

National Strategy for Climate Change Adaptation

The main content of the bill

The bill proposes two changes to the Planning and Building Act (2010:900) with the aim of improving municipalities' preparedness for climate change. One of these changes involves a requirement for municipalities to provide their views in their structure plans on the risk of damage to the built environment as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated. The other change involves the municipality being able to decide in a detailed development plan that a site improvement permit is required for ground measures that may reduce the ground's permeability and that are not being taken to build a street, road or railway that is compatible with the detailed development plan.

The Government also reports on a National Strategy for Climate Change Adaptation in order to strengthen climate change adaptation work and the national coordination of this work in the long term. The strategy was announced in the Government's written communication 'Kontrollstation för de klimat- och energipolitiska målen till 2020 samt klimatanpassning' ('Control station for the 2020 climate and energy policy objectives and climate change adaptation', Riksdag Communication 2015/16:87). Through the strategy, the Government also meets its obligations in accordance with the Paris Agreement and the EU Strategy on Adaptation to Climate Change, in which a national climate change adaptation strategy is highlighted as a central analytical instrument that is intended to explain and prioritise actions and investments.

It is proposed that the legislative changes enter into force on 1 August 2018.

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1 Proposed Riksdag decision

The Government proposes that the Riksdag adopts the Government's proposed act on changes to the Planning and Building Act (2010:900).

2 Proposed act on changes to the Planning and Building Act (2010:900)

It is hereby stipulated that Chapter 3, Section 5 and Chapter 9, Section 12 of the Planning and Building Act (2010:900) should have the following wording:

Current wording

Proposed wording

Chapter 3

Section 5¹

The structure plan shall detail

1. the basic elements in connection with the matter of the intended use of land and water areas,

2. the municipality's views on how the built environment should be used, developed and preserved,

3. how the municipality intends to satisfy the reported national interests and follow applicable environmental quality norms,

4. how the municipality intends – within physical planning – to take into account and coordinate the structure plan with relevant national and regional objectives, plans and programmes of significance for sustainable development within the municipality,

5. how the municipality intends to satisfy the long-term need for housing, *and*

6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code.

5. how the municipality intends to satisfy the long-term need for housing,

6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code, *and*

7. the municipality's views on the risk of damage to the built environment as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated.

Chapter 9

Section 12

A site improvement permit is required *for tree felling and forest planting within an area with a detailed development plan*, if the municipality has decided this in *the plan*.

A site improvement permit is required if the municipality has decided this in the *detailed development plan*, for

- 1. tree felling,*
- 2. forest planting, and*

¹ Most recent wording 2014:224.

3. ground measures that may Govt Bill 2017/18:163
reduce the ground's permeability.

*Despite what is stated in the first
paragraph, point 3, a site
improvement permit is not
required for measures taken to
build a street, road or railway on
land that may be used for this
purpose in accordance with the
detailed development plan.*

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1. This Act enters into force on 1 August 2018.
 2. Older regulations still apply to cases of adopting or amending a
structure plan where this has been commenced before entering into force.

3 The case and its preparation

The Government decided on 12 November 2015 to appoint a specific investigator tasked with analysing how responsibility should be divided between the state, the county councils, the municipalities and individuals in relation to taking measures to adapt ongoing and planned land use and built environments in line with a gradually changed climate. In those parts where the distribution of responsibility is unclear or unsuitable, the investigator should propose improvements. The remit also included analysing any obstacles and restrictions in the legislation in terms of carrying out adaptation measures, and proposing any changes to the legislation in order to make built environments safer from flooding (terms of reference 2015:115). The inquiry was named the Climate Change Adaptation Inquiry. The remit was given following a proposal from the All-Party Committee on Environmental Objectives (terms of reference 2010:74) in its report ‘Med miljömålen i fokus – hållbar användning av mark och vatten’ (‘A focus on the environmental objectives – sustainable use of land and water’, SOU 2014:50). The report ‘Vem har ansvaret?’ (‘Who is responsible?’, SOU 2017:42) was published in May 2017 and circulated for comment on 7 June 2017. The inquiry submitted a number of recommendations and proposals, of which only a few involve legislative changes. Two of the proposed legislative changes are dealt with in this legislative matter. A summary of the report to the extent that it relates to the legislative proposal can be found in *Appendix 1*. The report’s legislative proposal is described in *Appendix 2*. The report has been circulated for comment. A list of the referral bodies can be found in *Appendix 3*. The referral responses and a summary of these are available from the Ministry of the Environment and Energy (ref. M2017/01407/KI).

This bill also deals with proposals and recommendations submitted in other reports. On 19 December 2013, the Ministry of the Environment tasked the Swedish Meteorological and Hydrological Institute (SMHI) with working in cooperation with relevant agencies to follow up on and analyse the climate change adaptation work carried out since the Climate and Vulnerability Inquiry (SOU 2007:60), and to assess the outstanding need for measures with proposals for continued climate change adaptation work. SMHI reported on this remit in March 2015. The report was circulated for comment on 2 April 2015. The referral bodies’ opinions are available from the Ministry of the Environment and Energy (ref. M2015/01162/KI).

In the Government’s communication ‘Kontrollstation för de klimat- och energipolitiska målen till 2020 samt klimatanpassning’ (‘Control station for the 2020 climate and energy policy objectives and climate change adaptation’, Communication 2015/16:87) and in the 2018 Budget Bill, the Government announced its intention to report back to the Riksdag during the mandate period with a national Strategy for Climate Change Adaptation. Such a national strategy is proposed in this bill.

The Council on Legislation

On 8 February 2018, the Government decided to obtain the Council on Legislation’s statement on the legislative proposal in *Appendix 4*. The Council on Legislation’s statement can be found in *Appendix 5*. The Council on Legislation’s opinions are dealt with in sections 4.2 and 4.3. The Government has followed the Council on Legislation’s proposal.

4 Improving municipalities' preparedness for climate change

4.1 Adaptation to a changed climate

At the end of 2014, the Swedish Meteorological and Hydrological Institute (SMHI) reported on the climate science knowledge situation ahead of the Government's 2015 control station for the climate and energy policy objectives. This report states that Sweden's climate has become warmer, with higher precipitation.

Even if the global average temperature increase is limited to below 2°C, significant climate changes are expected to affect Sweden's natural environment and most sectors of society. According to SMHI's climate scenarios, the annual amount of precipitation may increase by between 10 and 40 percent during the coming century, depending on levels of greenhouse gas emissions. The biggest increase is expected during the winter months. At the same time, summer precipitation in southern Sweden is expected to decrease. Extreme weather events such as heatwaves, torrential rain and heavy rainfall are expected to increase in number, which can lead to increased flooding problems. The increase in precipitation also increases the risk of landslides and erosion. Flooding and saltwater intrusion are also expected to increase due to rising sea levels, particularly in low-lying coastal areas of southern Sweden.

Warming will probably have consequences for many ecosystems, and will have effects on ecosystem uses such as fishing, agriculture and forestry. Large parts of our built cultural heritage are also located close to watercourses or in shore and coastal areas, since water has historically been important for transportation, as a source of power, and for fishing. Flooding can therefore have serious consequences for our cultural heritage, and for the attractiveness of locations as residential areas or visitor destinations. Eventually, future opportunities for being able to understand Sweden's historical development may be negatively affected.

Today's society is adapted and built to suit a particular climate. With the climate changes that can already be seen and that can be expected in future, conditions for the whole of society will change. Cities and built-up areas are particularly sensitive to climate effects such as flooding and increased temperatures. It is therefore absolutely essential that the physical planning and development of these areas takes future climate changes into account. Measures can also involve adapting water supplies, sewage systems, electricity supplies, electronic communications, waterways, roads and buildings, to mention just a few examples.

Public agencies play an important role in initiating, supporting and evaluating climate change adaptation work within their fields of responsibility. The county administrative boards have had a regional coordination remit since 2009, and report on the progress of this work each year. The picture painted by the reports is that knowledge and commitment are gradually increasing in terms of climate change adaptations issues.

More of the decisions being taken at local level include climate change adaptation. This is particularly true within physical planning and in the work involved with risk and vulnerability analyses, as well as within fields such as the cultural environment. Nevertheless, relatively few concrete climate change adaptation measures are still being carried out at local level.

The municipalities play a central role in working with climate change adaptation. They are responsible for good technical support systems, and for the preventive work in connection with natural accidents within their geographical area. They are also responsible for physical planning, which is one of the most important areas in which climate change and its effects must be prevented and dealt with.

4.2 Requirements for risk assessment in the structure plan

The Government's proposal: In the structure plan, the municipality should provide its views on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated.

The inquiry's proposal largely corresponds with that of the Government, but is differently worded to some extent.

The referral bodies: The vast majority of the referral bodies, including *SMHI, the Swedish Agency for Marine and Water Management, Insurance Sweden, the Swedish Property Federation, the Swedish Homeowners Association and the Swedish Association of Local Authorities and Regions*, back the proposal and have no opinions to add. Many of the referral bodies believe that the proposal is good, but that the inquiry's definition is too narrow. Several referral bodies, including *Svea Court of Appeal (Land and Environment Court of Appeal), the Structure Plan Inquiry (N 2017:02), the Swedish Agency for Marine and Water Management, the Swedish Transport Administration, the National Board of Housing, Building and Planning, the Swedish Association of Local Authorities and Regions, Mariestad Municipality, Gullspång Municipality, Uppsala County Administrative Board and Insurance Sweden*, have opinions on the statute proposal, and some question the need for legislation. Several municipalities and a few county administrative boards requested guidance and additional resources.

The reasons for the Government's proposal

Environmental and risk factors in the structure plan

According to Chapter 3, Section 1 of the Planning and Building Act (2010:900), every municipality shall have a current structure plan that covers the entire municipality. The requirement for the structure plan to have a strategic and guiding function is detailed in Chapter 3, Section 2, which states that the structure plan should specify the direction for the long-term development of the physical environment. The need for a long-term approach was added with the introduction of the Planning and Building Act, in order to reinforce the structure plan's function as a strategic document. In this context, the legislator also highlighted the significance of the climate issue for sustainable development within the municipality (Govt Bill 2009/10:170, Part 1 p. 176).

According to Chapter 3, Section 4, the municipality should report in the structure plan on its assessment of how the obligation in accordance with Chapter 2 to take the public interest into consideration when deciding on the use of land and water areas will be satisfied. The previous Planning and Building Act (1987:10) included a reference to environmental and risk factors. The preparatory work for Chapter 3, Section 4 states that

the environmental and risk factors are fully dealt with in Chapter 2, and therefore do not need to be mentioned specifically in this paragraph (Govt Bill 2006/07:122 p. 68). It was emphasised in the preparatory work that the municipalities' reporting obligations are not reduced as a result of the reference to environmental and risk factors being removed.

Chapter 2, Section 4 of the Planning and Building Act includes a general suitability requirement for planning which states that land may only be considered for building on if it is suitable for the purpose from a general point of view. The general suitability requirement is detailed in Chapter 2, Section 5. The applicability of Chapter 2, Sections 4 and 5 to structure planning results from the definition of planning in Chapter 1, Section 4, which states that planning relates to work involved in drawing up a regional plan, a structure plan, a detailed development plan or special area regulations. Chapter 2, Section 5 states that, when planning, buildings and structures should be positioned on ground that is suitable for the purpose with regard to soil, rock and water conditions (point two) and the risk of accidents, flooding and erosion (point five).

The term 'water conditions' in Chapter 2, Section 5, point 2 means that attention should be paid not only to groundwater conditions but also to surface water conditions (Govt Bill 1988/89:116 p. 37). This provision means that, when deciding on the location of buildings, municipalities should take the risk of flooding into consideration.

The provision in Chapter 2, Section 5, point 5 was added in order to clarify the municipality's obligation to take environmental and risk factors into account (Govt Bill 2006/07:122 pp. 32–36). Here, it is stated that the requirement to take flooding and erosion into account has been added partly because flooding and erosion that occur slowly are not covered by the word 'accident', and partly because these natural events have not been taken into account when applying the second point of the provision in the manner intended by early preparatory work. In accordance with this bill, the word 'accident' (p. 35) means a sudden incident that has involved or can be feared to involve damage. This could involve fires, explosions, landslides, flooding, bad weather or discharges of harmful substances. What is relevant in terms of climate effects, then, is fires, landslides, flooding and bad weather such as storms.

Flooding, landslides and erosion are a few of the effects that can be expected as a result of climate change. The municipalities should thus already be taking these risk factors into account in the structure plan when deciding on the location of new buildings. They should therefore have a certain degree of experience and preparedness in terms of working with these issues. The municipalities should also have a certain amount of data for this work. Public agencies have also drawn up decision-making data to support many actors. This includes the flood risk portal produced by the Swedish Civil Contingencies Agency, the mapping services for landslides produced by agencies including the Swedish Geotechnical Institute, and the risk overview for beach erosion produced by the Geological Survey of Sweden.

Municipalities' climate change adaptation work must be strengthened

Adapting the built environment in line with the effects of a changed climate is often a planning issue. These issues must therefore be identified and included in social planning. Social planning is largely dealt with at municipal level. All municipalities will be affected by climate

change, but the consequences are of course different across the country. Climate change adaptation issues may, for example, be relevant to a greater extent in coastal municipalities than in inland municipalities. Of Sweden's 290 municipalities, 131 have coasts or shores with the four largest lakes and seas.

According to a questionnaire survey and municipality ranking carried out by IVL Swedish Environmental Research Institute and Insurance Sweden – 'Klimatanpassning 2017 – så långt har kommunerna kommit' ('Climate change adaptation 2017 – the municipalities' progress') – seven out of ten municipalities have analysed how they may be affected by a future climate. However, in only half of municipalities has the municipal council or the municipal board made a political decision to confirm that the municipality will work with climate change adaptation. Just four out of ten municipalities say that they have identified different possible climate change adaptation measures.

A few referral bodies, including *Svea Court of Appeal (Land and Environment Court of Appeal)*, *the Structure Plan Inquiry (N 2017:02)* and *the National Board of Housing, Building and Planning*, believe that current regulations also require the municipality to report on the risks of accidents, flooding and erosion, and that the proposal risks leading to duplication of regulation in terms of what already applies.

Chapter 2, Section 5 and Chapter 3, Section 4 of the Planning and Building Act certainly state that the municipalities should report their assessment in structure plans of how the risk of accidents (including landslides), flooding and erosion will be taken into account. According to current legislation, however, there is no requirement for the municipalities to give their views on climate-related risks that relate to the existing built environment. Nor is there any obligation for the municipalities to work strategically with reducing or eliminating these risks. To strengthen climate change adaptation work within the municipalities, explicit rules are needed which require the municipalities to provide their views in structure plans on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated. Clearly highlighting the importance of the municipality making such an assessment in the structure plan brings several advantages for successful climate change adaptation work at local level. Climate change adaptation work is anchored in existing processes within the municipality, and the process is also politically anchored through adopting the structure plan. It also provides better conditions for long-term strategic climate change adaptation work. It is important for society that climate change adaptation work within the municipalities is strengthened.

The provisions in Chapter 3, Section 5 of the Planning and Building Act on the structure plan's content should therefore be supplemented with a requirement that it should give the municipality's view on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how the identified risk of such damage can be reduced or eliminated. The Government does not agree with views from agencies including *the Swedish Association of Local Authorities and Regions* that the wording should be changed to "how the risks can be dealt with" or similar. This would counteract the aim of the provision.

The risk assessment should be of an overview, long-term nature

The structure plan is a suitable place for an overview, long-term risk assessment such as that now proposed by the Government. The advantage of the structure plan is that it is intended to be an overview and to constitute a

strategic document, that it is established by the municipal council, and that it includes the municipality's entire geographic area.

The Swedish Transport Administration, Svea Court of Appeal (Land and Environment Court of Appeal), the National Board of Housing, Building and Planning and Insurance Sweden question whether a structure plan is sufficiently detailed to be able to clarify the risks and measures. Some referral bodies believe that the risk assessment may be too extensive with regard to covering the entire municipality.

In order for the risk assessment to fulfil its function, it needs to include identifying at an overall level those areas with unsafe conditions or circumstances for poorer safety where more detailed investigations may be required. It should primarily be possible to carry out risk assessments using existing geological, geotechnical and topographic data, as well as sea level, flooding and landslide mappings provided by public agencies and county administrative boards. The intention is thus not to assess the ground conditions for individual plots or on a detailed level. Such a detailed assessment does not belong in a structure plan, but in a detailed development plan or a building permit assessment. The Inquiry is of the opinion that the risk assessment can constitute data which the municipalities can use to calculate how much climate change adaptation will cost. The Government is of the opinion that the risk assessment can constitute data for cost calculation. However, since the structure plan instrument does not provide the degree of detail required to carry out a comprehensive cost calculation, additional analyses are needed in order to calculate the costs of climate change adaptation.

When it comes to the risk of damage due to climate effects, it is important – as stated by *Mariestad Municipality, Gullspång Municipality and Uppsala County Administrative Board*, for example – that planning is of a long-term nature, and that it is adapted according to changed climate conditions. The assessment should include not only climate effects that can be expected to occur in the near future, but also climate effects that can be expected from a longer-term perspective. The fact that the structure plan should take a long-term perspective is stated in Chapter 3, Section 2 of the Planning and Building Act.

Based on the existing indications and risks, the municipality should prioritise the assessment of those areas where the risk of damage appears to be the greatest. When carrying out the risk assessment, attention should be paid to both the likelihood and the consequences of damage to the built environment.

The risk assessment should include the built environment and the factors flooding, landslides and erosion

The adaption of ongoing and planned land use and built environments in line with a gradually changed climate is an extremely broad area. On the basis of the six main areas identified in the Climate and Vulnerability Inquiry's report 'Sverige inför klimatförändringar – hot och möjligheter' ('Sweden in the face of climate change – threats and opportunities', SOU 2007:60), the Inquiry has limited the remit to one area: buildings and structures. The Inquiry is of the opinion that the other five areas need to be investigated individually. These areas are communication (roads, railways, shipping, etc.), technical supply systems (electricity systems, district heating, etc.), agriculture and tourism (forestry, farming, fishing, tourism, etc.), the natural environment and the environmental objectives, and human health.

The Structure Plan Inquiry (N 2017:02) points out that it is somewhat unclear which buildings the risk assessment is intended to cover. The Inquiry's proposal is that the analysis should relate to buildings and structures, as well as parks and other facilities in close proximity to and connected to buildings. The Inquiry is also of the opinion that facilities such as wind turbines and energy plants, as well as roads and railways, should be included. The Government agrees with the Inquiry's assessment. The legislative text should state that the analysis should include the built environment in the municipality, an expression that is already used in the Planning and Building Act regarding the requirements for the structure plan (see Chapter 3, Section 5, point 2).

Many referral bodies raise an objection that the Inquiry's delimitation is too narrow. For example, *the Swedish Agency for Marine and Water Management* proposes that environmental quality norms and action programmes within water management should be reported in the structure plan. With the Inquiry's delimitation, there is no basis for proposing such a change in this legislative matter. Several referral bodies also have opinions about which risk factors should be taken into account. For example, it is proposed that heat should be included. As proposed by the Inquiry, the risk factors should be limited to the risk of flooding, landslides and erosion, since these climate effects can cause significant damage to the built environment. Even if increased temperatures and humidity, for example, result in maintenance problems due to the risk of damp and mould, heat is not primarily a risk to buildings but a risk to health. As reported in the section above, the proposal should relate to damage to the built environment, and the Government is therefore of the opinion that heat should not be included in the calculation of the effects that the municipality should take into consideration in the risk assessment.

Guidelines for the structure of the risk assessment

Several referral bodies, including *the Swedish Association of Local Authorities and Regions*, have asked for guidelines, data and support for the work involved in structuring the risk assessment. The Government has tasked the National Board of Housing, Building and Planning with supervisory guidance for flooding risks in the appropriation document for 2017 and with supervisory guidance regarding landslides and erosion in the appropriation document for 2018.

The Council on Legislation

The Council on Legislation has noted that the proposed legislative text and statute comments do not clearly state that the future damage referred to does not relate to such damage that can be attributed to climate-related flooding, etc., that has already occurred, but – as expressed in the general motivation – to “climate effects that can be expected to occur in the near future... [and] climate effects that can be expected from a longer term perspective.” The Council on Legislation proposes that the words “as a result of” should be replaced by “that may occur as a result of” to emphasise that the provision is forward-looking in this way. The Government has followed the Council on Legislation's proposal.

4.3 Site improvement permit obligation for regulating the ground's permeability

The Government's proposal: The municipality can decide in a detailed development plan that a site improvement permit is required for ground measures that may reduce the ground's permeability and that are not being taken to build a street, road or railway that is compatible with the detailed development plan.

The Inquiry's proposal mainly agrees with the Government's, but the Inquiry does not propose any restriction on the opportunity to impose site improvement permit requirements.

The referral bodies: The vast majority of the referral bodies, including *Svea Court of Appeal (Land and Environment Court of Appeal)*, *the Structure Plan Inquiry (N 2017:02)*, *SMHI*, *the Geological Survey of Sweden*, *the National Property Board of Sweden*, *the Swedish Agency for Marine and Water Management*, *the National Board of Housing, Building and Planning*, *the Swedish Association of Local Authorities and Regions* and *Swedish Water*, back the proposal or have no opinions. Several referral bodies, including *Nacka District Court (Land and Environment Court)*, *the Structure Plan Inquiry (N 2017:02)*, *the Swedish Agency for Marine and Water Management*, *the National Board of Housing, Building and Planning*, *Svenska Kraftnät*, *Västra Götaland County Administrative Board*, *Gotland County Administrative Board*, *Malmö Municipality* and *the Swedish Homeowners Association*, have opinions on the statute proposal. A few county administrative boards and municipalities, *the Swedish Agency for Marine and Water Management* and *the Swedish Homeowners Association* have opinions on delimitations in the proposal. Some municipalities, *the Swedish National Tenant-Owner Cooperative Housing Association* and *the Geological Survey of Sweden* have requested guidance.

The reasons for the Government's proposal

The significance of ground properties for the presence of surface water

Climate change is expected to lead to increased volumes of precipitation in Sweden, particularly during the winter. Increased precipitation means an increased risk of flooding, for example, which can cause damage to the built environment. It is therefore important to create the right conditions for dealing with surface water.

In built-up areas, there are two parameters to work with when it comes to dealing with precipitation: management systems and other drainage, and the ground's ability to deal with, absorb or temporarily store the precipitation.

Ground properties are of decisive significance for the presence of surface water. The worse the conditions for the water being able to infiltrate the ground, the greater the quantity of surface water. Surface water appears with a small amount of precipitation on ground that has been asphalted or built on with housing, while a copse in a park can cope with more precipitation before surface water builds up.

The proportion of hard surfaces – in other words, the ground surface that does not let water through – thus has a major impact on drainage conditions in an area. Areas that are fully urbanised (i.e. that consist exclusively of hard surfaces and buildings) therefore often lack the ability to deal with precipitation through infiltration. Here, water must instead be led away. The larger

the area is, the greater the burden on the surrounding areas to which the water runs off.

The ground's ability to accept water and the capacity to lead water away interact with each other when it comes to an area's ability to deal with torrential rain. Flooding occurs if the ground cannot manage to absorb the quantities of water and the water is not led away. When carrying out construction work, systems are therefore put in place to transport water away as effectively as possible. In most communities in Sweden, there is a system based on water being channelled through pipes and away from the area to the nearest or most suitable watercourse, sea or lake.

Independently of climate change, other ongoing developments are also making it harder to deal with surface water. For example, the densification of cities involves green spaces being replaced with hard surfaces. There is also a general trend to replace garden lawns with maintenance-free hard surfaces. Another problem that can arise when surface water issues are not included in an area's planning occurs when an area is developed next to an existing area. If the existing area has a surface system that is dimensioned for that area, it may become under-dimensioned in relation to additional volumes when the new area is linked to it.

Surface water in detailed development planning

In detailed development planning for an area, the municipality has the opportunity to deal with issues that facilitate surface water management. According to Chapter 4, Section 5 of the Planning and Building Act, the municipality shall state limits for general sites, developed areas and water areas in the detailed development plan. When carrying out new development, this is an important instrument and a fundamental requirement in order to cope with surface water management, since ground can thereby be reserved for surface water management to protect against flooding in the event of heavy torrential rain. This can be achieved by ensuring that the area has sufficient public space that can also deal with water from torrential rain, for example. In accordance with Chapter 4, Section 10, the municipality can also regulate the ground's elevation in the detailed development plan, which creates additional opportunities for checking and controlling the routes taken by water, and for example leading it to selected flooding surfaces. In accordance with Chapter 4, Section 16, point 1, the municipality can also determine in this plan the extent to which the ground surface should be permeable to water, i.e. not hard (Govt Bill 1985/86:1 p. 582).

A site improvement permit obligation strengthens the municipality's ability to ensure good surface water management

The municipality thus has an opportunity to regulate the permeability of the ground surface in the planning regulations, for example by stating how much of a property may be hard surface. With regard to the significance of the nature of the ground in terms of drainage conditions, it is important that the municipality has sufficient tools for ensuring good surface water management and that planning regulations on permeability are adhered to. The possibility to stop measures that contravene plans with support of the legal orders in Chapter 11, Section 20 of the Planning and Building Act are not sufficient for achieving this aim, since this provision only provides an option to take action against measures that contravene plans, and only afterwards. Instead, the municipality should be given an

opportunity to introduce a site improvement permit obligation for ground measures that may reduce the ground's permeability into the detailed development plan. Such an application procedure would give the municipality information about which measures are planned and the opportunity to stop a measure that contravenes plans or is unsuitable before it is taken. In those cases where land has been set aside for a street, road or railway in the detailed development plan, the municipality has already taken a position during the planning process on how such infrastructure affects the ground's permeability. There is therefore no reason to introduce a site improvement permit obligation in these cases. The municipalities' opportunity to stipulate a site improvement permit obligation should therefore not include ground measures taken to build a street, road or railway on land that may be used for this purpose in accordance with the detailed development plan.

The National Board of Housing, Building and Planning, Västra Götaland County Administrative Board and Gotland County Administrative Board are of the opinion that the provision should be introduced into Chapter 9, Section 11 of the Planning and Building Act. The scope of the site improvement permit obligation is governed in Chapter 9, Sections 11–13. The provisions in Section 11 and 12 relate to measures within areas with detailed development plans, and Section 13 refers to measures in areas without detailed development plans. Section 11 includes a general requirement for a site improvement permit for trenching and filling in, unless the municipality decides otherwise in the detailed development plan. Section 12 includes the opportunity for the municipality to use a planning regulation to introduce the obligation to apply for a site improvement permit for tree felling and forest planting. The distinction between the general requirement for a site improvement permit in Section 11 and the optional opportunity in Section 12 is developed in the preparatory work to the older Planning and Building Act (Govt Bill 1985/86:1 pp. 296–302). This states that more extensive trenching and filling in is generally of great importance to the plot's suitability for buildings, the cityscape and the landscape, and the relationship between neighbours, but that the natural conditions do not generally have the same significance in planning. It is also pointed out that areas of woodland can affect drainage and groundwater conditions, climate, etc., and that the municipalities should therefore be able to introduce an obligation to apply for a site improvement permit for such measures through a planning regulation.

Just as with areas of woodland, the ground's permeability can also be of significance for drainage conditions. However, it is primarily in more urbanised areas that the ground's permeability can be significant in this way. There is therefore no reason to introduce a general requirement for a site improvement permit for such measures. Instead, it is sufficient for the municipality to be given the opportunity to regulate this in the detailed development plan. As some referral bodies point out, such a site improvement permit obligation will only apply if it is decided in a new or amended detailed development plan. Since the provision will be optional, it should be introduced into Chapter 9, Section 12 of the Planning and Building Act, as proposed by the Inquiry.

Nacka District Court (Land and Environment Court), the Structure Plan Inquiry (N 2017:02) and the Swedish Agency for Marine and Water Management point out that the report's proposed wording "changes to the shape of the ground surface" has an extensive scope, and could lead to a site improvement permit obligation being introduced for measures other than those intended by the Inquiry. The Government does not agree with these views. The opportunity to introduce a site improvement permit obligation should only relate to such ground measures that may reduce the ground's permeability.

A number of referral bodies (including *Malmö Municipality, the Swedish Agency for Marine and Water Management, the Swedish Homeowners Association and Svenska Kraftnät*) have opinions on which measures should be covered by the site improvement permit requirement, and under which circumstances the municipality should be able to introduce a site improvement permit obligation.

The assessment criteria for site improvement permits can be found in Chapter 9, Section 35 of the Planning and Building Act. This states that site improvement permit applications should be assessed against provisions on permeability in the detailed development plan, if such a plan exists. The municipality has the opportunity to announce provisions on permeability with the support of Chapter 4, Section 16, point 1. If the municipality believes that there are grounds to announce such planning regulations, there are often also grounds to introduce a provision on a site improvement permit obligation. If the detailed development plan does not contain any provision of a prohibitive nature that may constitute grounds for assessing a site improvement permit application in accordance with Chapter 9, Section 35, point 1, the assessment may instead be carried out only against other points in Chapter 9, Section 35.

The opportunity for the municipality to determine the scope of the site improvement permit requirements in a detailed development plan are governed by Chapter 4, Section 15 of the Planning and Building Act. With support of the provision, the municipality can stipulate in the plan which provisions are needed in order to regulate the physical conditions in a context that need to be determined from a general or neighbourly law point of view (see Govt Bill 1985/86:1 p. 573). The scope of these provisions should be determined with regard to both the measures that the plan intends to regulate within the planning area and the conditions in the planning area's surroundings. In other words, the intention is to provide the municipality with the necessary instruments to create a good overall solution based on the known circumstances at the time of planning. The municipality should justify the scope and the degree of detail of the plan's provisions in the plan description. The requirement for clarity in Chapter 4, Section 32, second paragraph should also be mentioned in this context. It is important that the detailed development plan clearly states which measures are covered by a provision on exemption from or increasing the permit requirement.

The Council on Legislation

The Council on Legislation has proposed an alternative wording of the legislative text that more closely follows the current wording of the paragraph and of other provisions on site improvement permits (Chapter 9, Sections 11 and 13 of the Planning and Building Act). The Government has followed the Council on Legislation's proposal.

4.4 Starting date

The Government's proposal: The legislative changes shall enter into force on 1 August 2018.

Older regulations still apply to cases of adopting or amending a structure plan where this has been commenced before entering into force.

The Inquiry's proposal is that the legislative changes should enter into force on 1 July 2018. The Inquiry has not proposed any transitional provisions.

The referral bodies: *Västerbotten County Administrative Board* and *Uppsala County Administrative Board* point out that certain municipalities will carry out the topicality review at the end of the next mandate period, and will be working with a new structure plan almost entirely during the mandate period that begins in 2022, and that 2026 is therefore more realistic as a target for the proposal. *The Structure Plan Inquiry (N 2017:02)* is of the opinion that 2022 is an optimistic assessment. Other referral bodies do not have any views on this issue.

The reasons for the Government's proposal: It is important that the proposed amendments enter into force as soon as possible. The legislative changes should therefore enter into force on 1 August 2018.

Drawing up a new structure plan or amending an existing plan is a time-consuming process. It is therefore reasonable for cases of adopting or amending structure plans that have been started in accordance with currently applicable legislation to be completed without having to be adapted in line with the proposed requirements for a risk assessment of climate change impact. For cases of adopting or amending structure plans that were started before 1 August 2018, older regulations should therefore still apply.

The provision on a site improvement permit obligation is optional. No transitional provision is therefore necessary. This means that the municipality has the option of introducing such an improvement permit obligation, even in ongoing planning work. The Planning and Building Act's procedural regulations for adopting detailed development plans must of course be followed.

5 Responsibility for taking preventive adaptation measures

The Government's assessment: The responsibility for protecting property lies primarily with the owner of the property. This provides a motivational force for avoiding building in risky areas and for taking appropriate protective measures. It applies to all property owners, and to both individuals and businesses, as well as local and government agencies.

According to the Planning and Building Act (2010:900), municipalities are responsible for new buildings being positioned in detailed development plans on suitable land with regard to the risk of accidents such as landslides or flooding and erosion.

In certain areas, the municipalities also have a legal responsibility. Otherwise, the municipalities have the opportunity to take preventive adaptation measures, provided that these measures are compatible with the public interest in the Local Government Act (2017:725).

The Climate Change Adaptation Inquiry's assessment agrees in part with that of the Government. In its analysis of responsibilities for taking adaptation measures, the Inquiry has studied buildings and structures within areas that have been planned in detail. The analysis was based on legal responsibility in accordance with the provisions in the Planning and Building Act and the Act (2003:778) on Protection against Accidents in particular. Legal responsibility refers to a responsibility that can be demanded through damages or other sanctions. The analysis was also based on the responsibility the Government or municipality can have without being a property owner.

The referral bodies: Responsibility for and financing of climate change adaptation for structures and buildings are issues that all referral bodies highlight as central for adaptation to a changed climate. The majority of them believe that the Inquiry's delimitation to structures and buildings was too narrow, and that climate change adaptation must be analysed from an overall perspective, including at drainage level, in order to achieve

results that are beneficial in the long term. Nor do *the county administrative boards* believe that the statute proposals make the distribution of responsibility clearer for climate change adaptation of existing buildings. Most of the referral bodies point out that the delimitation affects the issue of responsibility, which was a central part of the Inquiry. When only some structures and buildings are affected, many questions remain about who is responsible for climate change adaptation in other parts of society. The referral bodies are also of the opinion that the Inquiry's delimitation to structures and buildings has led to climate effects such as drought, heatwaves or the climate's effect on infrastructure such as railways not being dealt with, despite these already being topical issues for most of the referral bodies. *The National Board of Housing, Building and Planning* believes that there are obvious limitations on what can be achieved using the Planning and Building Act to protect existing buildings. *Jönköping Municipality* is of the opinion that the Inquiry is deferring much of the remit to future inquiries, and that the need to investigate the issue of responsibility therefore remains. *Stockholm Municipality* points out that since the Inquiry has established that it is not currently possible to change the applicable distribution of responsibility in an overall manner, ongoing work and a timetable for such a change are required. *HSB* and *SABO* believe that the provision on protective measures needs to be investigated further, since it is unclear whether various existing provisions in, for example, the Expropriation Act (1972:719), the Joint Facilities Act (1973:1149), and the easement legislation and the redemption regulation in the Planning and Building Act are sufficient to give the municipality ground on which to build necessary protective barriers. It is also unclear whether there are sufficient opportunities for property owners to work together on protective measures with or without the support of the municipality. *Lomma Municipality* believes that the Inquiry indirectly assumes that the municipalities are responsible for protecting existing buildings, but that an analysis of the municipalities' legal opportunities to put protective measures in place through planning and under their own management is lacking. *Falkenberg Municipality* is of the opinion that property owners are responsible for carrying out climate change adaptation measures for their own property, even if they do not have any obligation to do so. The municipality believes that more alternatives to legislative changes should be investigated to enable the municipalities to carry out climate change adaptation measures on property owners' land, and to help and encourage property owners to carry out climate change adaptation measures. *Ystad Municipality* and *Ängelholm Municipality* are of the opinion that the individual property owner's responsibility is currently too great, and that the owners of vulnerable properties are themselves burdened with the responsibility and the costs, which in future might no longer be covered by insurance collectives.

Lund University believes that conclusions on the property owner's responsibility for new buildings – and, to a certain degree, existing buildings – are misdirected, and that it is reasonable that those who choose to develop or purchase a property in an identified risk area should also be responsible for the majority of the costs that this may involve. It should therefore be a fundamental principle that the property owner has a responsibility to contribute towards necessary adaptation measures and to bear the costs of damage. *Lund University* and *the National Institute of Economic Research* are of the opinion that it is appropriate at a level of principle for the responsibility to lie with the party that can take relevant measures, but that this principle does not characterise the report.

The Climate Change Adaptation Inquiry has analysed how the responsibility for taking preventive adaptation measures is divided between the state, the municipalities and individuals in terms of adapting ongoing and planned use of land and built environments in line with a gradually changed climate. The Inquiry has primarily analysed the Planning and Building Act, the Act (2003:778) on Protection against Accidents and the Act (2006:412) on Public Water Services (hereinafter referred to as the Water Services Act). Below, the Government draws conclusions on the responsibility for taking preventive adaptation measures within the built environment.

Individual property owners' responsibility to take preventive measures

In the so-called Landslide Bill on preventive measures etc. against landslides and other natural accidents, it was noted that the responsibility for protecting property lies in the first instance with the owner of the property and the owner's insurance company (Govt Bill 1985/86:150, Appendix 3). The property owner's responsibility derives from the right of ownership. This responsibility involves taking the consequences, i.e. bearing the risk of damage. This applies to all property owners: individuals, as well as businesses and local and national authorities and agencies. In many cases, buildings used for public operations such as preschools and schools, for social and medical care, and for various technical functions are owned by municipalities or county councils. The municipalities are also responsible for public places and for municipal roads and other municipal infrastructure. As property owners, municipalities are also responsible for the land they own.

As a general rule, property owners do not have any obligation to carry out climate change adaptations for their property, but are obliged to ensure that the use of their own property does not cause inconvenience in the surroundings (Chapter 3, Section 1 of the Land Code). This responsibility covers not only when a measure is carried out, for example during construction, but also if precautions are not taken.

The municipality's responsibility to take preventive measures to protect new and existing buildings in accordance with the Planning and Building Act

Chapter 1, Section 2 of the Planning and Building Act sets out the fundamental principle that planning the use of land and water is a municipal concern – the so-called 'municipal planning monopoly'. This principle means that it is the municipality that can decide through planning how land and water within the municipality can be used and developed. According to the Planning and Building Act, the municipalities are responsible for new buildings being positioned in detailed development plans on suitable land with regard to the risk of accidents such as landslides or flooding and erosion. When drawing up detailed development plans, the municipality should therefore assess whether the land is suitable for the intended building. The building committee should also closely follow the general trend within the municipality and its immediately surroundings, and should take the necessary initiative on issues such as planning, construction and property registration (Chapter 12, Section 2, point 2 of the Planning and Building Act).

Existing buildings should be covered by the risk assessment that the Government proposes the municipality should carry out, which is addressed in section 4. According to the proposal, the municipality should report in the structure plan its view of the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides

and erosion, and of how such risks can be reduced or eliminated.

Another measure proposed by the Climate Change Adaptation Inquiry in order to carry out climate change adaptation to homes and buildings is to introduce an exception in the Planning and Building Act for detailed development plans in which the implementation time has expired. According to the proposed exception, an application for a building permit may be rejected if there is an obvious risk of damage to the property or the structure due to flooding, landslides or erosion. The Government has decided not to proceed with the proposal at present, but this is still a proposal to consider if it proves to be necessary.

The municipality's responsibility in accordance with the Civil Protection Act

According to the Civil Protection Act, it is the municipalities who have primary responsibility for rescue services. In the event of accidents or imminent danger of accidents, the municipality shall have responsibility for the rescue services. This responsibility involves preventing and limiting damage, but not ultimately replacing destroyed property. Instead, these costs are incurred by the property owner and the insurance collective.

The municipality's responsibility in accordance with the Water Services Act

The Water Services Act includes an obligation for the municipality to organise sewage, for example, in a wider context for a certain existing or future building if necessary with regard to the protection of human health and the environment. If required, the municipality is obliged to organise surface water management through a public wastewater facility, and to ensure that it is managed for as long as the need remains. The municipality's obligations may apply to both new and existing buildings. The responsibility rules contained in the Water Services Act do not replace the municipality's responsibility for new buildings being positioned in detailed development plans on suitable land with regard to the risk of accidents, such as precipitation-related flooding. The responsibility in accordance with the Water Services Act only applies to damage attributable to the wastewater facility. The responsibility rules contained in the Water Services Act do not thus cover all types of flood damage caused by precipitation. For example, flooding attributable to water running above the ground often falls outside the responsibility of the authority responsible for the wastewater facility. This is common in the case of heavy torrential rain.

The Climate Change Adaptation Inquiry proposes that an opportunity to require property owners in certain cases to deal with surface water within their own property should be added to the Water Services Act. However, the Government is of the opinion that the consequences of this proposal need to be analysed further before it can form the basis for legislation.

The municipality's responsibility to take climate effects into account in environmental assessments of detailed development plans

As a result of amendments in Chapter 6 of the Environmental Code dealing with environmental assessments, such environmental effects as can be expected due to risks associated with the operation's or the measure's exposure to external events in the form of serious accidents or disasters should be included in an environmental assessment (Govt Bill 2017/18:200, Committee Report 2017/18:MJU5, Riksdag Communication 2017/18:20). The amendments to the act entered into force on 1 January 2018. It is therefore relevant to take into account in the environmental assessment and the environmental impact assessment how

climate change can lead to risks for the individual operation and thus which environmental effects can be expected in connection with these risks, and how such environmental effects can be prevented, hindered or counteracted.

The municipality's opportunities to take preventive measures

Municipal autonomy is enshrined in the Instrument of Government (Chapter 14, Section 2) and means that municipalities and county councils deal with local and regional matters of public interest on the basis of municipal autonomy. Municipalities and county councils have the right to charge taxes for dealing with these matters. The Local Government Act states that municipalities and county councils must deal with such matters of public interest themselves that relate to the municipality's or the county council's geographical area or its members (the principle of location). The Act also states that municipalities and county councils may not charge higher fees than those corresponding to the costs of the services or benefits provided by the municipality or the county council (the cost price principle). Municipalities and county councils shall also treat their members equally, unless there are objective grounds for acting otherwise (the principle of equality). These principles control which measures a municipality can take in those areas where it has not been granted specific authorities in special legislation.

What determines whether or not a matter is of public interest is whether it can be deemed to be a general, social interest linked to the authority's own area for the municipality or the county council to carry out a measure. This question must be assessed based on whether it is suitable, appropriate and reasonable for the municipality or the county council to concern itself with the matter. The public interest does not require there to be a quantitatively significant need. If it can be deemed to be in the public interest for a municipality or a county council to deal with a matter, the municipality or the county council may deal with it even if the measure only directly benefits a small proportion of its area or a small number of its members. The so-called Landslide Bill (Govt Bill 1985/86:150, Appendix 3) states that it is within a municipality's field of competence to take preventive measures when the responsibility for such measures does not fall within the framework of rescue services or is not covered by insurance.

The municipalities play a central role in working with climate change adaptation within their responsibility for municipal technical support systems such as water and sewage, street cleaning, etc., and based on their responsibility for social planning and work to prevent natural accidents within their geographical area.

Like other operators, municipalities have their own responsibility for and interest in taking measures if areas for which they are responsible, such as municipal streets and public spaces, or municipal schools and other municipal operations, are threatened. In this respect, the municipalities have a dual role, both as property owners to protect the municipality's property and economic interests, and to ensure that damage to buildings and other structures does not lead to societal functions being interrupted.

According to the Climate Change Adaptation Inquiry, the primary barrier to climate change adaptation of buildings is the lack of funding.

The Government is reviewing opportunities to make it easier for municipalities to take climate change adaptation measures. To this end, the Government has given the Inquiry an additional remit on sustainable water services (M 2017:02) in order to investigate the opportunities available in accordance with current rules to take measures to adapt surface water management in line with a changed climate, and to propose how wastewater service charges can be used to fund such adaptations (terms of reference 2017:129). See also section 9.5 Financing certain climate change adaptation measures.

The state's responsibility to take preventive measures

As mentioned, the Government has a responsibility for climate change adaptation in its capacity as a property owner and an operator. When it comes to planning, the Government also has a supervisory responsibility for construction work through the county administrative board, in accordance with the Planning and Building Act. The county administrative board should review and withdraw decisions on detailed development plans or special area regulations if, for example, a building becomes unsuitable in view of human health or safety, or of the risk of accidents, flooding or erosion (Chapter 11, Sections 10–11 of the Planning and Building Act). These grounds for government intervention are an expression of the state's overall responsibility for national issues.

6 The climate is changing – effects and consequences

6.1 Climate change in Sweden

The Fifth Assessment Report from the UN's Intergovernmental Panel on Climate Change (IPCC) contains a number of scenarios describing possible future climate trends. SMHI has described what these scenarios mean for Sweden in its report 'Uppdatering av det klimatvetenskapliga kunskapsläget' ('Updating the climate science knowledge situation', SMHI, Klimatologi no. 9, 2014). SMHI based its report on the IPCC's report and other studies including regional climate scenarios carried out at SMHI's climate research unit, Rossby Centre. Like previous summaries, the calculations show that Sweden has already become warmer, with higher precipitation.

According to the climate scenarios, temperatures will rise more than the global average in Sweden and Scandinavia. The average temperature in Sweden is predicted to rise by 3–5 degrees by the 2080s compared with 1960–1990. Winter temperatures may rise by 10 degrees in northern Sweden. This increase in temperatures will lead to milder snow and ice conditions, which in turn will reinforce the increase in temperatures. In Sweden, the increase will therefore be greater in the winter than the summer. Warming will lead to the growing season being extended.

The precipitation pattern will also change. As early as the middle of this century (2041–2070), one scenario with continued high greenhouse gas emissions (RCP8.5) shows an increase in precipitation of almost 20 percent for much of the country. These increases apply to all seasons, but mostly in northern Sweden and the winter. During the summer in southern Sweden, the increase is

considerably smaller, and around half of the climate model simulations even show reduced precipitation for parts of southern Sweden. Precipitation shows extensive variability on different timescales, meaning that there is a wide range of possible future trends, and that the degree of uncertainty is generally greater than for temperature.

In terms of wind and storms in Sweden in the future, the results are more uncertain. According to SMHI's report, Sweden will continue to experience more or less stormy years or decades in the future, and the prevalence of storms will probably not differ significantly from today's climate conditions.

6.2 Effects of climate change

Changes in temperature, precipitation and wind have knock-on effects, which in turn have consequences within many areas of society. More precipitation increases the risk of flooding, and can also lead to landslides and erosion due to poorer ground stability. Other effects of a changed climate include changed ground and air humidity, changed snowfall volumes, heatwaves, drought and fire. These climate effects and the geographical areas in Sweden that may be particularly affected are described below.

6.2.1 Physical effects

Flooding

According to the Ordinance (2009:956) on flood risks, flooding refers to when land that is not usually under water is temporarily covered by water. This includes flooding from lakes, watercourses and mountain waterfalls, and from the sea in coastal areas. Flooding can also occur after prolonged or heavy precipitation. The risk of flooding will increase during the next century as a result of extreme waterflows in lakes and watercourses, increasing and more intense precipitation, and rising sea levels.

Flooding from lakes and watercourses

To date, flooding alongside lakes and watercourses is the most common type of flooding in Sweden. According to a mapping commissioned by the Swedish Civil Contingencies Agency (MSB) of significant flooding incidents during 1901–2010, 70 percent of flooding has taken place alongside lakes and watercourses. High flows in lakes and watercourses may become more common in much of Götaland and northwest Norrland, in the southern mountain regions and on the coastland of southern Norrland. These flows are expected to be lower in parts of Svealand, in inland Norrland and on the northern coastland of Norrland. However, the local differences are considerable.

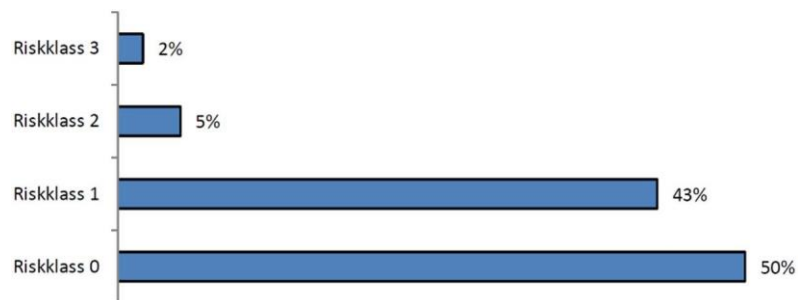
Within the framework of the work involved with the Ordinance on flood risks, MSB has drawn up maps of 18 areas that are threatened by flooding, and where the consequences of flooding from lakes and watercourses are deemed to be considerable. Uppsala, Gothenburg, Kristianstad, Karlstad and Kungsbacka are particularly vulnerable to flooding from lakes and watercourses. Housing and

workplaces are affected, but the consequences for infrastructure and the natural and cultural environments are also significant. It is assumed that several of these places will experience increased problems with high flows in a changed climate, according to SMHI's county climate analyses (SMHI Klimatologi no. 16–36). The national interest in roads and railways, and in cultural environments and nature reserves, is affected to a large extent by flooding from a 100-year flow around these locations.

The consequences of flooding alongside the large lakes have been detailed in several reports and inquiries, including by SMHI (2017), which studied lakes Vänern, Vättern, Mälaren and Hjälmaren, calculated future water levels and water temperatures, and brought together knowledge about the problems associated with the large lakes and how they might change in the future. The shore areas of all these lakes already face major problems in several locations linked to high water levels with today's climate. Due to the expansion of the social structure and the geological and geotechnical stability conditions, the problems associated with Lake Vänern and along the Göta River are particularly difficult.

The Climate Change Adaptation Inquiry carried out a risk classification to assess the proportion of municipalities that are vulnerable to flooding from lakes and watercourses.

Figure 6.1 Proportion of municipalities by risk category, flooding from lakes and watercourses



Source: The Climate Change Adaptation Inquiry SOU 2017:42

Some municipalities have been classified as risk class 3 or 2 based on whether MSB assessed them within the framework of the work involved with the Flooding Directive to face a very large or large risk respectively of flooding from lakes and watercourses. Other municipalities have been classified as risk class 1 if they border water and as risk class 0 if they do not border water to any significant extent.

Flooding from torrential rain

On average, the western mountain regions, the western side of the South Swedish Highlands and the Norrland coast have the most precipitation in Sweden over the course of a year. They are also the areas that have the most precipitation on average during a 24-hour period. Intense rainfall with large volumes and intensity occurs annually in Sweden. The greatest precipitation quantities of all during a 24-hour period with a return period of 100 years often affects the southern Norrland coast, as well as western Götaland and particularly inner Halland. During the period 1961–2014, extreme

precipitation has affected the whole country, but has been more common along the Norrland coast, and in Svealand, eastern Götaland and Skåne (SMHI, report 2014-36). The estimates of future changes and climate factors that have been carried out to date generally suggest a future increase in extreme short-term precipitation. The results indicate an increase in intensities with durations shorter than one hour (see SMHI, *Klimatologi* no. 37, 2015). Rain showers may become more intense, even in areas where total precipitation is not expected to increase or maybe even decrease. In today's climate, extreme short-term precipitation is relatively evenly distributed across the country. Nor does the future increase show any clear regional differences.

In its risk classification of municipalities that are vulnerable to torrential rain, the Climate Change Adaptation Inquiry calculated that all municipalities in Sweden run a higher risk of torrential rain, regardless of their location. The actual consequences of torrential rain depend on the town's density, topography, proportion of green spaces, position of socially important functions, capacity and design of surface water system, etc.

Rising sea level

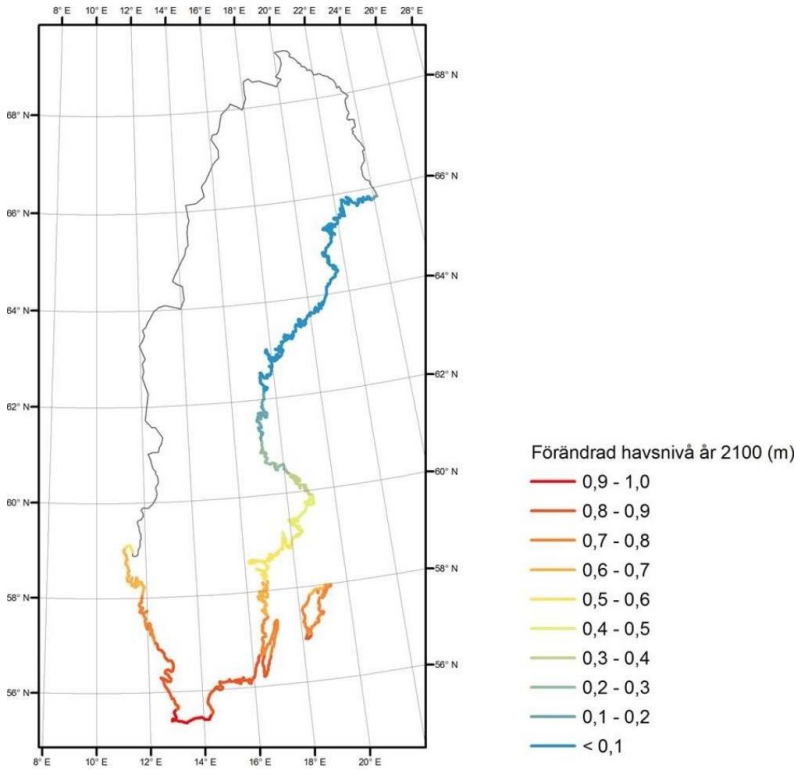
A rising sea level leads to an increased flooding risk at times of high water in coastal areas. A higher sea level also leads to changes to the coastline, since areas that were previously not under water will be permanently covered by water. In these cases, this is no longer a case of flooding but a new normal condition.

The global sea level has risen by an average of 1.7 millimetres per year during the period 1901–2010. During 1993–2010, the rate of increase was 3.2 millimetres per year. In the future, the sea level is expected to continue to rise at a higher rate. In its most recent evaluation, the IPCC assessed that the increase in sea level will be around one metre by 2100 (see SMHI, *Klimatologi* no. 9 and no. 14).

In much of Sweden, the rising sea level is countered by land uplift. The degree of land uplift varies. It is greatest in northern Sweden on the Bothnian Bay coast (approximately 10 millimetres per year) and least in Skåne (approximately 0 millimetres per year). In Stockholm, the land level is rising by approximately 5 millimetres per year. In the long term, this could mean that the Baltic Sea runs into Lake Mälaren, which would affect the lake as a source of drinking water. Flooding in low-lying coastal area may be exacerbated in connection with high sea conditions and rising sea levels. Higher sea conditions will occur temporarily as a result of prevailing air pressure and storms, which can lead to erosion problems for low-lying areas. This is particularly true in southern Sweden, which is more developed and more exposed to storms from the west, and which has more beaches which are susceptible to erosion. The net effect of a one-metre global rise in sea levels over 100 years and land uplift is reported in Figure 6.2.

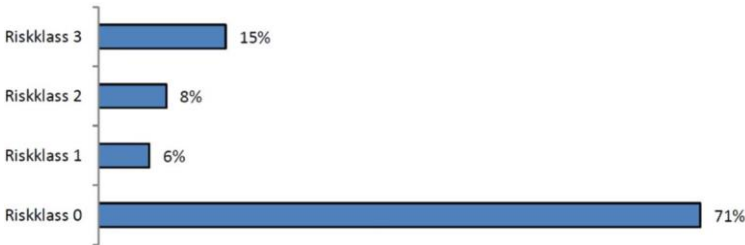
Based on the map in Figure 6.2, the Climate Change Adaptation Inquiry carried out a risk classification of the proportion of municipalities affected by flooding as a result of rising sea levels. Risk class 1 (net rise of 0–0.3 metres) means that only isolated protective measures will probably be needed, while risk classes 2 and 3 will require wider-reaching measures. Risk class 0 means that the municipalities are not in coastal locations.

Figure 6.2 Net effect of rising sea levels and land uplift
The net effect of rising sea levels and land uplift in Sweden, assuming a global rise in seal levels of one metre over 100 years. The land uplift calculation is based on the Swedish Mapping, Cadastral and Land Registration Authority's land uplift model NKG2005LU



Source: IPCC future sea levels AR5 WG 2 2013-2014, the Swedish Environmental Protection Agency, SMHI

Figure 6.3 Proportion of municipalities by risk category, flooding from the sea



Source: The Climate Change Adaptation Inquiry SOU 2017:42

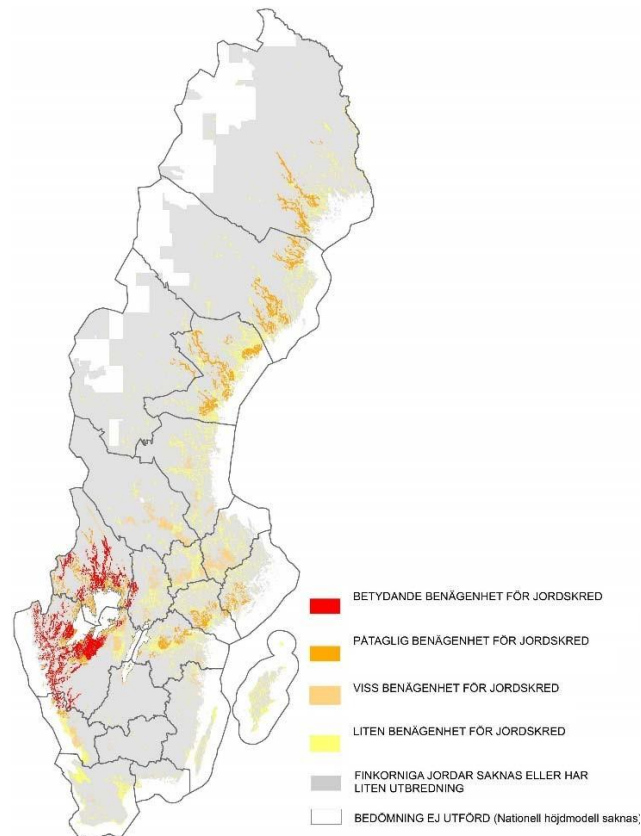
Landslides are rapid mass movements in the soil cover (the loose layers of earth) or in the bedrock. Strong precipitation, increased flows in watercourses and higher, varying groundwater levels increase the risk of landslides. These increased risks arise particularly in areas where the risk is already high, such as the provinces around Lake Vänern, the Göta River valley, eastern Svealand and almost the entire Norrland coast. Local conditions determine where the risks will be the greatest. The risk of mudslides (water that carries soil masses with it) is also increasing particularly in mountain areas and in undulating terrain with moraine soil.

Damage in the event of a landslide involves both damage to land and buildings within the affected landslide area, and damage with the area of land below the slope where the landslide masses end up. If landslides occur on contaminated land, the contaminants can be spread to wider areas, including watercourses, and can cause additional damage to the environment and human health. Landslides are often the result of a natural erosion process, and can be triggered by factors such as heavy precipitation or human intervention in nature. One common denominator is that they can occur quickly, more or less without warning. There is currently no known method for measuring or registering land signals that can give any advance notice of landslides in the Swedish geological environment (with the exception, to some extent, of mudslides that are strongly linked to precipitation).

During 2009–2012, the Swedish Geotechnical Institute (SGI) carried out the Göta River Inquiry in connection with increased flows in the river in a changed climate. The Inquiry investigated the risks of landslides along the Göta River, how these are affected by increased draining through the river, and which erosion and landslide prevention measures need to be taken. The Göta River valley is one of Sweden's most susceptible valleys in terms of landslides. The main reasons for the high frequency of landslides in the Göta River valley are the geological conditions, with immense, loose layers of clay that formed in the sea during the melting of the inland ice, the varying flow of the river which causes erosion, and the impact of society's expansion and operations on land and in the water. Due to the presence of highly sensitive clay, known as quick clay, landslides can be extensive. The Göta River Inquiry showed that there are many areas within the Göta River valley with a high risk of landslides under current conditions, and that the risks will increase in a changed climate. There is also contaminated land around the river. Climate change means that around 25 percent of the mapped areas will have a higher risk level by 2100 if no measures are taken. Areas with a high risk of landslides are expected to increase by around 10 percent by 2100 compared with current figures if no measures are taken.

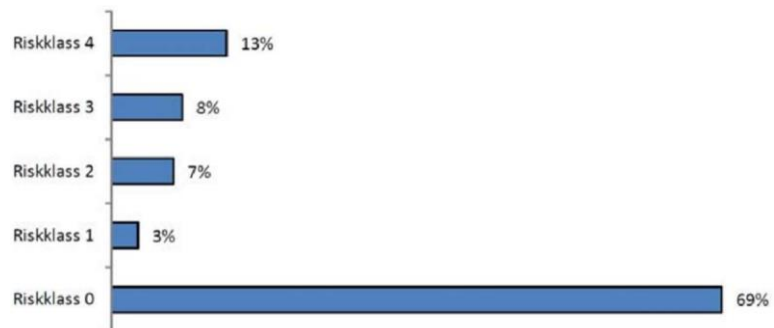
Within the framework of the Climate Change Adaptation Inquiry, SGU and SGI have carried out a geographic information systems (GIS) analysis to classify Sweden's municipalities with regard to the risk of landslides. The risk classifications are numbered 1 to 4, with 4 being the highest risk.

Figure 6.4 National overview of fine soil's landslide susceptibility



Source: The Geological Survey of Sweden (SGU)

Figure 6.5 Proportion of municipalities by risk category, landslides



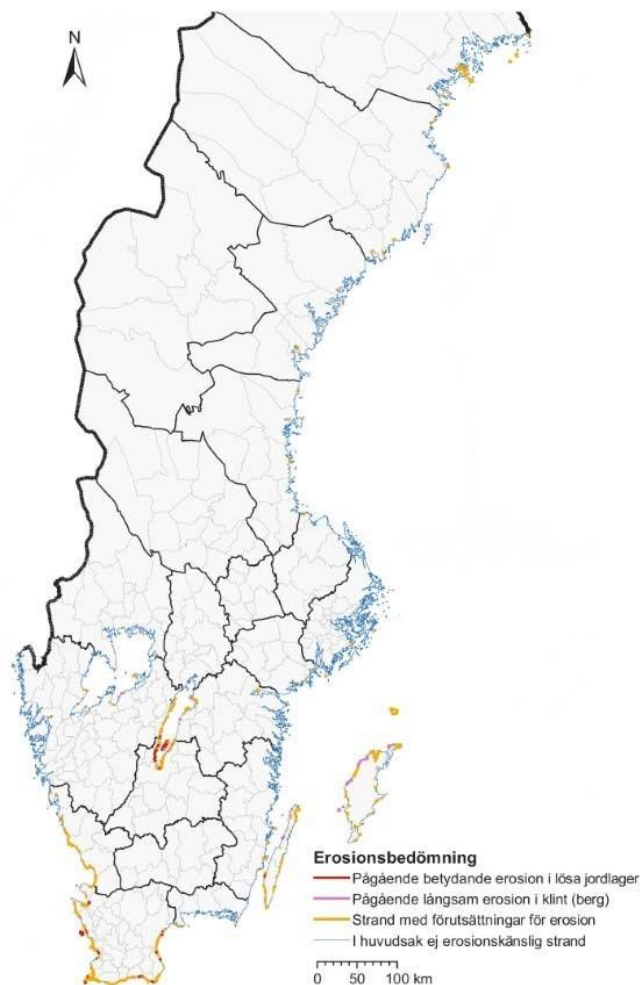
Source: The Climate Change Adaptation Inquiry SOU 2017:42

Erosion

Erosion is the wearing down and carrying away of soil, rock or other material due to the effects of wind, running water, waves, etc.

Erosion is a natural process that affects mountains, coasts, watercourses and lakes, and creates the physical conditions for many valuable and endangered species. Erosion can also threaten buildings and socially important infrastructure. Erosion can be divided into three different types: coastal erosion, erosion in watercourses and vessel-generated erosion (where the wake from vessels causes erosion). Erosion in watercourses occurs along most watercourses. When landslides happen next to watercourses, this is often a consequence of erosion there. Coastal erosion affects areas to the greatest extent when they consist of mobile soil or sand. Rising sea levels mean an increased risk of beach erosion along coasts. The likelihood of coastal erosion is greatest in southern Sweden, particularly in Halland, Skåne, Blekinge, Öland and Gotland, and it is here that the consequences for society are also the greatest. The biggest beach erosion problems are expected to occur in Skåne.

Figure 6.6 National overview of coastal erosion



Source: The Geological Survey of Sweden (SGU)

Figure 6.7 Proportion of Sweden's coastline by risk category

The Climate Change Adaptation Inquiry has assessed the proportion of Sweden's coastline by risk category, with assistance from SGU.



Source: The Climate Change Adaptation Inquiry SOU 2017:42

Ground and air humidity

Air humidity (the proportion of water vapour in the atmosphere) is a result of water in seas, lakes and the ground, for example, being heated up and rising. Air humidity has a significant impact on weather and climate, and is the greenhouse gas that has the most effect on the warming of the Earth. A warmer planet means that evaporation increases. This makes the air moister, further strengthening the greenhouse effect. When air humidity is too low, materials can dry out. When air humidity is too high, this can result in mould or corrosion. If electronics are exposed to air that is too dry, static electricity can be generated. If the humidity is too high, this can create condensation, leading to flashover. If food is stored in conditions that are too dry or too damp, this can lead to food drying out or going mouldy. Air humidity also plays a part in ice accretion on aircraft, wind turbines and masts. When relative air humidity – the amount of water vapour in the air in relation to the maximum amount at the prevailing temperature – is high and the wind is weak, the air feels sticky and close. Sweat is then unable to evaporate, and in combination with high temperatures this can lead to heatstroke. However, there is a certain degree of uncertainty about how relative humidity will change in Sweden.

Snow cover

In the valleys of the northernmost mountain regions, the first snow cover normally appears at the start of October. In the high mountains, this happens as early as September. The temperature is relatively high during the autumn and early winter closest to the sea and lakes, which is why coastal regions generally have little snow in early winter. Along the south coast of Skåne, snow cover tends to appear some way into December. Climate change may mean that it takes considerably longer before longer lasting snow cover forms, particular in the southern parts of the country. South of a line running from central Värmland, through southern Dalarna to central Gästrikland, the snow cover cannot be counted on lasting right through the winter. With climate change, the duration of snow cover is expected to reduce. In the southern parts of Sweden, long-lasting snow cover will probably become rare.

When the temperature changes across the freezing point for water during a 24-hour period, this is called a zero-crossing. Zero-crossings have consequences in areas such as winter road maintenance and agriculture. Zero-crossings are currently most common of all in central Sweden, where they happen 100-120 times a year on average. The lowest numbers of zero-crossings are recorded in Skåne, around Lake Vänern and along the coasts of Götaland and Svealand. Nationally, the highest number of zero-crossings is generally seen in the spring, but they happen almost as often in the autumn and winter. According to the latest summary of climate scenarios from SMHI, zero-crossings will decrease in number throughout the country during the autumn and the spring. During the winter, the number will decrease in the southern parts of Sweden, but will increase in central and northern parts.

Heatwaves

In Sweden, heatwaves are relatively rare compared with Southern Europe. Since our society is adapted for a climate that is cooler on average, temperatures that are regarded as normal in other countries may however feel uncomfortably hot here. Another important factor is what is known as the heat island effect in cities. The effect that heatwaves have depends on how people live and their opportunities to find coolness in cities in the form of parks, watercourses and airconditioned public indoor environments. In recent years, research has shown that warm periods result in increased mortality, including in Sweden. Heatwaves will probably become more common in Sweden in the future. Researchers at SMHI's Rossby Centre have estimated that extreme heat events, which so far have occurred every twenty years on average, may occur every three to five years by the end of the century. Temperatures of 40°C may occur every twenty years in southern Sweden.

Water shortages

Climate scenarios suggest that access to water will be reduced in much of southern Sweden. This reduction will be mainly due to plants consuming more, since the growing season will be extended in a warmer climate. Eastern parts of Götaland and Svealand will be particularly affected. Low water flow in watercourses and low water levels in lakes and groundwater lead to water shortages and competition between uses of water for water supply and irrigation or sewage. Long spells of dry weather also result in many fires in forests and on open land. Higher temperatures mean that more water will evaporate from the land and watercourses. In an analysis, SMHI has reported the estimated trend for access to water, the number of days per year when the land will be relatively dry and the number of days per year with low water flow in water courses. When it comes to ground moisture, the biggest changes are expected in Skåne and in the areas around lakes Vänern and Vättern, with more than 60 more days of dry weather every year by the turn of the next century.

Fire

The risk of forest and vegetation fires varies regionally within Sweden. Some parts of the country are worse affected by drought than others, and differences in vegetation mean that the fires that start behave differently. Every year, there are on average between 3,000 and 4,000 fires in forests and on open land in Sweden. The extent of these fires varies significantly from year to year, but often affects more than 2,000 hectares. There are great economic consequences in the form of costs for rescue services and damage to forests and buildings. Fires in forests and on open land are mainly caused by lightning strikes and various human activities, such as campfires, children playing with fires, arson, burning grass or sparks from trains and machinery. The number of fires is greatest in the densely populated metropolitan regions where many people spend time in nature, and in the drier eastern part of the country. The size of the area that burns is due to factors such as drought and wind conditions, as well as how soon the fire is discovered and the available firefighting resources. Larger areas of forest are therefore more often affected by fires in the coastal and inland areas of southern Norrland.

6.2.2 Biological and ecological effects

As the climate becomes warmer, the climate zones and vegetation zones are moving further north. This affects plants' and animals' living conditions, reproduction, distribution and population sizes, and the incidence of pests. Some species may disappear, while new species may become established. This could happen even with small changes in temperature. A warmer climate may also lead to differences arising in previously stable systems, for example between the arrival of spring with trees coming into leaf or between insect peaks and the arrival of migratory birds. Northerly species may disappear due to the lack of retreat routes north of Scandinavia. The most threatened species are those between central and high Alpine zones and those that require large amounts of space. If dispersal barriers appear that are too large, ecosystems may suffer a reduction in species with important functions without new species appearing, which is why an effective green infrastructure is significant in terms of climate change.

Changed conditions can also be expected for fish stocks, for example due to higher temperatures, reduced salinity, increased oxygen deficiency and other climate-related factors that affect species composition, diet and the speed at which fish grow. Ocean acidification affects marine ecosystems and risks further reducing the sea's ability to withstand climate change. Acidification occurs when carbon dioxide is absorbed by the sea and affects stocks of shell-forming species and crustaceans, which in turn are important sources of food for fish stocks.

6.2.3 Effects and consequences in different parts of Sweden

Götaland

Götaland is the province that will be affected the most by the anticipated rise in sea levels. High flows in lakes and watercourses may also become more common in large parts of Götaland. Gothenburg, Kristianstad and Kungsbacka are three of the places highlighted by MSB within the framework of the Flooding Directive

as being particularly vulnerable to high flows in lakes and watercourses. The national interest in roads and railways is affected by a climate-adapted 100-year flow. In Gothenburg, the West Coast Railway, the Western Main Line, the Norway/Vänern Railway and several major roads such as the E6, the E45 and the E20 are affected. On average, the western side of the South Swedish Highlands is one of the areas that has the most precipitation in Sweden over the course of a year and per 24-hour period. The greatest precipitation quantities of all during a 24-hour period that occur once a century often affect western Götaland and particularly inner Halland. On the other hand, eastern Götaland in particular is expected to experience less precipitation during the summertime, which may result in water shortages. Extreme precipitation events can happen anywhere in the country, but during the period 1961–2014 they were more common in areas such as eastern Götaland and Skåne.

The increased risks of landslides arise particularly in areas where the risk is already high. This includes the provinces around Lake Vänern and the Göta River valley, which is deemed to be Sweden's most susceptible valley in terms of landslides. The largest areas with a high risk of landslides are in the northern part of the valley. The stretch from Trollhättan to Ödegärdet south of Lilla Edet is the largest continuous area with a high risk of landslides. The likelihood of coastal erosion is greatest in southern Sweden, particularly in Halland, Skåne, Blekinge, Öland and Gotland, and it is here that the consequences for society are also the greatest. The biggest beach erosion problems are expected to occur in Skåne. Temperatures of 40°C may occur as often as every twenty years in southern Sweden. When it comes to dry ground, the biggest changes are expected in Skåne and in the areas around Lake Vänern and Lake Vättern.

Svealand

Svealand will be affected by the anticipated rise in sea levels. The flows from lakes and watercourses are expected to become lower in parts of Svealand, but there are significant local differences. Uppsala, Karlstad and Stockholm have been singled out by MSB as being particularly susceptible to flooding from lakes and watercourses. The risk for Stockholm will be reduced with the reconstruction of Slussen. The national interest in roads and railways will be affected by a climate-adapted 100-year flow. In Stockholm, this involves for example the Älvsjö–Stockholm–Ulriksdal railway stretch and the E4. Extreme precipitation events have affected the whole of Sweden during the period 1961–2014, but have been more common in areas such as Svealand. Eastern Svealand is currently susceptible to landslides, and the risk is expected to increase in a changed climate. South of a line running from central Värmland, through southern Dalarna to central Gästrikland, the snow cover cannot always be counted on to last right through the winter. Long periods with little or no precipitation can lead to dry years with water shortages. Eastern parts of Götaland and Svealand are particularly affected.

Norrland

High flows in lakes and watercourses may become more common in areas such as northwesternmost Norrland, the southern mountain regions and the coastland of southern Norrland. These flows are expected to be lower in inland Norrland and on the northern coastland of Norrland, for example. However, the local differences are considerable. The western mountain regions and the Norrland coast are among the areas that, on average, have

the most precipitation in Sweden over the course of a year. They are also the areas that have the most precipitation on average during a 24-hour period. The greatest precipitation quantities of all during a 24-hour period that occur once a century often affect areas such as the southern Norrland coast. Extreme precipitation events have affected the whole of Sweden during the period 1961–2014, but have been more common in areas such as the Norrland coast. The risk of landslides may increase along almost the whole of the Norrland coast in those areas that are already susceptible to landslides. During the winter, the number of zero-crossings will increase in central and northern Sweden. Larger areas of forest are currently more often affected by fires in the coastal and inland areas of southern Norrland than in the rest of Sweden. These fires may increase in number in a warmer climate. The natural environment will be affected to a large extent. Northerly species may disappear due to the lack of retreat routes north of Scandinavia. The most threatened species are those between central and high Alpine zones and those that require large amounts of space. When it comes to the ability to adapt, species and habitats in mountain areas, pine forests and bogs are deemed to be the most vulnerable. There are particularly sensitive ecosystems in northern Scandinavia. Mountainous areas are especially sensitive to climate change, and the size of Sweden's alpine areas is expected to decrease sharply when the tree line rises as a result of higher temperatures.

Proportion of municipalities exposed to risks from climate effects

The Climate Change Adaptation Inquiry has assessed the proportion of municipalities that are vulnerable to risks from flooding and landslides, and the proportion of Sweden's coastline that is vulnerable to erosion. The summary is shown in Table 6.1.

Table 6.1 Risk classification

Results from the risk classification of the proportion of municipalities and proportion of coastline

Climate effect	Risk class				
	0	1	2	3	4
Flooding	71%	6%	8%	15%	
Flooding – lakes and watercourses	50%	43%	5%	2%	
Flooding – torrential rain		100%			
Landslides	69%	3%	7%	8%	13%
Erosion	99.5%	0.5%			

Virtually all municipalities are exposed to the risk of flooding due to torrential rain. The situation in individual cases depends on factors such as the town's density, topography, surface water management and proportion of green spaces. Accordingly, of the effects analysed by the Climate Change Adaptation Inquiry, landslides are the climate effect that poses a risk for the largest proportion of municipalities. The next greatest risks are flooding as a result of rising sea levels and flooding from lakes and watercourses.

6.3 Effects and consequences for society

Today's society is adapted and built to suit a particular climate. Climate change, with higher temperatures and changed precipitation, will result in changed conditions and increased risks for society. Risk is usually defined as a combination of the likelihood of an event and its consequences. Below is an overall description of what can happen and the possible consequences within different areas of society.

6.3.1 Transport links

The consequences of climate change will be significant for several communication systems. Roads and railways are particularly vulnerable, with rising precipitation and increasing flows in watercourses and drainage systems potentially causing major problems. The climate effects for communications may include flooding and washout of roads and embankments, damage to bridges and heightened risks of landslides and erosion. Within the framework of MSB's work with the Flooding Directive, it has transpired that the national interest in roads and railways will be affected by a climate-adapted 100-year flow in several locations. In Stockholm, this involves for example the Älvsjö–Stockholm–Ulriksdal railway stretch and the E4. In Gothenburg, the West Coast Railway, the Western Main Line, the Norway/Vänern Railway and several major roads such as the E6, the E45 and the E20 are affected. Shipping, aviation, telecommunications and radio and TV transmission are deemed to be less vulnerable, even though certain factors such as disruption to electricity supplies also affect these.

Climate change and its effects thus affect the robustness and reliability of the transport system and infrastructure, and can also cause accidents. Climate change and its effects will thus affect the conditions for achieving the overall objective of Swedish transport policy, i.e. to ensure the provision of transport for citizens and industry throughout the entire country, which is socioeconomically effective and sustainably in the long term.

6.3.2 Energy and water supply systems

The Climate and Vulnerability Inquiry and SMHI's Control Station 2015 report describe how energy and water supply systems, for example, are affected by climate change. The term 'technical supply systems' includes electricity systems, dams, heating and cooling requirements, district heating and drinking water supplies. The inquiry and the report were of the opinion that since climate change is expected to result in increased precipitation in much of Sweden, this will create good conditions for gradually increasing hydropower production. Wind power production is also expected to be able to increase somewhat.

Climate change may make power supplies more vulnerable. Weather events are already having a major impact on energy supplies, since

extreme heat, strong winds and bad weather, for example, have caused operational disruption. Climate change also means that certain events will become more frequent or stronger. The Swedish Energy Agency has carried out a government assignment on the energy sector's vulnerability to future extreme weather events, resulting in a report (ER 2009:33) confirming the risk picture. The report shows that climate change will affect both natural gas systems and district heating systems in the long term, including through increased corrosion to pipes and ground displacement/subsidence as a result of increased amounts of rain. According to the 2016 Energy Policy Agreement, Sweden shall have a robust electricity system with high reliability, low environmental impact and electricity at competitive prices. Climate change may affect the conditions for reliability, and thus the overall objective of the energy policy.

The supply of drinking water is critical for society. Access to and quality of drinking water will be affected by changed precipitation patterns, drought, torrential rain, increased spread of contaminants and increased microbiological risks. The Drinking Water Inquiry's (N L 2013:02) report 'Klimatförändringar och dricksvattenförsörjningen' ('Climate change and drinking water supply', SOU 2015:51) describes how climate change is already affecting the conditions for a secure drinking water supply, and will continue to do so at a growing rate. In addition to quantitative and qualitative changes to the water in the raw water resources on which the drinking water supply relies, water shortages and saltwater intrusion in water sources may also occur. The scope of chemically and microbiologically dependent health risks may increase. About half of the total supply of public drinking water is dependent on surface water. Surface water resources are exposed to a greater extent, and are thus particularly vulnerable to changed land use and sources of contamination. The demands in terms of advance notice and dealing with new risk panoramas require technological development and adapted attitudes in order to deal with undesired water-borne microorganisms in the drinking water distribution system, for example. Supply systems for purposes such as surface water management can also include nature-based solutions such as open surface water solutions, permeable land and ensuring that the area has sufficient public spaces that can also deal with water from torrential rain at times.

6.3.3 Buildings and structures

A changed climate is expected to lead to increased risks for buildings and structures to a significant degree. This involves greater risks of flooding for buildings near beaches, increased risks of landslides, coastal and beach erosion, additional load on sewage systems, etc. Estimates carried out by bodies including the Climate and Vulnerability Inquiry (2007) show that even in today's climate, six million square metres of construction land alongside watercourses risk being flooded on average once every hundred years. The size of this area will probably increase.

In western and southwestern Sweden, flooding alongside watercourses is expected to become more frequent. Increased 100-year flows in the mountain regions that spread down alongside watercourses can also present a risk for buildings. A higher

sea level places greater demands on measures and planning for new buildings, in particular along Sweden's southern coasts.

Anticipated larger and more intense volumes of precipitation and changed groundwater levels will probably also increase the risk of landslides and erosion, especially in southwestern and western Sweden and on parts of the east coast.

Higher sea levels, particularly on Sweden's southernmost coasts, lead to beach erosion with consequences for buildings and infrastructure, as well as large value losses. The risk of basement flooding from the significantly higher load on sewage systems is also higher. This is due to increased amounts of rain and a redistribution of rain to the autumn, winter and spring, when evaporation is low and the ground is saturated, as well as a higher frequency of extreme torrential rain which leads to pipes becoming overloaded.

More precipitation also brings a greater risk of damp and mould damage, and to increased external maintenance needs for new and existing buildings. Higher temperatures lead to less need for heating, but the need for cooling also increases. Historic buildings are often particularly vulnerable to climate change. Since people have long used water as a source of energy and a means of communication, these buildings are often located in sensitive areas such as along the coast. The knock-on effects that risk arising from a warmer, damper climate such as mould, more vegetation and pest infestations can also make it considerably harder to preserve valuable cultural environments.

The Government's objectives for housing and construction involve meeting consumer demand, structures being sustainable in the long term and ensuring a good living environment when building society. One objective is to build at least 250,000 new homes by 2020. Climate change affects the conditions within these objective areas since the availability of land for housing may come into conflict with objectives on structures being sustainable in the long term and ensuring a secure living environment, for example in the case of demand for housing near to coasts and beaches. The *A Good Built Environment* environmental quality objective is also highly relevant, particularly in terms of its specification for sustainable building structure, sustainable social planning, infrastructure that takes the cultural environment into account, natural and green areas, and health and safety. This objective is also affected by the Government's cultural environment work to promote a sustainable society with a diversity of cultural environments that are preserved, used and developed (Govt Bill 2012/13:96, Committee Report 2012/13:KrU9, Riksdag Communication 2012/13:273).

6.3.4 Agriculture and tourism

Climate change affects the conditions for agriculture and tourism in Sweden. A longer vegetation period and warmer winters generally favour plant cultivation, with opportunities for larger harvests and new crops. However, flooding and torrential rain can cause significant economic damage as a result of destroyed harvests, soil damage and increased labour and production costs. A warmer climate with increased evaporation – combined with wider variation in precipitation during the summer – can lead to lower ground moisture, with poorer crop establishment and growth as a result. There is also a risk of reduced access to water for irrigation and livestock farming. Longer periods of flooding may

lead to a need for more water-resistant crops. A warmer climate may also involve new plant pests becoming established and bigger problems with existing pests. Agriculture and tourism are also affected by changes to biodiversity and ecosystems.

In addition, a warmer, damper and more varied climate affects the health and wellbeing of agricultural animals. Diseases can spread more easily, and heat stress may be a more serious problem in the future. A longer growing season with warmer springs and autumns provides opportunities for grazing animals to spend more time outside.

The consequences for Swedish forestry and agriculture are expected to be considerable. Increased growth leads to greater timber production, with increased frequency and scope of damage from plant pests and storms in particular, as well as wetter forest land which can involve significant costs. Wetter, warmer winters mean less ground frost and thus forests that are more sensitive to storms. The risk of landslides can also increase, particularly in connection with forest management and felling. When it becomes warmer and precipitation is concentrated to fewer occasions, the risk of drought becomes greater and the risk of forest fires rises to a corresponding degree. Climate change affects the conditions for achieving the *Sustainable Forests* and *A Varied Agricultural Landscape* environmental objectives and their specifications, as well as the production and environmental objectives of Sweden's forestry policy and thus also the *Reduced Climate Impact* environmental quality objective. The Government's Food Strategy and its objectives are also affected by the changed conditions, as are the national objectives adopted by the Riksdag for cultural environment work which include taking a holistic view of managing the landscape, taking the cultural environment into consideration within societal development. Most of the measures that relate to forest land and growing forests are characterised by being extremely long term in nature, and by income and expenditure appearing at intervals of many years. Investments in timber production have historically been seen as relatively low risk compared with other long-term investments. Changed winter snow conditions will make access to grazing land for reindeer more difficult, and will bring new challenges for winter tourism. However, the summer tourism season will be extended.

These industries are also indirectly affected by processes caused by climate changes in the wider world. The global consequences of climate change may affect demand for Swedish agricultural products. From a global perspective, food production may be negatively affected by factors such as drought. The indirect consequences of climate change may present challenges that are just as great for Sweden as the direct consequences. As a nation we are currently highly dependent on importing food, and the changed conditions for food production in other countries and the overall trading conditions may have consequences for Sweden. The Government's Food Strategy aims to create improved conditions for a greater degree of self-sufficiency.

The fishing industry potentially faces major changes as a result of ecosystem changes. Complex connections make it hard to assess how climate change will affect professional fishing, leisure fishing, aquaculture and fishing tourism in detail.

6.3.5 Nature and the environment

Climate change is expected to lead to major changes in terms of biodiversity, ecosystems and the landscape. Climate conditions – together with soil types and hydrology – largely determine whether or not a species can survive in a given area. The consequences for ecosystems will affect the opportunities to achieve several of the environmental objectives. This applies to *A Rich Diversity of Plant and Animal Life*, *Sustainable Forests*, *Thriving Wetlands*, *A Varied Agricultural Landscape*, *A Magnificent Mountain Landscape*, *Zero Eutrophication*, *A Balanced Marine Environment*, *Flourishing Coastal Areas and Archipelagos*, *Flourishing Lakes and Streams* and *Clean Air*. Ecosystem services are affected as an indirect effect of climate change, which has consequences for forestry, agriculture, reindeer herding, fishing, cultural heritage, tourism and outdoor leisure activities. When it comes to the ability to adapt, species and habitats in mountain areas, pine forests and bogs are deemed to be the most vulnerable. There are particularly sensitive ecosystems in northern Scandinavia. Mountain areas are especially sensitive to climate change, and Sweden's alpine areas are expected to shrink significantly as the tree line rises.

6.3.6 Human health

Human health can be directly affected by extreme weather events such as heatwaves and flooding. A warmer climate can also lead to indirect impacts through changes in patterns in the spread of communicable diseases and by new diseases reaching Sweden or gaining new opportunities of becoming established. Environmental changes caused by climate change can affect the health of both animals and humans. The health effects of climate change can be linked to several different areas and contexts. These subsidiary areas can be roughly divided up as follows:

- Impact on health and personal injuries in the event of extreme weather events (including mental health).
- The spread of infections and zoonoses (i.e. infections that can be transferred between animals and humans).
- The spread of infections and the contamination of municipal drinking water and individual wells, particularly in the case of flooding and overflow.
- Changed air quality and thermal comfort outdoors (ground-level ozone, pollen, forest fires and heat islands in cities).
- Changed air quality and thermal comfort indoors (damp, mould, mites and ticks, and heat).

Climate change affects the conditions for achieving the overall objective of public health policy, which is to create the right social conditions for good health on equal terms for the entire population. The overall objective is broken down into eleven objective areas, of which Environment and products, Health-promoting health services and Protection against communicable diseases are deemed to be the most relevant in terms of climate change adaptation work.

6.3.7 Changes in the world around us

Climate change can affect a country both directly through effects within the country's borders and indirectly through effects in the surrounding world. For a country in a region that is relatively less vulnerable from a climate changes perspective, the international dimensions of climate change effects present challenges that are at least as significant as the direct consequences.

The fact that the effects of climate changes can have consequences far beyond the region where they arise is emphasised in the IPCC's Fifth Assessment Report. The main reason for this is transnational interaction, including as a result of international trade. An import-dependent country such as Sweden is affected by how food production develops within its borders and in the regions from which it imports, as well as by how the entire globalised market changes since this is also affected by countries from which Sweden has limited or no imports.

For a country like Sweden with extensive international operations, it is particularly important to direct attention to possible impacts from changes in the wider world. The global effects of climate change may include shortages of food, water and safe living environments, with consequences such as poverty, social unrest and armed conflict. The impact on trade flows, economic development and migration are some of the areas in which an indirect impact of climate change can be predicted. There may be growing demand for military and humanitarian operations, rescue efforts, migration and integration initiatives, and aid. A general slowing of the global economy due to climate change may also affect national and regional economies, including in the form of reduced demand for products. At the same time, technological and social innovations that are developed to combat climate change and contribute towards communities' adaptation to climate change may lead to increased demand and exports.

6.3.8 Costs per instance of damage per sector

For damage costs, the Climate Change Adaptation Inquiry refers to the Climate and Vulnerability Inquiry (SOU 2007:60). The Climate and Vulnerability Inquiry's remit included assessing damage costs that may be caused by climate change. The Inquiry estimated damage costs and revenue increases. The Inquiry presented two scenarios (high and low) for costs and revenue. Damage costs refer to damage that would arise if no measures were taken to alleviate the consequences of different weather events. They can include the cost of repairing and restoring the damaged object, where possible, or the value of what has been destroyed. Damage costs only include a portion of the possible economic consequences.

The Climate and Vulnerability Inquiry assessed the biggest negative items to be health effects, flooding of infrastructure, buildings and agriculture, drinking water supply, coastal erosion with damage to buildings, electricity, water and sewage, agriculture and forestry, increased costs for

maintaining buildings and an increased need for cooling. The Inquiry estimated the increased damage costs as a result of flooding, landslides and erosion between 2011 and 2100 at SEK 90–225 billion, which in today's money (2016) is equivalent to SEK 98–245 billion. It should be emphasised that these cost items are based on assessments, not on probability calculations. When calculating the cost of the health effects of a changed climate, estimates were used for both heat-related deaths based on calculations for Stockholm and increased infection via food and drinking water. The total cost was then SEK 571–799 billion for the period 2011–2100.

The Inquiry assessed that agriculture will be both negatively and positively affected. A warmer climate with a longer growing season is expected to lead to large growth in harvests. The Inquiry calculated increased income within forestry at SEK 300–600 billion for the period 2011–2100. At the same time, an increased number of pests and difficulties with felling and transporting timber to roads and onwards to industry due to wetter winters and less ground frost will lead to higher costs. The higher cost by 2100 has been assessed at SEK 97 billion in a low scenario and SEK 281 billion in a high scenario. For farming, the increased return and changed use of land will give increased income of SEK 70–140 billion by 2100, but at the same time higher costs corresponding to around 50 percent of income would be incurred for more pesticides due to the increased incidence of plant pests and irrigation, as well as torrential rain, flooding of watercourses and lakes, and storms. The Inquiry also assessed that the fishing industry would receive less income, and that supplementary feeding of reindeer will become more common due to severe snow, snow crust and ice conditions.

The biggest individual positive item in the calculations is lower costs for heating homes and premises. A potentially significant positive effect that is not included in the improved conditions is summer tourism.

However, the Inquiry notes that many of the assumed effects do not have any direct effect on the economy, or have effects for which it is hard to calculate the costs. The impact on ecosystems, the cultural environment and human health are examples of such effects.

6.4 Important areas for climate change adaptation

The Government's assessment: Climate change adaptation measures should be taken within several sectors of society and geographic areas. Based on the predicted consequences for society, the following areas are particularly important for ongoing climate change adaptation work:

- Landslides and erosion that threaten communities, infrastructure and businesses.
- Flooding that threatens communities, infrastructure and businesses.
- High temperatures that involve risks for the health and wellbeing of people and animals.
- Water supply shortages for individuals, agriculture and industry.
- Biological and ecological effects that affect sustainable development.
- The impact on domestic and international food production and commerce.
- Increased incidence of pests, diseases and invasive non-native species that affect people, animals and plants.

The reasons for the Government's assessment: The descriptions in this section of climate change in Sweden, the effects of climate change and the effects and consequences for society show that most sectors of society and geographical areas are affected, even if the challenges may be different. The Climate Change Adaptation Inquiry has estimated the proportion of municipalities that are vulnerable to flooding, landslides and erosion. The Inquiry has reached the conclusion that, after flooding due to torrential rain, landslides are the climate effect that constitutes a risk to the largest proportion of municipalities. The Climate and Vulnerability Inquiry assessed the biggest costs in terms of damage resulting from a changed climate to be health effects due to heatwaves and the spread of infection, followed by flooding of infrastructure, buildings and agriculture, coastal erosion with damage to buildings, electricity, water and sewage, agriculture and forestry, and increased costs for maintaining buildings. For agriculture and forestry, there are also clear positive effects in the form of increased growth and returns.

The assessments of the two inquiries have been based on different perspectives. Health, for example, is an area that was only addressed by the Climate and Vulnerability Inquiry. One common conclusion, however, is that flooding and landslides affect several sectors and areas in Sweden, and thus have major societal consequences. In addition, it is clear that heatwaves can have major consequences for the health of humans and animals, both through the impact of heat and through increased spread of infection.

Agriculture will be affected by a changed climate. The positive changes include a longer growing season and higher productivity. The negative changes include new pests, diseases with more frequent outbreaks and varying access to water. The structure and drainage of the ground will also change. The natural environment will be affected to a significant degree, and this will affect both

agriculture and the opportunities for achieving more environmental quality objectives. Cultural environments and the built cultural heritage will also be affected, which in turn will affect the conditions for achieving cultural policy objectives and objectives for cultural environment work.

Climate change adaptation involves planning for today's situation and for a time horizon which stretches decades ahead into the next century. When making long-term investments within sectors that are deemed to be vulnerable and socially important, climate change adaptation is of great importance. This applies to investments in infrastructure, technical support systems, buildings and structures, for example, as well as within agriculture. An increase in the frequency of landslides and flooding is expected to have significant consequences for these sectors. It is therefore extremely important that the effects of a changed climate are taken into consideration in planning, maintaining and equipping existing buildings, facilities and systems, and when making new investments. It is of central importance in terms of socioeconomic effectiveness to do the right thing from the start, and to adapt new investments in line with a changed climate or to be prepared to adapt them in the future in a cost-effective manner. Several inquiries have also established that preventive work (climate change adaptation measures) is cheaper than bearing the damage costs that will arise from future accidents and damage, for example as a result of extreme weather events. According to these inquiries, the part of the country that will be affected the most by climate change is Götaland, which also has the most inhabitants. Here, there is a significant risk of flooding, both due to rising sea levels and from lakes and watercourses. The risk of landslides is also considerable, particularly along the Göta River. There is a risk of erosion along the coast of Skåne, for instance. High temperatures are expected to become more common, with reduced precipitation during the summer, particularly in eastern Götaland. Together with increased evaporation, this may lead to water shortages. However, these effects may also be observed elsewhere in Sweden. In Norrland, the natural environment is particularly vulnerable to the impact of a changed climate.

Based on the predicted consequences for society, the Government is of the opinion that those areas detailed in the box above are important to focus on for ongoing climate change adaptation work.

7 Current situation of adaptation work for a changed climate

7.1 How well prepared is Sweden for a changed climate?

The work to adapt society in line with a changed climate is continuing with regard to building up knowledge and disseminating information. The various decision-making and planning data that has been produced using government funding since the Climate and Vulnerability Inquiry in 2007 has contributed to increased knowledge about the risk of landslides and flooding, better management of the consequences of torrential rain and improved forecasting for

the risk of fire. Many agencies are drawing up action plans for climate change adaptation in which the vulnerability of their own operations to climate change is analysed and the need for measures is identified. Intersectoral collaboration and support from the county administrative boards to municipalities and other players is also being improved to some degree. However, the extent to which these measures will contribute to increased climate change adaptation and how the work should be carried out once the action plans that apply for the next two to three years have expired remains unclear. Despite increased knowledge about the need to adapt to a changed climate, relatively few concrete climate change adaptation measures are being implemented at local level. Continued and reinforced initiatives and investments are required within many different areas.

The costs of carrying out climate change adaptation measures for Sweden as a whole are both high and uncertain. The most recent calculation is included in the Climate Change Adaptation Inquiry's report (SOU 2017:42), and is estimated at SEK 137–205 billion between now and 2100. The Inquiry has carried out certain analyses of responsibility and cost allocation, but a great deal of work remains to be done. In the 2018 Budget Bill, the Government proposes an increase in funding for climate change adaptation to a total of SEK 461 million for the period 2018–2020. This increase includes funding for safeguarding against landslides in the Göta River valley and a delegation for this at the Swedish Geotechnical Institute (SGI).

The European Commission's evaluation of Sweden's work during 2015, in SMHI's Control Station 2015 report and in the Climate Change Adaptation Inquiry's report, singles out a few areas where there are deemed to be shortcomings. This involves a lack of national steering of climate change adaptation work, with the relevant agencies lacking a clear mandate to work with this issue. There are also shortcomings in the cooperation between sectors and across administrative boundaries. In addition, there is no clear structure for monitoring and evaluating climate change adaptation work. One reason why the work at local level has not taken off to the necessary extent is thought to be a lack of clarity in the distribution of responsibility and in terms of financial support.

The Government believes it is of central importance that all those involved work to analyse, prevent and alleviate the effects of climate change within their own field of responsibility. It is important to prepare sufficiently for direct and indirect effects of climate change within different sectors, and to develop objectives, strategies and measures that are relevant to operations.

Climate change adaptation at local level

As noted above in section 5, the municipalities have a central role to play in climate change adaptation work. The municipality is responsible for certain technical support systems, such as public water supply and sewage management, as well as for social planning and preventive work against natural accidents within its geographic area. The picture conveyed by the county administrative boards is that knowledge about and commitment to climate change adaptation issues is gradually increasing, and that more of the decisions being taken at local level include climate change adaptation. This is particularly true within physical planning and in the work involved with risk and vulnerability analyses, as well as within fields such as cultural assets. In a questionnaire survey (IVL 2017), 184 of Sweden's municipalities (of a total of 202 respondents) said that they are working with climate change adaptation,

but there are significant variations in how this is done. A political decision on climate change adaptation work has been made within around 50 percent of the municipalities that responded, and around 60 percent of the municipalities have someone with main responsibility for climate change adaptation. Forty percent of the municipalities have staff resources specifically for this purpose, and 30 percent have either earmarked financial resources or drawn up action plans for climate change adaptation, or have taken both of these measures. The Planning and Building Act warns that attention should be paid to certain environmental and risk factors that may be a consequence of a changed climate. The municipalities are of the opinion that the provisions in the Planning and Building Act affect the location and construction of new buildings, but that adapting existing buildings remains a complex matter. Financing measures is a major issue, with the municipalities generally requesting larger proportions of government funding.

Climate change adaptation at national and regional levels

Public agencies play an important role in initiating, supporting and evaluating climate change adaptation work within their fields of responsibility. A national knowledge centre for climate change adaptation at SMHI leads a network of 19 agencies. The centre has developed various tools and guidance for climate change adaptation work. To date, the county administrative boards and 13 public agencies (the National Electrical Safety Board, the Swedish Agency for Marine and Water Management (HaV), the Swedish National Heritage Board, the Sami Parliament, the Swedish Forest Agency, the Swedish Geotechnical Institute (SGI), the Swedish Board of Agriculture, the National Veterinary Institute (SVA), the Geological Survey of Sweden (SGU), the Swedish Agency for Economic and Regional Growth, the Swedish Transport Administration, the Swedish Transport Agency and the Public Health Agency of Sweden (FHM)) have drawn up or are drawing up action plans and developing tools for climate change adaptation. This work has involved a sharper focus on climate change adaptation among the agencies, and has led to new cooperation between and within them. Several agencies were assigned remits and reporting requirements in the appropriation document for 2018 to draw up or report on their climate change adaptation work, including action plans for climate change adaptation. This applies to the Swedish Armed Forces, the Swedish Defence Research Agency (FOI), the Swedish Energy Agency, Svenska Kraftnät, the National Electrical Safety Board, SMHI, the Swedish Environmental Protection Agency, the Swedish Agency for Marine and Water Management (HaV), the Swedish Transport Administration, the Swedish Maritime Administration and the Swedish Civil Contingencies Agency (MSB). The county administrative boards have had a regional coordination remit since 2009, and report on the progress of this work each year in their annual reports. The county administrative boards also carry out joint activities within their national network.

Research into climate change and adaptation to a changed climate is of great importance for this work. In the Government's research bill 'Kunskap i samverkan – för samhällets utmaningar och stärkt konkurrenskraft' ('Collaborating for knowledge – for society's challenges and strengthened competitiveness', Govt Bill 2016/17:50), the Government announced a ten-year climate research programme and an increase in Formas' research funding for this purpose of SEK 25 million in 2017, followed by an additional SEK 50 million in 2018 and SEK 55 million in 2019.

7.2 Description of the work with prioritised challenges

Below is an overview account of the ongoing work with the challenges identified as being particularly prioritised for the work involved in adaptation to a changed climate. Public agencies have been tasked with supporting society's various players with a knowledge base. The description below of the agencies' measures is not exhaustive. A more detailed account of ongoing activities is available from the climate change adaptation portal operated by SMHI in association with the National Network for Adaptation.

7.2.1 Landslides and erosion that threaten communities, infrastructure and businesses

The Swedish Geotechnical Institute (SGI) has a specific responsibility for issues relating to landslides and beach erosion. In 2017, SGI agreed on an action plan for sustainable geoconstruction in a changeable climate. The aim of the action plan is to contribute towards more coordinated, more effective climate change adaptation within the geoconstruction sector, and that this work should be monitored and evaluated. The plan includes proposed measures, how they can be carried out, and who takes the initiative. Since 2013, SGI has been tasked with utilising and supplementing material from the Göta River Inquiry, and with developing methods and mapping the risk of landslides elsewhere in the country. Ten areas where sizeable landslides have occurred so far, where the consequences of landslides could be significant for society, and where climate change is expected to clearly increase the risk have been prioritised for continued landslide mapping. In February 2017, SGI published coast vulnerability maps for Skåne and a map viewing service for coast planning in current and future climates. SGI has also been tasked with drawing up guidance for erosion protection that is adapted to nature. In addition, SGI is working to develop and test nature-adapted erosion protection in several projects, including for the Ume River and the Stockholm Archipelago. SGI coordinates and harmonises data relating to landslides and erosion. This cooperation includes SGI, the Geological Survey of Sweden (SGU), the Swedish Civil Contingencies Agency (MSB), the Swedish Meteorological and Hydrological Institute (SMHI), the Swedish Mapping, Cadastral and Land Registration Authority, the Swedish Forest Agency, the Swedish Agency for Marine and Water Management (HaV) and the Swedish Maritime Administration. These agencies have produced a guidance and map viewing service which shows and describes various data from the agencies.

In 2017, SGU decided on an action plan for climate change adaptation. SGU's contribution to the work with landslides involves producing underlying and processed geological data for continued studies in those areas with conditions for landslides. The agency continuously monitors groundwater and pore pressure in the areas which are susceptible to landslides. In its action plan, SGU has identified measures that it believes may be critical in order for society to be able to take the next step in climate change adaptation work. In connection with landslides and erosion,

SGU believes that it is of great importance that SGU produces improved geological data for climate change adaptation by mapping Sweden's soil types, groundwater and geology, and that SGU identifies areas in Sweden where climate change may cause greater problems with erosion and landslides. SGU has taken part in the Skånestrand project, in which susceptibility to erosion and signs of ongoing erosion were assessed, and a map visualisation service that describes erosion conditions was reported. SGU has also produced an overview map showing ground conditions for landslides nationally. New updated soil databases have been created in areas that are particularly susceptible to landslides, such as the Norsälven and Säreån valleys, and are shown in SGU's map visualiser.

The National Board of Housing, Building and Planning is the public agency for housing, construction, urban development and social planning, and thus has general supervisory responsibility for planning and construction in Sweden. The Board has also been tasked with working within its operational area to coordinate the public agencies' work with documentation for the application of the Planning and Building Act. Its operations include giving advice and providing knowledge and experience for planners and other groups. The consequences of climate change must be taken into account in many of its tasks, particularly when it comes to providing advice and knowledge. Its work helps to ensure that climate effects are taken into consideration, and is not limited to landslides or flooding, although these are important aspects since they involve major risks for the built environment. The Board has produced a planning guide for climate change adaptation in physical planning, and a guide on requirements regarding health, safety and the risk of accidents, etc. It is also working to draw up guidance on how ecosystem services can be integrated throughout the planning chain in accordance with the Planning and Building Act. In the appropriation document for 2017, the National Board of Housing, Building and Planning was tasked with drawing up supervisory guidance regarding flooding risks to create the right conditions for new buildings to be sustainable in the long term, and to ensure that the county administrative boards' supervision is coordinated and predictable.

In their annual report for 2016, the county administrative boards report that more and more of the decisions being taken at local level include climate change adaptation. This is particularly true within physical planning and in the work involved with risk and vulnerability analyses, as well as within fields such as the cultural environment.

7.2.2 Flooding that threatens communities, infrastructure and businesses

The Swedish Civil Contingencies Agency (MSB) is the agency responsible for issues relating to assessing and dealing with flooding risks. Since 1998, MSB – and before that the Swedish Rescue Services Agency – has carried out overview mapping of Sweden's watercourses and lakes, and has mapped which areas risk being flooded at different flows. To date, around 75 watercourses (approximately 10,000 kilometres) have been mapped. The mapped watercourses have been prioritised by MSB in consultation with SMHI and the county administrative boards. The aim of the flooding mapping is to facilitate planning work within municipalities and county administrative boards, for example, and to help adapt society till a changed climate. Within the framework of its work with the Ordinance (2009:956) on flood risks, MSB has drawn

up threat maps for 18 densely populated areas where the consequences of flooding from lakes and watercourses are deemed to be significant. Since 2016, MSB has also maintained a public portal in which it has published all the flooding maps produced. In addition, MSB has developed guidance aimed at municipalities on mapping methods and impact analyses for torrential rain.

The National Board of Housing, Building and Planning's work to support planning work is also highly relevant for reducing risks of flooding and coastal change. In the appropriation document for 2018, the National Board of Housing, Building and Planning has been tasked with drawing up supervisory guidance on the risk of landslides and erosion following proposals from the Climate Change Adaptation Inquiry.

The Swedish Transport Administration is responsible for the overall long-term infrastructure planning for all modes of transport, and for the construction, operation and maintenance of state-owned roads and railways. The Administration develops cooperation to improve the work involved with the transport network's climate change adaptation. It decided on a climate change adaptation strategy in 2015, which was followed by a climate change adaptation action plan in 2016. Three activities were deemed to be particularly important to carry out: to ensure a clear responsibility and mandate for working with climate change adaptation, to ensure that planning considers the need for resources to work with the climate's impact on roads and railways, and to ensure that steering documents and regulations take the climate's impact into account. In autumn 2017, the Administration submitted a proposed national plan for infrastructure 2018–2029. The plan includes proposals for climate change adaptation measures for the railway network totalling SEK 1,000 million. In its report, the Administration states that the overall need for climate change adaptation measures is very unclear. These were estimated in the 2015 strategic framework at around SEK 10,000–12,000 million. The Administration's latest calculations, as reported in its proposed national plan for the transport system 2018–2029, show that the cost of measures required for roads and railways is closer to around SEK 4,500 million, with SEK 1,500 million for measures needed in the railway network. However, even these estimates are uncertain. The proposed indicative framework of SEK 1,000 million has therefore been assessed by the Swedish Transport Administration to be a suitable level for starting to adapt the state railway network in order to cope with the impact of the climate and thus be able to achieve a more robust, more reliable railway. Risk reduction measures for the road network are carried out in accordance with the plan proposal via the bearing capacity appropriation. The plan proposal also contains measures for increasing bearing capacity and ensuring accessibility for heavy traffic on the road network, in the form of reinforcement measures for bridges and roads. The bearing capacity measures will contribute towards improving parts of the road network in rural areas, at a total cost of SEK 16.3 billion. This also includes risk reduction climate change adaptation measures for the regional and national road networks.

The Swedish National Heritage Board (RAÄ) was one of the first public agencies to draw up an action plan for climate change adaptation. During 2015, an action plan for climate change adaptation and energy efficiency improvements for historically valuable buildings was drawn up for the period 2015–2017. Among other things, RAÄ has mapped risks for cultural heritage based on climate-related and environmental changes, and the Board arranges an annual forum for climate and cultural heritage issues, as well as ongoing dialogue and exchanges of knowledge with relevant players. RAÄ has also produced guidance and an online handbook for supervisory authorities, clients, property owners and providers of care and

maintenance planning, dealing with process descriptions, risk and vulnerability analyses, and opportunities for indicator monitoring. This work is not specifically targeted towards flooding, but flooding is one of the areas that involves risks for our cultural heritage. For example, many older buildings are located alongside coasts, lakes and watercourses. Other risks for our cultural heritage include the indirect consequences of mould, more vegetation and pest infestations.

Since 2009, the Swedish Mapping, Cadastral and Land Registration Authority has built up a national elevation model. By the end of 2016, 98 percent of the planned 460,000 km² was complete.

Within the framework of the Food Strategy, the Government has tasked the Swedish Board of Agriculture with setting up a competence centre for sustainable water management within agriculture. This remit runs for three years from the beginning of 2017 to the end of 2019, and the final report will be submitted on 28 February 2020. Through collaboration, the competence centre shall contribute towards increasing agencies' competence on agricultural water conservation, in other words measures for dewatering and irrigation that provide the right amount of water at the right time for crop growth, bearing capacity for machinery and limited environmental impact.

The Swedish Board of Agriculture has also been tasked by the Government with mapping the measures needed to cope with dewatering of agricultural land in a changed climate with increased water flows. The report will be submitted on 1 April 2018.

7.2.3 High temperatures that involve risks for the health and wellbeing of people and animals

The Public Health Agency of Sweden has drawn up an action plan for its climate change adaptation work for the period 2017–2020. The aim is that the action plan should be a natural part of the Agency's operations by 2020. Identified areas for action include temperature-related mortality and ill-health, air quality, vector-borne, water-borne and food-borne infectious agents, and preparedness and crisis management. Examples of the Agency's work include having compiled knowledge and drawn up information materials about health risks from high temperatures, and guidance for organisations' work to develop their own action plans for heatwaves. The aim of this material is to enhance society's ability to deal with negative health effects as a result of heatwaves. It has been produced for municipalities, county councils, regions and private players with responsibility for health and social care. The Public Health Agency of Sweden is also carrying out a project to improve Sweden's heat alerts and climate change adaptation work with data about sickness rates and mortality during ongoing heatwaves. The Agency has also been tasked with developing the monitoring systems that it is responsible for or uses, so that they can be used as indicators of climate change effects.

MSB has analysed which factors risk leading to fires during the winter and how climate change affects the forecasting system for fire risk in vegetation.

7.2.4 Water supply shortages for individuals, agriculture and industry

During the summer months of 2016 and 2017, large areas of Götaland, Svealand and southern Norrland experienced shortages of ground and surface water sources, with water levels that were much lower than normal for the time of year. This also affected the county administrative boards' climate change adaptation work, for example due to greater demand for knowledge-enhancing climate change initiatives. The county administrative boards worked extensively with this issue, including by monitoring and providing information about the situation, and by working together with various players, particularly the municipalities. Supply plans and strategies were drawn up by several county administrative boards. The county administrative boards are also responsible for checking how the municipalities follow the legislation in this field. Municipalities, county administrative boards and relevant public agencies all monitored this issue, and the overall assessment was that the relevant players coped with their task of managing an urgent water shortage situation. Since water supply shortages are expected to become increasingly common in a changed climate, there are requirements for long-term planning.

Wetlands play an important role in the natural water cycle. Here, water is slowed down, some evaporates, and water drainage is evened out. Areas with slowly subsiding water flows have a more even water discharge, which also falls more slowly during dry periods, than areas with small storage opportunities. Drainage areas without lakes, small bodies of water, wetlands and other watercourses have small storage opportunities and therefore react quickly to heavy precipitation or drought, for instance. The Government has therefore initiated a multi-year initiative to restore and recreate wetlands for the period 2018–2020.

The National Food Agency is Sweden's expert and regulatory authority for food. This role will become both more important and more complex with climate change. During 2017, the Agency drew up an action plan for climate change adaptation to clarify how it can work to support the food and drinking water sector's adaptation to a changed climate. In association with other agencies, industry organisations and representatives from drinking water producers, the Agency is producing a handbook for applied climate change adaptation of drinking water. The handbook will provide practical support for all drinking water producers in their climate change adaptation work for the entire drinking water chain. The aim is to ensure a drinking water supply that is secure and balanced in the long term and in relation to health, and that can deal with chemical and microbiological risks and well as surpluses and deficits in raw water resources. Since 2006, the Agency has supported the county administrative boards' emergency preparedness work within drinking water, where there has often been a focus on the problem of flooding and on risk and vulnerability analyses. The Agency has also worked in partnership with other players since the early 2000s to operate a large number of development and knowledge projects with the aim of increasing local and regional competence for combatting the effects of climate change. Since 2009, the Agency has led and coordinated a national network for drinking water which aims to improve adaptability to a changed climate.

In its 2017 action plan for climate change adaptation, the Geological Survey of Sweden (SGU) identified measures that it deems to be critical for society's climate change adaptation. In relation to water supply, SGU is contributing towards the National Food Agency's work on a handbook for a climate-adapted drinking water supply, carrying out studies of the quantity and quality of climate change, and expanding its groundwater monitoring with a number of monitoring stations. SGU believes it is important that it identifies the areas in Sweden where groundwater is negatively or positively affected by climate change, and the effects this will have for society.

In June 2017, SGU and SMHI launched a service to facilitate preparing for possible water shortages. The service has been created due to the importance of the public remaining updated and, if necessary, helping to save water in the event of low groundwater and surface water levels. By disseminating information about the water situation, various players within society can contribute towards improved preparedness for any water shortages. The service covers both groundwater and surface water (lakes and watercourses).

The Swedish Board of Agriculture's action plan for climate change adaptation highlights water shortages as a serious consequence for the agricultural sector. The Board works with water shortages in various ways, including through a government remit to assess the agricultural sector's need for water supply with regard to the development of both the food market and the common agricultural policy, and to climate change. The documentation should be of use in the work involved with regional water supply plans for long-term assessments and forecasts in relation to other competing societal needs. The report will be submitted on 1 April 2018.

7.2.5 Biological and ecological effects that affect sustainable development

In September 2014, the Swedish Environmental Protection Agency was tasked – together with the Swedish Agency for Marine and Water Management (HaV), the Swedish Board of Agriculture, the National Board of Housing, Building and Planning, the Swedish Transport Administration and the Swedish Forest Agency – with drawing up guidelines and an implementation plan for the county administrative boards' work to coordinate and develop regional action plans for green infrastructure on land and in water. Within the framework of this remit, the agencies also provide advice and support for developing the regional action plans. The Swedish Environmental Protection Agency has also been tasked with producing a strategy for developing the national biodiversity work in order to deal in a strategic manner with the effects on biodiversity as a result of a changed climate. This work should be developed so that conservation objectives for biodiversity and ecosystem services can be achieved, while at the same time reducing the vulnerability of society and ecosystems to climate change. The remit was carried out together with the county administrative boards and the Swedish Meteorological and Hydrological Institute (SMHI), as well as HaV, the Swedish Forest Agency, the Swedish Board of Agriculture and the Sami Parliament. In the appropriation document for 2018, the Swedish Environmental Protection Agency was tasked with drawing up an action plan for climate change adaptation for the Agency's entire field of responsibility.

During 2017, HaV produced an action plan for promoting climate change adaptation within its field of responsibility, its work processes and its cooperation. In September 2017, HaV reported on how issues relating to climate change and reduced climate impact are integrated into its coordinating role for the water authorities' implementation of the Water Quality Management Ordinance (2004:660). According to the Maritime Spatial Planning Directive (Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning), the maritime spatial planning process must take into account long-term changes as a result of climate change. At the same time, the Member States must also strive through their maritime spatial planning to contribute towards the protection and improvement of the environment, including resilience to the effects of climate change.

In 2016, the Swedish Board of Agriculture produced an action plan for climate change adaptation. This emphasised the significance of cultivated plant diversity for climate change adaptation. In a changed climate, new plant species that are adapted to Swedish growing conditions are of great importance. The long-term sustainability and competitiveness of agricultural and horticultural production throughout Sweden requires access to appropriate plant varieties nationwide. A competence centre for plant breeding has therefore been established at the Swedish University of Agricultural Sciences. The Swedish Board of Agriculture carries out an annual risk and vulnerability analysis, which includes climate change effects.

The Swedish Forest Agency's 2016 action plan compiles those activities where the Agency most clearly works with climate change adaptation. This involves internal knowledge provision, advising the forestry sector, external strategy work and international cooperation. A campaign for varied forestry was run in 2017, focusing on options in connection with felling and regeneration. The Swedish Forest Agency already informs those working within forestry about the effects of climate change.

The Swedish National Heritage Board's action plan for climate change adaptation includes a focus on historically valuable buildings and the surrounding landscape, as well as damage and deterioration as a result of climate change. This work focuses on cooperation, dialogue, regulations and funding, as well as research and development, and is carried out in collaboration with the county administrative boards in particular. Several regional projects have been carried out focusing on developing risk assessment methods and impact factors, including a project on cultural heritage and climate change in western Sweden, as well as international cooperation to devise tools for easily carrying out risk assessments and producing action plans on site.

Within the framework of its action plan drawn up in 2016, the Sami Parliament has described ongoing and planned projects and activities. A research project has studied how climate change affects the conditions for reindeer herding. The Sami Parliament has also worked on a government remit to carry out an overview of alternative measures for adapting reindeer herding in line with changed climate conditions, and has analysed agreements on winter grazing outside the reindeer herding area. In October 2017, the Sami Parliament advertised funding for pilot Sami communities to draw up a climate and vulnerability analysis and an action plan for climate change adaptation for their Sami community or area. The aim is to produce an overall picture of how climate changes affect the conditions for reindeer herding, identify problems and analyse possible proposals for measures. This work is being carried out in cooperation

7.2.6 The impact on domestic and international food production and commerce

The National Board of Trade has produced a report on the contribution made by trade towards climate change adaptation. The aim is to highlight how trade and trading policy can be important tools in climate change adaptation work, and thus contribute towards environmental and development objects agreed in international negotiations.

In its action plan, the Swedish Board of Agriculture writes that it is carrying out analyses and environmental scanning within all its areas of operation. The Board takes part in international discussions and collaboration within the EU and with other organisations and institutions. The Board is responsible for the *A Varied Agricultural Landscape* environmental objective. An indicator that measures the area of agricultural land and return has been developed to monitor the status of this objective. In the in-depth evaluation in 2015, the Swedish Board of Agriculture referred to official statistics for 2014, in which the area of arable land was around 8,000 hectares less than the previous year. In total, the area of arable land has declined by around 72,000 hectares (approximately 3 percent) since 2003. The Swedish Board of Agriculture is the referral body for questions about when usable agricultural land can be built on.

In 2015, to help municipalities make decisions about their land that are sustainable in the long term, the Swedish Board of Agriculture produced a knowledge base on the value of agricultural land and a method for developing and preserving it. This material can provide support when municipalities update their overall plans and in discussions on a municipality's future development. When drawing up new detailed development plans and special area regulations, or when amending existing ones, the municipality can then adapt them so that agricultural land is affected as little as possible by development.

7.2.7 Increased incidence of pests, diseases and invasive non-native species that affect people, animals and plants.

In its action plan for climate change adaptation, the Public Health Agency of Sweden has identified vector-borne, water-borne and food-borne infectious agents as a prioritised area for action. The Agency has begun to cooperate with the National Veterinary Institute (SVA) on the early detection of vector-borne infectious agents that could become established in Sweden. Several agencies cooperate in connection with water infections and water-borne infections, including the National Veterinary Institute, the National Food Agency, the Swedish Environmental Protection Agency, the Swedish Agency for Marine and Water Management, county administrative boards, the National Board of Housing, Building and Planning, and the Public Health Agency of Sweden. Both SVA and the National Food Agency have functions for carrying out risk evaluations of infectious animal diseases and food, and since 2016 there has also been a risk evaluation function for plant pests at the Swedish University of Agricultural Sciences (SLU). SLU's Unit for Risk Assessment of Plant Pests is drawing up

documentation and risk evaluations to support the Swedish Board of Agriculture's risk management of new plant pests within agriculture, forests, gardens, green spaces and wild biotopes. These pests can include insects, nematodes, mites and ticks, fungi, bacteria and viruses.

The National Food Agency is leading an MSB project to produce a handbook on climate change adaptation in drinking water production. Cooperation between the Public Health Agency of Sweden, the Swedish Board of Agriculture, SVA and the National Food Agency is emphasised by the public agencies as being of the utmost importance to minimise the anticipated health outcomes of food-borne diseases in a changed climate. Control of raw water and its quality, and any need for statutory management of and requirements for dewatering water are also highlighted as two important factors that need to be taken into consideration in ongoing climate change adaptation work.

In 2012, the Swedish Board of Agriculture submitted a report to the Government titled 'Vässa växtskyddet för framtidens klimat – Hur vi förebygger och hanterar ökade problem i ett förändrat klimat' ('Enhancing plant protection for the climate of the future. Preventing and managing growing problems in a changed climate', report 2012:10). New EU rules on protective measures against plant pests will come into force in December 2019. The focus of the new legislation is on risk-based preventive measures and early measures in the event of an attack.

SVA has drawn up an action plan for climate change adaptation ('Handlingsplan klimatanpassning; En rapport om klimatets påverkan på djuren', 'Action plan for climate change adaptation: A report on the climate's effect on animals.'). In SVA's opinion, it is extremely important that the Institute can continue to maintain a high degree of preparedness and expertise, including with regard to climate-sensitive infectious agents, in order to manage to deal with increased and new illness in a changed climate.

On 1 March 2018, the Government decided on a proposal for the Council on Legislation on adding new provisions to the Environmental Code on invasive non-native species with the aim of fulfilling Sweden's obligations in accordance with Regulation (EU) No. 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

8 International view

8.1 The UN Framework Convention on Climate Change and the Paris Agreement

Like most of the world's countries, Sweden has ratified the United Nations Framework Convention on Climate Change ('the Climate Convention'), which entered into force in 1994. The aim of the convention is that the level of greenhouse gases in the atmosphere should be stabilised at a level whereby mankind's impact on the climate system will not be harmful. The Kyoto Protocol to the United Nations Framework Convention on Climate Change ('the Kyoto Protocol') contains legally binding limits for greenhouse gas emissions in industrialised nations. The Kyoto Protocol came into force in 2005, and has been ratified by Sweden and the EU. The 2012 Doha Amendment to the Kyoto Protocol established a second commitment period (2013–2020), although this has not yet entered into force. At the twenty-first session of the Conference of the Parties (COP21) held in Paris in December 2015, the world's nations agreed on a new globally and legally binding climate agreement (the Paris Agreement), which came

into force on 4 November 2016. The Paris Agreement provides a legally binding framework and replaces the approach that has applied since the Kyoto Protocol. According to the Paris Agreement, global warming shall be limited to well below 2°C, and efforts are being made to keep the increase below 1.5°C compared with the pre-industrial level. Both individual countries' undertakings and the overall global work will be reviewed every five years. The Paris Agreement is not time-limited, and it is the first legally binding climate agreement to establish legally binding undertakings for all parties to have nationally agreed determined contributions (NDCs) which shall be reported every five years. The NDCs shall include emission limits, and the parties can also include measures for adaptation, climate financing, capacity building and technology transfer.

The international policy context for climate change adaptation has undergone a clear change through the entry into force of the Paris Agreement. With the Paris Agreement, the parties have set a new direction that includes implementing regulations, a global outlook for 2023, and a relationship to Agenda 2030 and the Sustainable Development Goals. Among other things, the Paris Agreement establishes a global adaptation goal to improve the ability to adapt, strengthen resistance and reduce vulnerability to climate change in order to contribute towards sustainable development and to ensure appropriate adaptation measures within the framework of the agreement's temperature goals. The Paris Agreement also underscores the need to avoid, minimise and address losses and damage caused by the negative effects of climate change. The agreement states that every party should submit a continuously updated adaptation report that can include the party's prioritisations, needs in connection with implementation and support, and plans and measures (without creating additional burdens for developing countries). Developing countries can apply for funding for climate change adaptation through the Green Climate Fund (GCF), the Least Developed Countries Fund (LCDF) and the Adaptation Fund. Sweden is a major donor to these multilateral climate funds, and also carries out extensive bilateral climate work (see section 8.8). Climate change adaptation work should also build upon existing institutions and frameworks, and should complement and reinforce ongoing work.

Since the adoption of Agenda 2030 in 2015, Sweden has taken a leading role in the implementation of goal 14 on oceans, seas and marine resources. The UN high-level Ocean Conference was held in New York in June 2017, and was initiated and chaired by Sweden and Fiji. The conference clarified the link to marine issues in the work to implement the Framework Convention on Climate Change (UNFCCC). Sweden backs the results from the UNFCCC's Conference of the Parties in November 2017 (COP23), at which clear progress was made to anchor marine issues in climate negotiations.

Climate change adaptation is a strategically important question in Swedish climate diplomacy, and the Government notes that all nations (including the EU) must now consider how climate work can be made stronger. The Government emphasises the importance of national ownership, of integrating the climate into national development plans, of working to reinforce the link between the global adaptation goals in the Paris Agreement and Agenda 2030, and of highlighting our significant financial support for adaptation measures in developing countries. There are also opportunities to highlight and report on good examples of initiatives and the effects

of both our national adaptation work and our international efforts. This can be done, for example, by contributing good examples to the UN petitions drawn up by the EU.

8.2 The UN's Intergovernmental Panel on Climate Change

The UN's Intergovernmental Panel on Climate Change (IPCC) was formed in 1988, and consists of 195 states and a number of organisations. The IPCC carries out and compiles research on climate change. SMHI is responsible for Sweden's contact with the IPCC, and maintains contact with the IPCC's secretariat in Geneva. There are a total of four working groups, and climate change adaptation is dealt with by Working Group II (WGII). The IPCC is currently preparing the Sixth Assessment Report (AR6). AR6 consists of a main report in three parts, together with a synthesis report, a methodology report on greenhouse gas inventories and three special reports. The first special report addresses the effects of global warming of 1.5°C. This report will be completed in October 2018.

8.3 The UN Convention on Biological Diversity

Within the framework of the Convention on Biological Diversity (CBD), discussions have taken place and guidance has been drawn up for the parties' work with both climate change adaptation and climate work in general. Cooperation has also been initiated between the secretariats of relevant UN conventions. The aim is that measures carried out to achieve the objectives of the individual agreements should be mutually supporting. Work is currently being carried out to draw up voluntary guidance on ecosystem-based climate change adaptation and catastrophe risk reduction, which is expected to be agreed at CBD's next Conference of the Parties in November 2018. It is also important to highlight the opportunities in nature-based solutions that can help to preserve and make sustainable use of biodiversity and ecosystem services, and to reduce the effects of climate change. Sweden has made active contributions the work with the voluntary guidelines that are now being drawn up, and will continue to work to find ways for achieving increased cooperation between the work for biodiversity and the climate.

8.4 The EU Strategy on Adaptation to Climate Change

The overall aim of the EU Strategy on Adaptation to Climate Change agreed in June 2013 is to contribute towards a more climate-proof Europe. This involves improving preparedness and the capacity to adapt to the climate effects at local, regional, national and EU levels, developing a cohesive strategy and improving coordination.

The strategy proposes eight measures within three areas:

1. Promoting action by Member States through national adaptation strategies and action plans, providing funding via

the EU's environmental fund (LIFE) and measures in line with the Covenant of Mayors. The aim is to achieve coordination and cohesion at different levels of planning and steering.

2. Better informed decision-making through a strategy for bridging the following knowledge gaps: information on damage and adaptation costs and benefits, regional and local-level analyses and risk assessments, and support for decision-making and assessing how effective the various adaptation measures are. The aim is also to develop the Climate-ADAPT website as a shared contact point for information about climate change adaptation in Europe.
3. Climate-proofing action at EU level by integrating a climate change adaptation perspective into the common agricultural, fisheries and cohesion policies, ensuring that Europe's infrastructure is made more resilient to climate change, and promoting products and services through insurance and financial markets.

Alongside the strategy, there are also a number of supporting documents dealing with issues such as the Commission's work in relation to climate change adaptation, coastal and marine issues, infrastructure, health, and climate change and migration. The supporting documents also include guidance for integrating climate change adaptation into cohesion policy, recommendations for integrating climate change adaptation into the rural development programmes, and guidance on developing adaptation strategies. In addition, there is a green paper on developing insurance protection at EU level for both natural and manmade disasters. The EU's adaptation strategy states that the Commission may present legally binding instruments if Member States' adaptation measures are deemed to be insufficient.

During 2016, the European Commission has begun an evaluation of the EU's adaptation strategy to investigate its implementation and performance. This evaluation will be reported on at the end of 2018, and will look at which experience has been established, what has been done, and whether this work has been in line with the strategy's anticipated results. As part of the evaluation process, the Commission has developed an adaptation preparedness scorecard with key indicators for investigating Member States' degree of preparedness. This provides a picture of the adaptation situation in each Member State, which will then form the basis for the evaluation at the end of 2018.

8.5 Adaptation within the framework of the Baltic Sea Strategy – BaltAdapt

As part of the EU's Baltic Sea Strategy, which was adopted during Sweden's Presidency of the EU in 2009, a proposed climate change adaptations strategy for the Baltic Sea Region has been drawn up within the BaltAdapt flagship project. Sweden is responsible for compiling the strategy via the Swedish Meteorological and Hydrological Institute (SMHI). This work has included an extensive consultation process with various different players. Within the project, knowledge summaries have also been produced and a

proposed action plan has been drawn up for implementation. Shared knowledge databases, cooperation on funding and cooperation within research and industry are some of the proposals presented by BaltAdapt.

8.6 Adaptation within the Arctic Council

In recent years, the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP) working group has worked with adaptation and resilience, i.e. the ability of society and ecosystems to deal with change. To meet the need for an overall perspective on the Arctic, Sweden initiated the Arctic Resilience Report (ARR) during its chairmanship of the Arctic Council (2011–2013). The report focuses on the interaction between different driving forces that can lead to socioecological systems being wiped out or changing their character entirely. The aim has been to integrate a resilience perspective into the Arctic Council's work. A decision on a framework was taken at the meeting of foreign affairs ministers in May 2017. The Actions for a Changing Arctic (AACA) project was also presented during the meeting. The project describes adaptation measures for three geographic areas in the Arctic: Bering/Beaufort/Chukchi, Davis Strait/Baffin Bay and Barents. A summary of how tools and strategies can be developed for making better decisions at local level has also been produced. This primarily involves dealing with climate change, as well as other factors that have a negative impact on the environment. The Protection of the Arctic Marine Environment (PAME) working group is examining how area-based management tools such as marine protected areas and marine planning can be used in climate change adaptation to strengthen the resilience of the Arctic marine environment.

8.7 Adaptation within the Barents Cooperation

Sweden is chair of the Barents Euro-Arctic Council's environmental cooperation in 2018–2019, and the climate is one of the areas with the highest priority. The Government intends to strive for increased climate work in the region in terms of both emission limits and climate change adaptation. During Sweden's chairmanship, Sweden is prioritising increasing the pace of climate restructuring, drawing up a strategy for intact forests, and taking measures for wetlands and watercourses. The Government believes that there are good opportunities for the Barents Region to contribute towards the implementation of the Paris Agreement. Norrbotten County Administrative Board is leading work to develop regional climate strategies, in which representatives from Russia, Finland and Norway are also taking part. A climate action plan has been produced within the Barents Cooperation. An updated version was also adopted at the meeting of environment ministers in Vadsø, Norway, in November 2017.

8.8 Adaptation issues in Sweden's bilateral development cooperation

In 2017, Sida was tasked with reporting on its work to adapt to a changed climate and measures for reducing climate impact, as well as mapping Swedish support for capacity building that contributes towards developing nations' strengthened implementation of the Paris Agreement's goals. In 2016, around 50 percent of climate-related support was targeted at climate change adaptation, 17 percent at emissions reductions, and around 33 percent at both adaptation and emissions reductions. Support for adaptation goes to sectors such as water and disaster risk reduction. Through support for agriculture and forestry, both adaptation and emissions reductions can be achieved. Sida has also decided (June 2017) to increase its level of ambition within the field of the climate. This will involve a considerable increase in Sida's support and funding. According to Sida, the current distribution between support for adaptation and emissions reductions on the one hand and 'double objectives' on the other hand should remain, even under significantly increased climate funding. Sida's preparations and decision-making on climate-related initiatives are based on geographic or global thematic strategies. There is a high level of ambition within climate-related matters, both within the policy framework for development cooperation and through a large and growing number of strategies which now includes the environment, the climate and/or natural resources.

8.9 The climate issue within foreign and security policy

At the beginning of January 2017, the Government adopted its national security strategy. This constitutes a new starting point for joint efforts to strengthen Sweden's national security. Since then, an ever increasing part of the Government's work has been devoted to addressing national security issues in a coherent manner. Developments within Sweden and beyond give good reason to continue in the same direction. Eight security threats have been identified in the strategy, one of which is climate change and its effects.

Internationally, Sweden has been involved in making decisions within the UN Security Council in support of international peace and security. Sweden notes the links between the climate and security as part of the conflict prevention work of the UN Security Council. The Swedish knowledge base is being strengthened in terms of the link between the climate and security through, for example, projects with the Stockholm International Peace Research Institute (SIPRI) and other think tanks. A work plan has been drawn up for working with the climate and security during 2017–2018. Sweden is working to drive through changes within the UN system to give climate and security issues a suitable institutional position within the UN ahead of the Secretary-General's climate summit in September 2019.

9 The way ahead – ongoing climate change adaptation work

The Government announced a national Strategy for Climate Change Adaptation in its written communication ‘Kontrollstation för de klimat- och energipolitiska målen till 2020 samt klimatanpassning’ (‘Control station for the 2020 climate and energy policy objectives and climate change adaptation’, Communication 2015/16:87). The aim of the strategy was to strengthen climate change adaptation work and national coordination of this work in the long term. Through the strategy, the Government also meets its obligations in accordance with the Paris Agreement and the EU Strategy on Adaptation to Climate Change, in which a national climate change adaptation strategy is highlighted as a central analytical instrument that is intended to explain and prioritise actions and investments.

The national strategy that this bill constitutes is directed towards strengthening climate change adaptation work and national coordination of this work in the long term. Below, the Government describes the objective and principles for working with climate change adaptation, and how this should be organised at national level. In order to create the right conditions for effectiveness and continuity, a national policy cycle is being established for monitoring, evaluating and reviewing the strategy. This section also discusses financing measures, knowledge-enhancing initiatives and research, as well as certain specific initiatives that are important for the ongoing work.

9.1 Climate change adaptation objectives

The Government’s assessment: The Government’s objectives for society’s adaptation to a changed climate are to develop a society that is sustainable and robust in the long term, and that actively deals with climate change by reducing vulnerabilities and taking advantage of opportunities. The climate change adaptation goals in the Paris Agreement and Agenda 2030 and the Sustainable Development Goals should also be achieved. These goals should be taken into consideration in policies, strategies and planning at national level, and should be integrated into ordinary operations and responsibilities. Additional needs for goals or for clarification of the Government’s climate change adaptation objectives for different policy areas, sectors or identified vulnerabilities should be analysed.

The reasons for the Government’s assessment: It is of central importance that the work to adapt society in line with climate change is carried out in a long-term, continuous, intersectoral manner, and at all levels of society. The Government’s objective for society’s adaptation in line with a changed climate is to develop a society with long-term sustainability and robustness that actively deals with climate change by reducing vulnerabilities and taking advantage of opportunities (2018 Budget Bill, Govt Bill 2017/18:1).

Sweden backs international goals for adaptation in line with climate change and its effects. In 2015, the international work to achieve fair and sustainable global development made significant progress.

The world's leaders agreed to combine the international agendas for poverty reduction and sustainable development in a common, integrated global framework: Agenda 2030, with its 17 sustainable development goals (SDGs). The goals of Agenda 2030 are universal, and shall be achieved by all countries. In 2015, a new global, legally binding climate agreement was also adopted in Paris (the Paris Agreement). Together with the final document from the conference on financing sustainable development (the Addis Ababa Action Agenda) and the new Sendai Framework for Disaster Risk Reduction 2015–2030, these agendas form a new global framework for long-term sustainable development.

One of the Paris Agreement's three main aims is to increase the ability to adapt to the adverse effects of climate change and foster climate-resilient development, in a manner that does not threaten food production. Agenda 2030 includes climate change adaptation as an aspect in several of the 17 goals. One of the most important is goal 13: Take urgent action to combat climate change and its impacts. This includes strengthening resilience and adaptive capacity to climate-related dangers and natural disasters in all countries (target 13.1) and integrating climate change measures into national policies, strategies and planning (target 13.2). It also includes improving education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (target 13.3). Climate change adaptation is also part of Goal 11 Sustainable cities and communities. Target 11b involves, by 2020, substantially increasing the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and developing and implementing, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels. Goal 2 – zero hunger – also involves climate change adaptation aspects. Target 2.4 states: “By 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality.” During 2018, the Government will draw up an action plan for the implementation of Agenda 2030. The Government's climate change adaptation work is being carried out in line with the goals of Agenda 2030.

In the appropriation document for 2016, SMHI was tasked with reporting a proposal for how the national climate change adaptation work can be monitored on an ongoing basis. SMHI's report on the remit highlights the need for a national strategy and national objects. When compiling the report, opinions were obtained from county administrative boards, public agencies, certain industry organisations and the Swedish Association of Local Authorities and Regions. The international objectives for climate change adaptation are clearer than the national objectives decided on by the Government and the Riksdag. The Government therefore believes that Sweden's international undertakings should be clarified within the framework of policy, strategies and planning at national level in accordance with the focus of target

13.2 of Agenda 2030. In this way, the right conditions are created for an integrated working method in which objectives and measures follow mandates and resources. An analysis should therefore be carried out of whether time-bound, monitorable climate change adaptation objectives would contribute towards increased clarity, steering and coordination, and whether they would facilitate monitoring society's adaptation to a changed climate. In section 6.4, areas have been identified where continued climate change adaptation is particularly important. It is relevant to analyse these areas, in terms of the need for objectives or other clarifications of what the national adaptation objective involves for different sectors or societal functions, and whether these objectives or clarifications can contribute towards more effective climate change adaptation work. When carrying out such an analysis, it should be considered whether these areas already have objectives that include climate change adaptation, and on which level it is appropriate to set objectives for climate change adaptation.

A current situation analysis of the work within these areas identified as important areas for continued climate change adaptation (section 7) shows that work is taking place within all areas, but that the challenges are different. The Government intends to analyse which needs exist for new objectives or other clarifications, with the aim of guiding and inspiring society's various players. This analysis should explain whether – and if so, how – these objectives relate to existing objective structures within different policy areas. Key starting points for any new objectives are existing objectives, Agenda 2030, the Paris Agreement and objectives included in public agencies' action plans for climate change adaptation. In those cases where objectives are proposed, they should be time-bound, concrete, realistic, measurable and monitorable.

9.2 Principles for working with climate change adaptation

The Government's assessment: Climate change adaptation work should be carried out on the basis of guiding principles on sustainable development, mutuality, a scientific basis, the precautionary principle, integration of adaptation measures, flexibility, dealing with uncertainty and risk factors, a time perspective and transparency.

The Climate Change Adaptation Inquiry's assessment: The Government only shares the Inquiry's assessment in part.

The referral bodies: Many referral bodies, particularly certain *municipalities* and *county administrative boards*, agree with the Inquiry on the need for political guidance at national level regarding the choice of climate scenarios, time perspective and risk-taking. *SMHI* questions whether identifying fixed values for future climate change, years and sizes of change would benefit climate change adaptation work, and warns of socioeconomic ineffectiveness. The institute believes that climate change adaptation guidelines risk locking society into solutions that could later prove to be insufficient or overdimensioned. *SMHI* proposes drawing up national risk analysis guidelines instead, taking into account the current and future climate, with time perspectives that are relevant to the decisions to be taken and that balance the precautionary principle with socioeconomic values. *Linköping University* believes that the issue is multifaceted, and that clearer guidance would facilitate and improve comparability,

while dealing with different risks is a natural part of decision-making at local level.

The reasons for the Government's assessment: The Government does not share the Inquiry's assessment that political decisions are required from the Government or the Riksdag on, for example, the time perspective for buildings, which climate scenario it is reasonable to take as a starting point or which risks should be accepted. The Government believes that it would be unsuitable, and maybe even directly counterproductive, to establish at a specific point in time which climate scenario and time perspective should form the starting point for all types of decision-making by all players, and which risks can be deemed to be acceptable. Even though many players have asked for clear guidance regarding which temperature increase they should count on, which sea level increase should be taken into consideration or the time perspective in which adaptation work should take place, the Government believes that it would be problematic to 'draw a line' that all actors should follow. Different types of buildings, facilities and investments have different lifespans, functions, historic value, etc., which affects the consequences of extreme weather events, for example, and thus the assessment of which costs can be deemed acceptable for adaptation measures.

Knowledge about the dynamic between emissions, atmospheric concentrations, temperature changes and their consequences is also growing continuously. Emission levels are strong depending on technical developments, political desire and concrete measures in a global context. The UN's Intergovernmental Panel on Climate Change (IPCC) is responsible for regularly evaluating and assessing the combined science on climate change. The Government believes that it is reasonable for society's various players to review the topicality of their climate change adaptation work when there is new combined knowledge in connection with the IPCC's Assessment Report or when public agencies such as SMHI have converted the combined global knowledge in line with the Swedish context.

The Government also notes that clearer guidance may be needed on an approach to climate change adaptation work. Such guiding principles to support climate change adaptation work are described below. Tools may also be needed for assessing climate effects. In its report 'Klimatanpassning inom ramen för offentlig upphandling' ('Climate change adaptation within the framework of public procurement, SMHI ref. 224026), SMHI proposed developing standardised methods for modelling climate effects. This could include devising models for inquiries into flow flooding, rising sea levels, over-temperatures and their effects. Through modelling, climate effects can be clarified for assessing various alternatives and communicated between different players. The Government intends to task relevant agencies with developing such models.

Guiding principles for climate change adaptation work

The uncertainty about the development of greenhouse gas emissions, future climate effects and the resulting need for adaptations remains a challenge for society. However, this uncertainty cannot be seen as a reason for not acting. A focus is needed in order to deal with such adaptation opportunities that contribute towards sustainable development which is cost-effective and meaningful under different circumstances.

This should be guided by the following principles:

Sustainable development

Climate change adaptation work should be based on the principle of long-term sustainability, which involves decision-making, planning and implementation taking the interests of current and future generations into consideration. Sustainable development shall be achieved by balancing and combining economic, social and environmental development. When choosing adaptation measures, attention should be paid to measures that:

- have a positive effect on the environment and ecosystem services,
- are rewarding, regardless of the degree of climate change (‘no regret measures’) and that have positive effects on other sectors,
- are preventive and contribute towards socioeconomic effectiveness by reducing the cost of damage, and
- have positive effects on social cohesion, contribute towards sustainable economic growth and employment, good living environments and health, and do not disadvantage any social group.

Mutual support

Climate change adaptation measures complement initiatives for reduced climate impact. Both these areas are dependent on each other, and should be coordinated to as high a degree as possible. Climate change adaptation measures should not counteract measures for reducing greenhouse gas emissions and vice versa.

Scientific basis

Adaptation measures should have a scientific basis and be based on an analysis of risks and consequences, taking the latest available knowledge from the IPCC, for example, as their starting point.

The precautionary principle

When potential risks as a consequence of climate change are deemed to be demonstrated but available scientific knowledge is insufficient for a sound conclusion on the existence or extent of the risk, the lack of knowledge must not be used as a reason for deferring or avoiding cost-effective protective measures.

Integration of adaptation measures

All players within society should – within their own fields of responsibility – analyse, plan and carry out their operations with regard to the long-term risks and opportunities that may arise in a changed climate, and should take adaptation measures within their field of operations. Where possible and appropriate, adaptation strategies should be integrated into existing strategies and plans.

Flexibility

To the greatest possible extent, adaptation measures should be designed with the objective of being flexible and robust in a way that benefits different courses of action in future. Lock-in effects should be avoided.

When assessing future climate change, carrying out risk evaluation and planning adaptation measures, a future climate should be analysed based on different emission scenarios, and several possible outcomes based on these should be considered.

Managing risk

In the event of high risk, i.e. when the likelihood of an event, the extent of its consequences and its degree of seriousness are considered to be high, preventive measures should be taken, warning systems and preparedness should be designed, and responsibilities and cooperation should be clarified. In the event of serious danger to human life and health, serious or irreversible damage to ecosystems' bearing capacity and ability to recover, or extensive damage to the national interest, socially important operations or infrastructure and buildings, with high costs as a result, adaptation measures should prepare for events that are very unlikely to happen. Robust measures that work across a range of possible future scenarios should be prioritised.

Time perspective

The time perspective for climate change adaptation measures should be based on the lifespan of the specific object (infrastructure, buildings or investments).

Transparency

All players within society should be transparent in terms of dealing with uncertainty, choice of climate scenarios, risks and time perspectives in their adaptation work. For public agencies, this is a requirement in view of the fact that different players may be dependent on the assessments made within a specific agency. Other public players, such as local and regional agencies, should openly report their assessments.

9.3 Organisation and distribution of responsibilities

9.3.1 A national council to support climate change adaptation

The Government's assessment: There is a need for an overall picture of society's vulnerability to climate change and how climate change adaptation work is being developed in Sweden. A national function in the form of a council should therefore be established.

SMHI's proposal in Control Station 2015 largely agrees with that of the Government.

The referral bodies: The majority of the referral bodies that commented on the proposal for a national expert committee as a means of ongoing support for the Government take a positive view of the proposal, including that the committee's work should be led by the National Knowledge Centre for Climate Change Adaptation at SMHI. This includes *SGU, the Swedish Transport Administration, the county administrative boards of Uppsala, Värmland, Gävleborg and Jämtland, and Stockholm Municipality*. A couple of referral bodies would like the proposal to be clarified. *The Swedish Civil Contingencies Agency (MSB)* believes that it is important to use

existing agency networks, expert groups and other forums in the first instance, instead of setting up new ones. Some agencies, including *the National Board of Housing, Building and Planning*, question whether the committee should be tasked with drawing up documentation for a national climate change adaptation strategy. *SGI* believes that an independent agency should be responsible for monitoring and evaluating the work that is carried out. Some county administrative boards, including *the county administrative boards of Jönköping and Blekinge*, are of the opinion that the committee should report to a council equivalent to the Swedish Environmental Objectives Council. The expert committee can then draw up documentation for the council, which in turn will be responsible for conveying considerations and prioritisations to the ministries. *Uppsala County Administrative Board* questions whether it is appropriate to deal with climate change adaptation issues in a separate forum. The question should be included in existing processes and procedures. *The county administrative boards of Östergötland, Jönköping and Västerbotten* point out that no agency has all the competence required for coordinating climate change adaptation work in Sweden.

The reasons for the Government's assessment: SMHI has proposed forming a broadly compiled national expert committee to support the Government's climate change adaptation work. According to the proposal, the committee should draw up documentation for a national strategy and an action plan for climate change adaptation, and should provide ongoing support for decisions on prioritised measures. This work is taking place in line with the knowledge situation being updated and the effects of climate change and adaptation measures becoming clearer. According to the proposal, the work of the committee should be led by the National Knowledge Centre for Climate Change Adaptation at SMHI.

The Government shares the assessment that there is a need for an expert function that, in a combined manner and based on an intersectoral perspective, can contribute towards a continuously updated picture of society's vulnerability to climate change. This picture includes having knowledge about climate change, as well as adaptation measures that have been taken and their effects. In this way, knowledge gaps can be identified and prioritised areas for ongoing work can be proposed. The Government is of the opinion that an appropriate form for such an expert group would be to set up a council linked to SMHI. This council should be tasked with monitoring and evaluating climate change adaptation work and drawing up documentation for the focus of the national climate change adaptation work in advance of reviewing the national strategy. In order to ensure that different aspects are weighed up, the council should work to achieve broad support within society, and should be in contact with representatives from the research community, industry, industry organisations, national and regional agencies, and the Swedish Association of Local Authorities and Regions. The Government is deciding on the composition of the council, and intends to fund the council within appropriation 1:10 Climate Change Adaptation from 2019 onwards.

SMHI will be responsible for supporting the expert council. In accordance with its instructions, SMHI is currently responsible for producing, compiling and conveying information and knowledge about climate change and climate change adaptation, and for running the National Knowledge Centre for Climate Change Adaptation. SMHI is also responsible for the climate change adaptation portal, a collaboration between 18 public agencies and the county administrative boards. SMHI will now have greater responsibility as a source of support for the National Council for Climate Change Adaptation.

Adapting society in line with a changed climate is a complex issue that is highly intersectoral, and affects the national, regional and local levels of society. Climate change adaptation therefore requires

specialist knowledge, such an overview and better coordination and communication between the public agencies with responsibility for climate change adaptation work, as well as improved communication to the municipalities about the existing knowledge base. It has been stated in the documentation for Control Station 2015, the All-Party Committee on Environmental Objectives' report 'Med miljömålen i fokus' ('A focus on the environmental objectives') and the Climate Change Adaptation Inquiry's report 'Vem har ansvaret?' ('Who is responsible?') that there is a need for better and overall coordination of climate change adaptation work.

The National Knowledge Centre at SMHI already plays a role in the cooperation on national climate change adaptation work. Through the National Council for Climate Change Adaptation that will now be established, a more cohesive picture of climate change adaptation work in Sweden can be created. As pointed out by several referral bodies, climate change adaptation requires in-depth knowledge and understanding of the relevant subject area, and it is doubtful whether one agency has all the necessary knowledge. There can be improved coordination within relevant sectors, in accordance with the proposal for a stronger coordinating role for the National Board of Housing, Building and Planning in terms of buildings and structures (see section 9.3.3). It is also extremely important that climate change adaptation work is integrated into ordinary structures as far as possible.

9.3.2 Public agencies' climate change adaptation work

The Government's assessment: The Government has established that public agencies shall initiate, support and evaluate climate change adaptation work within their fields of responsibility, for example by drawing up action plans. The Government is of the opinion that the responsibility for climate change adaptation should be clarified.

SMHI's assessment in Control Station 2015 agrees in part with that of the Government.

The referral bodies: All referral bodies that commented on the proposal for relevant sector and expert authorities to have it stated in their instructions that they should initiate, support and monitor climate change adaptation work within their field of responsibility take a positive view of the proposal. *SJI* refers to the fact that the national work with environmental objectives is powerful thanks to the clarification in instructions and to ongoing monitoring and evaluation of joint objectives, and believes that the climate change adaptation work needs the same clarity and power. *The Swedish National Heritage Board* takes a positive view of the proposal, but emphasises the importance of intersectoral work and that the role of cultural heritage in societal development and the conditions for cultural environments must be known and driven by all those involved. *The county administrative boards* generally take a positive view of the proposal. They believe that adding remits to the instruction for all relevant agencies, combined with funding and action plan requirements, would go a long way. *The county administrative boards of Jönköping and Blekinge* point out that work to initiate and coordinate climate change adaptation at regional level has been made more difficult by several important sector authorities not having had any remit to work with climate change adaptation. *The Swedish Association of Local Authorities and Regions* also agrees with the proposal. *The Sami Parliament* is

of the opinion that it should also have it stated in its instructions that it should initiate, support and monitor climate change adaptation work within Sami society.

Three of the six referral bodies that commented on the proposal for objectives and action plans took a positive view of the proposal. Those that agree with the proposal include *the National Board of Housing, Building and Planning*, which believes that there should be careful consideration when introducing new objectives. *The Board* also refers to the *A good built environment* environmental quality objective, in which it believes climate change adaptation is implicitly included. *The Public Health Agency of Sweden* is of the opinion that the proposal on objectives and action plans should be clarified, since it is unclear which national objectives and action plans are referred to. *The Swedish Transport Administration* and *the Swedish Board of Agriculture* back the proposal. The latter emphasises the need for an overall picture of the effects of climate changes on different sectors, and for objectives and action plans linked to this.

The reasons for the Government's assessment: The Climate and Vulnerability Inquiry, the All-Party Committee on Environmental Objectives in 'Med miljömålen i fokus' ('A focus on the environmental objectives', SOU 2014:50) and SMHI in Control Station 2015 proposed that relevant agencies should be tasked in their instructions with initiating, supporting and monitoring climate change adaptation work within their field of operations. This proposal received broad support from the referral bodies when the document was circulated for comment. The Government believes that it is of the utmost importance that all players take responsibility for taking adaptation measures. The municipalities have the main responsibility for social planning within their geographic areas. Public agencies shall initiate, support and evaluate climate change adaptation work within their fields of responsibility, for example by drawing up action plans. By analysing their own operations based on current knowledge about a changed climate, agencies can build a picture of how climate change affects their opportunities to achieve the overall objectives for their operations. Based on this, they can plan to take the measures and steps needed to adapt operations within their field of responsibility in line with anticipated climate change.

In order for all players to take a greater responsibility for taking adaptation measures, the relevant agencies' opportunities to initiate, support and evaluate the climate change adaptation work within their field of responsibility should be clarified. It should also be possible to monitor and report on this work. The Government intends to regulate this in an ordinance. The Government believes that a general ordinance covering the relevant agencies is appropriate, since a number of agencies are affected and the remit that involves assigning frameworks for the agencies' work is identical and collective. As mentioned in section 7, several agencies have – at their own initiative or as a consequence of the remits assigned in, for example, the appropriation document for 2018 – drawn up action plans for climate change adaptation or received special remits on this. The work with the action plans should be a continuous process, in which every agency joins in according to where they are in the process. As far as possible, the aim is to build on the work that has already been carried out.

9.3.3 The National Board of Housing, Building and Planning's responsibility for climate change adaptation for buildings and structures

The Government's assessment: Coordinating responsibility is needed for adaptation within the physical planning sector. Strong coordination increases the opportunities for making data available that is relevant for new and existing buildings and analysing how buildings can be adapted in line with a changed climate.

The Climate Change Adaptation Inquiry's assessment agrees with that of the Government.

The referral bodies: The majority of the referral bodies back the proposal on the National Board of Housing, Building and Planning's remit as the coordinating authority for adaptation within the physical planning sector. *The National Board of Housing, Building and Planning* takes a positive view of the proposal to act as the coordinating authority for climate change adaptation in relation to buildings. However, *the Board* feels that the remit is somewhat unclear, and believes that municipal planning is only one aspect of the adaptation issue. *Lund University* and *Insurance Sweden* object to the proposal on the grounds that certain aspects of the adaptation issue risk not being considered, and that the National Board of Housing, Building and Planning lacks a natural link to climate change adaptation issues. Most of the referral bodies also want to broaden the circle of relevant agencies to support and cooperate with the Board, so that in addition to the Swedish Meteorological and Hydrological Institutet (SMHI), the Swedish Geotechnical Institute (SGI), the Swedish Civil Contingencies Agency (MSB) and the county administrative boards proposed by the Inquiry, this should also include the Geological Survey of Sweden (SGU), the Swedish Agency for Marine and Water Management, the Swedish Environmental Protection Agency and the Public Health Agency of Sweden. This cooperation will be made easier by regulation in instructions or remits to all relevant agencies. *SMHI* also believes that coordination cannot only be based on existing material from other agencies, and that initiatives are required in order to integrate materials from other sources and to create new materials. Several agencies also want to see coordination with relevant county administrative boards on issues, and believe that the National Board of Housing, Building and Planning should provide guidance on precautions and opportunities for regulation in detailed development plans and building permit issues.

The reasons for the Government's assessment: In the Climate Change Adaptation Inquiry's opinion, the authority structure for climate change adaptation of buildings is ineffective. There is a need for better coordination and communication between the public agencies with responsibility for climate change adaptation work, as well as improved communication to the municipalities about the existing knowledge base. There is agreement that agencies produce important and useful data, but that the knowledge does not always benefit the municipalities. The lack of an overview and coordination is the biggest problem, as well as the fact that climate scenarios are partly research-oriented and are not always easy for the municipalities to use.

The Government shares the Inquiry's assessment that the National Board of Housing, Building and Planning should be tasked with acting as the coordinating authority for climate change adaptation in relation to new and existing buildings. The National Board of Housing, Building and Planning is the administrative agency for issues relating to the built environment, the management of land and water areas,

physical planning, and the construction and management of buildings, and is therefore an appropriate body for coordinating the relevant data for new and existing buildings, and for analysing how buildings should be adapted according to available data on climate effects. The Board is already responsible for coordinating the *A Good Built Environment* environmental quality objective, with which the new remit has a natural connection. The change to the Board's remit should be detailed in the agency's instruction. The remit involves coordinating the data that expert authorities and research can provide on climate effects and climate change adaptation for buildings. Another important measure is monitoring the ongoing climate change adaptation work and analysing what it involves for new and existing buildings. In terms of support, the municipalities should be given 'a way in' to climate change adaptation, and thus gain access to relevant data free of charge. This does not refer to detailed data for specific buildings, but in the first instance to making existing data available, adapted for buildings and simpler to understand and use. This remit shall be carried out with support from SMHI, SGI, the county administrative boards and MSB, but other agencies may also be considered within their respective fields of responsibility. This does not mean that these agencies' responsibilities should be reduced, but that it is important that these agencies' important work continues. The Government intends to fund the National Board of Housing, Building and Planning's remit from appropriation 1:10 Climate Change Adaptation within UO20, and will propose in the 2019 Budget Bill that the Board's administrative appropriation should be increased by SEK 5 million with effect from 2019.

9.3.4 The county administrative boards' responsibility for regional coordination

<p>The Government's assessment: Since 2009, the county administrative boards have been tasked by the Government with coordinating the work involved in adaptation to a changed climate at regional level. The county administrative boards' existing remit</p>

The Climate Change Adaptation Inquiry's assessment agrees with that of the Government.

The referral bodies: The majority of the referral bodies support a clarification of the county administrative boards' remit on coordinating the regional climate change adaptation work. *The Swedish Association of Local Authorities and Regions*, a number of *county administrative boards*, *the Swedish Transport Administration* and *the National Board of Housing, Building and Planning* want to see a clarification of both the county administrative boards' role in terms of the National Board of Housing, Building and Planning's coordination remit and where the boundary lies between region-specific and municipal documentation. *The National Board of Housing, Building and Planning* and others also request nationally established guidelines and guidance on which data should be used, and a number of county administrative boards and municipalities want to see a greater degree of coordination for establishing nationally equal assessments. *Västerbotten County Administrative Board* and *the National Board of Housing, Building and Planning* have requested clearer national leadership and consensus, and call for planning guidelines that have been established in advance, since there is a great deal of data from the expert authorities but a lack of national guidance on which data should be used. The county administrative boards' work would be made easier if the national sector authorities were to state in their instructions that they will support the county administrative boards' coordination remit, and how they will do so.

The reasons for the Government's assessment: Within the framework of the remit in the instruction, the county administrative boards work to strength knowledge about climate change and its effects, both internally and in relation to the counties' various players, to integrate this work into existing processes and networks, to convey relevant and current data, and to provide recommendations and guidelines at regional level. The Government shares the Climate Change Adaptation Inquiry's assessment that the county administrative boards' existing formal remit does not need to be expanded, but believes that it needs to be made clearer with regard to what is included in regional coordination of climate change adaptation.

In its supervisory guidance, the National Board of Housing, Building and Planning shall provide the county administrative boards with data, including the data about flooding that was produced through the remit in the Board's appropriation document for 2017 and about landslides and erosion that is being produced through the remit in the appropriation document for 2018. In this way, the county administrative boards' regional remit will be made easier. The county administrative boards shall in turn convey this data to the municipalities free of charge as far as possible with regard to licence costs, for example. In the Government's opinion, the planning support that the county administrative boards shall give to the municipalities is already included in the existing remit, but can be clarified. It is also important to emphasise that this involves data that is relevant for the county.

When producing structure plans and detailed development plans, it is already the case that the municipality should consult with the county administrative board, which shall particularly work to ensure that buildings and structures do not become unsuitable with regard, for example, to the risk of flooding, accidents such as landslides, and erosion. In section 4.2, the Government proposes that the municipality should provide its views in the structure plan on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated. Since the municipality should consult with the county administrative board when drawing up the structure plan, the county administrative board will be given the opportunity to support the municipality in this work.

At most county administrative boards, regional coordination of climate change adaptation and reviews of detailed development plans are not dealt with in a coordinated manner. Efficiency gains could be achieved if these issues were coordinated within the county administrative board.

The county administrative boards also have a coordinating role from a more overall perspective when it comes to initiating, supporting and evaluating the climate change adaptation work within the municipalities in the county. This applies, for example, in issues such as green infrastructure, risks and vulnerability, and cultural environments, as well as in cross-municipality issues. SMHI's guidance on developing municipal action plans has been drawn up in cooperation between six county administrative boards and 15 municipalities in these counties. This tool provides a basis for continued work with local action plans in all counties. The county administrative boards also play an important role in promoting dialogue between different municipalities. Within the framework of their remit of drawing up regional action plans for green infrastructure, the county administrative boards have the task of reporting appropriate conservation initiatives such as consideration, protection, maintenance and restoration initiatives. Climate change adaptation of the landscape's ecosystems through developing green infrastructure, for example, is important. The Government shall work to ensure that the action plans for green infrastructure are followed up on, and that action programmes are initiated.

9.4 Monitoring, evaluation and revision

The Government's assessment: A five-year national policy cycle for Swedish climate change adaptation work should be established to ensure effectiveness and continuity.

SMHI's assessment in **Control Station 2015** agrees in part with that of the Government.

The reasons for the Government's assessment

Process cycle for the national climate change adaptation work

In its report 'Förslag till en metod för uppföljning av det nationella klimatanpassningsarbetet' ('Proposed method for monitoring the national climate change adaptation work', SMHI 2016/2480/1.1), SMHI states that there is a need for a strategic national framework for climate change adaptation, which places the monitoring process in a context, to ensure effectiveness and continuity in Swedish climate change adaptation work. SMHI therefore proposes that a national policy cycle should be established for Swedish climate change adaptation work, which is in line with the EU's climate change adaptation strategy. SMHI proposes that this policy cycle should last for seven years, and should include steps for monitoring the work and identifying risks and vulnerability, drawing up a national strategy for climate change adaptation based on this monitoring, and implementing the strategy including updating action plans and reporting results.

Like SMHI, the Government believes that it is important for climate change adaptation work to be carried out within a continuous process. However, the Government is of the opinion that a five-year policy cycle would be preferable. The national strategy for climate change adaptation needs to be reviewed and updated at regular intervals, at least initially, to ensure that the system develops as intended. A policy cycle should include repeated monitoring and evaluation of climate change adaptation work, which then leads to a review of the national strategy for climate change adaptation. As an important part of the national strategy, the Government is therefore establishing a five-year policy cycle with the following steps.

- 2018: The Government presents a national strategy for climate change adaptation.
- 2019–2022: The national expert council at SMHI is responsible for an updated climate and vulnerability analysis, and for monitoring and evaluating the climate change adaptation work carried out. A proposal for an updated strategy is being drawn up.
- 2023: The Government presents an updated national strategy for climate change adaptation.

An updated national strategy is then presented every five years.

SMHI's documentation for Control Station 2015 for adaptation in line with a changed climate and the European Commission's preliminary assessment of Sweden's climate change adaptation work noted that Sweden lacks a structure for evaluating the work to adapt in line with a changed climate. Against this background, SMHI was tasked in the appropriation document for 2016 with reporting a proposal for how the national climate change adaptation work can be monitored on an ongoing basis. Among other things, this monitoring should provide answers to the effect of the national work linked to identified problems and needs, and should be able to be used to report to the EU and other international organisations.

SMHI proposes an evaluation model with three different parts that can be used individually for different purposes, but that together provide a broad overall picture of the Swedish climate change adaptation work. The three different parts are intended to answer the following questions:

1. Are the processes necessary in order to work with climate change adaptation in situ? To what extent has the issue of adaptation been integrated into the Swedish administration system?

2. Which measures have been implemented to reduce the negative effects and vulnerabilities? Which sectors have been worked with and which central challenges and climate effects have been addressed?

3. What progress can we see in the work to reduce the negative effects (effect indicators)?

SMHI is of the opinion that extensive development work remains to be done in order to draw up effect indicators for different sectors and operations where, for example, the relevant agencies should draw up proposals for effect indicators for their own operations. The Government intends to task SMHI with continuing to develop a system for monitoring and evaluating the national climate change adaptation work. In the first instance, monitoring should consider the opportunities for cooperation with existing monitoring systems, indicators, measurements and other forms of monitoring, such as the environmental objectives system and Agenda 2030. Experience from other countries' monitoring and evaluation systems can also contribute towards the Swedish work. The remit should therefore include taking a position on whether experience from the British system, for instance, can be used in Sweden.

9.5 Financing certain climate change adaptation measures

The Government's assessment: The Government believes that the main principle is that costs for protecting one's own property are the responsibility of the owner of the property. The responsibility for preventing and repairing damage due to extreme weather events does not differ from the responsibility for other risk management in society. Incentives are thereby created to avoid developing in risky areas and to take suitable protective measures.

The Climate Change Adaptation Inquiry's assessment agrees in part with that of the Government.

The referral bodies: *The Swedish Association of Local Authorities and Regions, the county administrative boards of Kalmar, Värmland, Jämtland, Dalarna, Västerbotten, Blekinge, Södermanland, Västernorrland, Gotland and Västra Götaland, Arvika Municipality, Lomma Municipality and the Swedish Property Federation* believe that it is unfortunate that the Inquiry has not had the right conditions to investigate the issue of funding climate change adaptation measures, and that it is of the utmost importance that this issue is investigated and resolved as quickly as possible since it is vital in order to continue with climate change adaptation work. *Nynäshamn Municipality* points out that many municipalities are currently in a phase of significant expansion where more is being built than in a long time, with varying degrees of attention being paid to the future climate. *Gothenburg Municipality* is of the opinion that funding models can be looked at without knowing the exact total costs.

The Swedish Association of Local Authorities and Regions and Ystad Municipality believe that the Government must increase the appropriations for preventive measures while the funding issue is investigated. *Ängelholm, Gothenburg, Malmö, Arvika, Borgholm, Vellinge, Örnköldsvik, Mariestad and Jönköping municipalities* believe that the costs of climate change adaptation are enormous, and that the municipal grants proposed by the Swedish Civil Contingencies Agency (MSB) for climate-related preventive measures are insufficient and should therefore be increased. *Kristianstad, Vellinge, Jönköping and Kävlinge municipalities* do not feel that the SEK 75 million allocated for MSB is sufficient, and believe that smaller municipalities lack the expertise or the finances to draw up the documentation required by the Land and Environment Court for applications to build protection. The Government also needs to carry out additional reinforcements to deal with increased applications for action grants from the municipalities. *Värmland County Administrative Board* is also of the opinion that the Inquiry proposes an increase in funding to apply for from MSB, but that the proposed sum is low in relation to costs for climate financing in other EU nations, for example. *Örnköldsvik Municipality* is of the opinion that funding via MSB requires its own co-financing, which is not detailed in the Inquiry. This is important not least for smaller municipalities that tend to have fewer resources. *Västerbotten County Administrative Board* also believes that there should be other funding available for municipalities that have not yet started with climate change adaptation and for measures outside MSB's requirements.

The Swedish Transport Administration is of the opinion that the economic aspects should be clarified, for example to ensure sufficient certainty that the currently planned measures will be of use in a future changed climate. There are demands and questions from municipalities for the Swedish Transport Administration to participate in the funding and the implementation, and clearer rules are therefore needed in order to be able to allocate responsibilities and costs. *Ystad and Ängelholm municipalities* believe that the Government should take greater responsibility for drawing up models for blended finance of measures where those who benefit from a measure co-finance it together with municipal and government funding. The Government should also be responsible for helping the most vulnerable by developing principles for allocating resources according to need. *Arvika Municipality* points out that private players should co-finance certain climate change adaptation measures. *Gothenburg Municipality* is of the opinion that the Government should be keener to draw up a proposal for how co-financing of climate change adaptation measures should be funded. The municipality suggests that the Inquiry should have proposed an opportunity for municipalities to consolidate money from development companies.

The reasons for the Government's assessment: A changed climate will require adaptations to society in a very large number of areas. The combined cost for these measures will be significant for individual facilities, initiatives and sectors. However, many of these measures will be spread out over a long period of time, and can be carried out gradually within different areas in line with new investment, equipping, expansion, reviewing standards, etc. The cost of adaptation measures for society is therefore unlikely to be large compared with the cost of damage.

The Climate Change Adaptation Inquiry's analysis of responsibility for taking preventive climate change adaptation measures is, in principle, the same as that carried out by the Climate and Vulnerability Inquiry (2007) or, for example, by the Landslide Inquiry (1994). The responsibility for preventing and repairing damage due to extreme weather events does not differ from the responsibility for other risk management in society. The basic principle is that the responsibility for protecting property lies in the first instance with the owner of the property. This applies to all property owners: individuals, businesses and authorities. Incentives are thereby created to avoid building in risky areas and to take suitable protective measures. When it comes to buildings and structures, the municipalities are responsible in accordance with the Planning and Building Act for new buildings being located in detailed development plans on suitable ground without the risk of accidents such as landslides or flooding and erosion. Through their physical planning, the municipalities have an indirect responsibility for preventing direct and indirect effects that could otherwise occur in the surrounding countryside. A lack of time, knowledge and funding for concrete measures is often mentioned as a barrier to carrying out preventive measures.

In accordance with the so-called 1986 Landslide Bill (Govt Bill 1985/86:150 Appendix 3), an appropriation was introduced from which municipalities could apply for money to take preventive measures "against unforeseeable and sudden events". The bill states that, on the whole, municipalities should be responsible for preventive measures themselves, but that in a small number of municipalities there are large areas with increased risks of landslides and other natural damage. These more vulnerable municipalities would then be able to apply for additional grants from an appropriation administered by the former Swedish Rescue Services Agency.

The Government believes, in accordance with for instance the conclusions of the so-called Landslide Bill, that a certain redistribution of public funding may be justified due to climate change affecting different areas and sectors in Sweden differently. For example, municipalities can already apply for funding from appropriation 2.2 Preventive measures against landslides and other natural accidents. Through this appropriation, municipalities can obtain concrete measures to protect against landslides and flooding that are part-funded by the Swedish Civil Contingencies Agency (MSB).

In the 2018 Budget Bill, the Government announced a specific initiative for co-financing landslide mitigation measures along the Göta River. Concrete landslide mitigation measures along the river can thereby be taken to a greater extent. The risks of landslides along the river are already high in today's climate, but increased precipitation and increased drainage will make the risks considerably higher. This is described in the Göta River Inquiry 2009–2012. The Swedish Geotechnical Institute (SGI) will receive SEK 62 million in additional appropriation in 2018 for establishing a delegation for the Göta River and for financing measures to reduce the likelihood of landslides in the river valley. The delegation shall take

a position on which practical, geotechnical measures in the susceptible river valley should be prioritised to minimise the risk of landslides. The cost of these measures will then be partly financed by the state. The grant is due to the measure relating to a large area which covers several municipalities or counties, involving protecting areas of national interest or including extensive measures that exceed the municipality's ability to pay within a reasonable period of time, which means that government co-financing may be possible in exceptional cases.

In order to make it easier for the municipalities to take adaptation measures for flooding from torrential rain and prolonged precipitation, an additional directive has been given to the Inquiry on Sustainable Water Services (M 2017:02). This additional directive involves the Inquiry also examining which opportunities the current rules offer for adapting surface water management in line with a changed climate and proposing how water and sewage charges can be used to finance such adaptation measures.

In addition to the above support, municipalities can also include adaptation measures in other forms of government grant such as the greener cities grant. This grant can be applied for by municipalities, and aims to promote urban green spaces or ecosystem services increasing or developing in urban environments. In this way, it can also contribute towards climate change adaptation measures, for instance by counteracting heat islands and the creation of flooding zones.

At www.klimatanpassning.se, the National Knowledge Centre for Climate Change Adaptation has reported on various opportunities for obtaining financing for adaptation measures within different areas, both from Swedish sources and from the larger EU programmes. National sources of funding include the Swedish Governmental Agency for Innovation Systems (Vinnova), the Swedish Civil Contingencies Agency, Formas and the Swedish Foundation for Strategic Environmental Research (Mistra). Relevant EU programmes include the environmental fund (LIFE), the European Regional Development Fund programme, the Framework Programme for Research and Innovation (Horizon 2020) and the Rural Development Programme 2014–2020. Another highlighted example is that of so-called green loans. Larger investments can be financed using green obligations that offer an opportunity for interest rate investors to support lending for investment projects within climate change adaptation.

As described in section 5 Responsibility for taking preventive adaptation measures, both municipalities and the Government have a responsibility for taking preventive measures in their capacity as property owners and operators. The Climate and Vulnerability Inquiry (2007) assessed the cost of damage for the state road network at between SEK 5 billion and SEK 14 billion up until 2100. According to the Inquiry, the cost of damage prevention measures to eliminate 75 percent of the cost of damage is between SEK 2 billion and SEK 3.5 billion.

9.6 Knowledge-enhancing initiatives and research

The Government's assessment: Knowledge about climate change and its effects should be further strengthened to enable decisions to be made that lead to effective measures. One important part of the work involved in adaptation to a changed climate is knowledge-enhancing initiatives that support public agencies, municipalities and industry. Mapping and data collection provide a better basis for planning and decision-making. Research into climate change adaptation and development work is carried out continuously, and must quickly be made relevant and accessible to various players in order to be used.

The inquiries' assessment: The Climate Change Adaptation Inquiry proposes measures to make the planning data for municipalities more relevant, and this should be provided free of charge. In the first instance, this involves making existing data available, in a form that is adapted for buildings and easier to understand and use. In Control Station 2015, SMHI specifically highlighted the need for research and development with the aim of creating tools that bridge between research and application, aiming for example to (a) promote intersectoral cooperation; (b) assess overall pictures/syntheses that take into account effects within multiple sectors; (c) assess the cost and benefit of measures; (d) make decisions amid uncertainty; and (e) use green and blue infrastructure in built environments to integrate climate change adaptation with other aspects.

The referral bodies take a positive view of the proposal that the National Board of Housing, Building and Planning and the county administrative boards should have a more prominent role in providing planning documents. *The county administrative boards of Västmanland, Västerbotten, Kronoberg and Uppsala* and *Falkenberg Municipality* believe that it is essential to interpret what is meant by "relevant documentation" in order to facilitate ongoing work. *Jämtland County Administrative Board* is of the opinion that it is extremely important to clarify ownership of the documentation to be provided by the county administrative boards to the municipalities. This would make administering, updating and issuing GIS materials easier, for instance. *Jönköping Municipality* and *Kristianstad Municipality* say that it would be beneficial if the existing documentation could be made more accessible to the municipalities, and that usefulness and coordination could be increased. This is based on the recipient, often a municipal operation, being the focus of the work. *The Swedish Centre for Innovation and Quality in the Built Environment* asks how the collection and coordination of new knowledge from research and pilot projects will take place and be made available in various contexts. When Control Station 2015 was circulated for comments, *Sida* agreed on the importance of a national knowledge centre but did not see the link to international players within the field that can be valuable for learning and for exchanging knowledge and experience. *Sida, the National Board of Housing, Building and Planning* and *Uppsala University* believe that a perspective on integrated science, in which social sciences aspects are included in the natural sciences, is lacking. Broader knowledge about social governance is needed in order to deal with the climate issue. *The Swedish Maritime Administration, SLU* and *the Swedish Forest Agency* highlight the importance of climate change adaptation within their respective areas, including monitoring damage to forests and data for adaptive natural resource management, weather

radar to assess and follow up on extreme weather both regionally and locally, and development and information needs within the forestry sector. *The Swedish National Heritage Board* supports the proposals in Control Station 2015 for a national competence centre for cultural environment issues, and emphasises the importance of the relevant agencies taking an intersectoral approach and considering the bigger picture. *Stockholm County Administrative Board* believes that research which evaluates the effects of various measures is of great importance. *Västerbotten County Administrative Board* is of the opinion that knowledge about a number of issues needs to be developed, particularly when it comes to synergy effects and consequences for complex systems in nature that affect biodiversity and ecosystem services, as well as future competition for water. *Jämtland County Administrative Board* proposes that the Government tasks the responsible bodies with documenting and evaluating – for learning and research purposes – social disruption that can be linked to climate change, and reviewing what can be improved within management and preparedness, as well as in preventive work, including an analysis of effects and costs that could arise in a changed climate. *Mariestad Municipality* believes that research is needed into how existing built-up areas should be managed, such as technological solutions. *Stockholm University* is of the opinion that there must be sufficient government funding for universities and colleges to apply in competition for funding for research focused on climate change adaptation. *The Confederation of Swedish Enterprise* believes that one problem regarding climate change adaptation is that the knowledge level is too low. Both in society as a whole and within industry in particular, there is a lack of knowledge about how we can expect to be affected by a changed climate.

The reasons for the Government's assessment: The Government's goal for its research policy is for Sweden to be one of the world's foremost research and innovation countries and a leading knowledge nation, where high-quality research, higher education and innovation promote the development and wellbeing of society, enhance the competitiveness of the business sector, and respond to the challenges faced by society, both in Sweden and globally (Govt Bill 2016/17:50). One starting point is to defend free research while at the same time ensuring that research policy addresses global and national social challenges. The work to limit emissions and to build resistance to climate change, as well as building a secure, inclusive and sustainable society, is highlighted as a prioritised area that research must address. In this bill, the Government announced its intention to establish national research programmes based on the highlighted social challenges. In May 2017, Formas was tasked with initiating and running both a ten-year national climate research programme and a ten-year national research programme for building a sustainable society (M2017/01282/Mm). These programmes shall promote socially relevant research on sustainable urban development, better climate change adaptation and the route towards a fossil-free Sweden. These initiatives involve an increase in Formas' appropriation of SEK 205 million. The Government believes that there is a real need for research that is close to application, not least in terms of how emissions can be reduced and society adapted to climate change in an effective and inclusive manner, while at the same time taking the individual's place within society into consideration.

There is ongoing cooperation between the various Nordic climate change adaptation portals and contact through the EU's climate change adaptation portal, Climate-ADAPT.

Within the EU, research funding for climate change adaptation can be applied for, and projects have been carried out from which further knowledge can be developed. These include the EU's Copernicus environmental data programme, which is a world leader in terms of collecting data about the Earth's climate and other global systems. Copernicus is a long-term focus that will provide reliable environmental information over time, making it possible to follow long-term trends such as changes to vegetation or water environments. The Swedish Agency for Marine and Water Management has produced the report 'Öppna data från Copernicus – Möjligheter för klimatanpassningen' ('Open data from Copernicus – Opportunities for climate change adaptation', HaV report 2017:31) to show how the programme's data and services can be used for climate change adaptation.

Through appropriation 1:10 Climate Change Adaptation within UO20, the Government is funding preventive and knowledge-enhancing initiatives. This involves a focus on landslide, flooding and erosion mapping, for instance, by the Swedish Geotechnical Institute and the Swedish Civil Contingencies Agency. SMHI is also carrying out knowledge-enhancing initiatives that are financed by the appropriation. SMHI has analysed the effects of climate change for the large lakes in Sweden, as well as the consequences for their use and development. SMHI has produced planning data on future sea levels for Sweden's coastlines. A method has also been developed for calculating the highest possible water levels for Sweden's coastlines, and tools for visualising sea levels have been presented. Other data to support municipalities' planning, for example, has been produced by organisations including the county administrative boards and the National Board of Housing, Building and Planning.

Knowledge and awareness of the need for climate change adaptation has increased among many players in recent years. However, important challenges still remain in relation to the need for information and knowledge, as well as knowledge-enhancing initiatives for implementing climate change adaptation measures. The growing body of knowledge needs to be made relevant and easily accessible for different target groups. Section 9.3 states that the National Board of Housing, Building and Planning will play a coordinating role in adapting housing and construction. This role involves coordinating the data that the expert authorities and research can provide. The Government also intends to task the National Board of Housing, Building and Planning with working in partnership with the National Knowledge Centre at SMHI to map the municipalities' needs for knowledge, guidance and combined planning data, as well as any measures that are needed in order to meet the municipalities' needs in terms of relevance and accessibility. The National Knowledge Centre at SMHI has been tasked with gathering, compiling and making knowledge about climate change adaptation available to other agencies, municipalities and society as a whole. The National Network for Adaptation is responsible for the climate change adaptation portal (www.klimatanpassning.se). The network consists of 18 agencies with sectoral and information responsibility for how society is affected by the current and future climate, together with 21 county administrative boards with responsibility for coordinating climate change adaptation work at regional level. The portal includes tools for working with climate change adaptation within various risk areas (e.g. landslides, heatwaves and flooding) or within different subject areas (e.g. sewage, buildings, cultural heritage and the natural environment). These tools include guides, guidance, checklists, method descriptions, maps and other visual tools. The Climate Change Adaptation Inquiry proposed that the National Board of Housing, Building and Planning

should be tasked with developing supervisory guidance regarding the risk of landslides and erosion. The National Board of Housing, Building and Planning was given this remit in the appropriation document for 2018. The aim is that this supervisory guidance should create the right conditions for new buildings to be sustainable in the long term, and for the county administrative boards' supervision to be coordinated and predictable. The Board will report on the remit of producing supervisory guidance regarding the risk of flooding in February 2018.

9.7 Certain climate change adaptation measures

9.7.1 Remit on specific risk areas for landslides, flooding and erosion that threaten communities, infrastructure and businesses

The Government's assessment: There is a need to identify specific risk areas in Sweden regarding landslides, flooding and erosion, and to rank them based on likelihood, potential consequences and specific problems. Attention may also need to be paid to risks relating to contaminated land or many other players being affected.

The reasons for the Government's assessment: Risks associated with landslides, flooding and erosion can potentially have very significant consequences for human life and health, for ecosystems, and for infrastructure, buildings and cultural heritage. In the 2018 Budget Bill, the Government proposed increasing appropriation 1:10 Climate Change Adaptation within UO 20 to make concrete measures possible for safeguarding the Göta River against landslides (see section 7.2). The problem in the Göta River valley affects several municipalities where the risk areas for landslides are in small municipalities which, in certain cases, only have limited opportunities to finance measures on their own. Measures would also benefit municipalities located downstream, as the effect of a landslide of contaminated land could potentially destroy the drinking water source for 700,000 inhabitants in the Gothenburg region.

It is of central importance to have knowledge about specific risk areas with potentially serious consequences, and where there may be obstacles to carrying out measures. Matters such as cross-border issues between different administrative areas, complex risks or a lack of technical solutions for measures and funding models may be problematic.

Dealing with the Göta River is an illustrative example. It has taken a long time to analyse the problem, discuss the distribution of responsibility and financing, and start a collaboration process for cooperation between local, regional and national levels and between different players. A national target for when the preparatory process should be complete and when concrete measures should have been begun would guide the work and ensure a sharper focus on the issue. Ten specifically susceptible areas for landslides are currently undergoing additional analyses to provide more detailed knowledge about the risks that exist. The Geological Survey of Sweden (SGU), the Swedish Geotechnical Institute (SGI) and the Swedish Civil Contingencies Agency (MSB) have carried out mapping of landslides, erosion and flooding.

Based on these in-depth analyses and mappings, nationally prioritised areas of particular importance or involving complex problems should be highlighted and action plans drawn up, including the distribution of responsibility and costs, as well as prioritisations regarding concrete initiatives based on the seriousness of potential consequences and with regard to specific risks regarding contaminated land.

9.7.2 Pilot study on analysing responsibility for taking adaptation measures

The Government's assessment: There is a need to analyse the distribution of responsibility for measures against flooding of agricultural land.

The Climate Change Adaptation Inquiry's assessment agrees in part with that of the Government.

The referral bodies: *Gothenburg Municipality, Jönköping Municipality and the county administrative boards of Stockholm, Skåne, Kalmar, Västra Götaland and Kronoberg* are of the opinion that a new inquiry should investigate issues relating to the distribution of responsibility and financing. A large number of referral bodies emphasise the importance of the national strategy investigating those areas that the report did not address. *Värmland County Administrative Board* lacks an analysis of responsibility conditions for water operations carried out at dams and hydropower plants, for example, and *Södermanland County Administrative Board* wishes to point out that it is also important to investigate responsibility conditions during periods of low water levels. When analysing water operations in line with a changed climate, the importance of the 'polluter pays' principle should be considered. *Jönköping Municipality* is of the opinion that the Inquiry is deferring much of the remit to future inquiries, and so the need to investigate the issue of responsibility remains.

The reasons for the Government's assessment: The Climate Change Adaptation Inquiry has restricted its remit to one of the six main areas identified by the Climate and Vulnerability Inquiry: buildings and structures. The Inquiry is of the opinion that corresponding work must also be carried out for the other main areas: communication, technical supply systems, agriculture and tourism, the natural environment and the environmental objectives, and human health. The Inquiry proposes that the national strategy to be drawn up should clarify how this work should be carried out.

In a specific statement in the report, the Swedish Board of Agriculture and the Swedish Forest Agency have emphasised that the questions of responsibility for measures against flooding affect the ground drainage and wastewater legislation. They believe that an inquiry on the responsibility for measures to limit flooding of agricultural ground should take both sets of legislation into account. The measures that need to be taken will have consequences for agricultural land, and any changes in this legislation may have consequences for agriculture. The Swedish Board of Agriculture has also pointed out the need to investigate the question of responsibility for adapting agricultural land in line with a changed climate with increasing flows. The Government believes that there is a need to analyse these questions more closely, and intends to task the Swedish Board of Agriculture with carrying out a pilot study on the distribution of responsibility for measures against

flooding of agricultural land. Within this pilot study, the Swedish Board of Agriculture shall obtain views from the National Board of Housing, Building and Planning, municipalities and other relevant agencies.

10 Consequences

10.1 Legislative proposal on requirements for risk assessment in the structure plan

The proposal involves a requirement for the municipalities to assess risks due to the effect of climate change on the built environment in the structure plan. The main aim of this requirement is that the municipalities should start working to assess the risks, draw up strategies and begin dialogue with residents. This should be seen as the beginning of the extremely important climate change adaptation of buildings.

If buildings are not adapted, this will lead to significant costs. The Climate and Vulnerability Inquiry estimated that the increased cost of damage as a result of flooding, landslides and erosion during the period 2010–2100 will total SEK 90–225 billion. In today's money (2016), this corresponds to SEK 98–245 billion. As a point of reference from an individual event, the cost of the damage due to torrential rain in Malmö in 2014 has been estimated at around SEK 600 million.

The proposal affects municipalities (including municipal autonomy), county administrative boards, individuals and businesses.

Municipalities

According to the principle of municipal funding, decisions that involve new mandatory tasks for municipalities should be accompanied by government funding. The risk assessment that will be carried out within the structure plan will involve increased work and thus also financial consequences for the municipalities. The principle of funding should therefore be applied. The Inquiry notes that assessing the impact of climate effects should be the most demanding work, and that ongoing updates should be possible at a considerably lower cost. The Inquiry is of the opinion that the initial analysis should not cost more than an average of SEK 500,000 per municipality. This cost has been calculated based on three municipalities' actual costs for drawing up a climate change adaptation plan or a climate and vulnerability analysis. According to the Inquiry, it should be possible to carry out a reassessment at 20 percent of the basic cost, i.e. an average of SEK 100,000 per municipality per mandate period.

Certain factors suggest that the municipalities' work will not increase to the extent estimated by the Inquiry. The municipalities should carry out the risk assessment based on existing data from county administrative boards and other public agencies. This includes the flood risk portal produced by the Swedish Civil Contingencies Agency, the mapping services for landslides produced by agencies including the Swedish Geotechnical Institute, and the risk overview for beach erosion produced by the Geological Survey of Sweden. The assessment shall also

be carried out at an overall level, and does not involve a requirement to analyse costs for adaptation measures as proposed by the Inquiry.

In order to carry out the initial risk assessment, the municipalities may however need to draw up additional documentation over and above the existing documentation. Effective initial work also provides a firm foundation for continued work. The Government therefore agrees with the Inquiry that remuneration per municipality for the initial assessment should total SEK 500,000. However, the reassessment of the risk assessment should generally be possible based on the initial assessment and with the support of existing data, and thus at a considerably lower cost than proposed by the Inquiry. The cost of updating the risk assessment is thus negligible. The municipalities do not therefore need to be assigned funding after 2022. It is proposed that the cost increase for which the municipalities are compensated should be charged to appropriation 1:10 Climate Change Adaptation within expenditure area 20. The Inquiry believes that both fundamental and practical reasons suggest a general government grant to be regulated through the level of appropriation 1.1 Economic equalisation for municipalities under expenditure area 25 being changed and assigned SEK 36,250,000 per year during the period 2019–2022.

Municipal autonomy

The proposal may involve a limitation on the municipal planning monopoly, and may thus also affect municipal autonomy. Chapter 14, Section 3 of the Instrument of Government establishes that a limitation on municipal autonomy should not go beyond what is necessary with regard to the purposes that have led to it. The risks of accidents, flooding and erosion are areas where the Government has retained its supervisory role, since the Government has overall responsibility for society's development and opportunities to intervene in issues of national importance. The proposed regulation involves the data for government supervision being broadened and deepened. In relation to this interest, the restriction of municipal autonomy cannot be deemed to extend beyond what is necessary in the sense referred to in the Instrument of Government.

County administrative boards

The proposal means that, through the consultation procedure on the structure plan, the county administrative boards shall contribute towards this analysis being sufficient and appropriate. At the same time, the municipalities' data will facilitate the county administrative boards' review of the municipalities' structure plans. The Government therefore believes that the county administrative boards' costs will not increase.

Individuals and businesses

By the municipalities reporting in the structure plan their assessment of the risks of damage to the built environment within the municipality and how the risks can be reduced or eliminated, individuals and businesses can gain increased knowledge about these risks. This creates better conditions for individuals and businesses to take preventive measures instead of dealing with damage after the event. The proposal also creates better conditions for avoiding risk areas when planning new buildings.

Overall assessment

Many studies point out that the cost of dealing with damage in the built environment as a result of landslides, erosion and flooding is considerably higher than the cost of taking preventive measures. The proposal that the municipalities should assess the risk of damage in the structure plan and present a strategy for reducing or eliminating the risks provides greater opportunities for taking preventive measures. The Government is therefore of the opinion that a somewhat increased government regulation within these areas is reasonable. Several agencies have produced freely available planning data to support such analyses that the municipalities must carry out as a result of this requirement. There are thus good conditions for the municipalities' work, but the Government is still of the opinion that the requirement will involve a certain increase in work contributions. The municipalities will therefore be remunerated through a general government grant averaging SEK 500,000 per municipality. This will be regulated through the level of appropriation 1.1 Economic equalisation for municipalities under expenditure area 25 being changed and assigned SEK 36,250,000 per year during the period 2019–2022. Appropriation 1:10 Climate Change Adaptation within expenditure area 20 will be reduced by corresponding amounts during the period 2019–2022.

10.2 Legislative proposal on site improvement permit obligation for regulating the ground's permeability

The proposal involves the municipality being able to decide in a detailed development plan that a site improvement permit is required for ground measures that may reduce the ground's permeability. The intention is that the site improvement permit obligation should lead to a higher degree of compliance for those detailed development plans containing provisions on the ground's permeability. The question of the ground's ability to deal with surface water may be of great importance in certain areas. A control option for ensuring compliance with the demands would improve the area's protection against flooding.

The overall aim of the proposal is that society should be better prepared for flooding as a result of torrential rain and heavy rainfall. The cost of damage due to such incidents can be high. As mentioned above, the costs relating to torrential rain in Malmö in 2014 were estimated by the Inquiry at around SEK 600 million. Insurers' costs for natural water damage that is primarily caused by high water levels, torrential rain or deficiencies in the sewage system totalled SEK 170–310 million per year during 2011–2013 and 2015. This does not include, for example, costs for rescue services or uninsured public buildings.

If no regulation is put in place, the situation will continue as it currently stands. The municipality can regulate the ground's permeability in detailed development plans. However, the building committee will not have the opportunity to check that this requirement has been complied with. The municipality will therefore lack the necessary overview of the proportion of hard surfaces within an area, and will also be unable to influence where and to what extent new hard surfaces are built. This may lead to worsened problems with flooding, and significant costs as a result.

The proposal affects municipalities, property owners, developers and testing authorities.

For municipalities, the proposal means that there may be more permit applications, leading to an increased workload. The economic consequences for the municipality are linked to the charge applied by the municipality for site improvement permits. The fee that the municipality can charge may be no greater than the average cost for the type of case. The municipalities' costs are therefore not deemed to increase as a result of the proposal. In addition, it is the municipality itself which governs when the permit application may apply.

Property owners and developers

For property owners and other developers, the proposal involves costs, in particular due to the fact that they may need to pay a permit fee. The application process also involves certain work contributions and takes up a certain amount of time for assessing applications and any appeals. However, this change does not involve any consequences for property owners in relation to what they have a right to do with their land, since there is already an opportunity to regulate the ground's permeability in detailed development plans.

Nevertheless, the possible consequences of the proposal for property owners must be weighed up against the benefits. A control option for ensuring compliance with the demands would improve the area's protection against flooding. This effect will also benefit property owners, since the risk of the property being affected by flooding is reduced.

Reviewing authorities

Site improvement permit cases can be appealed to the county administrative board and then to a court of law. The reviewing authorities are thus affected by the proposal, since it involves increasing the site improvement permit obligation to include ground measures that may reduce the ground's permeability. The opportunity to introduce a site improvement permit obligation only applies to new or amended detailed development plans. Adopting or amending a detailed development plan can take anything from almost a year to several years. It will also take time for the municipality's building committee to review the site improvement permit application as the body of first instance. The Government is of the opinion that it is primarily in more built-up areas that the ground's permeability may be of such significance that there is reason to introduce a site improvement permit obligation. There can thus be expected to be very few cases during the few years after the change in legislation has entered into force, before subsequently increasing somewhat while still remaining relatively low in number. The Government is therefore of the opinion that the increasing number of cases is something that the reviewing authorities will be able to cope with using existing resources.

Overall assessment

Overall, the Government believes that the opportunity to introduce a permit process for measures that may reduce the ground's permeability is of such importance for surface water management that the advantages clearly outweigh the disadvantages that the proposal may involve for certain property owners through them being obliged to apply for a permit.

11 Statute comments

Proposal for changes to the Planning and Building Act (2010:900)

Chapter 3 Structure plan

Section 5 The structure plan shall detail

1. the basic elements in connection with the matter of the intended use of land and water areas,
2. the municipality's views on how the built environment should be used, developed and preserved,
3. how the municipality intends to satisfy the reported national interests and follow applicable environmental quality norms,
4. how the municipality intends – within physical planning – to take into account and coordinate the structure plan with relevant national and regional objectives, plans and programmes of significance for sustainable development within the municipality,
5. how the municipality intends to satisfy the long-term need for housing,
6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code, *and*
7. *the municipality's views on the risk of damage to the built environment as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated.*

This paragraph, which governs what shall be detailed in a structure plan, has been amended with the addition of a new *seventh point*. The considerations can also be found in section 4.2. The provisions have been structured in accordance with Council on Legislation's proposal.

According to *the seventh point*, the municipality should provide its views in the structure plan on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated.

The expression "the built environment" refers to the same thing as in the second point. The municipality's report on its view of these risks should be at an overall level. The assessment should relate to the risk that damage to the built environment may occur in both the short term and the longer term (cf. Chapter 3, Section 2). The provision is thus forward-looking, and does not include damage that can be attributed to flooding, landslides and erosion and that has already occurred. The assessment shall be carried out based on existing relevant data, such as geological, geotechnical and topographical data, as well as the sea level rise, flooding and landslide mapping held by county administrative boards and other agencies. In certain cases, additional data may be needed, for example from the Swedish Transport Administration if state infrastructure is located in a risk area. The assessment should be adapted according to the municipality's geographic conditions and building structure. The assessment need not relate to individual buildings or facilities.

The expression "climate-related" means that it should be matter of flooding, landslides or erosion as a consequence of processes that are due to the climate, for example precipitation or high water flows. However, it

Chapter 9 Building permits, demolition permits and site improvement permits, etc.

Site improvement permits

Section 12 *A site improvement permit is required if the municipality has decided this in the detailed development plan, for*

- 1. tree felling,*
- 2. forest planting, and*
- 3. ground measures that may reduce the ground's permeability.*

Despite what is stated in the first paragraph, point 3, a site improvement permit is not required for measures taken to build a street, road or railway on land that may be used for this purpose in accordance with the detailed development plan.

This paragraph, together with Chapter 9, Sections 11 and 13, regulates the scope of the site improvement permit obligation. The considerations can also be found in section 4.3. The provisions have been structured in accordance with the Council on Legislation's proposal.

In *the first paragraph, point 3*, an opportunity has been introduced to decide in a detailed development plan that a site improvement permit is required for ground measures that may reduce the ground's permeability, i.e. that may make it harder for water to enter the ground. Examples of such ground measures including making surfaces hard, for instance asphaltting plots that were not previously asphalted or replacing natural grass with artificial grass. Otherwise, the provision has only been amended in editorial terms, and no factual change in relation to what previously applied is intended.

The second paragraph is new, and involves a limitation on the opportunity to impose requirements on site improvement permits in accordance with the first paragraph.

The municipality may not thus decide that a site improvement permit is required for measures taken to build a street, road or railway on land that has been set aside for this purpose in the plan, even if the measure may reduce the ground's permeability. The expression "measures taken to build" refers to all measures needed to build a street, road or railway, i.e. including measures taken outside the land that has been set aside in the plan for the purpose in question. For example, this may involve protective measures for preventing oil leaks from the road or temporary arrangements, such as construction roads, during the construction period.

The words "road" and "railway" have the same meaning as in the Road Law (1971:948) and the Railway Construction Act (1995:1649).

Summary of the report ‘Vem har ansvaret?’ (‘Who is responsible?’)

Here is a summary of the report ‘Vem har ansvaret?’ (‘Who is responsible?’) (SOU 2017:42) to the extent that it refers to the legislative proposal.

Analysis requirements in the structure plan

The Inquiry proposes that an explicit requirement should be added for municipalities to specify an analysis in the structure plan on the risks of flooding, landslides and erosion for buildings and structures, and a strategy for how such damage can be reduced or prevented. The main aim of this requirement for such an analysis is that the work to assess the risks and to identify a strategy will be started, and that a dialogue will be initiated with the municipality’s members. The Inquiry’s assessment is that such a requirement for the municipalities may be a powerful first step towards the necessary climate change adaptation. The aim is not to make it harder for new buildings to be built, but to make it easier for sustainable new buildings to be built. This can be achieved, for example, through the municipalities taking a position at an overall level and at an early stage on which areas are suitable for new buildings, which areas should not be built on, and which areas can be built on provided that various protective measures are initiated. The entire analysis should be financed by government grants. The total amount is expected to be SEK 145 million.

Opportunity for site improvement permits when making changes to the shape of the ground surface

The Inquiry proposes that an opportunity be added to the Planning and Building Act (2010:900) for the municipality to decide in the detailed development plan that a site improvement permit is required for certain changes to the shape of the ground surface.

The aim of the proposal is that the municipality should have a better opportunity to ensure compliance with a regulation of the ground surface. For example, this could involve a regulation on a certain proportion of hard surfaces. The proportion of hard ground within an area is of great importance for drainage conditions. Better control of compliance with this issue will therefore bring advantages for surface water management.

The report's legislative proposal

It is hereby stipulated in relation to the Planning and Building Act (2010:900) that Chapter 3 Section 5 and Chapter 9 Section 12 should have the following wording:

Current wording

Proposed wording

Chapter 3

Section 5

The structure plan shall detail

1. the basic elements in connection with the matter of the intended use of land and water areas,
 2. the municipality's views on how the built environment should be used, developed and preserved,
 3. how the municipality intends to satisfy the reported national interests and follow applicable environmental quality norms,
 4. how the municipality intends – within physical planning – to take into account and coordinate the structure plan with relevant national and regional objectives, plans and programmes of significance for sustainable development within the municipality,
 5. how the municipality intends to satisfy the long-term need for housing, *and*
 6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code.
5. how the municipality intends to satisfy the long-term need for housing,
 6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code, *and*
 7. *the municipality's views on the risk of damage to buildings and structures due to flooding, landslides and erosion, and how these risks can be reduced or eliminated.*

Chapter 9

Section 12

A site improvement permit is required for tree felling *and* forest planting within an area with a detailed development plan, if the municipality has decided this in the plan.

A site improvement permit is required for tree felling, forest planting *and changes to the shape of the ground surface* within an area with a detailed development plan, if the municipality has decided this in the plan.

List of referral bodies

The Structure Plan Inquiry (N 2017:02), Svea Court of Appeal (Land and Environment Court of Appeal), Nacka District Court (Land and Environment Court), Vänersborg District Court (Land and Environment Court), Östersund District Court (Land and Environment Court), the Swedish Armed Forces, the Swedish Civil Contingencies Agency, the Swedish Coast Guard, the Public Health Agency of Sweden, the National Board of Housing, Building and Planning, the National Property Board of Sweden, the National Institute of Economic Research, the Swedish Fortifications Agency, the Swedish Agency for Public Management, Stockholm County Administrative Board, Uppsala County Administrative Board, Södermanland County Administrative Board, Östergötland County Administrative Board, Jönköping County Administrative Board, Kronoberg County Administrative Board, Kalmar County Administrative Board, Gotland County Administrative Board, Blekinge County Administrative Board, Skåne County Administrative Board, Halland County Administrative Board, Västra Götaland County Administrative Board, Värmland County Administrative Board, Örebro County Administrative Board, Västmanland County Administrative Board, Dalarna County Administrative Board, Gävleborg County Administrative Board, Västernorrland County Administrative Board, Jämtland County Administrative Board, Västerbotten County Administrative Board, Norrbotten County Administrative Board, the Royal Institute of Technology (KTH), Uppsala University, Linköping University, Lund University, Blekinge Institute of Technology, the University of Gothenburg, the Swedish Forest Agency, the Swedish Board of Agriculture, the National Veterinary Institute, the National Food Agency, the Swedish Agency for Marine and Water Management, the Sami Parliament, the Swedish Environmental Protection Agency, the Swedish Foundation for Strategic Environmental Research (Mistra), the Swedish Geotechnical Institute (SGI), the Swedish Meteorological and Hydrological Institute (SMHI), the Swedish Mapping, Cadastral and Land Registration Authority, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), the Swedish Transport Administration, the Swedish Maritime Administration, the Geological Survey of Sweden (SGU), the Swedish Governmental Agency for Innovation Systems (VINNOVA), the Swedish Agency for Economic and Regional Growth, Svenska Kraftnät, the Swedish Energy Agency, the Swedish Better Regulation Council, the Swedish Consumer Agency, the Swedish National Heritage Board, Arvika Municipality, Borgholm Municipality, Danderyd Municipality, Falkenberg Municipality, Falun Municipality, Gullspång Municipality, Gothenburg Municipality, Hallsberg Municipality, Haninge Municipality, Jönköping Municipality, Karlstad Municipality, Kristianstad Municipality, Kävlinge Municipality, Laxå Municipality, Lidköping Municipality, Ljusdal Municipality, Lomma Municipality, Lysekil Municipality, Malmö Municipality, Mariestad Municipality, Mölndal Municipality, Nynäshamn Municipality, Stockholm Municipality, Vellinge Municipality, Vännäs Municipality, Ystad Municipality, Åre Municipality, Älvkarleby Municipality, Örebro Municipality, Örnsköldsvik Municipality, the Church of Sweden, the Swedish Association of Local Authorities and Regions (SALAR), the Swedish Society for Nature Conservation, the Confederation of Swedish Enterprise, the Federation of Swedish Farmers (LRF), Swedish Water, the Board of Swedish Industry and Commerce for Better Regulation (NNR), Swedish Construction Clients, the Swedish Property Federation, the Swedish Society for Town and Country Planning, Sweden's Building Permit Reviewers and Building Department Secretary Association (FSBS), the Swedish Public Works Association (SPWA), If Skadeförsäkring, the Swedish Centre for Innovation and Quality in the Built Environment, IVL Swedish Environmental Research Institute, the Länsförsäkringar Alliance, SmåKom, Stockholm Water, Insurance Sweden, the Swedish Association of Public Housing Companies (SABO), the Swedish Association of Architects, the Swedish Construction Federation, the Swedish Homeowners Association, the World Wide Fund for Nature (WWF).

Comments have also been received from Ängelholm Municipality and the Swedish National Tenant-Owner Cooperative Housing Association.

Govt Bill 2017/18:163
Appendix 3

The legislative proposal referred to the Council on Legislation for consideration

It is hereby stipulated that Chapter 3, Section 5 and Chapter 9, Section 12 of the Planning and Building Act (2010:900) should have the following wording:

Current wording

Proposed wording

Chapter 3

Section 5²

The structure plan shall detail

1. the basic elements in connection with the matter of the intended use of land and water areas,

2. the municipality's views on how the built environment should be used, developed and preserved,

3. how the municipality intends to satisfy the reported national interests and follow applicable environmental quality norms,

4. how the municipality intends – within physical planning – to take into account and coordinate the structure plan with relevant national and regional objectives, plans and programmes of significance for sustainable development within the municipality,

5. how the municipality intends to satisfy the long-term need for housing, *and*

6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code.

5. how the municipality intends to satisfy the long-term need for housing,

6. such areas for rural development in coastal locations as referred to in Chapter 7, Section 18 e, first paragraph of the Environmental Code, *and*

7. the municipality's views on the risk of damage to the built environment as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated.

Chapter 9

Section 12

A site improvement permit is required for *tree felling and forest planting within an area with a detailed development plan, if the municipality has decided this in the plan.*

The municipality may decide in the detailed development plan that a site improvement permit is required for

- 1. tree felling,*
- 2. forest planting, and*

² Most recent wording 2014:224.

3. ground measures that may reduce the ground's permeability. Govt Bill 2017/18:163
Appendix 4

Point 3 does not apply to measures taken to build a street, road or railway on land that may be used for this purpose in accordance with the detailed development plan.

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1. This Act enters into force on 1 July 2018.
 2. Older regulations still apply to cases of adopting or amending a structure plan where this has been commenced before entering into force.

The Council on Legislation's statement

Extracts from the minutes taken at a meeting held on 13 February 2018

Present: Former Justices of the Supreme Court Gustaf Sandström and Christer Silfverberg, and Justice of the Supreme Court Anders Eka

Improving municipalities' preparedness for climate change

In accordance with a proposal referred to the Council on Legislation for consideration on 8 February 2018, the Government (the Ministry of the Environment and Energy) has decided to obtain the Council on Legislation's statement on a proposed act on changes to the Planning and Building Act (2010:900).

This proposal has been presented to the Council on Legislation by legal expert Christoffer Sheats.

The proposal resulted in the following statement from *the Council on Legislation*:

Chapter 3 Section 5

Chapter 2, Section 5, first paragraph, point 5 requires that in planning, for example, buildings and structures are located on ground that is suitable for the purpose in view of the risk of accidents, flooding and erosion. According to Chapter 3, Section 4, the municipality should report in the structure plan how, for example, the public interest will be satisfied.

The abovementioned provisions do not relate to the built environment, but the paragraph in question does. According to point 7, "the structure plan shall detail... the municipality's views on the risk of damage to the built environment that may occur as a result of climate-related flooding, landslides and erosion, and on how such risks can be reduced or eliminated."

The proposed legislative text and statute comments do not clearly state that the future damage referred to does not relate to such damage that can be attributed to climate-related flooding, etc., that has already occurred, but – as expressed in the general motivation – to "climate effects that can be expected to occur in the near future... [and] climate effects that can be expected from a longer term perspective."

The Council on Legislation proposes that the words "as a result of" should be replaced by "that may occur as a result of" to emphasise that the provision is forward-looking in this way.

Chapter 9 Section 12

In the presentation, based on alternatives offered by the reporter, there has been discussion on wording of the legislative text that more closely follows the current wording of the paragraph and of other provisions on

site improvement permits (Chapter 9, Sections 11 and 13). Such an adaptation can be achieved if the legislative text has the following wording.

Govt Bill 2017/18:163
Appendix 5

A site improvement permit is required if the municipality has decided this in the detailed development plan, for

1. tree felling,
2. forest planting, and
3. ground measures that may reduce the ground's permeability.

Despite what is stated in the first paragraph, point 3, a site improvement permit is not required for measures taken to build a street, road or railway on land that may be used for this purpose in accordance with the detailed development plan.

Ministry of the Environment and Energy

Extracts from the minutes taken at a Government meeting held on 8 March 2018

Attendees: Prime Minister Löfven, chairman, and ministers Lövin, Wallström, Y Johansson, Baylan, Bucht, Hultqvist, Regnér, Andersson, Hellmark Knutsson, Bolund, Damberg, Bah Kuhnke, Strandhäll, Shekarabi, Fridolin, Eriksson, Linde, Skog, Ekström and Eneroth

Presenter: Minister Skog

The Government adopts the National Strategy for Climate Change Adaptation Bill