Guidance to holistic risk and vulnerability assessment in the municipality

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PREFACE

The municipalities play a central role in civil protection and emergency planning. According to the Instruction on municipal preparedness, municipalities are required to work systematically and on a holistic basis on civil protection and emergency planning. The instruction underlines the municipality's important role as coordinator and driving force in civil protection.

The basis for civil protection at municipal level is awareness and knowledge of risk and vulnerability through a holistic risk and vulnerability assessment (holistic RVA). This will form the basis for the municipality's targeted work on reducing risk and vulnerability through prevention, strengthened preparedness, and better emergency response capabilities.

The purpose of Guidance to holistic risk and vulnerability assessment in the municipality is to provide a thorough description of methodology for implementing and following up a holistic RVA in accordance with the requirement for municipal preparedness as given in the Act of 25 June 2010 on the municipal preparedness duty, civil protection measures and Civil Defence (Civil Protection Act).

The requirements are specified in the Regulation of 22 August 2011 on municipal preparedness duty and in the Regulation of 18 December 2012 on the application of the Civil Protection Act in Svalbard and on the preparedness duty for Longyearbyen local government.

The guidance has been prepared by the Norwegian Directorate for Civil Protection (DSB) in cooperation with the County Governor of Rogaland and the University of Stavanger. In addition, important input has been obtained from other civil protection authorities. We have had good expert assistance from Proactima AS while working on the guidance.

Tønsberg, October 2014.

01

Introduction

INTRODUCTION

We never know when a hazard will strike us as a society, or what the hazard will be. However, what we can say with certainty is that hazards will happen, and that we as a society will be challenged. To acknowledge this is an essential prerequisite for good work on civil protection.

Hazards such as the fire in Lærdal in 2014, the flood in Gudbrandsdalen in 2013, Hurricane Dagmar during Christmas 2011, the terrorist attack on 22 July 2011 and the mud and rock slide in Hatlestad Terrasse in 2005 required a municipal response while also affecting the entire nation. The municipality must be prepared to deal with such hazards. At the same time, the municipality's work on civil protection and preparedness is primarily targeted at hazards that affect and challenge local communities.

The municipalities shall develop safe and robust local communities and have a general and basic responsibility to protect the population's[1] safety and security within their geographic area. The municipalities shall also help maintain critical societal functions during hazards. In this way, the municipalities constitute the foundation of Norwegian civil protection and emergency planning.

> "Good municipal preparedness is a fundamental prerequisite for good national preparedness."
>
> **White paper no. 29 (2011 – 2012)**

The purpose of the municipal preparedness is to ensure that the municipalities will work holistically and systematically on civil protection and preparedness across the sectors in the municipality. Knowledge of risk and vulnerability is essential for reducing the probability of a hazard occurring, and to reduce the consequences if it occurs.

By preparing a holistic risk and vulnerability assessment, the municipalities will have a better overview of and increased awareness of risk and vulnerability.

In addition, municipalities will gain knowledge of how risk and vulnerability can be addressed to strengthen work on civil protection.

The comprehensive risk and vulnerability assessment shall:

- provide an overview of adverse events that challenge the municipality
- provide awareness of the risks and vulnerabilities in the municipality
- spot risks and vulnerabilities across sectors
- provide knowledge of measures to avoid and mitigate risks and vulnerabilities in the municipality
- identify measures that are essential to the municipality's ability to handle stress
- provide a basis for objectives, priorities and necessary decisions in the municipality's work on civil protection and preparedness
- provide input into risk and vulnerability assessments within other municipal areas of responsibility and county RAV

In the guidance, we use holistic RVA as a term for the holistic risk and vulnerability assessment required by law and regulation.

[1] The population refers to those who are living and staying in the municipality at any given time.

1.1
STRUCTURE OF THE GUIDANCE

This guidance shows how a holistic RVA can be carried out in a municipality. While there is no requirement to follow the guidance, it will help meet the requirements for a holistic RVA in relation to the municipal preparedness duty. We have emphasised that the guidance should be easy to use for all the country's municipalities, regardless of size, geography and municipal organisation.

In the next chapter we will address the municipal preparedness duty of and holistic RVA. We will look at the demarcation between the municipal preparedness duty and the requirements for other risk and vulnerability assessments in the municipality. In addition, we go into further detail about the contents of the assessment.

In chapter three, we address how a holistic RVA can be conducted, from planning and practical carrying out to formulating measures and a plan for follow-up. We will use a consistent example to illustrate this.

In chapter four we go into more detail on how the municipalities can follow up a holistic RVA. We will look at how measures are decided and how they can be followed up in the municipality's holistic and systematic work on civil protection and preparedness, as well as integrated into plans pursuant to the Planning and Building Act.

In chapter five we give a brief summary of the main steps of a holistic RVA.

CHAPTER

02

The municipal preparedness duty and comprehensive risk and vulnerability assessment

2.1 MUNICIPAL PREPAREDNESS AND SECTOR PREPAREDNESS

Over the past decades, social developments have made sectors and functions in society more mutually dependent on each other. The purpose of the municipal preparedness duty is to help the municipality take civil protection-related challenges in the local community into consideration.

Civil protection and emergency planning in Norway is based on the principles of equality, proximity, responsibility and cooperation. This means that the municipality's various areas of responsibility will safeguard necessary civil protection and emergency preparedness in order to maintain its operations, even when subjected to stress.

The organisation of the emergency planning should be as similar as possible to ordinary organisation, and events shall be handled at the lowest possible level. For events that exceed ordinary capacity, and/or include several areas of responsibility, the municipality has a responsibility to facilitate holistic and coordinated emergency managment.

Hazards can entail that other actors such as the police, the Norwegian Radiation Protection Authority or the Norwegian Coastal Administration also have a response role. The municipality plays an integral role here as a cooperative actor with the other actors to resolve common challenges within the borders of the municipality. It will be the municipality's task to maintain the essential functions it is responsible for providing while safeguarding the population's need for safety and security.

There are special requirements and expectations for civil protection and preparedness in several municipal areas of responsibility, see Figure 1. This includes areas such as:

- fire and rescue services
- health and social preparedness
- acute pollution
- infectious disease control
- drinking water (where the municipality is the waterworks owner)
- planning and land use management
- serious incidents/preparedness in schools and kindergartens

The municipal preparedness duty does not replace the municipality's other responsibilities within civil protection and preparedness, but complements the readiness duties laid down in other regulations.

FIGURE 1. The municipal preparedness duty is holistic and cross-sectoral.

2.2 KEY CONCEPTS USED IN THE GUIDANCE

Many hazards are identified in a comprehensive risk and vulnerability assessment. They are analysed based on:

- Causes and probability
- Vulnerability
- Consequences
- Uncertainty

In a holistic risk and vulnerability assessment, we identify hazards that may occur, and we describe risks and vulnerabilities associated with them. Key concepts in this guidance are risk, probability, uncertainty, vulnerability, consequences and critical societal functions. In the guidance, we have used these as follows:

Risk is an assessment of whether an event may occur, what the consequences will be and uncertainty associated with this.

Probability is used as a measure of how likely it is that a specific event will occur within a specified period of time, given the available background knowledge. Risk is assessed based on certain knowledge. There are often many premises and assumptions and the knowledge can be good or limited, and some of the premises may turn out to be incorrect.

Vulnerability is an expression of the functional problems a system has when it is subjected to a hazard as well as the problems the system will have to resume its operations after the event has occurred (NOU (Official Norwegian Report) 2000:24). In other words, vulnerability states something about the ability the system has to withstand an event, and the system's ability to tolerate an event once it occurs. In this context, a system can be both technical subsystems (such as infrastructures) and larger organisational systems such as a municipality. A robust society has the ability to withstand and tolerate hazards, and the ability to quickly resume critical societal functions after failure.

For example, a nursing home in a municipality may be vulnerable to an energy supply failure because they have an old power generator with poor regularity and uncertain fuel capacity, while a nursing home in another municipality may be less vulnerable to an energy supply failure because they have a new power generator and plans for fuel delivery.

Critical societal functions are tasks that society must maintain in order to protect the population's safety and security. These are deliverables that cover the basic needs of the population. Food, beverages, heat and health services are examples of this. These services must be robust towards many different types of events. Failure of critical societal functions can amplify the consequences of an event, and create follow-up events that in turn give rise to new consequences (such as a power outage as a result of a storm).

Thus, a holistic RVA is an assessment of 1) the hazards that may occur, 2) the probability that a hazard will occur, 3) vulnerability of systems affecting the probability and consequences, 4) the consequences the event may have and 5) the uncertainty associated with the assessments, i.e. the quality of the knowledge we have about the phenomena to be assessed.

In the presentation of risk and vulnerability, it is important to disclose what is behind the specifications of probabilities and consequences, as well as the uncertainty associated with these assessments. What is it that causes us to believe a particular specification of probability? Why do we believe the consequences will be the way we describe? What circumstances affect the probability, consequences, and uncertainty?

Concrete and well-grounded risk and vulnerability descriptions that also include an assessment of the knowledge base provide a good basis for decisions about risk and vulnerability reduction measures.

Important parts of a risk and vulnerability assessment can be illustrated in a so-called bowtie diagram, see Figure 2.

FIGURE 2. Example of a bowtie diagram based on the hazard "landslide near residential area".

In the middle of the figure is a hazard. Possible causes that could cause the hazard to occur are shown to the left. Measures to prevent the hazard from occurring (probability-reducing measures) are also listed here. Possible consequences for different assets such as life and health, stability, environment and material assets are shown to the right. We also find measures to reduce the consequences (consequence-reducing measures) here.

Various factors will affect the probability that the hazard will occur, how well the measures work and how great the consequences will be. Such factors may be special characteristics of the municipality or an area in the municipality that causes the outcome of an event to be different than in other municipalities. Special characteristics may also be related to settlement patterns, infrastructure, topography, ground conditions and organisation. It is important to map these factors to say something about vulnerability.

2.3 WHAT IS A HOLISTIC RISK AND VULNERABILITY ASSESSMENT?

Risk and vulnerability assessments are carried out at different levels and for different operations and activities. There are statutory and regulatory requirements for special risk and vulnerability assessments within certain areas of responsibility such as health and fire preparedness and land use planning. The county governors are required to create risk and vulnerability assessments for the counties (county RVA). In addition come risk and vulnerability assessments carried out by, for example, local and regional infrastructure owners, industrial companies, etc. This is illustrated in Figure 3.

The guidance deals with a holistic RVA for a municipality. The municipality's many tasks require a holistic view of the assessment. This is to avoid the compilation of risk and vulnerability assessments within the municipality's areas of responsibility, without, for example, affecting mutual dependencies. A holistic RVA shall also manifest the municipality's important coordination role, promote the municipality's responsibility for civil protection across the municipality's areas of responsibility, and cooperation with external actors. Results from risk and vulnerability assessments at the national and county levels, as well as various areas of responsibility in the municipality, will form part of the basic material for a holistic RVA.

LEVEL	PUBLIC ADMINISTRATION	EXTERNAL ACTORS
State	• National risk assessment, (ministry, sector authorities)	
County Governor	• County RVA	
Municipality	• Holistic RVA	
Operation/field	• RVA assessment of municipal operation/field • RVA assessment for drinking water supply, health and fire preparedness • RVA assessment in development plans pursuant to the Planning and Building Act • Risk assessment of information systems that handle personal information	• RVA assessment of power supply • RVA assessments of transport • Risk assessments of enterprises handling hazardous substances (particularly major accident enterprises[2])

FIGURE 3. Risk and vulnerability assessments at different levels.

The following types of hazards shall be analysed in a holistic RVA:

- adverse events with potentially major consequences
- adverse events affecting multiple sectors/areas of responsibility and that require coordination
- adverse events that exceed the municipality's capacity to respond with the use of ordinary routines and rescue services
- adverse events that create great fear/concern in the population

[2] Enterprises covered by regulations concerning measures to prevent and limit the consequences of major accidents in enterprises in which hazardous chemicals are present (Norwegian Seveso Regulations)

The municipal preparedness duty stipulates that the overall objective is to ensure the safety and security of the population. How do we define the safety and security of the population? What assets do we need to protect? In this guidance, we have chosen to specify this in four societal assets with associated consequence types presented in Table 1.

SOCIETAL ASSET	CONSEQUENCE TYPES
Life and health	Deaths Injuries and illness
Stability	Lack of coverage of basic needs. Disruptions to everyday life
Nature and the environment	Long-term damage to natural environment Long-term damage to cultural environment/cultural monuments
Material assets	Economic losses

TABLE 1. Societal assets and consequence types for holistic RVA.

Section 2 d and e of the regulation emphasises assessing special challenges related to critical societal functions and loss of critical infrastructure. In addition, the municipality shall assess its own ability to maintain its operations when it is subjected to a hazard and the ability to resume its operations after the event has occurred. This means that a holistic RVA must include vulnerability assessments related to critical societal functions and loss of critical infrastructure.

Based on DSB's study of security in critical infrastructure and critical societal functions (KIKS, DSB 2012), we have prepared a list of critical societal functions in Table 2. The list is adjusted to the municipal level. It must be assessed in a holistic RVA whether these critical societal functions are relevant and suitable for the municipality.

Critical societal functions

1. Supply of food and medicines
2. Housing and heat
3. Supply of energy
4. Supply of fuel
5. Access to electronic communications
6. Supply of water and sewage disposal
7. Accessibility for people and goods
8. Follow-up of particularly vulnerable groups[3]
9. Health and care services
10. Emergency and rescue services
11. The municipality's crisis management and crisis

TABLE 2. Critical societal functions relevant for a municipality.

[3] Particularly vulnerable groups may, for example, include people with reduced functional ability, foreign language speakers, children, persons with a limited network or visitors.

CHAPTER

03

Comprehensive risk and vulnerability assessment – step by step

HOLISTIC RISK AND VULNERABILITY ASSESSMENT – STEP BY STEP

There are different approaches and standards for how risk and vulnerability assessments can be designed (for example, NS 5814:2008 and ISO 31000:2009). The main parts of the process are relatively the same in most standards and guidances, with a division into a planning phase, a phase of carrying out the assessment, and a follow-up phase. We will also follow this structure in the guidance, see Figure 4. At the same time, it is important to emphasise that the guidance is tailored to the expectations in the Norwegian municipal preparedness duty, and that this has been a guideline for the development of the guidance.

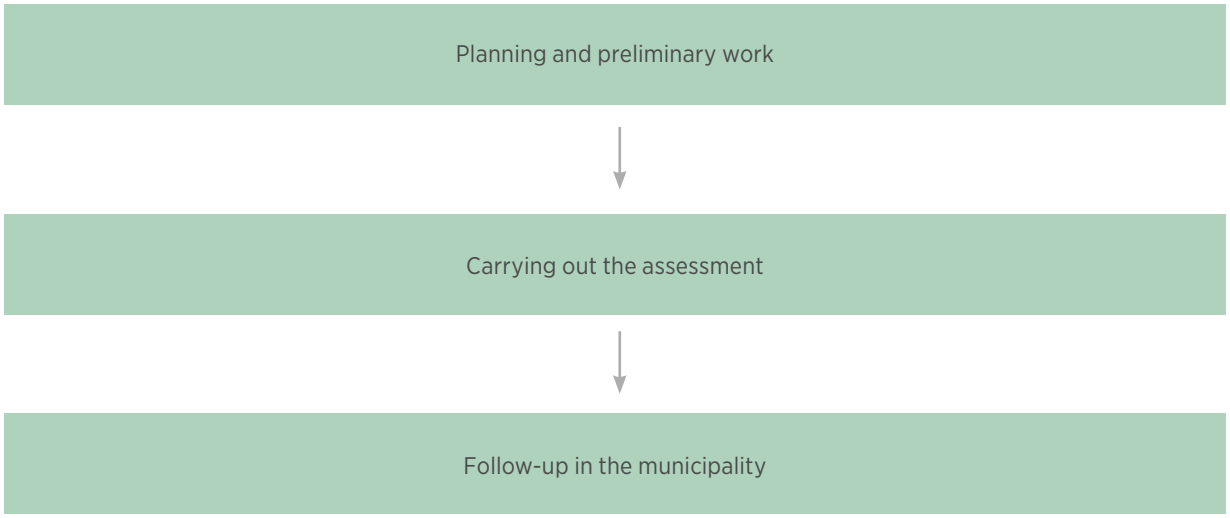

FIGURE 4. The main steps in a holistic RVA.

The main phases are divided into the following steps:

1. *Planning and preliminary work*

a. Anchoring and organisation of the assessment
b. Definition of purpose, delimitation, methodology and process (for the assessment)
c. Collection of information and description of the municipality

2. *Carrying out the holistic risk and vulnerability assessment*

a. Identification of hazards
b. Risk and vulnerability assessment of hazards
c. Presentation of risk and vulnerability scenario
d. Proposal for follow-up
e. Report

3. *Follow-up in the municipality*

a. Plan for follow-up
   - Goals, strategies, priorities
   - Measures for follow-up and development
b. Integration of civil protection and emergency preparedness in plans and processes pursuant to the Planning and Building Act

We will describe and give examples of how each step can be implemented in practice.

3.1 PLANNING AND PRELIMINARY WORK

Planning and preliminary work are important when the municipality is to begin work on a holistic RVA. Figure 5 shows the various steps of the planning phase.

3.1.1 ANCHORING AND ORGANISATION OF THE ASSESSMENT

It is practical to organise the work on a holistic RVA as a project with a project group, project manager and steering committee. As for other projects, the municipality's ownership and anchoring of the work is essential.

A holistic RVA is anchored with the municipality's administrative and political leadership to ensure ownership of the process, outcome and follow-up of the assessment. A holistic RVA must be anchored in the municipal council. We recommend that the municipal council be involved in the start-up, in the presentation of the results of the assessment and in the follow-up.

Representatives from the municipality's leadership should make up the project's steering committee and follow the work closely during the process. In order to ensure that the knowledge being developed is retained in the municipality, it is important that the project is implemented by the municipality's employees.

The project group should have an interdisciplinary composition to ensure expertise about the municipality's operations and geographic area. In addition, the project group should have expertise in, and experience from, risk and vulnerability assessments and civil protection and emergency planning.

An interdisciplinary project group can also contribute to learning, new knowledge and increased risk awareness across the areas of responsibility.

There should be a mandate, see Appendix 3, where purposes, demarcations, resource frameworks and progress are set out, see section 3.1.2.

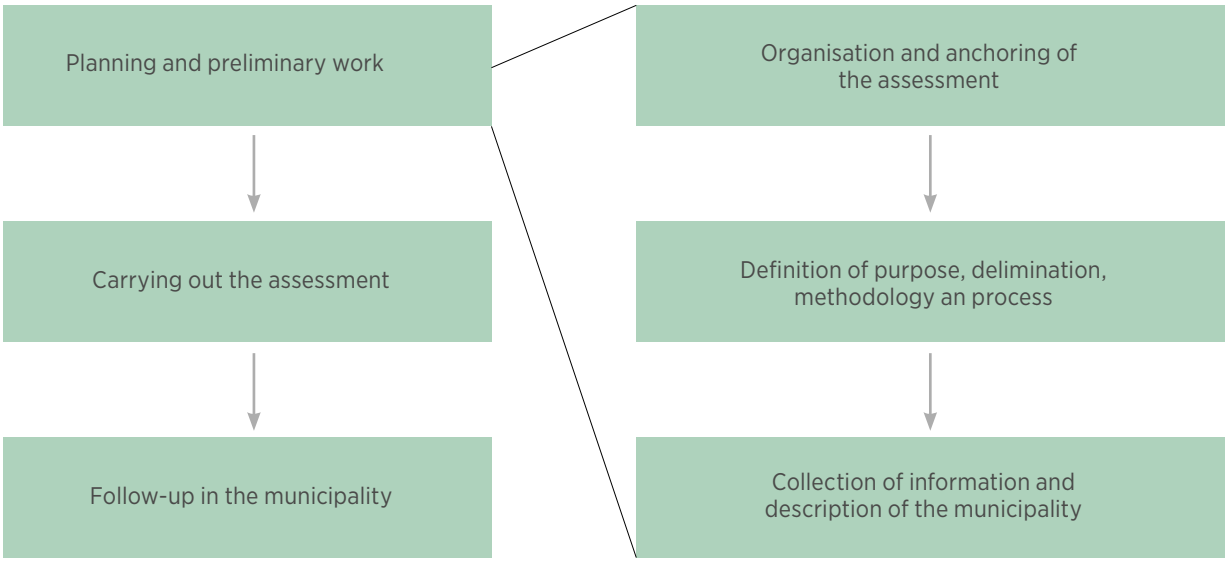

FIGURE 5. The steps in planning and preliminary work on a holistic RVA.

We recommend that several municipalities join forces to prepare a holistic RVA. Neighbouring municipalities often face the same challenges, and an event in one municipality may have consequences for another. It will often be the case that several municipalities would like to invite the same external players into the assessment process, and that collaboration around the preparation of the assessment will result in more efficient use of resources. Such collaboration would also help the municipalities to draw on each other's skills and resources. However, it is a requirement that each municipality shall have its own holistic RVA as an end product.

3.1.2 DEFINITION OF PURPOSE, DELIMITATION, METHODOLOGY AND PROCESS

The municipality prepares a mandate with clearly formulated purposes, issues and delimitations for a holistic RVA. This is to ensure that the assessment is relevant and provides the answers necessary to make good decisions. The mandate is presented to the project's steering committee.

Section 2 of the Regulation relating to the municipal preparedness duty describes the minimum requirements for what a holistic RVA should include. Although it is up to the municipality to describe the purpose of the assessment, the assessment should, at a minimum, safeguard these requirements.

The regulation's minimum requirements for the comprehensive risk and vulnerability assessment shall include:

a. existing and future risk and vulnerability factors in the municipality
b. risks and vulnerabilities outside the municipality's geographic area that may affect the municipality
c. how different risk and vulnerability factors can affect each other
d. special challenges related to critical societal functions and the loss of critical infrastructure.
e. the municipality's ability to maintain its operations when exposed to an adverse event and the ability to resume its operations after the event has occurred.
f. the need for alerting the population and evacuation

The municipality sets the framework and describes the expectations for a holistic RVA.

There are a number of clarifications and activities the project group must do as part of the planning process:

- selection of procedure
- grouping societal assets with related consequence types, as well as consequence and probability categories (see Appendix 2)
- identify critical societal functions (see Table 2)
- identify relevant information sources (see Appendix 6)
- identify relevant internal and external stakeholders
- assess necessary activities during the carrying out phase

It is important to obtain a good overview of risk and vulnerability in a holistic RVA. A holistic RVA should be followed up by more detailed assessments if there is a need for more precise information. The elements included in the assessment are shown in the bowtie diagram in Figure 7. We show how a holistic RVA can be carried out in practice in Chapter 3.2.

A number of choices that affect the outcome of the assessment are made while carrying out the risk and vulnerability assessment. This can be the choice of events to be included in the assessment, the societal assets, consequence types and critical societal functions that are to be used.

We do not propose the use of risk acceptance criteria in this guidance. Pre-establishing the acceptance criteria in an assessment process can easily be perceived as formal decision- making criteria and limit good discussions around what should be accepted by risk and vulnerability in both the project group and in the municipality's political and administrative leadership. At the same time, it is important that safety requirements in various laws/regulations are followed.

The project group must assess which internal and external actors are relevant to invite into the work, and when it is practical to involve them in the process. For example, internal operators may be involved initially, and external actors may be brought in at a later date.

In municipalities where a municipal emergency management council is established the council should be involved in the work.

The project group must also plan for other activities such as:

- status updates for the steering committee
- number of meetings and agenda for them
- consultation round for the assessment and the report
- presentation of outcomes and proposal for follow-up plan to the municipality's leadership

3.1.3 COLLECTION OF INFORMATION AND DESCRIPTION OF THE MUNICIPALITY

A part of the preliminary work is to obtain basic information about the municipality. Relevant information sources are:

- risk and vulnerability assessments of operations/ areas of responsibility in the municipality
- county RVA and subject map from specialist agencies,
- such as landslide and flood hazard zone maps
- evaluations and other reports of past events with significant consequences
- reports from inspections and exercises
- external assessments of critical societal functions
- risk assessments on a national level, such as the National Risk Assessment (DSB)
- research reports
- contact and collaboration with relevant actors

National specialist agencies publish a variety of digital subject maps that will also contribute important information:

- maps that provide an overview of areas that might be at risk of events
- maps that contribute to an overview of possible consequences of an event
- maps showing earlier events

All the digital map types can be combined freely, so they can provide the basis for assessing any simultaneous events, consequential events and consequences.

References to important map data and multiple sources of information are given in Appendix 6.

From the information collected and general knowledge of the municipality, the project group prepares a description of characteristics and conditions that characterise the municipality and are relevant in civil protection contexts. This can be:

- physical and natural conditions
- societal conditions: social, demographic and economic conditions
- transport (road, rail, air, sea)
- business/industry/tourism
- critical societal functions and systems
- plans for future development
- future climate

Appendix 4 gives examples of what may be special characteristics of a municipality.

The description of the municipality shall include various special characteristics:

- such as nature, business and communities that can entail a risk of hazards
- that render the community vulnerable to hazards
- that can pose a challenge when responding to hazards

Examples of special conditions in a municipality can be:

- areas with a risk of flooding or landslides near buildings
- companies that transport, use or store hazardous materials near schools or kindergartens
- events and tourism based on various activities
- communities with only one road connection
- areas with many nursing care-dependent individuals who live in their own home

Through the process of describing the municipality, the project group will gain an overview of the need for expertise to implement the assessment itself and which actors should be involved. The description of the municipality is to be included in the report that documents the holistic RVA.

3.2 CARRYING OUT THE HOLISTIC RISK AND VULNERABILITY ASSESSMENT

Once the municipality has collected information and compiles a description of the municipality, work begins on the actual carrying out of the assessment. Figure 6 shows the steps in carrying out a holistic RVA.

3.2.1 IDENTIFICATION OF HAZARDS

Identifying the hazards that can occur is an important part of the work on a holistic RVA. The hazards that may affect the individual municipality will vary.

To keep the assessment at an overall level, the following criteria are used for selection:

- hazards with potentially major consequences
- hazards affecting multiple sectors/areas of responsibility that require coordination
- hazards that exceed the municipality's capacity to respond with the use of ordinary routines and rescue services
- hazards that create great fear/concern in the population

The project group uses the description of the municipality as a basis for identifying hazards relevant to the municipality. Examples of hazards are given in Appendix 5. The list of examples is a useful tool for starting a discussion, and not an answer book for the hazards the project group is to assess.

The list of examples is divided into three types of events:

- natural hazards
- major accidents
- intentional acts

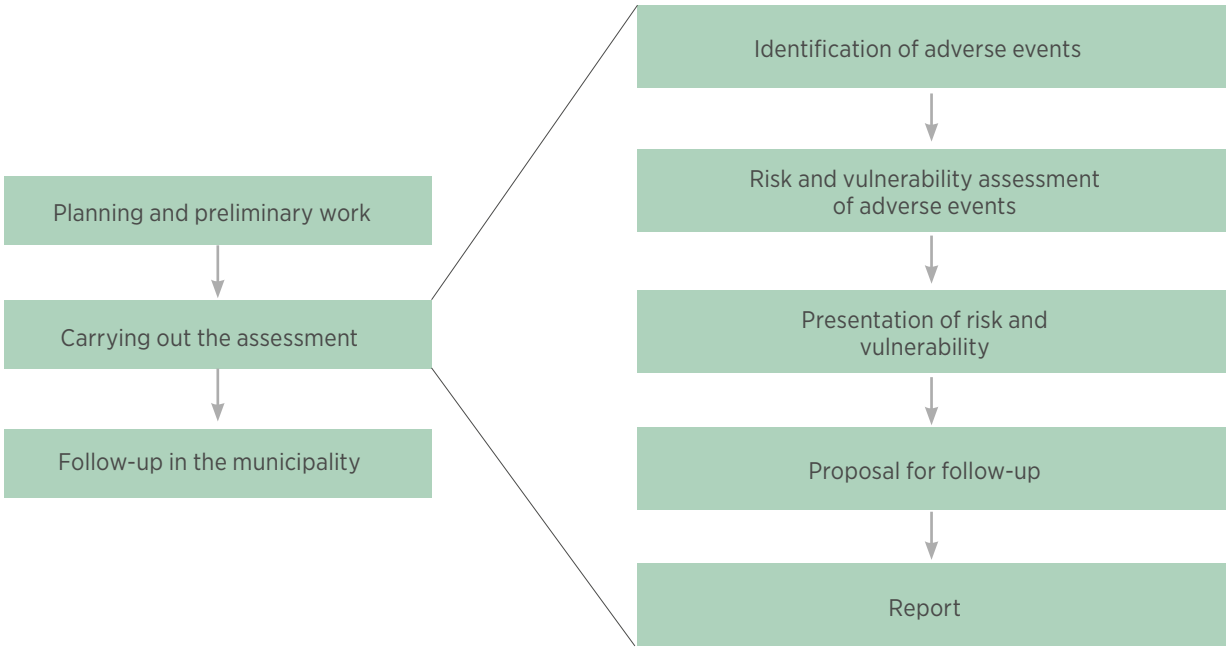

FIGURE 6. The various steps in the carrying out of a holistic RVA.

Natural hazars, major accidents and intentional acts can have a direct impact on life and health, stability, environmental and material assets, or they can have an indirect impact through the failure of critical societal functions. Examples of natural events can be storms, floods, landslides, avalanches and pandemics. For example, major accidents could be explosion accidents, transport accidents, or emissions of toxic gases or other substances.

Failure of critical societal functions and infrastructure can either occur as a consequential event of another hazard (such as natural event, accident, intentional event), but it may also be attributable to the direct failure of the societal function or infrastructure.

An example is an outage on a main power cable to an island or failure of the water supply due to technical failure of the treatment plant's control system. These events are included in the checklist as major accidents.

Intentional incidents are hazards that are caused by an actor who acts intentionally, such as a shooting episode at a school or sabotage of critical infrastructure.

The project group is responsible for identifying hazards. However, in this phase, it would make sense to invite other actors to join the process.
Relevant stakeholder can be:

- emergency response supervisor(s) in the municipality
- various municipal fields
  - fire and rescue
  - health and care services
  - technology and environment
  - culture
  - planning and building
  - school and childhood
- other emergency agencies
- representatives from critical societal functions
  - energy supply
  - water supply
  - transport
  - telecommunications/ICT
  - ports
- representatives from other activities
  - Civil Defence
  - hazardous industry
  - major events (sports, concerts, festivals)
  - dam owners
  - voluntary organisations
  - Norwegian Food Safety Authority
  - Norwegian Meteorological Institute

The involvement of other actors can be done in several ways.

Here are two suggested approaches:

Alternative 1: The project group arranges a meeting with participants from the municipality's areas of responsibility to involve staff and leaders in the discussion about the challenges the municipality faces. Input from the meeting will be the basis for the project group in the further process of identifying hazards.

Alternative 2: The project group organises one or more meetings with both internal and external actors to identify hazards.

In planning such meetings, the project group must consider:

- the actors that should be invited
- number of meetings
- how the individual meeting should be organised: setting goals, topics and organisation of the discussion

More meetings will be needed for some municipalities to identify the hazards. For other municipalities, the project group will carry out much of the identification process with contributions from the rest of the municipality.

The following agenda may be practical for both alternatives:

Agenda

1. Introduction to holistic RVA; background and purpose for identification of adverse events, methodology and process.
2. Description of municipality; review of the special characteristics of the municipality.
3. Identification of hazards
   a. open review to get input from participants
   b. structured review of checklist to supplement other hazards
4. Summary of identified hazards and the way forward.

After each meeting, the project group sorts and clarifies the identified hazards. The number of events selected will vary from municipality to municipality.

If a delimitation must be made in the number of hazards, this may be the basis for the prioritisation:

- Assumed high risk: Does the event have potential for high probability and/or major consequences?
- Representativeness: Can an event be representative of several similar events in the municipality?

The entire list of identified hazards should still be included in the report along with a brief explanation of why some of them are not included in the holistic RVA.

3.2.2 RISK AND VULNERABILITY ASSESSMENT OF HAZARDS

In carrying out a holistic RVA, the project group shall undertake a risk and vulnerability assessment of the hazards that have been selected. Regardless of the procedure, the project group shall ensure that relevant internal and external stakeholders are invited to be involved in the process. Suggestions for relevant actors can be found in section 3.2.1.

Here are two suggested approaches:

Alternative 1: The risk and vulnerability assessments can be carried out as one or more meetings for the project group only. Necessary background information is obtained through smaller meetings/conversations with relevant internal and external actors.

Alternative 2: The risk and vulnerability assessments are implemented as one or more meetings where the project group participates with relevant internal and external stakeholders.

Regardless of which alternative is chosen, it makes sense to plan the topics of the meetings with a view to the type of skills/actors needed. The division into event types such as natural events, major accidents and intentional events can be a starting point for such a structure. The goal is for the project group to collectively have sufficient knowledge to understand and describe the sequence of events and to assess risks and vulnerability.

The risk assessment assesses the events that can occur, the probability that they will occur, and the impact that these events can have. The vulnerability assessment is based on the systems exposed to events (stresses). The systems can be both technical subsystems (such as

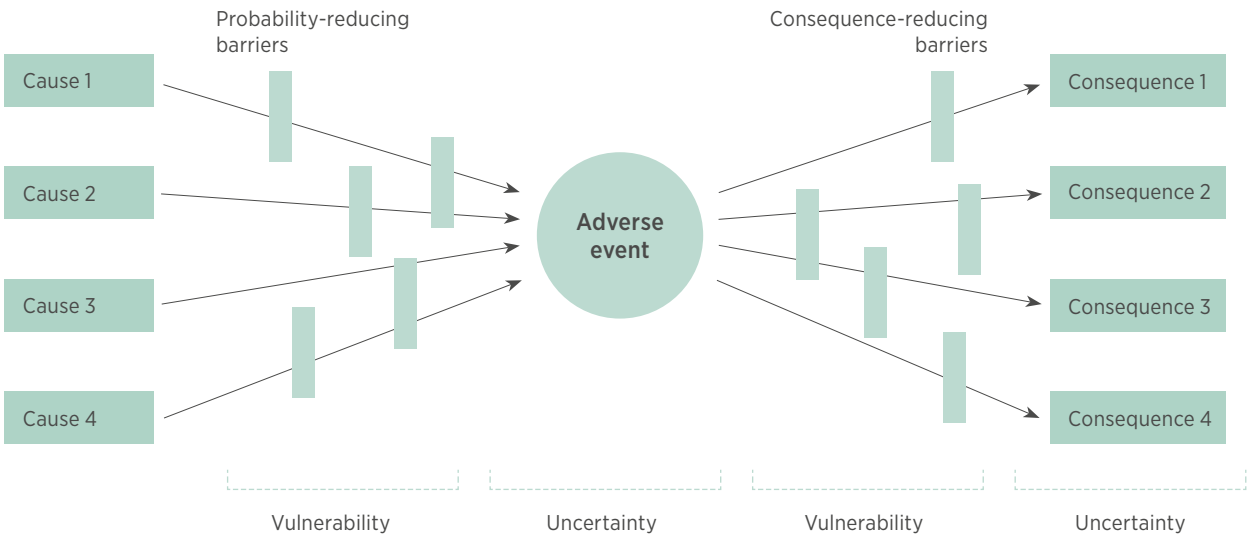

FIGURE 7. Bowtie diagram.

infrastructures) and larger organisational systems (such as a municipality). The vulnerability assessment should say something about how resilient the systems are to the stresses and the ability to recover. What do they tolerate, and when do they fail? Properties of both the event and the system that is affected affect the probability that hazards can occur and the impact of these events if they occur. See Figure 7.

A bowtie diagram illustrates the contents of a risk and vulnerability assessment. The left side shows what affects the probability of the hazard, and the right side what affects the consequences of the event. In both cases, this is about vulnerability and established barriers (measures). There are uncertainties both as to whether the event will occur and what the consequences will be.

It is the complex events that subject the municipality to the biggest tests and often it is a question of a chain of events. Where relevant, the assessment should include any simultaneous events (such as storm and fire) and consequential events (such as landslides caused by flooding, and power outages caused by storms). An example of a chain of hazards is shown in Figure 8.

In Figure 8, a storm is the triggering event that leads to the consequential power outage event, which in turn can lead to yet another consequential event: failure of the treatment plant. An assessment is often first made of the triggering event (e.g. flood, storm, accident) to identify possible consequential events, including failures. A vulnerability assessment of identified failures can be undertaken afterwards. An identified failure will then be a new hazard and assessed in the same way as the trigger event. A failure of the energy supply will be an important consequential event to consider because this often has implications for other critical societal functions.

The purpose of the vulnerability assessment is to understand the complexity of a hazard. If the event causes a failure of a critical societal function, this may result in a further development of the event that entails further consequences in addition to the direct impact of the event.

It is important to make a choice of where in the event chain the resources are to be employed. The failures the municipality wants to analyse in more detail depends on what the municipality is experiencing as most critical, what the municipality needs more knowledge about and what the municipality can influence.

For each of the hazards, a description is made of:

- course of events
- causes
- identified existing measures
- probability
- vulnerability
- consequences
- need to alert the population and evacuation
- uncertainty
- manageability
- proposals for new measures and improvement of existing measures
- transferability

The assessment of probability, vulnerability and consequences will be a process where new elements can emerge in the assessments so that specifications must be adjusted along the way.

It is important that the project group not only concentrates on a specific event in one particular area of the municipality, but also considers whether similar events can occur elsewhere in the municipality. We call this transferability in the assessment form.

The assessment of each hazard is documented in an assessment form. The assessment form found here. The following explains the process and use of the assessment form through a specific example.

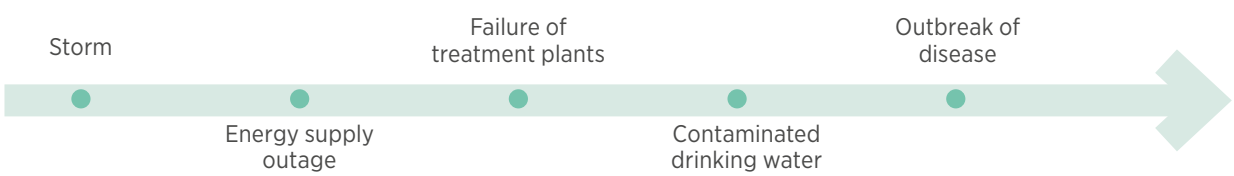

FIGURE 8. Chain of hazards.

NO.	HAZARD:
Description of hazard and local conditions	

CAUSES

IDENTIFIED EXISTING MEASURES

PROBABILITY	A	B	C	D	E	Explanation

Grounds for probability

VULNERABILITY ASSESSMENT

CONSEQUENCE ASSESSMENT							
Societal asset	Consequence type	Consequence category					Explanation
		1	2	3	4	5	
Life and health	Deaths						
	Injuries and illness						
Stability	Lack of coverage of basic needs						
	Disruptions to everyday life						
Nature and the environment	Long-term damage - natural environment						
	Long-term damage - cultural environment						
Material assets	Economic losses						

Overall explanation of consequence

Need to alert the population		
Need for evacuation		
Uncertainty		**Grounds**
Manageability		**Grounds**

Proposed measures

Transferability

FIGURE 9. Assessment form.

No.
Assign the hazard a unique number. This number can later be used when presenting the results of the assessment of the hazard.

Description of hazard and local conditions
Name the hazard. "The name" should describe a specific event, such as flooding in Lillebekk (Little Stream) that affects Lilleby (Little Town), landslide in the residential area Husløs (Homeless) or bus accident in the Lysløs tunnel (Lightless Tunnel).

Then give a more detailed description of the event and the area in which it is occurring, including critical societal functions and infrastructures. This description says something about geographic location, time, duration of the event and measures already established against this type of event. Special characteristics of the municipality that may influence the course of events should also be described.

Example of description of the hazard "Landslide in the residential area Husløs":

NO. 3 HAZARD: LANDSLIDE IN THE RESIDENTIAL AREA HUSLØS

Description of adverse event and local conditions

At the end of May a large quick clay landslide occurs in the residential area Husløs. The residential area consists of about 20 houses with approx. 70 inhabitants. The landslide occurs in the middle of the night when most people are sleeping. The landslide tears down the main high-voltage power supply to the centre of the municipality. This causes a failure of the power supply to large parts of the municipality for 3-5 days, including the hospital.

The road to the local medical centre runs through the residential area. Husløs is built on top of several quick-clay pockets, and during the rescue work the following day a new landslide occurs. The police have succeeded in evacuating the rest of the residents and rescue personnel.

Causes
Specify possible causes of the event.

Example of causes of the hazard "Landslide in residential area Husløs":

CAUSES

- Erosion
- Construction activities
- Precipitation

Identified existing measures
Before specifying probability and consequence, it is important that existing measures are mapped and documented so that the assessment takes these into consideration and considers their functionality.

Example of identified existing measures for the hazard "Landslide in the residential area Husløs":

IDENTIFIED EXISTING MEASURES

1. Plan for evacuation
2. Diversion/drainage of water

Probability

How likely is it that the hazard will happen? Suggestions for categories for specification of probability are given in Appendix 2. Historical data and accident statistics may be used where they are available, but many of the events will be rare, "unique" events where the data basis is deficient. Here, local knowledge and expert reviews can be a good help along with previous risk assessments and hazard mappings. An explanation should be given for why this probability has been specified.

It is important that the probability specification is assessed for the given course of events described, and takes into account the existing measures that have been established to avoid hazards. Landslides on one or another scale can conceivably occur relatively often in the municipality, but possibly not the specific course of events in "Landslide in the residential area Husløs".

Example of assessment of probability for the hazard "Landslide in the residential area Husløs":

PROBABILITY	A	B	C	D	E	Explanation
		X				Once every 100–1 000 years (0.1% – 1%)

Grounds for probability
Statistically, Norway can expect 2–3 major landslide accidents over the next 100 years. Local geological and topographical conditions in the area allow us to use the national statistics. No landslide mapping has been carried out in the residential area. For this reason, anti-landslide measures that could decrease the probability have not been carried out either.

Vulnerability assessment

It shall be assessed whether critical societal functions will be affected as a result of the hazard and how vulnerable these affected functions are to the event.

If the event causes failure of one or more critical societal functions, this may affect the consequences of the event. This must be described. In addition to considering the specific challenges associated with critical societal functions (see Table 2), an assessment shall also be made of the municipality's ability to handle the event and to maintain and resume its operations after the event takes place.

Help questions:

- Which critical societal functions will be affected by the hazard?
- Which critical societal functions is the municipality dependent on in order to handle the hazard?
- Which consequences will the loss of the function have for:
  - other critical societal functions
  - the municipality's handling of the hazard, including the municipality's ability to maintain and resume its operations
  - the societal assets (see Table 1)

VULNERABILITY ASSESSMENT

The landslide causes a failure of the power supply in much of the municipality. This affects the population, the municipality's operations, the hospital and large parts of the business community.

The municipality has recently invested in emergency power and alternative premises for the crisis management team in "Sorgenfri Nursing Home" and moves there. Both the waterworks and the nursing home have some emergency power.

However, it is unclear how long the generators will have fuel, and no arrangements have been made for the supply of fuel.

The local petrol stations cannot deliver as long as the power outage lasts because there is no emergency power for the fuel pumps. Manual pumps will not work, and the nearest petrol station is about 60 km away.

The telecommunications network has battery back-up for approximately four hours after the power outage. The mobile phone network will become overloaded and accessibility will become poor. The crisis management team has a satellite phone, but its capacity is poor. Due to the failure of the power supply, the municipality's website is down. This makes it difficult for the municipality to communicate with the population.

The municipality's evacuation centre offers evacuees heat and adequate food. The municipality's psychosocial health team is established and will seek out vulnerable groups in the municipality.

The road to the medical centre will be blocked as a result of the landslide and the area where the medical centre is located is without electricity. This entails reduced accessibility and the ability to provide health services. It will take about a week to put a temporary road solution into place. Meanwhile, the medical centre in the neighbouring municipality about 65 km away could be used.

Consequence assessment

The consequences can be systematised into four societal assets: life and health, stability, nature and the environment and material assets. Consequence types can be made for each of these societal assets. The project group creates consequence types and consequence categories for each societal asset adapted to its municipality.

Suggestions for consequence types and consequence categories are given in Appendix 2. In addition to specifying consequence, an explanation should be given for the specifications.

CONSEQUENCE ASSESSMENT

Societal asset	Consequence type	Consequence category					Explanation
		1	2	3	4	5	
Life and health	Deaths				X		6–10 deaths
	Injuries and illness				X		20–100 injured
Stability	Lack of coverage of basic needs						
	Disruptions to everyday life					X	> 1 000 affected for 2–7 days
Nature and the environment	Long-term damage - natural environment						
	Long-term damage - cultural environment						
Material assets	Economic losses	X					< NOK 100 million

Overall explanation of consequence

In the residential area Husløs there are 20 households with a maximum of 70 people who can be directly affected by a landslide. It is estimated that just under 9 human lives can be lost, and that up to 25 residents may be injured as a result of the event. Because an evacuation has been initiated, more lives will likely not be lost. The blocking of the road to the medical centre is not considered to have a bearing on the consequences for life and health because the medical centre in the neighbouring municipality can be used. The landslide caused a failure of the power supply to large parts of the municipality, including the hospital.

Life and health will at first not be affected by the power outage since the hospital has emergency power for emergency functions. The home care service does not have any users who depend on electrical medical equipment. Stability: Although essential needs are covered, the population will have significant disruptions to everyday life, many are evacuated and large parts of the municipality are without electricity.

Need to alert the population

Consider whether the hazard can trigger a need to alert the population. The purpose of alerting the population is to reduce the consequences of quickly reaching those who are or may be affected by the event. Examples of events that may conceivably result in a need to alert the population are the risk of large landslides, fire in the refuse incineration plant with the emission of toxic gases, distribution of contaminated drinking water, and a tank lorry accident with a risk of explosion.

Example of assessment of the need to alert the population of the hazard "Landslide in the residential area Husløs":

Need to alert the population	Residents of Husløs and surrounding areas are notified by neighbours and the police to get them out of the area as quickly as possible. It is not considered necessary to establish a plan for alerting the population in connection with the overall contingency plan.

Need for evacuation

Consider whether the hazard may trigger the need for evacuation, and specify the number of people with such a need. The purpose of the evacuation is to get affected people to safety and provide for basic needs. Examples of events that may conceivably cause a need for evacuation are landslides close to a residential area, nursing homes without electricity for a prolonged period, forecast of heavy flooding and a tank lorry accident with the risk of explosion.

Example of assessment of a need for evacuation for the hazard "Landslide in the residential area Husløs":

Need for evacuation	The police have ordered evacuation of all residents in the area, a total of 70 people. This does not exceed the capacity of the municipality's plan to receive evacuees in the overall contingency plan, but can be a challenge for the capacity to provide food.

Uncertainty

The uncertainty is related to whether, and if applicable when, a specific hazard will occur and what the consequences of this event will be. The specification of uncertainty concerns the knowledge base for the risk and vulnerability assessment of the event. Are relevant data and experiences available? Is the event/phenomenon that is being assessed well understood? Do the participants agree? If the answer is "no" to one or more of these questions, the uncertainty is considered high.

The purpose of assessing uncertainty is to highlight the need for new/greater knowledge of the event/phenomenon or about measures. There is also an awareness-raising process related to the knowledge base of the assessment, see Appendix 2.

Example of assessment of uncertainty related to the hazard "Landslide in the residential area Husløs":

Uncertainty	High	**Grounds** Lack of knowledge because landslide mapping has not been undertaken. Uncertainty about the drainage situation. Uncertainty about the duration of the power outage. Uncertainty about the capacity of emergency power generators and access to fuel replenishment.

Manageability

Manageability says something about the extent to which the municipality can control/manage the risks associated with a given event. How easy is it to implement measures that reduce the probability that the event may occur? How easy is it to take steps to reduce the impact of the event, or measures to raise readiness? Manageability can be specified at three levels: low, moderate, or high, see Appendix 2.

The purpose of assessing manageability is to give the municipality an additional tool to prioritise measures to prevent hazards, reduce consequences and strengthen emergency preparedness for further follow-up. That is, what can the municipality start to work on to quickly achieve results, and what requires longer and more time- consuming processes.

Example of assessment of manageability related to the hazard "Landslide in the residential area Husløs":

Manageability	High	**Grounds** There are several measures that can be undertaken following a decision by the municipality

Proposed measures

While working on the risk and vulnerability assessment, new and possible needs for improving existing measures are uncovered. The measures can affect probability, causes, vulnerability, consequences and uncertainty. If there is a need, measures related to warning the population and evacuation should also be assessed.

Example of proposals for measures related to the hazard "Landslide in the residential area Husløs":

PROPOSED MEASURES

1. Control erosion that can trigger landslides along streams and drainpipe outlets, subdrains and the like. Conduct simple erosion control to stop ongoing erosion and establish erosion control and cleaning of subdrains and culverts to prevent stray water.
2. The municipality initiates efforts to revise zoning plans for "the residential area Husløs" and the other residential areas with similar challenges related to landslide hazards. A risk and vulnerability assessment and necessary investigations of ground conditions for the areas are carried out during the process of identifying and revising plans. Areas where landslide hazards are disclosed must be followed up with zones requiring special consideration and associated provisions that prohibit development and restrictions on other measures such as digging and filling. During this process it is also assessed whether existing landslide protection in the residential areas "Tvangbodd" (Cramped Quarters) and "Luftig" (Airy) (see transferability) is sufficient.
3. Protect already developed landslide-prone areas against landslides, including permanent erosion control and counter filling. To be planned by geotechnical experts.
4. Inform residents of "Husløs" and the other relevant residential areas about the ground conditions and about caution concerning/ restrictions on changes of one's own residence and plot.
5. Reinforce the routines for digging notices in the exposed residential areas.
6. Consider alternate location or new road connection for the medical centre to ensure that the road to the centre is not cut off.
7. Ensure access to critical contingency resources also in the alternative premises of the crisis management team.
8. Ensure the supply of fuel to the municipality's emergency power generator.
9. Review the home care service's routines for following up users during adverse events.
10. Consider measures to strengthen communication with the population during adverse events.
11. Assess the priority of the mobile network and measures to increase the capacity for electronic communication in the crisis management team.
12. Increase the food provision capacity of the municipality's evacuation centre.
13. Secure expertise in resource overviews and notification lists to handle the landslide hazard.
14. Provide information to the population about self-preparedness during a power outage.

Transferability

It is important not only to focus on a specific event in one particular area of the municipality, but also to assess other areas where similar events can occur. For instance, several residential areas in the municipality may be prone to landslides.

Example of proposals for transferability for the hazard "Landslide in the residential area Husløs":

TRANSFERABILITY
Several other residential areas in the municipality are located near slopes where landslides can conceivably occur, such as the residential areas "Tvangbodd" and "Luftig". In these residential areas, there are fewer households and people that can be affected, and they do not contain exposed critical infrastructure. The event in the residential area Husløs is therefore considered to be the worst case scenario for this type of event in the municipality. Maintenance of existing landslide protection, along with a system for routine control/cleaning of culverts, subdrains and drainage systems and control of erosion along streams and drainage pipe/subdrain outlets, will be able to contribute to (resten har falt ut)

3.2.3 PRESENTATION OF RISK AND VULNERABILITY SCENARIO

Following the execution of the risk and vulnerability assessment, the project group shall present the results of the analysed events in an overall risk and vulnerability scenario.

Compiling the assessment forms for the hazards is the most important presentation of the risk and vulnerability scenario, see item 1 below. In item 2, we show how particular challenges associated with critical societal functions can be presented, and in item 3 we show examples of comparisons in risk matrices.

1. Presentation of risk and vulnerability scenario for the hazards

NO. 3 ADVERSE EVENT: LANDSLIDE IN THE RESIDENTIAL AREA HUSLØS						
Description of hazard and local conditions At the end of May a large quick clay landslide occurs in the residential area Husløs. The residential area consists of about 20 houses with approx. 70 inhabitants. The landslide occurs in the middle of the night when most people are sleeping. The landslide tears down the main high-voltage power supply to the centre of the municipality. This causes a failure of the power supply to large parts of the municipality for 3–5 days, including the hospital. The road to the local medical centre runs through the residential area. Husløs is built on top of several quick-clay pockets, and during the rescue work the following day a new landslide occurs. The police have succeeded in evacuating the rest of the resi dents and rescue personnel.						
CAUSES						
Erosion, construction activities and precipitation						
IDENTIFIED EXISTING MEASURES						
Plan for evacuation, diversion/drainage of water						
PROBABILITY	**A**	**B**	**C**	**D**	**E**	**Explanation**
		X				Once every 100–1 000 years (0.1% – 1%)
Grounds for probability Statistically, Norway can expect 2–3 major landslide accidents over the next 100 years. Local geological and topographical conditions in the area allow us to use the national statistics. No landslide mapping has been carried out in the residential area. For this reason, anti-landslide measures that could reduce the probability have not been carried out either.						

VULNERABILITY ASSESSMENT

The landslide causes a failure of the power supply in much of the municipality. This affects the population, the municipality's operations, the hospital and large parts of the business community.

The municipality has recently invested in emergency power and alternative premises for the crisis management team in "Sorgenfri Nursing Home" and moves there. Both the waterworks and the nursing home have some emergency power. However, it is unclear how long the generators will have fuel, and no arrangements have been made for the supply of fuel. The local petrol stations cann ot deliver as long as the power outage lasts because there is no emergency power for the fuel pumps.

Manual pumps will not work, and the nearest petrol station is about 60 km away.

The telecommunications network has battery back-up for approximately four hours after the power outage. The mobile phone network will become overloaded and accessibility will become poor. The crisis management team has a satellite phone, but its capacity is poor. Due to the failure of the power supply, the municipality's website is down. This makes it difficult for the municipality to commu nicate with the population.

The municipality's evacuation centre offers evacuees heat and adequate food. The municipality's psychosocial health team is established and will seek out vulnerable groups in the municipality.

The road to the medical centre will be blocked as a result of the landslide and the area where the medical centre is located is without electricity. This causes reduced accessibility and the ability to provide health services. It will take about a week to put a temporary road solution into place. Meanwhile, the medical centre in the neighbouring municipality about 65 km away could be used.

CONSEQUENCE ASSESSMENT

Societal asset	Consequence type	Consequence category					Explanation
		1	2	3	4	5	
Life and health	Deaths				X		6–10 deaths
	Injuries and illness				X		20–100 injured
Stability	Lack of coverage of basic needs						
	Disruptions to everyday life					X	200–1 000 affected for 2-7 days
Nature and the environment	Long-term damage - natural environment						
	Long-term damage - cultural environment						
Material assets	Economic losses	X					< NOK 100 million

Overall explanation of consequence

In the residential area Husløs there are 20 households with a maximum of 70 people who can be directly affected by a landslid e. It is estimated that just under 9 human lives may be lost, and that up to 25 residents may be injured as a result of the event.

Because an evacuation has been initiated, more lives will likely not be lost. The blocking of the road to the medical centre is not considered to have a bearing on the consequences for life and health because the medical centre in the neighbouring municipality can be used. The landslide caused a failure of the power supply to large parts of the municipality, including the hospital.

Life and health will at first not be affected by the power outage since the hospital has emergency power for emergency functions. The home care service does not have any users who depend on electrical medical equipment.

Stability: Although essential needs are covered, the population will have significant disruptions to everyday life, many are evacuated and large parts of the municipality are without electricity.

The landslide causes major damage to five residential properties and minor damage to eight adjacent properties. The total economic loss will be at least NOK 20 million.

Need to alert the population		Residents of Husløs and in the surrounding areas will be notified by neighbours and police to get them to leave the area as quickly as possible. It is not considered necessary to establish a plan for alerting the population in the overall contingency plan.
Need for evacuation		The police have ordered evacuation of all residents in the area, a total of 70 people. This does not exceed the capacity of the municipality to receive evacuees in the overall contingency plan, but can be a challenge for the capacity to provide food.
Uncertainty	High	**Grounds** Lack of knowledge because landslide mapping has not been undertaken. Uncertainty about the drainage situation. Uncertainty about the duration of the power outage. Uncertainty about the capacity of emergency power generators and access to fuel replenishment.
Manageability	High	**Grounds** There are several measures that can be undertaken following a decision by the municipality

PROPOSED MEASURES

1. Control erosion that can trigger landslides along streams and drainpipe outlets, subdrains and the like. Conduct simple erosion control to stop ongoing erosion and establish erosion control and cleaning of subdrains and culverts to prevent stray water.
2. The municipality initiates efforts to revise zoning plans for “the residential area Husløs” and the other residential areas w ith similar challenges related to landslide hazards. A risk and vulnerability assessment and necessary investigations of ground conditions for the areas are carried out during the process of identifying and revising plans. Areas where landslide hazards are disclosed must be followed up with zones requiring special consideration and associated provisions that prohibit development and restrictions on other measures such as digging and filling. During this process it is also assessed whether existing landslide protection in the residential areas “Trangbodd” and “Luftig” (see transferability) is sufficient.
3. Protect already developed landslide-prone areas against landslides, including permanent erosion control and counter filling. To be planned by geotechnical experts.
4. Inform residents of "Husløs" and the other relevant residential areas about the ground conditions and abo ut caution concerning/ restrictions on changes of one’s own residence and plot.
5. Reinforce the routines for digging notices in the exposed residential areas.
6. Consider alternate location or new road connection for the medical centre to ensure that the road to the centre is not cut off.
7. Ensure access to critical contingency resources also in the alternative premises of the crisis management team.
8. Ensure the supply of fuel to the municipality’s emergency power generator.
9. Review the home care service’s routines for following up users during hazards.
10. Consider measures to strengthen communication with the population during hazards.
11. Assess the priority of the mobile network and measures to increase the capacity for electronic communication in the crisis management team.
12. Increase the food provision capacity of the municipality’s evacuation centre.
13. Secure expertise in resource overviews and notification lists to handle the landslide hazard.
14. Provide information to the population about self-preparedness during a power outage.

TRANSFERABILITY

Several other residential areas in the municipality are located near slopes where landslides can conceivably occur, such as the residential areas “Tvangbodd” and “Luftig”. In these residential areas, there are fewer households and people that can be affected, and they do not contain exposed critical infrastructure. The event in the residential area Husløs is therefore considered to be the worst cas e scenario for this type of event in the municipality.

Maintenance of existing landslide protection, along with a system for routine control/cleaning of culverts, subdrains and drainage systems and control of erosion along streams and drainage pipe/subdrain outlets, will be able to contribute to general preven tion of landslides of this type in the residential areas.

2. Presentation of particular challenges in connection with critical societal functions, the need to alert the population and evacuation

Section 2 d of the Regulation relating to the municipal preparedness duty requires the assessment to illustrate special challenges associated with critical societal functions, including the loss of critical infrastructure. Challenges related to critical community functions provide a basis for assessing the robustness of the municipality's various functions and the municipality's readiness. The regulation also requires assessment of the need for alerting the population and evacuation.

These circumstances shall be described. In addition, they can be summarised in tabular form. In our project group envisioned for Lilleby municipality, four other hazards are assessed in addition to the landslide in Husløs, see Table 3. The table shows that some critical societal functions are vulnerable to several hazards.

CRITICAL SOCIETAL FUNCTIONS THAT ARE AFFECTED / ADVERSE EVENT	1. Supply of food and medicines	2. Safeguarding the need for shelter and	3. Supply of energy	4. Supply of fuel	5. Access to electronic communications	6. Supply of water and sewage	7. Accessibility for people and goods	8. Follow-up of particularly	9. Necessary health and care services	10. Emergency and rescue services	11. The municipality's crisis management and crisis handling	Need to alert the (resten har falt ut)	Need for evacuation
1. Bus accident in the Lysløs tunnel							X		X		X		
2. Flooding in Lilleelva which affects Lilleby			X		X		X					X	X
3. Landslide in the residential area Husløs		X	X	X	X		X	X	X		X		X
4. Fire at Sorgenfri Nursing Home								X	X	X			X
5. Shooting episode at Lærerik school									X	X	X	X	X
...													
...													

TABLE 3. Example of the summary of critical societal functions.

The table illustrates that the hazard "Landslide in the residential area Husløs" (no. 3 in the above table) may affect the critical societal functions: Safeguarding shelter and heat, supply of energy and fuel, access to electronic communication, accessibility for people and goods, safeguarding of necessary health and care services and the municipality's crisis management and crisis response. The event also triggers a need for evacuation. A more detailed explanation and assessment of the event can be found in the assessment form.

The assessments can illustrate that several societal functions are mutually dependent on each other. This is made particularly evident through the vulnerability assessments and can impact the municipality's ability to handle the hazard. Examples of dependencies that are uncovered can be presented in a table, see Table 4. The left column shows failures in the relevant societal functions, while the columns above show consequential events/ consequences for other societal functions.

FAILURE / FOLLOWING EVENTS / CONSEQUENCES	1. Supply of food and medicines	2. Safeguarding the need for shelter and heat	3. Supply of energy	4. Supply of fuel	5. Access to electronic communications	6. Supply of water and sewage disposal	7. Accessibility for people and goods	8. Follow-up of particularly vulnerable groups	9. Necessary health and care services	10. Emergency and rescue services	11. The municipality's crisis management and crisis handling
1. Supply of food and medicines											
2. Safeguarding the need for shelter and heat								X	X		
3. Supply of energy		X		X	X	X			X	X	X
4. Supply of fuel		X				X			X	X	X
5. Access to electronic communications			X	X	X				X	X	X
6. Supply of water and sewage disposal											
7. Accessibility for people and goods									X		
8. Follow-up of particularly vulnerable groups											X
9. Necessary health and care services										X	
10. Emergency and rescue services											
11. The municipality's crisis management and crisis response											

TABLE 4. Illustration of mutual dependencies in the hazard "Landslide in the residential area Husløs".

3. Simplified presentation of the risk and vulnerability scenario

The risk and vulnerability assessments for all the hazards can be summed up in matrix form to show certain parts of a risk and vulnerability scenario. An example is shown in Figure 10. One matrix should be used for each consequence type because the different consequence types cannot be compared. It is also possible to create a matrix for each societal asset (see Table 1). In cases where the societal asset contains more than one consequence type, the consequence types must be mutually weighted.

The hazards are placed in the matrix based on the assessment of probability and consequence. The events in the upper right part of the matrix are events that are assessed as having high probability and major consequences. The events in the lower left part of the matrix are events that are assessed as having high probability and major consequences. In the matrix, events with high uncertainty can, for example, be marked with a ring, see Figure 10.

PROBABILITY	CONSEQUENCE FOR LIFE AND HEALTH – DEATHS					
	No deaths	1–2 deaths	3–5 deaths	6–10 deaths	>10 deaths	
E: 10–100% Once every 10 years or more often						1. Bus accident in the Lysløs tunnel 2. Flooding in Lilleelva that affects Lilleby 3. Landslide in the residential area Husløs 4. Fire at Sorgenfri Nursing Home 5. Shooting episode at Lærerik School
D: 2–10% Once every 10-50 years			2			
C: 1–2% Once every 50–100 years					1	
B: 0.1–1% Once every 100–1 000 years				3	4	
A: < 0.1% Less than once every 1 000 years				5		

FIGURE 10. Example of risk matrix for the consequence type deaths.

3.2.4 PROPOSAL FOR FOLLOW-UP

The project group for Lilleby municipality has assessed five hazards. Based on the proposals for measures from these events, the project group drafts a plan for follow-up. This is to ensure that knowledge and experience from the work on a holistic RVA will be safeguarded in the continuing follow-up.

The proposed follow-up plan shall describe the measures that are identified. These can be measures to prevent, to strengthen readiness and response capabilities, but also measures to increase knowledge and suggestions for more detailed assessments and plans in some areas. The project group's proposal for a follow-up plan can be included in the report for a holistic RVA (see section 3.2.5).

In our example, the project group proposes the following measures for Lilleby municipality:

Follow-up of natural hazards in the municipality's planning and daily operations

- Control of erosion along streams and drainage pipe outlets, especially in landslide-prone areas. Implementation of simple erosion control to stop ongoing erosion.
- Cleaning of subdrains and culverts to prevent stray water and secure capacity in the event of flooding and large amounts of precipitation.
- A review of existing flood and landslide protection in residential areas. New and updated flood and landslide protection must be planned by geotechnical experts.
- Information to residents of landslide-prone residential areas about the ground conditions and about caution concerning/restrictions on changes of one's own residence and plot.
- Reinforced procedures for digging notices in landslide-prone residential areas.
- Review and revision of the zoning plans for the flood- and landslide-prone residential areas. In this work, a risk and vulnerability assessment is carried out that also takes into account climate change and necessary investigations of ground conditions. In the plans, special consideration zones for flood and landslide hazards are stipulated with associated provisions.

Crisis communication

- The municipality's plan for crisis communication must be revised with a view to reaching the population in different languages. There is a need for increased capacity, alternative types of communication and a closer partnership with local media.
- Increase capacity at the municipality's switchboard during hazards.

Contingency planning

- The municipality prepares an overall contingency plan on the basis of findings from a holistic RVA.
- A holistic RVA must be followed up in risk and vulnerability assessments and contingency plans in other emergency preparedness areas in the municipality.
- The municipality must coordinate its contingency planning internally, but also against other relevant civil protection actors in the municipality.
- On the basis of findings, special contingency measures must be considered, including the further development of resource overviews and notification lists for handling flood and landslide hazards with resources from NVE, geologists and machinery contractors.
- The municipality has a plan for evacuation, but has too little capacity to assist the evacuees considering that they find themselves in a difficult situation.
- The natural hazard events in the municipality shall be the basis for the development of scenarios for exercises together with the rescue agencies and other local actors.

The municipality's own preparedness

- Examining whether the municipality's areas of responsibility safeguards requirements for maintaining relevant functions during hazards, and whether adequate own preparedness is in place.
- Carry out a detailed assessment of the consequences in the municipality as a result of a prolonged disruption in the energy supply. In this assessment, a review of the municipality's emergency power capacity is done, and whether there are any uncovered areas. Furthermore, there is a need for plans for testing and maintenance, and agreements on replenishment of fuel during hazards.
- Assess priority in the mobile network, increased capacity and alternative solutions for electronic communication if normal telecommunications should fail.

Other

- General information to the population about self-preparedness.
- Review of the home care service's routines for following up users during hazards.
- Consider the location of critical societal functions in the municipality so that they are not cut off from users if they are exposed to an event.
- Dialogue with the grid company concerning energy supply security, with telecommunications providers concerning robustness and endurance associated with telecommunications and with the Directorate for Emergency Communication with respect to emergency networks.

The project group's proposed plan for follow-up should include proposals for objectives and strategies for the municipality's work on civil protection and preparedness. In the work on the objectives, the project group in this example has stressed that the municipality is prone to natural hazards.

Suggestions for objectives of the civil protection work in Lilleby:

1. Lilleby's location and nature challenges are an asset. The municipality shall ensure that expansion and development take into account the challenges nature has provided.
2. Lilleby shall have a planning and management system that safeguards the population, critical societal functions, and the business community's need for safety and security by reducing the probability that hazards occur through sound prevention.
3. Lilleby shall have a prepared and practiced crisis organisation to reduce the consequences for the population if we are exposed to a hazard.

4. Lilleby shall cooperate closely with external actors to strengthen civil protection.

5. Lilleby's work on civil protection and preparedness shall be instructional and in continuous development.

The proposed follow-up plan should have a design similar to what the municipality otherwise uses in various action plans so that it can be integrated into the municipality's planning and management system.

The municipality's leadership must prepare the anchoring of the holistic RVA in the municipal council, undertake a review of the project group's proposed goals, strategies and follow-up plan and facilitate internal processing. The further follow-up and development of civil protection and preparedness work must have a clear anchoring in the municipality. This is discussed in Chapter 4.

3.2.5 REPORT

The results from a holistic RVA must be documented in a report. The report must include a summary of the risks and vulnerabilities in the municipality and recommended measures to strengthen civil protection efforts. A proposal for the structure of the report is shown in Appendix 7. The purpose of the assessment should be clearly laid out and preconditions and delimitations must be clear.

The risk and vulnerability scenario shall be documented with complete assessment forms for all analysed events, summaries and assessments of special circumstances. It is also recommended to document the events that were not analysed further, see section 3.2.1.

The description of the municipality is an important part of the report, see section 3.1.3. It provides a view of known risks and vulnerabilities in the municipality, and describes the characteristics and conditions that characterise the municipality (special characteristics) with respect to civil protection. Background information found relevant for the assessment and the description of the municipality is enclosed with or referenced in the report.

The project group's proposed follow-up plan should be a part of the report. Any special circumstances the project group believes are important to keep a particular eye on going forward should also be documented.

The draft report shall be circulated for comments to internal and external actors who have been involved in the work. The project group will incorporate the changes and conclude the work of submitting a holistic RVA and the report to the project's steering committee.

CHAPTER

04

Follow-up of the municipality's comprehensive and systematic work on civil protection and preparedness

FOLLOW-UP OF THE MUNICIPALITY'S HOLISTIC AND SYSTEMATIC WORK ON CIVIL PROTECTION AND PREPAREDNESS

In addition to undertaking a holistic RVA, we recommend that the project group create a proposal for a follow-up plan (see section 3.2.4.). The plan should also include proposals for objectives and strategies for holistic and systematic work on civil protection and preparedness. The proposed follow-up plan is discussed by the municipality's leadership and internally in the municipality's areas of responsibility.

A holistic RVA can uncover risks and vulnerabilities lying outside the municipality's area of responsibility. Where these conditions are essential to the municipality's civil protection work, the municipality can be a driving force to take appropriate action. Examples of this can be cooperation with energy companies and telecommunication providers on contingency planning and cooperation agreements with the business community on critical supplies.In addition, the municipality has an important role in strengthening the self-preparedness of its residents.

Priorities and further specifications are laid down during the internal processing of follow-up plans. In connection with the submission of a holistic RVA to the municipal council, the follow-up plan should also be submitted for a decision and given status as a governing document for the municipality's work on civil protection and preparedness. The requirements for follow-up and revision should be the same as for plans pursuant to the Planning and Building Act.

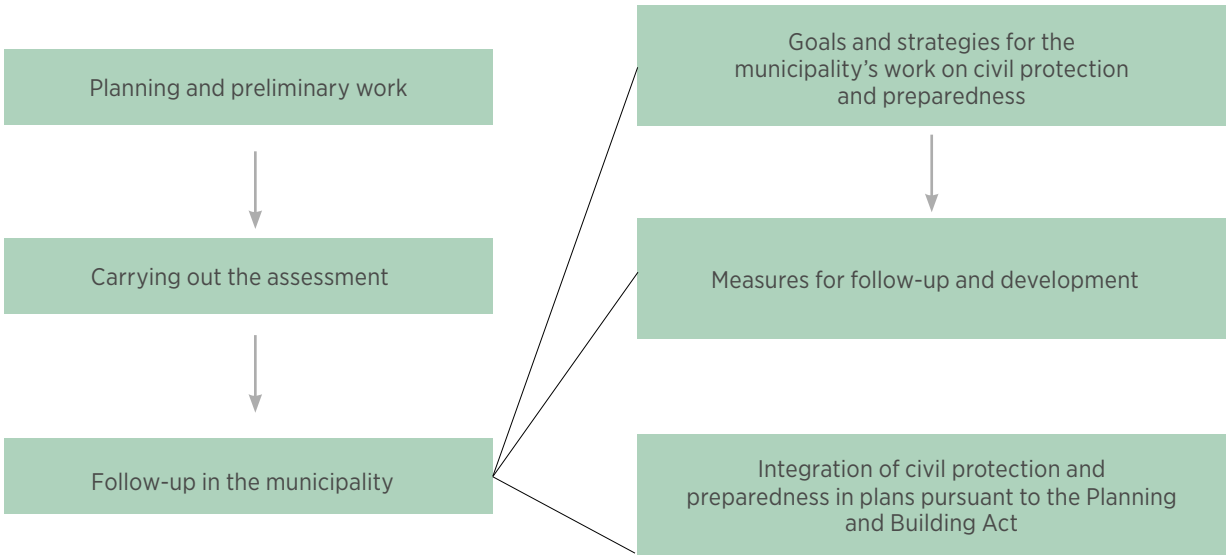

FIGURE 11. The municipality should have a plan for following up a holistic RVA.

4.1 FOLLOW-UP PLAN

The municipality makes a decision on a follow-up plan on the basis of a holistic RVA. The plan includes objectives, strategies and measures for developing the municipality's work on civil protection and preparedness for the next four years. The plan is revised each year.

4.1.1 GOALS AND STRATEGIES FOR THE MUNICIPALITY'S WORK ON CIVIL PROTECTION AND PREPAREDNESS

The municipality endorses the project group's proposals for goals and strategies (see section 3.2.4) in the general example and chooses to integrate these into the social element of the municipal master plan.

4.1.2 FOLLOW-UP AND DEVELOPMENT MEASURES

In our example from Lilleby municipality, all proposals for measures are now assessed in the municipality's various areas of responsibility and the municipality's leadership. New input and priorities arose during the process. On this basis, the municipality has prioritised the measures to be implemented in order to strengthen the municipality's work on civil protection and preparedness. The municipality's leadership has pointed out both persons in charge and deadlines for follow-up of the measures in the adopted follow-up plan.

Agency for Planning and Building Services

- Lilleby's location and natural challenges create uncertainty for the future. In addition, climate change will increase future risk. These circumstances are significant development characteristics in the municipality that must be integrated into municipal planning strategy and adopted as a basis for revising municipal plans and new development plans.
  - Ongoing
  - Follow up especially natural hazards and climate change in the work on municipal planning strategy and in land-use planning
  - Revise the checklist for development plans where this is followed up, with specific requirements for builders and carrying out risk and vulnerability assessments for development plans
- Implement landslide protection measures in cooperation with geotechnical experts in the landslide-prone residential areas.
  - Consider the possibility for cooperation on government support by 1 June XXXX
  - Follow up in the planning work in the follow-up point above
- Study the risk of flooding and landslides in the exposed residential areas further to assess a possible revision of the zoning plans. Risk and vulnerability assessments that look at existing flood and landslide protection are carried out in the process. In addition, necessary investigations of ground conditions are carried out. When new consideration zones with associated provisions are needed, the regulatory plan is to be revised by 1 June XXXX
- Follow up civil protection and preparedness as a special area of focus in the work on a new municipal master plan.
  - The work commences at the end of the municipal council period

Engineering services

- Inspect erosion along streams and drainage pipe outlets in flood and landslide-prone areas.
  - Ongoing
- Clean subdrains and culverts to prevent stray water and secure capacity in the event of flooding and large amounts of precipitation.
  - Ongoing
- Reinforce routines for digging notices in the landslide-prone areas, by 1 October XXXX
- A holistic RVA must be followed up in risk and vulnerability assessments and contingency plans within the emergency preparedness areas in engineering services, by 1 July XXXX.

Chief Municipal Executive's staff

- By information officer: Information to residents of landslide-prone residential areas about the ground conditions and about caution concerning/restrictions on changes of one's own residence and plot, by 1 April XXXX

- By information officer: The municipality's plan for crisis communication must be revised with a view to being able to reach the population in different languages regardless of situation. There is a need for increased capacity, alternative types of communication and a closer partnership with local media, by 1 May XXXX

- By information officer: General information to the population about self-preparedness, by 15 April XXXX

- By information officer: Apprise relevant partner actors of results of holistic RVA, by 15 April XXXX

- By service centre: Increase the capacity of the municipality's switchboard during hazards, plan for technical solution and staffing, by 1 May XXXX

- By emergency response supervisor: The municipality prepares an overall contingency plan on the basis of findings from a holistic RVA internally in cooperation with other emergency preparedness actors. The contingency plan is made into an implementation section of the social element of the municipal master plan, by 1 July XXXX

- By emergency response supervisor: The municipality must coordinate its contingency planning internally, but also against other relevant civil protection actors in the municipality, by 1 October XXXX

- By emergency response supervisor: On the basis of findings in the holistic RVA, special contingency measures must be considered, such as own preparedness in the municipality, the further development of resource overviews and notification lists for handling flood and landslide hazards with resources from NVE, geologists and machinery contractors, by 1 October XXXX

- By emergency response supervisor: The municipality has a plan for evacuation, but has too little capacity to operate the evacuation centre considering that the evacuees will find themselves in a difficult situation. It must be assessed whether the municipality can enter into a partnership with voluntary organisations to operate the evacuation centre, by 1 November XXXX

- By emergency response supervisor: Carry out a detailed assessment of the consequences in the municipality as a result of a prolonged disruption in the energy supply. In this assessment, a review of the municipality's emergency power capacity is done, and whether there are any uncovered areas.
- There is furthermore a need for plans for testing and maintenance, and agreements on replenishment of fuel during hazards.

- By emergency response supervisor: Assess the priority in the mobile network and increased capacity and alternative solutions for electronic communication if normal telecommunications should fail.

- By emergency response supervisor: Develop the natural hazard events from holistic RVA to the scenarios for co-exercises between the rescue agencies, the municipality and other local actors, by 1 February XXXX

All fields/sector areas in the municipality

- A holistic RVA shall be followed up in risk and vulnerability assessments and contingency plans in other emergency preparedness areas in the municipality, all fields/sector areas, by 1 July XXXX

The municipality as driving force

- Invite NVE, geologists and machinery contractors to cooperate and further develop resource overviews and notification lists for handling flood and landslide hazards, by the emergency response supervisor, by 1 October XXXX.

- Invite co-operation on contingency planning and exercises with relevant external civil protection actors, by the emergency response supervisor, by 1 October XXXX

- Invite grid companies to cooperation meetings to explore the consequences of a prolonged energy outage in Lilleby, by the chief municipal executive, by 1 November XXXX

- Invite partnerships with voluntary organisations to operate the evacuation centre, by the emergency response supervisor, by 1 November XXXX

- Have regular dialogue with grid companies, telecommunications providers and the Directorate for Emergency Communication on energy supply security, telecommunications and emergency network, by the chief municipal executive, ongoing

Measures for evaluation and development of work on civil protection and preparedness

To ensure updating and continuous development of the municipality's work on civil protection and preparedness, we recommend that a plan for follow-up also include measures for evaluation and development. It is natural that follow-up plans follow the planning cycle for plans pursuant to the Planning and Building Act, with four-year plans and annual revisions to document the status of the follow-up of measures.

The holistic risk and vulnerability assessment shall be updated/revised

- in step with the revision of municipal sector plans
- upon changes in the risk and vulnerability scenario

The first point implies that the municipality must consider updating the holistic risk and vulnerability assessment every four years in connection with the preparation of municipal planning strategy. Changes in the risk and vulnerability scenario that require updating of the holistic risk and vulnerability assessment can be the establishment of a new enterprise that handles hazardous substances, new knowledge about climate change or other circumstances uncovered in the work on a holistic RVA.

When updating/revising a holistic RVA, it is important to evaluate the assessment and assess the status of the measures taken. Has new knowledge emerged so that the risk and vulnerability scenario may have changed? Has the implementation of measures led to changes in the risk and vulnerability scenario? Have exercises or events uncovered new vulnerabilities? Does this require minor updates, or is it necessary that the municipality undertake a full review of a holistic RVA? Revision of holistic RVA shall always be followed up with a new plan for follow up.

The overall contingency plan must be updated and revised annually at all times.

In addition to the requirements for updating and revision, the municipality is expected to be a learning organisation in the work on civil protection and preparedness. This means that the municipality will also:

- conduct annual revisions and updates of holistic RVA, follow-up plan and contingency plans
- undertake any necessary changes to the risk and vulnerability assessment, contingency plans, and follow-up plan after evaluation of exercises and hazards
- undertake necessary changes to the civil protection and preparedness efforts pursuant to the County Governor's supervision and pursuant to the municipality's performance audits/own inspection of the civil protection area

4.2 INTEGRATION OF CIVIL PROTECTION AND PREPAREDNESS IN PLANS PURSUANT TO THE PLANNING AND BUILDING ACT

The Planning and Building Act requires a holistic planning and management system. Planning is placed in a broader social perspective that facilitates the strengthening and development of cross-sectoral socially oriented planning. Civil protection is one of the considerations the act shall safeguard. Section 3–1 states that plans shall "promote civil protection by preventing the risk of loss of life, injury to health, and damage to the environment and important infrastructure, material assets, etc."

By integrating the municipality's work on the municipal preparedness duty in the planning system, the work will become more visible and become more clearly anchored. This will also ensure continuous development and evaluation of the work. The Plan and Building Act is thus a well-suited tool for the municipality's work on civil protection and preparedness.

Municipal planning strategy
Municipal planning strategy deals with strategic choices related to the development of the municipality as an organisation and society. For this reason, the need for planning must be assessed during the municipal council period. We recommend that a holistic RVA be revised every four years. The revision may take place before new municipal planning strategy or afterwards, on the basis of an assessment of the municipality's strategic choices and social developments.

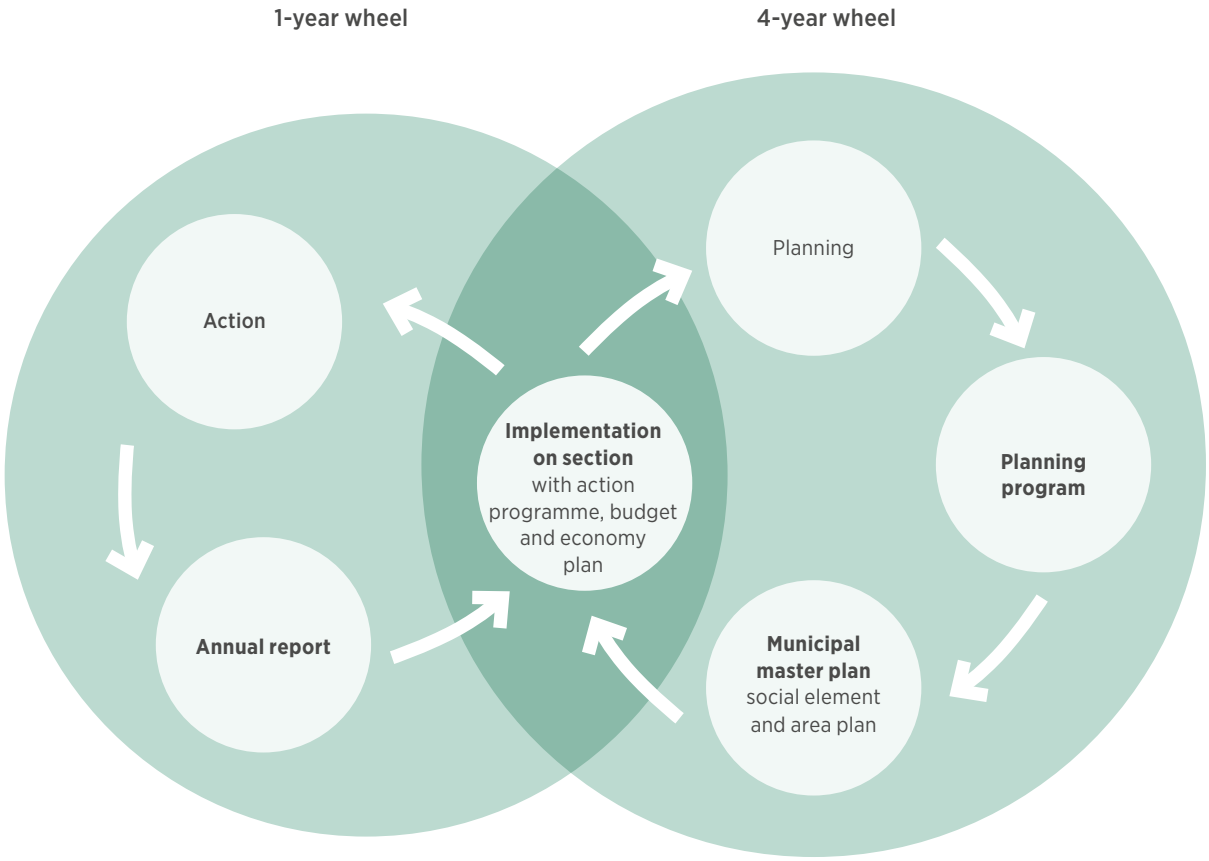

FIGURE 12. Integrated municipal planning.

The social element of the municipal master plan
The municipality takes a position on long-term challenges, goals and strategies in the social element of the municipal master plan. The social element is an important document that illustrates the coordination between the challenges of various areas of responsibility and the municipality's overall development.

The municipality's work on civil protection and preparedness has a natural place here. The social element provides guidelines for how priority topics should be followed up in different sectors and fields. Priority measures in the follow-up plan should be included in the implementation section of the municipal master plan and are revised annually.

If the municipality chooses to treat civil protection and preparedness as a separate subject plan of the municipal master plan, the follow-up plan will be an implementation section of this with the same requirements for revision.

The municipal master plan's land-use element
Land-use planning is important in following up the work on civil protection, particularly where holistic RVA has uncovered natural or operational hazards. The follow-up plan for a holistic RVA describes measures to be followed in land-use planning. For example, findings in a holistic RVA may be followed up in the municipality's regular routines for land-use plans. It can also be followed up through detailed requirements for further investigations and in RVA assessments for development plans in areas where risks have been uncovered.

CHAPTER

05

Summary: Comprehensive RAV – step by step

SUMMARY: HOLISTIC RVA – STEP BY STEP

Planning and preliminary work

- Anchor and establish project.
- Define purpose and delimitation.
- Determine the division into societal assets with related consequence types and consequence and probability categories.
- Identify critical societal functions.
- Collect information and description of the municipality
- Identify relevant internal and external actors
- Plan necessary activities during the carrying out phase

Carrying out the assessment

- Invite relevant internal and external actors
- Identification of hazards
- Review each identified hazard and:
  - give the event a name and a number
  - describe the course of events
  - map underlying causes and existing measures
  - indicate the probability of the hazard in the municipality
  - assess the vulnerability by mapping the critical societal functions that will be affected by the hazard and how this affects the municipality
  - specify the expected consequences of the event
  - assess the need for alerting the population and evacuation
  - specify uncertainty and manageability
  - propose measures to reduce risk and vulnerability
- Group all of the assessment forms in a risk and vulnerability scenario.
- Consider other relevant presentation forms:
  - challenges within critical societal functions
  - in risk matrixes
- Utarbeide forslag til oppfølging og mål for kommunens arbeid med samfunnssikkerhet og beredskap.
- Write report.
- Present risk and vulnerability scenario and proposal for follow-up plan to the municipality's leadership

Follow-up in the municipality

- Anchor holistic RVA in the municipal council.
- Decide plan for follow-up with goals, measures, responsibilities and deadlines.
- Establish holistic and systematic work on civil protection and preparedness.
- Integrate the work on civil protection and preparedness in the municipality's work on plans pursuant to the Planning and Building Act.

Appendix

APPENDIX 1
MUNICIPAL PREPAREDNESS DUTY IN STATUTE AND REGULATION

ACT 2010-06-25 No. 45: Act relating to the municipal preparedness duty, civil protection measures and Civil Defence (Civil Protection Act) [4]

CHAPTER V. MUNICIPAL PREPAREDNESS DUTY

Section 14. Municipal preparedness duty – risk and vulnerability assessment

The municipality is required to survey the hazards that may occur in the municipality, assess the probability of these events occurring and how their possible occurrence may affect the municipality. The results of this work must be assessed and collated in a holistic risk and vulnerability assessment.

The risk and vulnerability assessment shall be applied to the municipality's work on civil protection and preparedness, including in connection with the preparation of plans pursuant to Act No. 71 of 27 June 2008 relating to planning and the processing of building applications (the Planning and Building Act).

The risk and vulnerability assessment shall be updated in step with the revision of municipal section plans, cf. Section 11-4, first paragraph of Act No. 71 of 27 June 2008 relating to planning and the processing of building applications (the Planning and Building Act) and otherwise in the event of changes in the risk and vulnerability situation.

The Ministry may issue regulations with further provisions on carrying out the risk and vulnerability assessment.

Section 15. Municipal preparedness duty – contingency plan for the municipality

The municipality shall prepare a contingency plan based on the risk and vulnerability assessment pursuant to Section 14.

The contingency plan shall contain an overview of the measures the municipality has prepared to deal with hazards. At a minimum, the contingency plan shall include a plan for the municipality's crisis management, notification lists, resource overview, evacuation plan and plan for providing information to the population and media.

The contingency plan shall be updated and revised at least once a year. The municipality shall ensure that the plan is regularly practiced.

The Ministry may issue regulations with further provisions on the contents of the contingency plan and other requirements under this provision.

[4] The municipal preparedness duty has been applied to Svalbard through Regulation No. 1293 of 18 December 2012 on the application of the Civil Protection Act on Svalbard and on the preparedness duty for Longyearbyen local government.

REG-2011-08-22 NO. 894: REGULATION RELATING TO THE MUNICIPAL PREPAREDNESS DUTY

Section 1. Purpose

The regulation shall ensure that the municipality safeguards the general public's safety and security. The municipality shall work systematically and holisticly on civil protection work across sectors in the municipality, with a view to mitigating the risk for the loss of life, or damage or injury to health, the environment and material assets.

The duty covers the municipality's role as the authority within its geographic area, as a centre of operations and as a driving force towards other actors.

Section 2. Holistic risk and vulnerability assessment

The municipality shall conduct a holistic risk and vulnerability assessment, including mapping, systematising and assessing the probability of hazards that may occur in the municipality, and how these can affect the municipality. The holistic risk and vulnerability assessment shall be anchored in the municipal council.

At a minimum, the assessment shall include:

a. Existing and future risk and vulnerability factors in the municipality.
b. Risks and vulnerabilities outside the municipality's geographic area that may affect the municipality.
c. How different risk and vulnerability factors can affect each other.
d. Special challenges related to critical societal functions and the loss of critical infrastructure.
e. The municipality's ability to maintain its operations when exposed to a hazard and the ability to resume its operations after the event has occurred.
f. The need to alert the population and evacuation.

The municipality shall ensure that relevant public and private actors are invited to work on the preparation of the risk and vulnerability assessment.

Where there is a need for further assessments of details, the municipality shall undertake further assessments or encourage other relevant actors to implement them. The municipality shall encourage relevant actors to implement preventive and mitigating measures.

Section 3. Holistic and systematic civil protection and preparedness work

Based on the holistic risk and vulnerability assessment the municipality shall:

a. Prepare long-term goals, strategies and priorities, and the plan for the follow-up of civil protection and preparedness work.
b. Assess conditions that should be integrated into plans and processes pursuant to Act No. 71 of 27 June 2008 relating to planning and the processing of building applications (the Planning and Building Act).

Section 4. Contingency plan

The municipality shall be prepared to deal with hazards and shall prepare an overall contingency plan based on the holistic risk and vulnerability assessment. The municipality's overall contingency plan shall coordinate and integrate other contingency plans in the municipality. It shall also be co-ordinated with other relevant public and private crisis and contingency plans.

APPENDIX

At a minimum, the contingency plan shall include:

a. A plan for the municipality's crisis management that provides information on who constitutes the municipality's crisis management team and their responsibilities, roles and powers, including who is authorised to convene the crisis management team.
b. A notification list for actors who have a role in the municipality's crisis response. The municipality shall inform everyone on the notification list about their role in the response to the crisis.
c. A resource list containing information about the resources the municipality has at its disposal and the resources that are available at other actors in the event of hazards. The municipality should enter into advance agreements with relevant actors concerning assistance during crises.
d. Evacuation plans and plan for alerting the population based on the holistic risk and vulnerability assessment.
e. Plan for crisis communication with the population, media and own employees.

The contingency plan can be prepared as an implementation section of the municipal sector plan in accordance with the Planning and Building Act.

Section 5. Cooperation between municipalities

Where practical, cooperation should be established between municipalities on local and regional solutions to preventive and contingency-related tasks with the aim of achieving the best possible utilisation of overall resources. Each municipality shall have its own contingency plan and holistic risk and vulnerability assessment in accordance with the regulation.

Section 6. Updating/revision

The risk and vulnerability assessment shall be updated in step with the revision of municipal section plans, cf. Section 11-4, first paragraph of Act No. 71 of 27 June 2008 relating to planning and processing of building applications (the Planning and Building Act) and otherwise in the event of changes in the risk and vulnerability situation. The municipality's contingency plan is to be updated at all times, and is revised once a year at a minimum. The plan shall state who is responsible for updating the plan and when the plan was last updated.

Section 7. Exercises and training

The municipality's preparedness plan shall be exercised every other year. The scenarios for the exercises should be taken from the municipality's holistic risk and vulnerability assessment. The municipality shall hold exercises together with other municipalities and relevant actors where the chosen scenario and form of exercise make this appropriate. The municipality shall have a training system that ensures that everyone with an intended role in the municipality's crisis response has sufficient qualifications.

Section 8. Evaluation after exercises and hazards

The municipality shall evaluate its crisis response following any exercises and hazards. Where the evaluation provides grounds for such, the necessary changes shall be made to the risk and vulnerability assessment and contingency plans.

Section 9. Documentation

The municipality shall be able to document in writing that the requirements of the regulations have been met.

Section 10. Supervision

The County Governor shall supervise the legality of the municipality's fulfilment of its duties under this regulation. The supervision shall comply with the provisions of Chapter 10A of Act No. 107 of 25 September 1992 relating to municipalities and county authorities (Local Government Act).

APPENDIX 2
SOCIETAL ASSETS AND CONSEQUENCE TYPES, AS WELL AS CATEGORIES FOR CONSEQUENCE, PROBABILITY, UNCERTAINTY AND MANAGEABILITY

Proposals for societal assets with associated consequence types, as well as divisions into consequence categories, probability categories, specification of uncertainty and manageability are given below. However, the individual municipality must tailor the proposal to its own situation.

Probability categories

Below is an example of probability categories. The goal of establishing probability categories is to distinguish the various hazards from each other to obtain a spread in the risk and vulnerability scenario that can in turn provide a basis for priorities.

Category	Time interval	Probability (per year)	Explanation
E	More frequently than once every 10 years	> 10 %	Very high
D	Once every 10 to 50 years	2–10 %	High
C	Once every 50 to 100 years	1–2 %	Moderate
B	Once every 100–1 000 years	0,1–1 %	Low
A	Occurs less than once every 1 000 years	< 0,1 %	Very low

A probability of 0.1% sounds low and can be difficult to deal with. If all municipalities were equal, there is an over 40% probability that the event will occur in one of the country's over 400 municipalities. There will be an average of one event every 2 – 3 years nationwide. If a serious tank lorry accident is assessed as occurring every 100 years for an average municipality, this would mean that such an event could occur four times over the course of one year nationwide. It must then be considered whether this sounds sensible when stating the probability for a particular event in a municipality.

Societal assets and consequence types

SAFETY AND SECURITY OF THE POPULATION	
Societal assets	**Consequence types**
Life and health	Deaths Injuries and illness
Stability	Lack of coverage of essential needs Disruptions to everyday life
Nature and the environment	Long-term damage to natural environment Long-term damage to cultural environment/monuments
Material assets	Economic losses

APPENDIX

Consequence categories

Below is an example of consequence categories for the different consequence types. The goal of establishing consequence categories is to distinguish the various hazards from each other in terms of severity so that it can provide a basis for prioritisation. Comparing consequence types or assets is not the intention. Life and health cannot be weighed against nature and the environment. The categories are quantified from 1–5 where 5 is the most serious.

Category	Explanation
5	Very large
4	Large
3	Moderate
2	Small
1	Very small

Division into consequence categories, both number of categories and associated values, must be adapted to each municipality based, among other things, on the size of the municipality. This means that a municipality with few inhabitants can have an entirely different value on the most serious consequence category than the corresponding category for a large municipality.

Life and health

Category	Deaths
5	> 10
4	6–10
3	3–5
2	1–2
1	None

Category	Injuries and illness
5	> 100
4	20–100
3	6–20
2	3–5
1	1–2

Stability – Lack of coverage of basic needs

The population lacks food, drinking water, heat and medicines as a result of the event. The consequence categories 1–5 can be specified as a combination of the number of people affected by the event and duration:

Duration \ No. affected	< 50 people	50–200 people	200–1 000 people	> 1 000 people
> 7 days	Category 3	Category 4	Category 5	Category 5
2–7 days	Category 2	Category 3	Category 4	Category 5
1–2 days	Category 1	Category 2	Category 3	Category 4
< 1 day	Category 1	Category 1	Category 2	Category 3

Stability – Disruptions to everyday life

The population cannot communicate via ordinary channels, cannot get to work or school, lacks access to public services, infrastructures and goods.

The consequence categories 1–5 can be specified as a combination of the number of people affected and duration:

Duration \ No. affected	< 50 people	50–200 people	200–1000 people	> 1000 people
> 7 days	Category 3	Category 4	Category 5	Category 5
2–7 days	Category 2	Category 3	Category 4	Category 5
1–2 days	Category 1	Category 2	Category 3	Category 4
< 1 day	Category 1	Category 1	Category 2	Category 3

Nature and environment – Damage to the natural environment

Consequence categories 1–5 for damage to natural environment can be specified as a combination of geographic distribution and duration of damage. Distribution can be specified as an area in km2 or as length, such as km of coastline.

Duration \ Geographic distribution	< 3 km²/km	3-30 km²/km	30-300 km²/km	> 300 km²/km
> 10 years	Category 2	Category 3	Category 4	Category 5
3–10 years	Category 1	Category 2	Category 3	Category 4

Nature and environment – Damage to cultural environment

Loss and/or permanent degradation of cultural environment/cultural monuments can be specified based on preservation status/preservation value and degree of destruction:

Degree of destruction \ Preservation status / preservation value:	Preservation worthy Cultural monuments	Preservation worthy Cultural environment	Protected cultural monuments	Protected cultural environment
Extensive destruction	2	3	4	5
Limited destruction	1	2	3	4

Some definitions from the Directorate for Cultural Heritage:

Protected cultural monument
A protected cultural monument is a cultural monument that the authorities deem to be so valuable that it must be preserved for posterity. A protected cultural monument is automatically protected or protected by a decision. Protection is the most stringent form of preservation. Protection entails that encroachments/changes must be approved by the authorities. The laws that are used today for listing cultural monuments are the Cultural Heritage Act and the Svalbard Environmental Protection Act.

Preservation worthy cultural monument
A cultural monument worthy of preservation is a cultural monument that has undergone a cultural heritage assessment and is identified as worthy of preservation. The most preservation worthy cultural monuments are of national value. It is primarily these that are protected by the Cultural Heritage Act. Cultural monuments can also have regional or local value. Normally it will be the municipalities that ensure the protection of such cultural monuments by means of the Planning and Building Act. Another way of marking that a cultural monument is worthy of preservation is listing. Examples of such lists are the Cultural Heritage Management Office in Oslo's Yellow List, the Directorate for Cultural Heritage's vessel list and the list of Norwegian churches worthy of preservation.

Cultural environment
An area where cultural monuments are part of a larger whole or context. Natural elements of cultural history value can also be included in a cultural environment.

Material assets

Direct costs resulting from the event in the form of economic losses related to property damage, handling and normalisation.

Category	Economic losses
5	> 5 NOK billion
4	2–5 NOK billion
3	0.5–2 NOK billion
2	10–500 NOK million
1	< 100 NOK million

Specification of uncertainty

Uncertainty is assessed as **high** if one or more of the following conditions are met:

- Relevant data and experiences are unavailable or unreliable
- The event/phenomenon being analysed is poorly understood
- There is a lack of agreement among the experts involved in the assessment

In the opposite case, uncertainty is considered **low**.

Specification of manageability

The following qualitative categories are suggested for classifying manageability:

- **High:** The municipality can control/manage
- **Moderate:** The municipality can influence
- **Low:** The municipality cannot influence

APPENDIX 3
EXAMPLE OF MANDATE

Mandate

The project group is given a mandate to prepare a holistic risk and vulnerability assessment for XXXX municipality and document the result of the work in a report. Based on the holistic risk and vulnerability assessment, the project group shall prepare a proposal for a follow-up plan for the municipality's work on civil protection and preparedness.

The holistic risk and vulnerability assessment shall accommodate the requirements of the Act relating to the municipal preparedness duty, civil protection measures and Civil Defence and Regulation relating to the municipal preparedness duty.

Purpose

The purpose of the holistic risk and vulnerability assessment is to:

- provide an overview of risk and vulnerability circumstances in the municipality, and how they affect the municipality
- uncover vulnerability and mutual dependencies
- suggest measures on how risks and vulnerabilities can be reduced and handled
- provide a planning basis and decision support in the municipality's work on civil protection and preparedness

Organisation, roles and responsibilities

- The principal and owner of the holistic risk and vulnerability assessment is the municipality's leadership
- Representatives from the municipality's leadership make up the steering committee and designate the project manager and project participants for the project group's work
- The project group is responsible for planning and executing the holistic risk and vulnerability assessment
- The project manager shall keep the steering committee informed about the project's status during the process
- The municipality commits to active participation in the various activities in the project
- Relevant public and private actors shall be invited to contribute to carrying out the assessment
- The project manager shall present the results of the holistic risk and vulnerability assessment, including proposed follow-up plan, to the municipality's leadership
- The municipality's leadership is responsible for submitting the holistic risk and vulnerability assessment to the municipal council and following up the follow-up plan

Budget and schedule

- The project will have a budget framework of NOK XXX XXX
- The project shall commence week xx in 20XX, and a report must be submitted by week XX in 20XX

APPENDIX 4
EXAMPLES OF SPECIAL CHARACTERISTICS OF THE MUNICIPALITY

Category	Special characteristics
Physical conditions	Coastline Waterways Island Mountain Valley Open/isolated landscape Low-lying areas Coastal areas Neighbouring municipalities (conditions that may affect the municipality)
Natural conditions	Extreme weather Waves/wave height Snow/ice Frost/ground frost/severe cold Insufficient precipitation/extreme drought Storm surge Flooding in sea/waterways Urban flooding/floodwater Rising sea level Landslides and avalanches (clay, rock, earth, mountain, snow) Erosion Climate change
Societal factors	Number of inhabitants Distances Demographics Particularly vulnerable groups Other social conditions Size of municipality/administration Organisation Dependency on key people in central administration Visitors/tourists Students
Transport	Road Rail Aviation Airport Port Shipping
Business/industry	Economic basis Enterprise that administers critical societal functions Collocation of industry/industrial area Cornerstone company Enterprise that handles hazardous substances, including major accident enterprises Waste area/landfill Major events (sports, concerts, festivals, political meetings) Providers of risky consumer services
Cultural assets, nature and environment	Preservation worthy/protected cultural monument/cultural environment Natural and environmental resources

APPENDIX 5
EXAMPLES OF HAZARDS

Event types	Category	Examples of hazards
Natural disasters	Extreme weather	Storms and hurricanes Insufficient precipitation/extreme drought Extreme precipitation (rain, snow, hail) Lightning and thunderstorms Extreme cold
	Floods	Flood Urban floods Deluge Storm surge
	Landslides and avalanches	Quick clay landslide Rock and landslides Avalanche Wet snow avalanche Deep-seated landslide Tidal wave in connection with deep-seated landslide
	Epidemic	Epidemic Pandemic (humans, animals)
	Forest fires	Forest fires
	Earthquake	Earthquake
Major accidents	Road	Major traffic accidents Accident in tunnel Bus accident Dangerous goods accident
	Rail	Collision (train, car, person, animal) Derailment/overunning Fire/smoke development on trains
	Aviation	Plane crash (at the airport, in the municipality) Collision between planes on the ground Helicopter crash
	Sea	Ship collision Shipwreck Tanker accident Passenger ship accident Ferry accident Large oil spill
	Business/industry	Gas emission Emission of other hazardous substances Fire/explosion in industry (tank farm, oil terminal, LNG plant, refinery, diesel tanks, factory) Fire Explosion

APPENDIX

Major accidents	Offshore	Oil/gas emissions Fire/explosion on offshore facility Loss of offshore facility
	Nuclear accidents	Large airborne emissions from plants abroad that can spread to Norway and affect large or smaller parts of the country Airborne emissions from plants or other operations in Norway Local event in Norway or Norwegian surroundings without local connection Local events that evolve over time Major discharge to marine environment in Norway or in Norwegian surroundings, or rumour of considerable marine or terrestrial pollution Serious events abroad without direct consequences for Norwegian territory
	Fire	Fire in means of transport (road, rail, air, sea) Fire in buildings and facilities (hospitals, nursing homes, schools, kindergartens, sports halls/stands, reception centres for asylum seekers, prisons/detention centres, hotels, major workplaces, preservation worthy/protected cultural monument, stocks of explosives) Other fires
	Explosion	Explosion in industrial operation Explosion in tank farm Explosion in fireworks or explosives warehouse
	Other	Incidents during major events Reckless operation of (risky) consumer services An event outside the municipality's geographic area that is significant to the municipality (e.g. accident at company that causes pollution in neighbouring municipalities or emissions of hazardous gases that spread to neighbouring municipalities) Dam breach Collapse/total loss of building Prolonged loss of energy supply Prolonged loss of telecommunications/ICT Prolonged loss of drinking water supply Distribution of hazardous food (bacteria, toxins, viruses, fungi, parasites) Distribution of contaminated/poisoned drinking water (legionella, Giardia) Acute air pollution
Intentional incidents	Terrorism	Terrorist attack Bomb threat
	Criminal act	Disloyal employee Crime (aggravated robbery) Act of violence Shooting in progress (school, college, university, assembly hall, event) Sabotage of critical infrastructure (waterworks, power, ICT, transport networks) Kidnapping/hostage taking/hijacking
	Cyberspace	Cyber attacks Hacking

APPENDIX 6
POSSIBLE SOURCES OF INFORMATION

Type of information	Source of information	Specification
Risk and vulnerability assessments, contingency assessments and plans	Existing risk and vulnerability assessments	Past risk and vulnerability assessments from the municipality Neighbouring municipalities' risk and vulnerability assessments County RVA National Risk Assessment (DSB) Risk and vulnerability assessments from different fields in the municipality and other (health and social services, power supply, water, sewer and refuse collection, public roads administration, industry, fire service, ports in the municipality, climate vulnerability, acute pollution, other sectors) RVA assessments related to land-use and zoning plans/other planning areas Other actors' risk and vulnerability assessments
	Contingency plans	The municipality's overall contingency plan Contingency plans related to individual sectors/fields in the municipality Contingency plans associated with enterprises with major accident potential in the municipality External actors' contingency assessments and plans
Location-specific conditions	Local knowledge	Data/knowledge about local conditions Inspections Section assessments from the Norwegian National Rail Administration
	Inspection reports	The County Governor's inspection reports Supervision from other state authorities
	Historical data	Accident statistics. Some sources: • Statistics Norway's Cause of Death Register • Norwegian Patient Register • Norwegian Institute of Public Health: Public Health Profiles • DSB: Statistics on fires, electrical injuries, accidents related to • hazardous substances and transport of dangerous goods and product and consumer services. • Norwegian Public Roads Administration: Traffic accident register and register of fatal accidents • Norwegian Maritime Authority Fatal accidents with leisure boats • Norwegian People's Aid: Statistics on drowning accidents • Norwegian National Rail Administration (JBV): Statistics on hazards and conditions • What has happened in the municipality earlier? • What has happened in other municipalities?
	Data from key infrastructure and service providers	Information from local power providers Concerning the risk of railway accidents, contact sikkerhet@jbv.no
	Research works, guidances, and reports	
	Relevant impact assessments	
	Statistics Norway's population projections	
	Natural hazards and climate change	Information on natural hazards and climate adaptations is available from the Norwegian Meteorological Institute (MET), Norwegian Climate Service Centre, Norwegian Environment Agency, Norwegian Directorate for Civil Protection (DSB), Norwegian Water Resources and Energy Directorate (NVE), Norwegian Geotechnical Institute (NGI), Cicero
	Map data	See next page

DIGITAL TOPIC MAP

Some important sources of data:

Data provider	Data type	Application
NVE	A variety of map types with precautionary areas, hazard areas and risk areas for landslides, avalanches and floods. http://www.nve.no/no/Vann-og-vassdrag/Databaser-og-karttjenester/ http://www.nve.no/no/Flom-og-skred/Farekartlegging/ http://www.skrednett.no http://www.varsom.no These can be used from NVE's map viewing solutions, as downloadable data or as wms services	Areas at risk of events. Some types of maps with probability. Maps of past landslide and avalanche events.
DSB	Four types of maps showing facilities with hazardous substances, explosives facilities, major accident facilities and transport of dangerous goods. For access to data on hazardous materials, see http://www.dsb.no/no/Ansvarsomrader/Farlige-stoffer/FAST-anleggogkart/ For data to download, contact kart@dsb.no	Areas at risk of events.
Norwegian Public Roads Administration	Maps with average annual daily traffic and traffic accidents. Data for downloading.	Can be used in the assessment of risk, probability and consequence.
Statistics Norway	Population data, at address level, grid, and basic statistical units. Data for downloading.	Consequence overview
Directorate for Cultural Heritage	Maps for protected and preservation worthy cultural monuments. Data for downloading and access. www.kulturminnesok.no og Askeladden: Riksantikvaren	Consequence overview
Norwegian Environment Agency	Maps for protected and valuable nature. Data for downloading and access http://www.miljodirektoratet.no/no/Tjenester-og-verktoy/Database/Naturbase/	Consequence overview
JBV	Section assessment. The assessment provides an overview of risks, hazards, preparedness circumstances, images and maps. The data source is currently not open. Inquiries to sikkerhet@jbv.no	Can be used in the assessment of risk and consequences
Norwegian Meteorological Institute (MET)	A number of types of maps showing observations of precipitation from radar and forecasts for wind, temperature, precipitation (rain and snow) and wave conditions, see https://halo.met.no Also other types of observations and forecasts that are not in map form (graphs, tables, and text alerts) Municipalities can get users on Halo by post-halo@met.no	Consequence assessment

APPENDIX 7
PROPOSAL FOR STRUCTURE OF REPORT

Example of structure of report for comprehensive risk and vulnerability assessment:

1. Summary and conclusion.
2. Introduction with description of background, purpose, preconditions, delimitations.
3. The mandate for the work.
4. Description of municipality, incl. information basis.
5. Description of who has participated and how different stakeholders have been involved.
6. Methodology and work process.
7. Identification of adverse events.
8. Risk and vulnerability assessment.
9. Identification of measures.
10. Presentation of risk and vulnerability scenario.
11. Risk management – the project group's proposals for goals, strategies and measures in follow-up plan.
12. References.
13. Any attachments, such as assessment forms, the checklists used, etc.

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Norwegian Directorate for Civil Protection

Rambergveien 9
3115 Tønsberg

Telephone +47 33 41 25 00
Fax +47 33 31 06 60

postmottak@dsb.no
www.dsb.no

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