Universitetet i Stavanger

FACULTY OF SCIENCE AND TECHNOLOGY

MASTER'S THESIS

Study programme/specialisation: Environmental Engineering, Water Science and Technology	Spring semester, 2020 Open/Confidential
Author: Bjørn Mo	Bjørn Mo …………………………………………… (signature of author)

Programme coordinator: Roald Kommedal

Supervisor(s): Espen Enge

Title of master's thesis:

Reliability of a conductivity controlled slurry doser

Credits: 30

Keywords: Water chemistry Acidification Liming Slurry doser Conductivity	Number of pages: 38 + supplemental material/other: 25 Stavanger, 15.06.2020

Abstract

Anthropogenic emissions of sulphur and nitrogen oxides cause acid rain giving acidic waters. Moreover, the bedrock in the southern parts of Norway provides no or little buffer capacity. This combination has caused fish species like Atlantic salmon and brown trout to extinction in many regions and locations. Liming of freshwaters is used as mitigation and has improved the conditions for aquatic organisms. Different liming strategies are used. Regularly liming of the catchment area and continues liming in rivers by a liming station is considered as the two most viable methods. These liming stations are usually controlled by water flow in combination with pH. Unfortunately, erroneous measures and doses will occur after a short time due to unavoidable drift of the pH electrode, even with a frequent calibration. A conductivity electrode, on the other hand, is highly stable and reliable. The liming station in Ørsdalen is the first of its kind because it is using conductivity as a control mechanism for lime dosing. This is possible due to a dynamical relationship between pH and sea salts expressed as conductivity. The study establishes that the conductivity-controlled slurry doser can produce a stable pH regardless of the seasonal dynamic in water flow rate, pH upstream and the sea salt exposure. All episodes with pH values below critical value have been due to technical issues. The study suggests that the use of conductivity as a control parameter is more reliable than a pH-controlled liming station, as in Kvina. Ca measured downstream were found to be consistently higher than the doses curve implies, primarily due to the use of a preliminary dose table.

Preface

This master thesis concludes my study in Environmental Technology at the University in Stavanger.

I would like to give a huge thank to my supervisor Espen Enge for extraordinarily good support and assistance. I would also thank Henrik van der Hoeven for the use of his lab and Tor Sigve Hovland for weekly collection of water samples from Bjordalbekken.

Stavanger, June 2020

Bjørn Mo

Table of contents

1. Introduction

Fish populations in many Norwegian rivers and lakes were in decline as early as at the beginning of the 1900s. Atlantic salmon and brown trout are two of the fish species found in Norwegian freshwaters that were affected (Clair & Hindar, 2005; Sandøy & Romundstad, 1995). Studies in the 1970s found that Atlantic salmon populations were nearly extinct in several rivers in southernmost parts of Norway. There were also a considerable number of lakes and rivers were brown trout had become extinct due to low pH (Jensen & Snekvik, 1972). Early in the mid-1970s, these negative impact on wildlife became associated with acidic rain and was therefore recognized as a huge problem in Europe and North America. Affected freshwaters showed a decrease in the number of species and a dramatic change in the composition of species as a result (Clair & Hindar, 2005).

Burning of fossil fuels gives sulfuric and nitric acids as by-products. Emissions of these oxides are the major cause of the acidification because they deposit in soils and water (Clair & Hindar, 2005). Around 1980, the sulphur load was especially high and made the biggest influence on the acid rain (Atle Hindar et al., 1998). Today, international agreements on reducing the emission of sulphur have resulted in improved water qualities. However, to reduce and compensate for the damage which has already taken place, temporary mitigation is necessary (Clair & Hindar, 2005; Sandøy & Romundstad, 1995).

2. Water chemistry and acidification

2.1 General water chemistry

In general limnology, 95-99% of the total dissolved inorganic solutes in natural waters is considered to be represented by the cations Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, and the anions HCO_3^-, SO_4^{2-} and Cl^-. There are, however, huge variations in the ion composition in freshwaters which, to a large extent, can be explained by the geochemical condition in an area (Brezonik & Arnold, 2011).

Three essential factors primarily control the chemistry of lakes in Norway:
-Weathering of bedrock constitutes for most of the Ca, Mg, and HCO_3.
-Acid precipitation is the source of most of the SO_4^{2-} and H^+
-Sea salt brought by the wind constitutes for most of the Na and Cl found in the waters, and the concentrations of sea salts correlate well with distance to the sea (Wright & Henriksen, 1978).

Alkalinity is a measure of waters capacity to neutralize acid (Snoeyink & Jenkins, 1980). It is an essential parameter when regarding the acidification of freshwaters, and includes H^+ and ions like Ca. Another term for alkalinity is the acid-neutralizing capacity (ANC). It is defined as the difference between the concentration of nonmarine base cations [BC]* and strong acid anions [AN]*.

$[ANC] = [BC]^* - [AN]^* = [HCO_3^-] + [A^-] – [H^+] – [Al^{n+}]$

Where $[A^-]$ is the concentration of organic anions and $[Al^{n+}]$ is the sum of all positively charged aluminium ions (Atle Hindar et al., 1998). HCO_3^- has a ($pK_{a1} = 6.35$) and can both accept and donate protons. It, therefore, constitute for a main proportion of the alkalinity in waters (Brezonik & Arnold, 2011).

Al is an abundant metal in the lithosphere, but a minor constituent in freshwaters. It is mainly insoluble and unharmful due to fish to low concentration in circumneutral pH. Under anoxic conditions ($pH < 5$) it is more soluble, and the concentration increases. Due to its highly toxic effect in simple ionic form, it can cause harm to the biota in the freshwater system (Brezonik & Arnold, 2011).

2.2 Weathering of bedrock

Lakes located in areas with slow weathering granite bedrock and no calcareous soil is low in major ions and buffer capacity. They are consequently acidic when located in areas affected by acid precipitation (Brezonik & Arnold, 2011; Wright & Henriksen, 1978). Greenstone and calcareous bedrock have a high buffer capacity, and waters in such areas are not affected by acidification (Edmunds & Coe, 1986).

2.3 Atmospheric contribution

Particles and many gases entering the atmosphere will eventually deposit as either dry deposition (uptake at the earth's surface) or wet deposition (e.g., absorption into droplets followed by rain). The depositions are affected by particle size, wind velocity and wind direction (Zannetti, 1990).

Precipitation often has its origin from evaporated seawater and can travel vast distances before falling on landmasses. During its time in the earth's lower atmosphere, the water forms an equilibrium with the gasses in the atmosphere. The pH of water unaffected by anthropogenic gases is 5.5 to 6.5 due to the equilibrium established with the atmospheric CO_2. This pH is due to CO_2 being very soluble compared to other atmospheric constituents as N_2 and O_2. Anthropogenic emissions like SO_2 and NOx are two minor atmospheric constituents associated with anthropogenic emissions that may also influence the properties of the water. SO_2 is similar to CO_2 in being very soluble, and quickly lower the pH of the water even further than the pH caused by CO_2 equilibrium (Snoeyink & Jenkins, 1980).

Due to a slow weathering granite bedrock in southern Norway, most of the ions in the freshwaters, even at high latitude, comes from the sea (Wright & Snekvik, 1978). During severe storms, the pH in Norwegian waters may decrease significantly due to sea-salt episodes (Atle Hindar et al., 2004). Different types of cations are attached to negatively charged soil colloids. In acid environments, H^+ and Al represent a significant proportion of these. During sea-salt episodes, cations on the soil colloids mobilizes by sodium-ions (Na^+) retained in the soil profile. A sudden release of H^+ and Al occurs, causing particular low pH and dramatically high inorganic monomeric Al (A. Hindar et al., 1995).

The North Atlantic Oscillation (NAO) is the pressure difference at sea level between Iceland and the Azores. In general, the higher the pressure gradient, the heavier storm. Consequently, there is a strong relation between toxic levels of aluminium in rivers and higher NAO index values. Due to a lower deposition of sulphur and better water quality, the damaging effect of intense storms is less severe than earlier (Atle Hindar et al., 2004). This has been confirmed during sea salt episodes in southwestern Norway when looking at the toxic effect of inorganic Al. The ANC values have also improved (A. Hindar & Enge, 2006).

An increase of the concentration of dissolved organic carbon (DOC) has been observed in eastern North America and northern and central Europe. The increase of DOC concentration is shown to be in proportion with the decline in the atmospheric deposition of sulphur and sea salt. During the period from 1990-2004, the sulphur deposition was drastically reduced. Trends of increased DOC were seen most frequently in the southern part of Scandinavia, in the UK, and in the north-eastern USA (Monteith et al., 2007). DOC includes organic acids which contribute to the acidification of waters (Erlandsson et al., 2010).

2.4 Regulations on sulphur emissions

Since the early 1980s, acid emission controls have been implemented in both Europe and North America (Clair & Hindar, 2005). An international agreement, "Sulphur Protocol" was signed in Oslo in 1995 (Sandøy & Romundstad, 1995). Further, Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) was signed in 1999 (UNECE, n.d.). Due to regulations, a general improvement of the pH in the freshwater system is observed. In the mid-1980s, a pH < 5 was a typical value in lakes in south-eastern parts of Rogaland. From the 2000s, the pH typical ranged from 5-5.5 and even 5.5-6.0 (Enge, 2013b). However, if the emissions were reduced with 70-80% relative to the emissions in 1980, the load will still exceed a critical level, especially in southernmost parts of Norway (Atle Hindar et al., 1998). The first step for a freshwater community to recover is establishing a good water quality. The return of a community will occur in a later stage of the recovery, or could in the worst case never happen (Clair & Hindar, 2005). Although sulphur emissions are reduced, the emissions of nitrogen are about the same as in 1980 (Atle Hindar et al., 1998). Due to emission control, the acidification of waters has shown an improvement, primarily driven by reduced sulphur. The downward trend in nitrogen concentration is smaller, or non-existing in some regions. The relative importance of nitrogen for acidification has therefore increased (Garmo et al., 2014).

2.5 Critical limits for freshwater organisms

pH in waters is of great importance when it comes to the diversity of freshwater species. In general, the diversity decreases with pH, and the possible number of species is restricted at pH ≤ 4.7. With a pH < 5.5 however, the pH does not affect the diversity, but the diversity increases with increasing Ca content (Lien et al., 1996).

Atlantic salmon is susceptible to low pH/high Al^{n+}, making it a good indicator of the acidification status in a river. It is found that in all location where salmon populations where unaffected, the ANC was over 20 µeq/l. Hence, it is shown to be a critical value. Rivers without Atlantic salmon have values close to zero or below (Lien et al., 1996).

Brown trout and perch are more resistant than Atlantic salmon. Lakes with healthy populations of brown trout and perch have high mean pH (6), ANC > 0, a high Ca concentration (> 1mg/l) and labile Al close to zero. Lakes without brown trout have ANC < 0, pH < 4.7, Ca < 1 mg/l and labile Al > 130 µg/l. If a lake has a lower ANC < -40 µeq/l, most of the fish communities will be extinct (Lien et al., 1996).

2.6 Liming as a mitigation

Liming of waters can be performed with different approaches, and a combination of different strategies will give the most desirable effects (Henrikson & Brodin, 1995). Issues with liming in Norway is high precipitation, low retention time in lakes and seasonal variations (Rosseland & Hindar, 1988). Environmental problems caused by acidification can in a long term perspective only be solved by reducing the emissions. However, the acidification has already made an impact on large areas, and the recovery requires decades (Sandøy & Romundstad, 1995). To reverse some of the changes and compensate for the unfortunate effects of anthropogenic acidification, different methods of neutralizing, like liming, has been used as a mitigation method.

Due to Atlantic salmon being more sensitive than brown trout, a higher pH is required (Atle Hindar et al., 1998). The pH of the limed waters should, however, not be considerably higher than at its natural state due to both positive and negative effects on plants and animals in limed waters and terrestrial areas. Adverse consequences regarding the vegetation should always be taken into consideration when performing catchment liming (Henrikson & Brodin, 1995).

By using liming as a mitigation method, the water chemistry restores, but the ecosystem may not return to the original state. Fish species can be helped back with the use of active management, but the whole aquatic community contain fewer species and is more vulnerable than at its original state. The new ecosystem will also be dominated by organisms with a higher tolerance for acid conditions (Clair & Hindar, 2005).

2.6.1 Buffering compounds used in mitigation

Neutralizing agents can be added to streams, rivers, lakes, and catchments. Compounds commonly used in mitigation is calcite (limestone, $CaCO_3$) and dolomite ($CaMg(CO_3)_2$). Limestone is widely used in agriculture, and therefore readily available. Dolomite is most used for catchment liming. Another compound used is sodium silicate ($Na_2O{\cdot}SiO_2$) due to its strong ability to complex Al_i. (Clair & Hindar, 2005). The dissolution of these neutralizing agents is dependent on both the chemical, physical and mechanical factors (Atle Hindar et al., 1998).

2.6.2 Methods of liming

One method of liming is adding gravel-sized lime into the stream sediments which act as a filter and barrier. Liming of gravel can give Atlantic salmon a huge benefit in early stages. The densities of both fry and parr are found significantly higher in the immediate vicinity to lime gravel (Watt et al., 1984). In rivers where liming stations are used, lime in gravel will work as a safety barrier in case of episodes with the pH being too low. However, the effect is drastically reduced just after a couple of weeks, mainly due to an organometallic coating on the lime. Another issue is lime often get lost downstream in rivers with high flow. This method is therefore considered ineffective (Clair & Hindar, 2005; Olem, 1990; Watt et al., 1984).

Liming lakes surface with slurry, or fine-grained lime can be done using boats, helicopters or on the ice cover on lakes. Liming by helicopter is the costliest, but often the only option, due to it being efficient and well suited for liming remote lakes. The effect is an immediate improvement in pH and ANC. A drawback is this effect being rapidly reduced in the lakes with short retention time. Generally, there is also a considerable amount that is lost due to sedimentation. Another issue is that cold melting water does not mix with the deeper buffered water, but do only form a layer on the top (Clair & Hindar, 2005; Olem, 1990). During ice melt, the ice-cold water will create a cover on dimictic lakes due to thermal stratification. This will cause the water to overflow the deeper and warmer and water, causing severe acidification on the surface and in the outflow water. During these periods, the loss of Ca for limed lakes are reduced, but the acidic state at the surface and outflow location causes problems for the biota in those places (Abrahamsson, 1993). This makes lake liming insufficient. However, in Lake Store Hovvatn as an example, no death of fish has been associated with these episodes (Rosseland & Hindar, 1988).

Liming the catchments is usually done by helicopters. The three subcategories are liming the whole catchment, liming along the streams, and liming the wetland. An advantage is that problems regarding stratification of water columns are overcome with this strategy. It is the method allowing for the less frequent refill of lime (Clair & Hindar, 2005; Olem, 1990). Whole catchment liming to restore fish population is therefore considered as one of the best methods, especially in waters with low retention time. A liming experiment performed at Tjønnstrond in southernmost Norway. Liming of the catchment area gave immediate response when limestone was distributed by helicopter. The pH in the two small ponds increased from 4.5 to 7.0. Ca increased from 40 to 200 µeq/L, and reactive Al decreased from about 10 to 3 µeq/L. ANC increased from -30 to +70 µeq/L. Nine years after liming, the soil in the catchment area still contained about 75% of the added lime remained as exchangeable Ca. Whole catchment liming give a stable and good water quality. Data suggest that the concentration of sulphate/H^+ determines the release of added Ca. During snowmelt and rainstorm, the Ca release is sufficient to avoid episodes with a high content of toxic aluminium in the water (Traaen et al., 1997).

Another suitable method is adding lime directly to running waters. This is usually done by mixing fine-grained limestone powder with some of the water to form a slurry which is sent back to the river. The simplest way is to dose a fixed dose of lime by water flow to the river, with some variations on the summer/winter. A more sophisticated and more commonly used method is to determine the doses by a pH electrode in combination with water flow. Liming of One of its benefits is specifically targeting important rivers. There are also disadvantages to this method. The doser and all the equipment needed is expensive. It often needs to be operated daily, often year-round. The catchments soil is not improved, and the liming must continue until the soil base saturation has been restored. Another issue is that water upstream the doser will still be untreated. Dilution downstream must also be taken into consideration. Implementation of several dozing stations downstream, a river has been implemented at some locations to deal with this problem (Clair & Hindar, 2005).

3. Study area

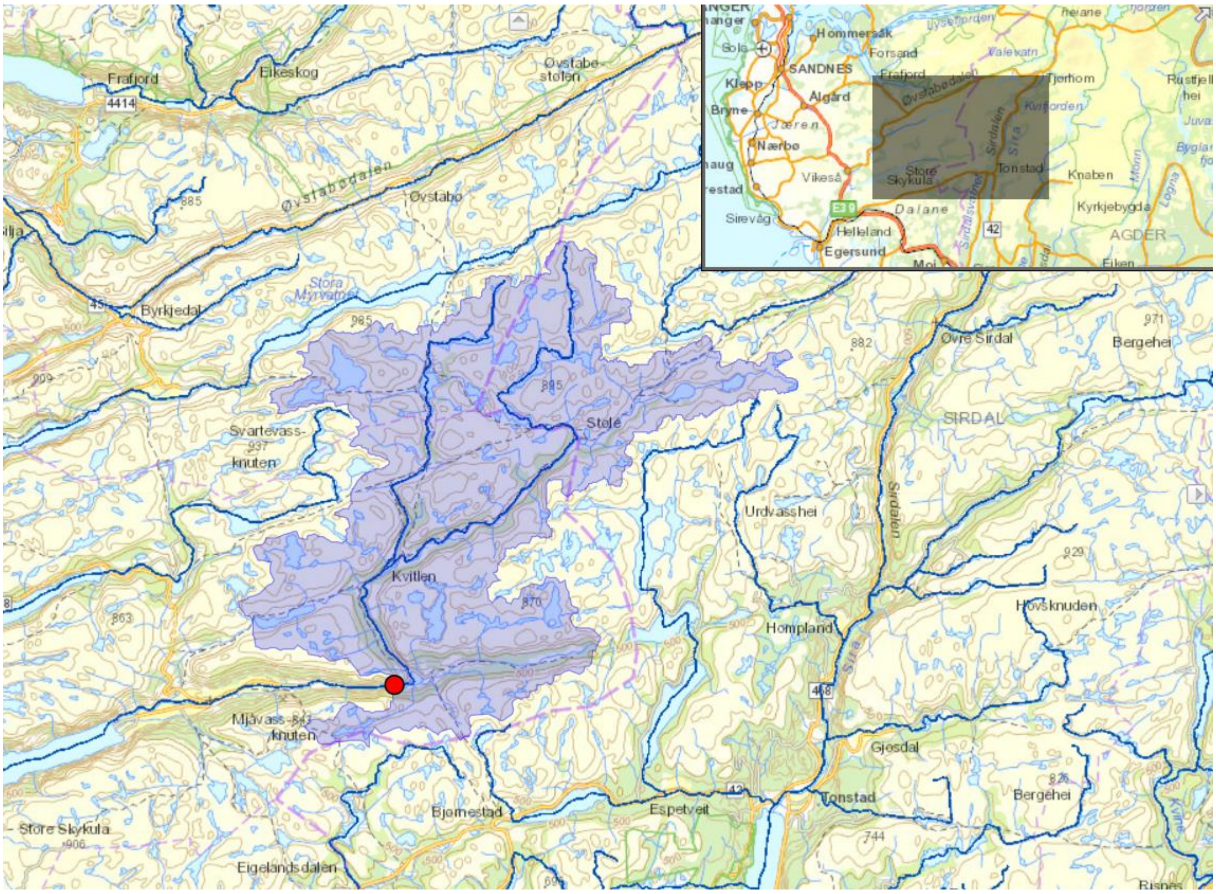

Figure 3.1 Catchment area of Bjordal liming station marked with a red dot (NVE, 2020a).

Bjordal is located in the innermost part of Ørsdalen, in Bjerkreim municipality in Rogaland (fig. 3.1). Like many other rivers in southern Norway, the population of Atlantic Salmon in Bjerkreim river was at a highly reduced level in the 1990s due to acidification. Storåna river that ends in Ørsdalsvatnet represents about 2/3 of the catchment of the lake and 1/5 of the whole Bjerkreim river. The possibility of liming Storåna was discussed between the County Governor and landowners in the mid-1990s (Enge, 2005).

Trout were extinct in most of the lakes in the eastern parts of Ørsdalen in the 1980s (Enge, 2005). A liming project was initiated in 2007 with the aim to improve the water quality for the whole river in Ørsdalen. The trout has therefore been able to re-establish a population. (Enge, 2012). Storavatnet and Stakkavatnet are two major lakes in the surrounding mountains, which are both limed annually (E. Enge, personal communication, 2020). A liming station controlled by conductivity was eventually built and started to operate in late 2013 (Enge, 2015).

Figure 3.2 Outlet of Bjordal and Loni when facing west. The lime added to the river is seen as a white/yellow cloud marked with the red arrow.

Figure 3.3 Bjordal and Loni when facing north. Storåna runs down the valley in the left part of the picture, and Fossbekken is seen running down the mountainside.

Storåna constitutes for about three-quarters of the water running true Loni (fig. 3.2 and 3.3). Several other streams are also entering the river in Loni, and the size of the most substantial has been estimated:

Table 3.1 Catchment area, mean runoff (1961-1990), flow and percentile flow of Loni and its main adjacent waterways (NVE, 2020a).

Parameter / Location	Catchment Area (A) [km^2]	Mean runoff (R) [$l/s/km^2$]	Flow (Q = A*R) [l/s]	Q / Q Loni outlet
Storåna	98	91	8873	77.5%
Fossbekken	4.7	104	490	4.3%
Bjordalsbekken	15.5	94	1457	12.7%
Bjørnestadbekken	1.5	95	141	1.2%
Mylandsbekken	0.8	95	74	0.6%
Slokebekken	3.0	103	304	2.7%
Σ of locations above	124	-	11393	99.5%
Loni outlet	125	92	11454	100%

3.1 Climate

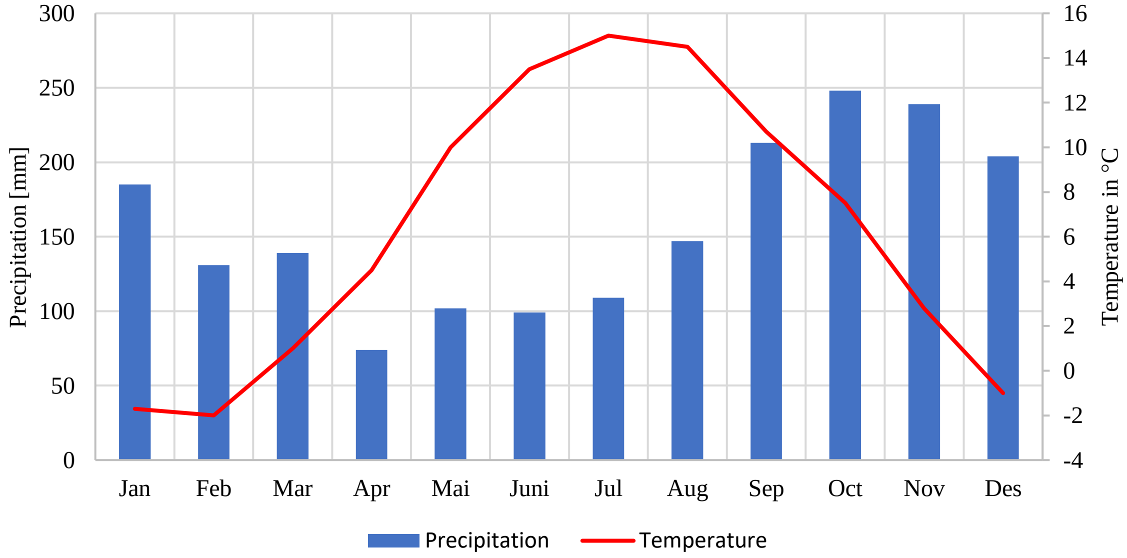

Figure 3.4 Precipitation and temperature over the normal period of 1961-1990 in Tonstad (Aune, 1993; Førland, 1993).

There is no weather station in Bjordal (70m.a.s.l). Approximate temperature and precipitation (fig. 3.4) are based on data from the closest measuring station, reported by the Norwegian meteorological institute. Both precipitation and temperature from the normal period of 1961-1990 have been measured in Tonstad (57 m.a.s.l) located 13 km from Bjordal. The monthly normal precipitation is > 70 mm for all months, with October having the highest amount of 248 mm and April being the driest month with 74 mm. The yearly precipitation is 1890 mm (Førland, 1993). The monthly average temperature is lowest in February with -2°C and highest in July with 15.0°C. The yearly average temperature is 6.2 °C (Aune, 1993).

Bjordal is assumed to have a similar climate as Tonstad. The temperature in the warmest month is ≥ 10 °C, and the coldest month is ≤ 18°C, but > -3°C. Based on Köppens climate classification, Tonstad has a marine west coast climate. The coldest month on the surrounding mountains over the treeline is < -3°C and is classified as continental subarctic climate (Encyclopedia Britannica, n.d.). Most of the catchment area of Bjordal is located in the mountains with a continental subarctic climate.

3.2 Geology

The bedrock in Bjordal and Ørsdalen is mainly granite and gneiss (NGU, 2020). Weathering of these bedrock types is slow and provides little Ca and Mg. Freshwater in these areas has therefore a low concentration of ions and low electrical conductivity. Therefore, ions from seawater salts represent a significant portion of the ions (Wright & Henriksen, 1978).

3.3 Bjordal liming station

In Storånå in Ørsdalen, the conductivity is low. In 2014 as an example, the conductivity was 13-34 µS/cm, and in 2015 it was measured to be 14-68 µS/cm. pH and conductivity have shown to be well correlated in Storåna (Enge, 2016). Studies have shown that accurate pH measurements of water are problematic with conductivity values < 100 µS/cm (Busenberg & Plummer, 1987). This is not the only issue with pH-electrodes. They are sensitive and have a constant drift in measured pH, which requires regular calibration, often several times a month (Høgberget, 2004). Because of the logarithmic scale, small changes in pH will give relatively large errors in the amount of lime dosed. Due to the reasons mentioned, a new liming station in Bjordal was built in 2013 and controlled by conductivity. The dozing station in Storånå aims to give a pH of 6.1 and ALK_E of 25. The pH should never be below 6.0 (Enge, 2016). The lime slurry used is “BioKalk”, comprising 67,5% weight per cent $CaCO_3$ (Atle Hindar, 2006).

3.4 Comparison with Kvina liming station

Kvina river is located in Agder county. Three liming stations located along the watercourse at different locations are used for liming. Mygland and Lindeland are controlled by water flow. The third station is located at Nyland, about 38 km from the liming station in Bjordal. The Nyland station is a slurry doser controlled by water flow and pH (Wang, 2005). It is therefore a suitable reference for the evaluation of the accuracy of the conductivity controlled slurry doser in Bjordal. The aim of Bjordal liming station is to be more polite and robust than a pH-controlled liming station.

4. Material and methods

4.1 Material

For this study, a weekly sample collected from Bjordalbekken between January 2019 to February 2020 has been measured. Additional tests were collected from Fossbekken, Bjordalbekken, Bjørnestadbekken, Mylandsbekken and Slokebekken (Appendix A).

Moreover, external data from Bjordal collected during the period of 2013 to 2019 (Enge, 2012, 2013a, 2014, 2015, 2016, 2017, 2018, 2019, 2020) is reviewed (Appendix B). These data comprise of weekly samples taken at three different locations in Storånå (fig. 4.1). Quantitative data are based on samples from Storåna downstream Bjordal since it is closest to the outlet of the liming station. Vassbø is most representative for the anadromous stretch and used for qualitative data.

2013-2018 data from Kvina (Atle Hindar et al., 2014, 2015, 2016, 2017, 2018, 2019) has also been reviewed for comparison of a conductivity controlled slurry doser with a pH-controlled.

Water flows from Bjordal is collected from “Sildre” (NVE, 2020b).

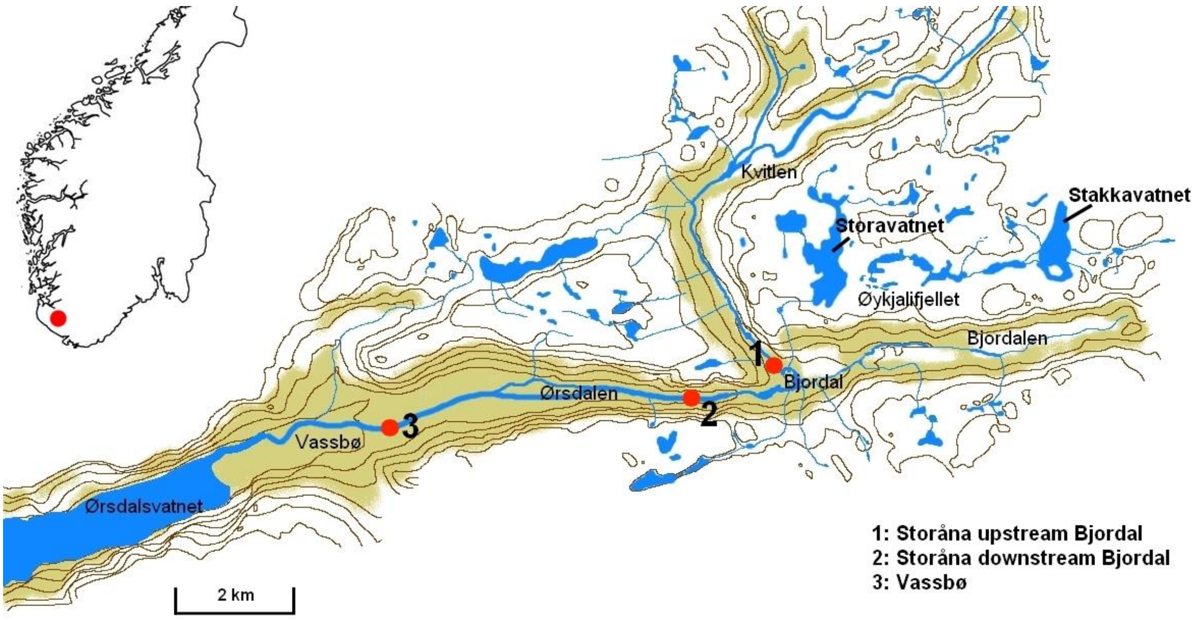

Figure 4.1 Map of Bjordal and its location in southwestern Norway marked with a red dot. The three sampling locations of the reviewed data from 2013-2019 is numbered. Storavatnet and Stakkavatnet are limed annually. Map basis: (Statens kartverk, n.d.)

4.2 Sampling

Figure 4.2 Map of Bjordal with Loni, Storåna and the sampling locations highlighted. Map basis: (Statens kartverk, n.d.).

The weekly sample from Bjordalbekken (fig. 4.2) was transported to the University in Stavanger for measuring. Most of them were measured by the author, and some by Espen Enge. The water was sampled with 250- and 125-ml HDPE. When sampling, the bottles were washed with water from the sample site several times before being filled up and capped underwater to avoid air in the bottle.

4.3 Analytical methods of externdal data in Bjordal

Methods for pH, conductivity and Al is found in Stølen & Enge (2019). Following standard deviations is found: pH ± 0.03, Al ± 2,4 µg/l, Na ± 0.03 mg/l, Cl ± 0.08 mg/l, Ca ± 0.023 mg/l, ALK ± 1µeq/l (Enge, 2020).

4.4 Analytical methods of collected data in Bjordal

All samples were analyzed at room temperature for pH, alkalinity, conductivity, colour, and Ca. pH was always measured first, immediately after the bottle was opened for testing. pH, conductivity, alkalinity and colour were measured at different locations. Measurements were performed at three different locations, and most of the measurements were taken in lab 1 (Table 4.1). The differences between the laboratories are found to be small (Rovik, 2020).

Following instrument were used:

Table 4.1 Equipment used for measuring pH, conductivity, and colour.

Parameter	Equipment	Lab 1	Lab 2	Lab 3
pH	pH-meter	Radiometer pHM92	Mettler Toledo FG2	Cole-Parmer 19101-05
	pH-electrode	Hamilton LIQ-Glass	Radiometer GK2401C	PHC4001
Conductivity	Conductivity meter	Radiometer CDM83	VWR CO-3100L	Amber Science 1056
Colour	Spectrophotometer	Spectronic Genesys		Shimadzu UV-120-01
	Cuvette	Hellma glass, 2 cm		Hellma glass, 1 cm

4.4.1 pH

pH was measured potentiometrically according to "Standard Methods", 4500-H^+ B (Eaton & Clesceri, 1995). Standards of 4.0 and 6.86/7.00 were used to calibrate the instruments.

Distilled water was measured as a control solution giving 5.58 ± 0.14 (n = 8) as a result. On a relevant sample from Bjordalsbekken, the pH was measured repeatedly, giving pH = 5.37 ± 0.005 (n = 57).

4.4.2 Conductivity

Conductivity is a measure of the ability of an aqueous solution to carry an electric current. It is dependent on the ions in the solution; concentration, mobility, valence and temperature. Conductivity was determined according to "Standard Methods" 2510 (Eaton & Clesceri, 1995). The instruments were calibrated with solutions of NaCl 210 µS/cm and KCl 147 µS/cm.

4.4.3 Colour

Colour was measured with 445nm, according to Norsk Standard 4722 (1973).

4.4.4. Alkalinity

Alkalinity was determined by titrating a 50 ± 10 ml determined to nearest 0.1 ml with H_2SO_4 to a fixed endpoint (pH = 4.50). Equivalence alkalinity (ALKe) was calculated according to Henriksen formula (Henriksen, 1982):

$$ALK_E = ALK_{pH = 4.50} - 32 + 0.646 * \sqrt{ALK_{pH = 4.50} - 32}$$

On a relevant sample from Bjordalsbekken, the ALK_E was measured repeatedly giving a mean value of 9 ± 1 (n = 57).

Test of 96.1 µeq/l sample with an average of 101.52 ± 0.90. The solution consists of a certified sodium carbonate solution with a theoretic ALKe = 102.

4.4.5 Calcium

Ca was measured with an ion-selective electrode ISE25 Ca, according to Rike & Rødne (2016).

4.5 Data processing

Statistical analysis was performed using Microsoft Excel. In scatter plots and regressions, days with missing data are not used. In the reviewed 2013-2019 data set (Appendix B), one LAl value < 5 (under detection limit) at Bjordal upstream was set to 2.5.

4.5.1 Estimation of lime doses in Bjordal

The lime doses used between 2013-2019 is based on data material from 2011-2012. It was empirical found that:

$pH = 5.30 + 0.033 * ALKe$ ($r^2 = 0.88$, $p < 0.001$, $n = 86$) (Enge, 2013a). (Equation 1)

Based on the model, an ALK_E of 25 µeq/l is needed for a sufficient pH of 6.1.

The liming station converts measured conductivity upstream to an estimated ALK_E based on the relationship found in 2011-2012 data:

$ALK_E = 65.2 – 19.6 (ln x); x = conductivity$ (Enge, 2013a). (Equation 2)

The amount of slurry added is based on missing ALK_E (Δ) which is converted to lime dose ($CaCO_3$ dose = Δ/20).

Table 4.2 Lime doses and conductivity, based on data from 2011 and 2012 (Enge, 2013a)
Δ = missing ALK_E for sufficient pH (6.1)

Conductivity	**ALK_E**	**Δ**	**$CaCO_3$**	**“SLURRY”**
µS/cm	µeq/l	µeq/l	g/m^3	g/m^3
10	20	5	0.2	0.4
20	6	19	0.9	1.4
30	-1	26	1.3	2.0
40	-7	32	1.6	2.5
50	-11	36	1.8	2.8

In this thesis, conductivity measured upstream Bjordal is used to estimate ALK_E and Δ, by using Eq 2. The liming station uses linear interpolation when estimating $CaCO_3$ doses based on Δ (Table 4.2). Linear interpolation is therefore used in the model as well. $CaCO_3$ doses is converted stoichiometrically to Ca doses. Ca downstream is then simulated based on estimated Ca doses + Ca measured upstream Bjordal.

4.5.2 Comparison with Kvina

Samples from Kvina are taken downstream Trælandsfossen, about 7 km downstream the pH-controlled slurry doser at Nyland. For reference, Vassbø is located approximately 6 km downstream of the Bjordal liming station. Bjordal liming station was not in operation before November 2013. For comparison with Kvina, only samples in the period 01.01.2014 - 01.10.2018 (n = 54) has been used in the calculations.

For Bjordal, the average and standard deviation were computed using two approaches:
-using all data from 01.01.2014 -01.10.2018 (n = 250).
-using coinciding weekly samples (maximum 2 days) (n = 54).

In Kvina, the water quality objectives from 2015 to 2018 of the salmon-bearing stretch are: 15/2-14/4: pH 6,2, 15/4-31/5: pH 6,4, 1/6-14/2: pH 6,0.
In 2014, the water quality objectives were slightly different by going from pH 6,2 to pH 6,4 1st of April instead of 15th of April.

Samples below water quality objective were counted and compared with samples water quality objective in Vassbø (pH < 6).

5. Results

5.1 Water chemistry upstream Bjordal

The liming station in Bjordal is controlled by conductivity. Relationships between conductivity and ions are therefore essential in the evaluation of conductivity as a reliable control mechanism.

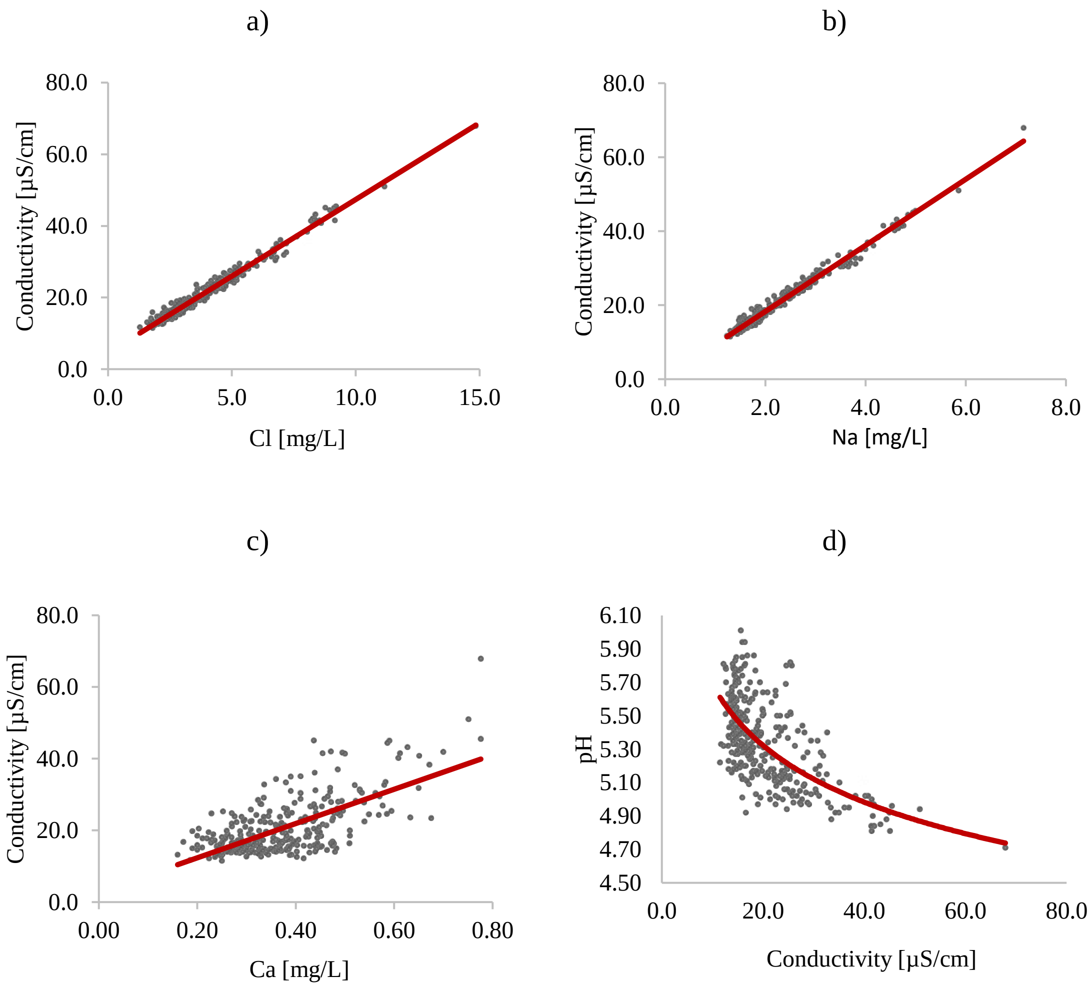

Figure 5.1 Correlations between conductivity and: **a)** Cl (y = 4.28x + 4.58, r^2 = 0.98, n = 322) **b)** Na (y = 8.93x + 0.44, r^2 = 0.98, n = 322) **c)** Ca (y = 47.8x + 2.78, r^2 = 0.44, n = 324) and **d)** pH (y = $7.07x^{-0.095}$, r^2 = 0.41, n = 324) from 25.11.2013-30.12.2019 at Storåna upstream.

A strong correlation (r^2 = 0.98) between conductivity and the sea salts Cl (fig. 5.1a) and Na (fig. 5.1b) is seen. Ca and conductivity (fig. 5.1c) correlates less (r^2 = 0.44). Low conductivity values (10-30µS/cm) are found in the pH range from 5-6, and the highest values (> 30 µS/cm) are associated with the lowest pH (fig. 5.1d).

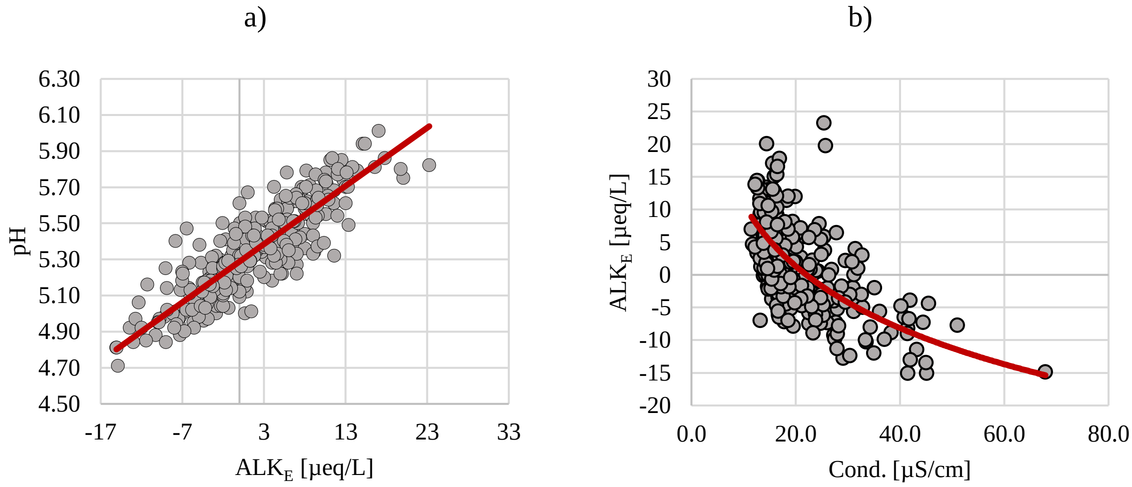

Figure 5.2 Scatter plot of pH and ALKe (a) and ALKe and conductivity (b) from 25.11.2013-30.12.2019 (n = 316) at Storåna upstream.

A positive linear relationship between ALK_E and pH (fig. 5.2a) is found:

$pH = 5.29 + 0.032 * ALKe$, ($r^2 = 0.75$, $p < 0.001$, $n = 316$) (equation 3)

ALKe and conductivity (fig. 5.2b) show a negative logarithmic relation:

$ALKe = 42.3 – 13.7 (ln\ Cond.)$. ($r^2 = 042$, $n = 316$) (equation 4)

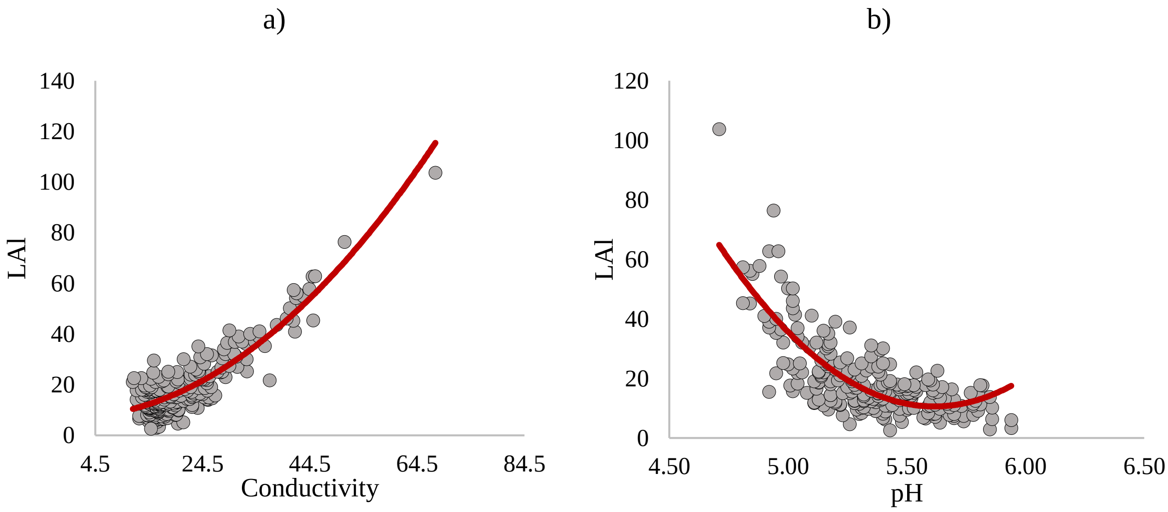

Figure 5.3 Scatter plot of LAl against: **a)** conductiocity ($y = 0.0231x^2 + 0.0275x + 7.0637$, $r^2 = 0.81$) and **b)** pH ($65.995x^2 - 741.33x + 2092.5$, $r^2 = 0.60$) from 05.01.2015-30.12.2019 (n = 243) at Storåna upstream.

The correlation ($r^2 = 0.81$) between LAl and conductivity is strong (fig. 5.3a). The parabolic curve demonstrates that LAl is at its lowest at pH around 5.5. LAl is increasing with decreasing pH, given a pH < 5.5 (fig. 5.3b).

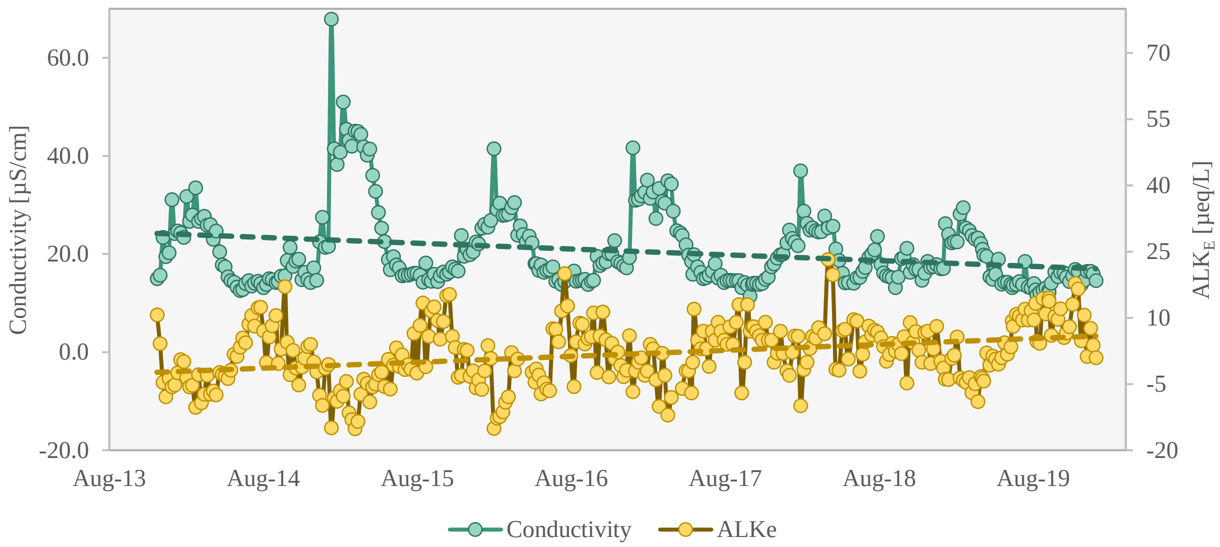

Figure 5.4 Comparative plot of conductivity (y = -0.0032x + 158.73, r² = 0.07, p < 0.001, n=324) and alkalinity (y = 0.0037x - 155.76, r² = 0.12, p < 0.001, n = 316) from 25.11.2013-30.12.2019 at Storåna upstream. The trend lines are linear.

The conductivity and alkalinity showed an opposite pattern during the season. Conductivity has the highest levels in winter and lowest at summer, while it is reversed for alkalinity.

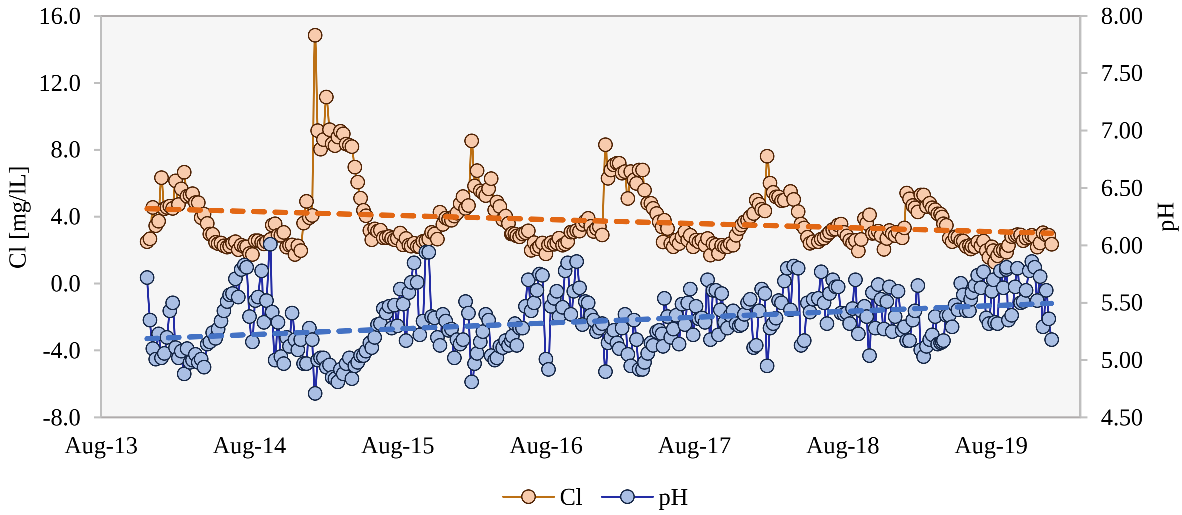

Figure 5.5 Comparative plot of Cl (y = -0.0007x + 31.912, r² = 0.06, p < 0.01, n = 322) and pH (y = 0.0001x - 0.5654, r² = 0.12, p < 0.01, n = 324) from 25.11.2013-30.12.2019 at Storåna upstream.

The Cl shows a decrease of 0.26 mg/l Cl per year. pH, on the other hand, shows an increase of 0.04 per year. A particular heavy sea salt episode occurred in January 2015 and resulted in a Cl value of 14.8 mg/l, which is the highest in this data set. On the same day, the pH measure was 4.71, making it the lowest in the dataset.

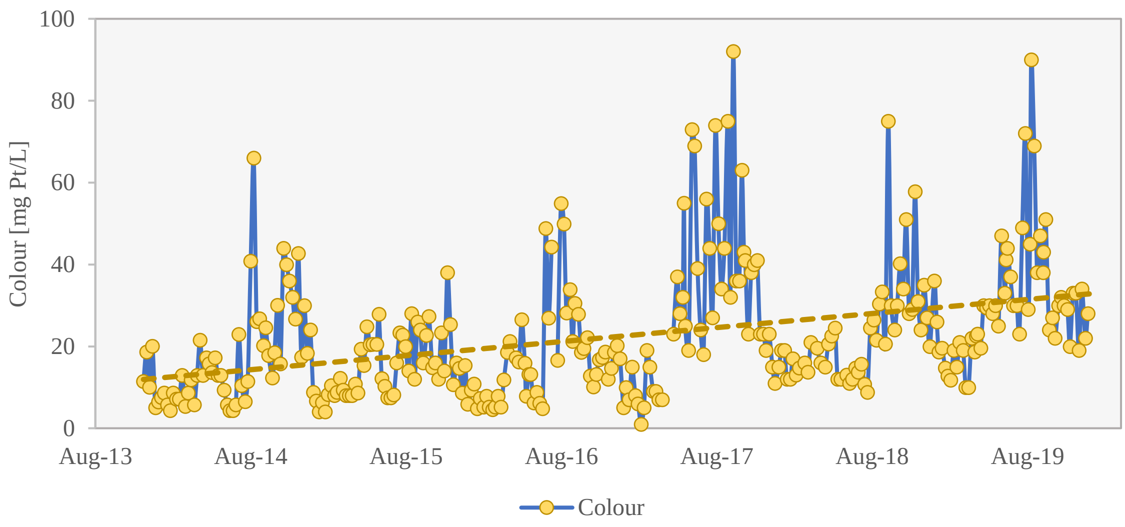

Figure 5.6 Plot of colour (y = 0.0094x – 378.9, r^2= 0.16, p < 0.001, n=316) over the time period 25.11.2013-23.12.2019 in Storåna upstream.

The figure shows a 3.43 increase in colour per year.

5.2 Lime doses in Bjordal

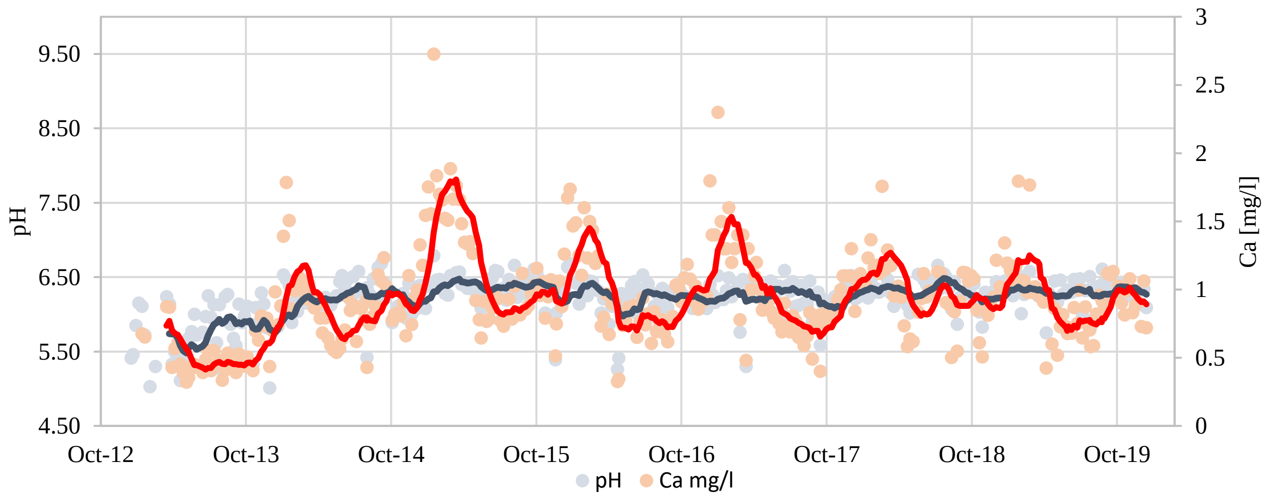

Figure 5.7: Moving average (period = 10) of Ca and pH at Vassbø from 02.01.2013-30.12.2019 (n = 366).

The pH can be considered stable (fig. 5.7). The Ca doses, on the other hand, shows a huge seasonal variation. Since the liming station started to operate in late November 2013, samples taken earlier have consequently low Ca and pH values.

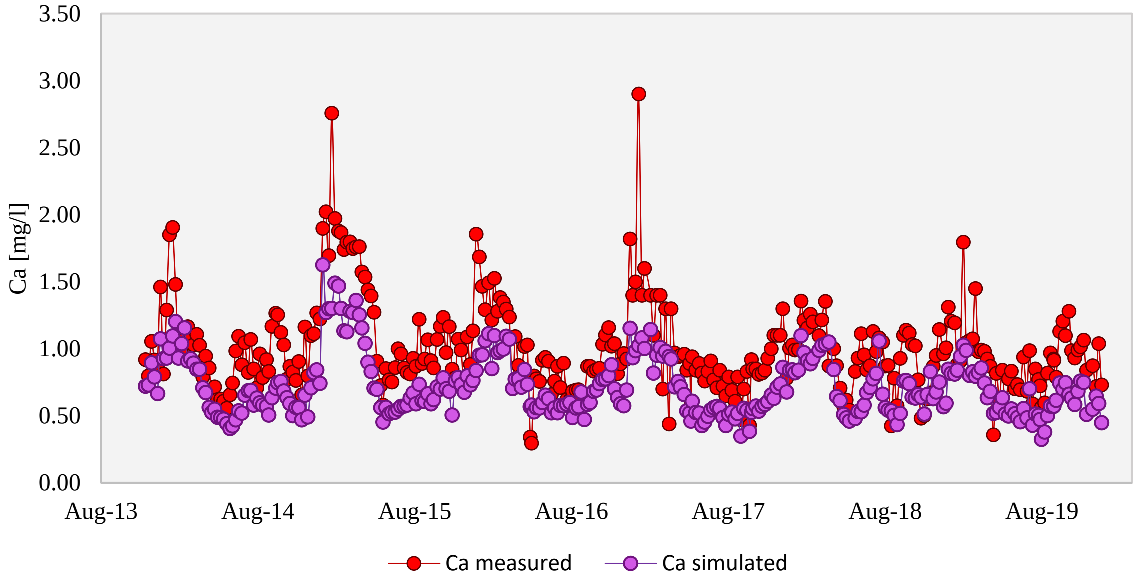

Figure 5.8 Plot of measured (Storåna downstream) and simulated Ca from between 25.11.2013-30.12.2019 (n = 319).

Ca measured downstream is higher than simulated, particularly during winter. In average Ca is 0.28 ± 0.21 mg/l, 39% higher than estimated.

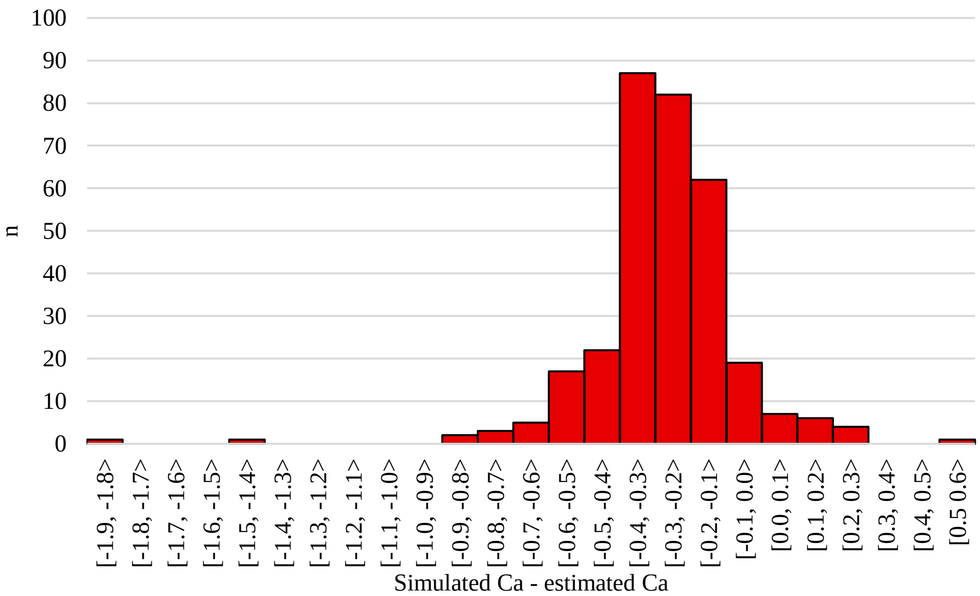

Figure 5.9 Difference between simulated and measured Ca at Storåna downstream (n = 319).

94% (301) of the days have a higher Ca measured than simulated (fig. 5.9).

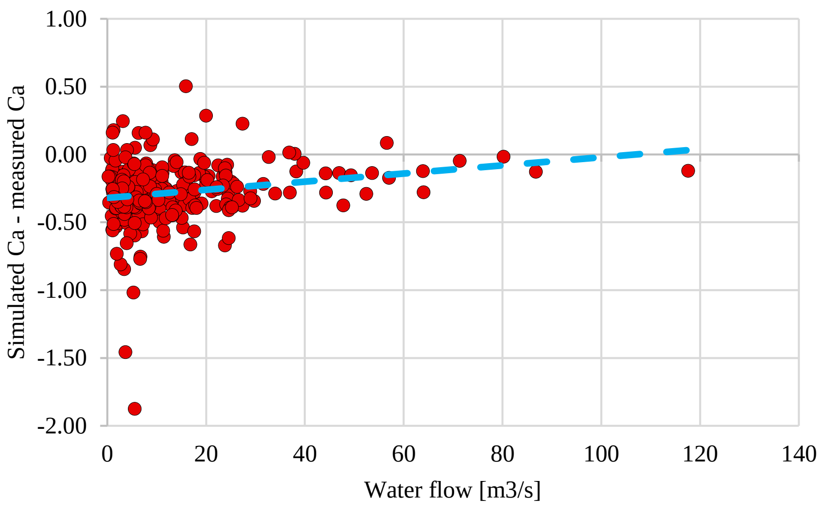

Figure 5.10 Difference between simulated and measured Ca at Storåna downstream ($r^2 = 0.04$, n = 319) against water flow.

A considerable spread of measurements independent of water flow (fig. 5.10) is seen. However, the most outlying plots are all found at low water flow. Difference between simulated and measured Ca is significantly dependent on water flow ($p < 0.001$). A water flow coefficient of 0.003 shows that Ca measured will decrease with 0.12 mg/l compared to the model in a scenario where flow increase from 10 m^3/s (normal water flow) to 50 m^3/s (more heavy flow).

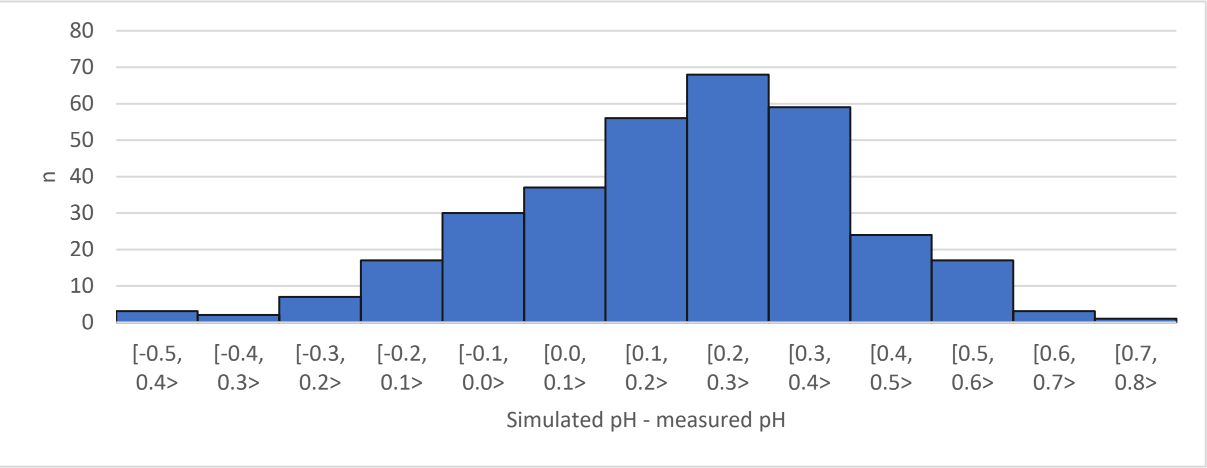

Figure 5.11 Difference between simulated and measured pH at Storåna upstream (n = 324), based on 2012 trend lines (Eq. 1 and Eq. 2).

Based on the preliminary trend lines (Eq. 1 and Eq. 2) found in 2012, the average difference between pH simulated and measured is 0.19 ± 0.21 (n = 324).

When the updated trend lines (Eq. 3 and Eq. 4) is used, the difference in pH simulated and measured is 0.00 ± 0.20 (n = 324). The new trend lines are also used to find new table values:

Table 5.1 Lime doses and conductivity, based on data from 2013-2019. Old values are found in parentheses.

Conductivity	**ALK_E**	**Δ**	**$CaCO_3$**
µS/cm	µeq/l	µeq/l	g/m^3
10	11 (20)	14 (5)	0.7 (0.2)
20	1 (6)	24 (19)	1.2 (0.9)
30	-4 (-1)	29 (26)	1,45 (1.3)
40	-8 (-7)	33 (32)	1.65 (1.6)
50	-11 (-11)	36 (36)	1.8 (1.8)

5.3 Bjordalbekken

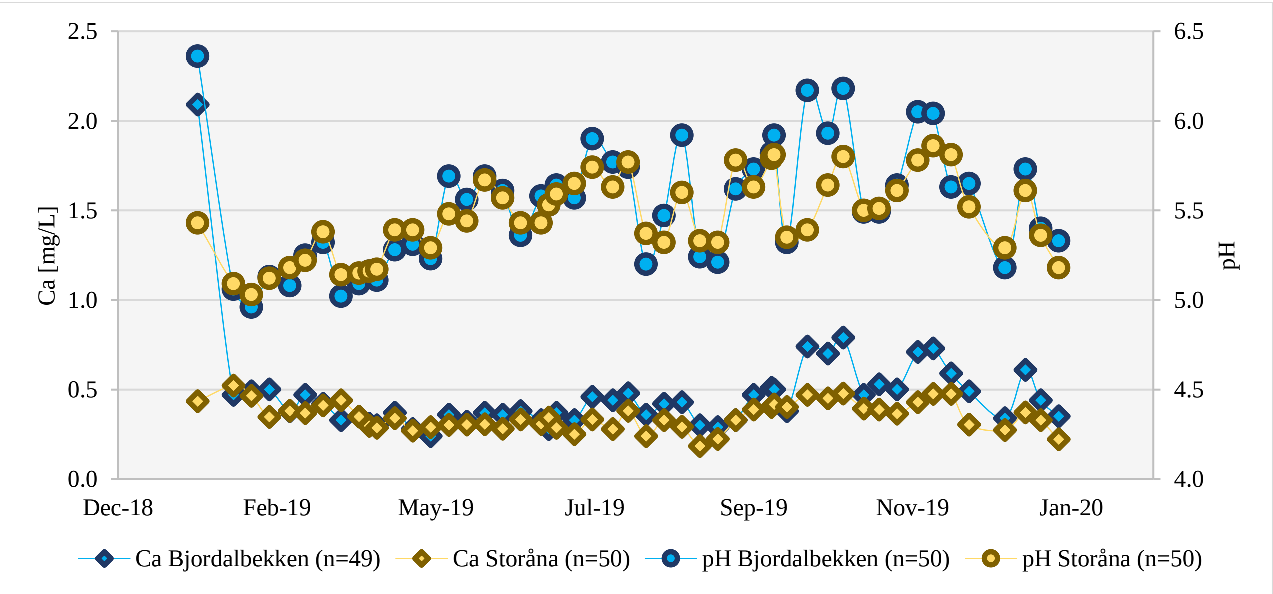

Figure 5.12 Ca and pH in Bjordalbekken and Bjordalåna

The pH in Bjordalbekken is in average 0.06 ± 0.21 higher than Storåna. The first measure of Ca and pH in Bjordalbekken is a high outlier (6 std). Regression on discrepancies between observed and simulated Ca-values did not show influence from Bjordalbekken ($p > 0.05$, $n = 47$) or water flow ($p > 0.05$, $n = 47$) based on data from 2019.

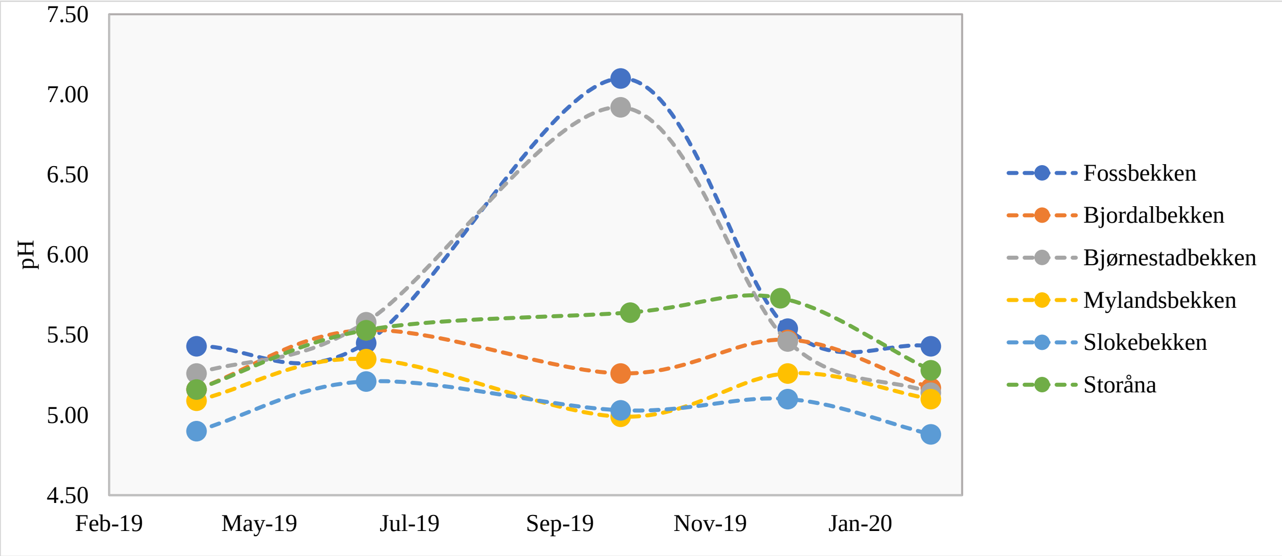

Figure 5.13 pH in the different rivers over the year (n = 5)

Most of the streams follow a relatively stable and similar trend in pH. Measures in October 2019 from Fossbekken and Bjordalbekken is not representative due to liming.

5.4 Comparison with Kvina liming station

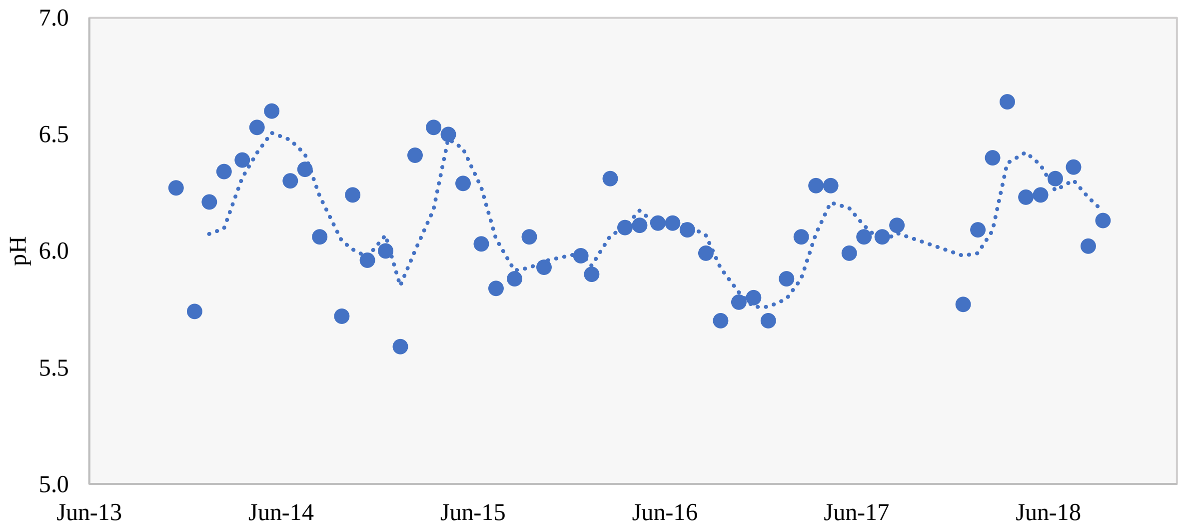

Figure 5.14 pH measurements in Kvina downstream Trælandsfoss after liming (Atle Hindar et al., 2014, 2015, 2016, 2017, 2018, 2019). Trend line; moving average (period = 3).

The pH downstream Kvina is seen to be around pH = 6 (fig. 5.14). There is a seasonal variation, and most of the samples with a low pH is taken in winter.

Table 5.2 pH of samples from Vassbø and Kvina downstream from 06.01.2014 to 01.10.2018. pH = 6.1 is the water quality objective for Vassbø, while Kvina has a seasonal variation. *Selection of weekly samples coinciding (maximum two days) with weekly samples in Kvina.

Location / Parameter	Vassbø	Vassbø*	Kvina
Number of samples (n)	250	54	54
Average pH	6.27	6.32	6.11
n with pH < 6	15 (6%)	2 (4%)	23 (43%)
n with pH < 5.5 (critical)	5 (2%)	0	0
n with pH < water quality objective	35 (14%)	3 (6%)	29 (54%)

The average pH downstream is lower in Kvina than for Vassbø (Table 5.2). During this period, zero samples from Kvina is below the critical value, while Vassbø has five. However, none of those five samples is included in the selection of coinciding weekly samples. 6% of the samples taken at Vassbø in this selected data set are below water quality objective. 54% of the samples from Kvina is below water quality objective.

6. Discussion

The study establishes that a conductivity-controlled lime doser can produce a stable pH regardless of the seasonal dynamic in water flow rate, pH upstream and the sea salt exposure. Discrepancies between simulated and observed Ca downstream were not explained by Ca in water from other tributaries on the stretch between the liming station and the sampling location.

6.1 Correlations and trends in Bjordal

The granite bedrock in the catchment area is slow weathering and provides little ions to the water, as demonstrated by low correlation ($r^2 = 0.44$) between Ca and conductivity (fig. 5.1c). Sea salts are assumed to constitute a major part of the ions in Bjordal. This assumption is supported by the correlations ($r^2 = 0.98$) with conductivity for both Cl (fig. 5.1a) and Na (fig. 5.1b). The high correlation between pH and conductivity (fig. 5.1d) is caused by the sea salt dynamic, where H^+ is mobilized due to ion exchange with Na^+. Sea salt concentrations rise during late autumn/winter due to increased wind. Heavy storms can cause episodes with extreme high sea salt concentrations, producing extremely low pH by ion exchange, as observed in 2015 (fig. 5.5).

pH has seasonal variations with an improving trend of a 0.037 pH increase in Bjordal per year (fig. 5.5), which is most likely due to reduced emissions of sulphur. The liming station started in 2013, and until 2019 there has been an approximate 0.2 pH increase of untreated waters. During the same period, an increase in colour is observed (fig. 5.6), affecting the improving trend of pH, due to the acidic properties of DOC (Erlandsson et al., 2010). The increase of DOC in Scandinavia is shown to be in proportion with the decrease concentrations of ions like sulphur and sea salt (Monteith et al., 2007). The comparative plot of conductivity and ALK_E (fig. 5.4) is similar to the comparative plot of Cl and pH (fig. 5.5), demonstrates the linear relation between Cl and conductivity (fig. 5.1a) and pH and ALK_E (fig. 5.2a). A sigmoidal curve represents the relationship between ALK_E and pH, with a linear area around pH 5-5.5.

Bjordal liming station gives variational doses over the year (fig. 5.7). The doses are usually more than doubled at winter compared to late summer when the doses are at its lowest. The pH, on the other hand, is relatively stable. Thus, the necessity of increased lime dose during winter to maintain a stable pH is well illustrated. A pH drop would occur during winter without the doses being increased. A strong correlation ($r^2 = 0.81$) between conductivity and LAl (fig. 5.3a) illustrates that the toxic aluminium is indirectly taken into consideration when dosing according to conductivity. LAl will have a steep increase if pH goes below 5.5 (fig. 5.3b), illustrating the critical value of pH 5.5. Critical low pH found downstream is due to technical problems unrelated to the control mechanism, like lime lumps, stones in the water pipe and other technical issues with the pumps (Enge, 2017, 2018, 2020).

The liming station is shown to give too high doses (fig. 5.8). 94% of the observations have a higher Ca than simulated (fig. 5.9). Even during the first full year of operation (Enge, 2015), a large proportion of the doses caused Ca downstream to be higher than predicted (fig. 5.8). Some outlier values found at relatively low water flow (fig. 5.10) can be explained by overdosing in winter due to effects of ice cover. Water flow is estimated based on the water level at the intake, and ice in the river profile could cause an increase in water level, despite stable water flow. However, since

Isolated, these unintentional higher lime doses are economically unfavourable. However, Ørsdalsvatnet, further downstream, was earlier limed by boat. When the liming station in Bjordal was planned, sufficient water quality in Ørsdalsvatnet was of concern. Despite liming in Bjordal, the pH downstream Ørsdalsvatnet has periodically been insufficient (Hellen, 2018). Therefore, extra lime is necessary to sustain suitable water chemistry in Ørsdalsvatnet. Furthermore, a certain decrease in the lime doses is found with increased water flow (fig. 5.10). A larger dose is consequently beneficial during episodes with high water flow as well.

The inlet of the liming station represents about 78% of the total flow at the outlet of Loni (Table 3.1). Since conductivity is measured at the intake, Bjordalbekken and smaller tributaries may explain some of the variations in Ca downstream Loni. Bjordalbekken constitutes 2/3 of the tributaries, and are influenced by lime from Stakkavatnet. Weekly samples have therefore been taken in search of an answer. The average pH and Ca in Bjordalbekken was found to be slightly higher than Storåna (fig. 5.12). A high outlier due to upstream liming was also seen in late January 2019. However, discrepancies between observed and simulated Ca-values could apparently not be explained by influence from Bjordalbekken ($p > 0.05$) or water flow ($p > 0.05$) based on data from 2019. On the other hand, water flow was found to have an influence on discrepancies between observed and simulated Ca-values ($p < 0.001$) when all years were taken into consideration (fig. 5.10). Given a more extensive data set, the possibility of discrepancies caused by influence from Bjordalbekken can therefore not be rejected. Mylandsbekken, Slokebekken and Bjørnestadbekken are believed to have a negligible effect on discrepancies in Ca downstream due to the small volumes and similar water quality as Storåna (fig. 5.13). Fossbekken is neither believed to have an effect on the Ca downstream du the too small volumes and similarities with Bjordalbekken.

pH upstream is systematically overestimated when using Eq. 1 and Eq. 2 (fig. 5.11). Eq. 3 and Eq. 4 includes all data (2013-2019) and gives a more precise estimation. The lime doses in the preliminary table 4.2 were therefore updated (Table 5.1). At low conductivity values, the lime doses are found to be higher than necessary. The estimated dose was similar at high conductivity (50µS/cm), which is when low-pH values are of most concern. It is conceivable that the smaller doses required at low conductivity values are partial explained by improved water quality over the recent years. However, a smaller dose at low conductivity may cause the frequency of insufficient water quality in Ørsdalsvatnet to decrease. Use of the new updated table values as a new control parameter would consequently be pure of economic interest.

6.2 Comparison with Kvina

Bjordal and Nyland are the only slurry dosing stations located in South-Western Norway, and the areas have comparable geology (NGU, 2020), acidification status, and weather. The Nyland station is controlled by pH, providing a pH around 6.1 (fig. 5.14).

When reviewing all samples from between 01.01.2014 and 01.10.2018, it was found that 6% (n = 250) of the samples in Bjordal and 30% (n = 54) from Nyland had a pH < 6 (Table 5.2). Bjordal is sampled once a week, while Nyland has a sampling frequency of once a month, giving a low possibility of detecting extreme values. As an example, a storm in December 2015 lead to a 50-year flood in Bjordal, and coincidental low pH values were seen. Data on this event in Kvina is none existing, as no samples were taken in December 2015. Due to different sampling frequency, the locations are best compared using coinciding weekly samples (maximum 2 days). Of those coinciding samples, Bjordal had 4% with a pH < 6 (Table 5.2), significantly lower than the 30% in Kvina.

However, the per cent of samples below the water quality objective had the most apparent difference. 6% (n = 54) of the coinciding samples from Vassbø is below water quality objective, while it was 54% (n = 54) downstream Kvina. Based on these number, Bjordal liming station has apparently a much better performance than Nyland liming station. The overall efficiency of the lime station at Nyland has been much lower than expected, but the cause is unknown (Atle Hindar, 2006).

Bjordal liming station has also proved its efficiency during sea salts episodes. An example was during the sea salt episode in 2015 when pH and LAl upstream were 4.71 and 104 µg/L, respectively, and added lime resulted in a downstream pH of 6.08 and LAL of 9 µg/L (Enge, 2016).

7. Conclusion

Bjordal liming station provides a stable pH with the use of conductivity as a control parameter. Even during the most significant storms, pH downstream has been sufficient. All incidents with a pH under critical value is caused by technical issues unrelated to the control mechanism. Compared to Nyland liming station, which is controlled by pH, Bjordal seems to be more reliable in attaining water quality objectives. Influence from Bjordalbekken could apparently not explain discrepancies between observed and simulated Ca. Ca downstream is found to be higher than anticipated due to systematic overdosing. Compared to the updated dose curve, the preliminarily curve applied today demonstrates the overdosing at low conductivity values. However, an update of the dose curve is likely to be unfortunate, as the water quality in Ørsdalsvatnet is periodically insufficient. The extra high dose acts as a safety barrier, and if the water quality is insufficient, high cost liming by boat may be necessary.

References

Abrahamsson, I. (1993). Impact of overflows on acid-base chemistry in limed lakes. *Vatten, 49(1)*, 4–33.

Aune, B. (1993). *Air temperature normals, normal period 1961-1990* (DNMI-Rapport 02/93 Klima). In Norwegian. Summary in English. Retrieved from: https://cms.met.no/site/2/klimaservicesenteret/Klimanormaler/_attachment/10911?_ts=159b2cddfb3

Brezonik, P. L., & Arnold, W. A. (2011). *Water chemistry: An introduction to the chemistry of natural and engineered aquatic systems.* Oxford University Press, New York.

Busenberg, E., & Plummer, L. N. (1987). *pH measurment of low-conductivity waters.* U.S. Geological Survey, Water Resources Invest. Report 87-4060.

Clair, T. A., & Hindar, A. (2005). Liming for the mitigation of acid rain effects in freshwaters: A review of recent results. *NRC Research Press*, 13, 91–128.

Eaton, A.D. (editor), Clesceri, L.S. (editor) and Greenberg, A.E (editor). (1995). *Standard Methods for the Examination of Water and Wastewater* (19.edt.). American Public Health Association, American Water Works Association & Water Environment Federation, Washington D.C.

Edmunds, W. M., & Coe, K. (1986). Geochemical aspects of acid rain. *Journal of the Geological Society, London, 143*, 619–620.

Encyclopedia Britannica. (n.d.). Koppen climate classification. Retrieved April 28, 2020, from https://www.britannica.com/science/Koppen-climate-classification

Enge, E. (2005). Kalking av innsjøer i øvre deler av Bjerkreimsvassdraget. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2012). Fiskeundersøkelser i Rogaland i 2011. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2013a). Fiskeundersøkelser i Rogaland i 2012. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2013b). Water chemistry and acidification recovery in Rogaland County. *VANN, 01-2013*, 78–88.

Enge, E. (2014). Fiskeundersøkelser i Rogaland—Summarisk rapport over undersøkelsene i 2013. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2015). Fiskeundersøkelser i Rogaland i 2014. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2016). Vannkjemisk og biologisk oppfølgning av kalking i østre deler av Bjerkreimsvassdraget i 2015. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2017). Vannkjemisk og biologisk oppfølgning av kalkingen i østre deler av Bjerkreimsvassdraget i 2016. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2018). Vannkjemisk og biologisk oppfølgning av kalkingen i østre deler av Bjerkreimsvassdraget i 2017. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2019). Vannkjemisk og biologisk oppfølgning av kalkingen i østre deler av Bjerkreimsvassdraget i 2018. Report to County Governor of Rogaland. In Norwegian.

Enge, E. (2020). (personal communiciation) University of Stavanger

Enge, E. (2020). Vannkjemisk oppfølgning av kalkingen i østre deler av Bjerkreimsvassdraget i 2019. Report to County Governor of Rogaland. In Norwegian.

Erlandsson, M., Cory, N., Köhler, S., & Bishop, K. (2010). Direct and indirect effects of increasing dissolved organic carbon levels on pH in lakes recovering from acidification. *Journal of Geophysical Research: Biogeosciences, 115(G3)*. https://doi.org/10.1029/2009JG001082

Førland, E. J. (1993). Precipitation normals, Normal period 1961-1990 (DNMI-Rapport 39/93 Klima) In Norwegian. Summary in English. Retrieved from: https://cms.met.no/site/2/klimaservicesenteret/Klimanormaler/_attachment/10912?_ts=159b2ce35a5

Garmo, Ø. A., Skjelkvåle, B. L., de Wit, H. A., Colombo, L., Curtis, C., Fölster, J., Hoffmann, A., Hruška, J., Høgåsen, T., Jeffries, D. S., Keller, W. B., Krám, P., Majer, V., Monteith, D. T., Paterson, A. M., Rogora, M., Rzychon, D., Steingruber, S., Stoddard, J. L., … Worsztynowicz, A. (2014). Trends in Surface Water Chemistry in Acidified Areas in Europe and North America from 1990 to 2008. *Water, Air, & Soil Pollution, 225(1880)*. https://doi.org/10.1007/s11270-014-1880-6

Hellen, B. A. (2018). 14. Bjerkreimsvassdraget. In *Kalking i laksevassdrag skadet av sur nedbør* (pp. 100–112). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/M1133/M1133.pdf

Henriksen, A. (1982). Alkalinity and acid precipitation research. *VATTEN, 38(1)*, 83–85.

Henrikson, L., & Brodin, Y. W. (1995). *Liming of Acidified Surface Waters: A Swedish Synthesis*. Springer, Berlin, Germany. http://dx.doi.org/10.1007/978-3-642-79309-7

Hindar, A., & Enge, E. (2006). *Sjøsaltepisoder under vinterstormene i 2005 - påvirkning og effekter på vannkjemi i vassdrag.* (NIVA-rapport;5114). In Norwegian. Retrieved from: https://niva.brage.unit.no/niva-xmlui/handle/11250/213002

Hindar, A., Henriksen, A., Kaste, Ø., & Tørseth, K. (1995). Extreme acidification in small catchments in southwestern Norway associated with a sea salt episode. *Water, Air, & Soil Pollution, 85(2)*, 547–552.https://doi.org/10.1007/BF00476886

Hindar, Atle. (2006). *Avsyringseffekt for ulike kalktyper i doseringsanlegg i Kvina og Lygna.* (NIVA-rapport;5224). In Norwegian. Retrieved from: https://niva.brage.unit.no/niva-xmlui/bitstream/handle/11250/213261/5224_200dpi.pdf?sequence=1&isAllowed=y

Hindar, Atle, Henriksen, A., Sandøy, S., & Romundstad, A. J. (1998). Critical Load Concept to Set Restoration Goals for Liming Acidified Norwegian Waters. Restoration Ecology, 6(4), 353–363. https://doi.org/10.1046/j.1526-100X.1998.06406.x

Hindar, Atle, Saksgård, R., & Fjellheim, A. (2014). 12. Kvinavassdraget. In *Kalking i laksevassdrag skadet av sur nedbør* (pp. 117–127). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/M208/M208.pdf

Hindar, Atle, Saksgård, R., & Fjellheim, A. (2015). 12. Kvinavassdraget. In *Kalking i laksevassdrag skadet av sur nedbør* (pp. 95–102). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/M412/M412.pdf

Hindar, Atle, Saksgård, R., & Fjellheim, A. (2016). 12. *Kvinavassdraget. In Kalking i laksevassdrag skadet av sur nedbør* (pp. 116–132). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/M582/M582.pdf

Hindar, Atle, Saksgård, R., & Halvorsen, G. A. (2017). 12. Kvinavassdraget. *In Kalking i laksevassdrag skadet av sur nedbør* (pp. 103–110). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/m821/m821.pdf

Hindar, Atle, Saksgård, R., & Halvorsen, G. A. (2018). 12. Kvinavassdraget. *In Kalking i laksevassdrag skadet av sur nedbør* (pp. 100–112). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/M1133/M1133.pdf

Hindar, Atle, Saksgård, R., & Velle, G. (2019). 12. Kvinavassdraget. In *Kalking i laksevassdrag skadet av sur nedbør* (pp. 134–142). Miljødirektoratet. In Norwegian. Retrieved from: https://www.miljodirektoratet.no/globalassets/publikasjoner/m1566/m1566.pdf

Hindar, Atle, Tørseth, K., Henriksen, A., & Orsolini, Y. (2004). The Significance of the North Atlantic Oscillation (NAO) for Sea-Salt Episodes and Acidification-Related Effects in Norwegian Rivers. *Environmental Science & Technology, 38(1)*, 26–33. https://doi.org/10.1021/es030065c

Høgberget, R. (2004). *Driftskontroll av kalkdoseringsanlegg i Mandalsvassdraget. Avviksrapport 2003*. (NIVA-rapport;4904). In Norwegian. Retrieved from: https://niva.brage.unit.no/niva-xmlui/handle/11250/212598

Jensen, K. W., & Snekvik, E. (1972). Low pH levels wipe out salmon and trout populations in southernmost Norway. *Ambio, 1*, 223–225.

Lien, L., Raddum, G. G., Fjellheim, A., & Henriksen, A. (1996). A critical limit for acid neutralizing capacity in Norwegian surface waters, based on new analyses of fish and invertebrate responses. *Science of The Total Environment, 177(1–3),* 173–193. https://doi.org/10.1016/0048-9697(95)04894-4

Monteith, D. T., Stoddard, J. L., Evans, C. D., de Wit, H. A., Forsius, M., Høgåsen, T., Wilander, A., Skjelkvåle, B. L., Jeffries, D. S., Vuorenmaa, J., Keller, B., Kopácek, J., & Vesely, J. (2007). Dissolved organic carbon trends resulting from changes in atmospheric deposition chemistry. Nature, 450(7169), 537–540 https://doi.org/10.1038/nature06316.

NGU (2020) Nasjonal berggrunnsdatabase Retrieved June 14, 2020, from http://geo.ngu.no/kart/berggrunn_mobil/

Norsk Standard 4722. (1973). Bestemmelse av fargetall. (1st ed.). *Norges Standardiseringsforbund (NSF).* In Norwegian.

NVE (2020a). NEVINA Nedbørfelt-Vannføring-Indeks-Analyse. Retrieved April 1, 2020, from http://nevina.nve.no/

NVE (2020b). Sildre. Retrieved February 1, 2020, from http://sildre.nve.no/sildre/

Olem, H. (1990). *Liming Acidic Surface Waters*. Lewis publishers, Chelsea, United States of America.

Rosseland, B. O., & Hindar, A. (1988). Liming of Lakes, Rivers and Catchments in Norway. In R. W. Brocksen & J. Wisniewski (Eds.), *Restoration of Aquatic and Terrestrial Systems* (pp. 165–188). Springer, Netherlands. https://doi.org/10.1007/978-94-009-2279-2_11

Rovik, S. (2020). *Stabiliteten til vannprøver over tid* (Bsc-thesis). Univeristy in Stavanger. In Norwegian.

Sandøy, S., & Romundstad, A. J. (1995). Liming of acidified lakes and rivers in Norway. *Water, Air, and Soil Pollution, 85(2),* 997–1002. https://doi.org/10.1007/BF00476960

Snoeyink, V. L., & Jenkins, D. (1980). *Water chemistry*. John Wiley & Sons, New York

Statens kartverk. (n.d.). Norgeskart. Retrieved April 3, 2020, from https://norgeskart.no/

Stølen, C., & Enge, E. (2019). Leakage water from rockfill dams and rock dumps – not always detrimental? *VANN, 2(2),* 77-87.

Traaen, T. S., Frogner, T., Hindar, A., Kleiven, E., Lande, E., & Wright, R. F. (1997). Whole-catchment liming at Tjønnstrond,Norway: An 11-year record. *Water: Air; and Soil Pollution, 94,* 163–180.

UNECE. (n.d.). Gothenburg Protocol. Retrieved December 3, 2019, from https://www.unece.org/environmental-policy/conventions/envlrtapwelcome/guidance-documents/gothenburg-protocol.html

Wang, P. (2005). Driftskontroll av kalkdoseringsanlegg i Kvina. (NIVA-rapport;5049). In Norwegian. Retrieved from: https://niva.brage.unit.no/niva-xmlui/bitstream/handle/11250/212874/5049_72dpi.pdf?sequence=1&isAllowed=y

Watt, W. D., Farmer, G. J., & White, W. J. (1984). Studies on the use of limestone to restore Atlantic salmon habitat in acidified rivers. *Lake and Reservoir Management, 1(1),* 374–379. https://doi.org/10.1080/07438148409354541

Wright, R. F., & Henriksen, A. (1978). Chemistry of small Norwegian lakes, with special reference to acid precipitation. *Limnology and Oceanography, 23(3),* 487–498. https://doi.org/10.4319/lo.1978.23.3.0487

Wright, R. F., & Snekvik, E. (1978). Acid precipitation: Chemistry and fish populations in 700 lakes in southernmost Norway. *SIL Proceedings, 1922-2010, 20(2),* 765–775. https://doi.org/10.1080/03680770.1977.11896597

Zannetti, P. (1990). Dry and Wet Deposition. In P. Zannetti (Ed.), *Air Pollution Modeling: Theories, Computational Methods and Available Software* (pp. 249–262). Springer, US. https://doi.org/10.1007/978-1-4757-4465-1_10

A Appendix A

Table 0.1 Chemical analysis

Sample location	Date	pH	Cond. µS/cm	Colour mg Pt/l	ALK_E µeq/l	Ca^{2+} mg/l
Bjordalbekken	28-Jan-19	6.36	28.6	22	50	2.09
Bjordalbekken	11-Feb-19	5.06	30.3	18	-5	0.47
Bjordalbekken	18-Feb-19	4.96	30.9	16	-5	0.49
Bjordalbekken	25-Feb-19	5.13	24.5	22	-1	0.50
Bjordalbekken	5-Mar-19	5.08	26.2	24	-1	0.38
Bjordalbekken	11-Mar-19	5.25	25.5	25	-6	0.47
Bjordalbekken	18-Mar-19	5.32	23.3	25	-5	0.42
Bjordalbekken	25-Mar-19	5.02	25.6	30	-9	0.33
Bjordalbekken	1-Apr-19	5.09	24.3	12	-3	
Bjordalbekken	5-Apr-19	5.16	23.1	23	-1	0.31
Bjordalbekken	8-Apr-19	5.11	21.6	33	-4	0.30
Bjordalbekken	15-Apr-19	5.28	21.4	21	1	0.37
Bjordalbekken	22-Apr-19	5.31	18.9	30	1	0.28
Bjordalbekken	29-Apr-19	5.23	15.5		-1	0.24
Bjordalbekken	6-May-19	5.69	15.8	34	7	0.36
Bjordalbekken	13-May-19	5.56	15.5	33	5	0.32
Bjordalbekken	20-May-19	5.69	14.2	25	6	0.37
Bjordalbekken	27-May-19	5.61	18.6	40	7	0.36
Bjordalbekken	3-Jun-19	5.36	16.1	67	6	0.38
Bjordalbekken	11-Jun-19	5.58	14.0	52	8	0.33
Bjordalbekken	14-Jun-19	5.53	13.3	69	9	0.28
Bjordalbekken	17-Jun-19	5.64	14.1	57	14	0.37
Bjordalbekken	24-Jun-19	5.57	13.5	61	13	0.33
Bjordalbekken	1-Jul-19	5.90	15.6	52	48	0.46
Bjordalbekken	9-Jul-19	5.77	15.3	51	18	0.44
Bjordalbekken	15-Jul-19	5.74	16.3	37	17	0.48
Bjordalbekken	22-Jul-19	5.20	14.2	78	52	0.36
Bjordalbekken	29-Jul-19	5.47	15.9	78	70	0.42
Bjordalbekken	5-Aug-19	5.92	14.2	40	15	0.43
Bjordalbekken	12-Aug-19	5.24	13.2	102	7	0.30
Bjordalbekken	19-Aug-19	5.21	13.5	96	7	0.29
Bjordalbekken	26-Aug-19	5.62	12.5	51	11	0.33
Bjordalbekken	2-Sep-19	5.73	14.2	55	13	0.47
Bjordalbekken	9-Sep-19	5.82	14.4	50	18	0.51
Bjordalbekken	10-Sep-19	5.92	13.0	53	19	0.50
Bjordalbekken	15-Sep-19	5.32	18.3	84	6	0.38
Bjordalbekken	23-Sep-19	6.17	16.5	34	26	0.74
Bjordalbekken	27-Sep-19	5.26	22.7	51	9	0.62
Bjordalbekken	1-Oct-19	5.93	16.7	35	13	0.70
Bjordalbekken	7-Oct-19	6.18	17.1	34	29	0.79
Bjordalbekken	15-Oct-19	5.49	17.1	49	11	0.47
Bjordalbekken	21-Oct-19	5.49	16.0	40	13	0.53

Table 0.1 continued

Sample location	**Date**	**pH**	**Cond.** μS/cm	**Colour** mg Pt/l	**ALK_E** μeq/l	**Ca^{2+}** mg/l
Bjordalbekken	28-Oct-19	5.64	16.1	43	14	0.50
Bjordalbekken	5-Nov-19	6.05	16.9	32	28	0.71
Bjordalbekken	11-Nov-19	6.04	17.7	29	27	0.73
Bjordalbekken	18-Nov-19	5.63	17.1	49	18	0.59
Bjordalbekken	25-Nov-19	5.65	14.9	40	13	0.49
Bjordalbekken	1-Dec-19	5.88	15.3	36	18	0.59
Bjordalbekken	5-Dec-19	5.47	16.3	56	12	0.42
Bjordalbekken	9-Dec-19	5.18	20.6		-1	0.34
Bjordalbekken	17-Dec-19	5.73	19.0	28	13	0.61
Bjordalbekken	23-Dec-19	5.40	18.0	31	8	0.44
Bjordalbekken	30-Dec-19	5.33	16.7		6	0.35
Bjordalbekken	6-Jan-20	5.23	21.1	28	0	0.43
Bjordalbekken	13-Jan-20	5.23	18.4	21	0	0.33
Bjordalbekken	20-Jan-20	5.28	22.8	23	6	
Bjordalbekken	27-Jan-20	5.04	20.3		0	
Bjordalbekken	2-Feb-20	5.17	19.5	26	-1	0.35

B Appendix B

Table 0.2 External data from Bjordal (Enge, 2012, 2013a, 2014, 2015, 2016, 2017, 2018, 2019, 2020)

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna upstream	25-Nov-13	5.72	15.0	11	11	0.48	2.5	1.5	41	
Storåna upstream	2-Dec-13	5.35	15.7	19	4	0.47	2.7	1.5	52	
Storåna upstream	9-Dec-13	5.10	23.4	10	-5	0.48	4.6	2.4	69	
Storåna upstream	16-Dec-13	5.01	19.5	20	-8	0.45	3.5	1.9	64	
Storåna upstream	23-Dec-13	5.23	20.3	5	-4	0.31	3.7	2.1	54	
Storåna upstream	30-Dec-13	5.02	31.1	6	-6	0.53	6.3	3.2	67	
Storåna upstream	6-Jan-14	5.06	24.2	8	-5	0.49	4.5	2.5	58	
Storåna upstream	13-Jan-14	5.20	24.7	9	-2	0.49	4.6	2.6	48	
Storåna upstream	20-Jan-14	5.43	24.3	6	1	0.57	4.6	2.6	42	
Storåna upstream	27-Jan-14	5.50	23.4	4	0	0.68	4.5	2.5	37	
Storåna upstream	3-Feb-14	5.11	31.8	9	-3	0.65	6.2	3.3	63	
Storåna upstream	10-Feb-14	5.02	26.7	7	-6	0.45	4.7	2.9	72	
Storåna upstream	17-Feb-14	5.08	28.0	7	-5	0.54	5.7	3.0	53	
Storåna upstream	24-Feb-14	4.88	33.5	13	-10	0.58	6.7	3.5	56	
Storåna upstream	3-Mar-14	5.10	26.7	5	-3	0.43	5.2	2.8	57	
Storåna upstream	10-Mar-14	4.98	27.3	9	-9	0.44	5.3	2.9	59	
Storåna upstream	17-Mar-14	5.00	27.7	12	-7	0.40	5.4	3.0	54	
Storåna upstream	24-Mar-14	5.05	25.9	6	-3	0.38	4.8	2.8	46	
Storåna upstream	31-Mar-14	4.98	26.0	13	-7	0.38	4.9	2.8	66	
Storåna upstream	7-Apr-14	5.01	23.0	22	-7	0.30	4.0	2.3	70	
Storåna upstream	14-Apr-14	4.94	24.7	13	-7	0.23	4.2	2.4	58	
Storåna upstream	22-Apr-14	5.14	20.5	17	-2	0.20	3.6	2.2	57	
Storåna upstream	28-Apr-14	5.16	17.8	16	-3	0.22	3.0	1.8	51	
Storåna upstream	5-May-14	5.24	17.4	14	-3	0.25	2.9	1.8	48	
Storåna upstream	12-May-14	5.19	15.4	17	-4	0.24	2.5	1.5	53	
Storåna upstream	19-May-14	5.27	14.6	13	-2	0.26	2.4	1.6	46	
Storåna upstream	26-May-14	5.34	14.3	13	2	0.26	2.4	1.5	40	
Storåna upstream	2-Jun-14	5.43	13.3	9	1	0.25	2.3	1.4	36	
Storåna upstream	10-Jun-14	5.51	12.6	6	3	0.24	2.2	1.4	30	
Storåna upstream	16-Jun-14	5.57	12.8	4	5	0.25	2.2	1.4	28	
Storåna upstream	23-Jun-14	5.58	14.0	4	4	0.26	2.4	1.5	13	
Storåna upstream	30-Jun-14	5.71	14.6	6	9	0.31	2.5	1.7	8	
Storåna upstream	7-Jul-14	5.55	13.5	23	11	0.32	2.0	1.4	70	
Storåna upstream	14-Jul-14	5.79	14.1	10	8	0.44	2.3	1.6	28	
Storåna upstream	22-Jul-14	5.83	14.5	7	12	0.46	2.2	1.6	26	
Storåna upstream	28-Jul-14	5.81	14.0	11	12	0.48	2.2	1.5	39	
Storåna upstream	4-Aug-14	5.38	13.2	41	7	0.39	1.8	1.4	89	
Storåna upstream	11-Aug-14	5.16	13.8	66	0	0.43	1.8	1.4	119	
Storåna upstream	18-Aug-14	5.52	15.0	26	6	0.36	2.6	1.7	72	
Storåna upstream	25-Aug-14	5.55	14.8	27	8	0.35	2.6	1.7	66	
Storåna upstream	3-Sep-14	5.78	14.2	20	11	0.36	2.5	1.6	52	

Table 0.2 Continued

Sample location	Date	pH	Cond. µS/cm	Colour mg Pt/l	ALK_E µeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al µg/l	LAl µg/l
Storåna upstream	8-Sep-14	5.33	14.4	25	0	0.28	2.4	1.5	70	
Storåna upstream	15-Sep-14	5.52	15.5	18	3	0.39	2.5	1.6	34	
Storåna upstream	24-Sep-14	6.01	15.6	12	17	0.45	2.6	1.7	36	
Storåna upstream	29-Sep-14	5.42	18.7	18	5	0.42	3.5	2.0	63	
Storåna upstream	6-Oct-14	5.00	21.4	30	-3	0.38	3.6	2.0	85	
Storåna upstream	13-Oct-14	5.33	17.5	16	3	0.39	2.9	1.8	58	
Storåna upstream	20-Oct-14	5.03	18.6	44	-1	0.31	2.9	1.9	85	
Storåna upstream	27-Oct-14	4.97	19.0	40	-5	0.26	3.1	1.9	75	
Storåna upstream	3-Nov-14	5.20	14.8	36	-1	0.27	2.2	1.5	60	
Storåna upstream	10-Nov-14	5.12	16.3	32	1	0.29	2.3	1.6	66	
Storåna upstream	17-Nov-14	5.41	14.9	27	3	0.33	2.3	1.6	53	
Storåna upstream	24-Nov-14	5.18	14.2	43	4	0.25	1.7	1.4	84	
Storåna upstream	1-Dec-14	5.09	17.2	17	0	0.36	2.3	1.6	51	
Storåna upstream	8-Dec-14	5.18	14.7	30	-2	0.26	2.0	1.5	72	
Storåna upstream	15-Dec-14	4.97	22.5	18	-7	0.31	3.6	2.2	70	
Storåna upstream	22-Dec-14	4.97	27.5	24	-10	0.33	4.9	2.7	64	
Storåna upstream	29-Dec-14	5.28	21.4	9	-1	0.46	4.0	2.2	58	
Storåna upstream	5-Jan-15	5.18	21.6	7	-1	0.36	4.1	2.3	44	14
Storåna upstream	12-Jan-15	4.71	67.9	4	-15	0.78	14.8	7.2	149	104
Storåna upstream	19-Jan-15	5.00	41.5	6	-8	0.61	9.2	4.8	86	50
Storåna upstream	26-Jan-15	5.02	38.3	4	-9	0.67	8.0	4.2	78	44
Storåna upstream	2-Feb-15	5.02	40.8	8	-6	0.65	8.6	4.7	84	50
Storåna upstream	9-Feb-15	4.94	51.0	10	-8	0.75	11.2	5.9	112	76
Storåna upstream	17-Feb-15	4.96	45.5	8	-4	0.78	9.2	5.0	96	63
Storåna upstream	23-Feb-15	4.85	43.2	9	-11	0.63	8.4	4.6	89	55
Storåna upstream	2-Mar-15	4.84	42.0	12	-13	0.47	8.3	4.6	99	56
Storåna upstream	9-Mar-15	4.81	45.1	9	-15	0.44	8.8	4.9	90	45
Storåna upstream	16-Mar-15	4.92	45.0	8	-13	0.59	9.1	5.0	103	63
Storåna upstream	23-Mar-15	4.88	44.4	8	-7	0.59	9.0	4.9	102	58
Storåna upstream	30-Mar-15	4.97	41.9	8	-4	0.70	8.3	4.7	94	54
Storåna upstream	7-Apr-15	5.02	40.2	11	-5	0.61	8.3	4.6	92	46
Storåna upstream	13-Apr-15	4.84	41.4	9	-9	0.50	8.2	4.7	92	45
Storåna upstream	20-Apr-15	4.95	36.1	19	-6	0.44	7.0	4.2	91	35
Storåna upstream	27-Apr-15	4.98	32.8	15	-5	0.34	6.1	3.7	82	25
Storåna upstream	4-May-15	5.04	28.5	25	-3	0.32	5.1	3.3	99	34
Storåna upstream	11-May-15	5.04	25.3	20	-2	0.25	4.4	2.8	71	22
Storåna upstream	18-May-15	5.08	22.6	21	-6	0.29	4.1	2.5	68	15
Storåna upstream	27-May-15	5.15	18.9	21	1	0.23	3.2	2.1	58	11
Storåna upstream	1-Jun-15	5.11	16.8	28	-6	0.17	2.6	1.8	63	12
Storåna upstream	8-Jun-15	5.20	19.5	12	-1	0.22	3.3	2.1	49	12
Storåna upstream	15-Jun-15	5.31	17.8	10	3	0.21	3.1	2.0	41	8
Storåna upstream	22-Jun-15	5.32	17.2	7	-1	0.24	3.2	2.0	38	12
Storåna upstream	29-Jun-15	5.45	15.6	7	2	0.27	2.7	1.8	31	13
Storåna upstream	6-Jul-15	5.41	15.8	8	-2	0.29	2.8	1.8	22	6
Storåna upstream	13-Jul-15	5.47	15.7	16	-1	0.32	2.8	1.8	43	10

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna upstream	20-Jul-15	5.28	15.9	23	-2	0.31	2.7	1.8	56	12
Storåna upstream	27-Jul-15	5.48	16.1	23	7	0.32	2.6	1.9	53	5
Storåna upstream	3-Aug-15	5.30	16.1	20	-2	0.37	2.7	1.9	57	11
Storåna upstream	10-Aug-15	5.62	15.7	14	8	0.42	3.0	1.9	42	8
Storåna upstream	17-Aug-15	5.49	14.3	28	13	0.37	2.3	1.6	64	15
Storåna upstream	24-Aug-15	5.17	18.2	12	-1	0.42	2.7	1.9	28	9
Storåna upstream	31-Aug-15	5.59	14.8	26	6	0.38	2.3	1.6	50	8
Storåna upstream	6-Sep-15	5.68	14.5	24	12	0.38	2.2	1.7	52	10
Storåna upstream	13-Sep-15	5.85	15.9	16	13	0.40	2.4	1.8	30	3
Storåna upstream	21-Sep-15	5.68	14.4	23	9	0.37	2.2	1.7	47	8
Storåna upstream	27-Sep-15	5.22	15.6	27	5	0.37	2.2	1.6	60	11
Storåna upstream	5-Oct-15	5.34	16.4	15	9	0.44	2.5	1.7	40	10
Storåna upstream	12-Oct-15	5.94	15.9	16	15	0.44	2.6	1.7	34	6
Storåna upstream	19-Oct-15	5.94	16.4	12	15	0.51	2.7	1.8	28	3
Storåna upstream	26-Oct-15	5.38	17.4	23	6	0.41	3.1	1.9	60	15
Storåna upstream	2-Nov-15	5.37	17.0	14	3	0.40	3.0	1.9	49	12
Storåna upstream	9-Nov-15	5.20	16.6	38	-3	0.23	2.7	1.7	69	12
Storåna upstream	16-Nov-15	5.13	23.8	25	-3	0.34	4.3	2.4	70	19
Storåna upstream	23-Nov-15	5.40	19.6	11	3	0.44	3.5	2.1	41	8
Storåna upstream	30-Nov-15	5.34	21.0	16	3	0.36	3.9	2.3	53	13
Storåna upstream	7-Dec-15	5.26	19.9	15	-3	0.33	3.9	2.2	41	5
Storåna upstream	14-Dec-15	5.27	20.5	9	-2	0.44	3.8	2.3	41	16
Storåna upstream	21-Dec-15	5.02	22.5	15	-6	0.33	4.0	2.3	49	16
Storåna upstream	27-Dec-15	5.18	22.1	6	-4	0.37	4.2	2.4	43	14
Storåna upstream	4-Jan-16	5.14	25.3	9	-6	0.38	4.8	2.6	48	21
Storåna upstream	11-Jan-16	5.18	26.1	11	-2	0.48	5.2	3.0	58	19
Storåna upstream	18-Jan-16	5.51	25.5	5	4	0.50	4.5	2.6	38	14
Storåna upstream	25-Jan-16	5.41	26.9	7	1	0.58	4.7	2.8	44	16
Storåna upstream	2-Feb-16	4.81	41.5	5	-15	0.45	8.5	4.4	84	57
Storåna upstream	9-Feb-16	4.97	29.1	8	-13	0.34	5.8	3.2	55	36
Storåna upstream	15-Feb-16	5.06	30.4	5	-12	0.56	6.8	3.7	61	32
Storåna upstream	23-Feb-16	5.16	27.9	5	-11	0.47	5.5	3.1	49	25
Storåna upstream	29-Feb-16	5.25	28.0	5	-9	0.49	5.4	3.1	49	27
Storåna upstream	7-Mar-16	5.40	28.2	8	-8	0.49	5.3	3.0	45	25
Storåna upstream	14-Mar-16	5.35	29.5	5	2	0.57	5.7	3.1	48	27
Storåna upstream	21-Mar-16	5.04	30.5	12	-2	0.53	6.3	3.5	76	37
Storåna upstream	29-Mar-16	5.00	23.9	19	1	0.28	4.4	2.8	68	25
Storåna upstream	4-Apr-16	5.02	25.8	21		0.31	4.9	2.8	73	23
Storåna upstream	11-Apr-16	5.12	24.0			0.34	4.6	2.6	63	16
Storåna upstream	18-Apr-16	5.11	22.6	17		0.31	3.8	2.5	57	12
Storåna upstream	25-Apr-16	5.17	23.7	16		0.42	4.0	2.5	64	35
Storåna upstream	2-May-16	5.13	22.3	27	-2	0.34	3.6	2.4	74	22
Storåna upstream	9-May-16	5.17	18.1	16	-5	0.26	3.0	1.9	54	24
Storåna upstream	12-May-16	5.21	18.1	8	-2	0.27	3.0	1.9	47	19
Storåna upstream	18-May-16	5.32	16.7	13	-3	0.25	3.0	1.8	48	18

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna upstream	23-May-16	5.13	17.8	13	-7	0.26	2.8	1.8	52	13
Storåna upstream	30-May-16	5.28	16.3	6	-5	0.29	2.8	1.7	34	12
Storåna upstream	6-Jun-16	5.28	16.7	9	-6	0.32	3.0	1.8	32	12
Storåna upstream	13-Jun-16	5.47	16.8	6	-6	0.37	3.1	1.9	22	7
Storåna upstream	20-Jun-16	5.70	17.4	5	8	0.33	3.2	2.0	22	7
Storåna upstream	27-Jun-16	5.43	14.5	49	7	0.30	2.0	1.6	93	18
Storåna upstream	4-Jul-16	5.50	14.8	27	5	0.33	2.5	1.7	63	15
Storåna upstream	11-Jul-16	5.61	13.8	44	12	0.32	2.1	1.6	80	18
Storåna upstream	18-Jul-16	5.75	14.4		20	0.36	2.2	1.7		
Storåna upstream	25-Jul-16	5.74	15.9	17	13	0.31	2.4	1.8	31	7
Storåna upstream	2-Aug-16	5.01	15.9	55	1	0.33	1.8	1.5	94	18
Storåna upstream	9-Aug-16	4.92	16.6	50	-6	0.32	2.3	1.5	81	15
Storåna upstream	15-Aug-16	5.47	14.5	28	5	0.26	2.5	1.6	60	13
Storåna upstream	23-Aug-16	5.54	14.6	34	9	0.33	2.4	1.6	77	16
Storåna upstream	29-Aug-16	5.60	14.8	21	9	0.34	2.4	1.6	46	11
Storåna upstream	4-Sep-16	5.38	14.9	31	4	0.44	2.7	1.6	74	22
Storåna upstream	12-Sep-16	5.46	13.8	28	5	0.27	2.3	1.5	60	18
Storåna upstream	19-Sep-16	5.78	14.5	19	6	0.36	2.4	1.6	42	11
Storåna upstream	25-Sep-16	5.85	14.7	19	11	0.37	2.5	1.5	52	14
Storåna upstream	3-Oct-16	5.40	19.6	22	-2	0.34	3.1	1.8	53	13
Storåna upstream	10-Oct-16	5.60	17.7	13	6	0.39	3.1	1.9	36	12
Storåna upstream	17-Oct-16	5.86	18.2	10	11	0.43	3.2	1.9	33	10
Storåna upstream	24-Oct-16	5.63	18.5	13	5	0.45	3.1	2.1	42	15
Storåna upstream	31-Oct-16	5.31	20.1	17	-3	0.42	3.5	2.2	55	21
Storåna upstream	7-Nov-16	5.51	20.1	17	4	0.45	3.7	2.4	53	18
Storåna upstream	14-Nov-16	5.50	22.8	19	1	0.47	3.9	2.4	61	16
Storåna upstream	21-Nov-16	5.39	18.5	12	2	0.38	3.4	2.1	51	18
Storåna upstream	28-Nov-16	5.35	18.1	15	-1	0.33	3.1	1.9	46	12
Storåna upstream	5-Dec-16	5.25	17.6	19	-3	0.29	3.3	1.9	57	17
Storåna upstream	12-Dec-16	5.28	17.2	20	-2	0.28	3.4	2.0	51	18
Storåna upstream	19-Dec-16	5.32	19.3	17	6	0.36	2.9	1.8	60	13
Storåna upstream	27-Dec-16	4.90	41.7	5	-7	0.49	8.3	4.5	85	41
Storåna upstream	2-Jan-17	5.15	31.0	10	-2	0.39	6.3	3.5	65	27
Storåna upstream	9-Jan-17	5.20	31.2	7	0	0.44	6.8	3.8	69	39
Storåna upstream	16-Jan-17	5.26	31.9	15	1	0.47	7.1	3.6	67	37
Storåna upstream	24-Jan-17	5.15	32.6	8	-3	0.52	7.2	3.9	65	36
Storåna upstream	30-Jan-17	5.10	35.1	6	-2	0.41	7.2	4.0	76	41
Storåna upstream	6-Feb-17	5.28	31.4	1	4	0.53	6.6	3.7	54	
Storåna upstream	13-Feb-17	5.40	32.7	5	3	0.58	6.7	3.8	57	30
Storåna upstream	20-Feb-17	5.05	27.3	19	-4	0.33	5.1	3.0	81	25
Storåna upstream	27-Feb-17	4.95	33.4	15	-10	0.38	6.7	3.7	84	40
Storåna upstream	7-Mar-17	5.35	30.8	9	2	0.47	6.2	3.6	61	31
Storåna upstream	13-Mar-17	5.18	30.4	9	-3	0.41	6.0	3.5	66	32
Storåna upstream	20-Mar-17	4.92	35.0	7	-12	0.39	6.8	3.9	70	39
Storåna upstream	28-Mar-17	4.92	34.3	7	-8	0.36	6.8	3.7	80	37

Table 0.2 Continued

Sample location	Date	pH	Cond. μS/cm	Colour mg Pt/l	ALK_E μeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al μg/l	LAl μg/l
Storåna upstream	2-Apr-17	4.98	28.8			0.41	5.6	3.1	69	32
Storåna upstream	10-Apr-17	5.06	24.8			0.27	4.8	2.7	54	22
Storåna upstream	18-Apr-17	5.15	24.3			0.32	4.8	2.7	51	22
Storåna upstream	23-Apr-17	5.13	23.8	23	-6	0.29	4.5	2.6	64	22
Storåna upstream	2-May-17	5.25	21.9	37	-2	0.27	4.2	2.5	60	22
Storåna upstream	8-May-17	5.26	19.8	28	-2	0.19	3.7	2.2	48	15
Storåna upstream	15-May-17	5.23	18.5	32	-7	0.20	3.4	2.1	51	15
Storåna upstream	18-May-17	5.12	15.9	55	0	0.20	2.5	1.7	68	
Storåna upstream	21-May-17	5.54	19.9	25	12	0.26	3.8	2.3	56	22
Storåna upstream	29-May-17	5.38	17.4	19	5	0.23	3.3	2.0	37	14
Storåna upstream	6-Jun-17	5.20	16.3	73	3	0.25	2.4	1.7	90	23
Storåna upstream	12-Jun-17	5.27	15.0	69	7	0.19	2.2	1.7	98	19
Storåna upstream	19-Jun-17	5.39	15.2	39	3	0.21	2.6	1.7	48	16
Storåna upstream	26-Jun-17	5.14	15.7	24	-1	0.24	2.4	1.8	65	21
Storåna upstream	3-Jul-17	5.49	16.5	18	7	0.27	2.8	1.9	58	18
Storåna upstream	10-Jul-17	5.31	18.1	56	5	0.25	3.1	2.1	78	25
Storåna upstream	17-Jul-17	5.50	15.1	44	9	0.33	2.6	1.8	55	13
Storåna upstream	24-Jul-17	5.62	15.7	27	7	0.30	2.9	1.9	32	7
Storåna upstream	31-Jul-17	5.22	14.2	74	5	0.27	2.2	1.6	86	11
Storåna upstream	7-Aug-17	5.47	14.6	50	4	0.20	2.6	1.7	58	17
Storåna upstream	14-Aug-17	5.36	14.7	34	8	0.28	2.5	1.7	45	10
Storåna upstream	21-Aug-17	5.37	14.6	44	4	0.30	2.6	1.8	55	9
Storåna upstream	29-Aug-17	5.33	14.6	75	9	0.25	2.3	1.8	78	
Storåna upstream	4-Sep-17	5.70	14.6	32	13	0.29	2.7	1.8	40	11
Storåna upstream	11-Sep-17	5.18	13.2	92	-7	0.16	1.7	1.5	87	18
Storåna upstream	18-Sep-17	5.61	14.2	36	0	0.34	2.4	1.6	37	8
Storåna upstream	25-Sep-17	5.61	13.7	36	13	0.34	2.3	1.6	42	16
Storåna upstream	1-Oct-17	5.22	11.5	63	7	0.25	1.8	1.3	59	21
Storåna upstream	6-Oct-17	5.44	13.8	43	8	0.32			43	
Storåna upstream	9-Oct-17	5.58	14.1	41	8	0.34	2.3	1.6	36	
Storåna upstream	16-Oct-17	5.33	14.1	23	7	0.36	2.2	1.6	39	
Storåna upstream	23-Oct-17	5.28	13.8	38	6	0.33	2.2	1.5	45	
Storåna upstream	30-Oct-17	5.39	14.0	40	5	0.36	2.4	1.6	41	13
Storåna upstream	6-Nov-17	5.43	14.9	41	9	0.35	2.3	1.5	42	<5
Storåna upstream	13-Nov-17	5.32	15.3	23	5	0.36	2.9	1.6	40	14
Storåna upstream	21-Nov-17	5.30	17.4	23	5	0.36	3.3	1.9	33	8
Storåna upstream	27-Nov-17	5.31	18.0	19	0	0.32	3.5	1.9	41	10
Storåna upstream	4-Dec-17	5.40	19.2	23	2	0.38	3.7	2.1	42	18
Storåna upstream	12-Dec-17	5.50	19.9	15	7	0.39	3.8	2.2	35	13
Storåna upstream	18-Dec-17	5.53	20.0	11	2	0.51	4.0	2.3	29	10
Storåna upstream	27-Dec-17	5.11	22.3	15	-2	0.28	4.2	2.4	32	19
Storåna upstream	2-Jan-18	5.13	24.9	19	-3	0.39	5.0	2.7	39	19
Storåna upstream	9-Jan-18	5.43	23.2	19	2	0.43	4.8	2.7	31	15
Storåna upstream	15-Jan-18	5.62	22.5	12	6	0.42	4.4	2.6	30	11
Storåna upstream	23-Jan-18	5.58	21.7	12	6	0.45	4.3	2.5	27	18

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna upstream	29-Jan-18	4.95	37.0	17	-10	0.49	7.6	4.0	54	22
Storåna upstream	5-Feb-18	5.28	28.8	13	-2	0.46	6.0	3.3	41	23
Storåna upstream	13-Feb-18	5.32	26.3	15	0	0.44	5.5	3.0	34	15
Storåna upstream	20-Feb-18	5.37	24.9		3	0.44	5.2	2.9		
Storåna upstream	26-Feb-18	5.52	25.4	16	6	0.47	5.2	2.9	35	14
Storåna upstream	5-Mar-18	5.50	24.8	14	5	0.48	5.0	2.8	30	15
Storåna upstream	12-Mar-18	5.69	24.5	21	8	0.55	5.0	2.8	36	16
Storåna upstream	19-Mar-18	5.80	24.6			0.59				
Storåna upstream	27-Mar-18	5.44	27.8	20	6	0.54	5.5	3.1	55	
Storåna upstream	4-Apr-18	5.82	25.4	16	23	0.59	5.0	2.9	36	18
Storåna upstream	15-Apr-18	5.80	25.7	15	20	0.38	4.3	2.7	36	15
Storåna upstream	22-Apr-18	5.13	21.1	21	-2	0.27	3.6	2.3	45	
Storåna upstream	30-Apr-18	5.17	18.7	23	-2	0.29	3.3	2.0	44	
Storåna upstream	8-May-18	5.50	16.1	25	7	0.25	2.8	1.8	37	
Storåna upstream	14-May-18	5.42	14.2	12	7	0.27	2.4	1.5	39	19
Storåna upstream	22-May-18	5.53	14.2	12	1	0.24	2.5	1.6	38	18
Storåna upstream	4-Jun-18	5.54	14.1	13	10	0.27	2.5	1.5	38	17
Storåna upstream	11-Jun-18	5.77	15.2	11	9	0.29	2.7	1.7	33	15
Storåna upstream	18-Jun-18	5.50	15.3	12	-2	0.29	2.7	1.7	39	17
Storåna upstream	25-Jun-18	5.32	16.5	15	2	0.30	2.9	1.8	24	10
Storåna upstream	1-Jul-18	5.58	17.3	14	5	0.38	3.1	1.9	16	6
Storåna upstream	9-Jul-18	5.70	19.4	16	8	0.37	3.2	2.1	15	8
Storåna upstream	16-Jul-18	5.64	20.0	11	6	0.42	3.3	2.2	18	10
Storåna upstream	23-Jul-18	5.64	20.9	9	7	0.45	***3.5***	2.3	15	5
Storåna upstream	30-Jul-18	5.41	23.6	25	7	0.63	3.6	2.4	23	11
Storåna upstream	7-Aug-18	5.40	17.9	26	5	0.35	3.1	2.0	42	7
Storåna upstream	13-Aug-18	5.41	16.2	22	4	0.29	2.9	1.8	29	9
Storåna upstream	20-Aug-18	5.32	15.6	30	0	0.29	2.6	1.7	48	12
Storåna upstream	27-Aug-18	5.45	15.4	33	2	0.29	2.4	1.7	49	15
Storåna upstream	3-Sep-18	5.70	15.2	21	4	0.26	2.6	1.7	41	13
Storåna upstream	10-Sep-18	5.23	13.2	75	3	0.25	1.9	1.5	63	8
Storåna upstream	17-Sep-18	5.43	15.3	30	4	0.27	2.6	1.7	49	25
Storåna upstream	25-Sep-18	5.47	19.1	24	2	0.43	3.9	2.1	45	16
Storåna upstream	1-Oct-18	5.38	19.4	30	6	0.43	3.6	2.1	50	15
Storåna upstream	8-Oct-18	5.04	21.2	40	-5	0.37	4.1	2.2	73	18
Storåna upstream	15-Oct-18	5.59	16.3	34	9	0.37	3.0	1.9	49	11
Storåna upstream	22-Oct-18	5.28	17.9	51	4	0.33	3.0	2.0	63	17
Storåna upstream	29-Oct-18	5.66	16.9	28	7	0.37	3.1	2.0	42	13
Storåna upstream	5-Nov-18	5.53	16.9	29	3	0.35	2.9	1.8	48	16
Storåna upstream	12-Nov-18	5.27	14.7	58	0	0.28	2.0	1.5	70	20
Storåna upstream	19-Nov-18	5.51	16.1	31	7	0.39	2.7	1.8	44	15
Storåna upstream	26-Nov-18	5.64	18.5	24	7	0.51	3.2	2.1	40	13
Storåna upstream	3-Dec-18	5.25	17.3	35	0	0.33	3.0	1.8	52	22
Storåna upstream	10-Dec-18	5.38	17.5	27	3	0.38	2.9	1.9	48	17
Storåna upstream	17-Dec-18	5.60	17.9	20	8	0.44	3.1	2.0	43	19

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna upstream	27-Dec-18	5.26	17.0	36	0	0.28	2.7	1.9	64	21
Storåna upstream	2-Jan-19	5.29	17.1	26	-1	0.30	3.3	1.9	54	
Storåna upstream	7-Jan-19	5.17	26.2	19	-4	0.38	5.4	2.8	63	31
Storåna upstream	14-Jan-19	5.17	24.1	20	-4	0.38	5.1	2.7	59	31
Storåna upstream	22-Jan-19	5.35	22.3	15	1	0.41	4.7	2.5	42	24
Storåna upstream	28-Jan-19	5.43	22.6	13	2	0.44	4.5	2.5	34	15
Storåna upstream	4-Feb-19	5.65	22.5	12	6	0.54	4.3	2.4	35	17
Storåna upstream	11-Feb-19	5.09	28.2	19	-4	0.52	5.3	3.0	59	30
Storåna upstream	18-Feb-19	5.03	29.5	15	-4	0.47	5.3	3.0	72	41
Storåna upstream	25-Feb-19	5.12	25.3	21	-5	0.35	4.6	2.6	71	32
Storåna upstream	5-Mar-19	5.18	24.8	19	-4	0.38	4.8	2.8	58	28
Storåna upstream	11-Mar-19	5.22	23.8	10	-7	0.37	4.5	2.7	55	25
Storåna upstream	18-Mar-19	5.38	23.1	10	-5	0.41	4.4	2.6	60	24
Storåna upstream	25-Mar-19	5.14	23.3	22	-9	0.44	4.2	2.5	59	26
Storåna upstream	1-Apr-19	5.15	22.2	19	-3	0.35	4.2	2.4	55	27
Storåna upstream	5-Apr-19	5.16	21.0	23	-4	0.30	4.0	2.4	69	30
Storåna upstream	8-Apr-19	5.17	19.8	23	-4	0.29	3.6	2.2	62	25
Storåna upstream	15-Apr-19	5.39	19.6	20	2	0.34	3.5	2.2	55	21
Storåna upstream	22-Apr-19	5.39	15.4	30	-1	0.27	2.7	1.9	55	29
Storåna upstream	29-Apr-19	5.29	14.9	29	1	0.29	2.5	1.6	50	17
Storåna upstream	6-May-19	5.48	15.9	30	1	0.30	2.8	1.7	52	17
Storåna upstream	13-May-19	5.44	19.0	28	0	0.31	2.8	1.7	32	11
Storåna upstream	20-May-19	5.67	13.9	30	1	0.31	2.6	1.6	32	11
Storåna upstream	27-May-19	5.57	14.3	25	4	0.28	2.6	1.6	48	7
Storåna upstream	3-Jun-19	5.43	14.3	47	2	0.33	2.2	1.6	65	11
Storåna upstream	11-Jun-19	5.43	13.9	33	3	0.31	2.3	1.6	49	19
Storåna upstream	14-Jun-19	5.53	13.2	41	9	0.34	2.1	1.6	55	15
Storåna upstream	17-Jun-19	5.59	13.7	44	8	0.29	2.2	1.6	53	20
Storåna upstream	24-Jun-19	5.65	13.8	37	11	0.25	2.2	1.6	50	12
Storåna upstream	1-Jul-19	5.74	14.4	30	10	0.33	2.5	1.7	33	6
Storåna upstream	9-Jul-19	5.63	13.8	30	10	0.28	2.3	1.6	44	
Storåna upstream	15-Jul-19	5.77	18.5	23	12	0.38	2.6	1.8	25	
Storåna upstream	22-Jul-19	5.37	13.3	49	10	0.24	2.0	1.5		
Storåna upstream	29-Jul-19	5.32	13.1	72	12	0.33	1.6	1.3	78	
Storåna upstream	5-Aug-19	5.60	14.0	29	10	0.29	2.2	1.6		
Storåna upstream	9-Aug-19	5.70	12.7	45	13	0.30	2.0	1.5	57	7
Storåna upstream	12-Aug-19	5.33	11.7	90	5	0.19	1.3	1.2	91	23
Storåna upstream	19-Aug-19	5.32	12.2	69	4	0.22	1.7	1.3	80	14
Storåna upstream	26-Aug-19	5.78	12.7	38	14	0.33	2.0	1.4	50	8
Storåna upstream	2-Sep-19	5.63	13.1	47	11	0.39	2.0	1.5	56	23
Storåna upstream	9-Sep-19	5.79	12.6	38	14	0.40	2.0	1.4	45	12
Storåna upstream	10-Sep-19	5.81	12.2	43	14	0.42	1.9	1.4	54	18
Storåna upstream	15-Sep-19	5.35	14.1	51	6	0.40	2.3	1.6	71	16
Storåna upstream	23-Sep-19	5.39	16.4	24	10	0.47	2.8	1.8	36	13
Storåna upstream	1-Oct-19	5.64	15.4	27	10	0.45	2.9	1.8	42	

Table 0.2 Continued

Sample location	Date	pH	Cond. µS/cm	Colour mg Pt/l	ALK_E µeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al µg/l	LAl µg/l
Storåna upstream	7-Oct-19	5.80	16.3	22	12	0.48	2.9	1.8	37	9
Storåna upstream	15-Oct-19	5.50	16.2	30	6	0.39	2.9	1.7	49	9
Storåna upstream	21-Oct-19	5.51	15.3	32	7	0.39	2.6	1.7	51	10
Storåna upstream	28-Oct-19	5.61	14.4	30	8	0.36	2.7	1.7	55	15
Storåna upstream	5-Nov-19	5.78	15.6	29	13	0.43	2.8	1.8	37	11
Storåna upstream	11-Nov-19	5.86	16.9	20	18	0.48	2.9	1.9	30	6
Storåna upstream	18-Nov-19	5.81	16.5	33	17	0.48	2.8	1.9	46	11
Storåna upstream	25-Nov-19	5.52	13.8	33	5	0.30	2.2	1.6	62	13
Storåna upstream	2-Dec-19	5.73	14.7	19	11	0.39	2.4	1.8	40	11
Storåna upstream	9-Dec-19	5.29	16.5	34	1	0.27	3.1	1.8	54	10
Storåna upstream	17-Dec-19	5.61	16.5	22	8	0.37	2.9	1.7	51	
Storåna upstream	23-Dec-19	5.36	16.0	28	4	0.33	2.9	1.7	59	13
Storåna upstream	30-Dec-19	5.18	14.6		1	0.22	2.4	1.6	52	13
Storåna upstream*	02-Feb-20*	5.28*								
Storåna downstream	25-Nov-13	6.34	17.5	13	36	0.92	2.6	1.6	33	
Storåna downstream	2-Dec-13	6.23	17.4	20	28	0.80	2.8	1.6	45	
Storåna downstream	9-Dec-13	6.24	25.2	17	31	1.06	4.9	2.4	50	
Storåna downstream	16-Dec-13	6.30	20.3	22	29	0.92	3.7	2.0	56	
Storåna downstream	23-Dec-13	6.35	22.2	9	33	0.89	3.9	2.2	31	
Storåna downstream	30-Dec-13	6.40	34.1	7	41	1.46	7.0	3.4	40	
Storåna downstream	6-Jan-14	6.18	22.4	25	27	0.81	3.9	2.3	53	
Storåna downstream	13-Jan-14	6.50	27.1	11	47	1.29	4.6	2.6	40	
Storåna downstream	20-Jan-14	6.75	29.7	9	79	1.85	4.5	2.6	25	
Storåna downstream	27-Jan-14	6.60	29.3	5	74	1.90	4.5	2.5	24	
Storåna downstream	3-Feb-14	6.42	33.7	11	42	1.48	6.2	3.3	48	
Storåna downstream	10-Feb-14	6.16	26.5	13	26	0.97	4.8	2.8	49	
Storåna downstream	17-Feb-14	6.17	29.0	11	27	0.97	6.0	3.1	33	
Storåna downstream	24-Feb-14	6.15	31.5	14	24	1.07	6.5	3.4	41	
Storåna downstream	3-Mar-14	6.35	27.7	9	36	1.16	5.2	2.9	40	
Storåna downstream	10-Mar-14	6.24	27.1	12	31	1.08	5.2	2.8	53	
Storåna downstream	17-Mar-14	6.20	26.3	13	27	1.03	5.1	2.9	32	
Storåna downstream	24-Mar-14	6.33	25.9	9	34	1.11	4.8	2.7	24	
Storåna downstream	31-Mar-14	6.12	25.5	13	25	1.03	4.8	2.8	47	
Storåna downstream	7-Apr-14	6.13	22.4	26	26	0.79	3.9	2.4	56	
Storåna downstream	14-Apr-14	6.21	22.9	14	27	0.95	4.3	2.5	46	
Storåna downstream	22-Apr-14	6.21	19.9	22	27	0.86	3.6	2.1	48	
Storåna downstream	28-Apr-14	6.15	17.3	19	25	0.69	2.9	1.8	40	
Storåna downstream	5-May-14	6.17	18.1	17	24	0.72	3.1	1.9	37	
Storåna downstream	12-May-14	6.12	15.3	22	22	0.62	2.5	1.6	44	
Storåna downstream	19-May-14	6.07	14.2	14	20	0.63	2.3	1.5	37	
Storåna downstream	26-May-14	6.10	14.4	17	23	0.61	2.3	1.5	32	
Storåna downstream	2-Jun-14	6.15	13.4	14	19	0.56	2.2	1.4	31	
Storåna downstream	10-Jun-14	6.32	14.2	9	26	0.66	2.3	1.5	23	
Storåna downstream	16-Jun-14	6.42	16.0	9	40	0.74	2.6	1.6	20	
Storåna downstream	23-Jun-14	6.30	17.0	4	46	0.98	2.6	1.6	8	

Table 0.2 Continued										
Sample location	**Date**	**pH**	**Cond.**	**Colour**	**ALK_E**	**Ca^{2+}**	**Cl^-**	**Na^+**	**Al**	**LAl**
			µS/cm	**mg Pt/l**	**µeq/l**	**mg/l**	**mg/l**	**mg/l**	**µg/l**	**µg/l**
Storåna downstream	30-Jun-14	6.38	18.3	6	51	1.09	2.7	1.7	14	
Storåna downstream	7-Jul-14	6.29	15.7	27	35	0.88	2.0	1.4	56	
Storåna downstream	14-Jul-14	6.36	17.7	15	46	1.05	2.4	1.6	19	
Storåna downstream	22-Jul-14	6.11	17.1	8	32	0.82	2.4	1.7	27	
Storåna downstream	28-Jul-14	6.37	18.0	17	48	1.07	2.4	1.6	38	
Storåna downstream	4-Aug-14	6.02	14.5	59	31	0.85	1.7	1.4	97	
Storåna downstream	11-Aug-14	5.73	17.3	66	22	0.71	2.5	1.9	122	
Storåna downstream	18-Aug-14	6.31	17.1	30	38	0.96	2.7	1.7	62	
Storåna downstream	25-Aug-14	6.26	16.4	31	32	0.79	2.6	1.7	58	
Storåna downstream	3-Sep-14	6.38	17.1	24	42	0.92	2.6	1.7	44	
Storåna downstream	8-Sep-14	6.18	15.9	29	33	0.83	2.4	1.6	69	
Storåna downstream	15-Sep-14	6.53	18.7	21	49	1.17	2.6	1.7	26	
Storåna downstream	24-Sep-14	6.50	20.6	16	58	1.27	2.8	1.9	32	
Storåna downstream	29-Sep-14	6.39	22.4	24	45	1.25	3.7	2.1	51	
Storåna downstream	6-Oct-14	6.23	22.5	38	34	1.12	3.9	2.2	73	
Storåna downstream	13-Oct-14	6.33	19.9	22	38	1.03	3.1	1.9	47	
Storåna downstream	20-Oct-14	5.71	19.0	48	22	0.77	3.0	1.9	71	
Storåna downstream	27-Oct-14	6.07	18.7	47	25	0.87	3.1	1.9	63	
Storåna downstream	3-Nov-14	6.14	15.1	43	25	0.83	2.0	1.5	63	
Storåna downstream	10-Nov-14	6.10	16.6	37	27	0.76	2.6	1.7	59	
Storåna downstream	17-Nov-14	6.30	17.0	28	35	0.90	2.5	1.7	40	
Storåna downstream	24-Nov-14	5.98	14.0	49	26	0.66	1.7	1.5	81	
Storåna downstream	1-Dec-14	6.47	18.7	21	50	1.16	2.4	1.7	33	
Storåna downstream	8-Dec-14	6.07	15.1	35	28	0.80	2.0	1.5	70	
Storåna downstream	15-Dec-14	6.20	23.4	21	30	1.10	4.0	2.3	50	
Storåna downstream	22-Dec-14	5.99	27.2	20	25	1.11	5.1	2.8	54	
Storåna downstream	29-Dec-14	6.33	24.6	9	46	1.27	4.2	2.4	46	
Storåna downstream	5-Jan-15	6.37	22.7	8	37	1.22	4.2	2.3	35	
Storåna downstream	12-Jan-15	6.21	54.9	8	36	1.90	12.7	5.9	68	
Storåna downstream	19-Jan-15	6.57	46.2	9	70	2.02	9.4	4.8	42	
Storåna downstream	26-Jan-15	6.49	38.4	7	51	1.70	7.5	3.9	40	
Storåna downstream	2-Feb-15	6.72	48.0	12	99	2.76	8.8	4.4	50	
Storåna downstream	9-Feb-15	6.44	49.2	10	52	1.97	10.1	5.2	52	
Storåna downstream	17-Feb-15	6.30	46.4	8	50	1.88	9.0	4.9	40	
Storåna downstream	23-Feb-15	6.49	42.1	10	50	1.87	8.1	4.6	44	
Storåna downstream	2-Mar-15	6.37	41.1	14	45	1.74	7.9	4.5	60	
Storåna downstream	9-Mar-15	6.34	43.3	17	41	1.80	8.5	4.9	60	
Storåna downstream	16-Mar-15	6.52	44.8	9	52	1.80	8.7	4.8	55	
Storåna downstream	23-Mar-15	6.50	44.3	8	54	1.75	8.9	4.8	48	
Storåna downstream	30-Mar-15	6.57	42.0	11	55	1.76	8.1	4.5	39	
Storåna downstream	7-Apr-15	6.44	40.7	11	52	1.76	7.7	4.4	44	
Storåna downstream	13-Apr-15	6.44	39.8	18	46	1.57	7.8	4.4	61	
Storåna downstream	20-Apr-15	6.39	35.3	22	43	1.54	6.7	4.0	59	
Storåna downstream	27-Apr-15	6.39	32.7	18	43	1.44	6.0	3.6	58	
Storåna downstream	4-May-15	6.30	29.2	29	45	1.39	5.2	3.2	69	

Table 0.2 Continued

Sample location	Date	pH	Cond. μS/cm	Colour mg Pt/l	ALK_E μeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al μg/l	LAl μg/l
Storåna downstream	11-May-15	6.39	26.2	22	39	1.27	4.5	2.9	48	
Storåna downstream	18-May-15	6.26	22.5	25	31	0.91	4.0	2.5	51	
Storåna downstream	27-May-15	5.96	19.4	23	26	0.73	3.1	2.2	50	
Storåna downstream	1-Jun-15	5.77	16.5	28	20	0.58	2.6	1.8	62	
Storåna downstream	8-Jun-15	6.08	20.2	15	28	0.85	3.3	2.1	39	
Storåna downstream	15-Jun-15	6.25	19.0	12	32	0.77	3.0	2.0	32	
Storåna downstream	22-Jun-15	6.36	18.1	9	26	0.75	3.2	1.9	27	
Storåna downstream	29-Jun-15	6.37	17.6	5	35	0.86	2.8	1.8	20	
Storåna downstream	6-Jul-15	6.50	18.6	8	42	1.00	2.9	1.9	13	
Storåna downstream	13-Jul-15	6.46	18.7	15	43	0.96	3.0	1.9	27	
Storåna downstream	20-Jul-15	6.11	18.4	30	32	0.86	3.0	2.0	57	
Storåna downstream	27-Jul-15	6.35	18.7	25	40	0.82	2.8	1.9	44	
Storåna downstream	3-Aug-15	6.14	18.6	29	37	0.81	2.9	1.9	57	
Storåna downstream	10-Aug-15	6.38	19.1	16	43	0.93	3.1	2.0	40	
Storåna downstream	17-Aug-15	6.25	16.2	35	37	0.87	2.4	1.7	51	
Storåna downstream	24-Aug-15	6.51	20.6	19	53	1.22	2.9	2.0	19	
Storåna downstream	31-Aug-15	6.16	16.9	27	37	0.89	2.4	1.7	45	
Storåna downstream	6-Sep-15	6.34	17.2	28	40	0.92	2.4	1.7	42	
Storåna downstream	13-Sep-15	6.26	20.2	28	47	1.07	2.7	1.9	23	
Storåna downstream	21-Sep-15	6.33	17.2	24	42	0.91	2.4	1.7	39	
Storåna downstream	27-Sep-15	6.26	16.4	31	36	0.86	2.3	1.6	53	
Storåna downstream	5-Oct-15	6.42	19.0	19	47	1.07	2.7	1.9	28	
Storåna downstream	12-Oct-15	6.50	19.9	20	53	1.17	2.7	1.9	28	
Storåna downstream	19-Oct-15	6.51	21.5	15	58	1.24	2.9	2.0	30	
Storåna downstream	26-Oct-15	5.95	24.0	31	30	0.97	4.4	2.6	73	
Storåna downstream	2-Nov-15	6.37	21.1	17	44	1.16	3.2	2.1	40	
Storåna downstream	9-Nov-15	6.09	16.8	49	27	0.85	2.6	1.8	64	
Storåna downstream	16-Nov-15	6.03	22.9	23	20	0.78	4.3	2.4	59	
Storåna downstream	23-Nov-15	6.33	22.3	13	39	1.07	3.7	2.2	42	
Storåna downstream	30-Nov-15	6.35	23.6	15	38	0.99	4.2	2.5	51	
Storåna downstream	7-Dec-15	6.12	20.4	13	22	0.74	3.8	2.2	36	
Storåna downstream	14-Dec-15	6.40	23.2	11	42	1.09	3.9	2.3	28	
Storåna downstream	21-Dec-15	6.15	22.2	18	24	0.88	4.2	2.4	37	
Storåna downstream	27-Dec-15	6.37	24.0	9	40	1.13	4.3	2.5	31	
Storåna downstream	4-Jan-16	6.68	37.6	13	66	1.86	5.1	2.8	32	
Storåna downstream	11-Jan-16	6.56	29.8	11	75	1.68	4.8	2.7	24	
Storåna downstream	18-Jan-16	6.45	28.7	5	52	1.47	4.5	2.6	22	
Storåna downstream	25-Jan-16	6.37	28.5	8	56	1.29	4.4	2.7	21	
Storåna downstream	2-Feb-16	6.26	43.8	9	25	1.49	9.0	4.6	40	
Storåna downstream	9-Feb-16	6.30	31.0	9	27	1.21	6.1	3.2	35	
Storåna downstream	15-Feb-16	6.35	33.4	5	41	1.52	6.0	3.3	29	
Storåna downstream	23-Feb-16	6.16	32.2	5	32	1.28	6.1	3.3	29	
Storåna downstream	29-Feb-16	6.20	30.8	7	34	1.38	6.4	3.1	21	
Storåna downstream	7-Mar-16	6.36	29.4	7	32	1.35		3.0	30	
Storåna downstream	14-Mar-16	6.25	30.7	5	39	1.30	5.5	3.0	27	

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna downstream	21-Mar-16	6.32	31.7	15	42	1.24	6.2	3.4	53	
Storåna downstream	29-Mar-16	5.95	23.9	21	23	0.70	4.3	2.7	64	
Storåna downstream	4-Apr-16	6.04	27.2	25		1.09	5.2	2.9	55	
Storåna downstream	11-Apr-16	6.25	24.7	21	34	0.88	4.6	2.6	50	
Storåna downstream	18-Apr-16	6.11	22.9	21	24	0.80	3.7	2.4	44	
Storåna downstream	25-Apr-16	6.25	24.2	13	30	1.02	4.1	2.5	38	
Storåna downstream	2-May-16	6.26	23.0	23	27	1.03	3.7	2.4	53	
Storåna downstream	9-May-16	5.20	17.8	17	-4	0.34	3.0	1.9	50	
Storåna downstream	12-May-16	5.29	16.9	13	-2	0.30	2.9	1.8	51	
Storåna downstream	18-May-16	6.20	22.3	15	28	0.80	3.0	1.8	39	
Storåna downstream	23-May-16	6.17	20.3	20	28	0.78	3.0	1.8	40	
Storåna downstream	30-May-16	6.12	17.5	13	26	0.76	2.8	1.7	26	
Storåna downstream	6-Jun-16	6.15	19.8	9	31	0.91	3.1	1.9	23	
Storåna downstream	13-Jun-16	6.19	19.8	10	27	0.94	3.3	1.9	17	
Storåna downstream	20-Jun-16	6.43	21.0	10	49	0.91	3.4	2.1	16	
Storåna downstream	27-Jun-16	5.95	15.0	61	26	0.66	1.9	1.7	97	
Storåna downstream	4-Jul-16	6.27	16.9	37	32	0.76	2.5	1.7	56	
Storåna downstream	9-Jul-16	6.29	16.9	23	25	0.69	2.7	1.8	32	
Storåna downstream	11-Jul-16	6.31	16.3	36	38	0.87	2.3	1.7	57	
Storåna downstream	18-Jul-16	6.25	16.5		46	0.71	2.3	1.7		
Storåna downstream	25-Jul-16	6.30	19.8	21	48	0.89	2.7	1.9	36	
Storåna downstream	2-Aug-16	5.97	14.2	62	29	0.62	1.7	1.5	88	
Storåna downstream	9-Aug-16	5.78	15.3	59	18	0.62	2.4	1.6	82	
Storåna downstream	15-Aug-16	6.29	15.9	32	32	0.68	2.5	1.6	50	
Storåna downstream	23-Aug-16	6.11	15.9	43	37	0.69	2.4	1.7	76	
Storåna downstream	29-Aug-16	6.31	17.4	27	36	0.70	2.7	1.7	41	
Storåna downstream	4-Sep-16	6.13	17.2	37	34	0.63	2.5	1.7	60	
Storåna downstream	12-Sep-16	6.10	15.3	33	30	0.63	2.4	1.5	58	
Storåna downstream	19-Sep-16	6.25	17.6	23	34	0.87	2.6	1.7	34	
Storåna downstream	25-Sep-16	6.25	17.6	28	36	0.87	2.6	1.7	46	
Storåna downstream	3-Oct-16	5.83	23.3	24	30	0.83	3.5	2.1	47	
Storåna downstream	10-Oct-16	6.27	20.4	14	34	0.85	3.2	1.9	31	
Storåna downstream	17-Oct-16	6.24	21.3	13	37	0.85	3.4	2.0	27	
Storåna downstream	24-Oct-16	6.25	22.7	18	37	1.03	3.4	2.2	33	
Storåna downstream	31-Oct-16	6.20	22.2	23	38	1.10	3.7	2.3	43	
Storåna downstream	7-Nov-16	6.22	22.8	15	38	1.16	3.9	2.3	43	
Storåna downstream	14-Nov-16	6.01	24.6	17	28	1.02	3.9	2.5	37	
Storåna downstream	21-Nov-16	6.20	22.4	15	33	1.04	3.5	2.2	32	
Storåna downstream	28-Nov-16	6.07	18.7	21	30	0.81	3.1	1.9	38	
Storåna downstream	5-Dec-16	6.14	18.7	20	31	0.89	3.2	2.0	46	
Storåna downstream	12-Dec-16	6.16	18.5	24	34	0.97	3.2	2.0	41	
Storåna downstream	19-Dec-16	6.10	19.2	18	42	0.92	3.0	2.0	55	
Storåna downstream	27-Dec-16	6.54	46.9	11	48	1.82	9.6	5.0	65	
Storåna downstream	2-Jan-17	6.25	33.3	13	43	1.40	6.0	3.5	39	
Storåna downstream	9-Jan-17	6.16	32.4	11	44	1.50	6.3	3.7	41	

Table 0.2 Continued										
Sample location	**Date**	**pH**	**Cond.**	**Colour**	**ALK$_E$**	**Ca^{2+}**	**Cl$^-$**	**Na$^+$**	**Al**	**LAl**
			µS/cm	**mg Pt/l**	**µeq/l**	**mg/l**	**mg/l**	**mg/l**	**µg/l**	**µg/l**
Storåna downstream	16-Jan-17	6.46	39.7	22	111	2.90	6.9	3.7	43	
Storåna downstream	24-Jan-17	6.21	33.7	8	42	1.40	7.2	3.9	43	
Storåna downstream	30-Jan-17	6.42	36.1	7	49	1.60	7.3	3.9	38	
Storåna downstream	13-Feb-17	6.47	34.5	1	51	1.40	6.5	3.7	41	
Storåna downstream	20-Feb-17	6.23	27.6	19	30	1.10	5.1	3.1	70	
Storåna downstream	27-Feb-17	6.34	33.9	16	35	1.40	6.6	3.7	64	
Storåna downstream	7-Mar-17	6.45	33.2	11	46	1.40	6.1	3.6	39	
Storåna downstream	13-Mar-17	5.60	29.3	12	11	0.70	6.0	3.5	61	
Storåna downstream	20-Mar-17	6.32	34.6	5	37	1.30	6.7	3.8	40	
Storåna downstream	28-Mar-17	5.15	32.8	15	-6	0.44	6.9	3.7	81	
Storåna downstream	2-Apr-17	6.33	29.1	19	36	1.30	5.5	2.9	52	
Storåna downstream	10-Apr-17	6.41	25.7	9	34	0.97	5.0	2.7	41	
Storåna downstream	18-Apr-17	6.32	25.7	17	38	0.94	4.8	2.7	38	
Storåna downstream	23-Apr-17	6.33	24.8	22	34	0.95	4.7	2.7	55	
Storåna downstream	2-May-17	6.25	22.0	38	36	0.96	4.3	2.7	41	
Storåna downstream	8-May-17	6.15	19.9	33	32	0.84	3.5	2.2	39	
Storåna downstream	15-May-17	6.27	19.4	34	35	0.89	3.3	2.1	43	
Storåna downstream	18-May-17	5.90	16.6	59	31	0.58	2.6	1.8	63	
Storåna downstream	21-May-17	6.39	20.7	25	41	0.94	3.6	2.1	42	
Storåna downstream	29-May-17	6.35	19.2	21	40	0.84	3.3	2.0	27	
Storåna downstream	6-Jun-17	6.25	20.2	39	48	0.89	3.2	2.0	44	
Storåna downstream	12-Jun-17	6.10	18.4	46	43	0.82	2.8	1.9	63	
Storåna downstream	19-Jun-17	6.22	16.9	42	31	0.76	2.7	1.8	48	
Storåna downstream	26-Jun-17	5.81	18.5	28	28	0.83	2.3	2.0	72	
Storåna downstream	3-Jul-17	6.43	19.9	15	43	0.91	3.1	2.1	30	
Storåna downstream	10-Jul-17	6.27	18.2	60	39	0.77	2.9	1.9	33	
Storåna downstream	17-Jul-17	5.99	16.6	59	32	0.71		1.9	55	
Storåna downstream	24-Jul-17	6.28	18.6	35	39	0.84	2.9	2.0	39	
Storåna downstream	31-Jul-17	5.97	15.0	86	32	0.72	2.1	1.6	84	
Storåna downstream	7-Aug-17	6.01	16.2	63	31	0.65	2.5	1.8	59	
Storåna downstream	14-Aug-17	6.22	17.9	41	39	0.79	2.8	1.8	39	
Storåna downstream	20-Aug-17	5.59	14.8	68	18	0.47	2.3	1.7		
Storåna downstream	21-Aug-17	5.90	17.9	51	27	0.69	2.5	1.8	55	
Storåna downstream	29-Aug-17	6.05	17.9	38	42	0.61	2.7	2.0	39	
Storåna downstream	4-Sep-17	6.35	17.9	34	44	0.79	2.7	2.0	35	
Storåna downstream	11-Sep-17	5.81	13.7	87	11	0.47	1.9	1.5	86	
Storåna downstream	18-Sep-17	6.06	16.4	42	21	0.70	2.4	1.7	33	
Storåna downstream	25-Sep-17	6.15	16.9	42	38	0.83	2.3	1.7	36	
Storåna downstream	1-Oct-17	5.65	10.5	82	15	0.43	1.4	1.1	53	
Storåna downstream	6-Oct-17	6.08	17.7	51	39	0.92	2.4	1.7	35	
Storåna downstream	9-Oct-17	6.15	16.6	44	32	0.85	2.4	1.7	33	
Storåna downstream	16-Oct-17	5.65	17.7	22	35	0.85	2.4	1.8	34	
Storåna downstream	23-Oct-17	5.96	15.8	44	31	0.81	2.3	1.6	41	
Storåna downstream	30-Oct-17	6.07	17.0	27	35	0.82	2.6	1.7	37	
Storåna downstream	6-Nov-17	5.87	17.9	39	32	0.84	1.8	1.8	59	

Table 0.2 Continued										
Sample location	**Date**	**pH**	**Cond.**	**Colour**	**ALK_E**	**Ca^{2+}**	**Cl^-**	**Na^+**	**Al**	**LAl**
			µS/cm	**mg Pt/l**	**µeq/l**	**mg/l**	**mg/l**	**mg/l**	**µg/l**	**µg/l**
Storåna downstream	13-Nov-17	6.05	18.2	24	36	0.93	3.0	1.8	29	
Storåna downstream	21-Nov-17	6.05	20.3	24	37	1.00	3.4	2.0	25	
Storåna downstream	27-Nov-17	6.22	21.4	21	43	1.10	3.7	2.1	34	
Storåna downstream	4-Dec-17	6.31	22.3	23	40	1.10	3.8	2.1	35	
Storåna downstream	12-Dec-17	6.35	25.2	22	63	1.10	4.2	2.4	19	
Storåna downstream	18-Dec-17	6.39	25.7	11	53	1.30	4.4	2.4	19	
Storåna downstream	27-Dec-17	6.26	23.2	14	31	0.78	4.4	2.5		
Storåna downstream	2-Jan-18	6.18	27.1	19	34	1.01	5.3	2.9	29	
Storåna downstream	9-Jan-18	6.23	26.9	21	35	1.03	5.0	2.8	23	
Storåna downstream	15-Jan-18	6.28	25.0	12	36	0.99	4.6	2.6	22	
Storåna downstream	23-Jan-18	6.28	24.1	17	37	0.99	4.3	2.5	17	
Storåna downstream	29-Jan-18	6.32	37.8	18	34	1.36	8.0	4.1	36	
Storåna downstream	5-Feb-18	6.00	34.4	2	40	1.21	5.8	3.5	25	
Storåna downstream	13-Feb-18	6.22	29.0	13	37	1.16		3.1	25	
Storåna downstream	20-Feb-18	6.24	29.1		43	1.26	5.3	3.0		
Storåna downstream	26-Feb-18	6.25	28.0		46	1.20	5.0	2.9		
Storåna downstream	12-Mar-18	6.27	26.7	16	34	1.10	5.1	2.8	26	
Storåna downstream	19-Mar-18	6.16	28.8			1.22				
Storåna downstream	27-Mar-18	6.30	30.7	20	38	1.35	5.5	3.1	31	
Storåna downstream	4-Apr-18	6.02	27.2	16	37	0.87	5.0	2.9	29	
Storåna downstream	15-Apr-18	6.17	26.3	15	32	1.00	4.2	2.7	32	
Storåna downstream	22-Apr-18	6.23	21.6	22	33	0.87	3.5	2.3	31	
Storåna downstream	30-Apr-18	6.24	20.1	24	31	0.71	3.3	2.0	32	
Storåna downstream	8-May-18	6.06	15.9	26	36	0.57	2.5	1.6	28	
Storåna downstream	14-May-18	5.80	15.3	13	24	0.62	2.4	1.5	30	
Storåna downstream	22-May-18	6.04	14.7	12	34	0.54	2.5	1.5	31	
Storåna downstream	4-Jun-18	6.03	16.7	12	19	0.83	2.7	1.6	33	
Storåna downstream	11-Jun-18	6.35	18.5	12	64	0.93	2.9	1.8	18	
Storåna downstream	18-Jun-18	6.36	19.1	11	42	1.11	2.8	1.7	29	
Storåna downstream	25-Jun-18	6.27	18.4	16	35	0.95	3.0	1.8	16	
Storåna downstream	1-Jul-18	6.21	19.2	20	31	0.84	3.1	1.9	9	
Storåna downstream	9-Jul-18	6.26	20.7	19	28	0.87	3.2	2.1	11	
Storåna downstream	16-Jul-18	6.29	23.3	16	42	1.13	3.5	2.3	10	
Storåna downstream	23-Jul-18	6.28	23.8	13	39	0.98	3.1	2.4	12	
Storåna downstream	30-Jul-18	6.01	25.5	24	31	1.08	3.8	2.5	14	
Storåna downstream	7-Aug-18	6.24	20.9	19	44	1.05	3.2	2.0	18	
Storåna downstream	13-Aug-18	6.33	18.7	24	36	0.87	3.0	1.9	29	
Storåna downstream	20-Aug-18	6.30	17.7	33	36	0.88	2.8	1.7	37	
Storåna downstream	27-Aug-18	5.73	16.4	34	12	0.43	2.6	1.7	47	
Storåna downstream	3-Sep-18	6.34	17.5	24	33	0.78	2.8	1.8		
Storåna downstream	10-Sep-18	5.75	14.1	69	23	0.58	1.8	1.5	67	
Storåna downstream	17-Sep-18	6.35			42	0.93				
Storåna downstream	25-Sep-18	6.20	22.1	23	43	1.10	4.1	2.2	28	
Storåna downstream	1-Oct-18	6.07	22.7	29	48	1.14	3.9	2.2	39	
Storåna downstream	8-Oct-18	6.33	21.9	35	36	1.12	4.0	2.3		

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Storåna downstream	15-Oct-18	6.28	18.8	41	43	1.03	3.0	1.9	43	
Storåna downstream	22-Oct-18	6.19	19.9	51	39	1.02	3.2	2.1	50	
Storåna downstream	29-Oct-18	6.01	17.9	37	21	0.77	3.2	1.9		
Storåna downstream	5-Nov-18	5.80	17.1	35	13	0.48	2.9	1.9	48	
Storåna downstream	12-Nov-18	5.78	15.0	61	15	0.50	2.2	1.6	64	
Storåna downstream	19-Nov-18	5.82	19.3	28	27	0.63	2.8	1.9	39	
Storåna downstream	26-Nov-18	6.05	19.3	30	23	0.67	3.3	2.1	44	
Storåna downstream	3-Dec-18	6.31	18.8	32	33	0.87	3.0	1.9	46	
Storåna downstream	10-Dec-18	6.17	18.6	32	33	0.95	3.0	2.0	38	
Storåna downstream	17-Dec-18	6.35	21.0	21	45	1.14	3.2	2.1	29	
Storåna downstream	27-Dec-18	6.28	19.2	39	34	0.96	2.9	2.0	55	
Storåna downstream	2-Jan-19	6.26	19.1	29	38	1.0	3.6	2.0	44	
Storåna downstream	7-Jan-19	6.50	27.6	20	40	1.3	5.4	2.8		
Storåna downstream	14-Jan-19	6.55	27.8	23	40	1.2	5.3			
Storåna downstream	22-Jan-19	6.33	25.3	15	41	1.2	4.5	2.5		
Storåna downstream	28-Jan-19	6.09	23.5	14	26	0.88	4.4	2.5		
Storåna downstream	4-Feb-19	6.22	23.9	14	25	0.91	4.2	2.5		
Storåna downstream	11-Feb-19	6.54	33.7	13	57	1.8	5.7	3.1	37	
Storåna downstream	18-Feb-19	5.93	30.6	20	30	1.0	5.3	3.0	54	
Storåna downstream	25-Feb-19	6.24	24.7	22	35	1.1	4.6	2.6		
Storåna downstream	5-Mar-19	6.36	26.3	22	35	1.1	4.8	2.8		
Storåna downstream	11-Mar-19	6.16	31.9	5	56	1.4	5.0	3.3	13	
Storåna downstream	18-Mar-19	6.20	24.9	16	25	0.98	4.4	2.6	47	
Storåna downstream	25-Mar-19	6.30	24.5	23	25	0.99	4.3	2.5	49	
Storåna downstream	1-Apr-19	6.30	23.1	23	35	0.98	4.2	2.5		
Storåna downstream	8-Apr-19	6.30	24.0	24	34	0.92	3.7	2.2	44	
Storåna downstream	15-Apr-19	6.28	21.1	22	32	0.87	3.7	2.3		
Storåna downstream	22-Apr-19	5.47	15.7	34	3	0.36	2.8	1.9	48	
Storåna downstream	29-Apr-19	6.28	16.7	31	35	0.82	2.6	1.7		
Storåna downstream	6-May-19	6.02	17.6	25	18	0.63	3.0	1.8	32	
Storåna downstream	13-May-19	6.31	17.2	27	33	0.84	2.9	1.8	22	
Storåna downstream	20-May-19	5.57	15.8	23	13	0.54	2.7	1.7	31	
Storåna downstream	27-May-19	6.26	16.2	30	29	0.78	2.6	1.7	49	
Storåna downstream	3-Jun-19	6.20	16.5	40	31	0.83	2.4	1.7	62	
Storåna downstream	11-Jun-19	5.91	15.8	35	26	0.70	2.3	1.6	41	
Storåna downstream	17-Jun-19	6.26	15.8	49	34	0.73	2.3	1.6		
Storåna downstream	24-Jun-19	6.30	15.4	46	35	0.69	2.3	1.7		
Storåna downstream	1-Jul-19	6.32	17.4	34	39	0.94	2.6	1.8		
Storåna downstream	9-Jul-19	6.25	16.1	33	40	0.68	2.3	1.7		
Storåna downstream	15-Jul-19	6.21	18.4	24	45	0.99	2.6	1.9		
Storåna downstream	22-Jul-19	5.72	16.7	73	42	0.59	1.9	1.5		
Storåna downstream	29-Jul-19	6.25	17.6	35	42	0.85	2.5	1.7		
Storåna downstream	5-Aug-19	6.17	16.3	34	36	0.77	2.3	1.7		
Storåna downstream	9-Aug-19	6.26	14.7	53	34	0.72	2.0	1.6	62	10
Storåna downstream	12-Aug-19	5.68	13.2	89	25	0.56	1.5	1.4		

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			μS/cm	mg Pt/l	μeq/l	mg/l	mg/l	mg/l	μg/l	μg/l
Storåna downstream	19-Aug-19	5.56	15.7	66	20	0.60	1.8	1.6		
Storåna downstream	26-Aug-19	6.31	15.1	42	41	0.82	2.1	1.5		
Storåna downstream	2-Sep-19	6.24	15.9	47	40	0.97	2.2	1.6		
Storåna downstream	9-Sep-19	6.34	15.1	39	44	0.93	2.1	1.5		
Storåna downstream	10-Sep-19	6.41	15.0	44	42	0.91	2.0	1.5		
Storåna downstream	15-Sep-19	5.99	14.9	63	28	0.79	2.2	1.5		
Storåna downstream	23-Sep-19	6.26	19.3	30	46	1.1	2.9	1.9		
Storåna downstream	1-Oct-19	6.41	18.7	28	47	1.2	3.0	1.8		
Storåna downstream	7-Oct-19	6.18	19.1	35	40	1.1	3.0	1.9		
Storåna downstream	15-Oct-19	5.92	19.5	30	46	1.3	3.0	1.8	49	
Storåna downstream	21-Oct-19	6.28	16.0	36	37	0.99	2.7	1.7	48	
Storåna downstream	28-Oct-19	6.17	17.0	32	36	0.93	2.8	1.7	45	
Storåna downstream	5-Nov-19	6.30	18.8	30	41	0.99	2.9	1.9		
Storåna downstream	11-Nov-19	6.35	19.7	21	44	1.0	3.0	2.0		
Storåna downstream	18-Nov-19	6.17	20.1	50	53	1.1	2.8	2.0		
Storåna downstream	25-Nov-19	6.06	15.7	38	30	0.84	2.2	1.7	49	
Storåna downstream	2-Dec-19	6.19	17.4	17	35				37	
Storåna downstream	9-Dec-19	5.99	18.8	38	26	0.87	3.3	1.9		
Storåna downstream	17-Dec-19	6.22	18.2	25	26	0.72	3.1	1.8		
Storåna downstream	23-Dec-19	6.37	18.2	28	44	1.0	3.0	1.7		
Storåna downstream	30-Dec-19	6.06	15.4		27	0.73	2.4	1.6		
Vassbø	2-Jan-13	5.41	14.8	20	5					
Vassbø	7-Jan-13	5.46	14.9	16	5					
Vassbø	14-Jan-13	5.85	17.5	15	14					
Vassbø	21-Jan-13	6.15	19.6	10	26					
Vassbø	29-Jan-13	6.11	23.8	12	33	0.68	4.0	2.1	27	
Vassbø	5-Feb-13	5.72	26.3	10	13	0.65	5.2	2.8	46	
Vassbø	18-Feb-13	5.03	23.5	8	-7					
Vassbø	4-Mar-13	5.30	27.3	8	-3				67	
Vassbø	1-Apr-13	6.24	24.8	1	32	0.88	4.3	2.7	25	
Vassbø	8-Apr-13	6.14	29.8	9	29	0.87	5.2	3.0	35	
Vassbø	15-Apr-13	5.33	27.6	21	4	0.43	4.9	2.7	65	
Vassbø	22-Apr-13	5.49	23.4	3	4	0.57	4.4	2.4	49	
Vassbø	29-Apr-13	5.31	25.9	10	2	0.61	4.9	2.6	78	
Vassbø	6-May-13	5.11	24.4	10	-4	0.45	3.9	2.4	70	
Vassbø	13-May-13	5.44	18.2	20	4	0.39	2.9	1.8	56	
Vassbø	21-May-13	5.41	14.2	22	8	0.32	2.2	1.3	41	
Vassbø	27-May-13	5.68	14.1	11	9	0.36	2.2	1.4	34	
Vassbø	3-Jun-13	5.77	13.4	14	10	0.43	2.0	1.3	37	
Vassbø	10-Jun-13	6.00	14.3	11	15	0.45	2.6	1.5	25	
Vassbø	16-Jun-13	5.72	14.3	26	14	0.43	2.2	1.5	51	
Vassbø	1-Jul-13	5.76	13.0	36	18	0.39	2.0	1.4	56	
Vassbø	8-Jul-13	5.97	13.7	24	18	0.49	2.0	1.5	34	
Vassbø	15-Jul-13	6.25	16.2	17	25	0.55	2.4	1.6	23	
Vassbø	22-Jul-13	5.96	15.2	19	21	0.41	2.6	1.8	27	

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	29-Jul-13	6.13	16.1	13	29	0.55	2.3	1.7	13	
Vassbø	5-Aug-13	5.62	12.6	43	14	0.46	1.6	1.4	53	
Vassbø	12-Aug-13	6.13	13.9	19	21	0.48	2.0	1.4	34	
Vassbø	19-Aug-13	5.24	11.4	73	4	0.34	1.1	1.1	74	
Vassbø	26-Aug-13	6.24	13.7	17	24	0.41	1.9	1.4	30	
Vassbø	2-Sep-13	6.27	15.8	22	33	0.53	2.1	1.6	33	
Vassbø	9-Sep-13	5.87	12.3	32	18	0.45	1.5	1.3	63	
Vassbø	16-Sep-13	5.68	12.7	49	18	0.45	1.6	1.3	94	
Vassbø	23-Sep-13	5.58	12.6	46	14	0.39	1.5	1.3	74	
Vassbø	30-Sep-13	6.14	13.8	17	28	0.53	1.7	1.4	34	
Vassbø	7-Oct-13	5.89	14.1	29	18	0.44	2.0	1.4	58	
Vassbø	14-Oct-13	5.98	13.8	20	17	0.44	1.9	1.4	43	
Vassbø	21-Oct-13	6.11	14.9	13	21	0.51	2.0	1.5	39	
Vassbø	28-Oct-13	5.33	14.7	28	6	0.44	2.2	1.4	70	
Vassbø	4-Nov-13	5.33	15.0	30	3	0.41	2.4	1.4	69	
Vassbø	11-Nov-13	6.09	16.1	15	24	0.70	2.5	1.5	59	
Vassbø	18-Nov-13	5.89	16.9	17	17	0.63	2.8	1.6	48	
Vassbø	25-Nov-13	6.29	17.1	10	29	0.81	2.6	1.6	37	
Vassbø	2-Dec-13	6.14	17.3	19	24	0.73	2.9	1.6	49	
Vassbø	9-Dec-13	5.82	25.1	13	16	0.79	5.1	2.5	65	
Vassbø	16-Dec-13	5.01	24.1	19	-8	0.44	4.4	2.3	86	
Vassbø	23-Dec-13	5.79	22.5	11	14	0.70	4.3	2.3	55	
Vassbø	30-Dec-13	5.81	30.8	11	13	0.98	6.7	3.2	57	
Vassbø	6-Jan-14	5.84	25.0	17	14	0.74	4.9	2.6	52	
Vassbø	13-Jan-14	6.11	26.6	11	26	0.88	5.0	2.8	48	
Vassbø	20-Jan-14	6.53	28.4	7	55	1.39	4.7	2.7	28	
Vassbø	27-Jan-14	6.47	29.1	5	65	1.78	4.6	2.5	28	
Vassbø	3-Feb-14	6.39	33.9	10	42	1.51	6.0	3.2	45	
Vassbø	10-Feb-14	5.89	28.3	11	19	0.86	5.2	3.0	61	
Vassbø	17-Feb-14	6.17	29.4	9	24	0.99	6.2	3.1	32	
Vassbø	24-Feb-14	6.04	31.4	13	20	1.03	6.6	3.4	41	
Vassbø	3-Mar-14	6.28	27.4	9	30	1.09	5.2	2.9	38	
Vassbø	10-Mar-14	6.21	26.9	12	30	1.02	5.1	2.8	43	
Vassbø	17-Mar-14	6.15	26.1	13	22	0.93	5.1	2.8	42	
Vassbø	24-Mar-14	6.30	26.3	7	32	1.05	4.7	2.7	33	
Vassbø	31-Mar-14	6.19	25.5	13	25	0.97	4.8	2.8	41	
Vassbø	7-Apr-14	6.22	23.4	27	31	0.87	4.0	2.4	54	
Vassbø	14-Apr-14	6.22	23.2	15	26	0.88	4.3	2.4	45	
Vassbø	22-Apr-14	6.19	19.6	17	26	0.79	3.5	2.1	49	
Vassbø	28-Apr-14	6.13	16.8	17	22	0.68	2.8	1.7	42	
Vassbø	5-May-14	6.23	18.3	13	24	0.79	3.0	1.9	34	
Vassbø	12-May-14	6.14	15.0	22	21	0.65	2.4	1.6	43	
Vassbø	19-May-14	6.12	13.9	15	21	0.59	2.2	1.5	33	
Vassbø	26-May-14	6.20	13.9	14	23	0.56	2.3	1.4	30	
Vassbø	2-Jun-14	6.25	13.6	7	18	0.54	2.3	1.4	26	

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK$_E$	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	10-Jun-14	6.44	14.7	10	26	0.57	2.5	1.6	19	
Vassbø	16-Jun-14	6.52	15.3	6	35	0.64	2.6	1.6	17	
Vassbø	23-Jun-14	6.36	15.7	7	33	0.70	2.6	1.6	9	
Vassbø	30-Jun-14	6.47	18.1	6	47	0.95	2.7	1.8	8	
Vassbø	7-Jul-14	6.20	17.1	30	32	0.85	2.1	1.5	61	
Vassbø	14-Jul-14	6.51	16.8	16	36	0.89	2.4	1.6	19	
Vassbø	22-Jul-14	6.30	15.3	11	18	0.62	2.3	1.6	25	
Vassbø	28-Jul-14	6.58	17.2	13	33	0.87	2.4	1.7	26	
Vassbø	4-Aug-14	6.10	14.9	58	30	0.86	1.7	1.5	96	
Vassbø	11-Aug-14	6.15	15.9	42	28	0.78	2.2	1.7	75	
Vassbø	18-Aug-14	5.42	16.7	32	12	0.43	x	1.8	75	
Vassbø	18-Aug-14	6.36	17.4	32	35	0.93	2.8	1.8	64	
Vassbø	25-Aug-14	6.27	16.9	31	33	0.75	2.7	1.8	57	
Vassbø	3-Sep-14	6.48	16.8	24	38	0.81	2.6	1.7	42	
Vassbø	8-Sep-14	6.18	16.2	33	32	0.88	2.4	1.6	71	
Vassbø	15-Sep-14	6.63	18.4	21	46	1.11	2.6	1.7	27	
Vassbø	24-Sep-14	6.69	18.9	12	44	1.06	2.8	1.8	27	
Vassbø	29-Sep-14	6.43	22.8	23	43	1.24	3.9	2.2	47	
Vassbø	6-Oct-14	6.24	23.1	33	33	1.02	4.0	2.3	70	
Vassbø	13-Oct-14	6.30	20.5	22	38	0.99	3.1	2.0	50	
Vassbø	20-Oct-14	5.89	19.6	49	21	0.77	3.2	2.0	72	
Vassbø	27-Oct-14	6.01	18.8	44	24	0.82	3.2	1.9	62	
Vassbø	3-Nov-14	6.11	15.4	47	24	0.83	2.2	1.5	62	
Vassbø	10-Nov-14	6.07	16.9	37	27	0.81	2.6	1.8	58	
Vassbø	17-Nov-14	6.28	17.4	28	33	0.91	2.6	1.8	40	
Vassbø	24-Nov-14	5.95	14.4	53	27	0.66	1.8	1.5	81	
Vassbø	1-Dec-14	6.42	18.9	24	46	1.10	2.5	1.7	35	
Vassbø	8-Dec-14	6.00	15.7	38	25	0.74	2.0	1.6	73	
Vassbø	15-Dec-14	6.13	23.9	21	26	0.94	4.1	2.4	55	
Vassbø	22-Dec-14	6.08	27.5	20	26	1.00	5.2	2.9	53	
Vassbø	29-Dec-14	6.39	24.8	10	47	1.33	4.1	2.3	42	
Vassbø	5-Jan-15	6.34	23.4	7	38	1.18	4.2	2.4	37	5
Vassbø	12-Jan-15	6.08	52.4	5	27	1.54	12.2	5.8	59	9
Vassbø	19-Jan-15	6.43	44.7	7	53	1.75	9.4	4.7	47	5
Vassbø	26-Jan-15	6.38	40.8	8	47	1.56	8.4	4.3	38	<5
Vassbø	2-Feb-15	6.79	48.9	8	104	2.73	9.0	4.6	57	6
Vassbø	9-Feb-15	6.46	47.7	10	50	1.84	10.0	5.1	49	<5
Vassbø	16-Feb-15	6.47	47.1	11	49	1.70	9.2	5.0	32	<5
Vassbø	23-Feb-15	6.37	41.4	13	45	1.66	7.9	4.5	46	<5
Vassbø	2-Mar-15	6.28	39.8	12	37	1.52	7.7	4.4	60	<5
Vassbø	9-Mar-15	6.26	42.5	16	35	1.51	8.3	4.9	64	<5
Vassbø	16-Mar-15	6.52	46.1	8	54	1.89	8.9	5.0	49	<5
Vassbø	23-Mar-15	6.48	44.6	7	50	1.66	8.8	4.9	41	<5
Vassbø	30-Mar-15	6.56	42.4	8	55	1.76	8.3	4.6	35	<5
Vassbø	7-Apr-15	6.57	40.3	8	46	1.66	8.0	4.4	40	<5

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	13-Apr-15	6.40	39.3	17	41	1.48	7.7	4.4	62	5
Vassbø	20-Apr-15	6.40	34.5	22	41	1.35	6.5	3.9	56	<5
Vassbø	27-Apr-15	6.35	32.1	19	39	1.33	5.9	3.6	53	<5
Vassbø	4-May-15	6.42	29.6	25	44	1.35	5.2	3.3	62	<5
Vassbø	11-May-15	6.37	26.8	20	40	1.26	4.7	3.0	44	<5
Vassbø	18-May-15	6.30	22.7	27	30	0.92	4.0	2.5	57	<5
Vassbø	27-May-15	6.25	19.2	23	35	0.78	3.2	2.1	54	5
Vassbø	1-Jun-15	6.08	16.7	28	24	0.65	2.7	1.8	57	<5
Vassbø	8-Jun-15	6.27	20.4	15	30	0.91	3.4	2.1	43	<5
Vassbø	15-Jun-15	6.35	19.0	10	33	0.77	3.1	2.0	36	10
Vassbø	22-Jun-15	6.39	17.5	10	26	0.78	3.1	1.9	25	<5
Vassbø	29-Jun-15	6.49	17.9	6	35	0.86	2.8	1.9	20	7
Vassbø	6-Jul-15	6.59	18.6	10	39	0.95	2.9	1.9	10	<5
Vassbø	13-Jul-15	6.58	18.4	11	39	0.93	3.0	1.9	25	<5
Vassbø	20-Jul-15	6.23	17.2	34	29	0.77	2.8	1.9	55	<5
Vassbø	27-Jul-15	6.35	18.6	22	32	0.73	2.9	2.0	39	<5
Vassbø	3-Aug-15	6.19	17.4	32	32	0.78	2.7	1.9	61	9
Vassbø	10-Aug-15	6.47	19.5	16	42	0.93	3.1	2.1	32	<5
Vassbø	17-Aug-15	6.25	16.2	32	34	0.78	2.4	1.7	49	<5
Vassbø	24-Aug-15	6.66	19.7	19	43	1.03	3.0	2.1	23	8
Vassbø	31-Aug-15	6.23	16.6	30	35	0.81	2.4	1.7	46	<5
Vassbø	6-Sep-15	6.36	17.0	27	36	0.81	2.5	1.8	43	<5
Vassbø	13-Sep-15	6.49	20.2	20	47	1.12	2.7	1.9	22	<5
Vassbø	21-Sep-15	6.40	16.9	24	37	0.86	2.4	1.7	40	<5
Vassbø	27-Sep-15	6.27	16.8	30	38	0.88	2.4	1.7	53	<5
Vassbø	5-Oct-15	6.50	19.6	18	48	0.97	2.8	1.9	28	<5
Vassbø	12-Oct-15	6.61	19.3	19	44	1.03	2.8	1.9	31	<5
Vassbø	19-Oct-15	6.56	20.9	13	52	1.16	2.9	2.0	22	<5
Vassbø	26-Oct-15	6.26	20.2	26	35	0.96	3.4	2.0	54	<5
Vassbø	2-Nov-15	6.45	21.2	18	35	1.06	3.2	2.0	36	<5
Vassbø	9-Nov-15	6.02	17.2	47	26	0.79	2.7	1.8	73	<5
Vassbø	16-Nov-15	6.26	24.7	17	32	0.95	4.4	2.6	50	<5
Vassbø	23-Nov-15	6.37	22.7	12	34	1.07	3.7	2.3	39	<5
Vassbø	30-Nov-15	6.31	23.9	15	32	1.00	4.2	2.4	50	<5
Vassbø	5-Dec-15	5.39	23.5	24	2	0.51	4.6	2.6	50	10
Vassbø	7-Dec-15	6.02	21.5	16	25	0.75	3.9	2.3	37	5
Vassbø	14-Dec-15	6.33	23.6	13	39	1.06	4.2	2.4	27	<5
Vassbø	21-Dec-15	6.13	22.8	19	24	0.88	4.3	2.5	38	<5
Vassbø	27-Dec-15	6.32	25.3	7	43	1.26	4.4	2.5	32	<5
Vassbø	4-Jan-16	6.64	31.0	11	61	1.67	5.1	2.9	31	<5
Vassbø	11-Jan-16	6.68	29.7	7	77	1.74	4.7	2.6	25	<5
Vassbø	18-Jan-16	6.43	28.5	5	45	1.47	4.5	2.7	19	<5
Vassbø	25-Jan-16	6.42	29.2	7	53	1.49	4.5	2.7	18	<5
Vassbø	2-Feb-16	6.14	43.5	8	22	1.25	9.3	4.7	42	9
Vassbø	9-Feb-16	6.27	31.7	9	27	1.11	6.3	3.3	38	12

Table 0.2 Continued

Sample location	Date	pH	Cond. µS/cm	Colour mg Pt/l	ALK_E µeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al µg/l	LAl µg/l
Vassbø	15-Feb-16	6.47	35.6	7	46	1.60	6.5	3.4	30	7
Vassbø	23-Feb-16	6.25	31.1	7	25	1.23	5.9	3.3	26	<5
Vassbø	29-Feb-16	6.45	32.2	8	33	1.50	6.3	3.3	25	5
Vassbø	7-Mar-16	6.44	30.1	7	32	1.44	5.2	3.1	21	<5
Vassbø	14-Mar-16	6.34	29.7	5	29	1.19	5.6	3.0	27	7
Vassbø	21-Mar-16	6.32	31.7	12	39	1.25	6.3	3.4	51	8
Vassbø	29-Mar-16	6.02	24.1	20	31	0.73	4.4	2.7	57	7
Vassbø	4-Apr-16	6.21	26.1	23	30	0.80	4.4	2.8	55	<5
Vassbø	11-Apr-16	6.27	25.1	18	30	0.97	4.8	2.6	48	<5
Vassbø	18-Apr-16	5.87	22.4	20	10	0.67	3.8	2.4	49	<5
Vassbø	25-Apr-16	6.11	24.1	16	31	0.90	4.1	2.4	38	10
Vassbø	2-May-16	6.23	23.1	21	29	0.91	3.8	2.5	55	<5
Vassbø	9-May-16	5.26	17.1	16	-4	0.33	2.8	1.8	56	22
Vassbø	12-May-16	5.41	16.3	14	0	0.35	2.9	1.8	50	19
Vassbø	18-May-16	6.28	21.8	13	30	0.84	3.0	1.8	33	7
Vassbø	23-May-16	6.11	18.1	21	20	0.74	3.0	1.8	47	<5
Vassbø	30-May-16	6.27	17.6	11	34	0.77	2.9	1.7	21	<5
Vassbø	6-Jun-16	6.23	18.9	9	28	0.87	3.0	1.8	20	<5
Vassbø	13-Jun-16	6.39	19.2	12	25	0.87	3.2	1.9	16	<5
Vassbø	20-Jun-16	6.44	20.4	10	40	0.89	3.1	2.0	13	<5
Vassbø	27-Jun-16	6.01	14.7	61	24	0.65	1.6	1.7	100	13
Vassbø	4-Jul-16	6.30	16.3	34	35	0.76	2.4	1.7	64	11
Vassbø	11-Jul-16	6.53	17.3	28	41	0.94	2.5	1.8	42	<5
Vassbø	18-Jul-16	6.35	17.2		47	0.74	2.4	1.7		
Vassbø	25-Jul-16	6.41	18.8	20	39	0.82	2.6	1.9	27	<5
Vassbø	2-Aug-16	5.97	15.2	64	28	0.61	1.7	1.5	89	11
Vassbø	9-Aug-16	6.11	18.2	64	35	0.84	2.6	1.7	73	<5
Vassbø	15-Aug-16	6.28	16.1	31	32	0.69	2.5	1.7	53	7
Vassbø	23-Aug-16	6.22	17.0	40	30	0.73	2.5	1.7	74	9
Vassbø	29-Aug-16	6.35	17.3	25	38	0.78	2.5	1.7	39	<5
Vassbø	4-Sep-16	6.10	17.3	40	29	0.68	2.6	1.7	66	8
Vassbø	12-Sep-16	6.09	15.5	37	28	0.62	2.3	1.5	59	11
Vassbø	19-Sep-16	6.31	17.1	23	35	0.78	2.4	1.6	31	<5
Vassbø	25-Sep-16	6.31	17.4	27	30	0.80	2.5	1.7	46	7
Vassbø	3-Oct-16	6.27	21.1	21	35	1.04	3.5	1.9	42	5
Vassbø	10-Oct-16	6.34	20.8	13	37	1.01	3.2	1.9	30	7
Vassbø	17-Oct-16	6.28	21.6	14	37	0.91	3.4	2.1	30	8
Vassbø	24-Oct-16	6.25	21.4	16	36	1.09	3.5	2.3	33	7
Vassbø	31-Oct-16	6.21	22.4	23	34	1.18	3.8	2.4	42	7
Vassbø	7-Nov-16	6.22	22.7	15	33	1.08	3.8	2.3	44	7
Vassbø	14-Nov-16	6.08	24.4	13	33	0.92	4.1	2.5	32	<5
Vassbø	21-Nov-16	6.20	22.0	16	34	1.03	3.9	2.3	35	<5
Vassbø	28-Nov-16	6.07	20.1	19	24	0.86	3.0	1.8	38	<5
Vassbø	5-Dec-16	6.15	18.7	19	30	0.94	3.7	1.9	49	8
Vassbø	12-Dec-16	6.10	18.6	28	31	0.92	3.1	1.9	42	5

Table 0.2 Continued

Sample location	Date	pH	Cond. µS/cm	Colour mg Pt/l	ALK_E µeq/l	Ca^{2+} mg/l	Cl^- mg/l	Na^+ mg/l	Al µg/l	LAl µg/l
Vassbø	19-Dec-16	6.08	19.7	26	30	0.96	3.1	2.0	55	5
Vassbø	27-Dec-16	6.40	50.9	13	44	1.80	10.4	5.3	69	14
Vassbø	2-Jan-17	6.27	33.4	12	45	1.40	6.0	3.5	43	6
Vassbø	9-Jan-17	6.16	32.6	12	38	1.40	6.4	3.7	39	5
Vassbø	16-Jan-17	6.52	40.0	15	101	2.30	7.1	3.7	42	12
Vassbø	24-Jan-17	6.21	34.7	11	45	1.50	7.6	3.9	42	8
Vassbø	30-Jan-17	6.20	36.0	5	37	1.30	7.1	4.0	36	<5
Vassbø	6-Feb-17	6.32	33.2	5	43	1.30	6.5	3.7	35	
Vassbø	13-Feb-17	6.49	35.7	7	55	1.60	6.6	3.8	29	<5
Vassbø	20-Feb-17	6.24	29.5	23	34	1.20	5.3	3.2	69	7
Vassbø	27-Feb-17	6.31	32.8	16	34	1.30	6.3	3.6	54	6
Vassbø	7-Mar-17	6.42	34.0	11	44	1.40	6.3	3.6	34	6
Vassbø	13-Mar-17	5.76	29.5	11	12	0.78	6.1	3.5	57	19
Vassbø	20-Mar-17	6.47	35.8	5	42	1.40	7.0	3.9	38	<5
Vassbø	28-Mar-17	5.30	31.5	15	-4	0.48	6.8	3.7	82	25
Vassbø	2-Apr-17	6.30	29.2	19	36	1.30	5.4	3.0	53	9
Vassbø	10-Apr-17	6.38	25.8	15	32	1.00	5.0	2.7	40	<5
Vassbø	18-Apr-17	6.35	26.4	13	39	1.10	4.9	2.5	37	8
Vassbø	23-Apr-17	6.37	25.4	22	36	1.20	4.6	2.7	51	<5
Vassbø	2-May-17	6.40	23.8	32	32	1.00	4.3	2.6	40	5
Vassbø	8-May-17	6.28	19.3	32	26	0.85	3.4	2.1	38	<5
Vassbø	15-May-17	6.22	19.1	32	33	0.90	3.3	2.1	46	6
Vassbø	21-May-17	6.37	20.3	23	40	0.89	3.6	2.1	44	7
Vassbø	29-May-17	6.45	18.9	18	39	0.84	3.3	2.0	28	<5
Vassbø	6-Jun-17	6.23	19.6	33	36	0.79	3.2	2.1	50	6
Vassbø	12-Jun-17	6.30	17.9	41	39	0.81	2.9	1.9	67	11
Vassbø	19-Jun-17	6.38	17.0	36	28	0.75	2.8	1.9	40	6
Vassbø	26-Jun-17	6.02	15.3	32	25	0.69	2.3	1.8	73	14
Vassbø	3-Jul-17	6.59	20.0	12	38	0.90	3.2	2.0	32	6
Vassbø	10-Jul-17	6.39	18.4	36	35	0.74	3.0	1.9	44	8
Vassbø	17-Jul-17	6.31	16.1	56	32	0.69	2.4	1.8	73	12
Vassbø	24-Jul-17	6.44	18.0	34	36	0.81	2.9	2.0	35	<5
Vassbø	31-Jul-17	6.11	14.9	81	32	0.77	2.2	1.6	84	<5
Vassbø	7-Aug-17	6.12	15.5	60	28	0.65	2.5	1.7	62	10
Vassbø	14-Aug-17	6.39	16.7	39	34	0.72	2.6	1.7	38	<5
Vassbø	21-Aug-17	6.15	18.0	53	25	0.59	2.4	1.8	61	12
Vassbø	29-Aug-17	6.13	17.2	44	37	0.66	2.6	1.9	43	
Vassbø	4-Sep-17	6.45	17.9	31	48	0.83	2.8	1.9	34	7
Vassbø	11-Sep-17	5.90	14.0	80	11	0.49	1.9	1.6	84	15
Vassbø	18-Sep-17	6.26	16.5	37	25	0.75	2.4	1.8	33	<5
Vassbø	25-Sep-17	6.30	16.7	37	38	0.81	2.3	1.7	36	7
Vassbø	1-Oct-17	5.59	10.3	87	14	0.40	1.3	1.1	57	13
Vassbø	6-Oct-17	6.15	16.1	35	27	0.76	2.4	1.6	38	
Vassbø	9-Oct-17	6.20	16.8	45	31	0.81	2.4	1.7	33	
Vassbø	16-Oct-17	6.07	17.1	29	38	0.86	2.5	1.7	28	

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	23-Oct-17	6.00	15.5	39	31	0.79	2.3	1.6	44	
Vassbø	30-Oct-17	6.14	16.8	31	33	0.84	2.5	1.7	42	9
Vassbø	6-Nov-17	6.24	15.5	42	39	0.86	2.3	1.6	37	<5
Vassbø	13-Nov-17	6.12	18.3	23	35	0.93	2.9	1.8	38	12
Vassbø	21-Nov-17	6.17	20.8	20	38	1.00	3.5	2.0	22	<5
Vassbø	27-Nov-17	6.19	21.8	16	37	1.10	3.8	2.1	33	<5
Vassbø	4-Dec-17	6.44	22.3	23	41	1.10	3.9	2.2	36	10
Vassbø	12-Dec-17	6.45	23.0	17	43	1.10	3.9	2.2	22	<5
Vassbø	18-Dec-17	6.52	25.0	13	54	1.30	4.1	2.3	22	<5
Vassbø	27-Dec-17	6.21	23.1	18	30	0.84	4.4	2.5	30	10
Vassbø	2-Jan-18	6.23	27.7	18	27	1.03	5.5	2.9	29	5
Vassbø	9-Jan-18	6.37	26.9	21	36	1.12	5.0	2.8	21	6
Vassbø	15-Jan-18	6.33	25.3	13	36	1.04	4.5	2.7	22	3
Vassbø	23-Jan-18	6.31	24.2	17	33	1.03	4.3	2.5	17	4
Vassbø	29-Jan-18	6.22	37.9	20	26	1.23	7.9	4.2	38	16
Vassbø	5-Feb-18	6.46	33.4	16	44	1.37	6.3	3.5	23	4
Vassbø	13-Feb-18	6.30	27.9	16	35	1.16	5.4	3.0	28	11
Vassbø	20-Feb-18	6.34	28.2		40	1.18	5.3	2.9		
Vassbø	26-Feb-18	6.30	28.3	16	40	1.12	5.1	3.1	20	3
Vassbø	5-Mar-18	6.67	31.7	14	82	1.76	5.1	2.9	20	
Vassbø	12-Mar-18	6.34	27.2	11	36	1.15	5.1	2.8	25	8
Vassbø	19-Mar-18	6.47	28.8			1.29	5.0	2.8		
Vassbø	27-Mar-18	6.29	31.0	18	37	1.18	5.3	3.1	37	
Vassbø	4-Apr-18	6.11	27.4	14	43	0.95	5.1	2.9	24	6
Vassbø	15-Apr-18	6.25	26.6	15	39	1.03	4.3	2.8	27	6
Vassbø	22-Apr-18	6.26	21.7	21	34	0.94	3.6	2.3	28	
Vassbø	30-Apr-18	6.23	19.9	24	30	0.73	3.2	2.0	36	
Vassbø	8-May-18	6.12	15.8	26	47	0.58	2.5	1.6	27	
Vassbø	14-May-18	6.02	14.9	14	45	0.64	2.4	1.5	27	8
Vassbø	22-May-18	6.19	15.3	11	25	0.62	2.6	1.6	31	9
Vassbø	4-Jun-18	6.54	16.3	12	50	0.83	2.6	1.6	27	9
Vassbø	11-Jun-18	6.52	18.6	11	53	0.93	2.9	1.8	21	3
Vassbø	18-Jun-18	6.47	19.0	11	45	1.12	2.8	1.7	29	6
Vassbø	25-Jun-18	6.40	18.6	14	35	0.95	3.1	1.8	17	3
Vassbø	1-Jul-18	6.42	20.9	17	41	0.99	3.2	2.1	14	4
Vassbø	9-Jul-18	6.46	21.7	16	34	0.99	3.3	2.2	11	2
Vassbø	16-Jul-18	6.46	22.7	13	41	0.98	3.5	2.3	12	8
Vassbø	23-Jul-18	6.66	24.5	12	52	1.13	3.4	2.4	10	2
Vassbø	30-Jul-18	6.35	25.1	14	40	1.12	3.8	2.5	10	5
Vassbø	7-Aug-18	6.55	20.8	20	43	1.06	3.3	2.0	17	2
Vassbø	13-Aug-18	6.50	18.6	23	36	0.90	3.0	1.9	25	4
Vassbø	20-Aug-18	6.35	17.9	35	34	0.89	2.6	1.7	41	6
Vassbø	27-Aug-18	6.07	17.1	33	17	0.50	2.6	1.8	42	8
Vassbø	3-Sep-18	6.44	18.0	23	36	0.84	2.7		30	3
Vassbø	10-Sep-18	5.87	14.0	73	19	0.55	1.9	1.5	62	6

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	17-Sep-18	6.23	20.7	28	37	0.91	3.0	1.9	43	
Vassbø	25-Sep-18	6.26	23.0	22	40	1.13	4.1	2.3	34	2
Vassbø	1-Oct-18	6.31	22.1	26	42	1.12	3.9	2.2	35	3
Vassbø	8-Oct-18	6.28	22.3	28	33	1.06	4.0	2.4	51	7
Vassbø	15-Oct-18	6.26	20.0	32	41	1.10	3.1	2.0	45	3
Vassbø	22-Oct-18	6.41	19.3	44	38	1.08	3.0	2.0	48	4
Vassbø	29-Oct-18	6.18	18.5	36	28	0.85	3.1	2.0	39	7
Vassbø	5-Nov-18	6.03	17.7	34	20	0.61	2.9	1.9	44	11
Vassbø	12-Nov-18	5.83	15.8	59	17	0.51	2.3	1.7	67	13
Vassbø	19-Nov-18	6.30	18.4	31	39	0.90	2.8	1.9	33	3
Vassbø	26-Nov-18	6.16	19.8	25	27	0.81	3.3	2.2	35	6
Vassbø	3-Dec-18	6.26	19.4	32	31	0.92	3.1	1.9	45	12
Vassbø	10-Dec-18	6.31	19.0	32	35	0.94	3.1	2.0	39	7
Vassbø	17-Dec-18	6.44	22.1	23	46	1.21	3.2	2.1	26	5
Vassbø	27-Dec-18	6.30	20.3	33	39	1.02	2.9	2.1	53	11
Vassbø	2-Jan-19	6.31	21.2	28	37	0.99	3.6	2.1	46	
Vassbø	7-Jan-19	6.45	28.0	19	41	1.3	5.4	2.9	40	5
Vassbø	14-Jan-19	6.39	27.2	21	38	1.2	5.3	2.8	44	6
Vassbø	22-Jan-19	6.36	24.9	15	39	1.1	4.6	2.5	28	9
Vassbø	28-Jan-19	6.25	24.7	13	34	1.07	4.6	2.5	23	5
Vassbø	4-Feb-19	6.36	24.8	13	33	1.2	4.2	2.5	23	6
Vassbø	11-Feb-19	6.52	33.8	16	58	1.8	5.7	3.2	33	1
Vassbø	18-Feb-19	6.01	29.6	20	25	1.1	5.6	3.1	54	18
Vassbø	25-Feb-19	6.27	24.8	23	35	1.1	4.5	2.6	49	5
Vassbø	5-Mar-19	6.35	26.6	20	33	0.98	4.9	2.9	40	9
Vassbø	11-Mar-19	6.58	29.3	12	68	1.8	4.7	2.8	39	8
Vassbø	18-Mar-19	6.33	24.8	16	24	0.98	4.3	2.6	38	0
Vassbø	25-Mar-19	6.34	24.9	22	30	1.0	4.3	2.6	49	3
Vassbø	1-Apr-19	6.25	23.0	20	34	1.0	4.2	2.4	38	4
Vassbø	5-Apr-19	6.32	22.1	28	32	0.99	4.0	2.4	60	12
Vassbø	8-Apr-19	6.29	24.0	25	29	0.94	3.5	2.1	46	6
Vassbø	15-Apr-19	6.33	21.6	20	35	0.91	3.7	2.4	42	6
Vassbø	22-Apr-19	5.75	17.0	32	7	0.42	2.7	1.9	43	10
Vassbø	29-Apr-19	6.28	16.9	29	35	0.92	2.6	1.7	40	6
Vassbø	6-May-19	6.19	16.9	21	21	0.60	2.9	1.8	30	10
Vassbø	13-May-19	6.45	17.0	29	32	0.86	2.9	1.8	23	-5
Vassbø	20-May-19	6.16	14.9	25	15	0.52	2.7	1.7	24	-1
Vassbø	27-May-19	6.46	16.2	32	28	0.73	2.6	1.7	39	-5
Vassbø	3-Jun-19	6.27	16.5	38	29	0.82	2.4	1.7	47	5
Vassbø	11-Jun-19	6.28	15.5	36	28	0.73	2.3	1.6	38	7
Vassbø	14-Jun-19	6.33	14.7	44	31	0.68	2.1	1.6	42	5
Vassbø	17-Jun-19	6.32	15.5	45	34	0.72	2.2	1.7	40	7
Vassbø	24-Jun-19	6.30	15.4	41	34	0.68	2.2	1.7	45	5
Vassbø	1-Jul-19	6.47	17.9	34	38	0.87	2.7	1.9	26	2
Vassbø	9-Jul-19	6.32	16.0	34	42	0.75	2.3	1.7	33	11

Table 0.2 Continued

Sample location	Date	pH	Cond.	Colour	ALK_E	Ca^{2+}	Cl^-	Na^+	Al	LAl
			µS/cm	mg Pt/l	µeq/l	mg/l	mg/l	mg/l	µg/l	µg/l
Vassbø	15-Jul-19	6.48	18.5	26	47	1.0	2.7	1.9	19	
Vassbø	22-Jul-19	5.99	14.1	66	33	0.65	1.8	1.5		
Vassbø	29-Jul-19	6.32	17.2	29	38	0.87	2.5	1.8	26	
Vassbø	5-Aug-19	6.33	16.2	33	33	0.74	2.3	1.7		
Vassbø	9-Aug-19	6.51	14.6	53	31	0.71	2.0	1.6	57	4
Vassbø	12-Aug-19	5.83	12.8	89	26	0.58	1.5	1.4	88	15
Vassbø	19-Aug-19	5.93	12.9	76	23	0.59	1.7	1.4	76	4
Vassbø	26-Aug-19	6.37	15.3	40	42	0.82	2.1	1.5	39	0
Vassbø	2-Sep-19	6.33	15.9	47	40	0.96	2.2	1.6	45	13
Vassbø	9-Sep-19	6.40	15.4	40	44	0.93	2.1	1.5	39	7
Vassbø	10-Sep-19	6.61	15.1	41	42	0.91	2.1	1.5	41	12
Vassbø	15-Sep-19	6.10	14.6	67	32	0.85	2.2	1.4	58	6
Vassbø	23-Sep-19	6.26	18.6	28	46	1.1	2.9	1.9	24	1
Vassbø	1-Oct-19	6.43	18.8	26	45	1.1	3.0	1.8	30	
Vassbø	7-Oct-19	6.47	19.5	23	46	1.1	3.0	1.9	26	2
Vassbø	15-Oct-19	6.38	18.0	26	39	0.95	3.0	1.8	43	11
Vassbø	21-Oct-19	6.32	15.9	34	37	1.0	2.6	1.7	45	2
Vassbø	28-Oct-19	6.43	16.7	34	37	0.90	2.8	1.7	48	5
Vassbø	5-Nov-19	6.29	18.0	26	33	0.81	2.9	1.9	27	6
Vassbø	11-Nov-19	6.37	20.0	21	41	0.99	3.1	2.1	27	7
Vassbø	18-Nov-19	6.35	18.8	36	46	1.1	2.8	2.0	35	2
Vassbø	25-Nov-19	6.23	15.6	37	33	0.83	2.2	1.7	57	3
Vassbø	2-Dec-19	6.30	17.5	17	35	0.89	2.6	1.9	31	6
Vassbø	9-Dec-19	6.17	19.2	37	29	0.91	3.4	2.0	50	9
Vassbø	17-Dec-19	6.13	18.6	22	24	0.73	3.2	1.9	43	
Vassbø	23-Dec-19	6.34	18.8	26	43	1.1	3.0	1.8	51	7
Vassbø	30-Dec-19	6.09	15.5		27	0.72	2.5	1.6	48	11
Fossbekken	30-Nov-15	5.63	21.6	4	8	0.38	4.0	2.4	37	

*(E. Enge, personal communication, 2020)