
Voss herad
Handling and Mitigation of a Flood Event
- before, during and after
Bjørg Lirhus Ree
Driftsavdelinga
Voss herad
VOSS
bygd for sterke opplevingar

Voss herad

Voss Municipality

- Area: 2042 km^2
- 16 211 inhabitants

Transport hub in the region:	
Railway	
European road	91 km
National road	86 km
County road	195 km
Municipal road	310 km
Private road	686 km

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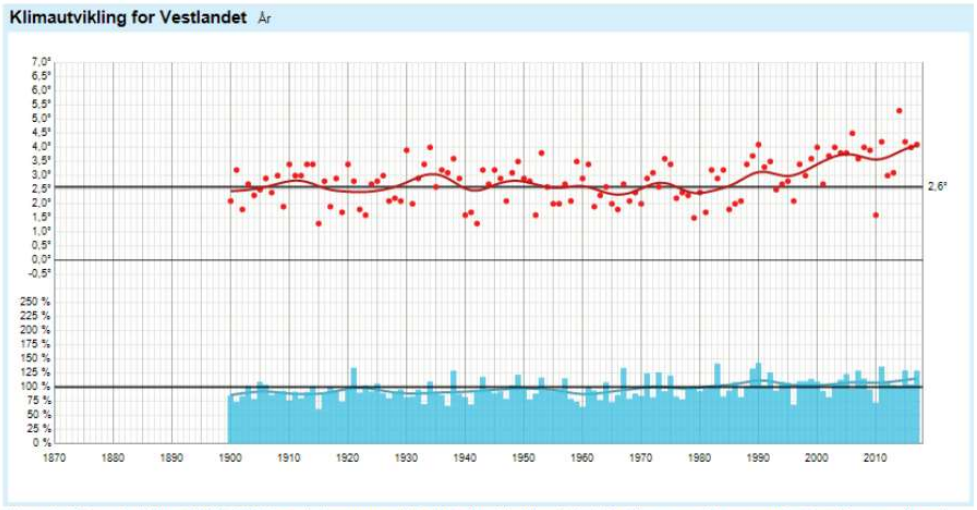
Climate

Climate change allowance 40 %

- West – coastal climate
- East – inland climate
- Vossevangen 5,8 °C / 1330 millimeters/year

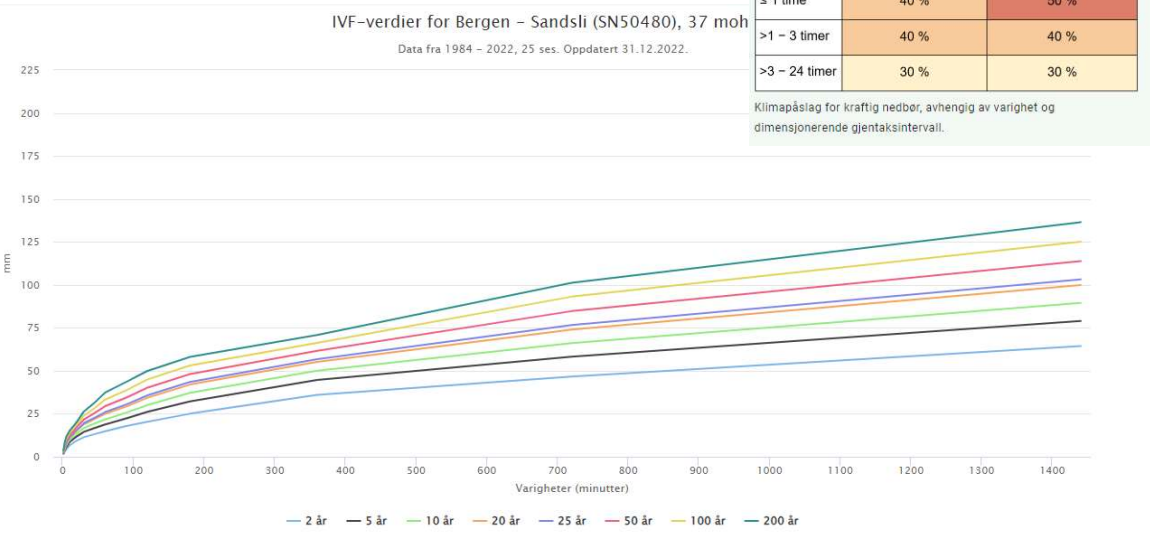


Figur 5. Klimautvikling 1900-2017 med gjennomsnittsdata for Vestlandet, data fra yr.no. Temperatur i rødt og nedbør i blått, trendlinjer er glattet over 10 år.

NVE report 44/2019

	Dimensjonerende gjentaksintervall < 50 år	Dimensjonerende gjentaksintervall ≥ 50 år
≤ 1 time	40 %	50 %
>1 – 3 timer	40 %	40 %
>3 – 24 timer	30 %	30 %

Klimapåslag for kraftig nedbør, avhengig av varighet og dimensjonerende gjentaksintervall.



www.klimaservisesenter.no

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CLIMATE IN NORWAY 2100

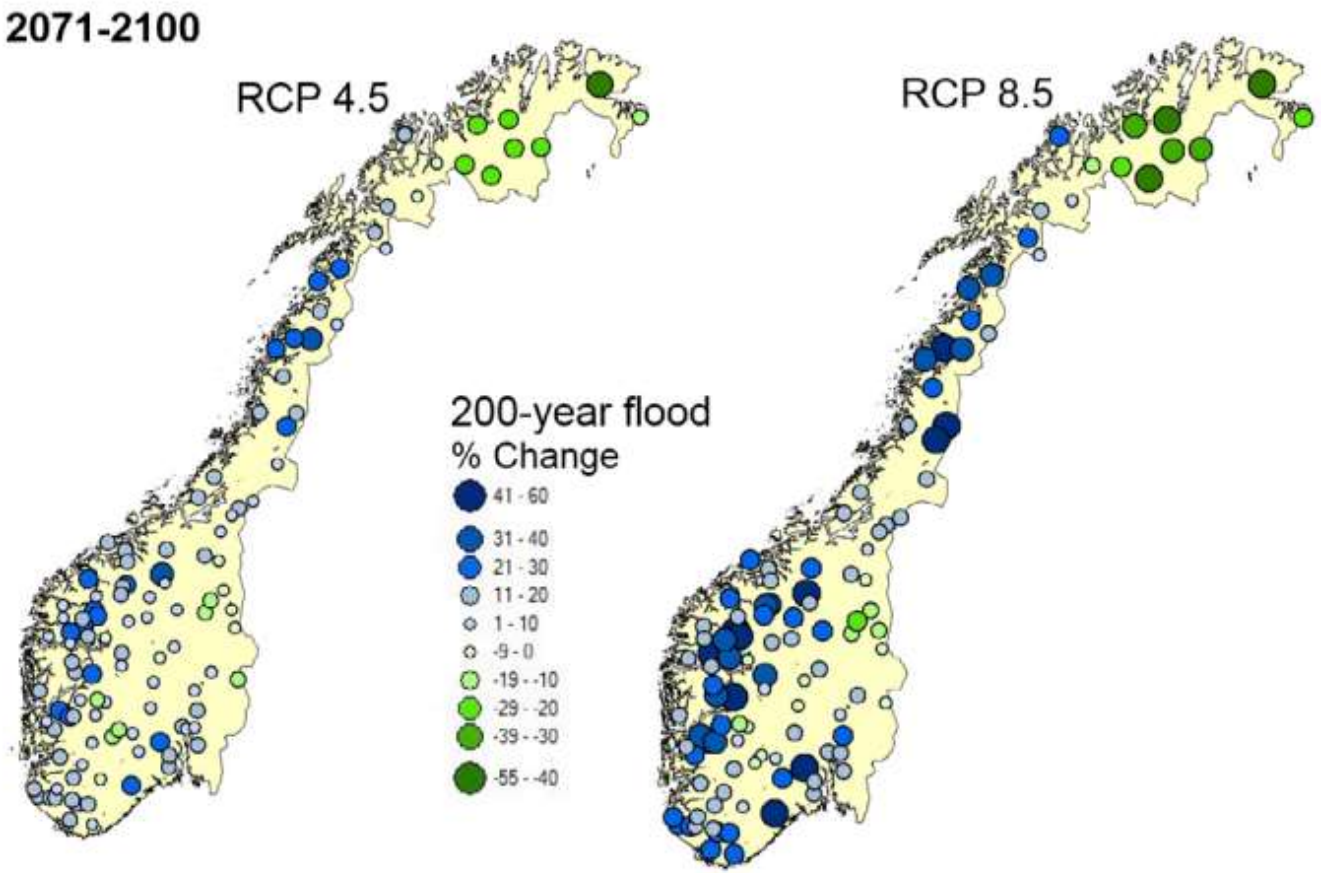

Figure 4.5 Percentage change in the 200-year flood for medium (RCP4.5) and high (RCP8.5) emissions. Green indicates a reduction and blue an increase in flood magnitude.

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https://klimaservicesenter.no/

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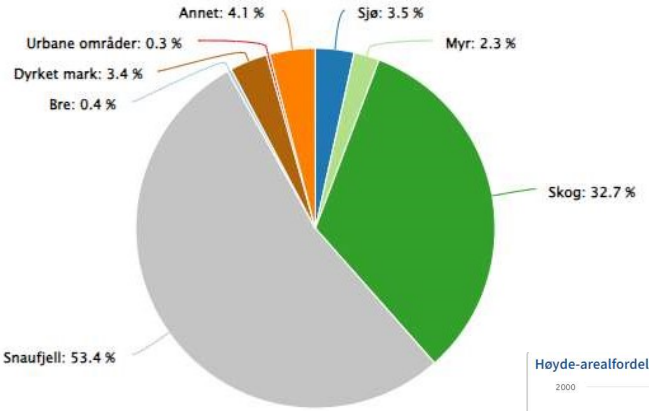
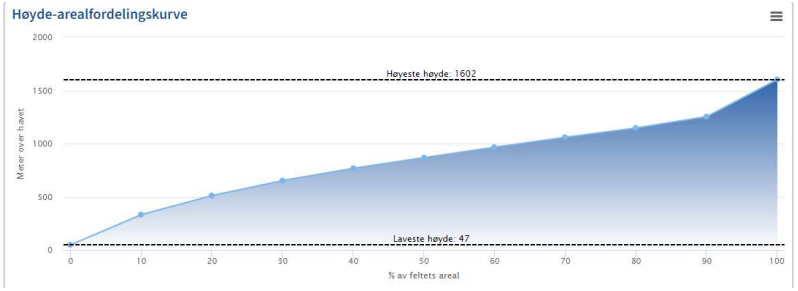
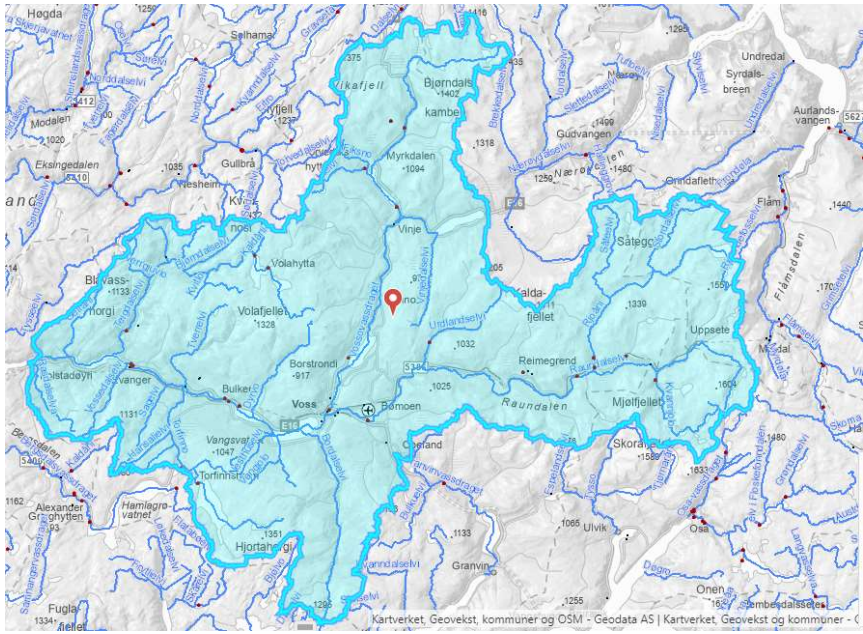
062.Z Vossovassdraget (Vosso River system)

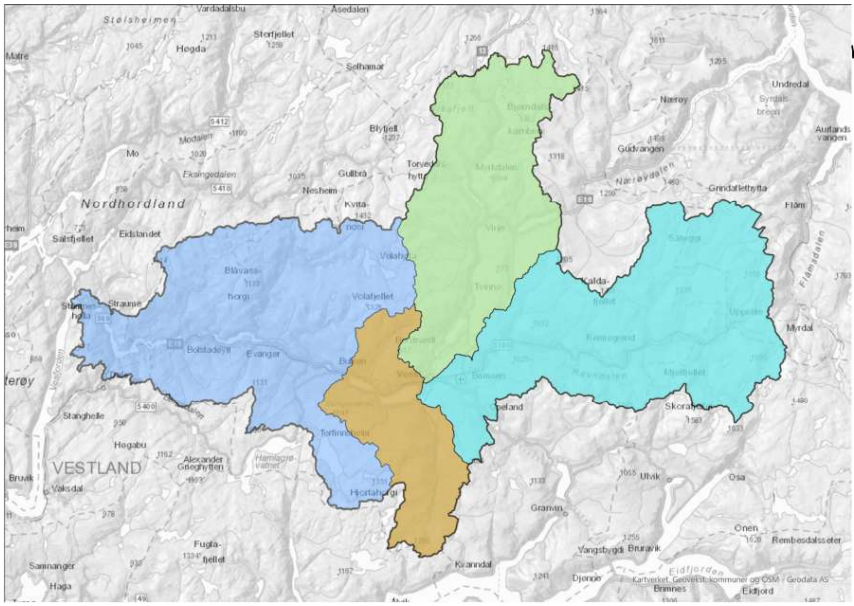
Catchment area: 1497 km^2
River length: 82,46 km
Discharge: 3440,38 mill m^3/year

Mainly rain flood during late autumn (October – December)









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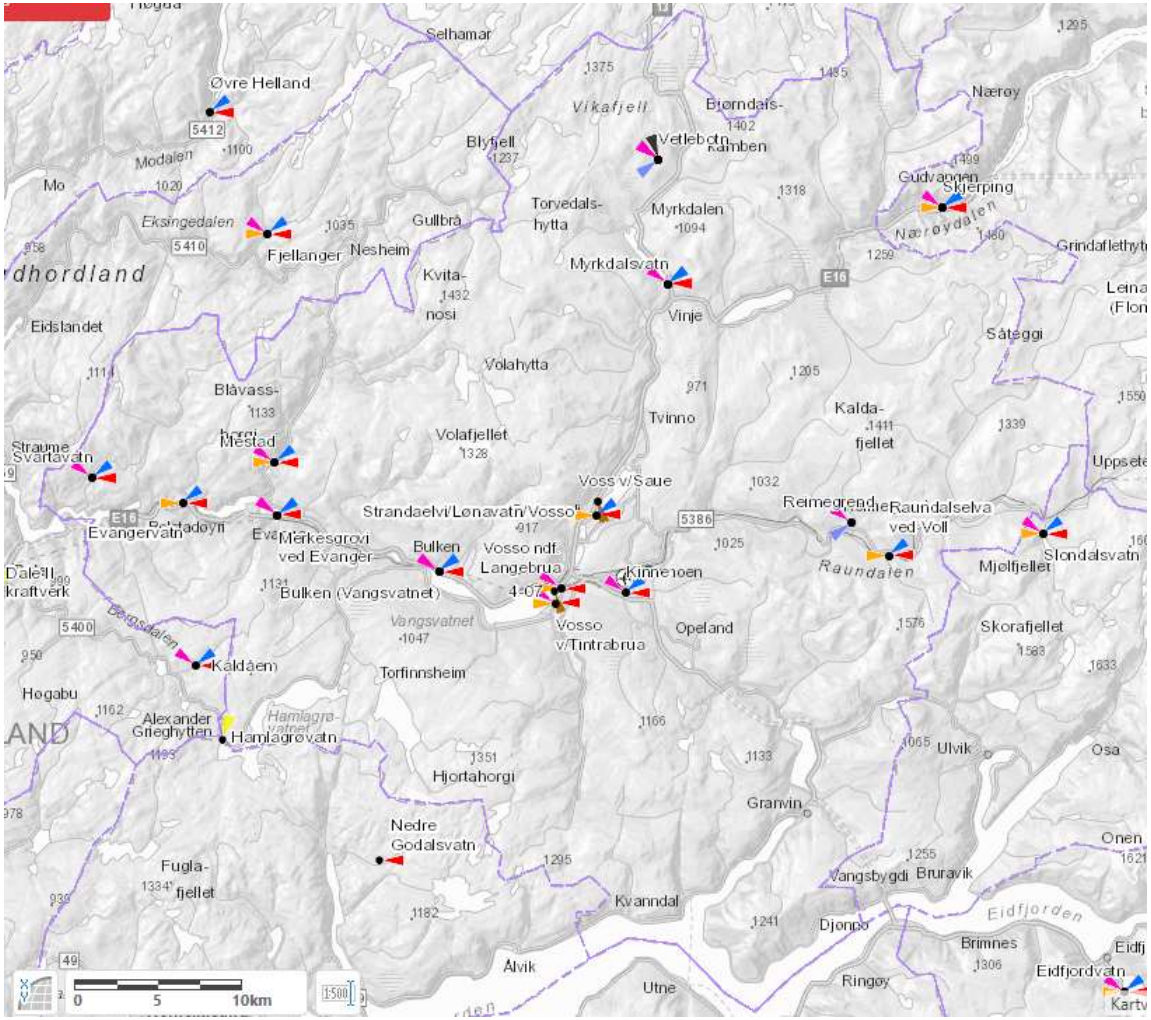

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History

- There have always been large floods in the Vosso River System
- Lowering of overflow 2 times, 1865/66 and in 1999/2000
- Flood hazard map in 2006. Building limit line into the municipal master plan: All new buildings must be positioned above maximum flood level. Exception: Parking basements, storage areas etc.
- Trial Vosso – Evanger
- Damage flood 2014 (considered to be a 700 – 800 year flood according to old flood zone map)
- High flood again in 2015. An eye-opener – this will happen more often in the future.
- New flood calculation resulted in a new maximum flood level for Voss and Evanger (2015)
- New flood hazard map in 2020.
- High flood in 2020,
- New damage flood in 2022. The climate add-on is already here.

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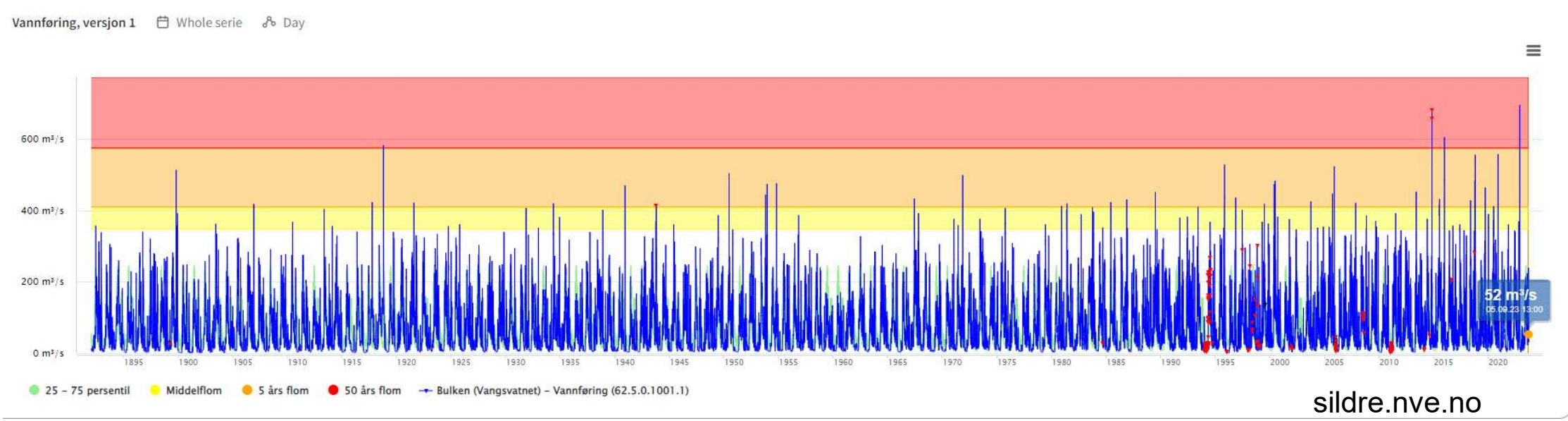
62.5 Bulken (Lake Vangsvatnet)

Established January 1892



sildre.nve.no

25-75 percentile – Middle flood – 5 years flood – 50 years flood

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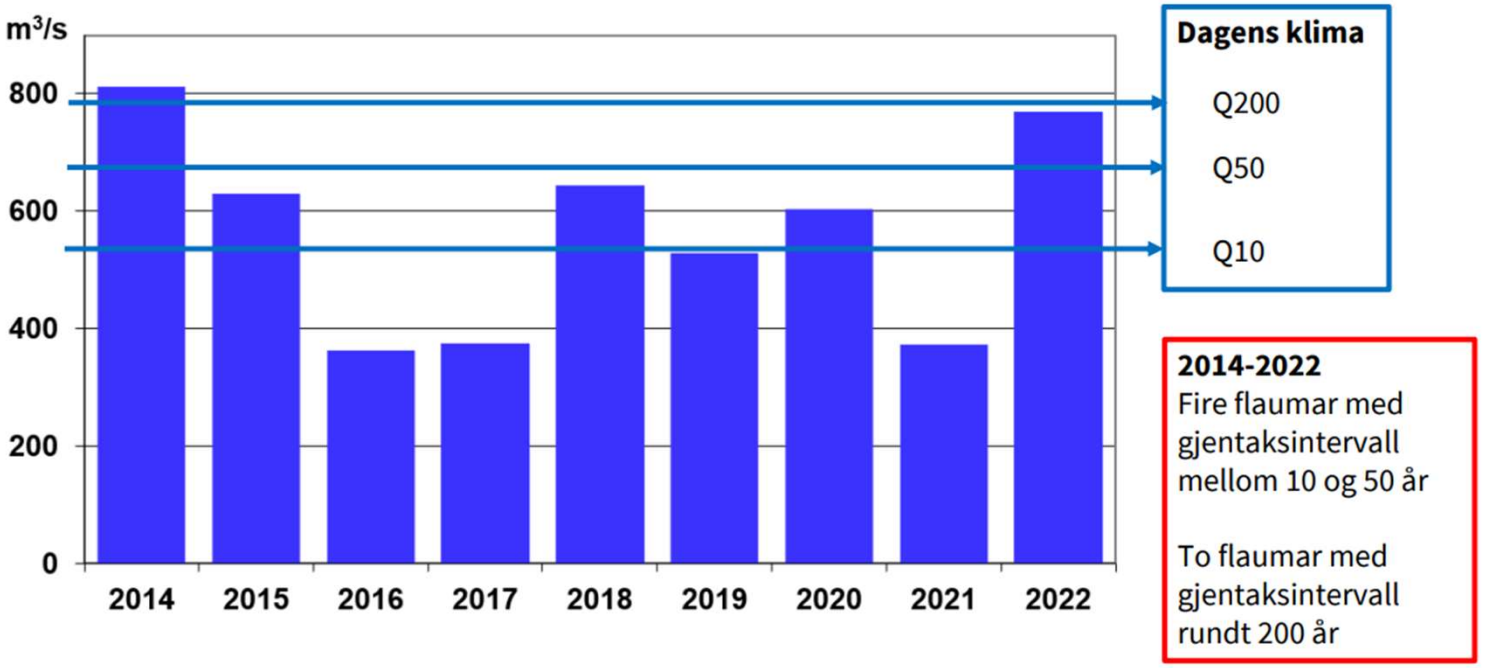
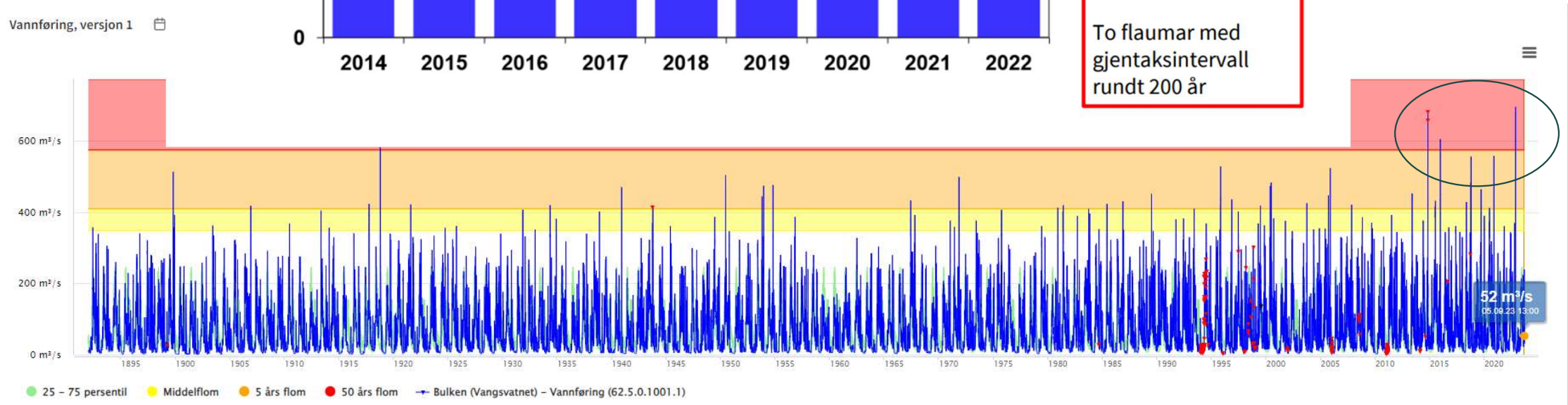
Several high floods in the lake Vangsvatnet 2014-2022





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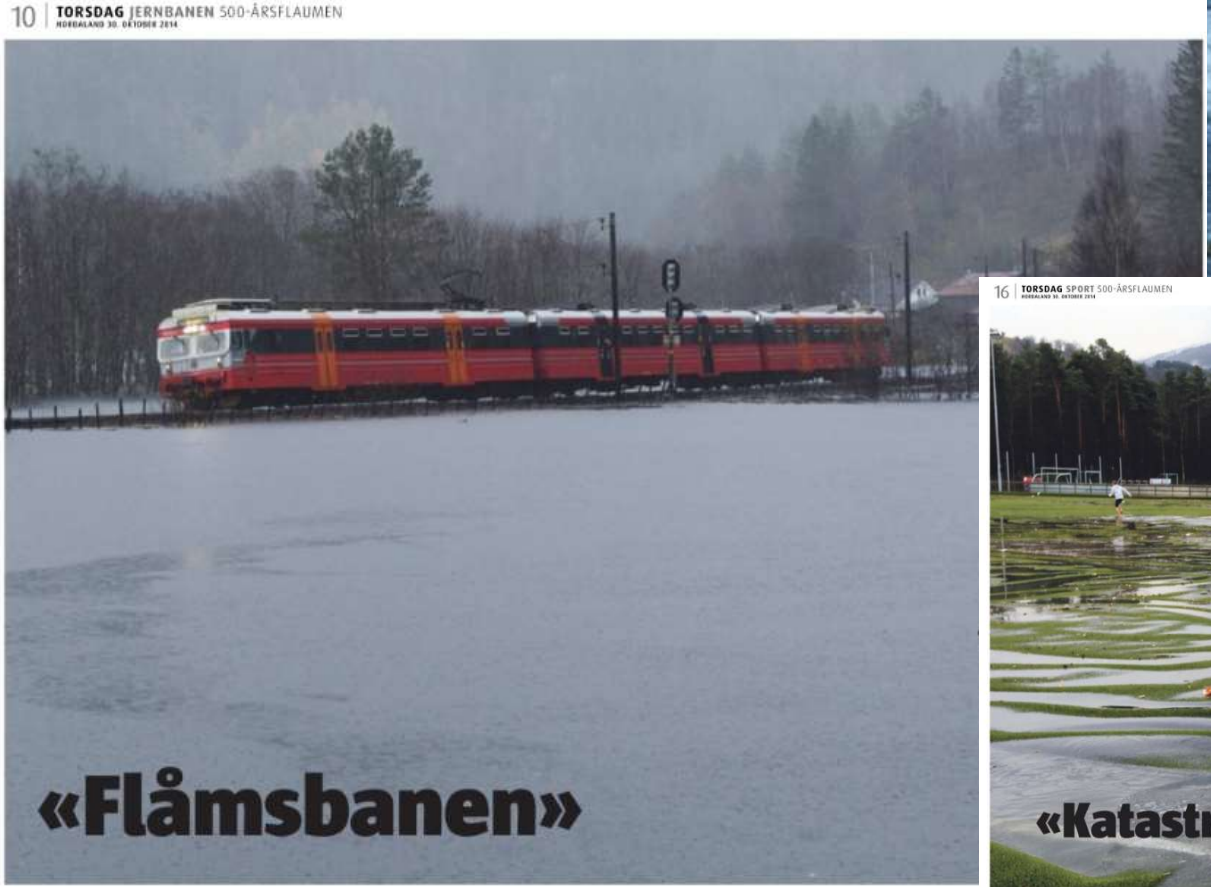
Oct. 28 2014



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10 | TORSDAG JERNBANEN 500-ÅRSFLAUMEN
HORDALAND 30. OKTOBER 2014

Flood damage costs
– estimated at 450 mill. 2014 NOK

14 | LAURDAG SAMFERDSEL 500-ÅRSFLAUMEN
HORDALAND 1. NOVEMBER 2014

Jobbar på spreng heile døgeret – toget går måndag

Klokka 06.00 på måndag har Jernbaneverket anslått opning av strekninga mellom Voss og Dale. Bergensbanen skal då vera i normal drift att.

LAURDAG SAMFERDSEL 500-ÅRSFLAUMEN | 15
HORDALAND 1. NOVEMBER 2014

Våt helg, men ikkje problemvêr

VOSS: Regn eller regbyer vil prega store delar av helga. Men i hellt udramatiske menger, forsikrar meteorologane i Bergen.

Kva er skadd?

Offentlege bygg/anlegg

- Voss kulturhus
- Voss Tinghus
- Voss ungdomsskule
- Vossevangen, Vassverk
- Friluftsbadet
- Diverse pumpestasjoner avløp
- Voss idrettshall
- Voss ungdomshus
- Heradshuset på Evanger
- Tintrabrua
- Rongavegen
- E16 ved Skorve
- Jernbanen ved Evanger

Private bygg/ anlegg

- Park Hotell
- Fleischers motell
- Minigolfen
- Kunstgrasbanar
- Forretningsbygg Voss sentrum
- Bustadhus sentrum
- Bustadhus Evanger sentrum
- Butikk/verkstad Evanger
- Nortura sitt anlegg Evanger
- Bustader i Elvegata, Haugamoen, langs Vosso
- Fredheim
- Denja; Vossafår, Meieriet
- Butikkar og bygg i sentrum

https://publikasjoner.nve.no/rapport/2016/rapport2016_36.pdf

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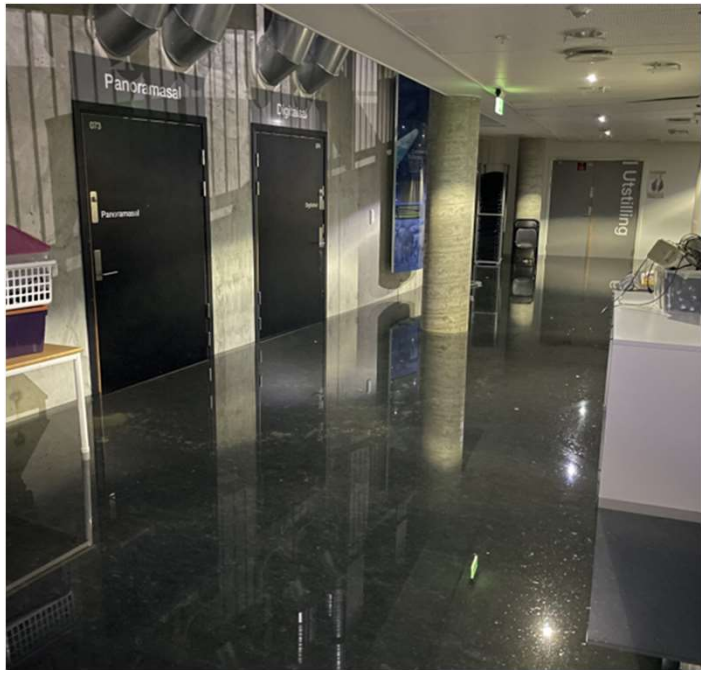
Nov. 11-12 2022



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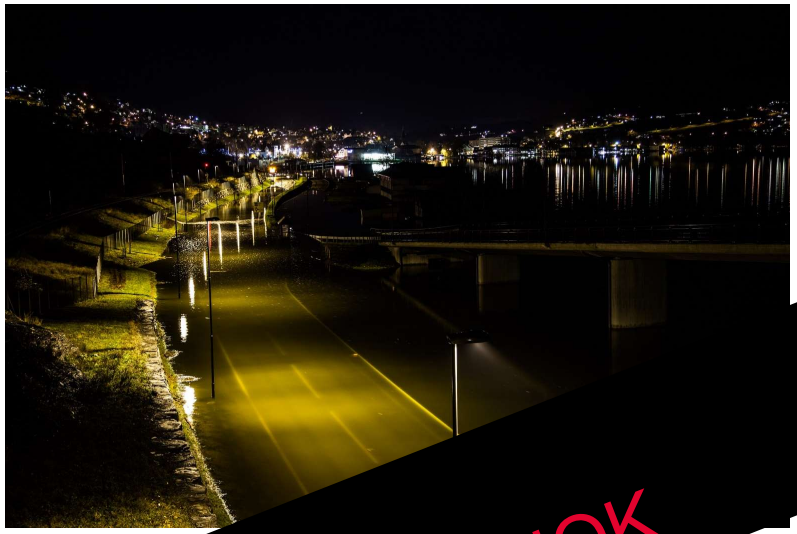
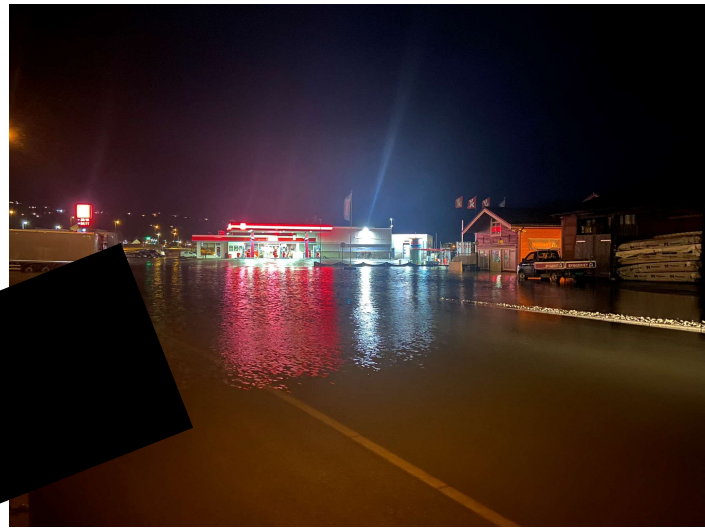
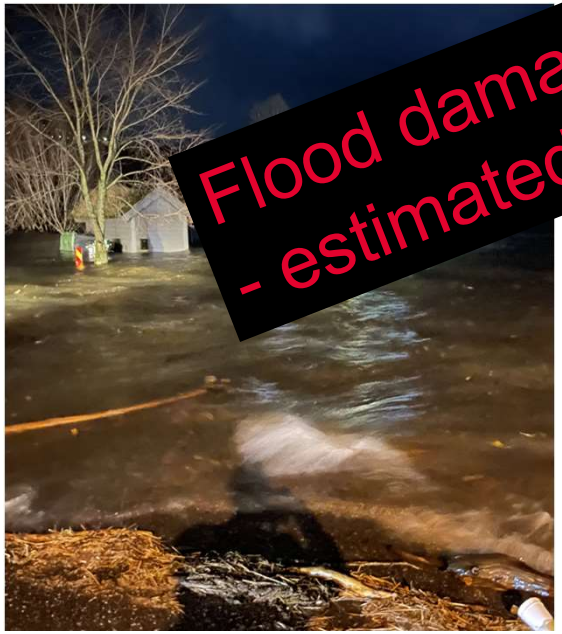
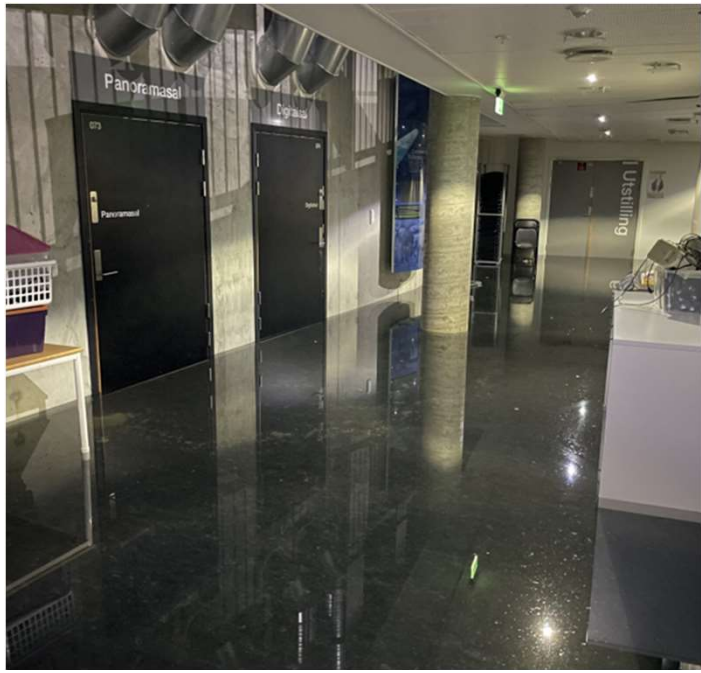




Flood damage costs
- estimated at 150 mill. 2022 NOK





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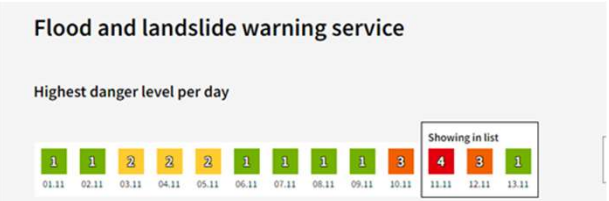
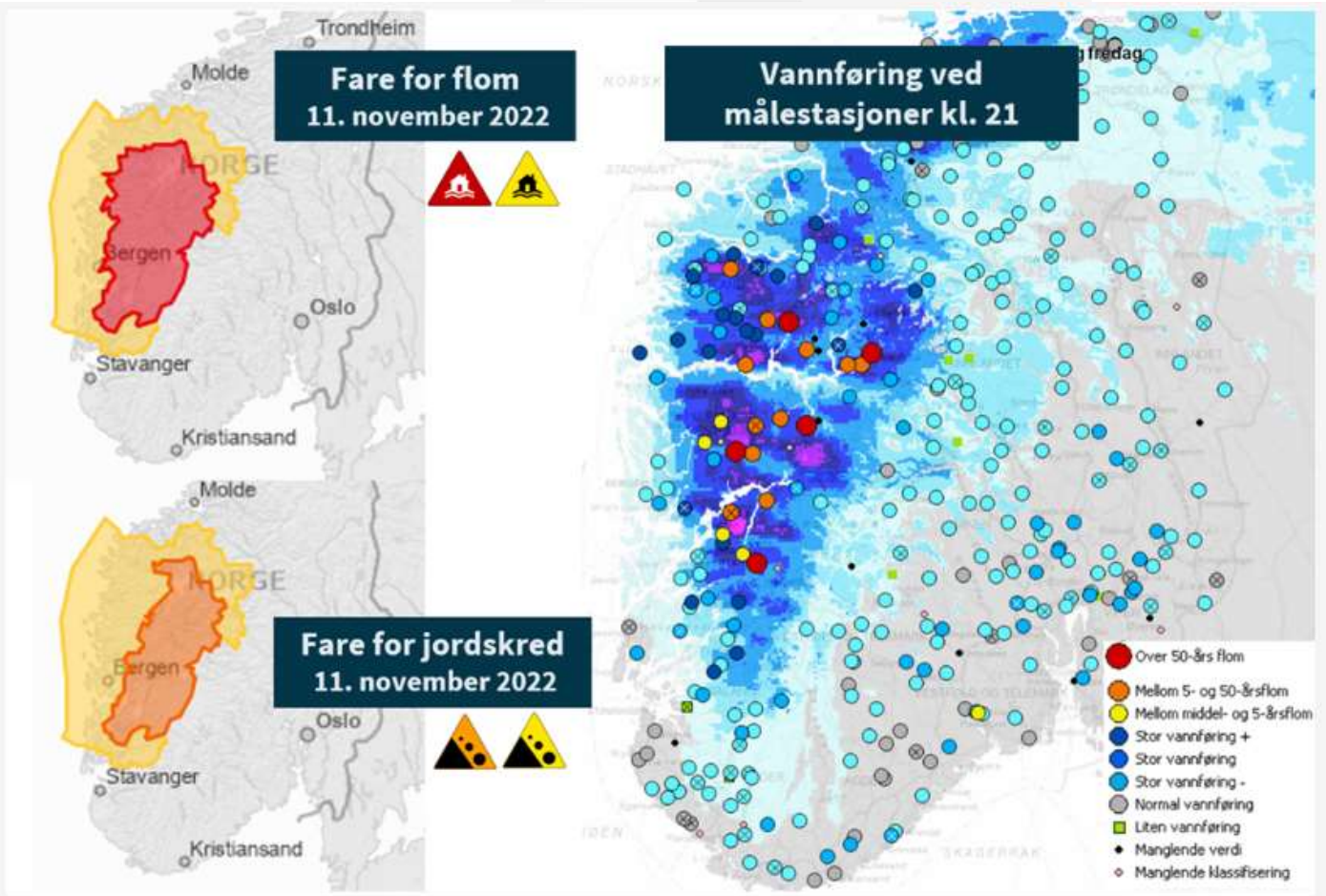
Flood Warning

- Use weather forecast and flood warning from NVE and MET
- Varsom.no
- Sildre.nve.no
- Xgeo.no

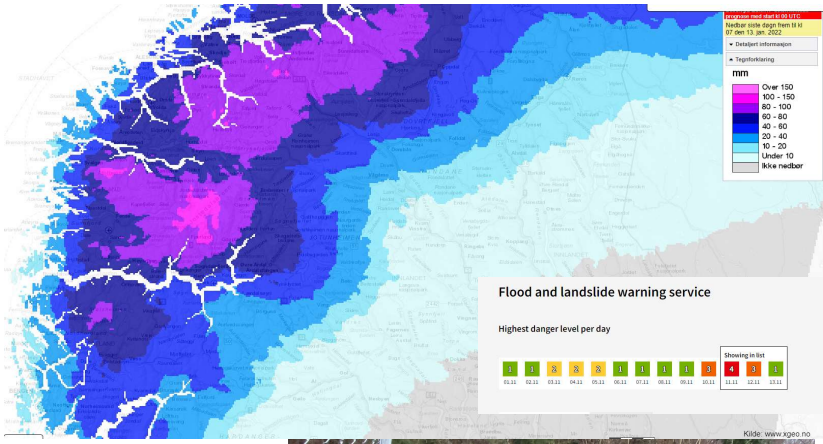




NVEs farevarsel for flom og jordskred samt observasjoner fredag 11. november 2022. Illutrstrasjon NVE.

Preparedness in the Municipality

- Proactive and Reactive Damage Control during Flooding Events



Yellow level

- Proactive damage control (culverts, stream - and drainage system, spill water)
- monitoring the situation closely
(varsom, xgeo sildre, met)

Orange level

- Proactive damage control (culverts, stream - and drainage system, spill water)
  - SMS warning to the public if necessary
  - monitoring the situation closely
  (varsom, xgeo sildre, met)
- The municipal crisis management team (KKL) is called in
- Red level
  - municipal crisis management team is active

Drainage system with self cleaning grates

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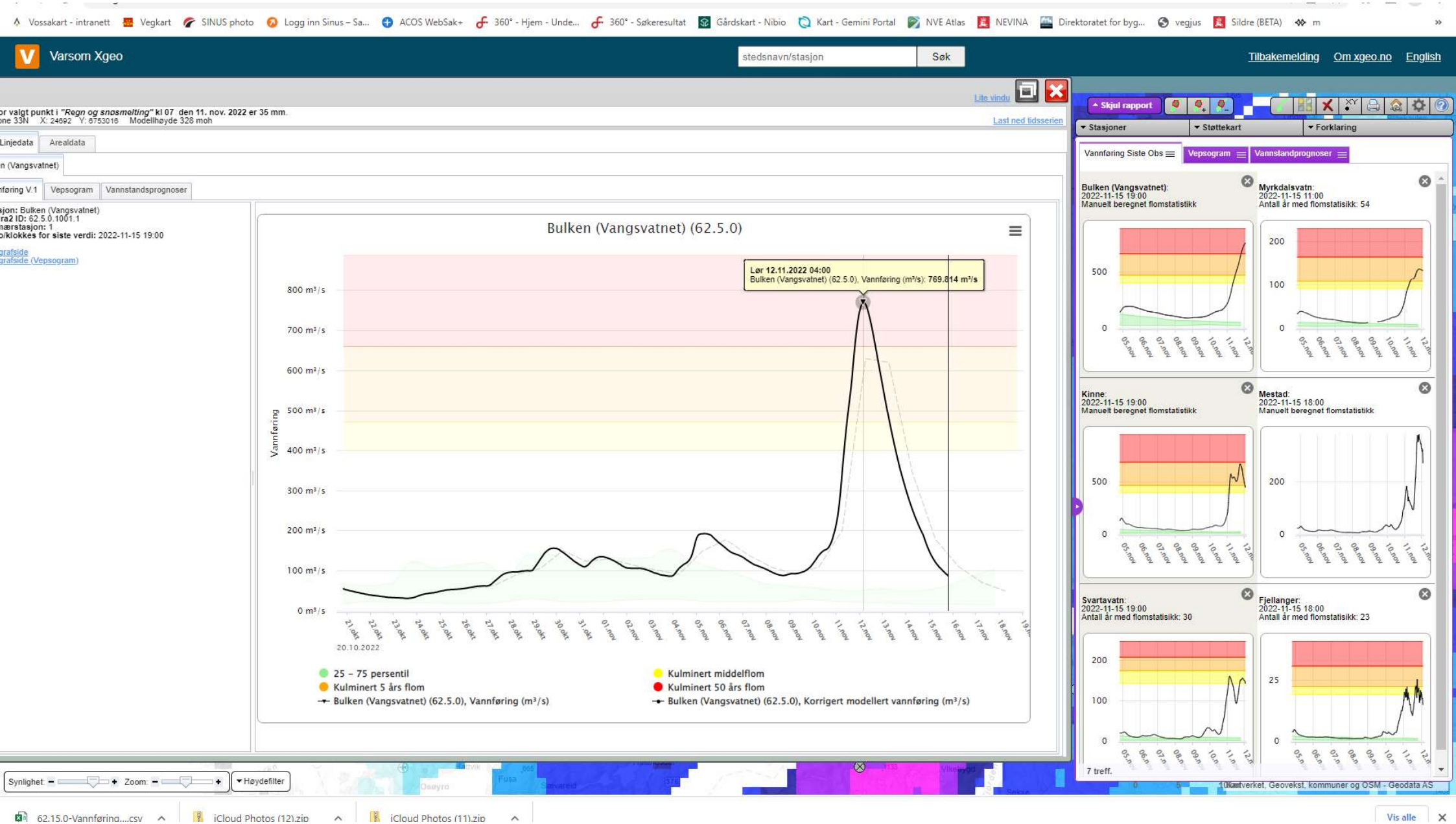
During the Flood

- Safeguard as much valuables as possible
- Drain water – secure water supply
- Keep track of closed roads etc, and assist fire/rescue/police
- All crew available called out to assist
- Emergency plans - Evacuation?
- Monitoring flood plains – registering flood levels


Varsom Xgeo
stedsnavn/stasjon
Søk
Tilbakemelding
Om xgeo.no
English
Lite vindu
Last ned tidsserien
Linjedata
Arealdata
Vepsogram
Vannstandsprognoser
Bulken (Vangsvatnet) (62.5.0)
Lør 12.11.2022 04:00
Bulken (Vangsvatnet) (62.5.0), Vannføring (m³/s): 769.814 m³/s
Vannføring
800 m³/s
700 m³/s
600 m³/s
500 m³/s
400 m³/s
300 m³/s
200 m³/s
100 m³/s
0 m³/s
20.10.2022
25 – 75 persentil
Kulminert 5 års flom
Bulken (Vangsvatnet) (62.5.0), Vannføring (m³/s)
Kulminert middelflom
Kulminert 50 års flom
Bulken (Vangsvatnet) (62.5.0), Korrigert modellert vannføring (m³/s)
Skjul rapport
Stasjoner
Støttekart
Forklaring
Vannføring Siste Obs
Vepsogram
Vannstandprognoser
Bulken (Vangsvatnet):
2022-11-15 19:00
Manuelt beregnet flomstatistikk
Myrkdalsvatn:
2022-11-15 11:00
Antall år med flomstatisikk: 54
Kinne:
2022-11-15 19:00
Manuelt beregnet flomstatistikk
Mestad:
2022-11-15 18:00
Manuelt beregnet flomstatistikk
Svartavatn:
2022-11-15 19:00
Antall år med flomstatisikk: 30
Fjellanger:
2022-11-15 18:00
Antall år med flomstatisikk: 23
7 treff.
Synlighet:
Zoom:
Høydefilter
62.15.0-Vannføring....csv
iCloud Photos (12).zip
iCloud Photos (11).zip
Vis alle

Lake Vangsvatnet 15. September 2023, Q= 460l/s, vst. Foto: Bjørg Lirhus Ree Voss herad


12. nov. 2022 Foto: Voss herad

Voss herad

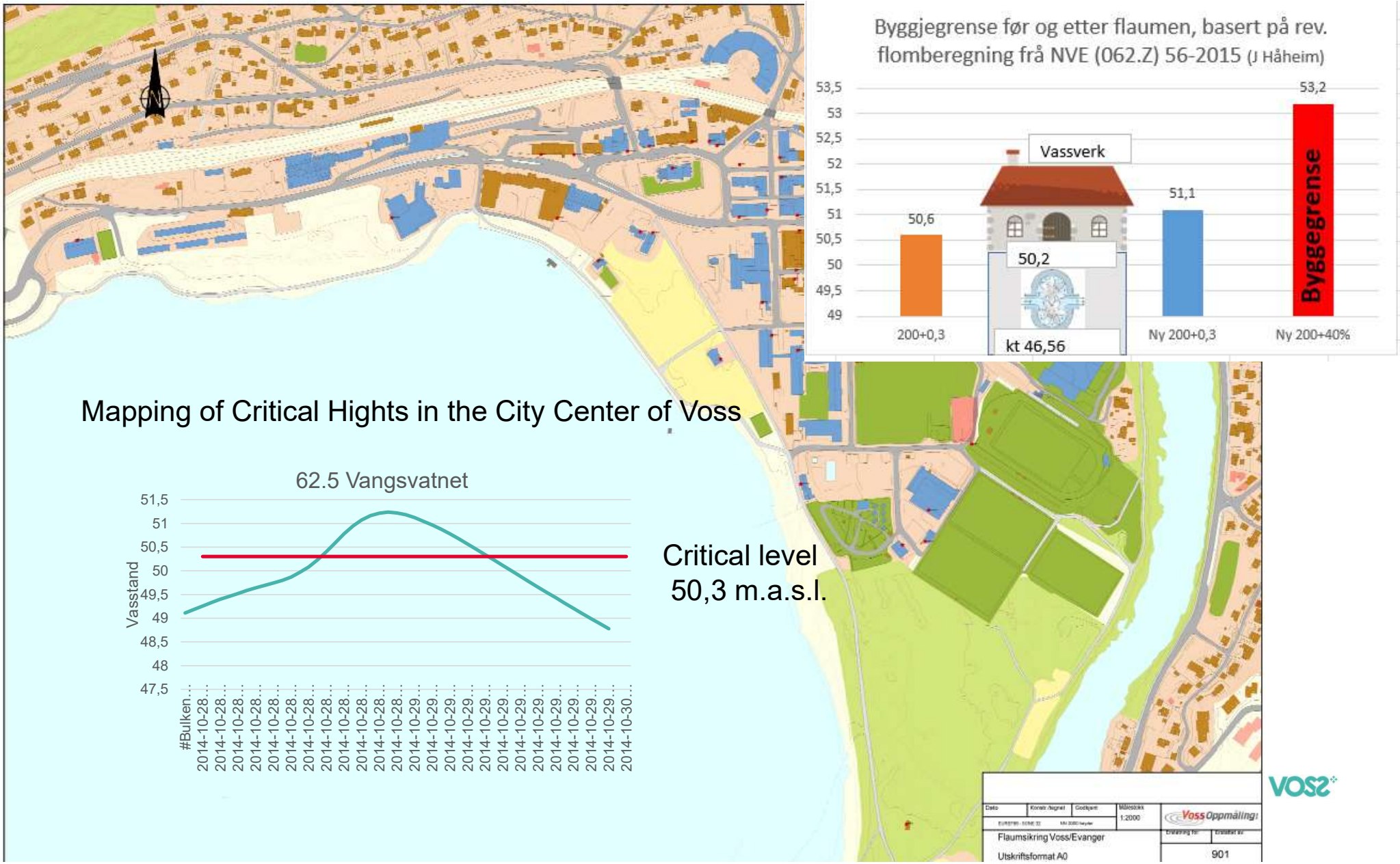
After the 2014 Flood

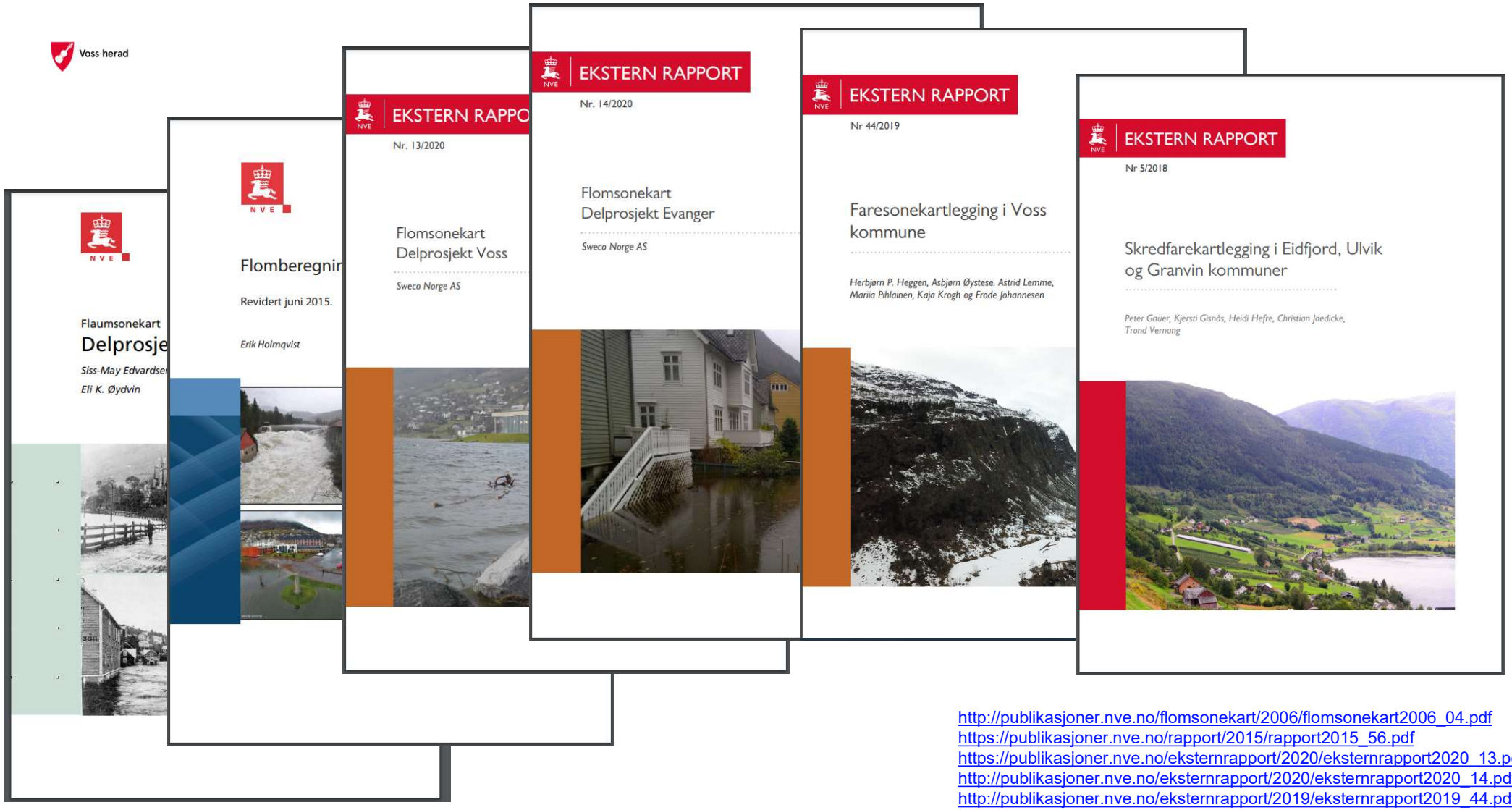
- Municipal master plan – new building limit lines
- Mapping of critical hights in the city centre
- Mapping of critical points in the waterways
- Spot possible improvement
  - Water treatment plant
  - Erosion protection
  - Installation of non-return valves
  - Reconstruction of destroyed infrastructure

NVE

Flood Preventing Project NVE

FlomRisk – Voss herad pilot project


Byggjegrense før og etter flaumen, basert på rev. flomberegning frå NVE (062.Z) 56-2015 (J Håheim)
53,5
53
52,5
52
51,5
51
50,5
50
49,5
49
50,6
51,1
53,2
Byggegrense
Vassverk
50,2
kt 46,56
200+0,3
Ny 200+0,3
Ny 200+40%
Mapping of Critical Hights in the City Center of Voss
62.5 Vangsvatnet
Vasstand
51,5
51
50,5
50
49,5
49
48,5
48
47,5
#Bulken...
2014-10-28...
2014-10-29...
2014-10-30...
Critical level
50,3 m.a.s.l.
Flaumsikring Voss/Evanger
Utskriftsformat A0
1:2000
Voss Oppmåling
901



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https://publikasjoner.nve.no/rapport/2015/rapport2015_56.pdf
https://publikasjoner.nve.no/eksternrapport/2020/eksternrapport2020_13.pdf
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http://publikasjoner.nve.no/eksternrapport/2019/eksternrapport2019_44.pdf
http://publikasjoner.nve.no/eksternrapport/2018/eksternrapport2018_05.pdf

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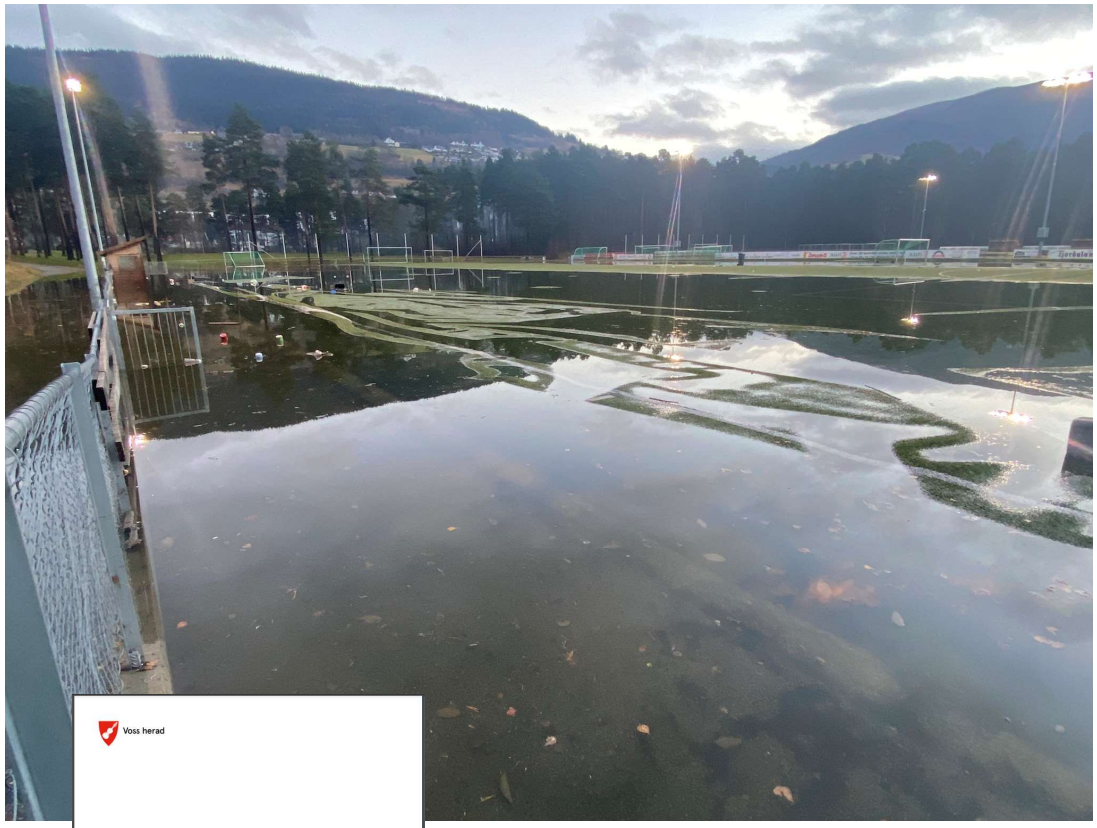
After Flood 2022

- Evaluation of the flood event
- Vossa Climate 2030
  - *«Strategy' for climate adaption»*
- Review of VossaROS (2023)
- Scenario 3: *«Evanger under water»*
- Identfy improvement possibilities for buildings and infrastructure
  - Financial support to prevent future damage
- Review of the municipal master plan 2024- 2035.
  - ➢ increased focus on flooding and storm water

What can we do better next time …



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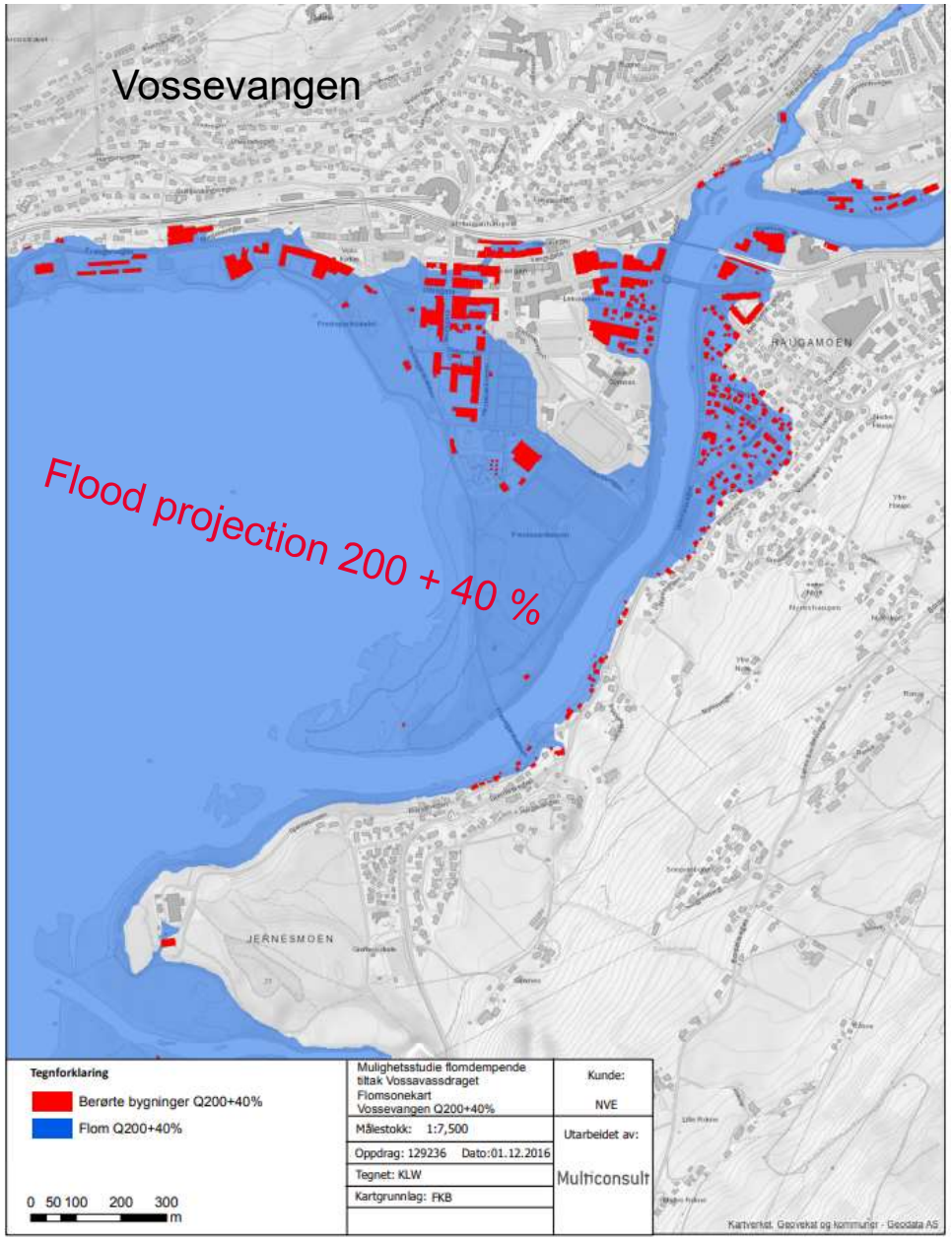
Climate Projection - Wetter and Wilder

- Wetter and wilder climate
  - Flood projection + 40 %
  - Annual precipitation increase 15 %
  - Rainfall intensity increasing by 30 %
  - Recommended dimensioned precipitation + 40 %



Voss herad

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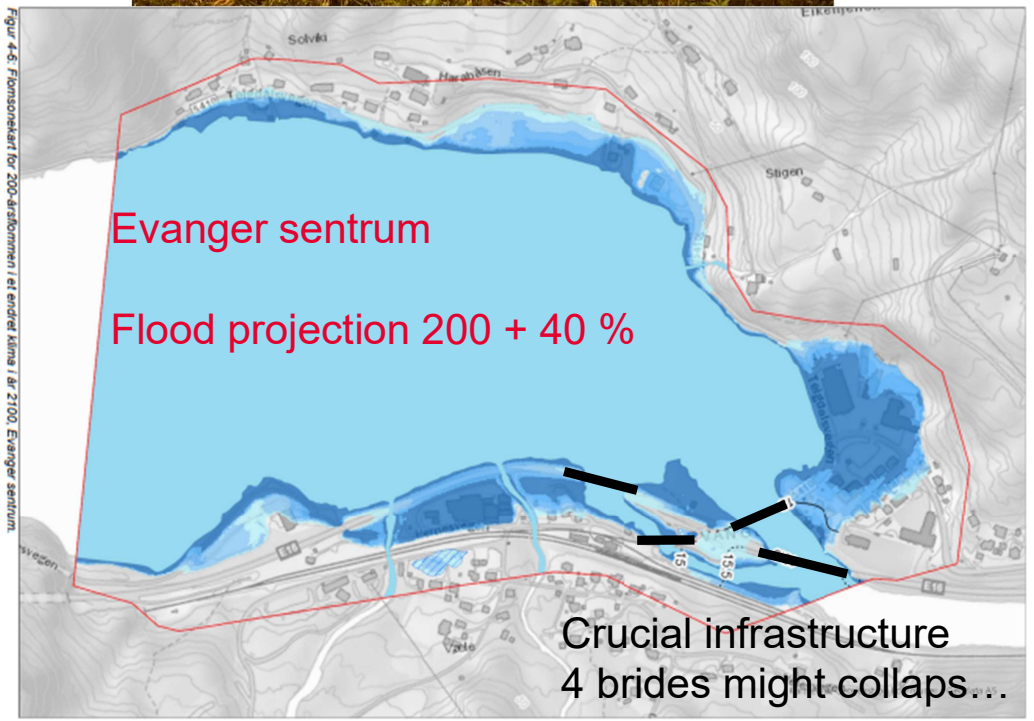
Evanger bridge, 12. nov. 2022 foto: Bjørg Lirhus Ree/Voss herad



https://publikasjoner.nve.no/eksternrapport/2020/eksternrapport2020_14.pdf

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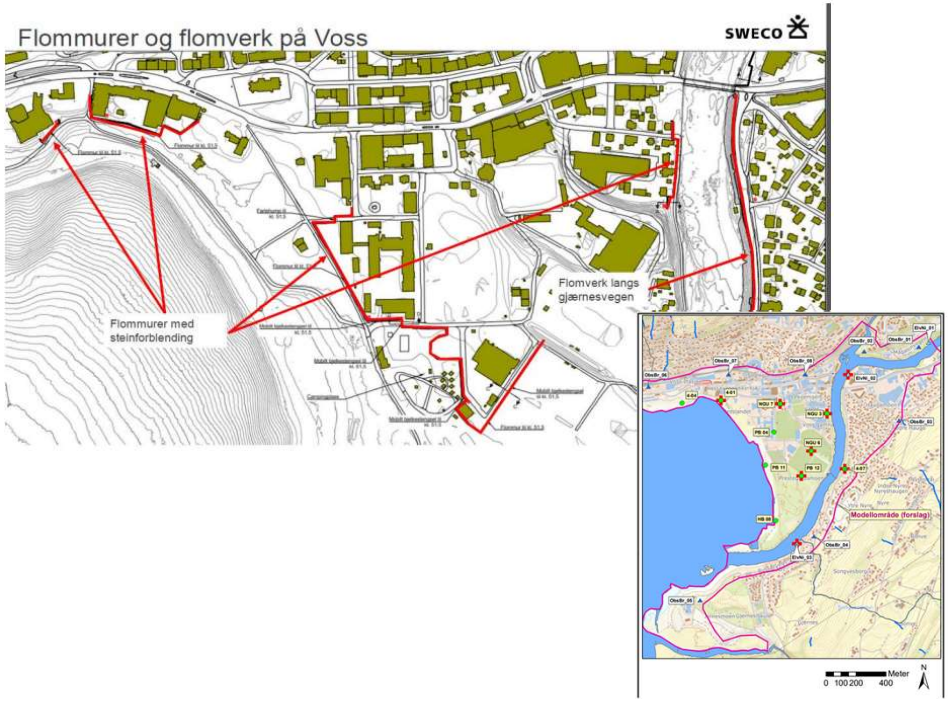
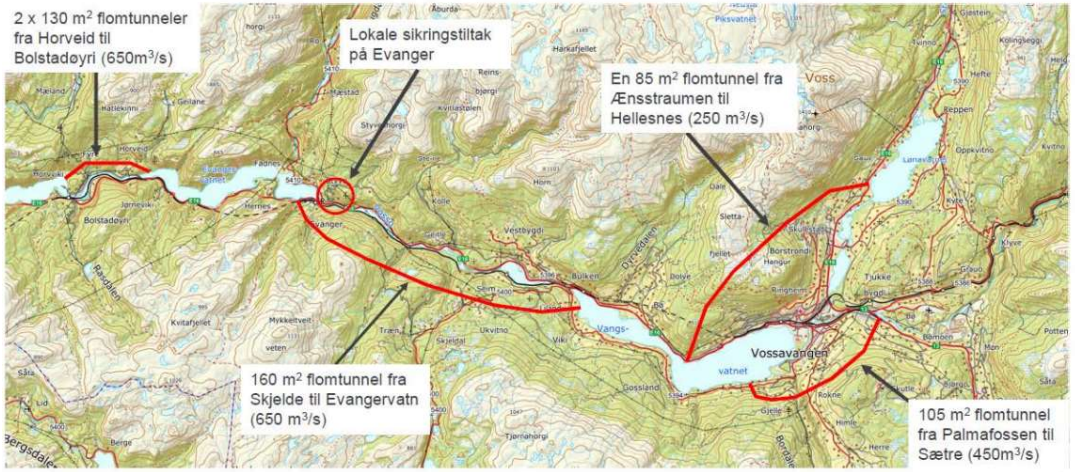
Tecnical Solutions

- permanent flood protection installations and pumping stations
- flood tunnels

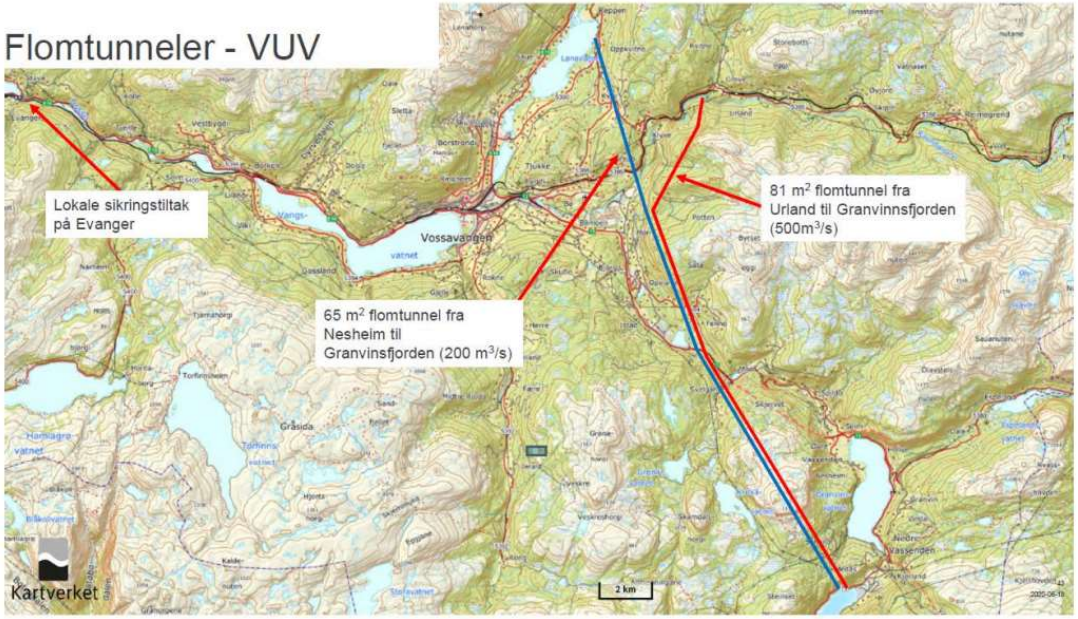
NVE



Flomtunneler - VIV



Flomtunneler - VUV



https://www.nve.no/nytt-fra-nve/nyheter-skred-og-vassdrag/flaumsikring-langs-vossovassdraget-moglege-loysingar-og-nye-kart/

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Tecnical Solutions

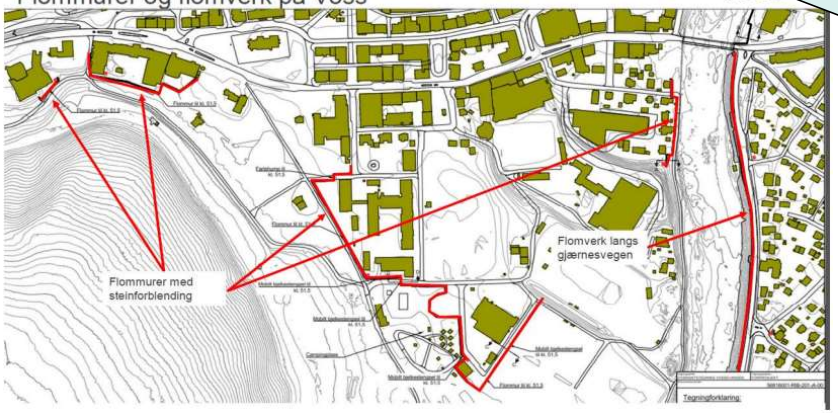
- permanent flo ions and
pumping stati
- flood tunnel

Future?

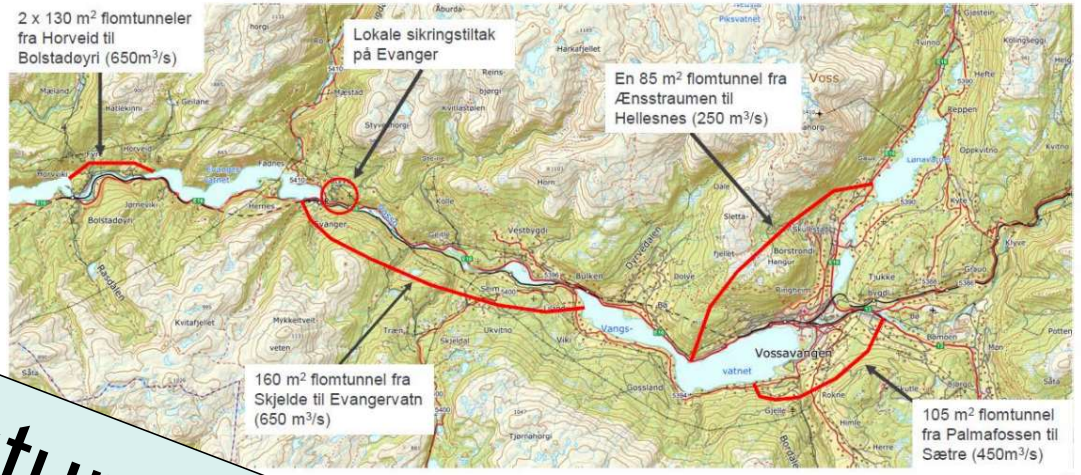
- combined road - and flood tunnel?!

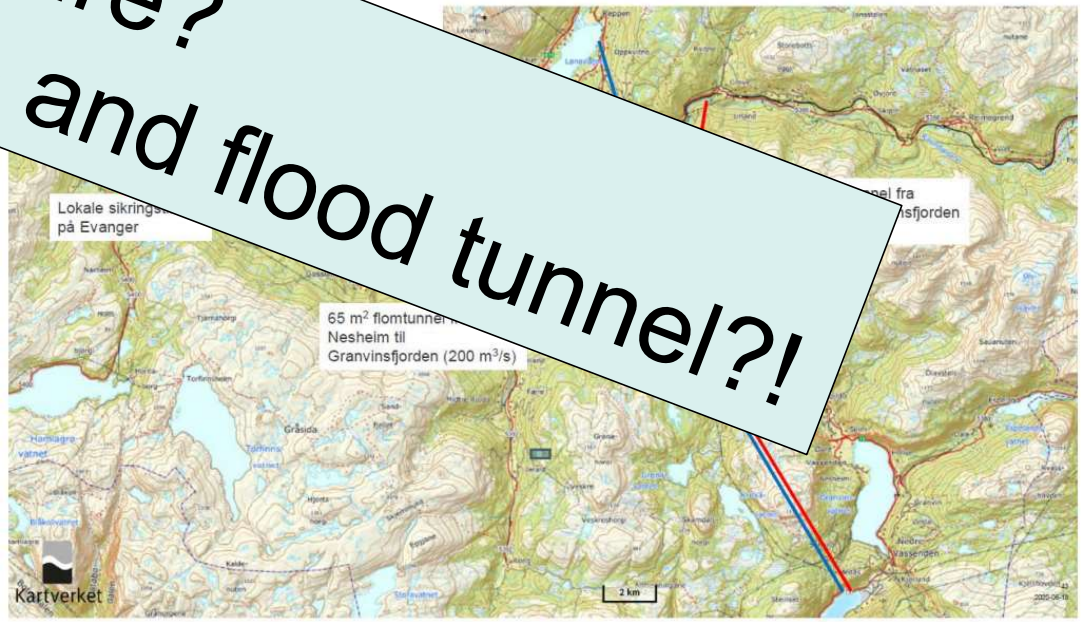
NVE

Flommurer og flomverk på Voss



Flomtunneler - VIV





https://www.nve.no/nytt-fra-nve/nyheter-skred-og-vassdrag/flaumsikring-langs-vossovassdraget-moglege-loysingar-og-nye-kart/

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Or Adapt to the Climate?

Can natural based solutions solve some of our challenges with storm water and small, steep drainage areas?

- Improvement of stream courses
- Re-opening streams
- Reestablishment of wetlands
- Vegetation as protection against landslides
- Permeable cover in urban areas
- Surface water

Foto: Bjørg Lirhus Ree/Voss herad

Project: «Nature Based Solutions to Future Floods» - assigned NORCE, start Sept. 2023

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Work in Progress

- Preparedness - ROS
- Mitigation during a flood event, how to handle the situation

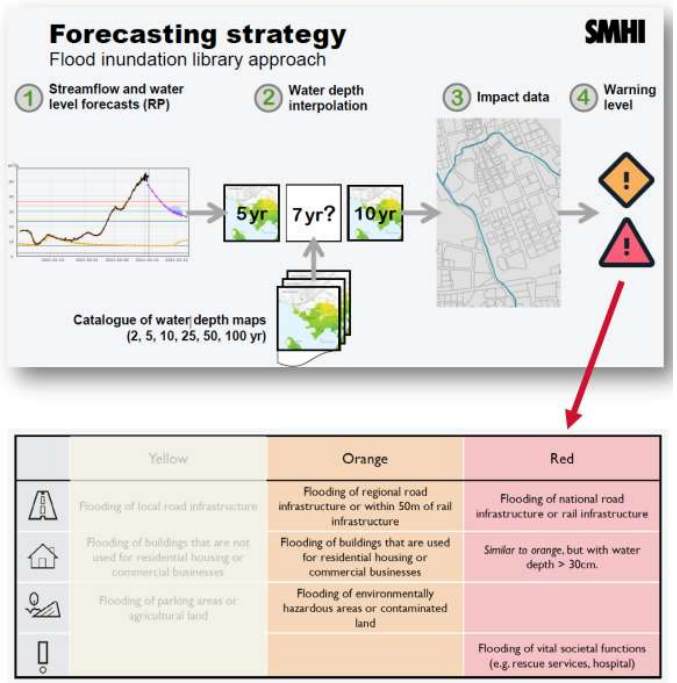
- 1-2 year perspective: What can we do to minimize the damage in the event of a new flood?
- 2-5 year perspective: Local solutions that protect valuables and minimize damage
- 5-10 year perspective: The longer perspective – where are we going?
  - Flood tunnels, local solutions

Evanger sentrum, 12. nov. 2022 foto: Bjørg Lirhus Ree/Voss herad

Voss herad

"FloodRisk"

- Pilot project NVE - early warning



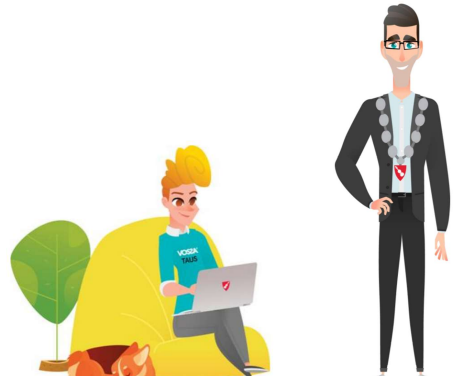
	Yellow	Orange	Red
	Flooding of local road infrastructure	Flooding of regional road infrastructure or within 50m of rail infrastructure	Flooding of national road infrastructure or rail infrastructure
	Flooding of buildings that are not used for residential housing or commercial businesses	Flooding of buildings that are used for residential housing or commercial businesses	*Similar to orange*, but with water depth > 30cm.
	Flooding of parking areas or agricultural land	Flooding of environmentally hazardous areas or contaminated land	
			Flooding of vital societal functions (e.g. rescue services, hospital)

Prognose

Resultat

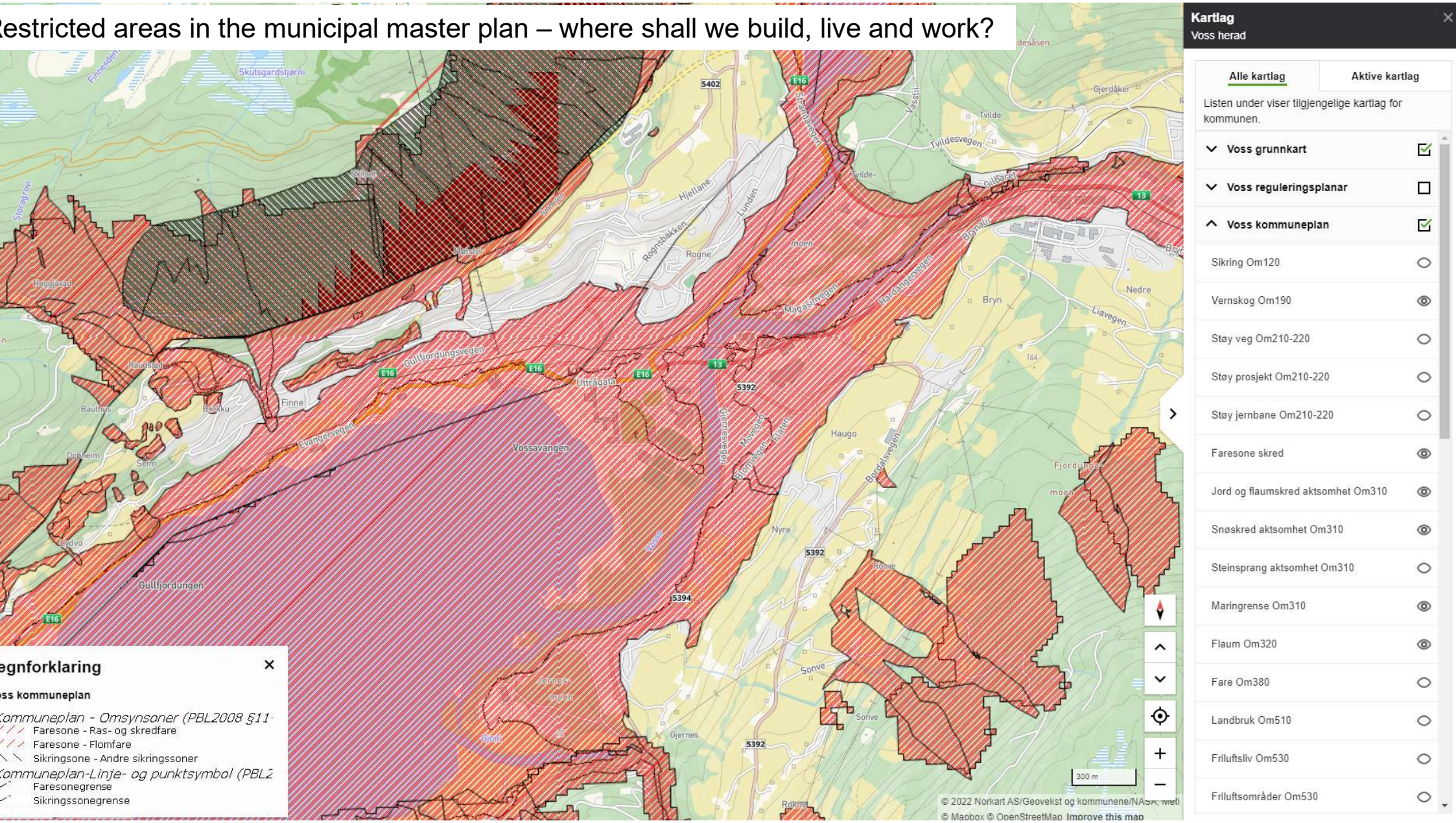
Challenges for the Municipality

- Conflicts of Interest:



- Electricity production – protected watershed – transmission of water to alternative watersheds
- Nature conservation area – soil protection – protection of cultural heritage
- Biological diversity - fish – agriculture
- Fishing, hunting, outdoor life – river sports – extreme sports
- Preparedness - life and health – cruzial infrastucture - closed roads – broken
- Ecconomic interests – how own the problem and who is going to pay?
- Municipal responabilities - private interests – construction/buildings –
- Existing buildings – the insurance companies have larger influence(and incentive) to induce a change, than the municipalities (financial motives/incentives)?

Restricted areas in the municipal master plan – where shall we build, live and work?



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Questions

- What risk are the society willing to take?
- Should some areas be given up?
- What part should NVE/national authorities play, and what should the municipalities be expected to manage themselves? Are the roles clear, or do we need changes in this matter?
- Should there be a standard plan or guidelines for how municipalities should act in the case of larger flood challenges, and how to adjust to a future, changed climate?
- How likely is it, that we manage to land projects that cost billions?

Vosso, 11. nov. 2022 foto: Bjørg Lirhus Ree/Voss herad

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Thank you for your attention!
Question?

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