

Too Much Water is just as Problematic as Too Little Water, an Example from the Flooding of the Village Nesbyen in Norway August 2023

Arild SUNDE, Norway

Key words: Flooding disasters, Map analyses, Organisation, Compensation to Landowners

1. SUMMARY

We are experiencing major climate change all over the world and storms, torrential rain, floods, etc. create challenges for local communities, food-producing areas and public health. In August 2023, southern Norway was hit by storm "Hans" with a lot of precipitation in a short time that led to major destruction. The village of Nesbyen experienced a major flood when the Hallingdal river flooded parts of the municipal center. The article describes the process for the protection measures that are planned, primary by establishing flood embankments around the village and in this way securing vital municipal city center functions, life and property in the event of a new crisis. Flood-affected buildings outside the flood embankment will not be allowed to be rebuilt without flood protection. The example from Nesbyen has given us a description of how to organize the protection of other local communities against similar natural disasters.

SUMMARY IN NORWEGIAN

Tittel: For mye vann er like problematisk som for lite vann, eksempel fra flommen i tettstedet Nesbyen, Norge i august 2023

Vi opplever store klimaendringer over hele verden, og stormer, kraftig regn, flom osv. skaper utfordringer for lokalsamfunn, matproduserende områder og folkehelsen. I august 2023 ble Sør-Norge rammet av stormen "Hans" med mye nedbør på kort tid som førte til store ødeleggelser. Tettstedet Nesbyen opplevde en stor flom da Hallingdalselva oversvømte deler av kommunesenteret. Artikkelen beskriver prosessen rundt de beskyttelsestiltakene som er planlagt primært ved å etablere flomvoller rundt landsbyen og dermed sikre viktige kommunale funksjoner, liv og eiendom i tilfelle en ny krisesituasjon. Flomrammede bygninger utenfor flomvollen vil ikke bli tillatt gjenoppbygd, og grunneiere må gi fra seg eiendom mot økonomisk kompensasjon. Eksempelet fra Nesbyen har gitt oss en beskrivelse av hvordan man kan organisere arbeidet med å beskytte også andre lokalsamfunn mot lignende naturkatastrofer.

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2. CLIMATE CHANGE

We are experiencing major climate change all over the world and storms, torrential rain, floods, etc. create challenges for local communities, food-producing areas, public health, etc. The same is happening in Norway, where we are experiencing more extreme weather with more often large amounts of precipitation and strong winds.

This article shows how to organize the work, implement measures and secure a local community against future flood events.

1.1. Weather statistics

The Norwegian Meteorological Institute has about 230 weather stations at its disposal on the mainland of Norway. In addition, there are almost 400 precipitation stations. These figures, together with other information, form the basis for analyses of how water volumes can affect different geographical areas.

1.2. Map analyses

Based on weather statistics, specific measurement points in watercourses, remote sensing from drones, aircraft and satellites, etc., it is possible to use geographical information systems (GIS) to prepare maps that show the extent of a flood for a given recurrence interval; 10-, 20-, 50-, 100-, 200-, 500- and even a 1000-year flood. Flood maps show zone areas that are flooded at different flood-sizes (recurrence intervals). In addition, the flood maps show protected areas where it can flood if the protection fails and where the terrain indicates that there is a potential for flooding. Flood events maps show registered floods in recent years.

A similar method was used to reconstruct a flood from a glacial lake pond at the end of the last ice age. At this time, a giant pond of ice had established itself in upper southern Norway. When the dam burst, this caused a gigantic flood that shaped much of the landscape we have today. In Norway, the consulting company Norconsult Norway AS, in collaboration with the Geological Survey of Norway and the University of Oslo, has prepared a map analysis to look at how this collapse affected the watercourse and the landscape on the lower side of this dam.

The article describes how this natural disaster about 10,400 years ago affected the whole of eastern southern Norway. (Aurland, K, Hagaas, Longva, O and Schuler T, 2024).

By studying the effect of this event, it is possible to ensure the quality of models that can describe how similar flood disasters can affect a watercourse today.

3. THE 100-YEARS STORM "HANS"

In August 2023, southern Norway was hit by storm "Hans" with a lot of precipitation in a short time and which led to major destruction. This flood is characterized as a 100-year flood and in some geographical areas as a 200-year flood. The incident caused damage of approximately NOK 7.4 billion or approximately USD 740 million.

3.1. Specifically, about Hallingdal

The Hallingdal watercourse is approximately 4230 km² in size and is located at relatively high altitude with considerable snow storage throughout the winter. Flooding is most frequent in the spring and less frequent flooding in summer and autumn. The watercourse is regulated with several hydropower plants.

3.2. Specifically, about the village of Nesbyen

The village of Nesbyen in Hallingdal experienced during "Hans" that the Hallingdal river flooded parts of the municipal centre. The 2023 storm was classified as a 100-year flood, partly a 200-years flood and caused damage to several buildings and agricultural land.

The watercourse at Nesbyen is regulated for hydropower, and without such regulation, the damage would have been greater. Without such regulation of the watercourse, the water level during the major flood "Hans" would have been 0.5-1.0 meters above the registered water level. This would have led to a significant doubling of flood damage. (Bratlie, R, Walløe K L and Halvorsen K. 2024)

4. THE WORK TO SECURE NESBYEN

Work is now underway to flood-proof Nesbyen so that it can withstand a 200-year flood with an additional precaution caused by the climate impact.

4.1. Map analyses carried out by NVE

The Norwegian Water Resources and Energy Directorate (NVE) are responsible for, among other things, flood safety in Norway. After the major flood in 2023, NVE carried out a new flood calculation in May 2024. (Trondsen, and Holmqvist E. 2024).

This calculation was the basis for an update of flood zone maps in the Hallingdal watercourse in 2025. (Starkloff, T. 2025)

A 20% climate surcharge was then added on most of the calculated flood sizes, for some smaller tributaries a 40% surcharge was recommended.

These flood calculations formed the premises for the flood zone map that is currently applicable to Nesbyen and indicates the heights necessary to secure the village against a future 20-, 200- and 1000-year flood. It is the flood zone map that formed the basis for the measures that NVE and the municipality wanted to implement to secure the city centre areas.

4.2. Plan to secure key areas

The protection work is planned to be done by planning for flood embankments along a side-river and around the village towards the main Hallingdal River. In this way, vital municipal city centre functions, residential- and commercial areas and land for further development can be secured in the event of a new flood situation. Flood-affected buildings outside the flood embankment will not be allowed to be rebuilt by the municipality, pursuant to the Norwegian Planning and Building Act. Landowners must accept acquisition of construction areas for the flood embankments, in return of compensation from the municipality.

Flood exposed buildings located outside the flood embankment, will not be allowed to be rebuilt.

The NVE is now working to finalise the tender documentation for the flood protection work and will announce this out to a public tender in the autumn of 2026. Construction work is planned to start in 2027.

4.3. Zoning plan

Planning for flood protection in Nesbyen, have been initiated through several zoning plans. A zoning plan-description for the village centre area (Nesflata) was prepared in March 2025 and describes how to secure the village against a 200-year flood with an additional precaution caused by the climate impact. (Larsen, Henning. 2025)

The solution is a flood embankment of approximately 1.5 km in length, 3-5 metres high and with a width of between approximately 15 and 25 metres. In total, the flood embankment will occupy around 25,700 m² (2.57 ha) of agricultural land and residential properties. The zoning plan facilitates an important initiative for the local community that will protect the village centre from flooding. It is expected that the plan will be adopted in 2026.

Furthermore, it has been initiated a zoning plan for the side-river called Rukkedøla. It is also necessary to establish a flood embankment along this watercourse, to protect the centre of Nesbyen. This zoning plan is being prepared and will be adopted at the same time as the plan for the village centre.

4.4. Land acquisition

In total, the zoning plans affects directly 3 commercial properties, 6 agricultural properties and 26 residential properties. Of these, there are 4 residential properties that were badly damaged by the flood during "Hans", in which will not be allowed to be rebuilt.

The municipality is in process for entering into agreements with the affected landowners and this is being carried out in collaboration with the consulting company Norconsult Norway AS.

5. FUNDING

The flood embankment will be built as a collaboration between NVE and Nesbyen municipality and is mainly financed by these two institutions. In addition, some residential buildings affected by the flood embankment will not be allowed to be rebuilt. The owners will receive full compensation from their insurance company, and the buildings will be demolished. The plot will be transferred to the municipality. In this way the insurance companies will also contribute in financing the project.

It is calculated that entire project has an estimated cost of NOK 400 million or approximately USD 40 million.

5.1. State funds

The main cost of the measure is the construction of the flood embankments. Engineering, project management and construction costs are covered by the Norwegian State through NVE. So far, NOK 300 million or USD 30 million is secured through the National Budget in Norway.

5.2. Norwegian Natural Perils Pool

Natural perils insurance is a compulsory cover linked to fire insurance of buildings in Norway. All insurers providing fire cover in Norway must be members of the Pool. This is a national compensation scheme to compensate for natural damage that is not covered by the policyholder's regular insurance. Typical costs that are covered are loss of crops, damage to cultivated land, restoration of areas, etc.

The Natural Perils Pool will not directly contribute to the financing of the flood protection, only compensate for any remaining loss for landowners after all other measures and insurance payments have been made.

5.3. Private insurance

Properties that were affected by flood damage are normally insured by a private insurance company. After the flood in 2023, several buildings were water damaged and the buildings that were within a 200-year flood were all given a building and property-dividing ban by the municipality. Without flood protection, these properties will not be allowed to be rebuilt.

After some discussion, with the help of the municipality, it was agreed between the private insurance companies and the policyholders that all buildings that will not be protected by the flood measures should be redeemed. This means that the policyholder must relinquish the property in exchange for being compensated equivalent to building a new home on a new plot. This will also apply to the properties that will be affected by the flood embankments itself. However, this is a beneficial financial arrangement for the policyholder and ensures that they are fully compensated for their properties.

Approximately 25 residential properties affected by the flood, will be protected by the flood embankments. With an average compensation to the landowners of approximately NOK 5 million, the possible total cost for the insurance companies without flood protection was up to NOK 125 million or USD 12,5 million. According to this, the project is also beneficial for the insurance companies.

4 buildings affected by the flood embankments will not be rebuilt but demolished by the insurance company. The plots will be transferred to the municipality from the insurance companies. This means that the municipality secures construction areas for parts of the flood embankments, financed by the insurance companies.

5.4. Municipalities

Nesbyen municipality must finance the land acquisition, costs for land use planning, emergency preparedness, building applications, technical infrastructure, etc. The total costs for the municipality is estimated at NOK 30-50 million or USD 3-5 million. A significant part of this is compensation to affected landowners of the flood embankments, especially over cultivated land.

After construction, the municipality will be responsible for the management, operation and maintenance of the flood protection system.

5.5. Landowners

Some landowners must give up land for flood embankments etc. Those of the landowners who will have areas within the flood embankment, will be protected against flooding. These properties will have good opportunities to be developed, which can increase their property values. This benefit can be deducted in the event of compensation for the project. So far, no actions have been taken to make such a claim.

6. EXPERIENCES

The municipality, the insurance companies, the landowners and the state through NVE have all contributed to securing Nesbyen village against future floods.

6.1. Organization

It was crucial that the municipality took the lead in promoting this project politically. Furthermore, it was important that the municipality took leadership for getting the flood protection implemented. The municipality's initiative led to the government being positive about allocating funds to NVE, so that the project could be realized. Specifically, this was ensured through substantial allocations through the National Budget.

A collaboration was then quickly established between the municipality and NVE to ensure progress in the project.

6.2. The municipality as a premise provider

The municipality is the planning authority. They chose to impose a comprehensive construction and property-dividing ban on all damaged properties that are at risk of being hit by a new flood without flood protection. As a result, damaged buildings were not granted building permits for reconstruction. Since these buildings could not be repaired and could not be used without repair, the conclusion was that they had to be redeemed entirely.

Buildings that were damaged but are located within the planned flood embankment were allowed to be rebuilt. This was an economical beneficial solution for the insurance companies, as the alternative to flood embankment was that none of the affected buildings would have been allowed to be rebuilt and with a significantly higher amount of compensation to the affected landowners.

The municipality is the initiator of the regulation of the flood embankments, and the plans also facilitate a development of Nesbyen centre within the flood embankment. This ensures further expansion and growth in the municipal centre.

6.3. Success factors

In this case, there has been extensive cooperation between NVE, the municipality, the insurance companies and landowners. Through such cooperation, access to state investment funds has been secured and facilitated the reconstruction of several buildings that will be protected by the flood embankments. Furthermore, the municipality's strict policy of not granting building permits to flood-prone buildings has been an important part of the solution.

The process has not been carried out without conflicts of interest, but a balanced solution has been found that will secure the village centre of Nesbyen.

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BIOGRAPHICAL NOTES

Master degree of Property from the Norwegian Environmental and Biotechnology University at Ås, Norway. Bachelor in Nature and Environmental Protection from Telemark University College in Bø, Norway. Legal studies at the University of Oslo.

31 years of land acquisition experience, land consolidation, surveying and property valuation. He has broad management experience.

Professional experience from the Ministry of Agriculture, government agencies as well as the Land Consolidation Court. Managed a private consulting company for 22 years.

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