CASE NO: 2024/2758 **DATE:** 2024-06-14

DAM SAFETY

Legislation, guidance and supporting documents

SVENSKA KRAFTNÄT

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Svenska kraftnät is a state owned enterprise with the task of maintaining the Swedish electricity transmission grid, which consists of about 16,000 kilometres of 400 kV and 220 kV transmission lines with substations and interconnectors. Svenska kraftnät is also the system operator for electricity in Sweden. Svenska kraftnät is developing the transmission grid and the electricity market to meet society's need for a secure, sustainable and cost-effective supply of electricity. In this, Svenska kraftnät plays an important role in implementing national climate policies.

In the role as national dam safety authority, Svenska kraftnät acts for a future with safe dams and coordinated preparedness for dam failures. We contribute to national coordination and development through clear requirements, guidance and follow-up. We provide supervisory guidance to the County Administrative Boards in matters of dam safety according to chapter 11 in the Environmental Code. We promote capacity building through research, development, education and information in collaboration with stakeholders. We follow up the progress and report to the government annually.

The report has been drafted by Dam Safety Experts at Svenska kraftnät and approved by the Electrical Preparedness Unit Manager.

Cover photo: The Sveg Dam in River Ljusnan. Photographed by Thomas Ärlemo.

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Foreword

Since the introduction of the revised and partly new legal framework of dam safety in 2014, Svenska kraftnät has published a number of guidelines, supporting documents and templates in the area of dam safety. These are compiled in this document, which provides information concerning

- dams and dam safety in Sweden
- regulations applicable to dam safety
- guidelines and knowledge compilations

The guidelines apply to dams where a dam failure can have significant societal consequences, i.e. dams with a dam safety class. They describe and develop the requirements of the Dam Safety Ordinance (2014:214). The main concerned parties are dam owners of classified dams and the County Administrative Boards that are supervising these dams. The recommendations are not legally binding.

Our expectations are that the guidelines and supporting documents for self-regulation and supervision will contribute to gradual improvements in dam safety and preparedness for a dam failure.

This document is an English translation of the original Swedish compilation. In the event of any discrepancies between the translated version and the original, the Swedish version shall prevail. The original Swedish text remains the authoritative source for all legal and technical references.

Contents

1 Dams in Sweden and their safety

Since the revised and partly new legal framework for dam safety entered into force in 2014, Svenska kraftnät has published a number of guidelines and supporting documents in the area of dam safety. The previous handbook has been replaced by this document and underlying guidelines and knowledge compilations. They constitute guidelines and supporting documents of Svenska kraftnät, in the field of dam safety.

This document provides:

- An overall description of dams and dam safety work in Sweden, the consequences of dam failures and roles and responsibilities in the area of dam safety (Chapter 1).
- An introduction to guidelines and supporting documents of Svenska kraftnät, for dam safety work (Chapter 2).
- A compilation of regulations applicable to dam safety (Chapter 3).

1.1 About the dams in Sweden

The terms dam, reservoir and dam facility
A *dam* is a structure that forms a barrier over a river or depression, for the purpose of storing, controlling and/or diverting water or water mixed with other materials. A legal definition of the concept is to be find under Chapter 11, Section 4 of the Environmental Code (1998:808) (the Environmental Code).

It happens that several dams needs to retain their water in one *reservoir*. *Dam facility* is used as a collective term for one or more dams which together retain a reservoir and/or protect lower-lying areas from flooding. This term also includes dams that regulate water reserves adjacent to the reservoir.

History
The water flow in rivers has been used by humans for a long time to perform heavy work, such as milling grain and sawing timber. To harness the power of water, dams were often necessary. The dams were used to accumulate the head at a specific point in the watercourse, regulate the water flow, and store water from one period to another.

In Sweden, the construction of dams began in the Middle Ages. During the 13th and 14th centuries, dams started to be mentioned in written documents. In addition to the aforementioned purposes, mines were also dependent on the power of water for pumping and hauling ore.

During the 17th and 18th centuries, dams were essential for the development of the Swedish iron industry. During the 19th century, dams played an important role in the transition to industrialism. Dam building technology enabled water to be used as a power source for industry and for transporting raw materials and finished products on rivers and through canals and locks.

1880-1950 various forms of land drainage were carried out in order to achieve better farming conditions on land that was too waterlogged for cultivation. Dams were sometimes built in lake outlets to enable water regulation and prevent too low water levels. Dikes and levees were built to gain land without draining and are still built today as protection from flooding.

During the 20th century, the expansion of hydro power for electricity generation was one of the cornerstones of the increase in prosperity. Knowledge and experience of dam construction techniques were crucial to this development.

Since the 1940s, dams also have been used in mining operations to create tailings ponds where residual products (tailings) from the processing of the mined ore are deposited.

Additional purposes for dams are water supplies for various operations, such as drinking water, process water and the manufacture of artificial snow.

Dams in Sweden

An estimation is that in Sweden there are about 10,000 dams of varying size and age. Most of them are small why a dam failure would not result in serious consequences. Around 2,000 dam facilities are used for hydroelectric power operations, of which just under 200 are large[1] dams, with a minimum height of 15 metres. Within the mining industry, there are active tailings storage facilities with large dams at around ten locations.

[1] Internationally, dams with a height of at least 15 metres, from the lowest foundation level to the crest of the dam, are often referred to as "large dams". There are around 60,000 large dams in the world. By way of comparison, Norway and Finland have 335 and 56 large dams, respectively.

1.2 The concepts of dam safety and dam failure

Dam safety

There is no legal definition of *dam safety* in either the Environmental Code or complementary regulations. The report *Dam safety – Clear rules and effective supervision*[2] (the report) describes dam safety as follows:

> *The following three factors are important for dam safety:*
>
> - *Safe dam structures*
> - *Safe operation (operation and status control)*
> - *Emergency management for dam failure and serious problems.*
>
> *According to this report, a definition of dam safety must include those three components. Dam safety can be defined as "the characteristics of the dam and the measures taken during operation and maintenance of the dam to prevent failure and to limit damage resulting from any such failure".*
>
> *Included in the characteristics are the inherent characteristics of a dam, i.e. its current safety status. The characteristics depend on the design, construction, history and operation of the dam, etc.*
>
> *The measures taken during operation and maintenance of the dam to prevent failure include status control, supervision, operation and maintenance, and the maintenance measures performed on the dam. This also includes in-depth investigations and analyses of the safety status, as well as renovation projects to strengthen and maintain the dam.*
>
> *The measures taken to limit damage resulting from failure include emergency management to prevent, but also to minimise the consequences of dam failure.*
>
> *For a dam facility to be safe, the water retaining functions and discharge functions must be correctly designed and function in all possible operating conditions. To ensure this, planning of dam safety operations, planning and implementation of status control measures to discover deficiencies, and rectification of any deficiencies discovered are required.*

The purpose of dam safety management is to avoid dam failure and to minimise the consequences if a dam failure should occur. An established principle in Sweden and internationally is that dam safety management should be based on potential

[2] Dammsäkerhet – Tydliga regler och effektiv tillsyn, SOU 2012:46.

consequences of a failure. This means that such dam facilities where a dam failure would lead to major societal consequences are prioritised in the dam safety management.

Both technical and organisational aspects affect dam safety. Traditionally, a safe dam has often been equated with a dam structure that is well-designed, well-built and well-maintained. The design of the dam facility and the technical system is, off-course, very important. However, the organisation and the personal managing these systems are also crucial ensuring dam safety. Over the past decades, increased attention has been paid to aspects such as risk analysis, instrumentation and supervision, dam failure emergency management, risk management safety management and organisational culture. These aspects are now central to dam safety management.

The dam safety development is affected by a number of different factors such as regulations and guidelines, supervision by authorities and emergency management, licensing and court practice. Furthermore, the provision of expertise and knowledge development among dam owners, authorities and academia, and technical expertise in general, are important aspects of maintaining and developing the safety of the dams in Sweden.

Dam failure
A *dam failure* is defined in Chapter 11 of the Environmental Code as

> *uncontrolled release of the water or mixture of water and other material that the dam is intended to retain or withhold.*

A dam failure can be caused by a sudden collapse of the dam or by gradual erosion. Mishandling leading to uncontrolled release of retained water is also included in the environmental codes definition of dam failure. When a dam fulfils its water retaining and discharge functions, but overtopping occurs anyway, for example during a flood situation, this does not constitute a dam failure.

1.3 Consequences of a dam failure

The consequences of a dam failure depends on conditions such as the dam water volume, type of dam structure, dam height and dam length, as well as topography and objects that may be damaged in the flooded area. In addition to flood damage, there may be collapse and landslides in slopes upstream and downstream of the dam, other erosion damage and failure of downstream dams. The “domino effect” is a phenomenon where a dam failure causes failures in dam facilities located downstream, so-called secondary dam failures. A dam failure in a dam facility with a large water reservoir located in the upstream part of a river can, in the worst case, causes failures in all dam facilities located downstream, i.e. a domino effect along the entire river down to the sea.

For the majority of the dams in Sweden, a dam failure would only have minor, local consequences, with less or negligible societal significance. About 450 dam facilities[3] have dam facilities in dam safety classes, which means that a dam failure there could have "significant"[4] societal consequences.

The consequences of a dam failure are often divided into impacts on the lives of people and health, damage to critical infrastructure and disruption of important societal functions, environmental damage, and damage to the cultural environment and economic assets. For some hydroelectric or regulating dams located in the upper part of large regulated rivers, a dam failure could lead to secondary failures in downstream dam facilities, causing serious disruption to society. The uncontrolled discharge of several hundred million cubic metres of the impounded water would then result in flooding along most of the river, with a risk of

- Loss of human life.
- Destruction of multiple homes and properties, cultural environments and workplaces.
- Extensive disruption to the country's electricity supply due to damage to the electricity grid and destroyed hydroelectric power stations.
- Extensive disruption of transports as a result of destroyed bridges along the river and damage to roads and railways.
- Destruction of infrastructure and extensive disruption to other essential activities, e.g. water supply facilities, radio-, and telecommunications.
- Serious environmental damage that cannot be restored for a long period of time.
- Substantial financial damage.

A dam failure could lead to severe strains as a result of the combined effect of the aggregated damages along a river. Overall, such a failure could have such serious consequences that it could lead to *a national crisis*. A national crisis is an event that affects many people and large parts of society and threatens fundamental values and functions[5].

[3] Number of dam facilities in dam safety classes A, B or C at the turn of the year 2021/2022.

[4] Significant consequences refer to consequences of very high, high or moderate societal importance. If a dam failure is judged to only have consequences of little societal importance, the dam in question should not have a dam safety class.

[5] Samhällets krisberedskap – stärkt samverkan för ökad säkerhet (Society's crisis planning – a strong society for increased safety), Swedish Government report skr. 2009/10:124

1.4 Dam safety development and the legal framework

Development of roles and regulations in the field of dam safety
Historically, dam safety issues in Sweden have not been subject to regulatory frames. The dams built during the expansion of Swedish hydropower were not governed by state standards or regulations for design, construction or operation. Instead, the industry has developed practices and guidance through various initiatives.

Applicable legal framework
Several different regulatory regimes are applicable in the area of dam safety, where the Environmental Code and the Civil Protection Act (2003:778) (the Civil Protection Act) and the complementary regulations are the most important. The requirements of the society are expressed in overarching and generally held rules, and the owners of the dam facilities have a great responsibility to do what is required to ensure dam safety. Other regulations, such as the Public Access to Information and Secrecy Act (2009:400), the Protective Security Act (2018:585), the Protection Act (2010:305), the Planning and Building Act (2010:900) and the Electrical Preparedness Act (1997:288) also applies to dam facilities to a varying degrees. Chapter 3 describes applicable regulations in the dam safety area in greater detail.

For dams of which a failure can have significant societal consequences, special dam safety and emergency preparedness requirements apply in addition to the general provisions set out in the Environmental Code and the Swedish Operator Self-Regulation Ordinance (1998:901). This concerns:

- Dams at over 450 facilities that have a dam safety class. Special requirements apply to these in accordance with the Dam Safety Ordinance (2014:214) (Dam safety Ordinance), see also section 3.2.
- Dams at around ten tailings storage facilities that constitute "risk facilities"[6]. These are subject to special requirements in accordance with the Regulation on the Extraction of Waste (2013:319), see also section 3.3.4.
- Dams at more than 150 facilities that constitute hazardous activities. These are subject to special requirements in accordance with the Civil Protection Act etc., see also section 3.4.1.

[6] For tailings storage facilities that constitute "risk facilities", the Regulation on the Extraction of Waste regulates all mining operations, including the dams. The regulation thus affects all mining operations and not only concerns dam safety.

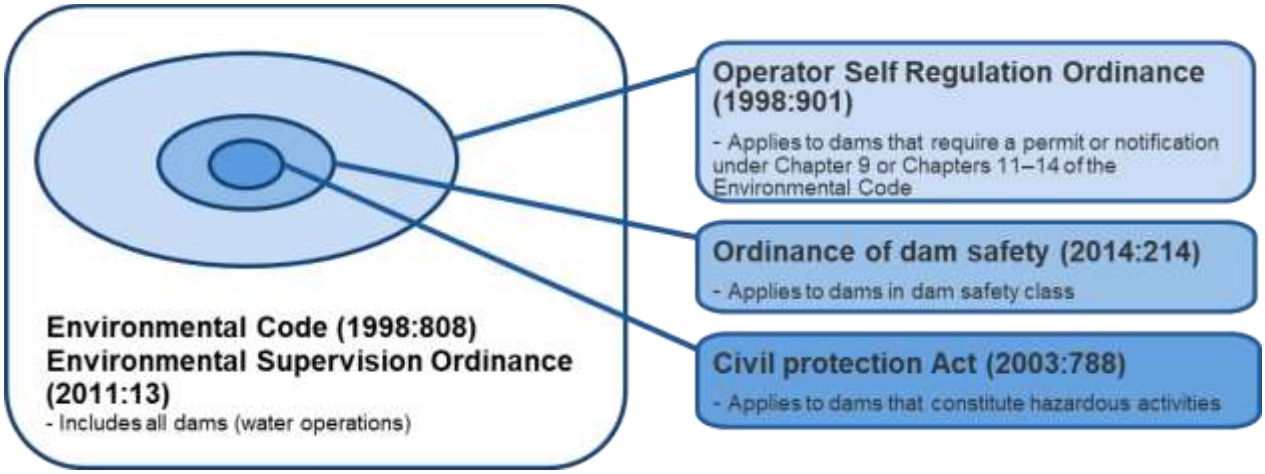

Figure 1. Schematic diagram of regulations applicable to different dam facilities/activities.

The revised regulations concerning dam safety in the Environmental Code and the Dam Safety Ordinance by 2014 aim to prevent dam failure by among other things supporting dam owners in developing their dam safety management and by strengthening the dam safety supervision undertaken by the County Administrative Boards. The regulation concerns dams where the consequences of failure of the dam in question can lead to a loss of human life or to significant societal consequences, regardless of the purpose of the dam.

The basis for the requirements set in the Dam Safety Ordinance is a system of dam classification based on the scope of the consequences that a dam failure might entail. For operators of dams with a dam safety class, special requirements are made regarding, e.g., self-regulation, overall assessment of dam safety and reporting to the supervisory authority. For supervisory authorities of dams in dam safety classes, there is an obligation to conduct dam safety supervision to ensure that the requirements are applied.

Industry guidelines, etc.

The majority of the dams in dam safety classes are owned by hydropower or mining companies. The owners are members of the industry organisations Swedenergy[7] and Svemin[8]. Swedenergy promotes dam safety among its member companies by among other things issuing Swedenergy's dam safety guidelines, RIDAS[9]. The guidelines state working methods and technical solutions for the members that follow good practices for dam safety, and can also provide support for authorities.

[7] Swedenergy (Energiföretagen) is an industry organisation that brings together close to 400 companies that generate, distribute, sell and store energy.

[8] Svemin is an industry organisation for mining and mineral and metal producers in Sweden.

[9] RIDAS – Swedenergy's dam safety guidelines – Swedenergy, rev. 2022.

Under the Svemin industry organisation, the mining companies have published a customised version of the guidelines called GruvRIDAS[10].

The guidelines are developed over time, account of new regulations, research and development, experience and events internationally and nationally. The guidelines have been thoroughly revised and updated since the introduction of the new dam safety regulations in 2014.

Svenska kraftnät, Swedenergy and Svemin have collaborated with the Swedish Meteorological and Hydrological Institute (SMHI) on drawing up guidelines for design flood determination for dam facilities[11]. The guidelines describe methods for calculating high to extreme floods and set requirements for design flood determination, i.e. the amount of water that a dam facility must be able to withstand or discharge without suffering serious damage. Although the guidelines are not legally binding, they have been used since the 1990s to evaluate existing dam facilities and to design new ones. The 2022 edition of the guidelines has been adapted to the Dam Safety Ordinance.

1.5 Roles and responsibilities

1.5.1 Dam owners/operators

Operators are subject to extensive responsibility under the Environmental Code and complementary regulations, as well as the Civil Protection Act. In the area of dam safety, this means that anyone who is obliged to maintain a dam structure, usually the dam owner, must acquire sufficient knowledge to protect human health and the environment. Such owner must prepare and follow self-regulation procedures. This includes planning operations, drawing up and following procedures for status controls and investigating and assessing the risks associated with operations so as to counteract or prevent deviations. Self-regulation must be documented and the supervisory authority must be notified immediately in the event of operational disruptions that may cause deviations. Unless unreasonable, the owner must also take the necessary protective measures and precautions and use the best possible techniques to avoid any damage. Should a dam failure occur, the dam owner holds strict liability for the consequences that follow the dam failure.

With the exception of small dams, the owner must investigate what consequences a dam failure could have and submit the consequence assessment and a proposed classification to the County Administrative Board. Dams that, in the event of a failure, would cause significant societal consequences receive a dam safety

[10] GruvRIDAS – Dam safety guidelines of mining companies – Svemin 2021.

[11] Riktlinjer för bestämning av dimensionerande flöden för dammanläggningar (Guidelines for Design Flood Determination for Dams). 2022 edition by Svenska kraftnät, Swedenergy and Svemin.

classification by decision of the County Administrative Board. For these dams, the Dam Safety Ordinance requirements for working in accordance with a safety management system, annual payment of supervision fees and reporting to the supervisory authority apply.

The owner or operator of dam facilities that constitute hazardous activities in accordance with Chapter 2, Section 4 of the Civil Protection Act shall also, to a reasonable extent, maintain or pay for preparedness, and otherwise take the necessary measures to prevent or limit serious damage to people or the environment.

1.5.2 The County Administrative Boards

In the majority of cases, the operational supervisory authorities for water operations in accordance with the Environmental Code, e.g. with regard to dam safety supervision, are the County Administrative Boards. Supervision includes, to the extent necessary, checking compliance with the Environmental Code and associated regulations and court rulings, for example including a follow-up of the annual dam safety reporting by the dam owner. Supervision also includes providing advice and support to owners, as well as any injunctions to rectify a situation.

It is the supervisory authority, i.e. normally the County Administrative Board, which, on the basis of the owner's or operator's consequence assessments, decides the dam safety classification of the dams located within the county, in line with the Environmental Code. It is also the task of the County Administrative Board, after consultation with the municipality where the dam facility is located, to make a decision on which dam facilities constitute hazardous activities in accordance with Chapter 2, Section 4 of the Civil Protection Act.

The County Administrative Board has geographical responsibility and coordinate crisis preparedness within the county and, before, during and after a crisis, work to coordinate and jointly focus on the measures that need to be taken.[12] This includes responsibility for ensuring that an overall regional status is compiled in crisis situations and supporting the actors responsible for crisis preparedness in the county with planning, risk and vulnerability analyses, as well as training and exercises.

1.5.3 The municipalities

The municipality has geographical responsibility at the local level[13] and, in the event of a crisis situation, must operate in a crisis management committee to fulfil tasks during extraordinary peacetime events and to ensure the coordination of

[12] Regulation on the County Administrative Boards crisis preparedness and elevated measures (2017:870)

[13] Lag (2006:544) om kommuners och landstings åtgärder inför och vid extraordinära händelser i fredstid och höjd beredskap (Act on the municipalities and county councils' tasks during extraordinary peacetime events and elevated measures).

information to the general public and the crisis management measures taken by various actors.

The municipalities are responsible for planning and exercising accident prevention activities and emergency rescue services. Emergency rescue services are responsible for immediate action to protect people, property and the environment,[14] which in the event of high floods or a dam failure may involve informing and warning the population, rescuing and evacuating people who are in immediate danger, deciding to evacuate affected areas, taking measures in connection with the evacuation in collaboration with the Swedish Police Authority, and supporting property owners in protecting property such as essential societal functions.

The municipalities exercise supervision of the preparedness of the dam owner for any dam failure that constitute hazardous activities, according to Chapter 2, Section 4 of the Civil Protection Act.

1.5.4 Svenska kraftnät

One assignment of Svenska kraftnät is to promote dam safety in Sweden.[15] The Ordinance of instruction for Affärsverket svenska kraftnät (2007:1119) states that Svenska kraftnät shall

1. *follow the impact of climate change and follow and contribute to developments in the country,*
2. *work to reduce the risks of serious disruption to society due to dam failure or high floods in regulated rivers,*
3. *report annually to the government on developments and, if necessary, propose measures,*
4. *encourage research, development and knowledge sharing, and*
5. *be responsible for supervisory guidance in accordance with the Environmental Supervision Regulation (2011:13) and collaborate with the county administrative boards to achieve effective supervisory work.*

The role of Svenska kraftnät is to provide guidance to the County Administrative Boards on their operational supervision, and coordinate, follow up and evaluate the operational supervision in matters relation to Chapter 11 of the Environmental Code. At the request of the Land and Environment Court, Svenska kraftnät may

[14] Chapter 1 Section 2 Civil Protection Act (2003:778).
[15] The Ordinance of instruction for Affärsverket svenska kraftnät (2007:1119)

also issue statements regarding dam safety in assessment cases in accordance with Chapter 11 of the Environmental Code.

Svenska kraftnät has some regulatory rights related to the dam safety requirements in the Dam Safety Ordinance in respect of consequence assessments, safety management systems, overall safety assessments and the annual dam safety reports of the owner.

1.5.5 The Swedish Civil Contingencies Agency

The Swedish Civil Contingencies Agency (in Swedish, Myndigheten för samhällsskydd och beredskap, in short MSB) is an authority responsible for issues concerning civil protection, public safety, emergency management and civil defence as long as no other authority has responsibility. Responsibility refers to measures taken before, during and after an emergency or crisis.

The Swedish Civil Contingencies Agency provides guidance to parties concerned under the Civil Protection Act and has issued general advice on obligations in connection with hazardous activities[16]. Since 2021 MSB has been supervising the Civil Protection Act with regard to such issues as municipal responsibility for emergency rescue services and accident preparation work.

The Swedish Civil Contingencies Agency provides supervisory guidance for issues relating to environmentally hazardous activities in accordance with Chapter 9 of the Environmental Code, in cases where the issues are regulated in provisions on the prevention and management of serious accidents in the Regulation on the Extraction of Waste. This e.g. concerns tailings storage facilities that constitute risk facilities.

The Swedish Civil Contingencies Agency is also one of the central authorities that is entitled to bring an action in connection with licensing under the Environmental Code and, when necessary, will represent environmental interests and other public interests.

[16] The Swedish Civil Contingencies Agency's general advice on obligations concerning hazardous activities MSBFS 2014:2

2 The guidelines and supporting documents of Svenska kraftnät

This chapter introduces the objectives and foundations of dam safety management. The following sections describe the overarching guidelines and resources that Svenska kraftnät provides in the area of dam safety.

2.1 Objectives and starting points

The Dam Safety Bill[17] prior to the introduction of the Dam Safety Ordinance states that

> *"A dam must at all times have the degree of safety against dam failure that is reasonable in terms of the costs of achieving this degree of safety. "*

This align with the general rules of consideration according to Chapter 2 in the Environmental Code, which together with the provisions in Chapter 11 constitute a framework for dam safety management in Sweden.

The interpretation of Svenska kraftnät is that the dam safety management of the operator should be conducted so that – through continuous oversight and improvements – it reduces both the likelihood of a dam failure occurring and the consequences of a failure should it nonetheless occur. For dams in classes A and B where the consequences of a failure would entail a significant risk of loss of human life and/or other extensive, severe consequences, it should be taken into account that low-probability events or conditions could also occur and that the necessary contingency arrangements should therefore be made. It is of great importance that safety is prioritised, that current environmental permits are followed and that there is transparency towards authorities with regard to the handling of risks and uncertainties.

Affected actors must be aware of and be able to act based on existing risk scenarios. The objective is that both community stakeholders and the general public have confidence that the operations in question are conducted responsibly, and that safety is perceived as reliable.

Given the uncertainties regarding the properties and condition of dams, as well as the loads and other circumstances they may be subjected to, caution and safety margins should be applied in dam safety management. Furthermore, measures should be flexible and robust, to promote a long-term perspective and various

[17] Proposition 2013/14:38 Dammsäkerhet (Dam Safety Bill)

future alternatives. The time perspective for protective measures should be based on the service life of the facility.

The starting points for dam safety work are summarised below.

Principles for dam safety management:

- Liability for the safety of a dam lies with its owner.
- A dam must at all times have the degree of safety against dam failure that is reasonable with regard to the cost of achieving this degree of safety.
- The consequences of a dam failure must be known, and dams must be classified according to the consequences of a failure.
- Dam safety requirements must be governed by the consequences of dam failure.
- Dam facilities must be designed, constructed, operated and maintained to ensure compliance with appropriate performance criteria.
- There must be coordinated and practiced procedures for the owner's emergency preparedness and the community's crisis management.
- Safety management systems must guarantee that safety work is carried out systematically and that continuous improvements are implemented.
- Reporting incidents and safety conditions to supervisory authorities must provide transparency and social insight into dam safety work.

2.2 Guidelines and supporting documents

This section describes the guidelines and supporting documents of Svenska kraftnät. They have been established to assist the actors concerned in developing dam safety measures that aligns with the intentions of the Dam Safety Ordinance. The recommendations in these guidelines and supporting documents are not legally binding but provide guidance from Svenska kraftnät to create a common basis for dam safety efforts and to align supervision.

Dam owners and the County Administrative Boards are the primary target groups for the guidelines that directly relates to provisions of the Dam Safety Ordinance. In addition to the dam owners and the County Administrative Boards, this document and other knowledge compilations target a wider group, including central authorities, municipalities, emergency services and consultants, etc.

All guidelines and supporting documents are available on the website of Svenska kraftnät; www.svk.se/dammsakerhet under the Guidelines and Support tab.

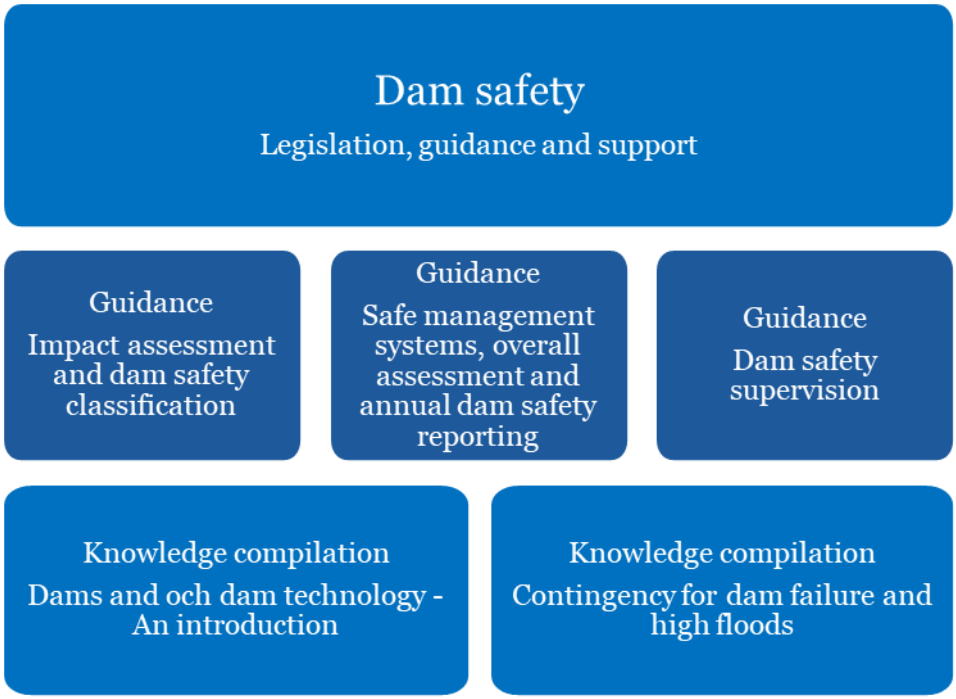

Figure 2. The guidance and supporting documents of Svenska kraftnät in the area of dam safety. References to paragraphs refer to the relevant paragraph of the Dam Safety Ordinance (2014:214).

2.2.1 Consequence assessment and dam safety classification

The guidelines on consequence assessment and the dam safety classification[18] support consequence assessments and the dam safety classification. The guidelines clarify the application of the regulation of Svenska kraftnät and includes what states the preparatory work for the constitutional provisions. The guidelines describe key concepts, identify for which dams a consequence assessment is required, outline the work process, specify the scope and documentation of consequence assessments, provide the basis for classification into dam safety classes, and explain the assessment of consequences. The guidelines can be applied to dams of all sizes, regardless of the purpose of the operation.

2.2.2 Safety management systems, overall assessment and annual dam safety reporting

The guidelines on safety management systems, overall assessment and annual dam safety reporting[19] are intended to provide overall support for operators of one or more dams in dam safety class in accordance with Chapter 11, Sections 24–25 of

[18] Konsekvensutredningar och dammsäkerhetsklassificering – Vägledning avseende Affärsverkets svenska kraftnät föreskrifter och allmänna råd om konsekvensutredning enligt 2 § förordningen (2014:214) om dammsäkerhet (Consequence assessments and dam safety classification – Guidelines concerning the regulations and general advice of Svenska kraftnät on consequence assessments under Section 2 of the Regulation), Svenska kraftnät, journal no. 2017/773.

[19] Säkerhetsledningssystem, helhetsbedömning och årlig dammsäkerhetsrapportering - En vägledning från Affärsverket svenska kraftnät jml. 5-8 § förordningen (2014:214) om dammsäkerhet, Svenska kraftnät, dnr. (Safety management systems, overall assessment and annual dam safety reporting - A guide from Svenska kraftnät, in accordance with Sections 5-8 of the Regulation (2014:214) on dam safety, Svenska kraftnät, journal no. 2019/1657.

the Environmental Code. The support relates to Sections 5-8 of the Dam Safety Ordinance. The guidelines clarifies the concepts of overall goals and action principles and illustrates what a safety management system for dam safety may contain. Furthermore, the purpose of the overall assessments of dam safety should be performed at least every tenth year, is described and support is given with regard to planning and preparatory work, content, scope, documentation and summary reporting. Finally, guidance is provided for annual dam safety reporting of the dam owner to the County Administrative Board.

2.2.3 Dam safety supervision

The guidelines on dam safety supervision[20] are intended to provide support for the administrators at the County Administrative Board that are responsible for dam safety supervision. The guidelines propose working methods for dam safety supervision, including prioritisation principles for supervision, procedures for reviewing the dam owners' annual dam safety reports, follow-up supervision at both on operational and facility level, and event-driven supervision. The guideline also described methods for annual dam safety supervision for reporting by the County Administrative Boards to Svenska kraftnät. Additionally, support is provided for collaboration between the County Administrative Boards and other authorities, as well as their work with permit reviews and dam safety improvement projects.

2.2.4 Emergency management for dam failure and high floods

The knowledge compilation on emergency management for dam failure and high floods[21] is intended to support the development of the operators' internal contingency planning and coordinated emergency preparedness planning, as well as to increase knowledge of other actors' responsibilities. Different forms of collaboration in the preparedness planning stage and in connection with high floods or dam failures are described. Suggestions for in-depth reading and role models are provided.

2.2.5 Dams and dam technology – An introduction

The book Dams and dam technology – An introduction[22] aims to provide basic knowledge about dams and dam technology and explains terminology. The book describes the development of dam construction and dam safety management, the different purposes of dams, the concepts of various types of dams and associated equipment work, and how a dam failure can occur. The focus of the book is on dam

[20] Dammsäkerhetstillsyn - En vägledning från Affärsverket svenska kraftnät, Svenska kraftnät, dnr. 2019/3216 (Dam safety supervision - A guide from the Svenska kraftnät, Svenska kraftnät), journal no. 2019/3216.

[21] Beredskapsplanering för dammhaveri och höga flöden - En kunskapssammanställning från Svenska kraftnät, Svenska kraftnät (Emergency management for dam failure and high floods - A knowledge compilation from Svenska kraftnät, Svenska kraftnät), journal no. 2018/2219

[22] Dammar och dammteknik – En introduktion (Dams and dam technology – An introduction), Svenska kraftnät, journal no. 2019/3255.

facilities used by the hydroelectric industry, but also tailings dams in the mining industry, canals and locks are described.

2.2.6 Templates and other supporting documents

The website of Svenska kraftnät: www.svk.se/dammsakerhet provides other supporting documents as well, some of which are listed below.

- Digital course for the guidelines and support of Svenska kraftnät, in the area of dam safety (PowerPoint presentation).
- Checklist regarding safety management systems and procedures for self-regulation of dam safety for dams in dam safety classes.[23]
- Templates for the dam owner annual dam safety reporting– company report, summary table and facility report.
- Template for the reporting of overall safety assessment by the dam owner.
- Form for consequence assessment and dam safety classification, Appendix to SvKFS 2014:1.
- Guidance for consequence assessment of small dams[24], which supplements the guidance on consequence assessments and dam safety classification of Svenska kraftnät and focuses on small dams causing limited damage in the event of dam failure.
- National procedures for raising the alarm and issuing warnings in the event of dam failure.[25]
- Guidelines for Design Flood Determination for Dams.[26]

[23] Checklista - Säkerhetsledningssystem och rutiner för egenkontroll av dammsäkerhet, (Checklist - Safety management systems and procedures for self-regulation of dam safety) Svenska kraftnät, journal. no. 2018/1212.

[24] Vägledning för konsekvensutredning av mindre dammar, WSP/HydroTerra på uppdrag av Svenska kraftnät (Guidelines for consequence assessment of small dams, WSP/HydroTerra commissioned by Svenska kraftnät), 2017.

[25] Raising the alarm and issuing warnings in the event of dam failure. Nationella rutiner - Utgåva 2022, dnr 2021/4430 (National procedures - Edition 2022, journal no. 2021/4430).

[26] Riktlinjer för bestämning av dimensionerande flöden för dammanläggningar (Guidelines for Design Flood Determination for Damsto). 2022 edition. Svenska kraftnät, Swedenergy and Svemin.

3 Regulations applicable to dam safety

This chapter describes the legal framework applicable to dam safety. At first, it presents the regulatory framework that entered into force in 2014 and that was revised in 2023. Next, it describes other rules in the Environmental Code and complementary regulations of importance for dam safety work. Finally, it mentions a selection of other regulations that are only relevant for certain dams, certain operators or certain situations.

3.1 Legal framework

In the Dam Safety Bill, it was proposed that overall regulation of dam safety issues should be introduced into the Environmental Code. The purpose of the proposed regulatory framework was to prevent dam failure by, among other things, supporting the development of dam owners' safety work and strengthening society's supervision of dam safety. Furthermore, in the Governmental Committee Directives, the government explained the main features of the overall regulation, as follows:

- *Dam safety level requirements should be specified.*
- *Dams in Sweden should be classified based on an assessment of the total consequences for its surroundings in the event of failure.*
- *Provisions on the self-regulation and reporting of dam owners should be introduced.*
- *The supervisory authority's supervision and ability to require physical dam safety measures should be strengthened.*
- *Dam safety supervision guidance should be strengthened.*

In 2014, the new and revised regulatory framework for dam safety came into force with the adoption of the Dam Safety Ordinance, along with additions to Chapter 11 of the Environmental Code and three additional regulations. In 2023, an amendment to Section 7 of the ordinance concerning overall assessments came into effect.

3.1.1 Environmental Code, Chapter 11, Sections 24–26: Safety classification of dams

Chapter 11, Sections 24–26 of the Environmental Code outline the classification of dams into one of three dam safety classes: A, B or C.

> *Section 24 A dam must be classified in a dam safety class, if failure of the dam might result in*
> *1. Loss of human life,*
> *2. Destruction of areas of national interest for cultural heritage conservation in accordance with Chapter 3, Section 6, second*

paragraph,
3. Disruption of electricity supply,
4. Destruction of infrastructure,
5. Destruction or disruption of vital social services,
6. Environmental damage, or
7. Economic damage.
The first paragraph does not apply to dams constructed to temporarily dewater an area in connection with construction or civil engineering work.
The first paragraph 1 does not apply if the risk of loss of human life is negligible. The first paragraphs 2-7 do not apply to consequences of little significance from a societal point of view. Act (2014:114).

Section 25 On classification in accordance with Section 24, the dam must be classified in
1. Dam safety class A, if failure of the dam could lead to a crisis that affects many people and large parts of society and threatens fundamental values and functions,
2. Dam safety class B, if failure of the dam could lead to major regional and local impacts or disruptions and the dam should not be classified in dam safety class A, and
3. Dam safety class C, if the dam should not be classified in dam safety class A or B.
If a dam failure could cause loss of life and the risk of this is not negligible, the dam must be classified in dam safety class A or B. Act (2014:114).

Section 26 Classification according to Sections 24 and 25 must be made by the authority that inspects the dam's safety. Act (2014:114).

When assessing dam safety classes, only consequences of societal significance should be considered. Minor consequences that only affect individuals and have little importance for society should not be considered. If a dam failure could result in loss of human life and the risk is not negligible, the dam should be classified in dam safety class A or B.

Temporary dams, such as cofferdams erected during maintenance work or other building measures, shall not be classified[27].

[27] Even though dams that temporarily replace a classified dam do not need to be classified, they should be designed, constructed, and monitored with consideration for the class of the dam they are replacing.

The classification shall be made by the authority that undertakes dam safety supervision, i.e. the County Administrative Board.

Appeal of a decision concerning dam safety class under the Environmental Code

The County Administrative Board's decision on dam safety class may be appealed. According to Chapter 16, Section 12, paragraph 1, the entity who is the subject of a decision has the right to appeal the decision if the decision is not in their favour. According to judicial practice, the dam owner is considered subject of a dam safety class decision and have the right to appeal the classification.

The appeal is lodged with the Land and Environment Court (in Swedish, Mark- och miljödomstolen, MMD) for assessment and decision. The judgement of the MMD on dam safety class may be appealed to the Land and Environment Appeals Court (in Swedish, Mark- och miljööverdomstolen, MÖD). In order for MÖD to examine the appeal a leave to appeal is required. It is not possible to appeal the judgement of MÖD according to Chapter 5, Section 5 of the Land and Environment Courts Act (2010:921).

3.1.2 Dam Safety Ordinance (2014:214)

The ordinance states that the entity who is responsible for maintenance of a dam, usually the owner, must produce a consequence assessment and an assessment of the consequences of a failure of the dam in question. It also lists the obligations of an owner of a classified dam. The owner is obliged to:

- Develop and work according to a safety management system for the dam in question.
- Conduct an overall assessment of the dam's safety at least every ten years.
- Submit a dam safety report to the supervisory authority annually.

Below are excerpts from Sections 2-10 of the Ordinance and statutory comments from the Dam Safety Bill[17]:

> ***Impact assessment***
> *Section 2 The entity responsible for maintaining a dam must ensure that there is always a documented current investigation and assessment that lists the consequences of a dam failure (consequence assessment).*
>
> *An consequence assessment must describe;*
> *1. How a dam failure is assumed to occur,*
> *2. Which areas can be flooded in the event of a dam failure, and*
> *3. What could be damaged in the areas that would be flooded in the event of a dam failure.*

Section 3 A consequence assessment does not need to be conducted, however, if:
1. The dam is lower than 5 metres, and
2. Failure of the dam would not mean the uncontrollable release of more than 100,000 cubic metres of water, or a mixture of water and other materials, at the time of the failure.

Section 4 The entity who is obliged to maintain a dam that is subject to the consequence assessment requirement must submit this to the supervisory authority together with a proposal for classification in accordance with Chapter 11, Sections 24 and 25 of the Environmental Code.

The regulations and general advice of Svenska kraftnät - SvKFS 2014:1[28] on consequence assessments specify the requirements for which dams that must undergo a consequence assessment, what the assessment should include, and when these assessments should be conducted and reviewed. In addition, Svenska kraftnät provides guidance on consequence assessment and dam safety classification[18], which complements the regulations outlined in SvKFS 2014:1.

Safety management system and self-regulation procedures

Section 5 The entity who is obliged to maintain a dam classified in accordance with Chapter 11, Sections 24 and 25 of the Environmental Code must develop and work according to a safety management system for their operations. The safety management system must include the methods, procedures and instructions that need to be established and applied with regard to
1. The organisation and defined tasks, areas of responsibility and competence requirements for personnel involved in dam safety work;
2. Identification and assessment of serious accident hazards;
3. Operation, status checks and maintenance;
4. Managing change;
5. Planning for emergencies; and
6. Audits and reviews.

The entity who is obliged to maintain a dam must draw up a document that provides a general description of the safety management system. The description must also include the overall goals and principles for the undertaking of safety work.

[28] Affärsverket svenska kraftnäts föreskrifter och allmänna råd om konsekvensutredning enligt 2 § förordning (2014:214) om dammsäkerhet (The regulations and general advice of Svenska kraftnät on consequence assessment under Section 2 of the Dam Safety Ordinance (2014:214)).

According to Section 5, the dam owner must develop principles for dam safety, and these principles should guide all aspects of their safety work. The Dam Safety Bill[17] states that the required level of safety for a specific dam should serve as the foundation for these overall goals and action principles.

The safety of an operation is also contingent on the operator's overall organisational structure. To ensure safe operation, the organisation must establish and maintain a comprehensive system that includes structures, responsibilities, and procedures, supported by appropriate resources and available technical solutions.

The goals, action principles, and safety management system for dam safety should be adapted to the risk of severe accidents (dam failures) inherent in the specific operation. It is essential to allocate the necessary resources to ensure the operation is conducted in line with the safety management system.

> *Section 6 The provision in Section 5 does not concern anyone liable for the maintenance of a dam that constitutes a risk facility as defined in Section 10 of the Regulation on the Extraction of Waste (2013:319).*

As stated in Section 6, certain mine dams are exempt from the provisions in Section 5. According to the Dam Safety Bill,[17] the purpose of this is to avoid double regulation[29].

Overall assessment of the safety of the dam

> *Section 7 The entity who is obliged to maintain a dam classified in accordance with Chapter 11, Sections 24 and 25 of the Environmental Code must conduct an overall assessment of the dam's safety every ten years. The assessment must also include the organisation of the operation. The results of the assessment must be documented.*

The Dam Safety Bill[17] states that an overall assessment in accordance with Section 7 involves considering the entirety of dam safety issues collectively. The primary objective of such assessment is to present a comprehensive overview of the dam's safety status. Its purpose is to determine whether the design and functionality of the dam complies with the specifications outlined in existing regulations and

[29] A classified tailings dam under the new ordinance can also constitute a risk facility under the Regulation on the Extraction of Waste (2013:319). For risk facilities, the operator must have a strategy to prevent serious accidents, a safety management system, a waste management plan and an internal emergency action plan. These provisions partly correspond to certain provisions of the new dam safety regulation. However, there is no reason to exempt tailings dams from the basic statutory provisions now proposed in the bill. On the other hand, the issue will be highlighted when ordinances are issued by the government and the authorities. In such case, some of these provisions will not apply to the tailings dams that constitute risk facilities.

standards, both domestic and international, as well as other applicable safety requirements.

The overall assessment must indicate whether the dam safety organisation and the operation is sufficient to ensure that the required safety level can be maintained until the next overall assessment. The overall assessment must include an assessment of whether organisational or structural changes need to be made in order to ensure an appropriate safety level based on the dam safety class of each dam.

Dam safety report

> *Section 8 The entity who is obliged to maintain a dam classified in accordance with Chapter 11, Sections 24 and 25 of the Environmental Code must annually submit a report to the supervisory authority on the dam's properties and the measures taken during operation and maintenance of the dam to prevent dam failure and to limit damage as a result of any such failure.*

The Dam Safety Bill[17] describes the reasons for introducing requirements for dam safety reporting for classified dams in accordance with Section 8. The description includes the following: The most important components of the new ordinance to achieve satisfactory dam safety are primarily that any party with a dam maintenance obligation has well-functioning self-regulation and that the supervisory authority checks that the self-regulation is appropriately designed. For the supervisory authority to be able to carry out its supervisory activities, the authority must be given good insight into the self-regulatory work. The parties obliged to undertake maintenance must therefore also be subject to certain reporting obligations in this area. Reporting requirements should be differentiated by dam safety class.

Authorisation for Svenska kraftnät

> *Section 9 Svenska kraftnät may issue regulations for when at the latest a consequence assessment in accordance with Sections 2 and 4 must be submitted to the supervisory authority.*
>
> *Section 10 Svenska kraftnät may issue regulations concerning the content, scope and documentation of*
> *1. The consequence assessment in accordance with Section 2,*
> *2. The safety management system in accordance with Section 5,*
> *3. The overall assessment in accordance with Section 7, and*
> *4. The report in accordance with Section 8.*

Svenska kraftnät has exercised the authority to issue regulations on consequence assessments[18]. Guidelines have been issued regarding impact assessments, dam

safety classification,[18] safety management systems, overall assessments and dam safety reporting[19], see section 2.2.

3.1.3 Ordinance on Fees for Examination and Supervision under the Environmental Code (1998:940)

The operator that maintains a dam (normally the dam owner) that is classified to a dam safety class must pay an annual fee for the dam safety supervision made by the County Administrative Board[30]. This annual supervision fee amounts to SEK 96,000 for a dam classified in dam safety class A, SEK 32,000 for a dam classified in class B and SEK 6,400 for a dam in class C. If several dams are included in a dam facility, the maximum amount specified for any of the dams as above will constitute the fee to be paid for the entire facility. The fee must be paid as from the following calendar year after a dam safety class decision has been announced.

Under Section 66, paragraph 3 of the Regulation on County Administrative Board Instructions (2007:825), revenues may be utilised by the county administrative board that performs the dam safety supervision.

The Ordinance on Fees for Examination and Supervision also[31] provides that fees for the county administrative board's supervision of water activities in accordance with Chapter 11 of the Environmental Code may be charged by the county administrative board according to a special decision and be paid at SEK 800 per hour.

3.2 Other rules applicable to dam safety under the Swedish Environmental Code

This section describes other rules in the Environmental Code and associated regulations that are applicable in the area of dam safety. These rules are more general in nature and do not solely concern dams in dam safety classes.

3.2.1 Swedish Environmental Code, Chapter 2, Sections 1–8: General rules of consideration, etc.

Chapter 2 of the Environmental Code includes general rules of consideration (Sections 2-6) that aim to prevent negative effects of operations and increase environmental consideration. The rules of consideration apply to everyone who conducts or intends to conduct an activity or undertake an action, and are applied, for example, in connection with licensing and supervision by the authorities. Concerning dam safety, the following are important:

[30] Förordning (1998:940) om avgifter för prövning och tillsyn, 3 kap 11 a § (Regulation (1998:940) concerning fees for examination and supervision, Chapter 3, Section 11 a).

[31] Förordning (1998:940) om avgifter för prövning och tillsyn 3 kap. 11 § (Ordinance (1998:940) on Fees for Examination and supervision, Chapter 3, Section 11).

- *The principle of the burden of proof* means that it is the entity who conducts or intends to conduct an activity that must demonstrate compliance with the general rules of consideration. This can be proved by, among other things, functioning self-regulation.
- *The knowledge requirement* means that the entity who conducts or intends to conduct an activity must have the knowledge needed to protect human health and the environment from harm and adverse effects.
- *The precautionary principle* means that the very risk of injury or adverse effects on human health or the environment obliges the operator to implement such protective measures, observe limitations and take the other precautionary measures necessary to prevent or counteract damage or adverse effects caused by the activity or measure. In professional operations, the best possible technology must be used.
- *The appropriate location principle* means that a suitable location must be selected for the operations, i.e. a place where the purpose can be achieved with minimum intrusion and inconvenience to human health and the environment.
- *Plausibility* means that the requirements set in the rules of consideration only apply to the extent that they are not considered unreasonable to fulfil. With regard to plausibility, the benefit of the protective measures must be compared with the cost, i.e. the requirements made must be environmentally justified without being financially unreasonable.
- *Liability for damages* means that the entity who caused an injury or inconvenience to people's health is responsible for rectifying the injury.

3.2.2 Environmental Code, Chapter 11, Water operations

Chapter 11, Section 9 of the Environmental Code: Permit obligation and obligation to report for water operations

The governing principle in Chapter 11, Section 9 of the Environmental Code is that water operations require a permit under the Environmental Code. This requirement generally applies for dam safety-enhancing measures. Even when a permit is not mandatory, operators can voluntarily apply for one to secure the legal benefits it provides

Permit applications are examined by the Land and Environment Court. . If the planned activity can be assumed to have a significant environmental impact, a specific environmental assessment must be made and an environmental impact assessment must be prepared by the operator. The rules for specific environmental assessments are described in Chapter 6, Sections 20–37 of the Environmental Code.

According to Chapter 11, Section 9a of the Environmental Code, it is sufficient for certain small water operations to submit a notification to the County Administrative Board. Section 19 of the Water Operations Ordinance (1998:1388) provides supplementary governance. Such water operations may start no earlier than eight weeks after notification has been made, provided that the County Administrative Board does not decide otherwise. In individual cases, the County Administrative Board can decide on the acceptance of the notification combined with the injunctions (conditions) that are required in order for the provisions of the Environmental Code to be followed. This may, for example, be a matter of precautionary measures to avoid injury or adverse effects on human health or the environment. If required, the supervisory authority may order the operator to apply for a permit in accordance with Chapter 11, Section 9 of the Environmental Code, or to make a decision to ban the operations.

According to Chapter 11, Section 12 of the Environmental Code, certain minor measures may be carried out without a permit or notification. This paragraph applies only if it is "evident that neither general nor individual interests are harmed by the impact on water conditions of water operations". The burden of proof for this lies entirely with the operator, and the evidence requirement is then very high.

Chapter 11, Section 16 of the Environmental Code: Measures that can be undertaken without prior permission

In the event of damage or other event that requires immediate permit-liable modification or repair measures to prevent harm to people or the environment, the owner or the person responsible for maintenance can invoke Chapter 11, Section 16 of the Environmental Code and undertake such measures without first having applied for or obtained a permit. The supervisory authority must always be informed of the planned measures before they are carried out. Applications for retroactive approval must be submitted as soon as possible. Examples of events where the use of the clause may be considered include damage to a dam structure that risks progressing rapidly (worsening) and jeopardising the safety of the dam and therefore requires immediate action.

Measures that contravene provisions concerning the containment and discharge of water may also be undertaken without prior permission if this is necessary to avert danger to life or health, save valuable property, or for a similar reason. Instances where this might be considered may be lowering the reservoir when it is necessary to secure the dam. Also in this case, the supervisory authority must be informed and an application for retroactive approval should be submitted as soon as possible.

It is important that this emergency clause is used for the original purpose of the clause, i.e. to be able to immediately undertake certain measures to avoid harm or danger to human health and the environment. The paragraph may not be used "for

practical reasons" to start work requiring a permit before a permit has been obtained.

The owner should not wait too long before submitting an application for retroactive approval, as the application for approval in accordance with the paragraph must be made as soon as possible. The length of time this concerns is not specified in the legislation, but may be determined on a case-by-case basis.

Chapter 11, Sections 17–18 of the Environmental Code: Maintenance obligation and strict responsibility for dam failure

The owner or maintenance manager of a water facility is obliged, in accordance to Chapter 11, Section 17 of the Environmental Code, to maintain the water facility so that there is no harm to general or individual interests due to changes in the water conditions.

This important paragraph concerning dam safety aims, among other things, to avoid a dam failure. Maintenance responsibility entails an obligation not only to carry out ongoing repairs, but also to upgrade and renew obsolete facilities.[32] Maintenance responsibility remains for as long as the facility remains in place. To remove the maintenance obligation, the facility must be dismantled[33].

According to Chapter 11, Section 18 of the Environmental Code, the entity who is responsible for maintenance of *a dam for water regulation* must pay compensation for the damage caused by a dam failure. This obligation applies even if neither the entity nor anyone for whom they are responsible is accountable for the failure. However, an entity responsible for maintenance who can prove that the dam failure was caused by an act of war or another action during an armed conflict, civil war, or insurrection is exempt from liability. Other antagonistic actions such as sabotage do not exempt the responsible entity from liability for compensation.

Chapter 11, Sections 27-28 of the Environmental Code: Modern environmental conditions for power plants and dams, etc.

On 1 January 2019, certain legislative amendments were introduced in Chapter 11 of the Environmental Code requiring, among other things, that all water operations that produce hydroelectric power must have modern environmental conditions. This means reassessments of water rights for virtually all hydroelectric power plants with associated dams will be done over the next 20 years.

The requirements for modern environmental permits are clarified in Sections 24-44 of the Water Operations Ordinance (1998:1388). In accordance with the ordinance, the Swedish Agency for Marine and Water Management, the Swedish Energy Agency and Svenska kraftnät have jointly drawn up a proposal for a

[32] Bill 1997/98:45, part 2, page 139.
[33] Environmental Code, Chapter 11, Sections 19-20.

national plan for modern environmental conditions.[34] The purpose of the national plan is to guide authorities in the permitting process and water management from a comprehensive national perspective, ensuring that the reassessments of the environmental conditions for the hydropower result in both the greatest possible benefit for the aquatic environment and an efficient national supply of hydroelectric power. The plan includes, among other things, a timeline for when hydropower owners must submit their applications to the court. It also briefly describes how dam safety should be considered.

3.2.3 Operator Self-Regulation Ordinance (1998:901)

Section 5 of the Operator Self-Regulation Ordinance[35] which applies to operators of professional activities or measures that require a permit or notification under Chapter 9 or Chapters 11–14 of the Environmental Code, describes how procedures must be developed for continuous supervision that operation and control equipment is kept in good condition. Under Section 6 of the Operator Self-Regulation Ordinance the operator must take responsibility for their environmental impact by continuously and systematically investigating and assessing the health and environmental risks which their operations entail. In the event of an operational disruption or similar event that could adversely affect human health or the environment, the operator must notify the supervisory authority immediately.

3.2.4 Regulation on the Extraction of Waste (2013:319)

The EU Directive (2006/21/EC) on the management of waste from extractive industries[36] has been implemented in Swedish legislation through the introduction of a regulation and amendments to several other regulations. The aim of the Directive is to establish measures, procedures and guidelines to prevent or, as far as possible, limit such adverse impacts on the environment, and the consequential threats to human health that may arise as a consequence of the management of waste from extractive industries. The Regulation on the Extraction of Waste is relevant for dams in the mining industry.

Certain facilities for extractive waste are defined as *risk facilities*. Risk facility refers to an extractive waste facility:

- Whose characteristics are such that there is a risk that a fault or deficiency in the facility or in its operations could cause a serious accident.[37]

[34] Förslag till nationell plan för omprövning av vattenkraft - Med beskrivning av vattenmiljö och effektiv tillgång till vattenkraftsel samt identifierade behov för fortsatt arbete, Havs- och Vattenmyndigheten, Energimyndigheten och Svk 2019

[36] Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries

[37] The term serious accident may refer to the failure of a safety-classified dam

- Which is containing a certain proportion of hazardous waste.
- Whose water phase or liquid has a chemical composition, which means that it has to be considered a hazardous chemical product.

An operator who has a risk facility is obliged to have a *strategy for prevention of severe accidents*, a *safety management system* implementing the strategy and an *internal emergency action plan* specifying the measures to be taken at the facility in the event of an accident.

For risk facilities, the municipality is obliged to provide information to the general public and to draw up the municipality's plan for rescue operations (regulated by Chapter 3, Section 6 of the Civil Protection Regulation).

3.2.5 Environmental Code, Chapter 26: Supervision

Chapter 26, Sections 1-2 of the Environmental Code: General provisions concerning supervision
The purpose of supervision shall be to ensure compliance with the objectives of the Environmental Code and rules issued in pursuance thereof. The supervisory authority shall assess whether the conditions for e.g. water operations are sufficient. The supervisory authority shall, through advice, information and similar activities, create prerequisites for fulfilling the purpose of the Code.

The supervisory authority shall report infringements of the provisions of this Code or rules issued in pursuance thereof to the police or public prosecution authorities where there are grounds for suspicion that an offence has been committed.

Chapter 26, Section 9 of the Environmental Code: Injunctions and prohibitions
An injunction or prohibition shall be without prejudice to a decision or judgement concerning a permit in an application case that is legally valid pursuant to Chapter 24, Section 1 of the Environmental Code. Chapter 26, Section 9, fourth paragraph item 1 of the Environmental Code, however, enables the supervisory authority to notify such urgent injunctions or prohibitions that are required to avoid ill health or the occurrence of serious damage to the environment.

In conjunction with the entry into force of the dam safety legislation, an addition was introduced in Chapter 26, Section 9, fourth paragraph, item 2 of the Environmental Code. The addition entails that the supervisory authority may issue injunctions and prohibitions concerning measures to improve the safety of safety-classified dams as specified in Chapter 11, Sections 24 and 25. The Dam Safety Bill[17] states that this exemption provision has been extended to include injunctions and prohibitions concerning dam safety that are not urgent in the manner referred to in item 1 above. The level of intervention may not exceed what is necessary in each individual case.

Chapter 26, Section 21 of the Environmental Code: Information and investigations
A supervisory authority may order an entity who pursues an activity or takes a measure that is governed by the provisions of this Code or rules issued in pursuance thereof to submit any information and documents to the authority that are necessary for the purposes of supervision.

3.2.6 Environmental Supervision Ordinance (2011:13).

Needs analysis and register
Chapter 1, Section 6 of the Environmental Supervision Ordinance 2011:13 (the Environmental Supervision Ordinance), describes the analysis that an operational supervisory authority must develop regarding the need for supervision for the area of responsibility of the authority. According to Chapter 1, Section 7 of the Environmental Supervision Ordinance, one of the tasks of the supervisory authorities is to maintain a register of the objects that require periodic supervision. In the area of dam safety, the respective County Administrative Board must therefore keep a register of dams in the county, and noting which of these dams have a dam safety classification and must be subject to dam safety supervision.

Supervisory authority and supervisory guidance authority
The County Administrative Board is the supervisory authority for water operations in accordance with Chapter 2, Section 29 of the Environmental Supervision Ordinance (2011:13) and thereby also for dam safety. The County Administrative Board is also the supervisory authority for environmentally hazardous activities in accordance with Chapter 9 of the Environmental Code. County Administrative Boards have the opportunity to transfer the supervisory task to municipal committees.

According to Chapter 3, Section 1 of the Environmental Supervision Ordinance a supervisory guidance authority shall provide supervisory guidance within its guidance area concerning the application of the Environmental Code, regulations issued under the Environmental Code and EU regulations. Supervisory guidance authorities shall actively work for coordination and collaboration in matters relating to supervisory guidance.

- The Swedish Environmental Protection Agency is the supervisory authority for those parts of the Environmental Code for which no other authority is designated in the Environmental Supervision Ordinance.
- The Swedish Agency for Marine and Water Management is the supervisory authority for all issues relating to water operations in accordance with Chapter 11, with the exception of issues relating to dam safety (responsibility of Svenska kraftnät) and issues relating to soil drainage (the responsibility of the Swedish Environmental Protection Agency).

- The Swedish Civil Contingencies Agency will provide supervisory guidance on issues relating to environmentally hazardous activities in accordance with Chapter 9 of the Environmental Code. That, in cases where the issues are regulated by the Act (1999:381) on Measures for the Prevention and Mitigation of Major Chemical Accidents, the Ordinance (2015:236) on Measures for the Prevention and Mitigation of Major Chemical Accidents, or provisions on the prevention and management of major accidents in the Regulation on the Extraction of Waste (2013:319).

3.3 Other regulations

This section describes a selection of regulations besides the Environmental Code and its associated regulations that are applicable to dams and pertain to dam safety. These "other regulations" only apply to certain dams, operators or situations.

3.3.1 The Civil Protection Act (2003:788)

The Civil Protection Act makes special requirements of the owner and operator of activities that are deemed hazardous. According to general advice of the Swedish Civil Contingencies Agency on obligations in connection with hazardous activities,[16] dams and other water facilities should be considered hazardous when they contain such impounded water volumes or such a quantity of pollutants that people or the environment could suffer serious harm or damage in the event of a dam failure. Dam facilities with dams in safety classes A and B are designated in this advice.

The special requirements made of owners or operators of hazardous activities entail that the owner or operator must, to a reasonable extent, maintain or pay for contingency measures for personnel and property, and otherwise take the measures necessary to prevent or limit such serious damage. The owner or operator of hazardous activities may, according to Chapter 2, Section 5 of the Civil Protection Act and, with the consent of the municipality, utilise the warning devices installed to warn the general public in cases of high alert and in the event of accidents in peacetime. Furthermore, the operator of the hazardous activity is obliged to analyse the risks of the aforementioned accidents. The operator is also subject to certain reporting obligations in the event of an accident or imminent danger of an accident.

According to Chapter 2, Section 1 of the Civil Protection Act, anyone who discovers or otherwise becomes aware of an accident that presents a risk to someone's life or a serious risk to someone's health or to the environment, must, if possible, warn those who are in danger and, if necessary, call for help. The same applies to anyone who becomes aware that there is an imminent danger of such an accident.

After consultation with the municipality, the County Administrative Board decides which facilities are hazardous activities in accordance with Chapter 2, Section 4 of the Civil Protection Act. Supervision of the individual's commitments is exercised

by the municipality. The Swedish Civil Contingencies Agency exercises central supervision of, among other things, the obligations of the municipalities under the Civil Protection Act.

3.3.2 The Act (2023:407) on important announcements to the public (VMA:s)

On January 1, 2024, new regulations entered into force regarding important notices to the public- the Act (2023:407) on Important Notices to the Public d (the VMA-act) and the regulation (2023:579) on important notices to the public (the VMA-regulation). According to the law, broadcasting of VMA may be requested when there is danger to life or health or for extensive damage to property or the environment, if the message urgently needs to reach the public in order to prevent or limit the danger or damage. The government and authorities are given the right to request VMA. The Authority for Public safety and Emergency preparedness may issue additional regulations or, in individual cases, decide who may, in addition, request the sending of important messages to the public regarding warnings and information. For owners of dam facilities, the new regulations mean that, as a general rule, they can no longer request VMA.

3.3.3 The Planning and Building Act (2010:900)

The Planning and Building Act (2010:900) applies to building structures, including dams. Structures that are erected or modified must, among other things, have the technical properties that are essential in terms of load bearing, stability and durability. The Planning and Building Ordinance (2011:338) specifies requirements for the technical properties of buildings, which may be relevant with regard to buildings that are connected/technically linked to dams, such as technical buildings, storage buildings and power plant buildings. The Swedish National Board of Housing, Building and Planning has issued regulations and general advice on the application of European design standards (eurocodes), BFS 2011:10[38].

3.3.4 The Electrical Preparedness Act (1997:288)

The Electrical Preparedness Act (1997:288) (the Act) regulates the obligations of electricity companies to take measures to fulfil the need of the society for electricity supply in the event of severe strain and high alert. The legal obligations apply to companies that generate electricity, transfer electricity and trade in electricity. Dam owners in the hydroelectric power industry are thus subject to the obligations of the law and the supplementary provisions set out in the Electrical Preparedness Ordinance (1997:294).

[38] Boverkets föreskrifter och allmänna råd (2011:10) om tillämpning av europeiska konstruktionsstandarder (eurokoder) (The Swedish National Board of Housing, Building and Planning's regulations and general advice on the application of European design standards (eurocodes)).

The Act contains provisions on the obligation to take contingency measures in the electricity sector. Contingency measures are those measures needed to prevent, withstand and manage disruptions in the electricity supply that can impose severe strain on society. Contingency measures also pertain to making it possible to take the measures needed in the event of high alert. Operations that generate electricity, trade in electricity or transfer electricity on the basis of a grid licence in accordance with Chapter 2, Section 1 of the Electricity Act (1997:857) must take the contingency measures adopted under this Act. Further, they shall draw up a risk- and vulnerability analysis regarding the safety of their operations, and submit the information to the electricity contingency authority that the authority requires to be able to prepare the national risk and vulnerability analysis for the electricity sector.

Svenska kraftnät is the Swedish electricity preparedness authority in accordance with Section 1 of the Electrical Preparedness Ordinance. Svenska kraftnät has published regulations and general advice on contingency measures [39] . Before a facility of significant importance for the electricity supply in Sweden or within a location or area is erected, converted or otherwise modified, notification must be made to the electricity preparedness authority for testing. Work may not begin until the authority has made a decision on the matter.

Pursuant to Section 19 of the Electrical Preparedness Act, certain goals under Chapter 11 of the Environmental Code concerning permits for facilities subject to the provision of the Electrical Preparedness Act, or for substantial conversion, modification or extension of such facilities, may not be determined before testing has taken place under the Electrical Preparedness Act.

3.3.5 The Protective Security Act (2018:585)

Security protection concerns protecting the information and operations that are of importance for security of Sweden, against espionage, sabotage, terrorist offences and certain other threats. Security protection is regulated in the Protective Security Act (2018:585), the Protective Security Ordinance (2021:955) and the regulations on security protection of the Swedish Security Service. Svenska kraftnät has regulations in the field of security that supplement those of the Swedish Security Service.

If certain facilities, objects, systems, property or other assets of importance to the security at authorities and companies in Sweden are exposed to an attack, this could threaten the security in Sweden. This may, for example involve operations in the field of power supply and dam facilities. To fulfil their role, such security-sensitive operations may also need to handle information that is of importance for

[39] The regulations of Svenska kraftnät on electricity contingency measures (SvKFS 2023:1).

Sweden's security. If this information is disclosed, changed, made unavailable or destroyed, this may impact the security in Sweden. Security-sensitive operations need special security protection. Security protection is maintained via information security, physical security and personnel security measures.

Svenska kraftnät is the supervisory authority for individual operators in the areas of power supply and dam facilities, with the exception of nuclear activities. The role includes exercising supervision, handling certain consultation cases and providing guidance. More information about security protection can be found on the website of Svenska kraftnät.

The guidelines of Svenska kraftnät on safety management systems, overall assessment and annual dam safety reporting[19] provide examples of how dam owners and County Administrative Boards can assess and manage data that requires protection. Svenska kraftnät assesses that dams in dam safety class A and certain dams in dam safety class B are often security-sensitive operations. Dam owners of such dams should conduct a security protection analysis to investigate whether they are conducting security-sensitive operations.

3.3.6 Public Access to Information and Secrecy Act (2009:400)

The processing of requests for public documents by authorities and certain other bodies is regulated by the Public Access to Information and Secrecy Act (2009:400).

General documents must be registered as soon as they are received or created by an authority. If, upon receipt of a report from a dam owner, the county administrative board considers that there may be information in a general document that may not be disclosed due to a confidentiality provision, the board can indicate this by making a special note (confidentiality marking) on the document.

Whenever someone requests a document, the County Administrative Board must perform a confidentiality assessment before possible disclosure. If the County Administrative Board deems that the necessary legal support is in place, a decision is made to keep protected information confidential in the document. The confidential information may not be disclosed.

Examples of information for which confidentiality may be considered:

- *Defence secrecy* - Information relating to activities to defend the country, planning or other activities that can be assumed to damage the country's defence or otherwise endanger Sweden's security, if the information is disclosed, belongs to this category (Chapter 15, Section 2 of the Public Access to Information and Secrecy Act).

- *Risk and vulnerability analyses of authorities* - Information relating to an authority's risk and vulnerability analyses in respect of peacetime crisis situations, planning and preparations for such situations or handling of such situations are also subject to confidentiality (Chapter 18, Section 13 of the Public Access to Information and Secrecy Act).

Certain non-disclosure provisions and exceptions to confidentiality are contained in the Public Access to Information and Secrecy Act. Chapter 10, Section 2 states that information may be submitted to an individual or to another authority if this is necessary for the disclosing authority to be able to perform its activities. According to Chapter 10, Section 17, such information may be submitted to an authority, if the information is needed for supervision or auditing by the authority where the information exists.

3.3.7 Installations Protection Act (2010:305)

The Installations Protection Act (2010:305) contains provisions on certain measures to protect against sabotage, terrorism and espionage. It also regulates what can be deemed to be protected objects (e.g. power plants) and regulates issues concerning prohibition of access and photography and monitoring of protected objects. The Installations Protection Ordinance (2010:523) clarifies, among other things that the County Administrative Board decides on civil protection objects within the county. The decision that a power supply installation should be protected is thus made by the County Administrative Board. Decisions on protected objects usually entail that access by unauthorised persons is not permitted, and that there are greater opportunities to achieve police monitoring, etc.

The Dam Safety Bill states that an owner of a facility must assess whether an installation needs more comprehensive protection from the reasons for protection (sabotage, terrorism, espionage and aggravated robbery) specified in the Installations Protection Act. If the owner deems that such a need exists, an application can be submitted to the County Administrative Board. The County Administrative Board then assesses whether the facility should constitute a protected area. The government believes that certain dam facilities should reasonably be covered by the more far-reaching protection offered by the Installations Protection Act. For example, there may be a need for enhanced protection of dams in cases where the dam is part of a nationally vital power generation plant or where, in the event of failure, the dam could cause significant damage to downstream power generation or its surroundings. The government considers it important that for each dam facility with dams in dam safety classes A and B, the responsible operators carefully consider whether the dam should be a protected object or not.

3.3.8 Act (1929:404) on the validity in this realm of the Swedish-Norwegian Water Law Convention of 11 May 1929

The Act (1929:404) on the validity in this realm of the Swedish-Norwegian Water Law Convention of 11 May 1929 (the Act) constitutes legislation that concerns owners of and supervisory authorities for rivers and water bodies on the border between Sweden and Norway. It is supplemented by the *Act containing certain provisions for the carrying into effect in the Kingdom of the Water Rights Treaty concluded between Sweden and Norway on 11 May 1929 (1929:405).*

The Act refers to "*facilities, work or other measures in rivers in one country that cause noticeable changes in rivers in the other country in terms of depth, location, direction, water level or water quantity, or that cause obstacles to fish migration that damages fisheries within that country"*. As it only affects a few dams we don't get into any details in this document. Concerning the process of cases relating to these dams, contact may need to be made with the Norwegian Water Resources and Energy Directorate, NVE, which constitutes the dam safety authority in Norway.

Svenska kraftnät is a state owned enterprise with the task of maintaining Sweden's electricity transmission grid, which consists of about 16,000 kilometres of 400 kV and 220 kV transmission lines with substations and interconnectors. Svenska kraftnät is also the system operator for electricity in Sweden. Svenska kraftnät is developing the transmission grid and the electricity market to meet society's need for a secure, sustainable and cost-effective supply of electricity. In this, Svenska kraftnät plays an important role in implementing national climate policies.

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