of the various compounds in samples of char and trout muscle at Storøya and in Tyrifjorden.

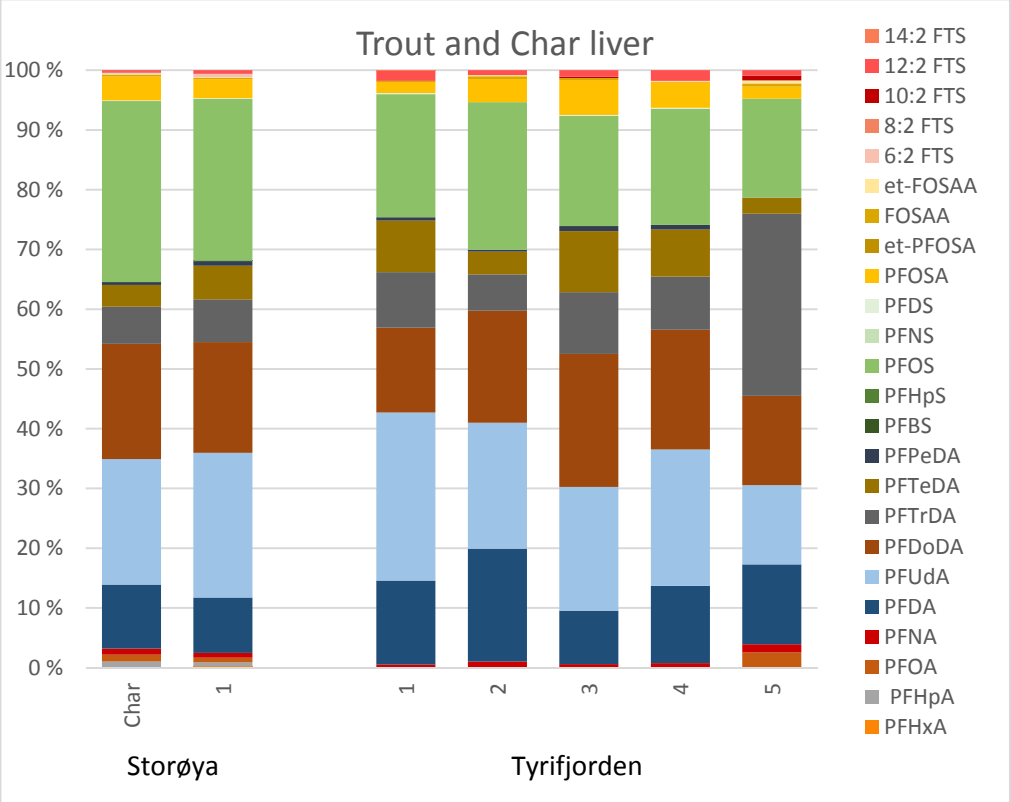


Figure 13. Percentage distribution of the various compounds in samples of char and trout liver at Storøya and in Tyrifjorden.

Appendix D

STATISTICAL ANALYSIS

Contents

D1 Statistical analysis

Relationships between concentrations of selected PFAS (PFOS, sum long-chain PFCA (PFOA, PFNA, PFDA, PFUdA, PFDoDA, PFTrDA, PFTeDA, PFPeDA, PFHxDA), sum preFOS and sum long chained FTS (8:2, 10:2, 12:2, and 14:2 FTS)) and weight, length, trophic level, and $\delta^{13}C$ of the biota were tested using Kruskal–Wallis one-way analysis of variance (Kruskal–Wallis) followed by Bonferroni correction.

Differences between the fraction of branched PFOS (br-PFOS) in pore water in the different stations were tested using One Way Analysis Of Variance (ANOVA) followed by Tukey's honest significance test (Tukey's HSD).

PFAS concentrations below the limit of quantification (LOQ) were treated as 0.

PFAS concentrations (PFOS, sum long chain PFCA [PFOA, PFNA, PFDA, PFUdA, PFDoDA, PFTrDA, PFTeDA, PFPeDA, PFHxDA], sum preFOS and sum long chain FTSA [8:2, 10:2, 12:2, and 14:2 FTS]) in biota were tested for normal distribution using Shapiro-Wilk w test and data histograms. PFAS concentrations were not normally distributed. Thus, relationships between PFAS levels and weight, length, trophic level, and $\delta^{13}C$ of the biota were evaluated using the non-parametric correlation test, Spearman rank correlation coefficient (Spearmans rho). Similarly, differences between the fraction of br-PFOS in fish liver in the different stations were tested using the non-parametric Kruskal–Wallis one-way analysis of variance (Kruskal–Wallis) followed by Bonferroni correction.

The fraction of br-PFOS in pore water at the stations in Storelva, Nordfjorden, Storøya, Vikersund, and Holsfjorden were tested for equality of variance using Levene's test. No significant differences were found between groups ($p<0.05$). Normal distributions were assumed (not possible to test due to small group sample size n=2-3). Thus, differences between stations in the fraction of br-PFOS in pore water were tested using One Way Analysis of variance (ANOVA) followed by Tukey's honest significance test (Tukey's HSD).

Appendix E

PROCEDURE FOR CATHCING FISH

Contents

E1 Introduction

The method used for catching fish had two main purposes:

- Ensure a humane treatment of the fish
- Prevent cross contamination of PFAS

The procedure is based on The Environmental Specimen Bank's (Norwegian: Miljøprøvebanken) procedure 001: Collection and sampling of freshwater fish.

Fish sampling was carried out by local fishermen in the Tyrifjorden area all of which were members of the local fishing club in Steinsfjorden. The fishing started on the 29th of June 2018, and NGI participated in the first sampling trip, ensuring that the procedures were followed in sampling.

E2 Sample treatment

By the time the fish sampling started, the fish spawning season had come to an end, and the fish had returned to their summer habitats.

Collection, transport and handling of live fish was carried out in accordance with the Norwegian Animal Welfare Act (Norwegian: Dyrevelferdsloven). Fish were killed instantaneously with a stroke to the head.

E3 Prevent cross contamination

To prevent cross contamination, the sampled biota were handled using nitrile glows (when possible), transferred into boxes coated with aluminium foil, packed in three layers of aluminium foil and a clean bag, before being frozen (whole) as soon as possible after being caught (maximally four hours).

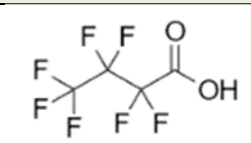
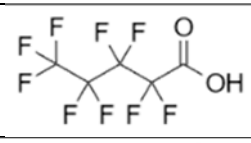
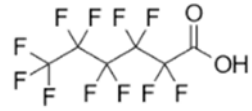
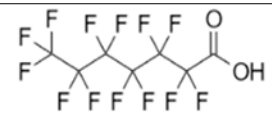
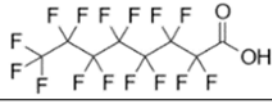
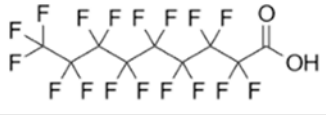
Cross contamination was also discussed prior to sampling start up, where NGI focused on the possibility of cross contamination from outdoor clothing and Teflon coated surfaces.

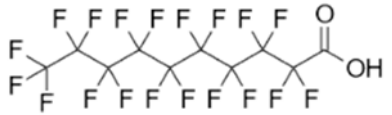
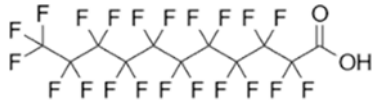
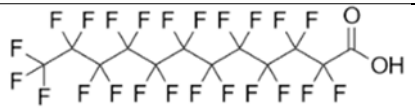
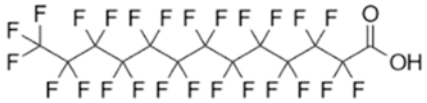
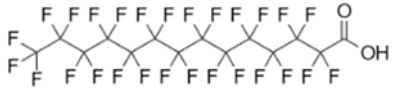
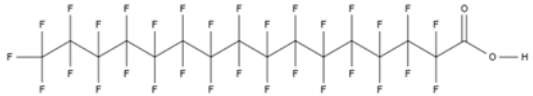
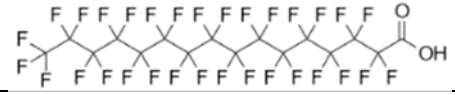
Appendix F

LIST OF CHEMICAL COMPONENTS

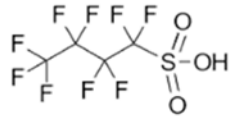
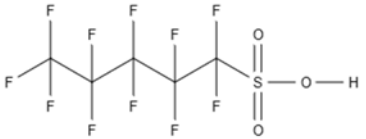
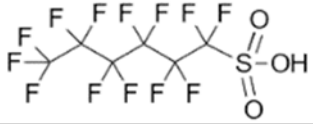
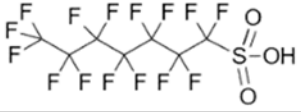
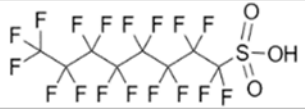
Contents

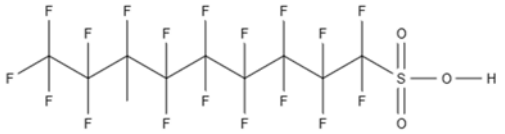
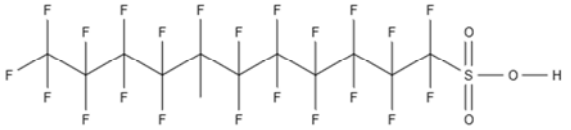
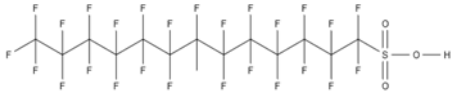
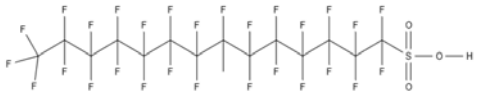
F1 Perfluoroalkyl carboxylic acids (PFCA)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
Perfluorobutanoic acid	PFBA	4	375-22-4	
Perfluoropentanoic acid	PFPA, PFPeA	5	2706-90-3	
Perfluorohexanoic acid	PFHxA	6	307-24-4	
Perfluoroheptanoic acid	PFHpA	7	375-85-9	
Perfluorooctanoic acid	PFOA	8	335-67-1	
Perfluorononanoic acid	PFNA	9	375-95-1	

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
Perfluorodecanoic acid	PFDA, PFDeA	10	335-76-2	
Perfluoroundecanoic acid	PFUnA, PFUnDA	11	2058-94-8	
Perfluorododecanoic acid	PFDoA, PFDoDA	12	307-55-1	
Perfluorotridecanoic acid	PFTrA, PFTrDA	13	72629-94-8	
Perfluorotetradecanoic acid	PFTA, PFTeDA	14	376-06-7	
Perfluoropentadecanoic acid	PFPeDA	15	18024-09-4	
Perfluorohexadecanoic acid	PFHxDA	16	67905-19-5	

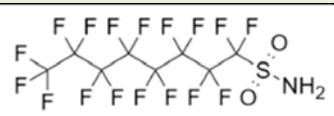
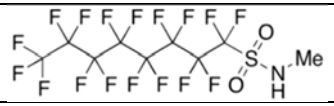
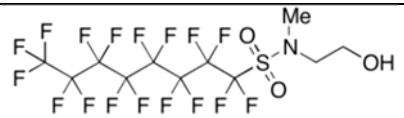
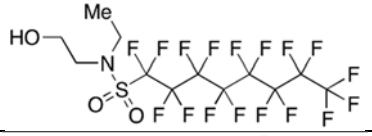
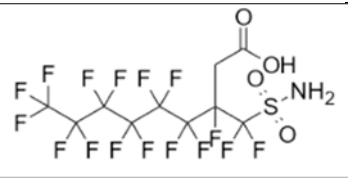
F2 Perfluoroalkyl sulfonic acids (PFSA)

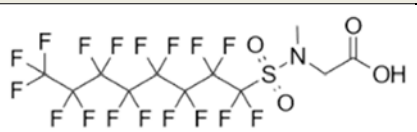
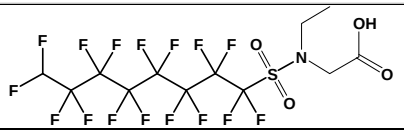
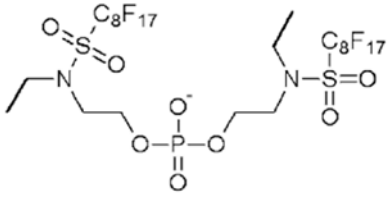
Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
Perfluorobutane sulfonic acid	PFBS	4	375-73-5	
Perfluoropentane sulfonic acid	PFPeS	5	2706-91-4	
Perfluorohexane sulfonic acid	PFHxS	6	355-46-4	
Perfluoroheptane sulfonic acid	PFHpS	7	375-92-8	
Perfluorooctane sulfonic acid	PFOS	8	1763-23-1	

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
Perfluorononane sulfonic acid	PFNS	9	474511-07-4	
Perfluorodecane sulfonic acid	PFDS	10	335-77-3	
Perfluoroundecane sulfonic acid	PFUdS, PFUnDS	11	749786-16-1	
Perfluorododecane sulfonic acid	PFDoS, PFDoDS	12	79780-39-5	
Perfluorotridecane sulfonic acid	PFTrS	13	749786-16-1	
Perfluorotetradecane sulfonic acid	PFTeS	14	NA	

NA = not available

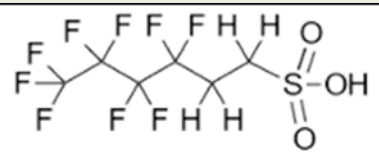
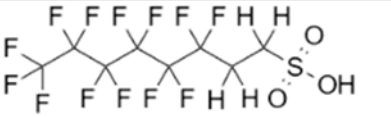
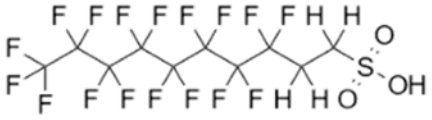
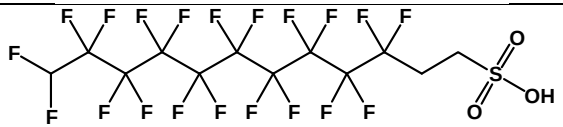
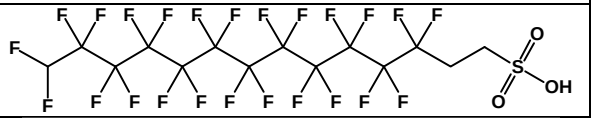
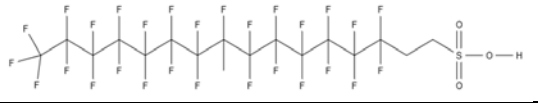
F3 Perfluorooctane sulfonamido substances (preFOS)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
Perfluorooctane sulfonamide	PFOSA	8	754-91-6	
N-Methyl perfluorooctane sulfonamide	me-PFOSA, N-MeFOSA	8	31506-32-8	
N-Ethyl perfluoroctane sulfonamid	et-PFOSA, etFOSA, N-EtFOSA	8	4151-50-2	
N-Methyl perfluorooctane sulfonamidoethanol	me-PFOSE, MeFOSE	8	24448-09-7	
N-ethyl perfluorooctane sulphonamidoethanol	et-PFOSE, N-EtFOSE	8	1691-99-2	
Perfluorooctane sulfonamidoacetic acid	FOSAA	8	2806-24-8	

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
N-Methyl perfluorooctane sulfonamidoacetic acid	me-FOSAA, N-MePFOSAA	8	2355-31-9	
N-Ethyl perfluorooctane sulfonamidoacetic acid	et-FOSAA, N-EtPFOSAA	8	2991-50-6	
Perfluorooctane Sulfonamido Ethanol-Based Phosfate (SamPAP) Diester	diPAPs, SAmPAP Di-Ester	16	2965-52-8	* 

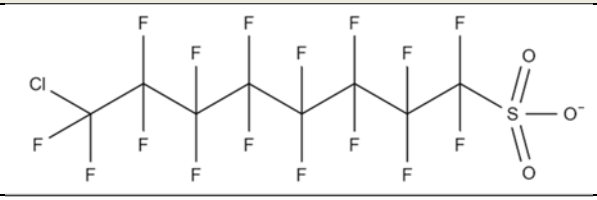
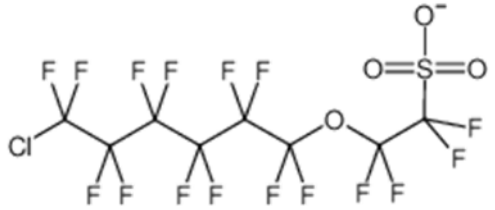
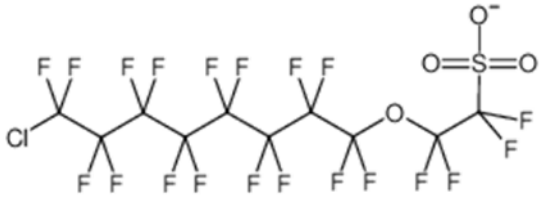
* Benskin et.al (2013)

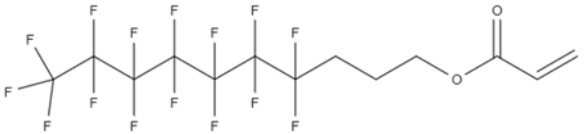
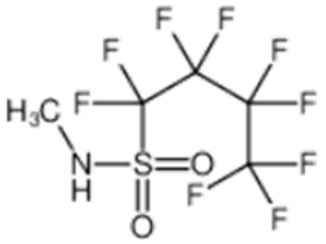
F4 Fluorotelomer sulfonic acids (FTSA)

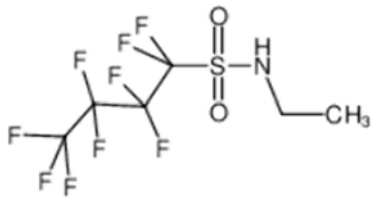
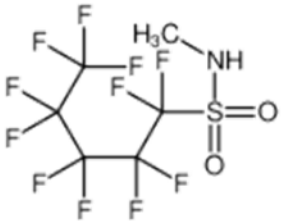
Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
4:2 Fluorotelomer sulfonic acid	4:2 FTS, 4:2 FTSA	4	757124-72-4	
6:2 Fluorotelomer sulfonic acid	6:2 FTS, 6:2 FTSA	6	27619-97-2	
8:2 Fluorotelomer sulfonic acid	8:2 FTS, 8:2 FTSA	8	39108-34-4	
10:2 Fluorotelomer sulfonic acid	10:2 FTS, 10:2 FTSA	10	120226-60-0	
12:2 Fluorotelomer sulfonic acid	12:2 FTS, 12:2 FTSA	12	149246-64-0	
14:2 Fluorotelomer sulfonic acid	14:2 FTS, 14:2 FTSA	14	NA	

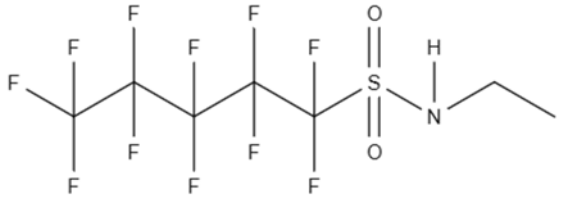
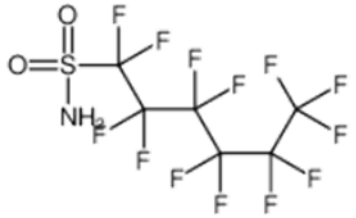
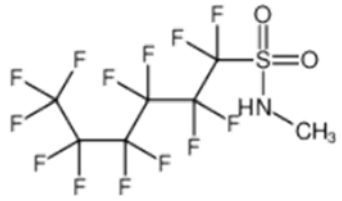
NA = not available

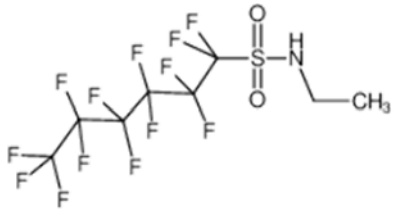
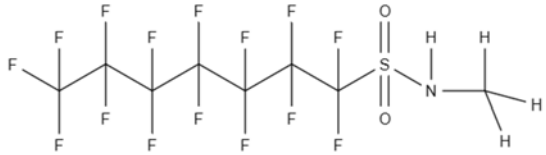
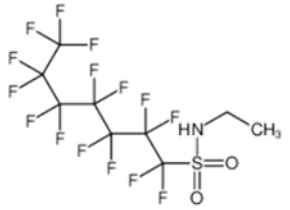
F5 Other analysed PFAS

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
8Cl-perfluoro-1-octanesulfonate	8Cl-PFOS	8	NA	
2-[(6-chloro-1,1,2,2,3,3,4,4,5,5,6,6-dodecafluorohexyl)oxyl]-1,1,2,2-tetrafluoroethanesulfonic acid	6:2 F53B	8	73606-19-6	 1)
2-[(8-chloro-1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,-hexadecafluorohexyl)oxyl]-1,1,2,2-tetrafluoroethanesulfonic acid	8:2 F53B	10	83329-89-9	 1)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
7:3 Fluortelomer acrylate	7:3 FTAC	7	812-70-4	
Perfluoro-1-butansulfonamide	PFBSA	4	30334-69-1	
N-methyl perfluoro-1-butansulfonamide	meFBSA	4	68298-12-4	 1)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
N-ethyl perfluoro-1-butansulfonamide	etFBSA	4	40630-67-9	 1)
Perfluoro-1-pentansulfonamide	PFPeSA	5	82765-76-2	
N-methyl perfluoro-1-pentansulfonamide	meFPeSA	5	68298-13-5	 1)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
N-ethyl perfluoro-1-pentansulfonamide	etFPeSA	5	162682-16-8	
Perfluoro-1-hexansulfonamide	PFHxSA	6	41997-13-1	 1)
N-methyl perfluoro-1-hexansulfonamide	meFHxSA	6	68259-15-4	 1)

Full name	Abbreviation(s)	Number of fluorinated carbon atoms in backbone	CAS-number	Molecular structure
N-ethyl perfluoro-1-hexansulfonamide	etFHxSA	6	87988-56-5	 1)
Perfluoro-1-heptansulfonamide	PFHpSA	7	82765-77-3	
N-methyl perfluoro-1-heptansulfonamide	meFHpSA	7	68259-14-3	
N-ethyl perfluoro-1-heptansulfonamide	etFHpSA	7	68957-62-0	 1)

NA = not available
1) Molecular structure found at http://www.molbase.com

Appendix G

LIMITS OF QUANTIFICATION (LOQS) FOR PFAS
IN ANALYSED MATRICES

Compound	SEDIMENTER (ng/g dw)	BIOTA (ng/g ww)	WATER (ng/L)
PFPA	0,5	0,5	0,5
PFHxA	0,5	0,5	0,5
PFHpA	0,5	0,5	0,5
PFOA	0,5	0,5	0,5
PFNA	0,4	0,4	0,4
PFDA	0,4	0,4	0,4
PFUdA	0,4	0,4	0,4
PFDoDA	0,4	0,4	0,4
PFTrDA	0,4	0,4	0,4
PFTeDA	0,4	0,4	0,4
PFPeDA	0,4	0,4	0,4
PFHxDA	0,4	0,4	0,4
PFBS	0,1	0,1	0,1
PFPeS	0,1	0,1	0,1
PFHxS	0,1	0,1	0,1
PFHpS	0,1	0,1	0,1
PFOS	0,1	0,1	0,1
br-PFOS	0,1	0,1	0,1
PFNS	0,1	0,1	0,1
PFDS	0,1	0,1	0,1
PFDoS	0,2	0,2	0,2
PFOSA	0,1	0,1	0,1
me-PFOSA	0,3	0,3	0,3
et-PFOSA	0,3	0,3	0,3
me-PFOSE	2	2	2
et-PFOSE	2	2	2
FOSAA	0,3	0,3	0,3
me-FOSAA	0,3	0,3	0,3
et-FOSAA	0,3	0,3	0,3
4:2 FTS	0,3	0,3	0,3
6:2 FTS	0,3	0,3	0,3
8:2 FTS	0,3	0,3	0,3
10:2 FTS	0,3	0,3	0,3
12:2 FTS	0,3	0,3	0,3
14:2 FTS	0,3	0,3	0,3
8Cl-PFOS	0,3	0,3	0,3
4:2 F53B	0,3	0,3	0,3
8:2 F53B	0,3	0,3	0,3
PFUdS	0,3	0,3	0,3
PFTrS	0,3	0,3	0,3
PFTeS	0,3	0,3	0,3
7:3 FTAC	0,3	0,3	0,3
PFBSA	0,3	0,3	0,3
meFBSA	0,3	0,3	0,3
etFBSA	0,3	0,3	0,3
PFPeSA	0,3	0,3	0,3
meFPeSA	0,3	0,3	0,3
etFPeSA	0,3	0,3	0,3
PFHxSA	0,3	0,3	0,3
meFHxSA	0,3	0,3	0,3
etFHxSA	0,3	0,3	0,3
PFHpSA	0,3	0,3	0,3
meFHpSA	0,3	0,3	0,3
etFHpSA	0,3	0,3	0,3

Appendix H

ANALYSED SAMPLES AND CONCENTRATIONS

Naming of samples - lab analysis

Sediments	Area
STEIN	Steinsfjorden
HOL	Holsfjorden
HOLKJ	Holsfjorden, core sample
Storø	Storøya
Nord	Nordfjorden
NORDKJ	Nordfjorden, core sample
Storf	Storfjorden
Vik	Vikersund
Viul	Viul
Brann	Downstream fire station

Source tracking	Area
KS-Ha	Haga
KS-Br	Fire station
KS-HVA	Hvalsmoen
KS-SCH	Schjongslunden
KS-VD	Vikersund deposit
KS-NP	Nordic Paper

Sediment traps	Area
Trap 1	Upstream Viul
Trap 2	Downstream Viul
Trap 3	Storelva, by Busund
Trap 4	Storelva, by Helgelandsmoen
Trap 5a	Outlet Storelva, parallell A
Trap 5b	Outlet Storelva, parallell B
Trap 6	Bay towards Vikersund

Porewater and -sediments	Area
Vik	Vikersund
Stor	Storøya
Hol	Holsfjorden
Nord	Nordfjorden
Stein	Steinsfjorden
Brann	Downstream fire station

Water	Area
Hol	Holsfjorden
Stein	Steinsfjorden

Biotic samples	Area
NF	Nordfjorden
VU	Viul
SF	Steinsfjorden
SØ	Storøya
VI	Vikersund
TYR	Tyrifjorden
BR	Downstream fire station
S	Storfjorden

Biotic samples	Species	Norwegian name	Latin name
A	Perch	Abbor	*Perca fluviatilis*
G	Pike	Gjedde	*Esox Lucius*
B	Bream	Brasme	*Abramis brama*
M	Roach	Mort	*Rutilus rutilus*
S*	Whitefish	Sik	*Coregonus lavaretus*
Ø	Trout	Ørret	*Salmo trutta*
R	Char	Røye	*Salvelinus alpinus*
KP	Crayfish	Kreps	*Astacus astacus*

*The two samples named S-S-1 and S-S-2 are pelagic whitefish from Storfjorden, the other are benthic whitefish

tot-F target	Explanation
sed SØ	Sediment, Storøya
sed V	Sediment, Vikersund
sed HOL	Sediment, Holsfjorden
sed NF	Sediment, Nordfjorden
sed SF	Sediment, Storfjorden
sed VU	Sediment, Viul
sed BR	Sediment, downstream fire station
NF-A1	Nordfjorden, perch
NF-G2	Nordfjorden, pike
SØ-A1	Storøya, perch
SØ-Ø1	Storøya, trout
SØ-R1	Storøya, char
SF-A1	Steinsfjorden, perch
SF-G1	Steinsfjorden, pike
VU-A1	Viul, perch
VU-G1	Viul, pike

NOTES (in rawdata): *No standards. Quantified against 10:2 FTS

** No standard, quantified against PFOS. Probably underestimated.

SEDIMENTS	NIVA nr	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g
STEIN 1	NR-2018-11309	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,18	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 2	NR-2018-11310	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,15	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 3	NR-2018-11311	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,26	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 4	NR-2018-11312	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,38	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 5	NR-2018-11313	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,18	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 6	NR-2018-11314	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,36	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 7	NR-2018-11315	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,24	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 8	NR-2018-11316	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,21	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 9	NR-2018-11317	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,31	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 10	NR-2018-11318	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,36	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 11	NR-2018-11319	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,37	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 12	NR-2018-11320	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,39	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 13	NR-2018-11321	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,12	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 14	NR-2018-11322	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 15	NR-2018-11323	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,48	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 16	NR-2018-11324	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,29	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 17	NR-2018-11325	<0,5	1,6	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,25	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 18	NR-2018-11326	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,18	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 19	NR-2018-11327	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,12	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 20	NR-2018-11328	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,17	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 21	NR-2018-11329	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,28	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 22	NR-2018-11330	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,15	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 23	NR-2018-11331	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,27	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 24	NR-2018-11332	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,32	<0,1	<0,1	<0,1	<0,2	<0,1
STEIN 25	NR-2018-11333	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,27	<0,1	<0,1	<0,1	<0,2	<0,1
HOL 1	NR-2018-11334	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,9	<0,4	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,6	<0,1	<0,1	<0,1	<0,2	1,1
HOL 2	NR-2018-11335	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,19	<0,1	<0,1	<0,1	<0,2	<0,1
HOL 3	NR-2018-11336	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,15	<0,1	<0,1	<0,1	<0,2	<0,1
HOL 4	NR-2018-11337	<0,5	2,2	<0,5	<0,5	1,4	1,9	0,8	0,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,4	0,4	<0,1	<0,1	<0,2	1,5
HOL 5	NR-2018-11338	<0,5	1,4	<0,5	<0,5	<0,4	0,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	15,1	0,3	<0,1	<0,1	<0,2	0,4
HOL 6	NR-2018-11339	<0,5	<0,5	<0,5	<0,5	1,0	<0,4	<0,4	0,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,1	<0,1	<0,1	<0,1	<0,2	0,8
HOL 7	NR-2018-11340	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	2,2	<0,4	1,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,9	<0,1	<0,1	<0,1	<0,2	1,4
HOL 8	NR-2018-11341	<0,5	<0,5	<0,5	<0,5	<0,4	1,4	0,8	1,0	<0,4	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,1	<0,1	<0,1	<0,1	<0,2	0,6
HOL 9	NR-2018-11342	<0,5	2,0	<0,5	<0,5	<0,4	1,5	0,7	0,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,4	0,2	<0,1	<0,1	<0,2	1,4
HOL 10	NR-2018-11343	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,7	0,5	<0,1	<0,1	<0,2	<0,1
HOL 11	NR-2018-11344	<0,5	2,8	<0,5	<0,5	<0,4	3,2	2,0	2,0	0,6	1,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	22,3	0,6	<0,1	<0,1	<0,2	14,6
HOL 12	NR-2018-11345	<0,5	<0,5	<0,5	<0,5	<0,4	0,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,5	0,2	<0,1	<0,1	<0,2	<0,3
Storø 1	NR-2018-12454	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	0,8	1,4	0,7	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,1	<0,1	<0,1	<0,1	<0,2	0,3
Storø 2	NR-2018-12455	<0,5	<0,5	<0,5	<0,5	<0,4	3,3	2,4	3,1	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,3	0,5	<0,1	<0,1	<0,2	4,2
Storø 3	NR-2018-12456	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,2	0,2	<0,1	<0,1	<0,2	0,8
Storø 4	NR-2018-12457	<0,5	4,0	<0,5	<0,5	<0,4	5,5	2,6	3,3	0,6	2,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	24,2	0,9	<0,1	<0,1	<0,2	6,1
Storø 5	NR-2018-12458	<0,5	<0,5	<0,5	<0,5	<0,4	3,6	2,8	3,8	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	15,2	0,5	<0,1	<0,1	<0,2	5,1
Storø 6	NR-2018-12459	<0,5	<0,5	<0,5	<0,5	<0,4	2,0	1,7	2,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,0	0,4	<0,1	<0,1	<0,2	1,8
Storø 7	NR-2018-12460	<0,5	<0,5	<0,5	<0,5	<0,4	1,2	1,3	0,6	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,2	0,3	<0,1	<0,1	<0,2	2,8
Storø 8	NR-2018-12461	<0,5	1,0	<0,5	<0,5	<0,4	4,7	4,2	3,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	18,6	0,7	<0,1	<0,1	<0,2	5,7
Storø 9	NR-2018-12462	<0,5	1,9	<0,5	<0,5	<0,4	5,4	1,9	7,6	2,5	3,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,9	0,6	<0,1	<0,1	<0,2	5,3
Storø 10	NR-2018-12463	<0,5	2,5	<0,5	<0,5	<0,4	3,9	3,4	2,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	14,0	0,6	<0,1	<0,1	<0,2	4,2
Storø 11	NR-2018-12464	<0,5	<0,5	<0,5	<0,5	<0,4	4,4	1,3	5,3	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	15,7	0,7	<0,1	<0,1	<0,2	7,3
Storø 12	NR-2018-12465	<0,5	<0,5	<0,5	<0,5	<0,4	2,6	3,8	1,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,2	0,5	<0,1	<0,1	<0,2	1,9
Storø 13	NR-2018-12466	<0,5	2,5	<0,5	<0,5	<0,4	5,7	2,8	6,6	1,5	4,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	12,8	0,7	<0,1	<0,1	<0,2	6,2
Storø 14	NR-2018-12467	<0,5	1,7	<0,5	<0,5	<0,4	3,8	0,6	3,4	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	16,7	0,6	<0,1	<0,1	<0,2	5,4
Storø 15	NR-2018-12468	<0,5	<0,5	<0,5	<0,5	<0,4	0,6	<0,4	0,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,3	<0,1	<0,1	<0,1	<0,2	0,1
Storø 16	NR-2018-12469	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Storø 17	NR-2018-12470	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	1,4	2,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,1	0,3	<0,1	<0,1	<0,2	1,8
Storø 18	NR-2018-12471	<0,5	<0,5	<0,5	<0,5	<0,4	1,5	1,5	1,2	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,0	0,3	<0,1	<0,1	<0,2	2,1
Storø 19	NR-2018-12472	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Storø 20	NR-2018-12473	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,8	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,4	0,1	<0,1	<0,1	<0,2	0,3
Storø 21	NR-2018-12474	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	0,8	1,0	0,6	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,7	0,2	<0,1	<0,1	<0,2	0,8
Nord 1	NR-2018-12475	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	<0,4	1,7	<0,4	1,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,4	<0,1	<0,1	<0,1	<0,2	0,8

SEDIMENTS	NIVA nr	me-PFOSA ng/g	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS* ng/g	14:2 FTS* ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g
STEIN 1	NR-2018-11309	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 2	NR-2018-11310	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 3	NR-2018-11311	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 4	NR-2018-11312	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 5	NR-2018-11313	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 6	NR-2018-11314	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 7	NR-2018-11315	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 8	NR-2018-11316	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 9	NR-2018-11317	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 10	NR-2018-11318	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,0	<0,3	<0,3	0,9	0,5	0,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 11	NR-2018-11319	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,0	<0,3	<0,3	0,4	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 12	NR-2018-11320	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 13	NR-2018-11321	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 14	NR-2018-11322	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 15	NR-2018-11323	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 16	NR-2018-11324	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,5	<0,3	<0,3	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 17	NR-2018-11325	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 18	NR-2018-11326	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 19	NR-2018-11327	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 20	NR-2018-11328	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 21	NR-2018-11329	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 22	NR-2018-11330	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 23	NR-2018-11331	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,9	<0,3	<0,3	0,4	0,9	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 24	NR-2018-11332	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	1,8	0,5	0,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 25	NR-2018-11333	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 1	NR-2018-11334	<0,3	0,7	<2,0	14,3	4,2	<0,3	13,1	<0,3	<0,3	1,1	21,8	11,7	0,8	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 2	NR-2018-11335	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	1,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 3	NR-2018-11336	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 4	NR-2018-11337	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	0,8	9,8	15,0	1,1	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 5	NR-2018-11338	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	1,0	1,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 6	NR-2018-11339	<0,3	0,4	<2,0	15,4	2,8	<0,3	14,6	<0,3	<0,3	0,5	24,7	2,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 7	NR-2018-11340	<0,3	1,0	<2,0	72,2	2,8	<0,3	19,6	<0,3	<0,3	2,9	87,1	58,2	3,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 8	NR-2018-11341	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	1,2	23,1	30,8	3,4	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 9	NR-2018-11342	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	0,7	7,0	15,7	1,6	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 10	NR-2018-11343	<0,3	<0,3	<2,0	<2,0	0,8	<0,3	<0,3	<0,3	<0,3	0,4	2,2	6,6	0,8	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 11	NR-2018-11344	<0,3	0,5	<2,0	<2,0	<0,3	<0,3	3,4	<0,3	<0,3	3,0	52,4	54,5	3,9	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 12	NR-2018-11345	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	0,1	1,4	1,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 1	NR-2018-12454	<0,3	0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,7	2,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 2	NR-2018-12455	<0,3	<0,3	<2,0	<2,0	0,8	<0,3	5,1	<0,3	<0,3	3,6	23,1	8,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 3	NR-2018-12456	<0,3	0,3	<2,0	<2,0	0,3	<0,3	1,0	<0,3	<0,3	<0,3	0,9	1,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 4	NR-2018-12457	<0,3	<0,3	<2,0	<2,0	0,4	<0,3	0,6	<0,3	<0,3	4,3	45,7	20,5	1,1	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 5	NR-2018-12458	<0,3	<0,3	<2,0	<2,0	0,8	<0,3	4,7	<0,3	<0,3	4,8	34,9	13,8	0,6	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 6	NR-2018-12459	<0,3	<0,3	<2,0	<2,0	1,0	<0,3	3,1	<0,3	<0,3	2,2	26,1	9,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 7	NR-2018-12460	<0,3	0,3	<2,0	<2,0	0,3	<0,3	1,1	<0,3	<0,3	0,5	2,2	1,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 8	NR-2018-12461	<0,3	0,9	<2,0	<2,0	0,9	<0,3	4,5	<0,3	<0,3	4,6	43,0	14,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 9	NR-2018-12462	<0,3	<0,3	<2,0	<2,0	1,3	<0,3	7,4	<0,3	<0,3	11,8	181	71,6	3,0	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 10	NR-2018-12463	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	1,8	25,5	7,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 11	NR-2018-12464	<0,3	<0,3	<2,0	<2,0	1,0	<0,3	2,7	<0,3	<0,3	5,7	72,1	25,1	1,1	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 12	NR-2018-12465	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,4	<0,3	<0,3	1,8	10,7	6,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 13	NR-2018-12466	<0,3	<0,3	<2,0	<2,0	0,6	<0,3	1,8	<0,3	<0,3	8,3	108	37,9	1,6	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 14	NR-2018-12467	<0,3	<0,3	<2,0	<2,0	0,4	<0,3	0,7	<0,3	<0,3	1,4	11,3	9,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 15	NR-2018-12468	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 16	NR-2018-12469	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 17	NR-2018-12470	<0,3	<0,3	<2,0	<2,0	0,6	<0,3	2,7	<0,3	<0,3	1,3	10,0	11,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 18	NR-2018-12471	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,5	<0,3	<0,3	1,0	8,8	5,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 19	NR-2018-12472	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 20	NR-2018-12473	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,6	<0,3	<0,3	<0,3	0,6	1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 21	NR-2018-12474	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,5	<0,3	<0,3	<0,3	0,8	1,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 1	NR-2018-12475	<0,3	<0,3	<2,0	14,5	1,1	<0,3	41,2	<0,3	<0,3	6,5	64,8	41,8	1,3	<0,3	<0,3	<0,3	<0,3	<0,3

SEDIMENTS	NIVA nr	PFTeS ng/g	7:3 FTAC ng/g	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
STEIN 1	NR-2018-11309	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 2	NR-2018-11310	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 3	NR-2018-11311	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 4	NR-2018-11312	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 5	NR-2018-11313	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 6	NR-2018-11314	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 7	NR-2018-11315	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 8	NR-2018-11316	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 9	NR-2018-11317	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 10	NR-2018-11318	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 11	NR-2018-11319	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 12	NR-2018-11320	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 13	NR-2018-11321	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 14	NR-2018-11322	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 15	NR-2018-11323	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 16	NR-2018-11324	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 17	NR-2018-11325	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 18	NR-2018-11326	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 19	NR-2018-11327	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 20	NR-2018-11328	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 21	NR-2018-11329	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 22	NR-2018-11330	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 23	NR-2018-11331	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 24	NR-2018-11332	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
STEIN 25	NR-2018-11333	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 1	NR-2018-11334	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 2	NR-2018-11335	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 3	NR-2018-11336	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 4	NR-2018-11337	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 5	NR-2018-11338	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 6	NR-2018-11339	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 7	NR-2018-11340	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 8	NR-2018-11341	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 9	NR-2018-11342	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 10	NR-2018-11343	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 11	NR-2018-11344	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOL 12	NR-2018-11345	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 1	NR-2018-12454	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 2	NR-2018-12455	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 3	NR-2018-12456	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 4	NR-2018-12457	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 5	NR-2018-12458	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 6	NR-2018-12459	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 7	NR-2018-12460	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 8	NR-2018-12461	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 9	NR-2018-12462	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 10	NR-2018-12463	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 11	NR-2018-12464	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 12	NR-2018-12465	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 13	NR-2018-12466	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 14	NR-2018-12467	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 15	NR-2018-12468	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 16	NR-2018-12469	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 17	NR-2018-12470	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 18	NR-2018-12471	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 19	NR-2018-12472	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 20	NR-2018-12473	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storø 21	NR-2018-12474	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 1	NR-2018-12475	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

SEDIMENTS	NIVA nr	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g
Nord 2	NR-2018-12476	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	<0,4	1,3	0,8	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,1	<0,1	<0,1	<0,1	<0,2	1,4
Nord 3	NR-2018-12477	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	0,4	0,8	<0,4	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,5	0,2	<0,1	<0,1	<0,2	0,4
Nord 4	NR-2018-12478	<0,5	<0,5	<0,5	<0,5	<0,4	0,4	0,5	1,6	0,5	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,5	<0,1	<0,1	<0,1	<0,2	1,1
Nord 5	NR-2018-12479	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,7	<0,1	<0,1	<0,1	<0,2	0,3
Nord 6	NR-2018-12480	<0,5	<0,5	<0,5	<0,5	<0,4	1,3	0,9	2,5	<0,4	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,7	0,3	<0,1	<0,1	<0,2	0,8
Nord 7	NR-2018-12481	<0,5	<0,5	<0,5	<0,5	<0,4	0,6	0,5	0,8	<0,4	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,6	0,1	<0,1	<0,1	<0,2	0,8
Nord 8	NR-2018-12482	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,8	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,1	<0,1	<0,1	<0,1	<0,2	1,6
Nord 9	NR-2018-12483	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	<0,4	0,9	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,3	<0,1	<0,1	<0,1	<0,2	<0,1
Nord 10	NR-2018-12484	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	<0,4	0,6	<0,4	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,4	<0,1	<0,1	<0,1	<0,2	<0,1
Nord 11	NR-2018-12485	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,2	<0,1	<0,1	<0,1	<0,2	0,8
Nord 12	NR-2018-12486	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Nord 13	NR-2018-12487	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Nord 14	NR-2018-12488	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,8	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,8	<0,1	<0,1	<0,1	<0,2	1,6
Storf 1	NR-2018-12489	<0,5	<0,5	<0,5	<0,5	<0,4	2,3	1,7	2,9	0,8	3,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,3	0,1	<0,1	<0,1	<0,2	1,5
Storf 2	NR-2018-12490	<0,5	<0,5	<0,5	<0,5	<0,4	1,4	1,8	6,1	1,3	4,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,2	0,2	<0,1	<0,1	<0,2	1,6
Storf 3	NR-2018-12491	<0,5	<0,5	<0,5	<0,5	<0,4	1,5	1,0	3,4	0,9	3,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,2	0,1	<0,1	<0,1	<0,2	1,2
Storf 4	NR-2018-12492	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	0,8	2,7	0,7	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,6	0,1	<0,1	<0,1	<0,2	1,1
Storf 5	NR-2018-12493	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	0,8	3,2	1,1	3,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,1	<0,1	<0,1	<0,1	<0,2	0,7
Storf 6	NR-2018-12494	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	0,6	0,6	<0,4	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,4	0,2	<0,1	<0,1	<0,2	0,8
Storf 7	NR-2018-12495	<0,5	<0,5	<0,5	<0,5	<0,4	1,9	2,3	3,1	0,9	2,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,9	0,2	<0,1	<0,1	<0,2	1,4
Storf 8	NR-2018-12496	<0,5	2,3	<0,5	<0,5	<0,4	4,6	4,4	6,3	1,8	4,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	17,8	1,1	<0,1	<0,1	<0,2	13,1
Storf 9	NR-2018-12497	<0,5	1,1	<0,5	<0,5	<0,4	2,2	1,5	1,4	0,6	0,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,6	0,4	<0,1	<0,1	<0,2	2,1
Storf 10	NR-2018-12498	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	0,5	0,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,4	0,2	<0,1	<0,1	<0,2	0,5
Storf 11	NR-2018-12499	<0,5	<0,5	<0,5	<0,5	<0,4	2,2	2,6	3,2	0,9	2,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,9	0,4	<0,1	<0,1	<0,2	1,6
Storf 12	NR-2018-12500	<0,5	1,6	<0,5	<0,5	<0,4	4,5	3,1	6,3	1,5	4,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,8	0,4	<0,1	<0,1	<0,2	3,5
Storf 13	NR-2018-12501	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,6	0,2	<0,1	<0,1	<0,2	0,1
Storf 14	NR-2018-12502	<0,5	1,2	<0,5	<0,5	<0,4	4,7	3,5	7,4	2,1	4,3	<0,4	<0,4	0,19	<0,1	<0,1	<0,1	10,2	0,5	<0,1	<0,1	<0,2	5,7
Storf 15	NR-2018-12503	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	1,1	1,9	0,5	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,1	0,2	<0,1	<0,1	<0,2	0,7
Vik 1	NR-2018-12504	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,4	0,4	<0,1	<0,1	<0,2	<0,1
Vik 2	NR-2018-12505	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,2	0,2	<0,1	<0,1	<0,2	<0,1
Vik 3	NR-2018-12506	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Vik 4	NR-2018-12507	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Vik 5	NR-2018-12508	<0,5	<0,5	<0,5	<0,5	<0,4	0,5	<0,4	0,6	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,0	0,6	<0,1	<0,1	<0,2	2,8
Vik 6	NR-2018-12509	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	1,5	1,4	<0,4	0,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,1	0,3	<0,1	<0,1	<0,2	0,6
Vik 7	NR-2018-12510	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	1,2	1,9	0,6	1,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,0	0,2	<0,1	<0,1	<0,2	1,2
Viul upstream 1	NR-2018-13904	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	2,17	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Viul upstream 2	NR-2018-13905	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	1,49	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Viul 1	NR-2018-14418	<0,5	1,6	1,0	7,5	1,8	27,8	11,6	24,0	5,4	23,7	2,1	3,1	<0,1	<0,1	<0,1	<0,4	6,1	2,5	<0,1	0,3	0,1	3,5
Viul 2	NR-2018-14419	<0,5	5,0	7,8	81,6	65,9	665	186	184	24,6	203	11,1	23,7	<0,1	<0,1	<0,1	21,3	1780	677	<0,1	6,0	1,9	112
Viul 3	NR-2018-14420	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,19	<0,1	<0,1	<0,1	<0,1	0,3
Viul 4	NR-2018-14421	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,14	<0,1	<0,1	<0,1	<0,1	0,1
Viul 5	NR-2018-14422	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Viul 7	NR-2018-14423	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	1,6	<0,4	<0,4	<0,1	<0,1	1,48	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Viul 8	NR-2018-14424	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	1,37	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Viul 9	NR-2018-14425	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	3,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,62	<0,1	<0,1	<0,1	<0,1	7,3
Viul 10	NR-2018-14426	<0,5	1,4	2,6	2,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,91	<0,1	<0,1	<0,1	<0,1	12,9
Brann 4	NR-2018-13903	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Brann 3	NR-2018-13902	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Brann 2	NR-2018-13901	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Brann 1	NR-2018-13900	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
KS-Ha-upstream	NR-2018-14427	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,16	1,1	<0,1	<0,1	<0,1	1,4
KS-Ha-downstream	NR-2018-14428	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,74	<0,1	<0,1	<0,1	<0,1	<0,1
KS-Br-sludge1	NR-2018-14429	<0,5	<0,5	<0,5	4,9	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	2,64	2,89	35,9	4,3	513	105	2,8	2,0	1,2	31,2
KS-Br-sludge2	NR-2018-14430	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,24	0,26	2,63	0,35	56,6	8,2	0,3	0,2	0,2	2,7
KS-HVA-manhole	NR-2018-13892	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,18	<0,1	<0,1	<0,1	<0,1	<0,1
KS-HVA-outlet	NR-2018-13894	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-SB-manhole	NR-2018-13893	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-SCH1-sed	NR-2018-13895	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-SCH2-sed	NR-2018-13896	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1

SEDIMENTS	NIVA nr	me-PFOSA ng/g	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS* ng/g	14:2 FTS* ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g
Nord 2	NR-2018-12476	<0,3	0,3	<2,0	26,2	2,8	<0,3	88,2	<0,3	<0,3	4,4	51,4	35,0	1,8	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 3	NR-2018-12477	<0,3	<0,3	<2,0	4,4	1,2	<0,3	12,6	<0,3	<0,3	1,2	10,9	7,1	0,5	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 4	NR-2018-12478	<0,3	<0,3	<2,0	10,9	1,3	<0,3	48,5	<0,3	<0,3	3,5	29,0	36,1	1,7	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 5	NR-2018-12479	<0,3	<0,3	<2,0	<2,0	1,0	<0,3	7,8	<0,3	<0,3	<0,3	0,8	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 6	NR-2018-12480	<0,3	<0,3	<2,0	3,5	1,5	<0,3	11,8	<0,3	<0,3	4,9	57,4	35,1	1,8	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 7	NR-2018-12481	<0,3	<0,3	<2,0	6,5	1,6	<0,3	14,3	<0,3	<0,3	1,9	22,1	18,1	0,8	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 8	NR-2018-12482	<0,3	0,5	<2,0	38,4	1,4	<0,3	70,3	<0,3	<0,3	1,0	10,1	6,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 9	NR-2018-12483	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,1	<0,3	<0,3	1,3	2,9	3,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 10	NR-2018-12484	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,5	<0,3	<0,3	1,2	3,9	4,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 11	NR-2018-12485	<0,3	0,3	<2,0	67,5	1,6	<0,3	107	<0,3	<0,3	1,8	15,3	10,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 12	NR-2018-12486	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 13	NR-2018-12487	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	0,4	1,1	2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 14	NR-2018-12488	<0,3	0,4	<2,0	44,9	2,5	<0,3	126	<0,3	<0,3	2,1	19,9	13,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 1	NR-2018-12489	<0,3	0,7	<2,0	55,4	6,2	<0,3	52,5	<0,3	<0,3	9,6	100	79,3	4,8	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 2	NR-2018-12490	<0,3	0,8	<2,0	37,9	8,6	0,4	27,9	<0,3	<0,3	15,8	221	254	18,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 3	NR-2018-12491	<0,3	0,8	<2,0	41,8	4,2	<0,3	23,6	<0,3	<0,3	8,0	115	108	7,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 4	NR-2018-12492	<0,3	1,1	<2,0	69,7	4,0	<0,3	27,3	<0,3	<0,3	4,4	80,6	45,2	3,1	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 5	NR-2018-12493	<0,3	0,3	<2,0	12,5	2,2	<0,3	8,6	<0,3	<0,3	10,2	93,2	85,4	4,2	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 6	NR-2018-12494	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	0,3	1,2	2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 7	NR-2018-12495	<0,3	0,5	<2,0	25,7	3,9	<0,3	28,4	<0,3	<0,3	4,8	45,5	57,9	2,6	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 8	NR-2018-12496	<0,3	0,7	<2,0	<2,0	1,5	<0,3	3,8	<0,3	<0,3	6,2	92,9	52,0	1,8	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 9	NR-2018-12497	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	0,1	<0,3	<0,3	0,7	4,6	6,8	0,5	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 10	NR-2018-12498	<0,3	<0,3	<2,0	<2,0	0,5	<0,3	4,1	<0,3	<0,3	0,6	3,5	3,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 11	NR-2018-12499	<0,3	0,5	<2,0	21,3	3,9	<0,3	19,9	<0,3	<0,3	3,3	34,3	29,8	1,6	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 12	NR-2018-12500	<0,3	0,5	<2,0	<2,0	1,8	<0,3	7,9	<0,3	<0,3	12,5	156	67,2	2,2	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 13	NR-2018-12501	<0,3	<0,3	<2,0	<2,0	0,7	<0,3	3,0	<0,3	<0,3	0,6	2,4	2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 14	NR-2018-12502	0,4	0,8	<2,0	<2,0	1,7	<0,3	7,0	<0,3	<0,3	8,9	184	89,7	3,7	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 15	NR-2018-12503	<0,3	0,4	<2,0	23,1	2,6	<0,3	16,5	<0,3	<0,3	2,9	43,5	26,0	1,9	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 1	NR-2018-12504	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 2	NR-2018-12505	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,6	3,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 3	NR-2018-12506	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 4	NR-2018-12507	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 5	NR-2018-12508	<0,3	<0,3	<2,0	<2,0	0,4	<0,3	1,0	<0,3	<0,3	<0,3	0,5	1,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 6	NR-2018-12509	<0,3	<0,3	<2,0	<2,0	1,0	<0,3	4,2	<0,3	<0,3	1,6	16,9	7,2	0,5	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 7	NR-2018-12510	<0,3	0,6	<2,0	15,4	2,0	<0,3	11,4	<0,3	<0,3	2,6	37,7	22,5	1,4	<0,3	<0,3	<0,3	<0,3	<0,3
Viul upstream 1	NR-2018-13904	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul upstream 2	NR-2018-13905	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 1	NR-2018-14418	<0,3	13,0	<2,0	485	4,2	<0,3	669	<0,3	1,0	160	387	348	33	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 2	NR-2018-14419	<0,3	49,4	<2,0	2455	19,2	<0,3	1831	<0,3	6,6	2150	2120	1041	222	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 3	NR-2018-14420	<0,3	<0,3	<2,0	151	<0,3	<0,3	2,8	<0,3	<0,3	9,0	17,6	42,8	7,9	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 4	NR-2018-14421	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	1,2	2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 5	NR-2018-14422	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 7	NR-2018-14423	<0,3	<0,3	<2,0	5,6	<0,3	<0,3	10,6	<0,3	<0,3	5,9	61,8	177	29,8	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 8	NR-2018-14424	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	0,7	1,4	0,4	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 9	NR-2018-14425	<0,3	0,6	<2,0	3,3	1,1	<0,3	5,0	<0,3	<0,3	9,9	117	363	73,5	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 10	NR-2018-14426	<0,3	4,4	<2,0	29,4	2,0	<0,3	56,6	<0,3	<0,3	196	2014	1723	688	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 4	NR-2018-13903	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3	NR-2018-13902	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 2	NR-2018-13901	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 1	NR-2018-13900	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-upstream	NR-2018-14427	<0,3	0,7	<2,0	10,3	4,6	<0,3	34,5	<0,3	<0,3	389	107	27,9	3,5	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-downstream	NR-2018-14428	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-sludge1	NR-2018-14429	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	1,3	<0,3	11,6	<0,3	3,5	2,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-sludge2	NR-2018-14430	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	0,9	<0,3	0,4	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-manhole	NR-2018-13892	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-outlet	NR-2018-13894	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-manhole	NR-2018-13893	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH1-sed	NR-2018-13895	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH2-sed	NR-2018-13896	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

SEDIMENTS	NIVA nr	PFTeS ng/g	7:3 FTAC ng/g	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
Nord 2	NR-2018-12476	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 3	NR-2018-12477	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 4	NR-2018-12478	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 5	NR-2018-12479	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 6	NR-2018-12480	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 7	NR-2018-12481	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 8	NR-2018-12482	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 9	NR-2018-12483	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 10	NR-2018-12484	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 11	NR-2018-12485	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 12	NR-2018-12486	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 13	NR-2018-12487	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord 14	NR-2018-12488	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 1	NR-2018-12489	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 2	NR-2018-12490	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 3	NR-2018-12491	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 4	NR-2018-12492	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 5	NR-2018-12493	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 6	NR-2018-12494	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 7	NR-2018-12495	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 8	NR-2018-12496	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 9	NR-2018-12497	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 10	NR-2018-12498	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 11	NR-2018-12499	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 12	NR-2018-12500	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 13	NR-2018-12501	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 14	NR-2018-12502	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Storf 15	NR-2018-12503	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 1	NR-2018-12504	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 2	NR-2018-12505	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 3	NR-2018-12506	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 4	NR-2018-12507	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 5	NR-2018-12508	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 6	NR-2018-12509	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik 7	NR-2018-12510	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul upstream 1	NR-2018-13904	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul upstream 2	NR-2018-13905	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 1	NR-2018-14418	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 2	NR-2018-14419	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 3	NR-2018-14420	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 4	NR-2018-14421	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 5	NR-2018-14422	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 7	NR-2018-14423	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 8	NR-2018-14424	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 9	NR-2018-14425	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 10	NR-2018-14426	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 4	NR-2018-13903	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3	NR-2018-13902	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 2	NR-2018-13901	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 1	NR-2018-13900	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-upstream	NR-2018-14427	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-downstream	NR-2018-14428	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-sludge1	NR-2018-14429	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-sludge2	NR-2018-14430	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-manhole	NR-2018-13892	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-outlet	NR-2018-13894	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-manhole	NR-2018-13893	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH1-sed	NR-2018-13895	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH2-sed	NR-2018-13896	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

SEDIMENTS	NIVA nr	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g
KS-SCH4-sed	NR-2018-13897	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-SCH5-sed	NR-2018-13898	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-SCH6-sed	NR-2018-13899	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-VD-creek1	NR-2018-13889	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-VD-creek2	NR-2018-13890	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-VD-TYR	NR-2018-13891	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
KS-NP-basement	NP Slam Kjeller	<0,5	<0,5	21,3	201	<0,4	<0,4	<0,4	1,2	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	111	24,8	<0,1	<0,1	<0,2	52,6
KS-SCH7-bland	NR-2018-13924	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,51	<0,1	<0,1	<0,1	<0,2	<0,1
KS-SCH8-bland	NR-2018-13925	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
KS-SCH9-bland	NR-2018-13926	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,81	<0,1	<0,1	<0,1	<0,2	0,1
Trap 1	NR-2018-13912	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	3,12	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Trap 2	NR-2018-13913	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,99	<0,1	<0,1	<0,1	<0,2	<0,1
Trap 3	NR-2018-13906	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,24	<0,1	<0,1	<0,1	<0,2	<0,1
Trap 4	NR-2018-13907	<0,5	1,2	3,4	5,2	1,5	0,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,85	<0,1	<0,1	<0,1	<0,2	<0,1
Trap 5a	NR-2018-13908	<0,5	<0,5	1,4	4,9	<0,4	1,9	1,3	2,1	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,37	<0,1	<0,1	<0,1	<0,2	0,4
Trap 5b	NR-2018-13909	<0,5	<0,5	1,0	2,6	<0,4	1,7	1,4	2,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,32	<0,1	<0,1	<0,1	<0,2	0,5
Trap 6	NR-2018-13910	<0,5	<0,5	<0,5	8,4	<0,4	2,4	1,2	1,8	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,28	<0,1	<0,1	<0,1	<0,2	<0,1

SEDIMENTS	NIVA nr	me-PFOSA ng/g	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS* ng/g	14:2 FTS* ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g
KS-SCH4-sed	NR-2018-13897	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH5-sed	NR-2018-13898	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH6-sed	NR-2018-13899	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek1	NR-2018-13889	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek2	NR-2018-13890	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-TYR	NR-2018-13891	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-basement	NP Slam Kjeller	<0,3	53,7	<2,0	3310	23,6	<0,3	880	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH7-bland	NR-2018-13924	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH8-bland	NR-2018-13925	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH9-bland	NR-2018-13926	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 1	NR-2018-13912	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 2	NR-2018-13913	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 3	NR-2018-13906	<0,3	<0,3	<2,0	5,9	<0,3	<0,3	0,4	<0,3	<0,3	<0,3	<0,3	4,7	1,8	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 4	NR-2018-13907	<0,3	<0,3	<2,0	3,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	2,4	1,0	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 5a	NR-2018-13908	<0,3	<0,3	<2,0	7,3	<0,3	<0,3	<0,3	<0,3	<0,3	1,1	3,3	15,3	6,9	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 5b	NR-2018-13909	<0,3	<0,3	<2,0	9,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	1,9	17,7	6,1	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 6	NR-2018-13910	<0,3	<0,3	<2,0	2,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	6,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

SEDIMENTS	NIVA nr	PFTeS ng/g	7:3 FTAC ng/g	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
KS-SCH4-sed	NR-2018-13897	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH5-sed	NR-2018-13898	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH6-sed	NR-2018-13899	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek1	NR-2018-13889	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek2	NR-2018-13890	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-TYR	NR-2018-13891	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-basement	NP Slam Kjeller	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH7-bland	NR-2018-13924	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH8-bland	NR-2018-13925	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH9-bland	NR-2018-13926	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 1	NR-2018-13912	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 2	NR-2018-13913	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 3	NR-2018-13906	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 4	NR-2018-13907	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 5a	NR-2018-13908	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 5b	NR-2018-13909	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Trap 6	NR-2018-13910	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

FISH LIVER	NIVA no.	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g	me-PFOSA ng/g
NF-A-1	NR-2018-11619	<0,5	<0,5	<0,5	<0,5	<0,5	14,0	20,6	33,9	21,2	10,5	0,9	<0,4	<0,1	<0,1	<0,1	0,27	101	9,0	<0,1	<0,1	<0,2	3,6	<0,3
NF-A-2	NR-2018-11620	<0,5	<0,5	<0,5	<0,5	<0,5	3,8	5,9	11,0	6,7	3,6	<0,4	<0,4	<0,1	<0,1	<0,1	0,17	131	3,9	<0,1	<0,1	<0,2	0,2	<0,3
NF-A-3	NR-2018-11621	<0,5	<0,5	<0,5	<0,5	<0,5	22,2	26,6	42,6	28,8	13,3	1,1	<0,4	<0,1	<0,1	<0,1	<0,1	109	5,0	<0,1	<0,1	<0,2	0,9	<0,3
NF-A-4	NR-2018-11622	<0,5	<0,5	<0,5	<0,5	<0,5	4,7	6,2	10,4	6,4	3,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	36,0	2,3	<0,1	<0,1	<0,2	2,2	<0,3
NF-A-5	NR-2018-11623	<0,5	<0,5	<0,5	<0,5	<0,5	1,6	2,1	7,9	4,4	3,7	<0,4	<0,4	<0,1	<0,1	<0,1	0,19	84,0	3,6	<0,1	<0,1	<0,2	0,7	<0,3
NF-G-1	NR-2018-11624	<0,5	<0,5	<0,5	1,0	1,1	15,5	38,2	33,5	5,1	11,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	29,8		<0,1	0,27	<0,2	5,1	<0.3
NF-G-2	NR-2018-11625	<0,5	<0,5	<0,5	<0,5	<0,5	8,7	12,9	22,2	13,0	5,4	0,7	<0,4	<0,1	<0,1	<0,1	0,26	65,0		<0,1	<0,1	<0,2	10,6	<0,3
NF-S-1	NR-2018-11615	<0,5	<0,5	<0,5	<0,5	<0,5	2,2	1,6	3,2	1,8	2,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	34,0		<0,1	<0,1	<0,2	33,5	<0,3
NF-S-6	NR-2018-11616	<0,5	<0,5	<0,5	<0,5	<0,5	3,7	2,7	6,9	3,0	4,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	58,0		<0,1	<0,1	<0,2	55,1	<0,3
NF-S-11	NR-2018-11617	<0,5	<0,5	<0,5	<0,5	<0,5	4,8	3,3	7,7	3,5	5,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	35,0		<0,1	<0,1	<0,2	45,6	<0,3
NF-M-01	NR-2018-11618	<0,5	<0,5	<0,5	<0,5	<0,5	4,4	6,3	10,9	2,6	3,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	27,0		<0,1	<0,1	<0,2	6,9	<0,3
VU-A-1	NR-2018-11626	<0,5	1,2	<0,5	<0,5	<0,5	17,3	9,2	22,3	17,1	11,1	0,7	<0,4	<0,1	<0,1	<0,1	0,19	203	8,3	<0,1	<0,1	<0,2	5,6	<0,3
VU-A-2	NR-2018-11627	<0,5	1,2	<0,5	<0,5	<0,5	33,8	15,1	39,2	17,2	12,5	0,6	<0,4	<0,1	<0,1	<0,1	1,61	640	87,9	<0,1	<0,1	<0,2	18,6	<0,3
VU-A-3	NR-2018-11628	<0,5	<0,5	<0,5	<0,5	<0,5	16,0	14,9	96,2	31,6	52,3	1,0	<0,4	<0,1	<0,1	<0,1	0,36	291	38,1	<0,1	<0,1	<0,2	195	<0,3
VU-A-4	NR-2018-11629	<0,5	<0,5	<0,5	<0,5	<0,5	36,5	24,5	27,2	25,1	10,6	0,7	<0,4	<0,1	<0,1	<0,1	0,79	402	26,7	<0,1	<0,1	<0,2	2,5	<0,3
VU-A-5	NR-2018-11630	<0,5	1,1	<0,5	<0,5	<0,5	23,3	7,8	25,2	9,1	7,0	<0,4	<0,4	<0,1	<0,1	<0,1	0,48	320	21,8	<0,1	<0,1	<0,2	0,5	<0,3
VU-G-1	NR-2018-11631	<0,5	1,3	<0,5	<0,5	<0,5	6,4	4,1	<0,4	3,8	2,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	47,8		<0,1	<0,1	<0,2	20,9	<0,3
VU-G-2	NR-2018-11632	<0,5	<0,5	<0,5	<0,5	<0,5	1,7	<0,4	<0,4	2,4	1,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	22,5		<0,1	<0,1	<0,2	64,6	<0,3
VU-G-3	NR-2018-11633	<0,5	<0,5	<0,5	<0,5	0,8	5,3	5,0	6,7	10,2	3,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	83,4		<0,1	<0,1	<0,2	140	<0.3
VU-G-4	NR-2018-11634	<0,5	1,4	<0,5	<0,5	<0,5	3,8	2,4	4,1	3,3	3,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	40,3		<0,1	<0,1	<0,2	169	<0,3
SF-A-1	NR-2018-11591	<0,5	<0,5	5,2	3,9	1,3	18,2	11,4	12,0	8,9	1,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	163	1,0	<0,1	<0,1	<0,2	0,1	<0,3
SF-A-2	NR-2018-11592	<0,5	<0,5	<0,5	<0,5	<0,5	18,0	10,2	6,4	5,0	1,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	158	1,4	<0,1	<0,1	<0,2	0,4	<0,3
SF-A-3	NR-2018-11593	<0,5	<0,5	<0,5	<0,5	<0,5	14,8	9,5	7,6	7,1	1,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	146	0,8	<0,1	<0,1	<0,2	0,1	<0,3
SF-A-4	NR-2018-11594	<0,5	<0,5	<0,5	<0,5	<0,5	14,9	10,8	10,0	8,3	2,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	111	0,7	<0,1	<0,1	<0,2	0,2	<0,3
SF-A-5	NR-2018-11595	<0,5	<0,5	<0,5	<0,5	<0,5	15,1	9,7	11,2	7,9	1,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	133	0,9	<0,1	<0,1	<0,2	<0,1	<0,3
SF-S-1	NR-2018-11596	<0,5	<0,5	<0,5	<0,5	<0,5	4,0	3,5	1,8	0,9	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	32,0		<0,1	0,31	<0,2	3,5	<0,3
SF-M-1	NR-2018-11597	<0,5	<0,5	<0,5	<0,5	<0,5	3,9	6,3	5,4	4,2	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	8,0		<0,1	0,71	<0,2	0,3	<0,3
SF-G-1	NR-2018-11598	<0,5	<0,5	<0,5	<0,5	<0,5	9,2	5,5	3,9	3,2	1,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	78,0		<0,1	<0,1	<0,2	1,8	<0,3
SF-G-2	NR-2018-11599	<0,5	<0,5	<0,5	<0,5	<0,5	5,8	3,3	2,7	2,5	0,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	51,0		<0,1	<0,1	<0,2	1,5	<0,3
SF-G-3	NR-2018-11600	<0,5	<0,5	<0,5	<0,5	<0,5	23,3	18,9	13,2	17,3	1,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	110		<0,1	<0,1	<0,2	2,3	<0,3
SF-G-4	NR-2018-11601	<0,5	<0,5	<0,5	<0,5	3,7	6,8	4,6	2,9	3,7	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	46,0		<0,1	<0,1	<0,2	1,7	<0,3
SF-G-5	NR-2018-11602	<0,5	<0,5	<0,5	<0,5	2,6	7,7	4,0	3,0	2,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	56,0		<0,1	<0,1	<0,2	0,9	<0,3
SF-B-1	NR-2018-11603	<0,5	<0,5	10,3	8,4	3,8	25,4	15,1	5,6	2,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	83,0		<0,1	<0,1	<0,2	2,5	<0,3
SF-B-2	NR-2018-11604	<0,5	<0,5	<0,5	<0,5	<0,5	36,5	22,0	7,3	2,7	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	97,0		<0,1	<0,1	<0,2	8,9	<0,3
SØ-S-1	NR-2018-11605	<0,5	<0,5	<0,5	<0,5	<0,5	11,9	8,9	14,9	4,3	5,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	99,0		<0,1	0,45	<0,2	49,5	<0,3
SØ-S-6	NR-2018-11606	<0,5	<0,5	<0,5	<0,5	8,6	28,8	18,9	25,3	10,4	6,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	136		<0,1	<0,1	<0,2	33,2	<0,3
SØ-M-1	NR-2018-11607	<0,5	<0,5	<0,5	<0,5	<0,5	17,5	31,1	44,4	9,9	10,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	71,0		<0,1	0,84	<0,2	10,9	<0,3
SØ-M-6	NR-2018-12573	<0,5	<0,5	<0,5	<0,5	0,2	2,2	4,7	4,5	2,3	2,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	24,1		<0,1	<0,1	<0,2	0,8	<0,3
SØ-M-11	NR-2018-12574	<0,5	<0,5	<0,5	<0,5	0,4	10,5	24,7	46,6	11,7	14,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	60,5		<0,1	<0,1	<0,2	2,8	<0,3
SØ-S-10	NR-2018-12575	<0,5	<0,5	<0,5	<0,5	4,3	25,7	18,0	38,3	10,1	11,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	202		<0,1	<0,1	<0,2	66,1	<0,3
VI-S-1	NR-2018-12576	<0,5	<0,5	<0,5	<0,5	1,6	6,5	5,0	5,6	2,7	4,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	37,3		<0,1	<0,1	<0,2	6,3	<0,3
VI-S-6	NR-2018-12577	<0,5	<0,5	<0,5	<0,5	1,6	6,4	6,0	8,8	4,4	9,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	56,8		<0,1	0,22	<0,2	7,0	<0,3
VI-S-11	NR-2018-12578	<0,5	<0,5	<0,5	<0,5	6,0	20,0	10,2	10,4	3,6	6,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	75,1		<0,1	<0,1	<0,2	9,9	<0,3
VI-A-1	NR-2018-12579	<0,5	<0,5	<0,5	<0,5	1,1	22,7	19,2	14,5	7,4	7,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	161	2,9	<0,1	<0,1	<0,2	0,28	<0,3
VI-A-2	NR-2018-12580	<0,5	<0,5	<0,5	4,1	1,0	29,3	57,8	41,2	25,9	15,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	156	2,3	<0,1	<0,1	<0,2	0,51	<0,3
VI-A-3	NR-2018-12581	<0,5	<0,5	<0,5	<0,5	0,6	9,7	10,4	10,4	7,7	9,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	57,4	1,2	<0,1	<0,1	<0,2	0,14	<0,3
VI-A-4	NR-2018-12582	<0,5	<0,5	<0,5	<0,5	1,0	20,0	22,1	32,5	9,9	9,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	197	2,8	<0,1	<0,1	<0,2	<0,1	<0,3
VI-A-5	NR-2018-12583	<0,5	<0,5	<0,5	4,5	2,5	30,9	27,2	22,9	12,7	13,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	291	5,1	<0,1	<0,1	<0,2	1,8	<0,3
VI-M-1	NR-2018-12584	<0,5	<0,5	<0,5	<0,5	<0,4	3,8	5,8	6,3	3,1	4,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	22,5		<0,1	0,39	<0,2	2,5	<0,3
VI-M-6	NR-2018-12585	<0,5	<0,5	<0,5	<0,5	<0,4	4,4	6,5	13,5	4,5	5,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	37,6		<0,1	0,27	<0,2	3,2	<0,3
VI-M-11	NR-2018-12586	<0,5	<0,5	<0,5	<0,5	<0,4	5,9	9,7	19,4	4,9	8,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	32,7		<0,1	0,38	<0,2	5,7	<0,3
SØ-A-1	NR-2018-11608	<0,5	3,6	16,8	18,5	8,0	96,8	163	285	222	110	1,7	<0,4	<0,1	<0,1	<0,1	0,27	528	7,1	<0,1	1,73	<0,2	10,5	<0,3
SØ-A-2	NR-2018-11609	<0,5	<0,5	2,1	2,1	0,9	10,5	17,8	24,2	10,3	7,2	1,2	<0,4	<0,1	<0,1	<0,1	<0,1	98,4	3,0	<0,1	<0,1	<0,2	0,4	<0,3
SØ-A-3	NR-2018-11610	<0,5	1,1	8,3	8,1	4,1	9,7	13,2	22,3	12,3	6,0	<0,4	<0,4	<0,1	<0,1	<0,1	0,24	122	2,9	<0,1	0,2	<0,2	1,0	<0,3
SØ-A-4	NR-2018-11611	<0,5	<0,5	2,6	2,5	1,9	11,3	16,4	24,6	10,4	6,9	<0,4	<0,4	<0,1	<0,1	<0,1	0,19	109	3,2	<0,1	<0,1	<0,2	1,2	<0,3
SØ-A-5	NR-2018-11612	<0,5	0,9	5,5	5,2	3,0	16,5	23,7	32,9	17,2	6,4	<0,4	<0,4	<0,1	<0,1	<0,1	0,26	81,6	2,3	<0,1	0,17	<0,2	1,3	<0,3
SØ-Ø-1	NR-2018-11613	<0,5	0,8	2,5	2,9	3,0	34,7	90,5	69,4	26,8	21,0	2,9	<0,4	<0,1	<0,1	<0,1	0,17	101		<0,1	0,5	<0,2	12,0	<0,3
SØ-R-1	NR-2018-11614	<0,5	<0,5	2,4	2,7	2,4	25,2	49,3	45,3	14,6	8,6	1,1	<0,4	<0,1	<0,1	<0,1	<0,1	71,1		<0,1	0,28	<0,2	9,3	<0,3
TYR-Ø-1	NR-2018-14470	<0,5	<0,5	<0,5	<0,5	2,6	65,1	131	66,0	43,2	40,0	2,6	<0,4	<0,1	<0,1	<0,1	<0,1	95,8		<0,1	0,87	<0,2	8,6	<0.3

FISH LIVER	NIVA no.	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS ng/g	14:2 FTS ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g	PFTeS ng/g	7:3 FTAC ng/g
NF-A-1	NR-2018-11619	<0,3	<2	<2	0,4	<0,3	2,4	<0,3	<0,3	0,7	4,0	18,4	1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-2	NR-2018-11620	<0,3	<2	<2	<0,3	<0,3	1,9	<0,3	<0,3	2,9	3,7	7,1	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-3	NR-2018-11621	<0,3	<2	<2	<0,3	<0,3	1,1	<0,3	<0,3	0,4	2,6	14,8	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-4	NR-2018-11622	<0,3	<2	<2	<0,3	<0,3	1,0	<0,3	0,6	0,5	1,0	3,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-5	NR-2018-11623	<0,3	<2	<2	<0,3	<0,3	5,1	<0,3	<0,3	0,8	3,9	6,9	0,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-G-1	NR-2018-11624	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-2	NR-2018-11625	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,2	1,0	3,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-1	NR-2018-11615	<0,3	<2	<2	<0,3	<0,3	7,4	<0,3	<0,3	<0,3	0,6	3,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-6	NR-2018-11616	<0,3	<2	<2	0,3	<0,3	4,6	<0,3	<0,3	<0,3	0,5	8,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-11	NR-2018-11617	<0,3	<2	<2	<0,3	<0,3	2,5	<0,3	<0,3	<0,3	<0,3	3,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-M-01	NR-2018-11618	<0,3	<2	<2	0,7	<0,3	0,4	<0,3	<0,3	<0,3	1,7	4,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-1	NR-2018-11626	<0,3	<2	<2	<0,3	<0,3	5,3	<0,3	0,9	6,7	37,5	16,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-2	NR-2018-11627	<0,3	<2	<2	0,8	<0,3	55,9	<0,3	<0,3	3,1	28,1	27,9	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-3	NR-2018-11628	<0,3	<2	<2	0,6	<0,3	64,0	<0,3	<0,3	5,5	42,4	55,6	1,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-4	NR-2018-11629	<0,3	<2	<2	<0,3	<0,3	6,5	<0,3	<0,3	14,3	19,7	11,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-5	NR-2018-11630	<0,3	<2	<2	<0,3	<0,3	6,6	<0,3	<0,3	5,7	29,1	10,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-1	NR-2018-11631	<0,3	<2	<2	0,4	<0,3	1,3	<0,3	<0,3	1,7	7,0	5,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-2	NR-2018-11632	<0,3	<2	<2	<0,3	<0,3	4,3	<0,3	<0,3	0,4	1,9	2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-3	NR-2018-11633	<0.3	<2	<2	<0.3	<0.3	2,8	<0.3	<0.3	1,2	3,7	2,9	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-4	NR-2018-11634	1,4	<2	<2	<0,3	<0,3	6,4	<0,3	<0,3	1,1	4,0	4,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-1	NR-2018-11591	<0,3	<2	<2	<0,3	<0,3	0,3	<0,3	<0,3	0,1	0,3	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-2	NR-2018-11592	<0,3	<2	<2	<0,3	<0,3	0,5	<0,3	<0,3	0,4	0,1	0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-3	NR-2018-11593	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,1	0,3	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-4	NR-2018-11594	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,2	0,3	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-5	NR-2018-11595	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,0	0,2	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-S-1	NR-2018-11596	<0,3	<2	<2	<0,3	<0,3	0,3	<0,3	<0,3	3,5	0,1	0,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-M-1	NR-2018-11597	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	0,9	1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-1	NR-2018-11598	<0,3	<2	<2	<0,3	<0,3	0,3	<0,3	<0,3	1,8	0,3	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-2	NR-2018-11599	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	1,5	0,1	0,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-3	NR-2018-11600	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	2,3	0,2	0,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-4	NR-2018-11601	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	1,7	1,4	0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-5	NR-2018-11602	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	0,9	0,0	0,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-B-1	NR-2018-11603	<0,3	<2	<2	0,3	<0,3	0,4	<0,3	<0,3	2,5	0,6	0,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-B-2	NR-2018-11604	<0,3	<2	<2	0,5	<0,3	0,9	<0,3	<0,3	8,9	0,8	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-1	NR-2018-11605	<0,3	<2	<2	0,6	<0,3	1,5	<0,3	<0,3	49,5	0,9	7,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-6	NR-2018-11606	<0,3	<2	<2	1,0	<0,3	3,2	<0,3	<0,3	33,2	0,7	5,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-1	NR-2018-11607	<0,3	<2	<2	2,2	<0,3	0,3	<0,3	<0,3	10,9	7,3	25,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-6	NR-2018-12573	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	0,41	<0.3	0,7	4,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-11	NR-2018-12574	<0.3	<2	<2	1,3	<0.3	<0.3	<0.3	<0.3	<0.3	6,3	16,7	0,48	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-10	NR-2018-12575	<0.3	<2	<2	2,3	<0.3	1,9	<0.3	<0.3	<0.3	1,0	24,4	1,35	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-1	NR-2018-12576	<0.3	<2	<2	<0.3	<0.3	0,4	<0.3	1,02	<0.3	0,2	6,0	0,43	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-6	NR-2018-12577	<0.3	<2	<2	0,6	<0.3	0,8	<0.3	1,75	<0.3	0,4	12,8	0,99	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-11	NR-2018-12578	<0.3	<2	<2	<0.3	<0.3	0,8	<0.3	2,42	<0.3	0,7	13,9	0,95	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-1	NR-2018-12579	<0.3	<2	<2	<0.3	<0.3	0,4	<0.3	<0.3	<0.3	0,6	4,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-2	NR-2018-12580	<0.3	<2	<2	<0.3	<0.3	0,3	<0.3	<0.3	<0.3	1,7	6,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-3	NR-2018-12581	<0.3	<2	<2	<0.3	<0.3	1,3	<0.3	<0.3	<0.3	0,8	5,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-4	NR-2018-12582	<0.3	<2	<2	<0.3	<0.3	0,9	<0.3	<0.3	<0.3	0,8	4,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-5	NR-2018-12583	<0.3	<2	<2	<0.3	<0.3	2,7	<0.3	0,77	<0.3	1,8	10,2	0,33	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-1	NR-2018-12584	<0.3	<2	<2	0,4	<0.3	0,1	<0.3	<0.3	<0.3	1,3	6,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-6	NR-2018-12585	<0.3	<2	<2	0,4	<0.3	0,2	<0.3	<0.3	<0.3	2,1	9,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-11	NR-2018-12586	<0.3	<2	<2	0,6	<0.3	0,1	<0.3	<0.3	<0.3	4,3	16,2	0,36	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-1	NR-2018-11608	<0,3	<2	<2	<0.3	<0,3	0,9	<0,3	0,6	<0.3	3,2	14,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-2	NR-2018-11609	<0,3	<2	<2	<0.3	<0,3	0,3	<0,3	1,1	<0.3	0,2	1,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-3	NR-2018-11610	<0,3	<2	<2	<0.3	<0,3	0,6	<0,3	2,2	<0.3	0,8	2,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-4	NR-2018-11611	<0,3	<2	<2	<0.3	<0,3	0,4	<0,3	0,9	<0.3	0,5	1,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-5	NR-2018-11612	<0,3	<2	<2	<0.3	<0,3	0,5	<0,3	1,2	<0.3	0,4	1,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-Ø-1	NR-2018-11613	<0,3	<2	<2	0,8	<0,3	0,3	<0,3	2,1	<0.3	0,2	2,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-R-1	NR-2018-11614	<0,3	<2	<2	0,8	<0,3	0,3	<0,3	0,5	<0.3	0,2	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
TYR-Ø-1	NR-2018-14470	<0.3	<2	<2	0,9	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	7,9	0,32	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH LIVER	NIVA no.	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
NF-A-1	NR-2018-11619	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-2	NR-2018-11620	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-3	NR-2018-11621	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-4	NR-2018-11622	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A-5	NR-2018-11623	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-G-1	NR-2018-11624	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-2	NR-2018-11625	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-1	NR-2018-11615	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-6	NR-2018-11616	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-S-11	NR-2018-11617	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-M-01	NR-2018-11618	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-1	NR-2018-11626	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-2	NR-2018-11627	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-3	NR-2018-11628	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-4	NR-2018-11629	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A-5	NR-2018-11630	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-1	NR-2018-11631	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-2	NR-2018-11632	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G-3	NR-2018-11633	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-4	NR-2018-11634	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-1	NR-2018-11591	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-2	NR-2018-11592	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-3	NR-2018-11593	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-4	NR-2018-11594	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A-5	NR-2018-11595	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-S-1	NR-2018-11596	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-M-1	NR-2018-11597	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-1	NR-2018-11598	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-2	NR-2018-11599	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-3	NR-2018-11600	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-4	NR-2018-11601	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G-5	NR-2018-11602	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-B-1	NR-2018-11603	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-B-2	NR-2018-11604	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-1	NR-2018-11605	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-6	NR-2018-11606	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-1	NR-2018-11607	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-6	NR-2018-12573	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-M-11	NR-2018-12574	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-S-10	NR-2018-12575	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-1	NR-2018-12576	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-6	NR-2018-12577	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-S-11	NR-2018-12578	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-1	NR-2018-12579	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-2	NR-2018-12580	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-3	NR-2018-12581	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-4	NR-2018-12582	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-A-5	NR-2018-12583	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-1	NR-2018-12584	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-6	NR-2018-12585	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VI-M-11	NR-2018-12586	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-1	NR-2018-11608	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-2	NR-2018-11609	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-3	NR-2018-11610	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-4	NR-2018-11611	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A-5	NR-2018-11612	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-Ø-1	NR-2018-11613	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-R-1	NR-2018-11614	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
TYR-Ø-1	NR-2018-14470	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH LIVER	NIVA no.	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g	me-PFOSA ng/g
TYR-Ø-2	NR-2018-14471	<0,5	<0,5	<0,5	<0,5	1,5	28,2	31,5	28,0	9,1	5,7	0,5	<0,4	<0,1	<0,1	<0,1	<0,1	36,9		<0,1	<0,1	<0,2	5,8	<0.3
TYR-Ø-3	NR-2018-14472	<0,5	<0,5	<0,5	<0,5	1,1	17,3	40,0	43,1	20,0	19,7	1,7	<0,4	<0,1	<0,1	<0,1	<0,1	35,6		<0,1	0,31	<0,2	11,3	<0.3
TYR-Ø-4	NR-2018-14473	<0,5	<0,5	<0,5	<0,5	1,7	29,8	52,4	46,1	20,4	18,1	1,8	<0,4	<0,1	<0,1	<0,1	<0,1	44,7		<0,1	0,32	<0,2	9,7	<0.3
TYR-Ø-5	NR-2018-14474	<0,5	<0,5	<0,5	1,7	0,9	8,7	8,7	9,7	19,9	1,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,8		<0,1	<0,1	<0,2	1,3	<0.3
BR-A-1	NR-2018-14475	<0,5	<0,5	<0,5	<0,5	0,4	18,0	17,8	25,0	2,7	5,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	91,7		<0,1	0,24	<0,2	0,7	<0.3
BR-A-2	NR-2018-14476	<0,5	<0,5	<0,5	<0,5	<0,4	5,1	9,6	14,6	10,0	6,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	77,6		<0,1	<0,1	<0,2	0,6	<0.3
BR-S-1	NR-2018-14477	<0,5	<0,5	<0,5	<0,5	3,0	18,6	15,0	10,2	9,7	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	651		0,29	<0,1	<0,2	12,9	<0.3
S-S-1	NR-2018-14478	<0,5	<0,5	<0,5	<0,5	0,7	2,4	1,9	0,9	1,9	0,4	<0,4	<0,4	0,23	<0,1	<0,1	<0,1	30,3		<0,1	<0,1	<0,2	3,1	<0.3
S-S-2	NR-2018-14479	<0,5	<0,5	<0,5	<0,5	0,8	2,3	1,7	0,6	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	27,2		<0,1	<0,1	<0,2	2,0	<0.3
SØ-G-1	NR-2018-14480	<0,5	<0,5	<0,5	<0,5	0,5	5,6	6,5	9,6	0,4	3,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	26,8		<0,1	<0,1	<0,2	0,8	<0.3
SØ-G-2	NR-2018-14481	<0,5	<0,5	<0,5	2,7	0,8	7,2	9,8	13,8	5,1	4,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	22,8		<0,1	<0,1	<0,2	3,7	<0.3
SØ-G-3	NR-2018-14482	<0,5	<0,5	<0,5	<0,5	<0,4	6,2	9,7	11,6	10,3	5,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	57,0		<0,1	<0,1	<0,2	0,7	<0.3

FISH LIVER	NIVA no.	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS ng/g	14:2 FTS ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g	PFTeS ng/g	7:3 FTAC ng/g
TYR-Ø-2	NR-2018-14471	<0.3	<2	<2	0,7	<0.3	0,3	<0.3	<0.3	<0.3	<0.3	1,2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-3	NR-2018-14472	<0.3	<2	<2	0,7	<0.3	<0.3	<0.3	<0.3	<0.3	0,4	2,1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-4	NR-2018-14473	<0.3	<2	<2	0,4	<0.3	0,3	<0.3	<0.3	<0.3	<0.3	4,1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-5	NR-2018-14474	<0.3	<2	<2	0,4	<0.3	0,3	<0.3	<0.3	<0.3	0,5	0,6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-1	NR-2018-14475	<0.3	<2	<2	<0.3	<0.3	0,3	<0.3	<0.3	<0.3	0,4	4,7	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-2	NR-2018-14476	<0.3	<2	<2	<0.3	<0.3	1,1	<0.3	<0.3	1,3	2,2	10,2	0,4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-S-1	NR-2018-14477	<0.3	<2	<2	<0.3	<0.3	0,5	<0.3	<0.3	<0.3	<0.3	0,6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
S-S-1	NR-2018-14478	<0.3	<2	<2	<0.3	<0.3	0,2	<0.3	<0.3	<0.3	<0.3	0,8	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
S-S-2	NR-2018-14479	<0.3	<2	<2	<0.3	<0.3	0,3	<0.3	<0.3	<0.3	<0.3	0,6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-1	NR-2018-14480	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-2	NR-2018-14481	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,7	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-3	NR-2018-14482	<0.3	<2	<2	<0.3	<0.3	0,3	<0.3	<0.3	<0.3	0,5	2,7	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH LIVER	NIVA no.	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
TYR-Ø-2	NR-2018-14471	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-3	NR-2018-14472	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-4	NR-2018-14473	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-5	NR-2018-14474	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-1	NR-2018-14475	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-2	NR-2018-14476	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-S-1	NR-2018-14477	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
S-S-1	NR-2018-14478	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
S-S-2	NR-2018-14479	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-1	NR-2018-14480	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-2	NR-2018-14481	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-3	NR-2018-14482	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH		PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTrDA	PFTeDA	PFPeDA	PFHxDA	PFBS	PFPeS	PFHxS	PFHpS	PFOS	br-PFOS	PFNS	PFDS	PFDoS	PFOSA
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SØ-A-6	NR-2018-12556	<0,5	<0,5	<0,5	<0,5	<0,4	1,9	1,3	0,7	0,4	0,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,65		<0,1	<0,1	<0,2	0,21
SØ-A-7	NR-2018-12557	<0,5	<0,5	<0,5	<0,5	0,5	6,7	3,5	5,4	2,4	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	15,6		<0,1	<0,1	<0,2	0,21
SØ-A-8	NR-2018-12558	<0,5	<0,5	<0,5	<0,5	<0,4	1,1	1,3	1,5	1,2	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,29		<0,1	<0,1	<0,2	0,10
SØ-A-9	NR-2018-12559	<0,5	<0,5	<0,5	<0,5	<0,4	2,8	1,7	1,0	0,7	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,23		<0,1	<0,1	<0,2	0,12
SØ-A-10	NR-2018-12560	<0,5	<0,5	<0,5	<0,5	<0,4	1,6	1,8	1,6	1,4	0,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,27		<0,1	<0,1	<0,2	0,05
VI-A-1	NR-2018-12565	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	0,7	1,0	0,7	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,92		<0,1	<0,1	<0,2	<0,1
VI-A-2	NR-2018-12566	<0,5	<0,5	<0,5	<0,5	<0,4	1,8	3,0	4,7	2,8	1,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	8,71		<0,1	<0,1	<0,2	<0,1
VI-A-3	NR-2018-12567	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	0,7	0,8	0,7	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,21		<0,1	<0,1	<0,2	<0,1
VI-A-4	NR-2018-12568	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	0,9	1,1	0,7	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	8,42		<0,1	<0,1	<0,2	<0,1
VI-A-5	NR-2018-12569	<0,5	<0,5	<0,5	<0,5	<0,4	1,1	1,1	0,9	0,5	0,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,1		<0,1	<0,1	<0,2	<0,1
SF-A-1	NR-2018-11449	<0,5	<0,5	<0,5	<0,5	<0,4	1,3	0,8	0,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,9		<0,1	<0,1	<0,2	<0,1
SF-A-2	NR-2018-11450	<0,5	<0,5	<0,5	<0,5	<0,4	1,5	0,9	0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,5		<0,1	<0,1	<0,2	<0,1
SF-A-3	NR-2018-11451	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	0,8	0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	8,5		<0,1	<0,1	<0,2	<0,1
SF-A-4	NR-2018-11452	<0,5	<0,5	<0,5	<0,5	<0,4	1,2	1,1	0,5	0,6	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,2		<0,1	<0,1	<0,2	<0,1
SF-A-5	NR-2018-11453	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	0,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	7,9		<0,1	<0,1	<0,2	<0,1
SF-A-6	NR-2018-11454	<0,5	<0,5	<0,5	1,5	<0,4	0,8	0,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,5		<0,1	<0,1	<0,2	<0,1
SF-A-7	NR-2018-11455	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	0,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	7,2		<0,1	<0,1	<0,2	<0,1
SF-A-8	NR-2018-11456	<0,5	<0,5	<0,5	<0,5	<0,4	1,6	1,2	0,8	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,9		<0,1	<0,1	<0,2	<0,1
SF-A-9	NR-2018-11457	<0,5	<0,5	<0,5	<0,5	<0,4	1,1	1,1	0,6	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	20,8		<0,1	<0,1	<0,2	<0,1
SF-A-10	NR-2018-11458	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,1		<0,1	<0,1	<0,2	<0,1
SF-G-1	NR-2018-11472	<0,5	<0,5	2,3	1,3	0,6	0,5	0,5	0,5	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,72		<0,1	<0,1	<0,2	0,41
SF-G-2	NR-2018-11473	<0,5	<0,5	<0,5	1,0	0,5	0,5	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,54		<0,1	<0,1	<0,2	0,28
SF-G-3	NR-2018-11474	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	0,7	0,5	0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,09		<0,1	<0,1	<0,2	0,44
SF-G-4	NR-2018-11475	<0,5	<0,5	<0,5	<0,5	<0,4	0,5	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,37		<0,1	<0,1	<0,2	0,57
SF-G-5	NR-2018-11476	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,84		<0,1	<0,1	<0,2	0,31
SØ-A-1	NR-2018-11493	<0,5	<0,5	<0,5	<0,5	0,7	9,7	15,5	33,5	22,6	10,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	38,1		<0,1	<0,1	<0,2	2,63
SØ-A-2	NR-2018-11494	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	1,6	3,0	1,8	1,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,60		<0,1	<0,1	<0,2	<0,1
SØ-A-3	NR-2018-11495	<0,5	<0,5	<0,5	<0,5	<0,4	1,4	2,0	3,1	1,9	1,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	11,8		<0,1	<0,1	<0,2	0,20
SØ-A-4	NR-2018-11496	<0,5	<0,5	2,5	1,5	0,6	1,9	2,6	4,2	1,9	0,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	12,6		<0,1	<0,1	<0,2	0,27
SØ-A-5	NR-2018-11497	<0,5	<0,5	<0,5	<0,5	0,4	2,1	2,9	4,6	2,3	1,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	7,98		<0,1	<0,1	<0,2	0,28
SØ-Ø-1	NR-2018-11498	<0,5	<0,5	<0,5	<0,5	0,5	2,0	3,2	6,5	3,7	1,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,47		<0,1	<0,1	<0,2	0,38
SØ-R-1	NR-2018-11499	<0,5	<0,5	<0,5	<0,5	<0,4	1,7	2,8	4,8	2,5	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,38		<0,1	<0,1	<0,2	0,50
NF-A-1	NR-2018-11524	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	1,5	2,5	1,3	0,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,35		<0,1	<0,1	<0,2	0,61
NF-A-2	NR-2018-11525	<0,5	<0,5	<0,5	<0,5	<0,4	0,5	0,7	0,6	0,6	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,2		<0,1	<0,1	<0,2	0,04
NF-A-3	NR-2018-11526	<0,5	<0,5	<0,5	<0,5	<0,4	1,9	2,5	3,6	1,9	1,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	8,11		<0,1	<0,1	<0,2	0,11
NF-A-4	NR-2018-11527	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	1,1	0,9	0,7	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,18		<0,1	<0,1	<0,2	0,96
NF-A-5	NR-2018-11528	<0,5	<0,5	4,2	2,6	0,6	0,5	0,4	0,3	0,4	0,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,71		<0,1	<0,1	<0,2	0,25
NF-G-1	NR-2018-11539	<0,5	<0,5	<0,5	<0,5	<0,4	0,5	1,2	2,5	1,2	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,61		<0,1	<0,1	<0,2	3,96
NF-G-2	NR-2018-11540	<0,5	<0,5	<0,5	<0,5	<0,4	0,7	0,7	1,0	0,8	0,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,27		<0,1	<0,1	<0,2	2,96
VU-A-1	NR-2018-11541	<0,5	<0,5	<0,5	<0,5	<0,4	1,1	0,6	1,1	0,7	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,97		<0,1	<0,1	<0,2	1,85
VU-A-2	NR-2018-11542	<0,5	<0,5	<0,5	<0,5	<0,4	1,9	1,1	2,7	0,9	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	37,5		<0,1	<0,1	<0,2	3,40
VU-A-3	NR-2018-11543	<0,5	<0,5	1,5	3,1	<0,4	1,1	1,0	5,3	1,2	2,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	12,3		<0,1	<0,1	<0,2	23,9
VU-A-4	NR-2018-11544	<0,5	<0,5	0,7	0,9	0,6	2,8	2,0	2,3	1,0	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	28,6		<0,1	<0,1	<0,2	0,32
VU-A-5	NR-2018-11545	<0,5	<0,5	0,5	<0,5	<0,4	3,3	1,3	3,3	0,9	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	37,6		<0,1	<0,1	<0,2	0,10
VU-G-1	NR-2018-11552	<0,5	<0,5	<0,5	<0,5	<0,4	1,2	0,4	0,8	0,2	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,70		<0,1	<0,1	<0,2	11,3
VU-G-2	NR-2018-11553	<0,5	<0,5	<0,5	<0,5	<0,4	0,1	<0,4	0,7	0,1	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,53		<0,1	<0,1	<0,2	13,1
VU-G-3	NR-2018-11554	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	0,7	0,7	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,4		<0,1	<0,1	<0,2	9,6
VU-G-4	NR-2018-11555	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,25		<0,1	<0,1	<0,2	30,4
SØ-KP-1	NR-2018-	<0,5	<0,5	<0,5	<0,5	0,7	<0.4	2,0	6,5	6,0	5,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,78		<0,1	<0,1	<0,2	0,16
SØ-KP-2	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	0,4	1,0	3,5	2,2	3,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,49		<0,1	<0,1	<0,2	0,53
SØ-KP-3	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	0,4	2,4	9,1	6,6	7,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,53		<0,1	<0,1	<0,2	0,31
SØ-KP-4	NR-2018-	<0,5	<0,5	<0,5	<0,5	0,6	0,8	2,1	7,5	6,2	8,0	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,17		<0,1	<0,1	<0,2	1,22
SØ-KP-5	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	0,9	3,0	11,6	9,2	9,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,90		<0,1	<0,1	<0,2	0,62
SØ-KP-6	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	<0.4	3,4	16,8	16,8	13,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,72		<0,1	<0,1	<0,2	0,31
SØ-KP-7	NR-2018-	<0,5	<0,5	<0,5	<0,5	0,4	0,5	1,1	3,7	2,6	4,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,37		<0,1	<0,1	<0,2	0,58
SØ-KP-8	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	0,6	1,6	3,6	2,2	3,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,30		<0,1	<0,1	<0,2	0,42
SØ-KP-9	NR-2018-	<0,5	<0,5	<0,5	<0,5	<0.4	0,4	1,0	1,9	1,3	2,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,77		<0,1	<0,1	<0,2	0,54
SØ-KP-10	NR-2018-	<0,5	<0,5	<0,5	<0,5	0,5	1,0	4,9	23,8	16,9	12,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,45		<0,1	<0,1	<0,2	3,03
SF-KP-1	NR-2018-11419	<0,5	<0,5	<0,5	<0,5	0,9	<0.4	0,8	1,4	1,5	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,31		<0,1	<0,1	<0,2	<0.1
SF-KP-2	NR-2018-11420	<0,5	<0,5	<0,5	<0,5	<0.4	0,8	3,1	3,1	3,3	1,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,98		<0,1	<0,1	<0,2	0,13
SF-KP-3	NR-2018-11421	<0,5	<0,5	<0,5	<0,5	0,6	0,5	2,0	0,1	4,9	1,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,26		<0,1	<0,1	<0,2	<0.1

FISH		me-PFOSA	et-PFOSA	me-PFOSE	et-PFOSE	FOSAA	me-FOSAA	et-FOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	14:2 FTS	8Cl-PFOS	4:2 F53B	8:2 F53B	PFUdS	PFTrS
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SØ-A-6	NR-2018-12556	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	1,22	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-7	NR-2018-12557	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	0,41	<0.3	0,50	1,83	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-8	NR-2018-12558	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	0,71	<0.3	<0.3	0,66	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-9	NR-2018-12559	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	0,76	<0.3	<0.3	0,41	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-10	NR-2018-12560	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,02	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-1	NR-2018-12565	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,69	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-2	NR-2018-12566	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,25	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-3	NR-2018-12567	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,97	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-4	NR-2018-12568	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,59	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-5	NR-2018-12569	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,23	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-1	NR-2018-11449	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-2	NR-2018-11450	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-3	NR-2018-11451	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-4	NR-2018-11452	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-5	NR-2018-11453	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-6	NR-2018-11454	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-7	NR-2018-11455	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-8	NR-2018-11456	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-9	NR-2018-11457	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-10	NR-2018-11458	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-1	NR-2018-11472	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-2	NR-2018-11473	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,38	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-3	NR-2018-11474	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-4	NR-2018-11475	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-5	NR-2018-11476	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-1	NR-2018-11493	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,35	0,74	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-2	NR-2018-11494	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,53	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-3	NR-2018-11495	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-4	NR-2018-11496	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-5	NR-2018-11497	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-Ø-1	NR-2018-11498	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-R-1	NR-2018-11499	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-1	NR-2018-11524	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,34	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-2	NR-2018-11525	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,41	0,48	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-3	NR-2018-11526	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,23	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-4	NR-2018-11527	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,34	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-5	NR-2018-11528	<0.3	<0.3	<2	<2	<0.3	<0.3	0,49	<0.3	<0.3	<0.3	<0.3	0,32	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-1	NR-2018-11539	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-2	NR-2018-11540	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-1	NR-2018-11541	<0.3	<0.3	<2	<2	<0.3	<0.3	0,34	<0.3	<0.3	<0.3	1,61	0,44	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-2	NR-2018-11542	<0.3	<0.3	<2	<2	<0.3	<0.3	4,51	<0.3	<0.3	<0.3	1,79	1,04	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-3	NR-2018-11543	<0.3	<0.3	<2	<2	<0.3	<0.3	3,85	<0.3	<0.3	<0.3	1,86	1,31	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-4	NR-2018-11544	<0.3	<0.3	<2	<2	<0.3	<0.3	0,52	<0.3	<0.3	0,68	1,67	0,50	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-5	NR-2018-11545	<0.3	<0.3	<2	<2	<0.3	<0.3	0,97	<0.3	<0.3	0,67	2,82	0,65	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-1	NR-2018-11552	<0.3	<0.3	<2	<2	<0.3	<0.3	0,26	<0.3	<0.3	0,31	0,55	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-2	NR-2018-11553	<0.3	<0.3	<2	<2	<0.3	<0.3	0,37	<0.3	<0.3	0,08	0,18	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-3	NR-2018-11554	<0.3	<0.3	<2	<2	<0.3	<0.3	0,45	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-4	NR-2018-11555	<0.3	<0.3	<2	<2	<0.3	<0.3	0,42	<0.3	<0.3	0,12	0,34	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-1	NR-2018-	<0.3	<0.3	<2	<2	0,13	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,80	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-2	NR-2018-	<0.3	<0.3	<2	<2	0,37	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,88	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-3	NR-2018-	<0.3	<0.3	<2	<2	0,28	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,84	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-4	NR-2018-	<0.3	<0.3	<2	<2	0,35	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2,49	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-5	NR-2018-	<0.3	<0.3	<2	<2	0,36	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2,70	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-6	NR-2018-	<0.3	<0.3	<2	<2	0,39	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,74	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-7	NR-2018-	<0.3	<0.3	<2	<2	0,32	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,79	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-8	NR-2018-	<0.3	<0.3	<2	<2	0,20	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2,90	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-9	NR-2018-	<0.3	<0.3	<2	<2	0,33	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,89	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-10	NR-2018-	<0.3	<0.3	<2	<2	0,82	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	3,15	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-1	NR-2018-11419	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-2	NR-2018-11420	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-3	NR-2018-11421	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH		PFTeS	7:3 FTAC	PFBSA	meFBSA	etFBSA	PFPeSA	meFPeSA	etFPeSA	PFHxSA	meFHxSA	etFHxSA	PFHpSA	meFHpSA	etFHpSA
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SØ-A-6	NR-2018-12556	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-7	NR-2018-12557	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-8	NR-2018-12558	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-9	NR-2018-12559	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-10	NR-2018-12560	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-1	NR-2018-12565	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-2	NR-2018-12566	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-3	NR-2018-12567	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-4	NR-2018-12568	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VI-A-5	NR-2018-12569	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-1	NR-2018-11449	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-2	NR-2018-11450	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-3	NR-2018-11451	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-4	NR-2018-11452	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-5	NR-2018-11453	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-6	NR-2018-11454	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-7	NR-2018-11455	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-8	NR-2018-11456	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-9	NR-2018-11457	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-A-10	NR-2018-11458	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-1	NR-2018-11472	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-2	NR-2018-11473	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-3	NR-2018-11474	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-4	NR-2018-11475	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-G-5	NR-2018-11476	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-1	NR-2018-11493	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-2	NR-2018-11494	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-3	NR-2018-11495	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-4	NR-2018-11496	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-A-5	NR-2018-11497	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-Ø-1	NR-2018-11498	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-R-1	NR-2018-11499	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-1	NR-2018-11524	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-2	NR-2018-11525	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-3	NR-2018-11526	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-4	NR-2018-11527	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-5	NR-2018-11528	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-1	NR-2018-11539	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-G-2	NR-2018-11540	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-1	NR-2018-11541	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-2	NR-2018-11542	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-3	NR-2018-11543	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-4	NR-2018-11544	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-A-5	NR-2018-11545	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-1	NR-2018-11552	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-2	NR-2018-11553	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-3	NR-2018-11554	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
VU-G-4	NR-2018-11555	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-1	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-2	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-3	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-4	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-5	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-6	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-7	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-8	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-9	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-KP-10	NR-2018-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-1	NR-2018-11419	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-2	NR-2018-11420	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-3	NR-2018-11421	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH		PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTrDA	PFTeDA	PFPeDA	PFHxDA	PFBS	PFPeS	PFHxS	PFHpS	PFOS	br-PFOS	PFNS	PFDS	PFDoS	PFOSA
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SF-KP-4	NR-2018-11422	<0,5	<0,5	<0,5	<0,5	<0.4	0,5	1,1	1,5	1,3	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,82		<0,1	<0,1	<0,2	<0.1
SF-KP-5	NR-2018-11423	<0,5	<0,5	<0,5	<0,5	<0.4	0,5	1,5	2,4	3,0	1,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,41		<0,1	<0,1	<0,2	<0.1
SF-KP-6	NR-2018-11424	<0,5	<0,5	<0,5	<0,5	0,4	<0.4	1,4	0,1	1,4	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,46		<0,1	<0,1	<0,2	<0.1
SF-KP-7	NR-2018-11425	<0,5	<0,5	<0,5	<0,5	<0.4	<0.4	1,0	1,6	1,4	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,43		<0,1	<0,1	<0,2	<0.1
SF-KP-8	NR-2018-11426	<0,5	<0,5	<0,5	<0,5	<0.4	<0.4	1,2	1,5	1,5	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,45		<0,1	<0,1	<0,2	<0.1
SF-KP-9	NR-2018-11427	<0,5	<0,5	<0,5	<0,5	0,6	0,4	1,2	1,4	1,5	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,73		<0,1	<0,1	<0,2	<0.1
SF-KP-10	NR-2018-11428	<0,5	<0,5	<0,5	<0,5	<0.4	0,6	2,5	4,1	4,9	1,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,65		<0,1	<0,1	<0,2	<0.1
TYR-Ø-1	NR-2018-14483	<0,5	<0,5	<0,5	<0,5	<0,4	2,0	4,3	8,1	3,7	2,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,96		<0,1	<0,1	<0,2	0,17
TYR-Ø-2	NR-2018-14484	<0,5	<0,5	<0,5	<0,5	<0,4	0,9	1,1	1,4	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,15		<0,1	<0,1	<0,2	0,35
TYR-Ø-3	NR-2018-14485	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	1,5	3,2	1,6	1,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,38		<0,1	<0,1	<0,2	0,18
TYR-Ø-4	NR-2018-14486	<0,5	<0,5	<0,5	<0,5	<0,4	0,8	1,2	2,5	0,9	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,94		<0,1	<0,1	<0,2	0,29
TYR-Ø-5	NR-2018-14487	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,55		<0,1	<0,1	<0,2	<0,1
BR-A-1	NR-2018-14488	<0,5	<0,5	<0,5	<0,5	<0,4	1,3	1,6	2,4	0,9	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	11,3		<0,1	<0,1	<0,2	0,13
BR-A-2	NR-2018-14489	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	1,0	1,6	0,9	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,49		<0,1	<0,1	<0,2	<0,1
SØ-G-1	NR-2018-14490	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	0,6	1,0	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,96		<0,1	<0,1	<0,2	0,42
SØ-G-2	NR-2018-14491	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	0,9	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,11		<0,1	<0,1	<0,2	1,02
SØ-G-3	NR-2018-14492	<0,5	<0,5	<0,5	<0,5	<0,4	0,6	0,8	1,2	<0,4	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,06		<0,1	<0,1	<0,2	0,56
NF-A-6	NR-2018-11529	<0,5	<0,5	<0,5	<0,5	<0,4	0,6	0,8	1,1	0,5	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,33		<0,1	<0,1	<0,2	0,11
NF-A-7	NR-2018-11530	<0,5	<0,5	<0,5	<0,5	<0,4	4,4	4,3	5,5	1,8	1,1	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	29,4		<0,1	<0,1	<0,2	1,07
NF-A-8	NR-2018-11531	<0,5	<0,5	<0,5	<0,5	<0,4	0,5	0,9	1,5	0,7	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	25,6		<0,1	<0,1	<0,2	0,73
NF-A-9	NR-2018-11532	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	0,6	0,9	0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,68		<0,1	<0,1	<0,2	0,91
NF-A-10	NR-2018-11533	<0,5	<0,5	<0,5	<0,5	<0,4	1,0	1,1	2,1	0,9	0,6	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,4		<0,1	<0,1	<0,2	0,32

FISH		me-PFOSA	et-PFOSA	me-PFOSE	et-PFOSE	FOSAA	me-FOSAA	et-FOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	14:2 FTS	8Cl-PFOS	4:2 F53B	8:2 F53B	PFUdS	PFTrS
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SF-KP-4	NR-2018-11422	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-5	NR-2018-11423	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-6	NR-2018-11424	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-7	NR-2018-11425	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-8	NR-2018-11426	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-9	NR-2018-11427	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-10	NR-2018-11428	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-1	NR-2018-14483	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,93	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-2	NR-2018-14484	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-3	NR-2018-14485	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-4	NR-2018-14486	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-5	NR-2018-14487	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-1	NR-2018-14488	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,37	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-2	NR-2018-14489	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,83	5,76	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-1	NR-2018-14490	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,56	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-2	NR-2018-14491	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-3	NR-2018-14492	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0,74	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-6	NR-2018-11529	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,37	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-7	NR-2018-11530	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2,82	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-8	NR-2018-11531	<0.3	<0.3	<2	<2	<0.3	<0.3	0,68	<0.3	<0.3	<0.3	<0.3	1,61	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-9	NR-2018-11532	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1,46	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-10	NR-2018-11533	<0.3	<0.3	<2	<2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	2,73	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

FISH		PFTeS	7:3 FTAC	PFBSA	meFBSA	etFBSA	PFPeSA	meFPeSA	etFPeSA	PFHxSA	meFHxSA	etFHxSA	PFHpSA	meFHpSA	etFHpSA
MUSCLE	NIVA no.	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
SF-KP-4	NR-2018-11422	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-5	NR-2018-11423	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-6	NR-2018-11424	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-7	NR-2018-11425	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-8	NR-2018-11426	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-9	NR-2018-11427	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SF-KP-10	NR-2018-11428	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-1	NR-2018-14483	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-2	NR-2018-14484	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-3	NR-2018-14485	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-4	NR-2018-14486	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TYR-Ø-5	NR-2018-14487	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-1	NR-2018-14488	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
BR-A-2	NR-2018-14489	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-1	NR-2018-14490	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-2	NR-2018-14491	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
SØ-G-3	NR-2018-14492	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-6	NR-2018-11529	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-7	NR-2018-11530	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-8	NR-2018-11531	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-9	NR-2018-11532	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
NF-A-10	NR-2018-11533	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

WATER	NIVA nr	PFPA ng/L	PFHxA ng/L	*PFHpA* ng/L	PFOA ng/L	PFNA ng/L	PFDA ng/L	PFUdA ng/L	PFDoDA ng/L	PFTrDA ng/L	PFTeDA ng/L	PFPeDA ng/L	PFHxDA ng/L	PFBS ng/L	PFPeS ng/L	PFHxS ng/L	PFHpS ng/L	PFOS ng/L	brPFOS ng/L	PFNS ng/L	PFDS ng/L	PFDoS ng/L	PFOSA ng/L
KS-Br-water1	NR-2018-14447	5934	16059	3854	4513	205	11,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	962	926	3175	930	6775	4064	38,5	3,7	<0,2	104
KS-Br-water2	NR-2018-14448	2464	3724	565	2007	105	13,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	441	464	2448	815	707	3643	131	17,2	<0,2	204
KS-Ha-upstream	NR-2018-14449	1,4	2,8	5,1	7,5	0,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,7	0,4	1,7	0,2	2,2	3,3	<0,1	<0,1	<0,2	<0,1
KS-Ha-downstream	NR-2018-14450	41,0	40,8	99,0	472,7	34,2	7,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	5,6	2,7	12,1	4,9	214	119	<0,1	<0,1	<0,2	107
KS-NP-basement	NR-2018-14451	8,3	10,4	19,3	93,8	3,0	5,2	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,2	<0,1	0,5	0,8	131	29	<0,1	<0,1	<0,2	181
KS-NP-effluent	NR-2018-14453	3,7	7,8	16,6	83,5	2,6	2,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,2	<0,1	0,6	1,0	153	36	<0,1	<0,1	<0,2	82,1
KS-NP-river	NR-2018-14452	1,0	2,3	5,2	7,2	0,8	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,6	1,4	<0,1	<0,1	<0,2	3,8
KS-VD-creek1	NR-2018-13914	8,0	8,9	15,0	17,1	1,7	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,7	<0,1	0,5	<0,1	1,4	1,3	<0,1	<0,1	<0,2	<0,1
KS-VD-creek2	NR-2018-13915	3,3	5,5	11,1	14,6	1,1	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,2	<0,1	0,1	<0,1	2,0	0,9	<0,1	<0,1	<0,2	<0,1
KS-VD-creek3	NR-2018-13916	2,6	4,1	9,6	9,8	1,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,2	<0,1	<0,1	<0,1	1,0	0,2	<0,1	<0,1	<0,2	<0,1
KS-SB-manhole	NR-2018-13917	2,4	5,2	11,2	14,2	1,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,1	<0,1	<0,1	<0,1	0,5	0,4	<0,1	<0,1	<0,2	<0,1
KS-SB-creek	NR-2018-13918	2,2	3,8	10,0	11,3	0,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,7	0,3	<0,1	<0,1	<0,2	<0,1
KS-HVA-outlet	NR-2018-13919	1,9	3,8	7,9	11,1	0,9	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,5	<0,1	0,5	0,1	2,4	1,8	<0,1	<0,1	<0,2	<0,1
KS-SCH1	NR-2018-13920	2,8	6,3	14,5	14,4	1,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
KS-SCH2	NR-2018-13921	1,0	2,2	5,1	6,7	0,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
KS-SCH3	NR-2018-13922	0,6	1,7	4,0	5,1	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Viul 1	NR-2018-14446	0,5	1,3	3,2	3,5	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1
Hol A	NR-2018-11303	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,15	0,08	<0,1	<0,1	<0,2	<0,1
Hol B	NR-2018-11304	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,15	0,07	<0,1	<0,1	<0,2	<0,1
Hol C	NR-2018-11305	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,14	0,07	<0,1	<0,1	<0,2	<0,1
Stein A	NR-2018-11306	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,19	0,12	<0,1	<0,1	<0,2	<0,1
Stein B	NR-2018-11307	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,18	0,09	<0,1	<0,1	<0,2	<0,1
Stein C	NR-2018-11308	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,16	0,10	<0,1	<0,1	<0,2	<0,1
PORE WATER																							
Hol A pore water		62,0	121	350	363	63,3	23,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	1,5	<0,1	3,3	2,5	376	77,8	<0,1	<0,1	<0,2	0,7
Hol B pore water		32,6	58,9	185	194	34,6	9,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,7	<0,1	4,8	6,1	491	84,5	<0,1	<0,1	<0,2	<0,1
Hol C pore water		35,6	76,3	247	230	35,4	11,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,9	<0,1	3,2	2,8	310	94,4	<0,1	<0,1	<0,2	<0,1
Vik A pore water		31,1	38,0	78,6	203	23,9	15,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	2,8	<0,1	0,3	0,1	44,7	7,5	<0,1	<0,1	<0,2	<0,1
Vik B pore water		56,3	64,9	110	257	28,1	20,3	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	1,5	<0,1	0,1	0,1	72,8	6,2	<0,1	<0,1	<0,2	<0,1
Vik C pore water		92,6	92,4	126	437	46,3	31,3	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	1,7	<0,1	0,4	<0,1	77,4	6,7	<0,1	<0,1	<0,2	3,4
Brann 3 pore water		7,0	11,1	23,0	43,8	3,7	1,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,4	<0,1	0,2	<0,1	5,3	2,1	<0,1	<0,1	<0,2	0,2
Brann 4 pore water		12,9	24,3	45,5	62,9	4,6	2,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,2	<0,1	<0,1	<0,1	7,5	2,7	<0,1	<0,1	<0,2	<0,1
KS-SCN-1 pore water		3,9	7,0	17,2	24,9	2,1	1,3	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,9	1,4	<0,1	<0,1	<0,2	<0,1
Stor A pore water		10,9	27,1	68,8	101	7,1	1,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,4	<0,1	0,9	0,7	115	21,5	<0,1	<0,1	<0,2	<0,1
Stor B pore water		21,8	43,4	93,7	122	10,5	4,2	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,5	<0,1	1,4	1,0	117	24,9	<0,1	<0,1	<0,2	<0,1
Stor C pore water		10,1	25,8	79,3	144	13,0	2,7	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,5	<0,1	1,5	1,3	175	28,2	<0,1	<0,1	<0,2	<0,1
Nord A pore water		112	129	317	1181	16,9	26,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,1	<0,1	3,2	0,5	42.1	8,8	<0,1	<0,1	<0,2	4,2
Nord B pore water		112	163	396	1310	19,5	31,9	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	0,7	<0,1	13,7	1,4	80,0	15,8	<0,1	<0,1	<0,2	5,4

WATER	NIVA nr	me-PFOSA ng/L	et-PFOSA ng/L	me-PFOSE ng/L	et-PFOSE ng/L	FOSAA ng/L	me-FOSAA ng/L	et-FOSAA ng/L	4:2 FTS ng/L	6:2 FTS ng/L	8:2 FTS ng/L	10:2 FTS ng/L	12:2 FTS* ng/L	14:2 FTS* ng/L	8Cl-PFOS ng/L	4:2 F53B ng/L	8:2 F53B ng/L	PFUdS ng/L	PFTrS ng/L
KS-Br-water1	NR-2018-14447	<0,3	<0,3	<5	<5	2,5	<0,3	1,1	<0,3	150	1,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-water2	NR-2018-14448	<0,3	<0,3	<5	<5	5,6	<0,3	<0,3	<0,3	148	5,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-upstream	NR-2018-14449	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-downstream	NR-2018-14450	<0,3	15,4	<5	<5	66,8	<0,3	343	<0,3	1,1	4,2	3,8	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-basement	NR-2018-14451	<0,3	20,7	<5	63,5	22,8	<0,3	236	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-effluent	NR-2018-14453	<0,3	5,9	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-river	NR-2018-14452	<0,3	<0,3	<5	<5	0,7	<0,3	9,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek1	NR-2018-13914	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek2	NR-2018-13915	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek3	NR-2018-13916	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-manhole	NR-2018-13917	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-creek	NR-2018-13918	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-outlet	NR-2018-13919	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH1	NR-2018-13920	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH2	NR-2018-13921	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH3	NR-2018-13922	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 1	NR-2018-14446	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol A	NR-2018-11303	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B	NR-2018-11304	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C	NR-2018-11305	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein A	NR-2018-11306	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein B	NR-2018-11307	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein C	NR-2018-11308	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
PORE WATER																			
Hol A pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	5,3	1,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik A pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik B pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik C pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3 pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 4 pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCN-1 pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor A pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor B pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor C pore water		<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord A pore water		<0,3	<0,3	<5	<5	18,8	<0,3	49,2	<0,3	<0,3	15,2	5,7	4,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord B pore water		<0,3	<0,3	<5	<5	8,4	<0,3	46,4	<0,3	<0,3	17,9	11,2	5,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

WATER	NIVA nr	PFTeS ng/L	7:3 FTAC ng/L	PFBSA ng/L	meFBSA ng/L	etFBSA ng/L	PFPeSA ng/L	meFPeSA ng/L	etFPeSA ng/L	PFHxSA ng/L	meFHxSA ng/L	etFHxSA ng/L	PFHpSA ng/L	meFHpSA ng/L	etFHpSA ng/L
KS-Br-water1	NR-2018-14447	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Br-water2	NR-2018-14448	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-upstream	NR-2018-14449	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-Ha-downstream	NR-2018-14450	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-basement	NR-2018-14451	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-effluent	NR-2018-14453	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-NP-river	NR-2018-14452	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek1	NR-2018-13914	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek2	NR-2018-13915	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-VD-creek3	NR-2018-13916	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-manhole	NR-2018-13917	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SB-creek	NR-2018-13918	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-HVA-outlet	NR-2018-13919	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH1	NR-2018-13920	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH2	NR-2018-13921	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCH3	NR-2018-13922	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Viul 1	NR-2018-14446	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol A	NR-2018-11303	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B	NR-2018-11304	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C	NR-2018-11305	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein A	NR-2018-11306	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein B	NR-2018-11307	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein C	NR-2018-11308	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
PORE WATER															
Hol A pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik A pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik B pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik C pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3 pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 4 pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
KS-SCN-1 pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor A pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor B pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor C pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord A pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord B pore water		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

Pore water	PFPA	PFHxA	*PFHpA*	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTrDA	PFTeDA	PFPeDA	PFHxDA	PFBS	PFPeS	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFDoS
SEDIMENTS	ng/g	ng/g	*ng/g*	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Vik A	<0,5	<0,5	0,9	1,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,3	<0,1	<0,1	<0,2
Vik B	<0,5	<0,5	<0,5	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,3	<0,1	<0,1	<0,2
Vik C	<0,5	<0,5	<0,5	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,2	<0,1	<0,1	<0,2
Stor A	<0,5	1,2	2,8	4,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,4	<0,1	<0,1	<0,2
Stor B	<0,5	0,8	1,6	2,8	0,5	0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	7,4	<0,1	<0,1	<0,2
Stor C	<0,5	<0,5	1,0	2,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	6,0	<0,1	<0,1	<0,2
Hol A	<0,5	2,3	5,1	5,8	0,9	0,9	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	9,6	<0,1	<0,1	<0,2
Hol B	<0,5	<0,5	1,2	1,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	4,0	<0,1	<0,1	<0,2
Hol C	<0,5	0,5	1,1	1,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,4	<0,1	<0,1	<0,2
Nord A	<0,5	1,1	3,0	14,2	1,0	4,8	0,8	1,2	<0,4	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,9	<0,1	<0,1	<0,2
Stein A	<0,5	1,2	2,7	4,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,4	<0,1	<0,1	<0,2
Brann 3	<0,5	<0,5	0,7	0,9	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,2

Pore water	PFOSA	me-PFOSA	et-PFOSA	me-PFOSE	et-PFOSE	FOSAA	me-FOSAA	et-FOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS*	14:2 FTS*	8Cl-PFOS	4:2 F53B	8:2 F53B	PFUdS	PFTrS	PFTeS
SEDIMENTS	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Vik A	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik B	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik C	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor A	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor B	0,5	<0,3	<0,3	<2,0	5,8	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	1,2	2,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor C	0,2	<0,3	<0,3	<2,0	2,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	0,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol A	0,8	<0,3	<0,3	<2,0	3,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	3,0	2,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B	0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,6	0,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C	0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,8	0,6	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord A	1,2	<0,3	<0,3	<2,0	18,3	6,3	<0,3	166	<0,3	<0,3	3,9	19,2	31,9	2,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein A	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3	<0,1	<0,3	<0,3	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

Pore water	7:3 FTAC	PFBSA	meFBSA	etFBSA	PFPeSA	meFPeSA	etFPeSA	PFHxSA	meFHxSA	etFHxSA	PFHpSA	meFHpSA	etFHpSA
SEDIMENTS	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Vik A	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik B	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Vik C	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor A	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor B	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stor C	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol A	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol B	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Hol C	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Nord A	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Stein A	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Brann 3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

Sediment core	NIVA no.	PFPA ng/g	PFHxA ng/g	*PFHpA ng/g*	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	PFNS ng/g	PFDS ng/g	PFDoS ng/g	PFOSA ng/g	me-PFOSA ng/g
NORDKJ 1	NR-2018-14431	<0,5	3,16	15,9	13,4	2,0	0,9	0,6	0,7	0,6	0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,41	<0,1	<0,1	<0,2	<0,1	<0,3
NORDKJ 2	NR-2018-14432	<0,5	3,18	19,9	28,5	1,4	2,1	1,0	1,6	0,5	0,7	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,55	<0,1	<0,1	<0,2	<0,1	<0,3
NORDKJ 3	NR-2018-14433	<0,5	0,75	4,6	5,0	0,9	1,9	0,9	2,4	0,4	1,3	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,52	<0,1	<0,1	<0,2	0,85	<0,3
NORDKJ 4	NR-2018-14434	<0,5	<0,5	3,0	2,2	<0,4	0,7	<0,4	0,7	<0,4	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,2	<0,1	<0,1	<0,2	1,5	<0,3
NORDKJ 5	NR-2018-14435	<0,5	<0,5	2,6	2,9	0,4	0,6	1,1	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,6	<0,1	<0,1	<0,2	1,4	<0,3
NORDKJ 6	NR-2018-14436	<0,5	<0,5	2,0	<0,5	0,5	0,5	1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,0	<0,1	<0,1	<0,2	1,6	<0,3
NORDKJ 7	NR-2018-14437	<0,5	<0,5	2,0	<0,5	<0,4	<0,4	1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,8	<0,1	<0,1	<0,2	1,5	<0,3
NORDKJ 8	NR-2018-14438	<0,5	<0,5	1,9	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,8	<0,1	<0,1	<0,2	1,1	<0,3
NORDKJ 9	NR-2018-14439	<0,5	<0,5	1,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,9	<0,1	<0,1	<0,2	0,67	<0,3
NORDKJ 10	NR-2018-14440	<0,5	<0,5	1,3	<0,5	<0,4	<0,4	0,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,3	<0,1	<0,1	<0,2	0,65	<0,3
NORDKJ 11	NR-2018-14441	<0,5	1,24	7,8	6,2	0,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	3,5	<0,1	<0,1	<0,2	1,6	<0,3
NORDKJ 12	NR-2018-14442	<0,5	0,78	4,2	2,2	0,6	<0,4	0,6	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,4	<0,1	<0,1	<0,2	0,48	<0,3
NORDKJ 13	NR-2018-14443	<0,5	<0,5	2,3	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,93	<0,1	<0,1	<0,2	0,30	<0,3
NORDKJ 14	NR-2018-14444	<0,5	<0,5	2,1	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,66	<0,1	<0,1	<0,2	<0,1	<0,3
NORDKJ 15	NR-2018-14445	<0,5	<0,5	2,0	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,25	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 1		4	3,9	16,3	17,5	3,7	5,0	2,7	2,5	0,8	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	17,7	<0,1	<0,1	<0,2	3,2	<0,3
HOLKJ 2		1,1	1,4	5,1	1,5	1,4	1,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	13,2	<0,1	<0,1	<0,2	0,18	<0,3
HOLKJ 3		<0,5	<0,5	3,2	<0,5	0,8	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	10,8	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 4		<0,5	<0,5	1,4	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	5,7	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 5		<0,5	<0,5	0,9	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,97	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 6		<0,5	<0,5	1,0	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,11	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 7		<0,5	<0,5	1,3	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,12	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 8		<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1	<0,3
HOLKJ 9		<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,2	<0,1	<0,3

Sediment core	NIVA no.	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS* ng/g	14:2 FTS* ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g	PFUdS ng/g	PFTrS ng/g	PFTeS ng/g	7:3 FTAC ng/g
NORDKJ 1	NR-2018-14431	<0,3	<5	<5	1,5	<0,3	2,6	<0,3	<0,3	11,1	9,1	8,7	1,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 2	NR-2018-14432	<0,3	<5	<5	2,8	<0,3	7,8	<0,3	1,7	51,7	48,8	38,3	6,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 3	NR-2018-14433	<0,3	<5	10,3	3,4	0,4	50,2	<0,3	4,2	266	244	197	30,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 4	NR-2018-14434	1,0	<5	46,1	4,0	0,8	143	<0,3	0,9	27,6	36,6	18,4	3,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 5	NR-2018-14435	1,1	<5	42,6	4,0	1,0	178	<0,3	0,9	3,5	5,0	3,8	0,8	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 6	NR-2018-14436	1,5	<5	50,5	3,4	1,0	235	<0,3	1,0	10,6	16,3	8,6	1,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 7	NR-2018-14437	1,8	<5	60,6	2,7	1,3	278	<0,3	<0,3	2,4	2,0	1,7	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 8	NR-2018-14438	1,4	<5	45,8	2,1	1,8	185	<0,3	<0,3	1,9	1,5	1,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 9	NR-2018-14439	1,0	<5	36,7	6,2	1,3	140	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 10	NR-2018-14440	0,70	<5	25,1	3,1	0,6	91,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 11	NR-2018-14441	1,1	<5	30,6	1,4	0,7	205	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 12	NR-2018-14442	0,40	<5	13,6	0,7	0,1	105	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 13	NR-2018-14443	<0,3	<5	9,6	<0,3	<0,3	40,9	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 14	NR-2018-14444	<0,3	<5	<5	<0,3	<0,3	9,5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NORDKJ 15	NR-2018-14445	<0,3	<5	<5	<0,3	<0,3	2,2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 1		<0,3	<5	6,6	<0,3	<0,3	<0,3	<0,3	<0,3	2,5	8,5	17,9	1,4	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 2		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	0,5	<0,3	1,1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 3		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 4		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 5		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 6		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 7		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 8		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 9		<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

Sediment core	NIVA no.	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g	SAmPAPdi** ng/g
NORDKJ 1	NR-2018-14431	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	1,2
NORDKJ 2	NR-2018-14432	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	1,4
NORDKJ 3	NR-2018-14433	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	12,3
NORDKJ 4	NR-2018-14434	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	57,9
NORDKJ 5	NR-2018-14435	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	56
NORDKJ 6	NR-2018-14436	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	148
NORDKJ 7	NR-2018-14437	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	199
NORDKJ 8	NR-2018-14438	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	181
NORDKJ 9	NR-2018-14439	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	126
NORDKJ 10	NR-2018-14440	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	47,6
NORDKJ 11	NR-2018-14441	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	125
NORDKJ 12	NR-2018-14442	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	84,1
NORDKJ 13	NR-2018-14443	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	8,1
NORDKJ 14	NR-2018-14444	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	3,3
NORDKJ 15	NR-2018-14445	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 1		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	3,1
HOLKJ 2		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 3		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 4		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 5		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 6		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 7		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 8		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
HOLKJ 9		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

	PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTrDA	PFTeDA	PFPeDA	PFHxDA	PFBS	PFPeS	PFHxS	PFHpS	PFOS	br-PFOS	PFNS	PFDS	PFDoS
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Benthic org.	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,13	<0,1	<0,1	<0,1	<0,2
Zooplankton 1	2,9	5,5	12,3	13,5	3,15	15,2	26,9	47,4	16,3	15,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	20,1	<0,1	<0,1	<0,1	<0,2
Zooplankton 2	7,3	11,6	27	27,7	5,12	11,1	18,5	32,8	11,9	11,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	14,9	<0,1	<0,1	<0,1	<0,2

	PFOSA	me-PFOSA	et-PFOSA	me-PFOSE	et-PFOSE	FOSAA	me-FOSAA	et-FOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	14:2 FTS	8Cl-PFOS	4:2 F53B
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Benthic org.	<0,1	<0,3	<0,3	<2	<2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Zooplankton 1	1,8	<0,3	<0,3	<2	<2	3,6	<0,3	1,4	<0,3	<0,3	<0,3	0,3	5,4	0,9	<0,3	<0,3
Zooplankton 2	1,2	<0,3	<0,3	<2	<2	2,2	<0,3	0,8	<0,3	0,5	<0,3	<0,3	6,1	1,0	<0,3	<0,3

	8:2 F53B	PFUdS	PFTrS	PFTeS	7:3 FTAC	PFBSA	meFBSA	etFBSA	PFPeSA	meFPeSA	etFPeSA	PFHxSA	meFHxSA	etFHxSA	PFHpSA	meFHpSA	etFHpSA
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Benthic org.	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Zooplankton 1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
Zooplankton 2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

tot-F target	PFPA ng/g	PFHxA ng/g	PFHpA ng/g	PFOA ng/g	PFNA ng/g	PFDA ng/g	PFUdA ng/g	PFDoDA ng/g	PFTrDA ng/g	PFTeDA ng/g	PFPeDA ng/g	PFHxDA ng/g	PFBS ng/g	PFPeS ng/g	PFHxS ng/g	PFHpS ng/g	PFOS ng/g	br-PFOS ng/g	PFNS ng/g	PFDS ng/g
sed SØ	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,0	<0,1	<0,1	<0,1
sed V	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
sed HOL	<0,5	<0,5	<0,5	1,0	0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	2,5	<0,1	<0,1	<0,1
sed NF	<0,5	<0,5	<0,5	3,0	<0,4	0,9	0,5	0,6	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	1,1	<0,1	<0,1	<0,1
sed SF	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	0,1	<0,1	<0,1	<0,1
sed VU	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
sed BR	<0,5	<0,5	<0,5	<0,5	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
NF-A1	<0,5	<0,5	<0,5	<0,5	<0,4	4,8	7,3	9,8	5,1	3,8	0,5	<0,4	<0,1	<0,1	<0,1	<0,1	144	3,8	<0,1	0,1
NF-G2	<0,5	<0,5	<0,5	<0,5	0,6	4,5	7,8	12,1	4,2	3,2	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	50,4	0,4	<0,1	0,1
SØ-A1	<0,5	<0,5	<0,5	<0,5	1,7	64,9	119	82,9	54,4	49,1	1,0	<0,4	<0,1	<0,1	<0,1	<0,1	344	2,7	<0,1	1,1
SØ-Ø1	<0,5	<0,5	<0,5	<0,5	1,2	15,1	31,1	42,7	15,0	11,3	1,0	<0,4	<0,1	<0,1	<0,1	<0,1	57,7	0,5	<0,1	0,4
SØ-R1	<0,5	<0,5	<0,5	<0,5	0,8	9,4	18,2	25,5	8,8	4,2	0,4	<0,4	<0,1	<0,1	<0,1	<0,1	39,4	0,3	<0,1	0,2
SF-A1	<0,5	<0,5	<0,5	<0,5	1,2	9,7	5,4	2,9	1,9	0,8	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	119	0,7	<0,1	<0,1
SF-G1	<0,5	<0,5	<0,5	<0,5	<0,4	2,5	2,0	1,7	1,0	0,5	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	37,2	0,2	<0,1	<0,1
VU-A1	<0,5	<0,5	<0,5	<0,5	<0,4	9,3	9,0	40,0	8,3	22,0	0,9	<0,4	<0,1	<0,1	<0,1	<0,1	253	19,2	<0,1	0,1
VU-G1	<0,5	<0,5	<0,5	<0,5	<0,4	2,2	1,8	3,3	1,4	1,9	<0,4	<0,4	<0,1	<0,1	<0,1	<0,1	34,5	0,8	<0,1	<0,1

	PFDoS ng/g	PFOSA ng/g	me-PFOSA ng/g	et-PFOSA ng/g	me-PFOSE ng/g	et-PFOSE ng/g	FOSAA ng/g	me-FOSAA ng/g	et-FOSAA ng/g	4:2 FTS ng/g	6:2 FTS ng/g	8:2 FTS ng/g	10:2 FTS ng/g	12:2 FTS ng/g	14:2 FTS ng/g	8Cl-PFOS ng/g	4:2 F53B ng/g	8:2 F53B ng/g
sed SØ	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed V	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed HOL	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,5	0,4	<0,3	<0,3	<0,3	<0,3
sed NF	<0,2	0,5	<0,1	<0,1	<2,0	16,9	1,1	<0,3	56,4	<0,3	<0,3	1,5	12,1	9,3	3,3	<0,3	<0,3	<0,3
sed SF	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	<0,3	<0,3	<0,3	<0,3
sed VU	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,3	<0,3	<0,3	<0,3	<0,3
sed BR	<0,2	<0,1	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A1	<0,2	0,7	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	1,7	<0,3	<0,3	0,4	1,0	2,6	<0,3	<0,3	<0,3	<0,3
NF-G2	<0,2	3,9	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A1	<0,2	6,3	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	0,7	<0,3	<0,3	<0,3	0,9	3,1	<0,3	<0,3	<0,3	<0,3
SØ-Ø1	<0,2	3,7	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,9	<0,3	<0,3	<0,3	<0,3
SØ-R1	<0,2	2,4	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	0,4	<0,3	<0,3	<0,3	<0,3
SF-A1	<0,2	0,3	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G1	<0,2	0,5	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A1	<0,2	67,7	<0,1	<0,1	<2,0	<2,0	<0,3	<0,3	33,7	<0,3	<0,3	1,1	9,2	7,1	0,3	<0,3	<0,3	<0,3
VU-G1	<0,2	33,0	<0,1	0,7	<2,0	<2,0	<0,3	<0,3	2,9	<0,3	<0,3	0,3	1,7	1,0	0,0	<0,3	<0,3	<0,3

	PFUdS ng/g	PFTrS ng/g	PFTeS ng/g	7:3 FTAC ng/g	PFBSA ng/g	meFBSA ng/g	etFBSA ng/g	PFPeSA ng/g	meFPeSA ng/g	etFPeSA ng/g	PFHxSA ng/g	meFHxSA ng/g	etFHxSA ng/g	PFHpSA ng/g	meFHpSA ng/g	etFHpSA ng/g
sed SØ	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed V	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed HOL	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed NF	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed SF	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed VU	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
sed BR	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-A1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
NF-G2	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-A1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-Ø1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SØ-R1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-A1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
SF-G1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-A1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
VU-G1	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

	PFPA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUdA	PFDoDA	PFTrDA	PFTeDA	PFPeDA	PFHxDA	PFBS	PFPeS	PFHxS	PFHpS	PFOS
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Paper plate	255	3713	742	7156	349	4285	139	1255	57,4	659	5,6	179	<0,1	<0,1	<0,1	<0,1	<0,1

	PFNS	PFDS	PFDoS	PFOSA	me-PFOSA	et-PFOSA	me-PFOSE	et-PFOSE	FOSAA	me-FOSAA	et-FOSAA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	12:2 FTS	14:2 FTS	8Cl-PFOS
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Paper plate	<0,1	<0,1	<0,1	<0,1	<0,3	<0,3	<5	<5	<0,3	<0,3	<0,3	<0,3	70,8	1091	399	81,1	10,1	<0,3

	4:2 F53B	8:2 F53B	PFUdS	PFTrS	PFTeS	7:3 FTAC	PFBSA	meFBSA	etFBSA	PFPeSA	meFPeSA	etFPeSA	PFHxSA	meFHxSA	etFHxSA	PFHpSA	meFHpSA	etFHpSA
	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g	ng/g
Paper plate	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3

Appendix I

LAB-REPORT, TOC AND GRAIN SIZE DISTRIBUTION

Rapport

N1902349

1E1WST43F1E

Mottatt dato **2019-02-13**
Utstedt **2019-02-22**

NGI
Arne Pettersen
Miljøgeologi
Box 3930 Ullevål Stadion
N-0806 Oslo
Norway

Prosjekt **PFAS i Tyrifjorden 2018**
Bestnr **20180256**

Analyse av sediment

Deres prøvenavn **PFAS_STEIN 1**
Sediment/slam

Labnummer N00639411

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling [a ulev]	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm [a ulev]	**25.4**	2.5	%	1	1	SAHM
Kornstørrelse 63-2 µm [a ulev]	**67.5**	6.8	%	1	1	SAHM
Kornstørrelse <2 µm [a ulev]	**7.0**	0.7	%	1	1	SAHM
Tørrstoff (E) [a ulev]	**44.2**	2.68	%	2	1	SAHM
TOC [a ulev]	**1.50**	0.31	% TS	2	1	SAHM

Deres prøvenavn **PFAS_STEIN 2**
Sediment/slam

Labnummer N00639412

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling [a ulev]	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm [a ulev]	**59.1**	5.9	%	1	1	SAHM
Kornstørrelse 63-2 µm [a ulev]	**40.7**	4.1	%	1	1	SAHM
Kornstørrelse <2 µm [a ulev]	**0.2**	0.02	%	1	1	SAHM
Tørrstoff (E) [a ulev]	**35.6**	2.16	%	2	1	SAHM
TOC [a ulev]	**2.77**	0.56	% TS	2	1	SAHM

Deres prøvenavn **PFAS_STEIN 3**
Sediment/slam

Labnummer N00639413

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling [a ulev]	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm [a ulev]	**21.1**	2.1	%	1	1	SAHM
Kornstørrelse 63-2 µm [a ulev]	**78.5**	7.8	%	1	1	SAHM
Kornstørrelse <2 µm [a ulev]	**0.4**	0.04	%	1	1	SAHM
Tørrstoff (E) [a ulev]	**22.9**	1.40	%	2	1	SAHM
TOC [a ulev]	**3.62**	0.73	% TS	2	1	SAHM

Deres prøvenavn	**PFAS_HOL 1**
	Sediment/slam
Labnummer	N00639414

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**22.4**	2.2	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**76.6**	7.7	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**1.0**	0.10	%	1	1	SAHM
Tørrstoff (E) a ulev	**19.7**	1.21	%	2	1	SAHM
TOC a ulev	**3.87**	0.78	% TS	2	1	SAHM

Deres prøvenavn	**PFAS_HOL 2**
	Sediment/slam
Labnummer	N00639415

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**8.4**	0.8	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**75.4**	7.5	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**16.1**	1.6	%	1	1	SAHM
Tørrstoff (E) a ulev	**58.6**	3.54	%	2	1	SAHM
TOC a ulev	**0.43**	0.11	% TS	2	1	SAHM

Deres prøvenavn	**PFAS_HOL 3**
	Sediment/slam
Labnummer	N00639416

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**4.4**	0.4	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**77.0**	7.7	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**18.5**	1.8	%	1	1	SAHM
Tørrstoff (E) a ulev	**61.5**	3.72	%	2	1	SAHM
TOC a ulev	**0.42**	0.11	% TS	2	1	SAHM

Deres prøvenavn	**Storø 1**
	Sediment/slam
Labnummer	N00639417

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**84.5**	8.4	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**15.4**	1.5	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**56.2**	3.40	%	2	1	SAHM
TOC a ulev	**1.01**	0.21	% TS	2	1	SAHM

Deres prøvenavn	**Storø 2** **Sediment/slam**
Labnummer	N00639418

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**20.1**	2.0	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**79.2**	7.9	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.6**	0.06	%	1	1	SAHM
Tørrstoff (E) a ulev	**13.9**	0.86	%	2	1	SAHM
TOC a ulev	**3.67**	0.74	% TS	2	1	SAHM

Deres prøvenavn	**Storø 3** **Sediment/slam**
Labnummer	N00639419

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**75.8**	7.6	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**24.1**	2.4	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**44.4**	2.70	%	2	1	SAHM
TOC a ulev	**1.38**	0.28	% TS	2	1	SAHM

Deres prøvenavn	**Nord 1** **Sediment/slam**
Labnummer	N00639420

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**47.6**	4.8	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**52.0**	5.2	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.3**	0.03	%	1	1	SAHM
Tørrstoff (E) a ulev	**28.3**	1.73	%	2	1	SAHM
TOC a ulev	**4.50**	0.90	% TS	2	1	SAHM

Deres prøvenavn	**Nord 2** **Sediment/slam**
Labnummer	N00639421

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**35.1**	3.5	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**64.3**	6.4	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.5**	0.05	%	1	1	SAHM
Tørrstoff (E) a ulev	**22.9**	1.41	%	2	1	SAHM
TOC a ulev	**6.28**	1.26	% TS	2	1	SAHM

Deres prøvenavn	**Nord 3** **Sediment/slam**
Labnummer	N00639422

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**19.8**	2.0	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**79.5**	8.0	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.7**	0.07	%	1	1	SAHM
Tørrstoff (E) a ulev	**21.8**	1.34	%	2	1	SAHM
TOC a ulev	**5.08**	1.02	% TS	2	1	SAHM

Deres prøvenavn	**Storf 1** **Sediment/slam**
Labnummer	N00639423

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**14.9**	1.5	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**84.3**	8.4	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.8**	0.08	%	1	1	SAHM
Tørrstoff (E) a ulev	**19.4**	1.19	%	2	1	SAHM
TOC a ulev	**5.02**	1.00	% TS	2	1	SAHM

Deres prøvenavn	**Storf 2** **Sediment/slam**
Labnummer	N00639424

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**7.5**	0.7	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**91.9**	9.2	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.6**	0.06	%	1	1	SAHM
Tørrstoff (E) a ulev	**16.7**	1.03	%	2	1	SAHM
TOC a ulev	**4.93**	0.99	% TS	2	1	SAHM

Deres prøvenavn	**Storf 3** **Sediment/slam**
Labnummer	N00639425

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**7.4**	0.7	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**91.4**	9.1	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**1.2**	0.1	%	1	1	SAHM
Tørrstoff (E) a ulev	**18.5**	1.14	%	2	1	SAHM
TOC a ulev	**4.86**	0.97	% TS	2	1	SAHM

Deres prøvenavn	**Vik 1** **Sediment/slam**
Labnummer	N00639426

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**96.9**	9.7	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**3.0**	0.3	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**70.4**	4.26	%	2	1	SAHM
TOC a ulev	**0.26**	0.08	% TS	2	1	SAHM

Deres prøvenavn	**Vik 2** **Sediment/slam**
Labnummer	N00639427

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**92.0**	9.2	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**8.0**	0.8	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**65.3**	3.95	%	2	1	SAHM
TOC a ulev	**0.53**	0.12	% TS	2	1	SAHM

Deres prøvenavn	**Vik 3** **Sediment/slam**
Labnummer	N00639428

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**86.1**	8.6	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**13.8**	1.4	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**61.2**	3.70	%	2	1	SAHM
TOC a ulev	**0.89**	0.19	% TS	2	1	SAHM

Deres prøvenavn	**Viul 1** **Sediment/slam**
Labnummer	N00639429

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**92.7**	9.3	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**7.3**	0.7	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**56.2**	3.40	%	2	1	SAHM
TOC a ulev	**1.42**	0.29	% TS	2	1	SAHM

Deres prøvenavn	**Viul 1-3** **Sediment/slam**
Labnummer	N00639430

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**85.3**	8.5	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**14.6**	1.5	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**52.5**	3.18	%	2	1	SAHM
TOC a ulev	**3.44**	0.69	% TS	2	1	SAHM

Deres prøvenavn	**Viul 3** **Sediment/slam**
Labnummer	N00639431

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**99.5**	10.0	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**0.5**	0.05	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**79.6**	4.80	%	2	1	SAHM
TOC a ulev	**1.96**	0.40	% TS	2	1	SAHM

Deres prøvenavn	**Viul 10** **Sediment/slam**
Labnummer	N00639432

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**78.3**	7.8	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**21.6**	2.2	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**0.1**	0.01	%	1	1	SAHM
Tørrstoff (E) a ulev	**37.8**	2.30	%	2	1	SAHM
TOC a ulev	**2.18**	0.44	% TS	2	1	SAHM

Deres prøvenavn	**KS-SCH1-sed** **Sediment/slam**
Labnummer	N00639433

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**99.2**	9.9	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**0.7**	0.07	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**93.6**	5.65	%	2	1	SAHM
TOC a ulev	**1.49**	0.30	% TS	2	1	SAHM

Deres prøvenavn	**Brann 4** **Sediment/slam**
Labnummer	N00639434

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**99.1**	9.9	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**0.9**	0.09	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**80.9**	4.88	%	2	1	SAHM
TOC a ulev	**0.15**	0.07	% TS	2	1	SAHM

Deres prøvenavn	**Brann 3** **Sediment/slam**
Labnummer	N00639435

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**99.8**	10.0	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**0.2**	0.02	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**78.8**	4.76	%	2	1	SAHM
TOC a ulev	**0.38**	0.10	% TS	2	1	SAHM

Deres prøvenavn	**Brann 1**
	Sediment/slam
Labnummer	N00639436

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**99.4**	9.9	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**0.5**	0.05	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**<0.1**		%	1	1	SAHM
Tørrstoff (E) a ulev	**87.2**	5.26	%	2	1	SAHM
TOC a ulev	**0.13**	0.07	% TS	2	1	SAHM

Deres prøvenavn	**HOL KJERNE 1**
	Sediment/slam
Labnummer	N00639437

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	----------		%	1	1	PIHO
Kornstørrelse 63-2 µm a ulev	----------		%	1	1	PIHO
Kornstørrelse <2 µm a ulev	----------		%	1	1	PIHO
Tørrstoff (E) a ulev	**20.2**	1.24	%	2	1	SAHM
TOC a ulev	**3.02**	0.61	% TS	2	1	SAHM

Deres prøvenavn	**HOL KJERNE 2**
	Sediment/slam
Labnummer	N00639438

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling a ulev	----------		se vedl.	1	1	SAHM
Kornstørrelse >63 µm a ulev	**15.9**	1.6	%	1	1	SAHM
Kornstørrelse 63-2 µm a ulev	**83.1**	8.3	%	1	1	SAHM
Kornstørrelse <2 µm a ulev	**1.0**	0.10	%	1	1	SAHM
Tørrstoff (E) a ulev	**32.8**	2.00	%	2	1	SAHM
TOC a ulev	**3.58**	0.72	% TS	2	1	SAHM

Deres prøvenavn	**HOL KJERNE 3** **Sediment/slam**
Labnummer	N00639439

Analyse	Resultater	Usikkerhet (±)	Enhet	Metode	Utført	Sign
Kornfordeling [a ulev]	**----------**		se vedl.	1	1	SAHM
Kornstørrelse >63 µm [a ulev]	**5.0**	0.5	%	1	1	SAHM
Kornstørrelse 63-2 µm [a ulev]	**93.7**	9.4	%	1	1	SAHM
Kornstørrelse <2 µm [a ulev]	**1.2**	0.1	%	1	1	SAHM
Tørrstoff (E) [a ulev]	**33.5**	2.04	%	2	1	SAHM
TOC [a ulev]	**2.33**	0.47	% TS	2	1	SAHM

"a" etter parameternavn indikerer at analysen er utført akkreditert ved ALS Laboratory Group Norway AS.
"a ulev" etter parameternavn indikerer at analysen er utført akkreditert av underleverandør.
"*" etter parameternavn indikerer uakkreditert analyse.
Utførende laboratorium er oppgitt i tabell kalt Utf.
n.d. betyr ikke påvist.
n/a betyr ikke analyserbart.
< betyr mindre enn.
> betyr større enn.

	Metodespesifikasjon
1	**Kornstørrelse 2-63µm** Metode: ISO 11277:2009 Måleprinsipp: Sikting og laser diffraksjon Rapporteringsgrenser: >63 µm (sand) 0,1% 63-2 µm (silt) 0,1% <2 µm (leire) 0,1% Andre opplysninger: Det målbare området ved denne metoden spenner fra 2µm – 63mm.
2	**Bestemmelse av TOC ved bruk av IR** Metode: CSN ISO 29541, CSN EN ISO 16994, CSN EN ISO 16948, CSN EN 15407, CSN ISO 19579, CSN EN 15408, CSN ISO 10694, CSN EN 13137 Måleprinsipp: IR (LECO Rapporteringsgrenser: 0,1 %

	Godkjenner
PIHO	Pia Holm
SAHM	Sabra Hashimi

	Utf[1]
1	Ansvarlig laboratorium: ALS Laboratory Group, ALS Czech Republic s.r.o, Na Harfě 9/336, Praha, Tsjekkia Lokalisering av andre ALS laboratorier: Ceska Lipa Bendlova 1687/7, 470 03 Ceska Lipa Pardubice V Raji 906, 530 02 Pardubice Kontakt ALS Laboratory Group Norge, for ytterligere informasjon

Måleusikkerheten angis som en utvidet måleusikkerhet (etter definisjon i "Evaluation of measurement data – Guide to the expression of uncertainty in measurement", JCGM 100:2008 Corrected version 2010) beregnet med en dekningsfaktor på 2 noe som gir et konfidensinterval på om lag 95%.

Måleusikkerhet fra underleverandører angis ofte som en utvidet usikkerhet beregnet med dekningsfaktor 2. For ytterligere informasjon, kontakt laboratoriet.

[1] Utførende teknisk enhet (innen ALS Laboratory Group) eller eksternt laboratorium (underleverandør).

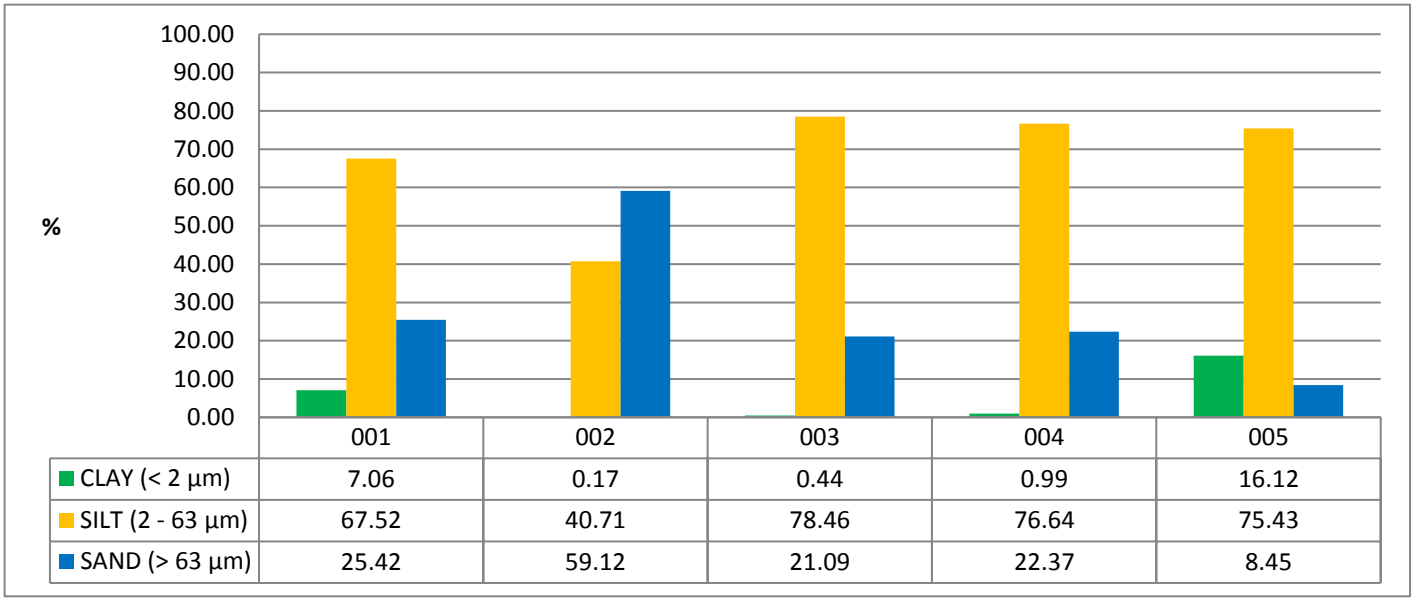
Måleusikkerhet skal være tilgjengelig for akkrediterte metoder. For visse analyser der dette ikke oppgis i rapporten, vil dette oppgis ved henvendelse til laboratoriet.

Denne rapporten får kun gjengis i sin helhet, om ikke utførende laboratorium på forhånd har skriftlig godkjent annet. Resultatene gjelder bare de analyserte prøvene.
Angående laboratoriets ansvar i forbindelse med oppdrag, se aktuell produktkatalog eller vår webside www.alsglobal.no

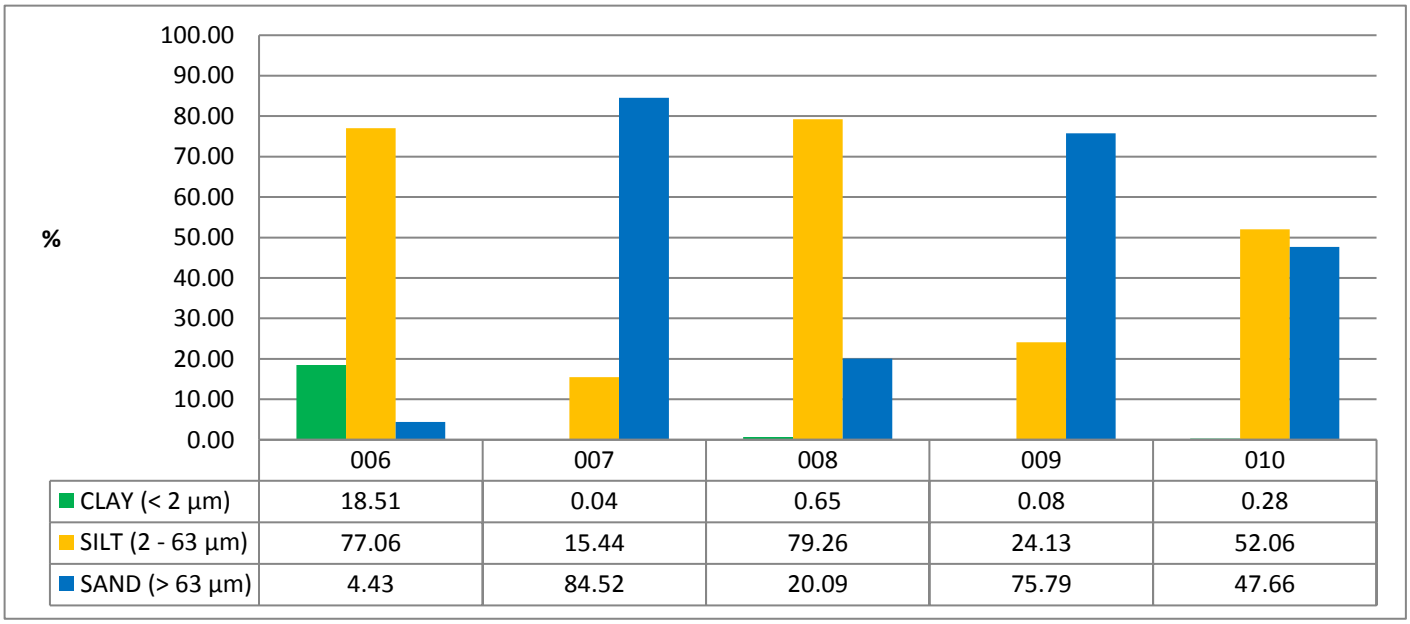
Den digitalt signert PDF-fil representerer den opprinnelige rapporten. Eventuelle utskrifter er å anse som kopier.

Attachment no. 1 to the certificate of analysis for work order PR1913128

Results of soil texture analysis



	001	002	003	004	005
CLAY (< 2 µm)	7.06	0.17	0.44	0.99	16.12
SILT (2 - 63 µm)	67.52	40.71	78.46	76.64	75.43
SAND (> 63 µm)	25.42	59.12	21.09	22.37	8.45



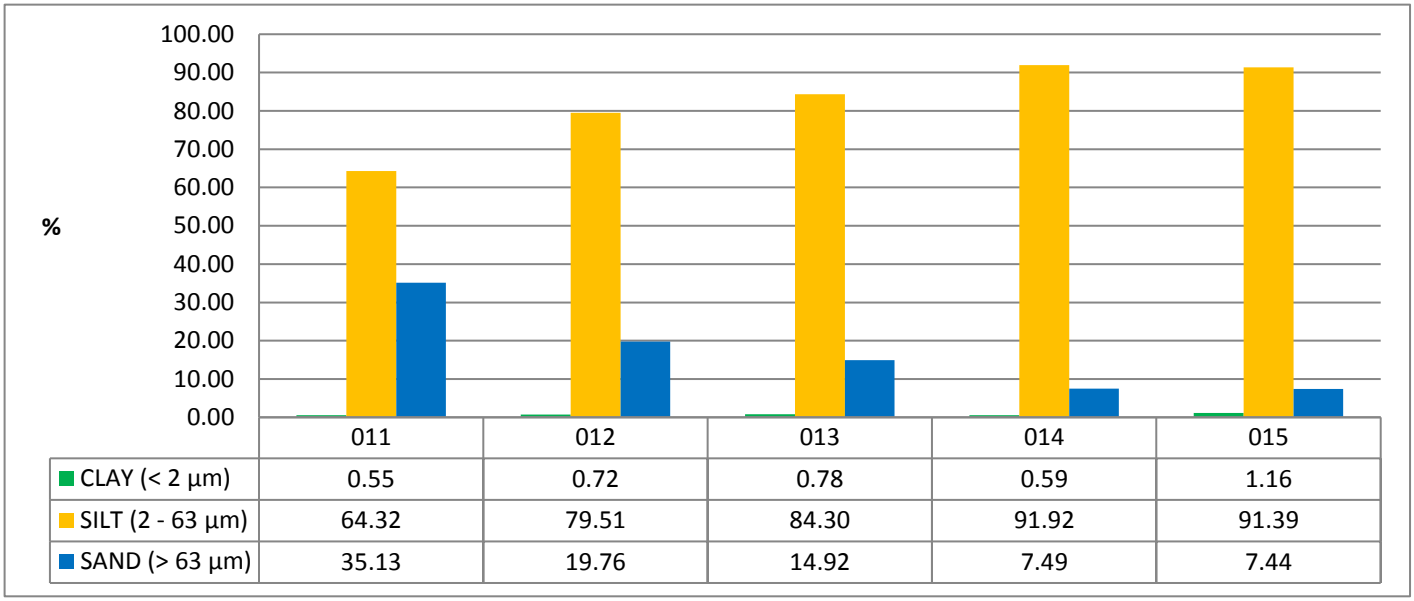
	006	007	008	009	010
CLAY (< 2 µm)	18.51	0.04	0.65	0.08	0.28
SILT (2 - 63 µm)	77.06	15.44	79.26	24.13	52.06
SAND (> 63 µm)	4.43	84.52	20.09	75.79	47.66

Test method specification: CZ_SOP_D06_07_120 Grain size analysis using the wet sieve analysis using laser diffraction (fraction from 2 µm to 63 mm) Fraction > 0.063 mm determined by wet sieving method, other fractions determined from the fraction "< 0.063mm" by laser particle size analyzer using liquid dispersion mode. Fractions "Sand >63 µm", "Silt 2-63 µm" and "Clay <2 µm" evaluated from measured data.

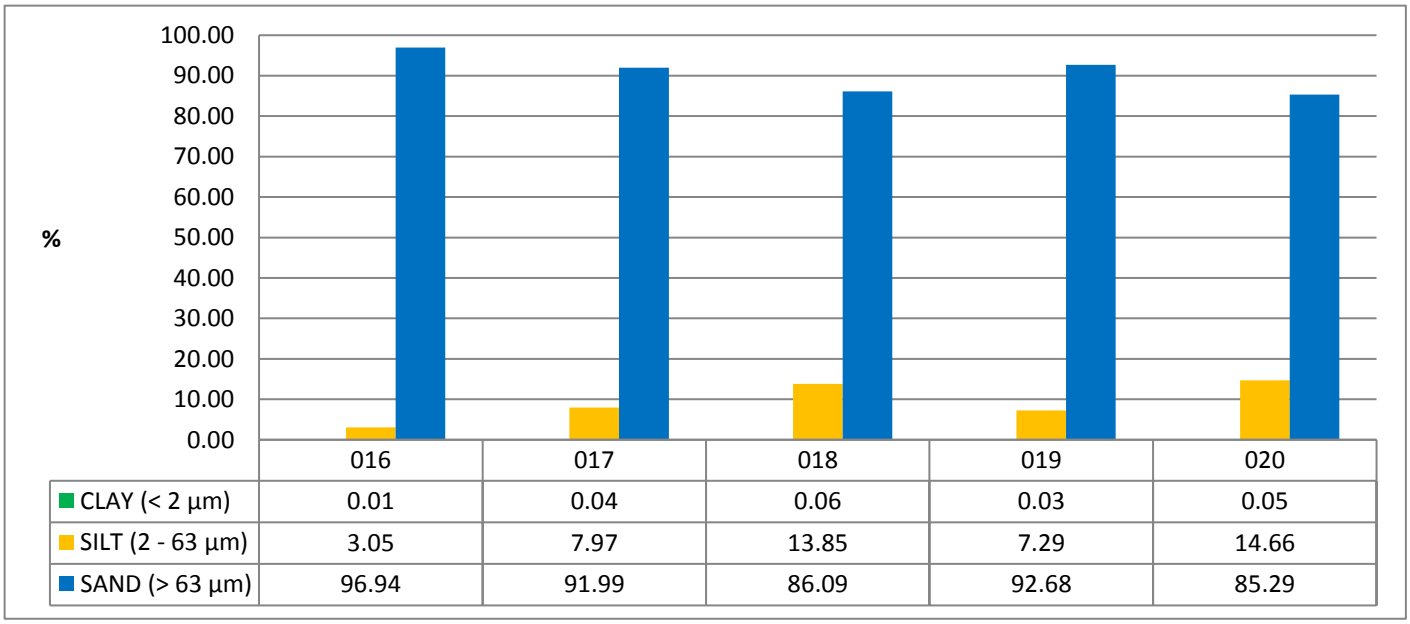
The end of result part of the attachment the certificate of analysis

Attachment no. 2 to the certificate of analysis for work order PR1913128

Results of soil texture analysis



	011	012	013	014	015
CLAY (< 2 µm)	0.55	0.72	0.78	0.59	1.16
SILT (2 - 63 µm)	64.32	79.51	84.30	91.92	91.39
SAND (> 63 µm)	35.13	19.76	14.92	7.49	7.44



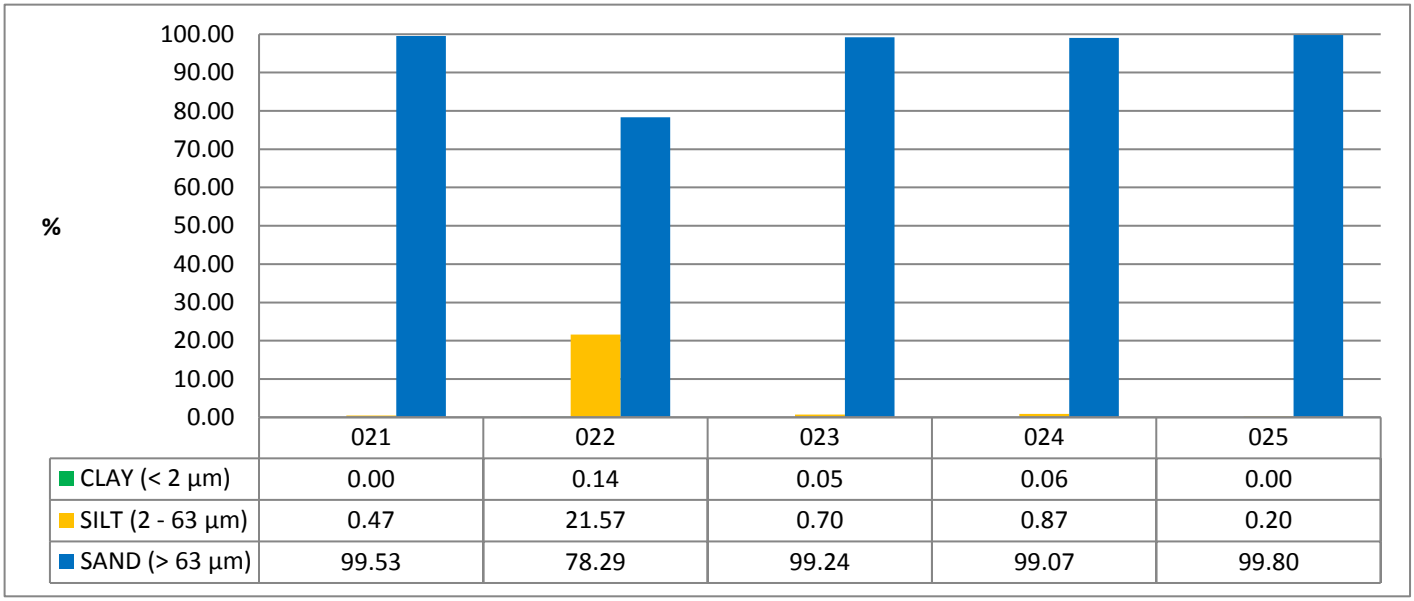
	016	017	018	019	020
CLAY (< 2 µm)	0.01	0.04	0.06	0.03	0.05
SILT (2 - 63 µm)	3.05	7.97	13.85	7.29	14.66
SAND (> 63 µm)	96.94	91.99	86.09	92.68	85.29

Test method specification: CZ_SOP_D06_07_120 Grain size analysis using the wet sieve analysis using laser diffraction (fraction from 2 µm to 63 mm) Fraction > 0.063 mm determined by wet sieving method, other fractions determined from the fraction "< 0.063mm" by laser particle size analyzer using liquid dispersion mode. Fractions "Sand >63 µm", "Silt 2-63 µm" and "Clay <2 µm" evaluated from measured data.

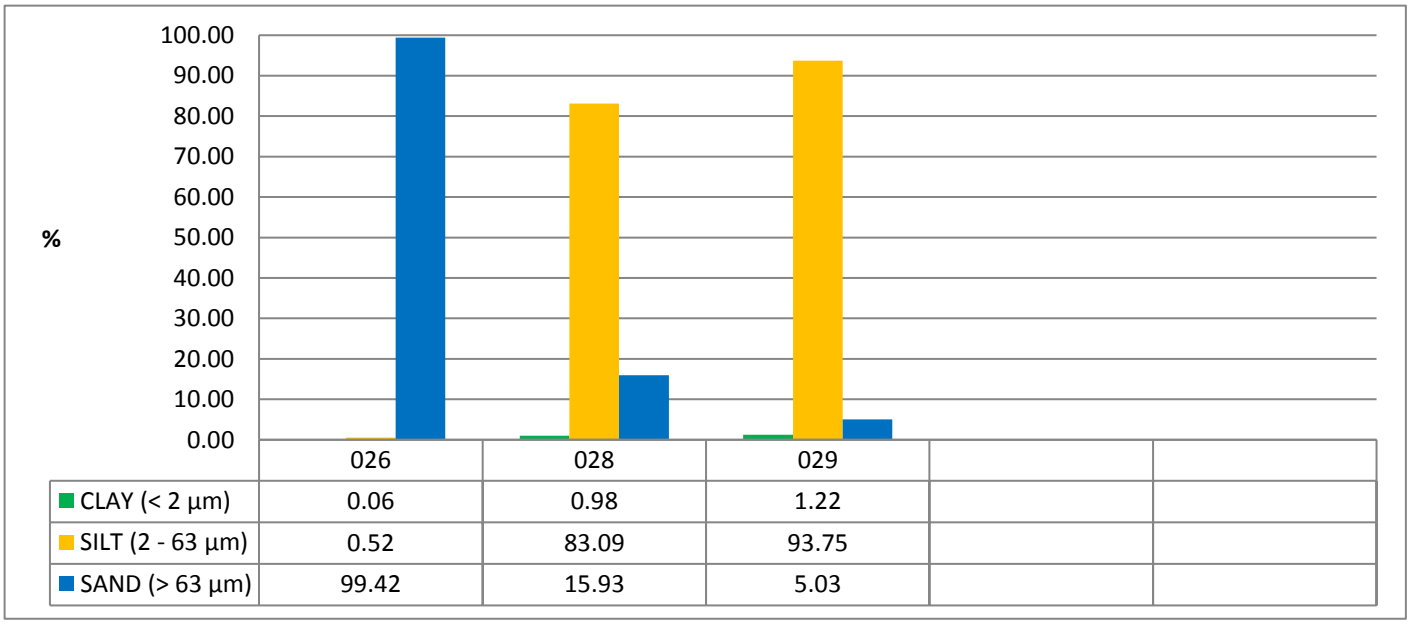
The end of result part of the attachment the certificate of analysis

Attachment no. 3 to the certificate of analysis for work order PR1913128

Results of soil texture analysis



	021	022	023	024	025
CLAY (< 2 µm)	0.00	0.14	0.05	0.06	0.00
SILT (2 - 63 µm)	0.47	21.57	0.70	0.87	0.20
SAND (> 63 µm)	99.53	78.29	99.24	99.07	99.80



	026	028	029		
CLAY (< 2 µm)	0.06	0.98	1.22		
SILT (2 - 63 µm)	0.52	83.09	93.75		
SAND (> 63 µm)	99.42	15.93	5.03		

Test method specification: CZ_SOP_D06_07_120 Grain size analysis using the wet sieve analysis using laser diffraction (fraction from 2 µm to 63 mm) Fraction > 0.063 mm determined by wet sieving method, other fractions determined from the fraction "< 0.063mm" by laser particle size analyzer using liquid dispersion mode. Fractions "Sand >63 µm", "Silt 2-63 µm" and "Clay <2 µm" evaluated from measured data.

The end of result part of the attachment the certificate of analysis