



Jernbaneverket



Statens vegvesen

The Natural Hazards Project:
Programme plan 2012-2015
for the Government Agency
Programme

“NATURAL HAZARDS – infrastructure for floods
and slides (NIFS)”

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The natural hazards project:

Programme plan 2012-2015 for the
Government Agency Programme
“NATURAL HAZARDS – infrastructure for
floods and slides” (NIFS)

*One spring the torrent washed it all away.
Their lives were spared. Ruined and stripped of all,
He set to work to make another clearing;
And, ere the autumn, smoke again arose
From a new, better-sheltered, mountain farmhouse.
Sheltered? From torrent – not from avalanche;
Two years, and all beneath the snow lay buried.
But still the avalanche could not daunt his spirit.
He dug, and raked, and carted – cleared the ground –
And the next winter, ere the snow-blasts came,
A third time was his little homestead reared.*

From *Peer Gynt* by Henrik Ibsen, 1867
Translated by William and Charles Archer, 1911

**The Norwegian Water Resources and Energy Directorate in partnership with the
Norwegian Public Roads Administration and the Norwegian National Rail
Administration**

2013

Report no. 57

Programme plan 2012-2015 for the Government Agency Programme
“NATURAL HAZARDS – infrastructure for floods and slides” (NIFS)

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Abstract: The report describes the multi-disciplinary research project entitled Natural hazards – infrastructure for floods and slides (NIFS). The project is a joint enterprise involving the Norwegian National Rail Administration, the Norwegian Water Resources and Energy Directorate and the Norwegian Public Roads Administration. The project period has been set to 2012 – 2015. The combined budgets allocated for the full project period amount to NOK 42 million. Additionally, thanks to considerable input of internal competence and professional development, approximately 30 man-years will be contributed from the various services over the same period. The project is already in its delivery phase; seven sub-projects have been set up and close to 100 staff from within the three services are involved to a greater or lesser extent.

Keywords: land use, emergency preparedness, flood, crisis management, quick clay, natural hazard, natural disaster, protection, landslide, avalanche

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1 November 2012

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FOREWORD

Natural hazards – infrastructure for floods and slides (NIFS) is a multi-disciplinary project based on Report no. 15 to the Storting15 (2011-2012) entitled *How to live with the risks – about floods and slides*, and the subsequent parliamentary debate.

The Norwegian National Rail Administration (JBV), the Norwegian Water Resources and Energy Directorate (NVE) and the Norwegian Public Roads Administration (NPRA) have been working well in partnership over a number of years and within a number of areas. They will now be drawing on this experience as they embark on a major targeted R&D initiative.

The project has a wide remit and will be throwing light on challenges ranging from the strategic to the operative sphere in connection with natural hazards. The project period has been set to 2012 – 2015, and NOK 42 mill. as well as considerable internal resources have been allocated to the task.

Significant importance is being attached to joint solutions and collaboration across agencies, as well as liaison with other resources in society within this area. This includes the research and teaching organisations, trade and industry and other public institutions.

The project outcomes will be published on an ongoing basis on our joint website www.naturfare.no. Relevant research outcomes will be implemented in accordance with the resolutions of our three organisations.

Oslo, 1 November 2012

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Anne Britt Leifseth Head of Safety and Contingency, The Norwegian Water Resources and Energy Directorate	Marit Brandtsegg Head of Traffic Safety, Environment and Technology The Norwegian Public Roads Administration	Sverre Kjenne Director of Technology The Norwegian National Rail Administration

1. DOCUMENT CONTROL

1.1 TITLE AND STATUS

Title:	Plan for the Government Agency Programme “NATURAL HAZARDS – infrastructure for floods and slides (NIFS)”
Document no:	NVE report 57

Status	Version	Description
<i>Draft</i>	<i>0.1</i>	“Draft programme plan, 2011-06-23”. The project partners receive the document and are asked to provide specific feedback by August: <ul style="list-style-type: none"> - Views on the programme structure (Chapt. 4.3) - Propose names for the Government Agency Programme (“Infrastructure and natural hazards” is the working title)
<i>Draft</i>	<i>0.2</i>	“Draft Programme Plan ahead of meeting in the week commencing 12 September”. The project groups, as per the recently approved project structure, to describe the scope of the project.
Programme plan	<i>1.0</i>	Programme plan submitted for budget approval. The various sub-projects are briefly described in this document, more detailed information about each individual sub-project is provided in the appendices.
Programme plan	<i>2.0</i>	Discussed by the steering committee in June 2012.
Programme plan	<i>3.0</i>	Approved programme plan for publication in November 2012

1.2 CHANGE LOG

Version:	1.0
Date:	05.10.2011
Changes since previous version:	Contributions from the various sub-projects have been collected. The management of the three partnering agencies have written their contributions to the general sections of the document.
Approved by	The steering committee
Version:	2.0
Date:	01.06.2012
Changes since previous version:	Updates following dialogue between sub-projects and the steering committee. Submitted for approval by the steering committee on 6 June 2012.
Approved by	The steering committee
Version	3.0
Date:	23.10.2012
Changes since	Updates prior to publication.

previous version:	Submitted to the steering committee for approval on 1 November 2012.
Approved by	The steering committee

1.3 DISTRIBUTION

This project plan is being distributed to the three partnering services as represented by the members of the steering committee, and also to:

- R&D coordinator, the Norwegian National Rail Administration (JBV)
- R&D coordinator, the Norwegian Water Resources and Energy Directorate (NVE)
- R&D coordinator, the Norwegian Public Roads Administration (NPRA)

2. BACKGROUND

This Government Agency Programme is a partnership project involving -NVE-, -JBV- and -NPRA-.

The programme is designed to accommodate close liaison with the Geological Survey of Norway (NGU), the Norwegian Meteorological Institute (met.no), the Norwegian Mapping Authority, Norwegian universities and research institutions, the county administrations, the county governors, local authorities as well as external experts and ongoing/planned research projects.

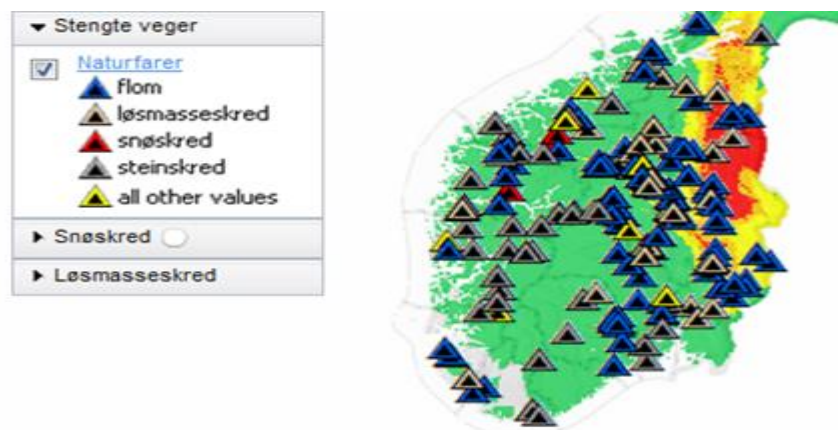
Natural hazards such as avalanches and landslides (soils, quick clay, rockfalls and rock slides), slips and floods with erosion expose infrastructure like roads, railways and buildings to risk. The agencies face major shared challenges, and a well working partnership will be cost effective and build competence within the organisations.

In recent years, considerable efforts have gone into the writing of reports on the need for climate adaptation.

- November 2010 saw the publication of NOU 2010:10 “Adapting to a Changing Climate”. This Official Norwegian Report was to be followed by a White Paper concerning “climate adaptation” submitted by the Ministry of the Environment in the autumn of 2012.
- In the autumn of 2010 the Norwegian Water Resources and Energy Directorate drew up a “Strategy for climate adaptation” as a basis for further work within the sector.
- In 2011 the Norwegian National Roads Administration completed its four-year R&D project entitled “Climate and Transport”, to which the Norwegian National Rail Administration, the Norwegian Water Resources and Energy Directorate and the Norwegian Meteorological Institute were the main contributing partners. The objective was to improve procedures and regulations for the planning, construction and operation of roads/ railway lines in the climate we have at present, and as the climate changes. Significant attention was paid to natural hazards under this project.
- In the spring of 2011 a foundation report on climate adaptation was written for the National Transport Plan 2014-2023. This report provides guidelines for the transport services and Avinor’s climate adaptation initiatives.

- The National Transport Plan (NTP) 2014-2023 was published in February 2012 and provides a set of parameters for natural hazards. The NTP will be debated by the Norwegian Parliament in the spring of 2013.
- In the spring of 2012 the Ministry of Petroleum and Energy submitted a White Paper to the Norwegian parliament, entitled “How to live with the risks – about floods and slides”. This has now been debated by the Norwegian parliament.

Because there is a close connection between the weather and natural hazards, each sub-project and each activity will take account of the climate and climate change. By strengthening the competence of each agency in providing protection against natural hazards we will have a chance to develop a more robust infrastructure. This allows us to reduce the risk of damage caused by natural hazards, to improve the traffic flow and to protect the infrastructure.



The picture is taken from <http://nyforevar.senorge.no> and shows road closures caused by natural perils in Southern Norway in the period 1 June - 4 October 2011.

It is important to provide a closer link between specialists within different agencies in order to secure an exchange of experiences and make even better use of the competence available within each department, while building on the collaborative relationship we established through the “Climate and transport” project.

The NVE, JBV and NPRA – working in partnership with met.no – are committed to an ongoing collaborative project on avalanche and landslide forecasting, entitled Faregrad SeNorge, the project owner being NVE. The partners are working on a number of ongoing projects associated with area stability and contingencies in relation to landslides involving quick clay.

This partnership will continue under an operational “national avalanche and landslide forecasting service” which was proposed under the 2013 Budget as one of NVE’s initiatives for the period 2013-16.

It is possible to limit the risk of damage from natural disasters by taking account of the hazards at the planning stage. Plans and designs must accommodate any prognoses for climate change that may lead to changes in the probability of landslides and floods. This may involve the siting of new infrastructure such as roads/railways and buildings away from areas prone to landslides, on safe ground, and on higher ground than where flooding may be expected. This means, among other things, that greater importance must be placed on the planning, building and maintenance of drains and culverts. The requirements imposed by the future climate must

be seen in connection with the life of the structure. For existing infrastructure there will be a need for increased resource allocations to maintenance and condition surveys as well as further development and strengthening of climate contingencies. Analyses that take account of climate change may form the basis for deliberations concerning the timing and scope of improvement initiatives. As part of this work, the project must make sure to employ risk and vulnerability assessment (RVA) RVAto pinpoint any vulnerable points.

It is important to sustain the investment in landslide and avalanche protection. There is a need to review the agencies' avalanche and landslide protection plans to assess whether re-prioritisation is required to allow for the impact of climate change. A good cost-benefit tool must be developed to ensure optimal use of allocated resources. Investment in permanent slope protection devices will reduce the cost of comprehensive inspections in the longer term.

Because large parts of our infrastructure are exposed to natural hazards, emergency preparedness constitutes a special focus area. Resources must be allocated to further development of proactive step-by-step contingencies. Furthermore, emergency preparedness plans must be drawn up for all types of avalanches and landslides, as well as forecasting systems that present and make use of good weather prognoses. This includes the development of climate models (especially short-term precipitation, wind and storm frequency) and the presentation of outcomes for practical use. The systems require a network of measurement stations and close liaison between agencies.

The project partners must draw up joint handbooks and guidelines by reviewing and revising regulations, standards and procedures associated with natural hazards in order to reduce the risk of harm and destruction on the borders between the agencies' respective areas of responsibility.

3. A NAME FOR THE GOVERNMENT AGENCY PROGRAMME

The choice of project title was based on a desire to find a name with which all agencies could identify, and which covers the shared problems faced by the agencies.

In connection with presentations held in various contexts, a specific visual profile has been designed for the project.

In order to maintain the validity of the Norwegian acronym in English, the project's English title has been somewhat adjusted to "Natural hazards – infrastructure for floods and slides".

4. OBJECTIVES AND OUTCOMES

4.1 OVERALL OBJECTIVE

The overall objective is a safer society with more robust infrastructure, safe buildings, safe transport and good forecasting systems for landslides, avalanches and floods.

The programme's main objective is to build and propose good partnership platforms by coordinating the activities of the agencies in order to reduce vulnerability and prevent accidents and injuries caused by landslides, avalanches and floods.

In order to achieve this objective, the agencies had to equip themselves with relevant tools and acquire the knowledge required to raise awareness and adjust their contingencies for situations that involve unacceptable levels of risk. Also, coordination and partnership in connection with databases, hazard mapping, forecasting systems and R&D will ensure more efficient use of government funds.

The programme must take account of current and future climate challenges. Climate change introduces increased vulnerability for society as a whole, as a consequence of changes to and increased frequency of floods, avalanches and landslides. Collaborative work to reduce the level of vulnerability is achieved by adapting to the consequences of expected climate change.

4.2 IMPACT TARGETS

Impact targets are used to describe the future situation the project should seek to attain. We wish to reach them by:

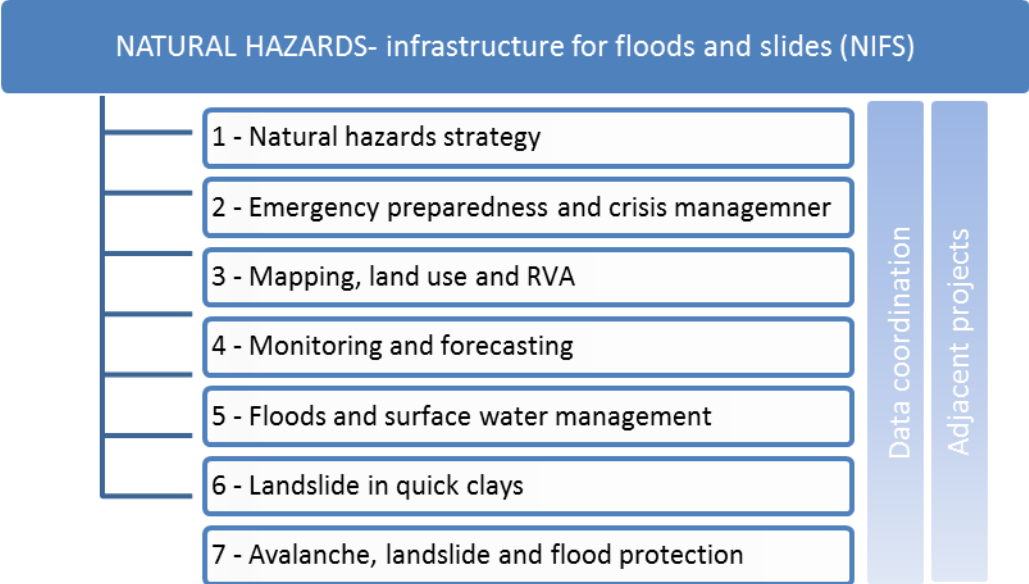
- Improving the level of safety for the population by providing infrastructure which is better designed to withstand the impacts of natural hazards, at their present level and in the future when there are heightened intensities and frequencies as a consequence of climate change.
- Step-by-step contingencies to ensure better preparedness in natural disaster situations.
- Better cooperation between agencies in disaster situations.
- Optimal use of financial and professional resources to solve shared challenges associated with natural hazards.
- Raised levels of safety and robustness, and improved regularity.

4.3 OUTCOME TARGETS

Specific outcome targets are listed under the various sub-projects. See Chapters 5.1-5.7. More detailed descriptions will be written up in separate reports for each sub-project. Outcome targets are defined as the specific results of the work we do.

5. TASKS AND ACTIVITIES UNDER THE PROGRAMME

The organisational structure of the Government Agency Programme and its sub-projects:



It is clear from the figure that there is an extensive need for data and information to be coordinated across the sub-projects.

Similarly, all the sub-projects interface in some way with various other projects that have been completed, are ongoing or are being planned. It is important for the project to clarify and meet the need for coordination, role appreciation and interaction.

5.1 SUB-PROJECT 1 – NATURAL HAZARDS STRATEGY

The purpose of this sub-project is to identify the framework for a natural hazards strategy within each agency, identify and gain from shared challenges with respect to floods, avalanches and landslides, coordinate activities and describe differences.

There is a need to harmonise the definitions of technical terms commonly used in connection with avalanches, landslides, floods and emergency preparedness, including the terminology used by the police. This includes standardisation of geodata/legends: symbols used, colour coding etc. to achieve unambiguous interpretation of hazard zone maps.

There is also a need to obtain an overview of controlling documents at national and agency level. This includes commitments with respect to express policy, approved strategies for gaining mutual understanding of each other's viewpoints as well as overall objectives and embedding of the project outcomes.



Photo: Culvert gone astray after local flooding in Buskerud (20121806, Andreas Gjærum – NPRA)

In the spring of 2012 the Ministry of Petroleum and Energy submitted a white paper entitled “How to live with the hazards – about floods and slides”. This has now been debated in the Norwegian parliament.

The white paper provides clear guidelines with respect to areas of investment. This sub-project aims to provide specific details for these guidelines with respect to natural hazards and infrastructure. This means that assessing the impact of the white paper on management – within each agency as well as generally with respect to landslides, avalanches and floods – is an important part of the work.

Dissemination, training, and in-house information within the three agencies are also important tasks in order to raise the level of competence and knowledge about the work of other agencies in areas where there is interaction.

This sub-project is also investigating the coordination of support for other R&D work.

5.2 SUB-PROJECT 2 – EMERGENCY PREPAREDNESS AND CRISIS MANAGEMENT

Emergency preparedness and crisis management are important and highly topical areas of work for all agencies, and the different disciplines will have a bearing on a number of subordinate activities in other sub-projects. The team has chosen to concentrate on general aspects to start with, to enable guidelines to be established for interaction between agencies.

Under each activity, the main focus is expected to centre on describing “best practice” and opportunities for effective *interaction* between agencies.



Photo: Whitsun flood and landslide in the valley of Gudbrandsdal (20110610, Niklas Eriksson - NRPA)

In order to structure the team's work, we have defined a set of main activities, each with a subset of action points. This may also provide a structure for the end report:

Project background, delineations

- Description of type of events
- Existing documents and guidelines
- Experience of transnational cooperation
- Body of data
- Description of the current situation, challenges and opportunities

Role appreciation and clarification of responsibilities

- The jobs, responsibilities and roles of the agencies
- Crisis definitions and clarification of terminology
- Interfaces between agencies
- Interfaces to external agencies
- Current interaction status

Planning for emergencies

- Type of events (including climate challenges)
- Understanding of strategic, tactical and operational levels
- Definition of emergency preparedness levels
- Design contingencies

- Contingency planning
- Guard duty rostering/TIB/Resources/Levels
- Forecasting (internally and externally)
- Tools, checklists, action cards
- RVA as a tool – cross-agency quality assurance



Photo: Trya Bridge on National Highway 3 after the floods at Whitsun in the valley of Østerdalen (2011 - NPRA)

Crisis management

- Definitions of crisis
- Normalisation, evaluation and lessons learnt, incl. reporting

Drills and training across agencies and externally

- Safety culture – understanding and foundation
- Understanding strategic, tactical and operational levels
- Training and drills
- Interaction in a crisis, with points of contact at all levels

Information flow

- Information flow and control – internally within the disaster organisations
- Risk communication – ability to provide information in a proactive way
- Coordinated external information flow, all agencies together and individually

Recommendations

Work under this sub-project will be documented on an ongoing basis, to ensure that any findings and points for improvement may be implemented as we go along. All strands will be presented in an end report.

5.3 SUB-PROJECT 3 – MAPPING, LAND USE AND RVA

The following key challenges have been identified:

Mapping floods, avalanches and landslides

The different agencies approach the task of mapping floods, avalanches and landslides in different ways. It will be useful to collate an overview of the various current mapping projects within each of the agencies, as this will enable us to meet the need for mapping in a more cost-effective way. This requires closer liaison between agencies to ensure that specific tasks are appropriately coordinated.

The methodology required for mapping floods, avalanches and landslides is being assessed. Specific outcomes are expected in the autumn of 2012.



Photo: Rockfall by National Highway 48 Mundheim – Eikelandsosen in the county of Hordaland (20040309, Kvam local authority)



Photo: Flood at Gildset School, kilometre post 460.37 (20110816 - JBV)

Data coordination

This activity aims to maintain an overview of work undertaken to coordinate databases and data on floods, avalanches and landslides within the NIFS project.

This includes work to achieve uniform formats, standardisation, visualisation etc as well as gaining the necessary access to established data within the project by means of downloadable solutions, Geonetwork and shared portals for NVE, NPRA and JBV.

We need to continue building on our existing shared web portal, www.skrednett.no, with the objective of collating and presenting proactive information and data about the mapping of flood, avalanche and landslide risks, hazard reports, protective measures, ground surveys etc. conducted by various players, in the public as well as the private sector, to make it easy for users to find joined-up information.

Risk and Vulnerability Assessment (RVA) plan

We need a better system for conducting RVA within and between agencies in order to ensure that the impact of potential floods, avalanches and landslides is sufficiently investigated and documented in all planning work.

We need better planning guidelines and procedures (for construction projects etc.) within the NPRA/NNRA in order to establish and check whether the necessary foundation analyses have been conducted, and to describe how the risk of floods, avalanches and landslides must be documented through RVA.

Flood and landslide events

Collaboration is required with respect to management plans for flood, avalanche and landslide events, including guidelines and procedures for recording data as well as data quality requirements and assurance. We also need to establish good routines for transferring data

between agencies. These tasks are important for the improvement of existing databases and will ensure the attainment of appropriate quality levels as well as an increase in the number of flood, avalanche and landslide events recorded.

We need to draw up guidelines and a coordinated programme to establish how NVE, NPRA, JBV etc. can implement adequate and uniform recording procedures (scope, content and quality) and manage (further process) recorded flood, avalanche and landslide events, feeding into the various tasks within the agencies and meeting the needs of society at large.



Photo: Quick clay slide at Lyngen a few days after the event (20100928 - Frode Oset, NPRA)

5.4 SUB-PROJECT 4 – MONITORING AND FORECASTING

This sub-project is intended to develop, test and evaluate a methodology for monitoring and forecasting the risk of avalanches and landslides. The sub-project is headed by Rune Engeset (NVE) and Jeanette Gundersen (JBV) and includes the following activities:

Monitoring the weather: Support ongoing weather station coordination projects for avalanches and landslides. The work team is headed by Cecilie Stenersen at met.no and reports to the steering committee for avalanche and landslide forecasting (NVE). NIFS representative: Knut Inge Orset (NPRA).

Monitoring stability/slide movements: Test, evaluate and recommend a methodology for physically measuring movements on and inside hazard objects/locations/slide courses which have already been identified /surveyed. NIFS representative: Halgeir Dahle (NPRA).



Photo: Hurrungane – Dry slab avalanche triggered by sunshine (Birgit K. Rustad, NVE)

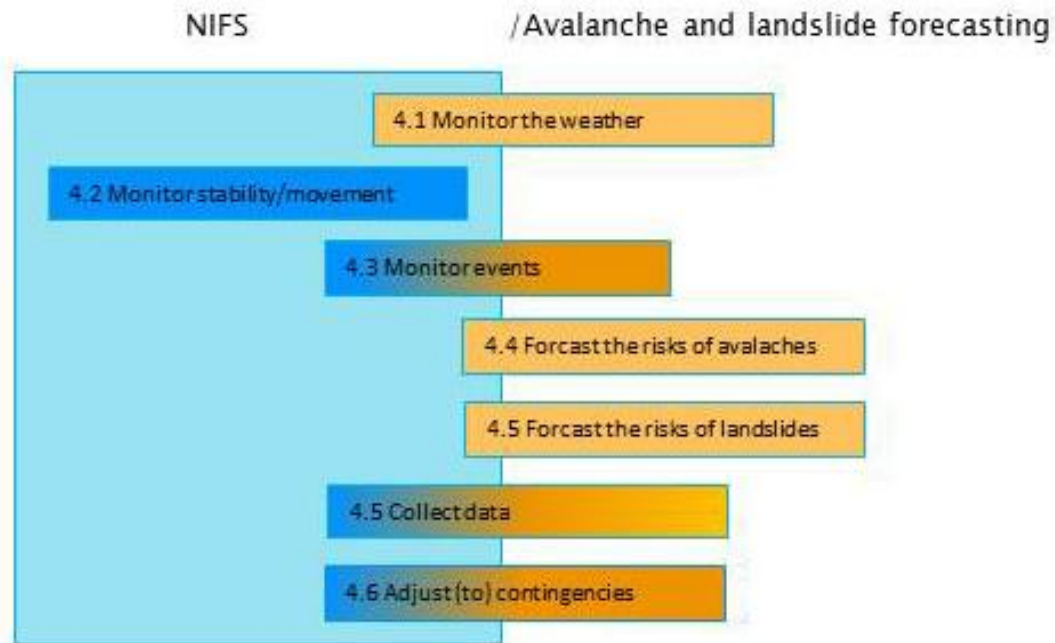
Monitoring events: Monitoring “acute events” and general avalanche and landslide activity with a view to real-time follow-up of the peril. Will help achieve the objectives of regObs and must be coordinated with the national database for avalanches and landslides. NIFS representatives: Ragnar Ekker (NVE) and Tore Humstad (NPRA).

Avalanche forecasting: Refers to shared tasks in connection with the implementation, research and development of avalanche forecasting. Will not involve an operative avalanche forecasting service from 2013. Arrangements are being made to involve a PhD project based at Oslo University. NIFS representative: Karsten Müller (NVE).

Landslide forecasting: Refers to shared tasks in connection with the implementation, research and development of landslide forecasting. Will not involve an operative landslide forecasting service from 2013. NIFS representatives: Graziella Devoli and Ingeborg Kleivane (NVE).

Collate monitoring and forecasting data: Development of the FøreVar web portal is being transferred from the NVE avalanche project to this sub-project. This will make the SeNorge portal a purely NVE site while FøreVar becomes a partnership solution accessed by all agencies for the purposes of forecasting and emergency preparedness. NIFS representative: Tore Humstad (NPRA).

Adjust the contingency work: Come up with proposals for interaction between the forecasting services and the user groups at NVE/JBV/NPRA. NIFS representatives: Tore Humstad (NPRA) and Jeanette Gundersen (JBV).



This sub-project differs from the other sub-projects in that the activities listed above (except 4.2) are funded by the avalanche and landslide forecasting projects and report to them.

NIFS will be a stakeholder and driving force behind adjacent R&D activities. The figure above shows the outline split between NIFS and the forecasting projects.

5.5 SUBPROJECT 5 – FLOODS AND SURFACE WATER MANAGEMENT

This sub-project has examined what constitute the greatest current and future challenges with respect to robust infrastructure and natural perils. In recent years, water-related problems such as localised flooding, surface runoff and water-related landslides have been the cause of most damage from natural perils. These challenges will increase in the time ahead and may become even more extensive in connection with climate change.



Photo: Notodden Railway Station in Telemark (20120723, NVE)

A high level of uncertainty associated with the body of data and the calculation tool, with respect to the design as well as the contingency/forecasting criteria (threshold values), is giving rise to further challenges.

The outcome of the Climate and Transport Project confirms that there are problems with respect to these considerable uncertainties, and the pilot projects in particular demonstrated the wide discrepancies that may arise from using different consultants. Inter-agency partnerships have already been set up and have been in operation for a number of years, for instance under the Climate and Transport Project. In addition, both met.no and NVE focus on and plan to improve parts of their calculation process and their body of data; some of this work has already commenced.

Many water-related events, especially in 2010 and 2011, have caused considerable damage to infrastructure due to flooding and water running off course, having failed to be satisfactorily collected by existing drains. This demonstrates that there is a great need for action in connection with operation and maintenance as well as new-builds. To try to prevent many of these problems, joint working on shared sections/ areas has proved necessary. In particular, alternative flood channels have become a key solution to minimising the level of flood damage when “normal” drainage channels no longer work.

The root cause of many problems, particularly with respect to operation and maintenance, is a lack of money. Consequently, we wish to focus on the fact that it pays to be proactive. This is achieved by clearly demonstrating the benefit by implementing good surface runoff solutions for new-builds, introducing good routines for operation and maintenance, and introducing a raft of measures with respect to existing drainage systems.

The main objective is to reduce personal injuries and damage to infrastructure caused by flooding and surface runoff by working in partnership with respect to construction and operation, and by cooperating to improve the guidelines and tools involved with hydrologic case work within the Public Roads Administration, the National Rail Administration, the Water Resources and Energy Directorate and the municipalities. The optimal solution would be to produce two joint guidelines, one for calculating localised flooding and one for managing floods and surface runoff in connection with the expansion and operation of water courses, as well as a report which demonstrates the financial benefit of proactive interventions based on various events.

This will be achieved by means of three activities under this sub-project:

- Design and flood calculations for localised flooding.
- Cooperation concerning the management of floods and surface runoff in connection with the expansion and operation of water courses.
- Events and costs.



Photo: Derailment on the Røros Line at Krokegga, kilometre post 217.000 (2010905, JBV)

5.6 SUB-PROJECT 6 – SLOPE STABILITY AND LANDSLIDE RELATED CHALLENGES IN QUICK CLAY

In the sensitive clay deposits of Norway, failure of slopes and landslides are particularly destructive, due to the possibility of small landslides initiating a flow, which may involve

massive soil movements in the order of millions of cubic meters. Quick clays of Norway, when provoked by manmade or natural causes, have led to several landslide disasters throughout history. The most well-known are the landslides in Verdal and Rissa that lead to 116 and 1 causality, respectively, and huge resource destruction. In the last 40 years there has been approximately 1 or 2 slides per decade with a volume exceeding 500 000 m³. Since flow slides in sensitive clays possess huge destructive capabilities, there is a need for accurate assessment and prediction of flow slide potential in such materials. However, this is not a straightforward task due to the complexity associated with understanding of such materials. Therefore, there is need for academic as well as industrial research for an assessment, prediction and mitigation of slope failure and landslide challenges posed by quick clay deposits of Norway.

This section identifies and describes quick clay related activities included in the Government Agency Programme.

The activities are described in brief. For a fuller description and background information, please refer to the separate report on quick clay (NVE 33/2012).

Main objective:

There are currently a number of guidelines and standards in use with respect to developments in quick clay areas. One of the Government Agency Programme's main objectives is to clarify and accommodate developments in current regulations and procedures.

Whether relating to the surveying and delineation of land, the interpretation of ground surveys, or to calculations and reports, this will provide a foundation for better and more uniform practice in quick clay areas, based on similar safety policies and irrespective of the location and the identity of the developer.



Photo: Quick clay slide (2010) at Lyngen, Troms (Andrea Taurisano, NVE)

The following activities have been planned and initiated:

Activity	Title	Impact target
Activity 6.1	Definition and delineation of overall stability of area	Agreed definitions and delineations integrated into the agencies' guidelines.
Activity 6.2	Source data for risk assessment	Web-based solution developed to provide access for developers and authorities to updated information at all times concerning ground conditions and quick clay zones, including reports and risk assessments.
Activity 6.3	Shorline slides	Updated landslide information made available to all developers, surveyors and central and local authorities.
Activity 6.4	Site investigation for surveying quick clay	Agreed interpretive models for detecting high-sensitivity clays based on the surveying methods applied.
Activity 6.5	Numerical models	Describe how calculation models are intended to handle and accommodate the real failure process in quick clay and other high-sensitivity clays.
Activity 6.6	Safety policies and regulations	The services' regulations and safety policies coordinated with respect to ground stabilisation and local safety measures in areas with quick clay or other high-sensitivity clays.
Activity 6.7	Landslide retrogression and run-out	Further development of an empirical and numerical tool for modelling the retrogression and run-out of landslides.
Activity 6.8	Stabilisation of quick clay	Further development of a method for stabilising quick clay if traditional work methods may cause reduced stability during the construction phase and in areas where topographical change is impossible or undesirable.

There are currently a number of guidelines and standards in use with respect to developments in quick clay areas.

One of the main objectives of the government agency programme is to clarify and accommodate the development of current regulations and procedures.

Whether relating to the surveying and delineation of land, interpretation of laboratory and field data, or development of new calculation tools, this will provide a foundation for better and more uniform practice in quick clay areas, based on similar safety policies and irrespective of the location and the identity of the developer.

5.7 SUB-PROJECT 7 – AVALANCHE, LANDSLIDE AND FLOOD PROTECTION

Every year vast sums of money are spent on flood defences and landslide /avalanche protection of roads, railways and water courses. New structures and initiatives must be optimal based on the knowledge available. There is a need to review all descriptions found in regulations, manuals, guidelines and checklists to see if they are adequate.



Photo: Surface runoff - the Randsfjord Line (20120807, Steinar Myrabø, JBV)

To ensure a good basis for carrying out the task, we need to review safety measures that have already been implemented to see how the planning and building processes were conducted and why the structures worked as planned or not, as the case may be. Based on the acceptable level of risk (to be debated in connection with a white paper on flood defences and avalanche/landslide protection submitted in the spring of 2012) the agencies need to align their acceptance criteria for landslide and flood events.

Activities under sub-project 7:

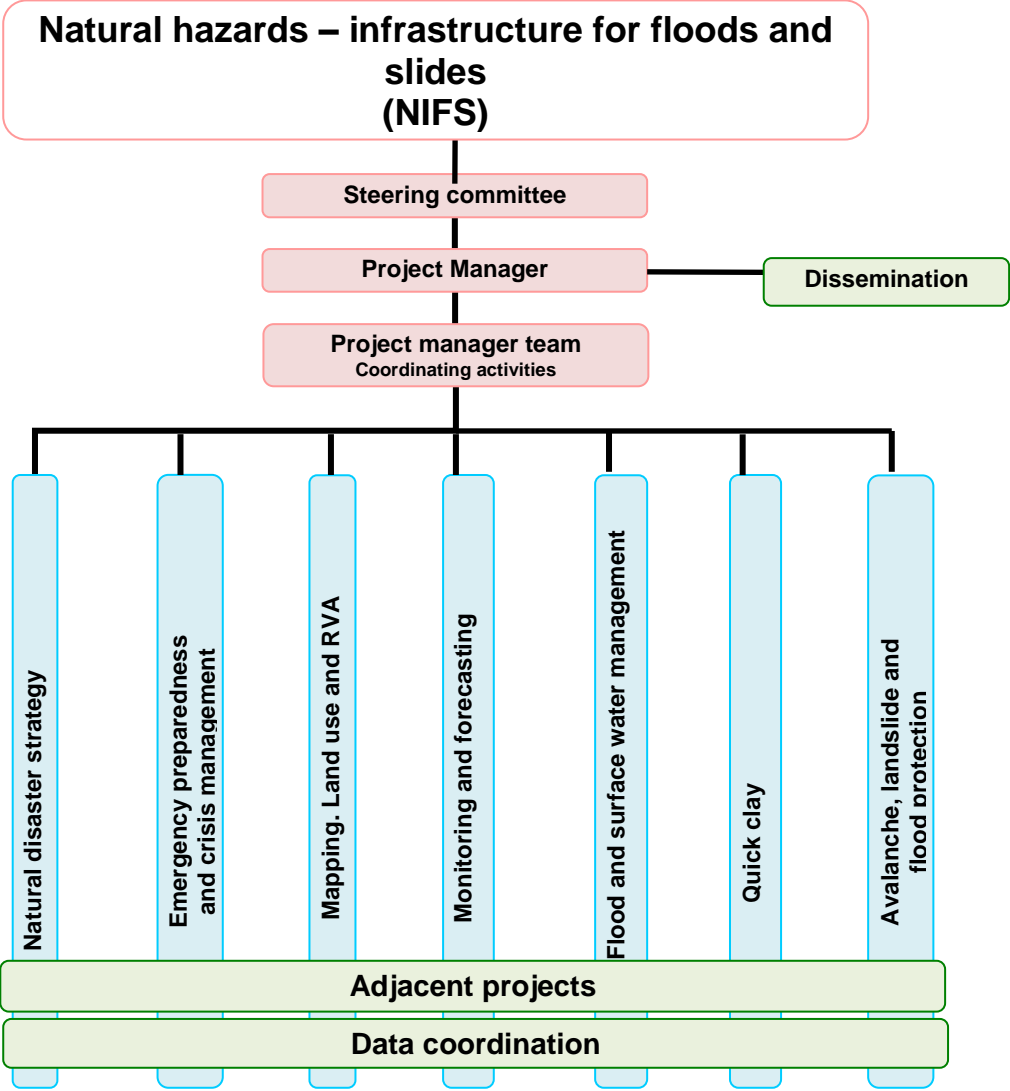
- Slide processes and protective measures (why things go wrong).
- Guidelines/handbooks/checklists (how to prevent things from going wrong).
- Flood, avalanche and landslide acceptance (when it is okay that things go wrong).

6. ORGANISATION

6.1 THE ORGANISATION OF THE GOVERNMENT AGENCY PROGRAMME

The figure below shows the organisational structure of the government agency programme. In general, it is organised with a steering committee, project manager, project manager team with underlying sub-projects and possibly a reference group. The members of the project’s steering committee obtain advice and support from their respective agencies.

The agencies have been working in partnership to advertise for and recruit a project manager for NIFS. The project manager will be working for the Norwegian Public Roads Administration, but will nevertheless have access to office space within the premises of all the agencies. The agencies have agreed to share the cost of advertising and have agreed how to split the payroll and recruitment costs.



Climate adaptation constitutes a basic premise for all sub-projects.

Other important tasks that will have an impact on all sub-projects include:

- Continuation of earlier work
- Coordination of data within the programme
- Coordination with adjacent projects

6.2 THE PARTNERSHIP

Organisationally, the Government Agency Programme is run by the Norwegian Public Roads Administration (the Traffic Safety, Environment and Technology Division, Geotechnology and Landslide Division), the Water Resources and Energy Directorate (Department for Safety and Contingency and the Landslide Section) and the National Rail Administration (Technology Department). The various agencies will involve their regional offices as they find appropriate.

Project contributions by staff will be controlled by an agreement between the Project Manager of the Government Agency Programme and the individual employee's Section Leader within the respective agencies. As a minimum, this agreement should control the amount of work contributed by each project officer. Separate agreements will be drawn up in connection with pilot schemes. These agreements will form a contract between the Government Agency Programme and the individual development projects.

The project is expected to run in tandem with other relevant internal R&D projects. It should be an objective to ensure that further alliances are considered during the project period e.g. EU projects or Research Council projects.



Photo: Trya Bridge on National Highway 3 after the floods at Whitsun in the valley of Østerdalen (2011 - NPRA)

There is already widespread collaboration between the different agencies. The Norwegian Public Roads Administration programme entitled "Climate and transport", has seen them work in partnership with the National Rail Administration and the Water Resources and Energy Directorate on actions required in response to climate change. The same agencies are also working in partnership under the avalanche and landslide forecasting project entitled "Faregrad SeNorge", with NVE as the project owner. This has developed into a joint initiative

to develop a nationwide regional forecasting service for avalanches and landslides in Norway. Met.no, the Geological Survey of Norway, and the Norwegian Mapping Authority are co-contributors. A joint application has been submitted seeking to continue the R&D investment into an operational phase commencing 2012/2013. The R&D investment in an avalanche and landslide forecasting system continues as part of the Government Agency Programme.

A number of map portals have been developed in partnership, designed to be continued under the Government Agency Programme, such as www.skrednett.no which requires hazard zone maps and risk maps to be designed and updated.

In connection with the “Climate and transport” project, a proposal for a climate portal was drawn up as a result of cross-agency partnership: “<http://nyforevar.senorge.no>”.

The collaborating partners have joined forces in supporting a number of PhD projects (two ongoing and one completed). A further PhD project is being supported in partnership with ICG and another with Met.no. Proposals have been put forward for further initiatives as part of the NIFS programme.

There are currently a number of adjacent projects of which the Government Agency Programme needs to take account. One example is the SINTEF project entitled “Consequences and initiatives for the impact of floods, avalanches and landslides on buildings and infrastructure”.

Important stakeholders outside the project team:

- Other players from within central government, such as the Norwegian Meteorological Institute (Met.no) and the Geological Survey of Norway (NGU), are important suppliers of knowledge and will become important contributors to a number of the sub-projects.
- Important stakeholders internally within the partner organisations, NPRA and JBV, with respect to joint work on the National Transport Plan.
- Research institutions, universities and university colleges as well as consultancies.
- Relevant government departments such as the Ministry of Transport and Communications, the Ministry of Petroleum and Energy, the Ministry of Education and Research, the Ministry of Local Government and Regional Development, as well as the Ministry of the Environment.

6.3 SCHEDULE

The Government Agency Programme is scheduled for completion over the period 2012 - 2015. The scope of activities under each sub-project will vary over the course of the programme period.

The scheduled rate of progress is intended to ensure that all seven sub-projects run over the entire project period, but different activities under the various sub-projects may have shorter production phases. Some of these activities will be finalised and form a basis for further/modified research input.

In the start-up year of 2012 we have particularly focused on the following topics under the various sub-projects (Sp):

- Sp1** Start-up and development of a PhD project as well as a joint Master's programme: information, dissemination and terminology.
- Sp2** Emergency preparedness and crisis management as well as step-by-step contingencies.
- Sp3** Mapping, area assessments and RVA.
- Sp4** Complete proposal for a regional avalanche and landslide forecasting system.
- Sp5** Flood and surface water management, incl. design calculations and data, particularly for small and medium-sized rivers.
- Sp6** Definition of area stability, safety policies and regulations, progressive failure, as well as coordination of source data.
- Sp7** Avalanche, landslide and flood protection, checklists, manuals and acceptance criteria.

The cooperating partners are planning a combined investment of approx. ten man-years annually throughout the project period. This level of investment is necessary to secure implementable research outcomes and a future-oriented accumulation of competence within each individual organisation. At the same time, this will ensure that our research is geared towards specific problems.

Milestones for 2012/2013:

- Regulations concerning area stability coordinated.
- Services ready to start running the avalanche and landslide forecasting project.
- New proposal for design calculations in connection with small and medium-sized water courses.

Sub-project outcomes are expected to be published on an ongoing basis, and schedules will be revised in line with documented results, budget decisions and as directed by the management team.



Photo: Landslide closing the E39 Highway at Insteffjorden in Sogn og Fjordane county, March 2010 (20090302, Njål Farestveit – NPRA)

Human resources and budgets

The agencies' steering committee has the following members:

- Anne Britt Leifseth (Head of the Landslides and Water Resources Division of the Norwegian Water Resources and Energy Directorate) chairs the steering committee in 2012
- Marit Brandtsegg (Head of the Traffic Safety, Environment and Technology Division of the Norwegian Public Roads Administration)
- Sverre Kjenne (Director of Technology, the National Rail Administration)

Also attending are Brigte Samdal (NVE), Roald Aabøe (NPRA), Ragnhild Wahl (JBV) and Project Manager Bjørn Kristoffer Dolva (NIFS).

Marie Haakensen (NPRA) is affiliated to the group in her role as Project Officer.

6.4 PERSONNEL AND COMPETENCE

Key specialist personnel from within all the agencies are involved at a high level. Highlighted names refer to confirmed sub-project managers. The others represent their respective agencies in the sub-project.

Sub-project	NVE	JBV	NPRA
Sp1 – Natural disaster strategy	Knut Sørgaard	Trond Børsting	Gordana Petkovic (L)
Sp2 – Emergency preparedness and crisis management	Kari Øvreid (L)	Trond Sandum	Hein Gabrielsen
Sp3 – Mapping, land use and RVA	Eli Øydvin (L)	Per Anton Fevang	Heidi Bjordal
Sp4 – Monitoring and forecasting	Rune Engeseth (L)	Steinar Myrabø	Tore Humstad
Sp5–Floods and surface water management	Sverre Husebye	Steinar Myrabø (L)	Kristine Flesjø
Sp6 – Slope stability and Landslide related challenges in quick clays	Odd Are Jensen	Arnulf Robsrud	Vikas Takur (L)
Sp7–Avalanche, landslide and flood protection	Knut Aune Hoseth	Margareta V (L)	Heidi Bjordal

6.5 BUDGET

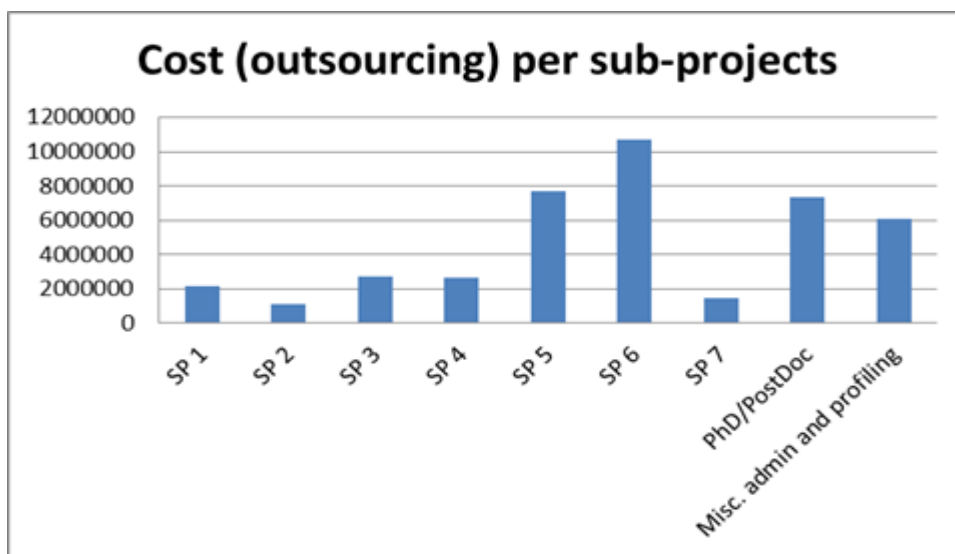
The Government Agency Programme has a maximum spending threshold of NOK 42 million over four years. Budget allocations to the different sub-projects have been based on planned activities and expected progress. Please note that the building and setting up of any pilot schemes must be funded through ongoing development projects.

The table below shows the resource allocations (in NOK and man-weeks) over the project period. The start-up year of 2012 and the overall period have been reconciled, but it will be necessary to adjust the input as we go along to accommodate our findings and the frameworks drawn up by the steering committee.

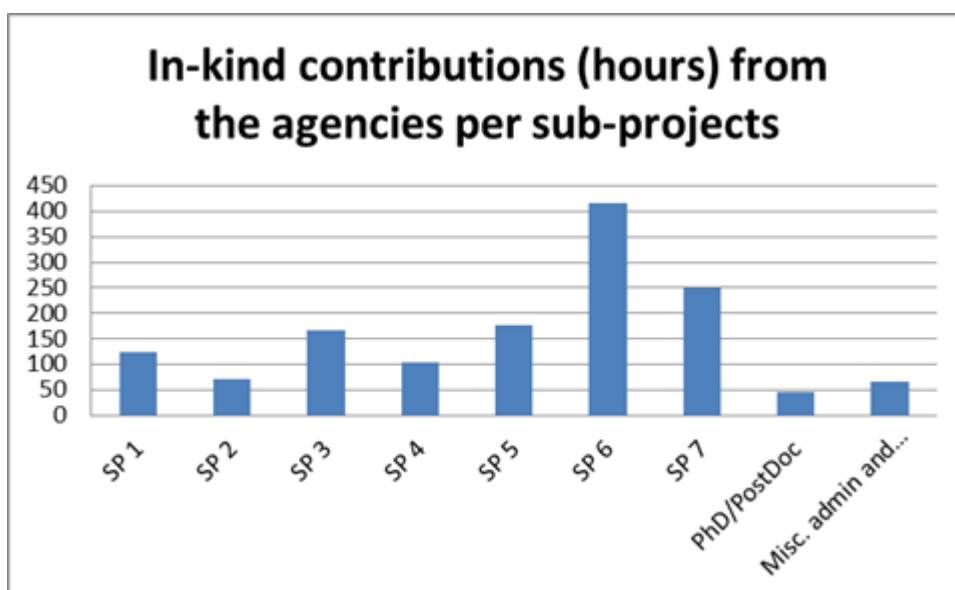
NIFS activity	2012 - NOK	2012 - time	2013 - NOK	2013 - time	2014 - NOK	2014 - time	2015 - NOK	2015 - time	Sum total - NOK	Sum total - time
Sp-1	600000	35	850000	38	500000	25	200000	25	2150000	123
Sp-2	400000	0	250000	24	250000	24	250000	24	1150000	72
Sp-3	400000	24	800000	48	750000	48	750000	48	2700000	168

Sp-4	600000	24	750000	27	800000	27	500000	27	2650000	105
Sp-5	2500000	44	2450000	44	1750000	44	1020000	44	7720000	176
Sp-6	3200000	124	2950000	116	2350000	88	2250000	88	10750000	416
Sp-7	100000	60	500000	70	500000	70	350000	50	1450000	250
PhD / PostDoc	200000	9	2430000	12	2500000	12	2200000	12	7330000	45
Profiling /admin.	1000000	20	1700000	15	1700000	15	1700000	15	6100000	65
Sum total	9000000	340	12680000	394	11100000	353	9220000	333	42000000	1420

The figure below shows planned resource allocations per sub-project in the form of services outsourced.



The figure below shows the resource allocations per sub-project in the form of in-kind contribution from the agencies.



6.6 FUNDING

Funding for the partnership project is provided by the Norwegian Public Roads Administration, the Norwegian National Rail Administration and the Norwegian Water Resources and Energy Directorate.

For some projects, additional grant funding is sought specifically from the Research Council of Norway. Separate budgets are also expected to be forthcoming for the running of a regional avalanche and landslide forecasting service by the same partners (+ Met.no).

The table shows the investment in NOK mill. as well as the split between the services.

Project partners	2012	2013	2014	2015
JBV	3	4	4	3
NPRA	3	4	4	3
NVE	3	4	4	3
Sum total	9	12	12	9

7. COMMUNICATION

The Government Agency Programme will communicate its work through different channels depending on the recipients. The civil service programme will draw up a communication plan in liaison with the press offices of the various organisations.

Examples of current and future dissemination of information:

- Design a dedicated project web page. See: www.naturfare.no
- Organise and conduct national and/or international project conference(s) during which outcomes will be presented and discussed with representatives of academia, research institutes and local/national authorities.
- Arrangements are made to ensure that outcomes may be presented on an ongoing basis at national and international conferences and workshops.
- Publication in scientific peer-reviewed journals.
- Publication in journals of a more populist character.
- Publication in National and International conferences and workshops
- News lettersPublication in the form of reports by the project partners.
- Fact sheets/ implementation notes.
- Communication via the media.

8. PROCUREMENT

The services of consultants will be purchased in compliance with current legislation (*the Public Procurement Regulations*) and the internal procurement procedures of each agency. Parts of the project are conducted under joint framework agreements.

Some of the research activities will be based on partnership projects involving the collaborating partners as well as universities/research institutions in the public sector. This work is funded by *research grants* and is not subject to *the Public Procurement Regulations*.

9. QUALITY

Project control and implementation go by the agencies' quality manuals. All outputs from the Government Agency Programme must maintain a high standard and be scientifically verifiable.

Additionally, the steering committee and any specialist representatives within reference groups will play an important role in assuring that the Government Agency Programme maintains a high standard with respect to project control as well as all specialist content.

9.1 QUALITY PLAN

No additional quality plan has been drawn up specifically for NIFS, but all work under the programme is based on the following principles.

- All documents prepared by or for the programme must be submitted to at least two people for quality assurance prior to publishing.
- All documents (including work documents) must have self-explanatory file names and be filed in an intuitive folder system at our shared **project hotel**.
- Documents will be published by our web editors on **www.naturfare.no**

9.2 HEALTH, SAFETY AND ENVIRONMENT (HSE)

All HSE work under the project will be carried out in compliance with current regulations within each agency.

10. UNCERTAINTY

No analysis of uncertainties has as yet been conducted.

11. PROJECT FOLLOW-UP

A meeting structure has been established by which:

- The project management meets the steering committee (3 - 4 meetings per year)
- Sub-project managers meet the project management (4 - 6 meetings per year)
- Sub-projects hold internal work meetings (as and when required)
- Work group meetings are held for each activity (as and when required)

Minutes of all meetings are prepared in writing and made available at the project hotel.

The project management and sub-project managers are responsible for keeping the project calendar updated.

- Budget and progress updates are provided monthly in connection with consultants' work contracts.
- Sub-project managers submit a monthly status report (budget, progress, outputs and non-conformance) to the project management.

Utgitt i Rapportserien i 2013

- Nr. 1 Roller i det nasjonale arbeidet med håndtering av naturfarer for tre samarbeidende direktorat
- Nr. 2 Norwegian Hydrological Reference Dataset for Climate Change Studies. Anne K. Fleig (Ed.)
- Nr. 3 Anlegging av regnbed. En billedkavalkade over 4 anlagte regnbed
- Nr. 4 Faresonekart skred Odda kommune
- Nr. 5 Faresonekart skred Årdal kommune
- Nr. 6 Sammenfatning av planlagte investeringer i sentral- og regionalnettet for perioden 2012-2021
- Nr. 7 Vandringshindere i Gaula, Namsen og Stjørdalselva
- Nr. 8 Kvartalsrapport for kraftmarknaden. Ellen Skaansar (red.)
- Nr. 9 Energibruk i kontorbygg – trender og drivere
- Nr. 10 Flomsonekart Delprosjekt Levanger. Kjartan Orvedal, Julio Pereira
- Nr. 11 Årsrapport for tilsyn 2012
- Nr. 12 Report from field trip, Ethiopia. Preparation for ADCP testing (14-21.08.2012)
- Nr. 13 Vindkraft - produksjon i 2012
- Nr. 14 Statistikk over nettleie i regional- og distribusjonsnettet 2013. Inger Sætrang
- Nr. 15 Klimatilpasning i energiforsyningen- status 2012. Hvor står vi nå?
- Nr. 16 Energy consumption 2012. Household energy consumption
- Nr. 17 Bioenergipotensialet i industrielt avfall
- Nr. 18 Utvikling i nøkkeltall for strømnetselskapene
- Nr. 19 NVEs årsmelding
- Nr. 20 Oversikt over vedtak og utvalgte saker. Tariffer og vilkår for overføring av kraft i 2012
- Nr. 21 Naturfareprosjektet: Delprosjekt Kvikkleire. Utstrekning og utløpsdistanse for kvikkleireskred basert på katalog over skredhendelser i Norge
- Nr. 22 Naturfareprosjektet: Delprosjekt Kvikkleire. Forebyggende kartlegging mot skred langs strandsonen i Norge Oppsummering av erfaring og anbefalinger
- Nr. 23 Naturfareprosjektet: Delprosjekt Kvikkleire. Nasjonal database for grunnundersøkelser (NADAG) – forundersøkelse
- Nr. 24 Flom og skred i Troms juli 2012. Inger Karin Engen, Graziella Devoli, Knut A. Hoseth, Lars-Evan Pettersson
- Nr. 25 Capacity Building in Hydrological Services. ADCP and Pressure Sensor Training Ministry of Water and Energy, Ethiopia 20th – 28th February 2013
- Nr. 26 Naturfareprosjektet: Delprosjekt Kvikkleire. Vurdering av kartleggingsgrunnlaget for kvikkleire i strandsonen
- Nr. 27 Kvartalsrapport for kraftmarknaden. Ellen Skaansar (red.)
- Nr. 28 Flomberegninger for Fedaelva, Kvinesdal kommune, Vest-Agder (025.3A1) Per Alve Glad
- Nr. 29 Beregning av energitilsig basert på HBV-modeller. Erik Holmquist
- Nr. 30 De ustabile fjellsidene i Stampa – Flåm, Aurland kommune. Sammenstilling, scenario, risiko og anbefalinger.
- Nr. 31 Naturfareprosjektet: Delprosjekt 4 Overvåking og varsling Overvåking ved akutte skredhendelser
- Nr. 32 Landsomfattende mark- og grunnvannsnett. Drift og formidling 2012. Jonatan Haga
- Nr. 33 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Saltdiffusjon som grunnforsterking i kvikkleire
- Nr. 34 Kostnadseffektivitet i distribusjonsnettet – En studie av referentene i kostnadsnormmodellen
- Nr. 35 The unstable phyllitic rocks in Stampa – Flåm, western Norway. Compilation, scenarios, risk and recommendations.
- Nr. 36 Flaumsonekart Delprosjekt Årdal i Sogn. Siss-May Edvardsen, Camilla Roald
- Nr. 37 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Skånsomme installasjonsmetoder for kalksementpeler og bruk av slurry
- Nr. 38 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Karakterisering av historiske kvikkleireskred og input parametere for Q-BING
- Nr. 39 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Natural Hazards project: Work Package 6 - Quick clay Characterization of historical quick clay landslides and input parameters for Q-Bing

Rapportserien i 2013 forts.

- Nr. 40 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Skred ved Døla i Vefsn. Undersøkelse av materialegenskaper
- Nr. 41 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. State-of-the-art: Blokkprøver
- Nr. 42 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Innspill til "Nasjonal grunnboringsdatabase (NGD) – forundersøkelse"
- Nr. 43 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Styrkeøkning av rekonsolidert kvikkleire etter skred
- Nr. 44 Driften av kraftsystemet 2012. Karstein Brekke (red.)
- Nr. 45 Ny forskrift om energimerking av energirelaterte produkter (energimerkeforskriften for produkter) Oppsummering av høringsuttalelser og endelig forskriftstekst
- Nr. 46 Natural Hazards project: Work Package 6 - Quick clay. Back-analyses of run-out for Norwegian quick-clay landslides
- Nr. 47 Årsrapport for utførte sikrings- og miljøtiltak 2012. Beskrivelse av utførte anlegg
- Nr. 48 Norges hydrologiske stasjonsnett. Ann-Live Øye Leine, Elise Trondsen, Lars-Evan Pettersson
- Nr. 49 Vannkraftkonsesjoner som kan revideres innen 2022. Nasjonal gjennomgang og forslag til prioritering
- Nr. 50 Endring i avregningsforskriften – AMS. Oppsummering av høringsuttalelser og endelig forskriftstekst
- Nr. 51 Filefjell og Anestølen forskningsstasjon. Evaluering av måledata for snø, sesongen 2011/2012
Hilde Landrø Fjeldheim, Emma Barfod
- Nr. 52 Kulturminner i norsk kraftproduksjon. Elisabeth Bjørsvik, Helena Nynäs, Per Einar Faugli (red.)
- Nr. 53 Øvelser. En veiledning i planlegging og gjennomføring av øvelser i NVE
- Nr. 54 Flom og skred i Nord-Norge mai 2013
- Nr. 55 Naturfareprosjektet: Delprosjekt 6 Kvikkleire. Workshop om bruk av anisotropi ved stabilitetsvurdering i sprøbruddmaterialer
- Nr. 56 Flom i Norge. Lars Roald
- Nr. 57 The Natural Hazards Project: Programme plan 2012-2015 for the Government Agency Programme "Natural Hazards – infrastructure for floods and slides (NIFS)"



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