Coast to Coast Climate Challenge

LIFE 2015 INTEGRATED PROJECTS
CLIMATE ACTION

Stage 2 - Full proposal

Phase 2 – Approved Amendment

LIFE15 IPC/DK/000006-C2C CC

Part 2 – A Actions and C Actions (from C1 – C14)

LIFE 2015 INTEGRATED PROJECTS

CLIMATE ACTION

LIFE15 IPC/DK/000006 – EU LIFE IP C2C CC

Part C

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LIFE Integrated Projects 2015

Climate Action

Stage 2 – Full proposal

TECHNICAL APPLICATION FORMS

Part C – detailed technical description of the proposed actions

Important notes:

- **All calculations and detailed cost breakdowns necessary to justify the cost of each action should be included in the financial forms F. In order to avoid repeating the financial information (with the risk of introducing incoherencies), Part C should only contain financial information not contained in the financial forms (e.g. details explaining how the cost of an action has been estimated).**
- **All forms in this section may be duplicated, so as to include all essential information.**
- **Each action described should have a clear indication of its physical target (e.g., action 1 will take place in area "X" and/or will target species "Y"). Whenever this is relevant, the location of these actions should also be identified on one or several maps which must be provided in annex.**
- **Any action that is sub-contracted should be just as clearly described as an action that will be directly carried out by the beneficiaries.**

DETAILS OF PROPOSED ACTIONS

A. Preparatory actions (elaboration of management/action plans, obtaining licences and permits, trainings, etc.)

Beneficiary responsible for implementation: C2C project management (PM)

Role:

- To carry out preparatory actions
- To coordinate with C2C CC beneficiaries and stakeholders
- To have dialogue with national ministries and agencies

A1. Legal barriers to integrated CCA, current CCA integration and policy recommendations

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days
What:

One of the major barriers for implementation of CCA plans can be found in the legal framework for municipalities', wastewater companies' and citizens' rights and obligations. This action has a double purpose: on the short run, to provide decision makers of partner municipalities with (equal) knowledge on legal barriers and past practice, and, on the longer run, to generate policy recommendations to legal changes. Both objectives are prerequisites to better CCA implementation: optimized information will make it possible for municipalities to better implement actual plans, whereas changes to existing regulation will optimize implementation in the longer run.

Since regulation of CCA is a relatively new phenomenon, legal barriers can be found within all spheres of the hydrological circle: sea and fjords, rainwater, groundwater, as well as lakes and rivers. Contending issues cover: who should pay for CCA? What are municipalities/wastewater companies/citizens allowed/obliged to do? Does CCA conflict with regulation in other (e.g. environmental) areas?

Regarding sea and fjords, holistic solutions against storm surges are hindered by inexpedient division of responsibilities between citizens and authorities; conflicting view of nature vs. efficient adaptation, multi-level governance, municipalities' conflict of role as owner vs. regulator, etc. In addition, coastal regulation is very complex, which is a burden to CCA projects.[1]

Regarding rainwater, a major issue concerns the responsibilities and possibilities of the wastewater companies in participating in CCA projects in the municipalities. The newest legal regulations enabled wastewater companies a new co-financing role in CCA projects,

[1] Rambøll, 2015 pp. 31 ff

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but these regulations suffer significant limitations, which have proven an intricate challenge for the companies, while their incentives to initiate new projects appear hamstrung by municipally conditions of a political and technical nature. Hence, many wastewater companies still use the traditional or the quality project model for financing CCA related projects.

Regarding lakes and rivers, CCA is not yet legally part of the WFD and the river basin management plans. Some CCA means are not coherent with the river basin management plans, e.g. in relation to the hydrological impact of a watercourse, and the balance between watercourse ecology and CCA. However, several means can be implemented with synergies to both CCA and watercourse ecology e.g. wetlands and meadows, and within the frames of the river basin management plans.

Regarding groundwater, CCA in regard of SUDS conflicts with groundwater protection in regard to infiltration of rainwater from roofs and roads and potential pollution of the groundwater resource, which hinders implementation of SUDS in areas with vulnerable groundwater resource. In regard to flooding caused by rising groundwater level, CCA means are only in the very beginning to be defined in the Danish context, and legislative conflicts may occur during the IP life time.

This action feeds directly into E3.1 and indirectly to all C and D actions.

How:

1. Conduct a thorough desk analysis of the legal framework, review all relevant documents relating to the water sectors, and gather information related to challenges in other EU countries' legal systems
2. Prepare a presentation on this extensive topic to be presented at a seminar in June 2017 (cf. E3.1)

Where:

The premises of the C2C CC secretariat

When:

Phase 1: 1/1/2017-31/3/2017

Reasons why this action is necessary:
This preparatory action is necessary as it provides crucial information to the consortium on legal barriers, CCA integration and on possible policy recommendations. The C2C CC partners need this information as background knowledge in order to work towards successful integration of CCA into the planning process and to accommodate any potential issues on this.

Constraints and assumptions
Any significant constraints are not expected for this action.

Expected results:
The expected results are a comprehensive understanding og the legal framework on CCA, the water sector and relevant practices of other EU countries' legal systems, and capacity building of C2C CC partners on how to navigate national legislation on CCA.

Cost estimation:
Based on working days, will salary of 47 € per hour and 347347,5 € per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A1.1	A memo sent to the beneficiaries explaining what the main findings of the research is and how the project management unit plans to present this in a clear and concise way at the seminar (E3.1)
A1.2	PowerPoint presentation

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A1.1	Desk research and interviews are conducted before this date	31/5/2017
A1.2	PowerPoint presentation is ready	31/5/2017

A2. Analyse state-of-the-art of current mainstreaming of CCA into local planning and possibilities for cross-sector cooperation

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days

What:

Danish municipalities are obliged to integrate and mainstream CCA into local planning. As a result of very different experiences with climate change, political attention, and capacities at their local level, municipalities have developed very different approaches to mainstreaming. Consequentially a significant need for obtaining knowledge of what constitutes best practice for mainstreaming CCA exists. It is therefore relevant to analyse which approaches the municipalities use, and how this affects the mainstreaming of CCA plans into their local planning. CDR has created a CCA template, which can also be used in this regard to further raise the level of CCA planning in the region.

Municipalities face major coordinating challenges in several sector areas: Within the environmental sector, challenges arise in coordinating the local plans and strategies.

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Secondly, in the coordination of the environmental area's plans and strategies with other sectorial areas. Some municipalities even apply a trial-and-error approach to using local plans as a toolkit to further CCA integration, which might be suboptimal. Lack of interdisciplinary and inter-sectoral cooperation is another challenge, which inhibit CCA mainstreaming. This is especially the case in larger municipalities having extensive specialised units and personnel with diverse professional background. It creates a lack of unified perspective and an environment infused with multiple – and often conflicting – interests. This especially materialises in abstract strategic planning, and less so in concrete projects. An understanding of how cross-sector cooperation is dealt with will provide a strategy (including tangible toolkit) for dealing with this and to ensure that cooperation with other sectors is ensured and prioritised in C2C CC. Beneficial possibilities for cross-sector cooperation remain potentially great and further analyses of CCA mainstreaming and cooperation could prove advantageous for applying best-practices in future CCA mainstreaming.

This action feeds into C1-C24

How:

1. Gather best practices at local, national and European level in order to present information on how CCA is being mainstreamed into local planning (desk research). Research will focus on Denmark and countries with a comparable climate and political environment. Issues of particular interest are among others:

    - Cross-sector co-opertion and network/cluster formation
    - Mainstreaming (formalised) into local regulation vs. informal cooperation fora as a means of co-creation among stakeholders
    - Ad hocism (CCA projects)

2. Research cross-sector cooperation and the challenges, which are found in this area
3. Create a presentation to be used at the seminar in June 2017 (cf. E3.1) informing the consortium about the information and conclusions of the research

Where: The premises of the C2C CC secretariat

When:

Phase 1: 1/1/2017-31/12/2017 (this activity will take place throughout the project period, however, the main work load is placed in the first year of the project)

Reasons why this action is necessary:
Danish municipalities face many obligations and challenges in regards to CCA. Many of the C2C CC partners are municipalities, and as the overall objective of C2C CC is to support the full implementation of the municipal CCA plans, it is crucial to gain an understanding of these challenges at an early point in the IP's lifetime.

Constraints and assumptions
No significant constraints are expected for this action.

Expected results:

The results are a comprehensive understanding of what successful CCA mainstreaming entails and how to incorporate cross-sector cooperation. Capcity building of CCA partners and stakeholders on how they mainstream their CCA actions into other planning.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A2.1	An overview of best practices in relation to CCA mainstreaming at local, national and European level
A2.2	A strategy on how to work with cross-sectoral cooperation
A2.3	A PowerPoint presentation

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A2.1	The desk research is conducted before this date	31/12/2017
A2.2	The strategy on cross-sectoral cooperation is drafted and ready to be presented at the forthcoming seminar (cf E3.1)	31/05/2018
A2.3	The PowerPoint presentation is ready	31/05/2018

A3. Collect existing data analyses and reports about the region as basis for integrative CCA planning and combine data in a common database

Budget: 17.130€

Number of days estimated spent on action in phase 1: 40 Days

What:

This background knowledge will help provide an indication on how to enable new planning and governance in the region, and it will provide best practices from other countries, e.g. the Rivers Trust project from the UK (an approved LIFE IP from 2014) and on relevant topics such as water areas/themes in connection with the River Basin Management Plans. Furthermore, a thorough understanding of all relevant EU directives, policies and strategies needs to be obtained by the project management unit, so it understands the context in

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which the project operates. All cross-cutting capacity building actions and demonstration projects will need access to this information in an easy and accessible way and the accumulated information will therefore be made available in a database on the online platform (cf. E2.1), which can be accessed from the project's website via the intranet for the project partners.

This action feeds into C5.1.1 (*New paradigm and a common regional strategy integrating municipal CCA plans*) and it is important to ensure that all the sub-projects/demonstration projects have access to up-to-date knowledge in the area.

How:

1. Conduct desk research
2. Conduct interviews with regional and municipal officials

Where: At the premises of the project management unit

When: Phase 1: 1/1-2017 – 31/07/2017

Reasons why this action is necessary:
It is crucial to collect existing data analyses and reports about the Central Danish Region in relation to integrative CCA planning to ensure that the project management unit and all partners have the necessary knowledge.

Constraints and assumptions
No significant constraints are expected for this action.

Expected results:
Comprehensive data analyses and reports that together with regional and municipal officials' opinions and experiences with CCA planning provide basis for integrative planning in the region.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A3.1	A database showing information from previous data analyses and reports
A3.2	A document showing both quantitative answers from the interviews, e.g. in statistics, and qualitative answers in full text

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A3.1	Desk research is conducted before this date	31/03/2017
A3.2	Interviews are conducted before this date	31/03/2017

A4. Interview municipal and utility officials

Budget: 21.065 €

Number of days estimated spent on action in phase 1: 20 Days

What:

After the initial desk research and review of current mainstreaming of CCA into local planning, the project management unit will interview municipal and utility officials in order to understand how these work with - and around - the legal barriers to integrated CCA planning. The PM will schedule the interviews at the officials' workplaces, and will schedule at least one interview per C2C CC municipality and per water utility. The interviewees will help identify where policy/legislation is a barrier to CCA planning and they are also able to make recommendations on methods to address these barriers. The interviews will be qualitative in nature in order to obtain as much information as possible from the interviewees. After all interviews are conducted, the answers will be analysed and when relevant translated into quantitative data. The conclusions from this research will be presented at the forthcoming seminar, cf. E3.1.

This action feeds directly into E3.1 and indirectly into C1-C24

How:

1. Conduct interviews with municipal and water utility officials
2. Analyse the interviewees' answers and convert these into quantitative and qualitative data
3. Present the research and conclusions at the forthcoming seminar (cf. E3.1)

Where: This activity takes place throughout the region of Central Denmark.

When: Phase 1: 1/4/2017-31/5/2018

Reasons why this action is necessary:
The initial desk research described in the previous A-actions are mainly focused on desk research, however, after information about legal barriers and existing and current mainstreaming of CCA has been reviewed, it is necessary to meet with and interview municipal and utility officials in order to understand how these work with the legal barriers to integrated CCA planning

Constraints and assumptions
All interviewees will need to allocate time for the interviews, however, in order to ensure as many as possible can take part in these, the duration of the interviews will be kept at approximately 30 min. It is therefore assumed that all relevant officials can take part in the research.

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Expected results:
Quantitative and qualitative insight and overview of municipal and water utility officials' way of working and experiences with CCA integration, and presented to C2C CC as background information of current practice.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee. External assistance is based on prior experience.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A4.1	A script used for conducting the interviews
A4.2	A document providing an overview of the answers (quantitative and qualitative)
A4.3	A PowerPoint presentation used to disseminate the information

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A4.1	The interview script is drafted	15/04/2017
A4.2	The document is finalised providing an overview of the interviewees' answers	31/05/2018
A4.3	The presentation is done for the seminar cf. E3.1	31/05/2018

A5. Start dialogue with Local Government Denmark (LGDK) and relevant ministries and agencies

Budget: 10.598 €

Number of days estimated spent on action in phase 1: 20 Days

What:

Local Government Denmark (LGDK) is the interest group of Danish municipalities and it therefore important to keep it informed on C2C CC objectives to ensure, that it provides support to a regional project involving almost 20 % of all Danish municipalities. LGDK is furthermore an important forum when it comes to replication and disseminating information about the project and how the results can be replicated in other parts of Denmark.

In Denmark, the relevant ministries for the C2C CC project are:

- the Danish Ministry of Energy, Utilities and Climate
- the Ministry of Environment and Food of Denmark
- the Ministry of Business and Growth Denmark

Two government agencies are primary stakeholders in C2C CC, i.e. the Danish Coastal Authority and the Danish Nature Agency. These are both agencies of the Ministry of Environment and Food of Denmark.

How:

1. Start dialogue with LGDK (continuous activity throughout the project period). Pinpoint contact persons and hold meetings to ensure the full backing of the municipalities' organisation in a project, where the overall objective is to support the full implementation of municipal plans.
2. Start dialogue with relevant public authorities (continuous activity throughout the project period). Hold meetings with the abovementioned ministries, including the corresponding relevant agencies to present the progress and more technical aspects of the project (e.g. C1-C24). In addition, these meetings are important forums for creating awareness and disseminating information about achieved milestones and results.

This action feeds into C1-C24 and F actions.

Where: This action takes place throughout Denmark as LGDK and the ministries are located in Copenhagen.

When: 1/1/2017-31/12/2022

Reasons why this action is necessary:
It is relevant – and necessary - to have the backing of the municipalities' organisation and the public authorities in Denmark when it comes to dissemination and progress reporting to external stakeholders. Despite the fact that this is a regional project and that some of these stakeholders are not included as primary stakeholders in C2C CC, it is important to include them as CCA is an issue which needs to be raised at the highest administrative level, and not merely at municipal and/or regional level.

Constraints and assumptions
It is assumed that C2C CC will have the interest of the public authorities in Denmark and that these stakeholders can see the value of supporting it and potentially assisting with dissemination activities. As no other region in Denmark is conducting such an extensive CCA project, the consortium expects a lot of focus to be given to the Central Danish Region.

Expected results:
The results of preparatory actions are an insight and overview of the legislative and practical barriers and challenges for CCA implementation. Officials within LGDK and relevant national ministries and agencies are pinpointed and a line of dialogue is established to ease implementation of CCA. Capacity building of C2C CC partners and stakeholder on how to navigate legislation and praxis.

Cost estimation:
Based on working days, will salary of 47 € per hour and347,5€ per day per senior employee and 35 € per hour and 259 € per day per junior employee.

Estimation of the costs for the total project management staff is based upon prior experience from other similar projects. The previously mentioned CDR staff assigned the action will correspond to the budget categories of academic senior and academic junior, where their more specific tasks described above further subdivides them into additional

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costs categories. The days assigned to each the academic senior and academic junior category types in the budget are considered to cover the staff assigned for the actions mentioned above and the actual costs will be defined in the employment phase.

Deliverables:

Action	*Deliverables*
A5.1	A memo is sent round to the C2C CC partners stating the names of the contact persons and what meetings are foreseen in the first year
A5.2	A memo is sent round to the C2C CC partners stating the names of the contact persons and what meetings are foreseen in the first year

Milestones:

Action	*QuantifiableQuantifiable milestones*	*Date by end of*
A5.1	Initial contact is made with LGDK and the first meeting is set up	31/03/2017
A5.2	Initial contact is made and the first meetings are set up	31/03/2017

C. Concrete implementation actions

This section will present the 24 actions (7 crosscutting capacity building actions and 17 demonstration actions).
Table 4 provides an overview of the C-actions, the responsible associated beneficiaries and which other actions, the individual action is linked to.

Table 1: Overview of the C-actions

Action	Action short name	Partner name	Primarily linked to actions
Cross-cutting capacity building actions			
C1	Sea and Fjords	CDR	C8, C9, C10, C11, C12, C14, C16, C17, C18, C21, C24
C2	Lakes and Rivers	CDR	C10, C12, C13, C14, C15, C16, C19, C20, C21, C24
C3	Groundwater	CDR	C8, C10, C15, C17, C18, C20, C23,
C4	Rainwater	CDR	C10, C14, C15, C16, C17, C19, C20, C22, C23, C24
C5	Governance	CDR	C8, C9, C11, C12, C13, C14, C15, C16, C17, C18, C19, C24
C6	Tools	CDR	C10, C11, C13, C14, C17, C18, C19, C22, C24
C7	Innovation	CDR	C15, C20, C21, C22, C23, C24
Regional actions dealing mainly with the open land			
C8	Håb til Håb	HEDKOM	C1, C3, C5, C24
C9	Thyborøn Channel and the Western Limfjord	LK, HbK, MK, SKK, STK, TK, VHK + LVS, MF, SKV, STF, TV, VESTF, VV	C1, C2, C5
C10	The Grenaa Catchment	NDK, SDK	C1, C2, C3, C4, C6
C11	Randers Fjord	NDK, RK	C1, C2, C5
C12	The River Gudenå	SIK, FK, HEDKOM, Horsens, RK, SFV, SK-KOM, VK	C1, C2, C5
C13	The River Storå	HK, HbK	C2, C5, C6
Regional actions dealing mainly with urban areas			
C14	Horsens Town Centre	Horsens	C1, C2, C4, C5
C15	CCA in Hedensted og Tørring	HEDKOM	C2, C3, C4, C5
C16	Climate Ribbon	Rk	C1, C2, C4, C5, C7
C17	Thyboron City and Harbour	LK, LVS	C1, C3, C4, C5, C6
C18	Citizen driven CCA in Juelsminde	HEDKOM	C1, C3, C5,
C19	SUDS as recreational elements	SAK	C2, C4, C5, C6

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Cross-cutting innovative actions			
C20	Aqua Globe	SFV	C2, C3, C4, C7, C21
C21	Climatorium	LVS	C1, C2, C7, C20
C22	Permeable coating	VIA	C4, C6, C7, C23
C23	Potentials for increased infiltration	VIA	C3, C4, C7
C24	Climate history	AU	C1, C2, C3, C4, C5,C7, C8

***ACTION C1*: Sea and Fjords**

Beneficiary responsible for implementation: Central Denmark Region

Budget: 132.723 €

Number of days estimated spent on action in phase 1: 150 Days

Role: C2C CC project management (CDR) take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
14 out of the 21 municipalities as well as 4 risk management plans mention flood risk from the sea and fjords as a major challenge in their CCA plans (cf. Figure 1). In the region, two cities are appointed to be risk-prone from the sea or fjords with reference to the EU floods Directive, these being Randers and Juelsminde. In Randers the flood risk is related to sea level rise, storm surges and combined events between river and fjord. In Juelsminde the risk is related to sea level rise and storm surges. Besides these two areas, the land facing the western part of the Limfjord is already experiencing flooding from storm surges regularly, especially during autumn and winter storms.

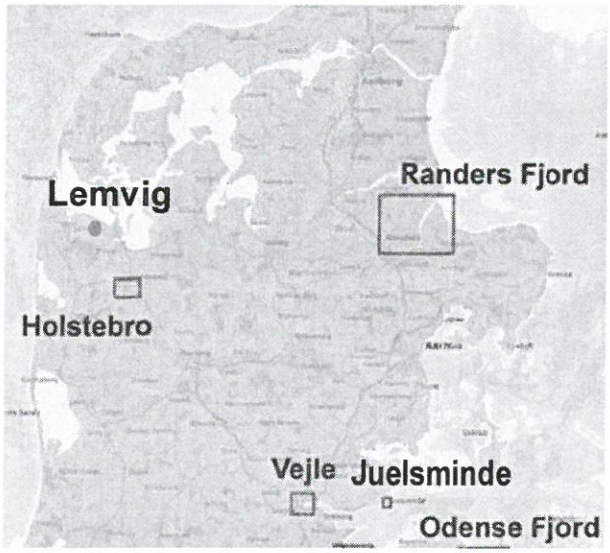

Figure 8: Risk Management plans under the EU Floods Directive in Central Denmark Region. The city Vejle is situated just south of Central Denmark Region, in South Denmark Region.

Linked to Complementary Actions
CCA in coastal urban areas: Urban development and construction project on CCA of an urban area facing the sea. Realdania's forthcoming program focuses on coastal urban areas, and a project within the region will support the IP by making an urban area resilient towards flooding from the sea. [Funded by Realdania].

Description (what, how, where and when):

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The region has approximately 1000 km of coastline and is experiencing increasing challenges related to storm surges. The largest event occurred in relation to the December storm in 2013 (in Denmark the storm was named Bodil), with the highest registered water level in Lemvig with 195 cm above normal and just 10 cm from flooding a recently established floodwall in Lemvig (cf. Figure 9). The increasing power of the storms due to higher sea temperatures are already experienced in Denmark and among the region's coastal areas. Sea level rise will only increase the risk of flooding of coastal habitats and livelihoods.

The objective of this action is: To increase the coastal resilience taking into consideration the environmental state and marine biodiversity and to enhance urban resilience.

Figure 9: Lemvig floodwall during the December Storm, December 2013.

C1.1 The CCA challenges of the coastlines:

What:

Many of the cities in the eastern part of the region are facing the sea of Kattegat, the landscape is formed by the ice age and is characterized with fjords and/or small river deltas. These cities experience similar challenges in handling coastal flooding. Municipalities are not always using the same climate scenarios in their risk maps, and thus may plan for preventive actions differently, e.g. two neighboring municipalities may both plan to establish dikes along the coast, however, not following the same climate risk scenario. There is a need to create an overview of the used climate risk scenarios and planned actions, and to establish fora for the municipalities to coordinate both design measures for preventive action and timing of implementation. The coordination of east coast plans and actions has specific attention in the IP (cf. actions C8 and C11).

At Thyboron Canal and Western part of the Limfjord the challenges are unique due to the location of an emergency harbor in Thyboron for ships in distress with a need for access to The North Sea, through Thyboron Canal. The canal is impacted by erosion and sedimentation from the increased

number and size of storms, and the maintenance of the canal impacts the water ecology of Western Limfjord. This west coast area has specific attention in the IP (cf. actions C9 and C17).

The challenges are different at the West Coast, the Danish Coastal Authority has for years had the responsibility for coastal protections in this area, spending millions of Euros on sand feeding along the coast, and establishing and maintaining dikes and sluices to protect towns and land. This area thus has less attention in the IP.

How:

1. Desk analysis and identification of knowledge gaps; CDR will review the CCA and risk management plans and gather knowledge in similarities and differences in the risk maps and planned actions. Knowledge across the CCA plans and risk management plans on the challenges and planned actions to handle increased storm surges and sea level rise have not yet been gathered. Related to this action are demonstration projects C8, C10, C11, C14 and C18 dealing with the cities of Juelsminde, Horsens, Randers and Grenaa. Experiences of these projects will benefit other coastal cities at the east coast, as well as benefit the five actions.

2. CDR facilitates common tenders and procurements, and gather national and international inspirational experiences to be disseminated at common meetings. Dialogue with partners on which capabilities and experiences which may provide some common benefits and contribute to tackling the challenges.

3. Study tour: Bus trip to Germany and The Netherlands to study CCA solutions on coastal challenges. CDR has good experience in facilitating and organizing similar study tours with visit to a number of important CCA sites and organizations responsible for implementing actions. Other Relevant cross-cutting actions (C2-C7) may benefit from a study your, which may easily cover other important aspects of CCA from lakes and rivers to innovation.

4. Workshop: Creation of a common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation. Relevant actions (C8, C9, C10, C11, C14, C17, C18) are challenged by the C2C advisory committee and CDR facilitates the dialogue.

5. Workshop: Developing and testing different organizational and management models for integrating and sustaining collaboration between stakeholders: citizens, associations, organizations, authorities and businesses with the aim of raising the quality of stakeholder collaboration and integrated coastal zone management. Inspired from the study trip in May 2018 to the Netherlands and spoken wishes from the partners, we will continue to introduce Mutual Gain Approach as a method.

6. Workshop. In a workshop we will become wiser on climate scenarios and work on setting common scenario choices for increases in water rises etc ..

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7. Workshop: To assess synergies and possibilities of integrated solutions for the fjords at the East Coast CDR will host a one day workshop for the municipalities to discuss how to coordinate future actions related to flooding along the east coast, and how to integrated this coordination in future CCA- and risk management plans.

8. Gathering of best practice experiences, dissemination and preparation for replication. Extra efforts are made for replication to other regions (nationally and internationally) and to other CCA associations (e.g. Vand I Byer and KLIKOVAND)
9. Integration of accumulated experience and ideas in work with a common strategy for climate adaptation in CDR

10. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where: CDR

When:
Phase 1: Activity 1-3 and 10
Phase 2: Activity 4-6 and 10
Phase 3: Activity 7-9

C1.2 Interaction between rivers and coastline

What:
The catchment areas of the fjords at the east coast of the region cause challenges with flooding in the coastal towns located at the mouths of rivers and in the bottom of the fjords. The challenges arise especially in coupled events combining heavy rains and storm surges. Solutions may be found in a combination of measures. Dikes and sluices may trap water from the catchment and cause flooding behind the coastal protections. Solutions to retain surface water upstream such as large wetlands may prevent floodings from heavy rains. A combination of solutions may have multiple purposes Actions C9, C10, C11, C12 and C13 may benefit from this action.

How:
1. CDR will facilitate knowledge sharing meeting for the project groups of action C9, C10, C11, C12 and C13 during the start-up of the actions. Experiences are drawn from the project 'Water from the country side' (Vandet fra landet) and international projects such as the Dutch project "Room for the river" project (www.ruimtevoorderivier.nl/meta-navigatie/english/room-for-the-river-programme/)
2. An afternoon workshop for all partners and municipalities in the region on the results and experiences drawn from the projects.
3. Create a partnership between the project, Realdania and the Danish Environmental Agency, as well as international actors for strategic cooperation.

4. Dialogue on the establishment of a permanent Danish integrated river-coastline network among municipalities and other stakeholders. Focus on organization, objectives and funding.
5. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR – location not decided, meeting rooms of CDR or the Municipalities, alternatively conference facilities organized through procurement agreements of CDR.

When:
Phase 1 : Activity 1 and 4
Phase 2: Activity 2 and 5
Phase 3: Activity 4

Reasons why this action is necessary:
Within CDR, major areas are affected during storm surges, which due to climate change are increasing in intensity and frequency. Tabel 5 and figures 10-13 shows the affected areas of a 100 year stormsurge event in 2050. There is a risk that each municipality define and construct solutions for coastal protections without regards to neighboring municipalities and/or sustainability and long term effects. Capacities within this field are in most municipalities lacking as it is a relatively new challenge, whereas the municipalites have the potential to gain from each others experiences and work together on gathering external expertise.

Table 5: Extent in m^2 and km^2 of a 100 year storm surge event for selected areas in 2050

Location	m^2	km^2
Western Limfjord	215634746	216
Thyborøn	74371965	74
Randers Fjord	99885696	100
Juelsminde	9518353	10

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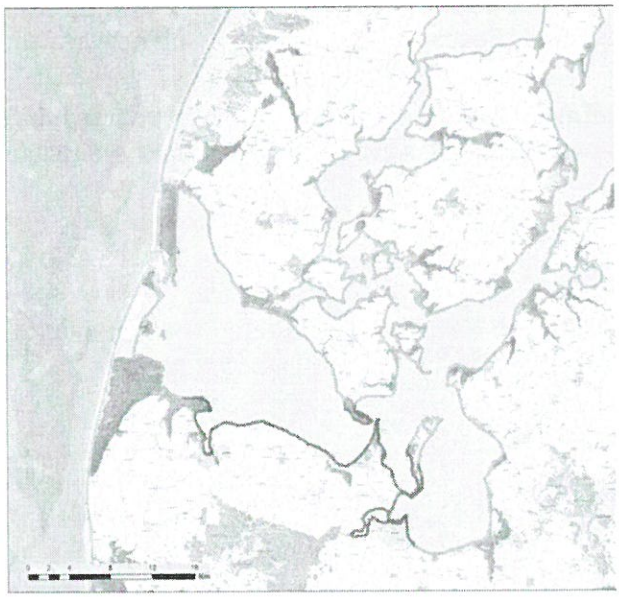

Figure 10: The flooded areas of the Western part of the Limfjord in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

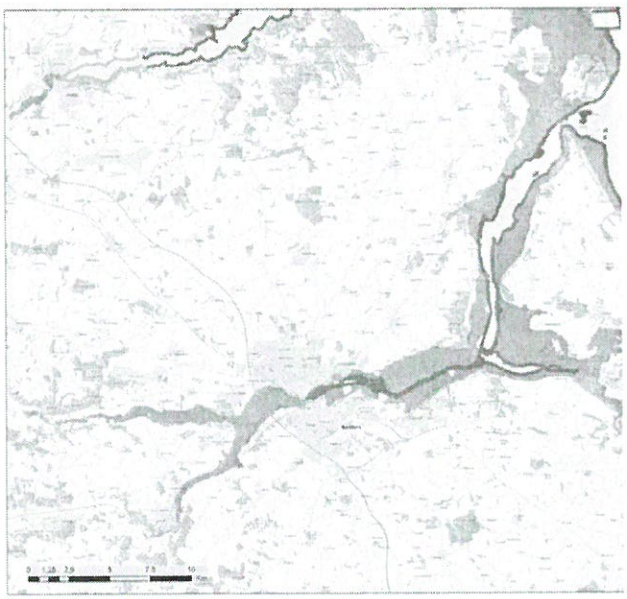

Figure 11: The flooded areas of Randers Fjord in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

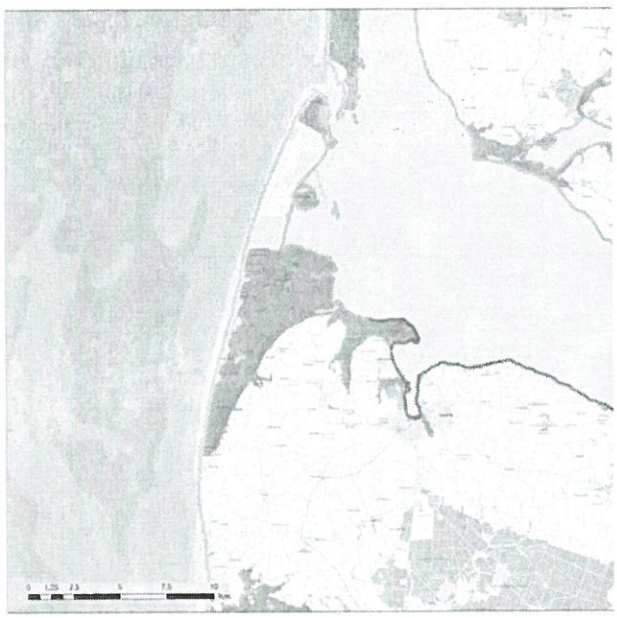

Figure 12: The flooded areas of Thyboron in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015)

Figure 13: The flooded areas of Juelsminde in a 100 year event in 2050 (The Danish Coastal Authority, NIRAS, 2015).

Constraints and assumptions

One constraint is that the actions (C8, C9, C10, C11, C14, C17, C18) will not follow the same time schedule, whereas some activities of C1 may not be of same relevance for all actions. This is

accommodated by action C1.1.2 and following knowledge sharing meetings and workshops to secure sufficient capacity building.

Expected results:
C1.1.
Phase 1: The results of C1 provides insight in the needs of the partners in regard to knowledge, analyses and tools on coastal issues. Capacity building of at least 25 professionals on national and international best practice on coastal protection. One study trip with at least 25 professional to the Netherlands and Germany to increase the inspiration on best practice. Development of common tenders and adjustment of Phase 2.

Phase 2: Awareness rising and capacity building of at least 25 professionals on holistic approaches and synergies between sustainability and coastal protection measures. Show casing and development of novel and innovative stakeholder organization- and governance models involving app. 25 professionals.
Adjustment of Phase 3.

Phase 3: Identify solutions together with at least 25 professionals for coastal protection from inside and outside the partnership. Suggestions for how to raise the level of coastal protection in CCA plans. Insight in other regions working with sea and fjords relevant for replications of C8, C9, C10, C11, C14, C17, C18.

C1.2: Phase 1: Capacity building of at least 25 professionals on combined scenarios on Rainfall and storm surges. Phase 2 and 3: Information and establishment of a capacity building network for and among the partners on CCA and coastal challenges (to be continued after the end of the IP) 25 professionals involved.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	Deliverables:
C1.1	**Phase 1:** Report on the desk analysis of knowledge gaps Minutes and presentations of meetings and workshops accessible on www.c2ccc.eu Evaluation of the meetings (digital form) Specifications on the tender materials Study tour dissemination material to be used before and after the study tour Common tender material to be used in the partnership **Phase 2:** Presentations on sustainable approaches to coastal protections. Accessible on www.c2ccc.eu

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	Presentations on new governance and involvement models. Accessible on www.c2ccc.eu Minutes and presentations of meetings, training courses and workshops accessible on MidtRum Evaluation of the meetings (digital form). Accessible in MidtRum **Phase 3:** Minutes of meetings accessible on www.c2ccc.eu Evaluation of the meetings (digital form) One note on replication of the findings in the project
C1.2	**Phase 1:** Minutes of meetings accessible on MidtRum Evaluation of the meetings (digital form). Accessible in MidtRum **Phase 2:** Minutes of meetings accessible in MidtRum Evaluation of the meetings (digital form). Accessible in MidtRum Phase 3: Note on the continuation of a CCA and coastal challenges network after the IP incl. recommendations on purpose, organisation and financing.

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C1.1	**Phase 1:**	
	One Desk analysis of knowledge gaps	01/08/2017
	One Study tour arranged and implemented	01/06/2018
	Specifications of the tender materials	01/12/2017
	One common tender material to be used in the partnership	01/02/2018
	Recommendations for changes in phase two	01/12/2018
	Phase 2:	
	One Workshop on sustainable approaches to coastal protections	01/06/2019
	One Workshop on new governance and involvement models	01/06/2020
	Phase 3:	
	One Workshop on synergies	01/12/2021
	One note on replication and gathering of experience	01/10/2022
C1.2	**Phase 1:**	
	One Knowledge sharing meeting	01/10/2017
	One Recommendations for changes in phase 2	01/12/2018
	Phase 2:	
	One Workshop on results	01/12/2020
	Phase 3:	
	One Final evaluation	01/12/2022

ACTION C2: Rivers and lakes

Beneficiary responsible for implementation: Central Denmark Region

Budget: 141.130 €

Number of days estimated spent on action in phase 1: 155 Days

Role: CDR take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
9 of the 21 municipalities as well as the 2 risk management plans mention issues related to lakes and rivers in their CCA plans (cf. Figure 1).

Linked to Complementary Actions

1. *Watercourse restoration:* Actual restoration of watercourses supplementing C2C CC by retaining water flow upstream and improving biodiversity. Complements C3. [Funded by the Danish AgriFish Agency under the EAFRD 2014-2020]

Description (What, how, when and where):
The objective of this action is: To increase the resilience of land alongside river banks taking into consideration the environmental state and biodiversity and to enhance urban resilience.

This action has a twofold purpose. Firstly, to secure knowledge sharing, inspiration and capacity building across the actions dealing with lakes and rivers within C2C CC. The following actions deal with river systems in different ways: C10, C11, C12, C13, C14 and C16. These actions will individually develop knowledge on CCA and rivers within different aspects, which can benefit the other actions. Furthermore, the actions can gain from each other's thoughts and processes, whereas continuous contact between the actions will encourage knowledge sharing. This is underlined by the fact that modeling, interpretations, analysis and data sampling are similar in the different catchments. Secondly, to draw on specific aspects across C10, C11, C12, C13, C14 and C16, which will benefit the CCA agenda nationally as well as within the EU. These aspects are currently the highly debated themes of the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration. In regard to the latter, Denmark is traditionally a country with a long agricultural history and an ongoing national debate deals with the delicate balance between agricultural development and the environment..

C.2.1 Experiences with modeling large catchments:

What:

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This action takes its point of departure in gathering and sharing knowledge between the C2C CC river projects (action C10, C11, C12, C13, C14 and C16) to secure that the projects gain from each other. Today modeling of rivers are often based on the models of Danish Hydrological Institute (DHI), which have largely divided modeling systems in rivers, sewer systems, coastal flooding and groundwater. These models are not easily integrated in a holistic model of the hydrological cycle. In the projects of C10, C11, C12, C13, C14 and C16, the need for integrated assessments are evident and it is important to knowledge share about the experiences of the approaches, methods, data sampling, storage and modeling. In order to make integrated analyses it may be relevant to involve water sector ICT businesses on modeling watercourse flow on catchment level.
Many of the catchment models has the same need for forecasting different scenarios. Therefore there is a need to work on developing an overall public offering to be used by the different projects (C10, C11, C12, C13, C14, C15 and C16).
A screening tool for overall risk on catchment level is developed in C6.2. To implement the use of the tool there will be initiated some activities related to the tool.

How:
The following sub-actions have the purpose to gather experiences, share knowledge between action and create a common tender to be used by the actions C10, C11, C12, C13, C14 and C16:

1. An initial consultation workshop between the project partners of action C10, C11, C12, C13, C14 and C16 on the background knowledge of the respective projects and their initial plans for watercourse modelling. Discussion of different approaches and unknowns with participation and input of the 'Advisory Committee'.
2. An interview process to initiate the common tender process
3. Preperation of a public tender on modelling of catchments
4. A workshop when the modelling of C10, C11, C12, C13, C14 and C16 are in process, with the main purpose to discuss the challenges and how to overcome the challenges with e.g. data, methods, and models.
5. A workshop on knowledge sharing on results and initial discussions on possible solutions.
6. Process to ensure that the screening tool presented in C6.2 is giving the right answers to be prepared for the tender process
7. Interactive 3D decision support tool on the water flow in catchment areas across municipal borders.
8. A workshop presenting the Interactive 3D decision support tool on water flow in catchment areas.
9. A workshop discussing need for future monitoring.
10. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
SDK, NDK, RK, HbK, HK, Horsens, HEDKOM, SK-KOM, SIK, FK, and VK.
The 3D decision support tool is developed to cover the whole region.

When:
Phase 1: Activities related to bullet 1-6 and 10
Phase 2: Activities related to bullet 7, 8 and 10
Phase 3: Activities related to bullet 9

C2.2 Warning system

What:
The public resilience to sudden events like flooding could increase significantly by providing access to information and forecasted data. Therefore there is a need to transform the existing and collected data to a format which may be distributed to the potential affected citizens. By alerting citizens and giving them information on how to act in a given flood situation they may act and prevent damage to their values. Development of forecasting systems with ICT businesses based on models and meteorological forecasts to ensure resilience act as key elements in this activity.

How:

1. Gathering of experiences of other relevant projects' use of warning systems incl. Aarhus Municipality.
2. Map the needs and wishes for working with Warning Systems in the partnership.
3. Workshop presenting the knowledge and experience within the field of early warning systems open to public
4. Study trip to England to gain experience and inspiration – one of the themes is warning Systems
5. Initiate the development of forecast systems with ICT businesses based on models and meteorological forecasts. The forecasting will be integrated in one of the catchments involved in C2C CC
6. Partner workshop on the topic 'Warning systems, civil protection and contingency planning'At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.
7. At the end of phase 2, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Regional activities in CDR

When:

Phase 2: Activities related to activities 1, 4 and 7
Phase 3: Activities related to activities 5-6

C2.3 The role of land use management and wetland restoration in CCA

What:
Often the most cost effective way to flood-prone urban areas in the context of CCA is by retaining great amounts of water outside the cities, because the construction here is less costly than in the

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cities. Agriculture involve the largest land owners in DK (About 60% covered by agriculture) and it is therefore essential to cooperate with farmers when doing CCA outside or adjacent to urban areas. Cooperation and thereby CCA may result in the implementation of projects of different nature including restoration of streams and establishment of wetlands. Drainage can be a challenge for agriculture in flat, wide river valleys, because of the slower water flow in the river, which increases the risk of critical high water levels and flooding. However, agricultural land facing the river banks may have less value for the farmers due to poor harvest, whereas there is a potential for farmers to lease land for CCA to the utilities and municipalities (however, not yet investigated in Denmark). CCA outside cities in demarcated areas often will benefit downstream agriculture and cities. Furthermore, wetlands remove nutrients such as nitrates and phosphorus, as well as degrade pesticides, and may thus be a beneficial mean to secure river ecology. A national political agreement further increases the implementation of wetlands as a measure to lower nutrient outwash from agricultural areas (Agreement on Food and Agricultural Policy). C2C CC will encourage the partnership to include the wetlands as a CCA measure. The actions will also draw on the experiences of the Danish project: "The farmer as a water manager", a project looking at the synergies (instead of the barriers) between CCA, river ecology and farming.

How:

1. Dialogue with the Secretariat of Utilities (Forsyningssekretariatet) in regard to possibilities for utilities to lease agricultural land in case of extreme flood events. Linked to preparatory action A1.
2. Dialogue with the Danish Agency of Nature on the implementation and possibilities of funding related to the newly approved Agreement on Food and Agricultural Policy which includes mini-wetlands as means for removal of nutrients (and CCA).
3. Develop business models incorporating city safety and compensation of farmers based on experiences from actions in C2C CC and other project
4. Screen for possible wetlands to support CCA and raising funds through "Fødevare og Landsbrugspakke" (Food and Agricultural Policy).
5. Gathering of state-of-the art knowledge on the synergies between agriculture, CCA and wetlands by the Advisory Committee'.
6. Test and demonstration of conceptual design in one of the catchments included in the project. Testing the proposed business models and synergies.
7. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR

When:
Phase 1: Activities related to activities 2 and 7
Phase 2: Activities related to activities 1, 3-5 and 7
Phase 3: Activity related to activities 6

C2.4 Impacts of CCA on freshwater ecology

What:

CCA in DK includes separation of rain water and waste water. Rain water is often discharged to recipients as streams and lakes, which includes a risk of increased exposure of the ecosystem.

Ecosystems consist of a number of biotic and abiotic elements. The biotic elements are composed of populations, manufacturers, consume and decomposers. The abiotic elements covering temperature conditions, oxygen level and light. As an example temperature differences due to increased discharge of rainwater can result in deterioration of living conditions and reproduction of trout. Another issue associated with CCA is the discharge of hazardous substances. Discharge of varying amounts of rainwater into streams and lakes containing various contaminants like metals, oil substances, pesticides and nutrients can potentially have a negative impact on the ecosystem as the abiotic factors may change in the recipient. The effect of varying amounts of rainwater containing hazardous substances can vary from acute toxicity to slow accumulation in the food chain. Discharge of hazardous substances can potentially change the competitive relationship and living conditions of plants and fauna, and ultimately foster unwanted species. The discharge of rainwater to recipients is regulated by the Water Framework Directive (WFD) and by Danish law (Danish environmental protection law and waste water order) which seek to minimize impacts on the ecosystem. Discharging rainwater to any recipient requires a discharge permit, which contains specific requirements related to e.g. hydraulics and toxic substances.

However, little knowledge is available on the long term effects of CCA on freshwater ecology, but research and knowledge from practice is currently developing. This action will collect data across the actions related to lakes and rivers: C10, C11, C12, C13, C14 and C16, but also to selected actions related to rainwater, as the source of the discharges originates from SUDS and the utilities' rainwater pipes (C4.1, C4.2, C4.3, C19, C22).

How:
Gather knowledge through:

1. Gathering of the actions' C10, C11, C12, C13, C14 and C16, technical reports
2. State-of-the art research through the Advisory Committee' partners
3. 1 partner workshop on the topic 'Impacts of CCA on freshwater ecology'
4. A study trip to England to exchange experiences and possibly jointly developing ideas.
5. At the end of phase 2, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR

When:
Phase 2

Reasons why this action is necessary:

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This action accommodates the pressing need of coordination and knowledge sharing across local authorities with similar challenges. Since the structural reform in 2007, the responsibility of water and environment lies with each individual municipality. Previously, the responsibility and knowledge related to the whole catchment area were based at the counties, which have now ceased to exist. New arenas of catchment based coordination and planning are emerging, not at least in the spin-off of the river basin management plans under the WFD. However, CCA is not yet included in this process. This action will contribute to rebuilding catchment based planning and will aid the future integration of CCA within the implementation of the WFD. The action contains comparative analysis and modeling in different basins. By tendering from a common pool and prepare specifications in the procurement through interdisciplinary collaboration, processes are optimized and the work carried out becomes more efficient.
Further, the optimization of corporation between up-stream land owners and flood risk threatened cities down-stream may encourage sustainable long lasting solutions via new public-private partnerships and business models for preventive CCA actions.

Constraints and assumptions
The actions of C10, C11, C12, C13, C14 and C16 will not be implemented concurrently in their respective processes. Thus it may be a challenge to plan inspirational meetings and workshops at times, benefitting all parties. However, as all the actions will start up in Phase 1, initial steps such as new approaches to integrative modeling of the catchments (action C2-1) may benefit all.

Expected results

C2.1:
Phase 1: Three workshops on knowledge sharing and capacity building on integrative modelling of water courses between the partners of action C10, C11, C12, C13, C14 and C16 (Involving 120 professionals). An interactive 3D decision support tool on the water flow in catchment areas across municipal borders (same as action C6.2), used by 10 municipalities. Common tendering material to be used in the individual catchements. Adjustment of Phase 2.

Phase 2: Two workshops on knowledge sharing between the partners of action C10, C11, C12, C13, C14 and C16 on their proposed solution in the respective catchment areas (Involving 80 professionals).

Phase 3: One Workshop discussing need for future monitoring (Involving 35 professionals).

C2.2:
Phase 2: State-of-the art knowledge on warning system practice as input to tool development. One workshop supporting capacity building among all partners with knowledge on 'Warning systems, civil protection and contingency planning' (100 professionals benefitting).

Adjustment of Phase 2.

Phase 3: 1 ICT businesses develop a forecast system based on models and meteorological forecasts.

C2.3:

Phase 1: Push for new CCA solutions to retain water upstream cities. Dialogue with two ministries initiated. Adjustment of phase 2. Phase 2: three different business models for incorporating city safety and compensation of the farmers (Used by 15 municipalities). 5 Municipalities apply for funding for wetland projects. Newest knowledge on the synergies between agriculture, CCA and wetlands. Adjustment of phase 3.

Phase 3: One test and demonstration of conceptual design in one of the catchments included in the project. Testing the proposed business models and synergies.

C2.4: Phase 2: Capacity buidling of 35 professionals build up among all partners with knowledge on 'Impacts of CCA on freshwater ecology'.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 Euros per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	Outputs
C.2.1.	Phase 1: Activity 1+4. Minutes and presentations of meetings accessible on the webpage www.c2ccc.eu Activity 2 +3. An interactive 3D decision support tool on the water flow in catchment areas across municipal borders (same as C6.2). Evaluation of the meetings (digital form)Activity 10: Phase 1 report Phase 2: Activity 5. Minutes and presentations of meetings accessible on the webpage www.c2ccc.eu Activity 10: Phase 2 report
C.2.2.	Phase 2: Activity 1, 2+4: Workshop material on 'Warning systems, civil protection and contingency planning' accessible on www.c2ccc.eu Activity 2: 1 forecast system based on models and meteorological forecasts available for the public Activity 4: Phase 1 and phase 2 report
C.2.3.	Phase 1-2: Activity 1 and 2: 1 Note on new concept for utilities to pay farmers to retain water upstream cities, and thus save costly investments in the cities. Activity 8: Phase 1 and 2 report Activity 5: 1 report on different business models to ensure win win solutions between the agriculture and urban areas. 7: Action Report on the synergies between agriculture, CCA and wetlands
C.2.4.	Phase 2: Activity 1+2+3: 1 report on 'Impacts of CCA on freshwater ecology'. Activity 4: Phase two report

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C.2.1 –C2.4	Phase 1: 4 interviews on model tender	

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	Report on specifications for the tender	01/03/2017
	Four workshops will be arranged (one every half year), 160 participants	01/09/2017 01/07/2017; 31/12/2017; 01/07/2018; 31/12/2018 01/06/2018
	Report on experience of warning system compiled	31/12/2018
	Investigation on possibilities of areas that can be flooded and possible funding of the investment	31/12/2019
	Phase 2: Three different business models investigated and developed	01/07/2019; 31/12/2019;
	Four workshops will be arranged. (160 participants).	01/07/2020; 31/12/2020
	Forecast model developed	31/12/2020
	Report on description of effects on fresh water ecology	31/12/2019
	Phase 3: One Workshop, (35 participants)	31/12/2021
	Test and demonstration of business model in one catchment area	31/12/2022

ACTION C3: Groundwater

Beneficiary responsible for implementation: Central Denmark Region

Budget: 131.591 €

Number of days estimated spent on action in phase 1: 160 Days

Role: C2C CC project management (CDR) take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
18 of the 21 municipalities mention challenges related to groundwater in their CCA plans (cf. Figure 1).

Linked to Complementary Actions

1. *"WaterCoG":* A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C2C CC will have strong synergies in relation to water management, planning and stakeholder involvement. Complements C0. (funded by InterregVB).
2. *"TOPSOIL":* Focusing on issues related to rising groundwater levels and related climate change implications. Includes beneficiaries from DK, DE, NL, BE and UK and will add European aspects on groundwater to C2C CC. Complements C4 (funded by InterregVB).

Description (what, how, where and when):
Climate change in Denmark is expected to lead to increased rainfall in autumn and winter, and less during summer, causing increased near-surface groundwater levels, especially during autumn and winter. An increase in groundwater levels varies across the regional geography and depends on e.g. geology, distance to the sea, land use, drainage and elevation of the area. This challenge is new, and municipalities are uncertain about how to deal with the problems of high groundwater levels. First, there is a lack of knowledge - where can we expect the groundwater to rise? How do we measure the changes? Secondly, there is a lack of measures - what is the right thing to do in the areas prone to rising groundwater levels?

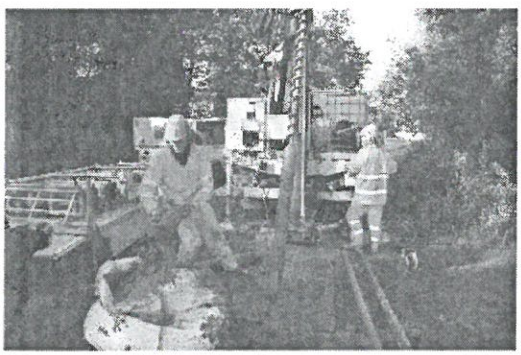

Figure 10: Investigations on soil conditions

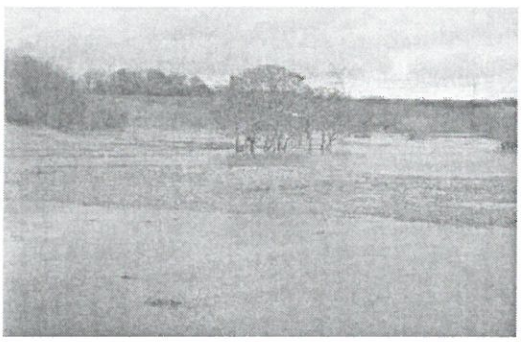

Figure 11: A groundwater flooded area in the eastern part of CDR

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The objective of this action is to increase the knowledge and resilience towards rising near-surface groundwater optimizing the use of surplus groundwater.

C3.1 Interaction between rainwater and rising groundwater level

What:

To support the described tool in section C6.1 there is a need to identify the needs and challenges in the municipalities. The challenges has a geographical variation. Groundwater levels in coastal areas are linked to sea level rise and hydraulically connections. Further, low lying areas inland are interacting with the river and lake systems. Work around the tool on groundwater is focused on gathering data and conducting desk analysis in order to define knowledge gaps for understanding the near-surface groundwater and bridge knowledge-gaps by involving applied knowledge and science. In advance, an examination of the need will be conducted to ensure that the tool is developed to support the challenges in the municipalities. After and during the development of the tool, sessions focusing on teaching and adaptation of the tool will be carried out.

How:
Activities:

1. Sessions and workshops with municipalities and "Advisory committee' experts on groundwater and modelling to ensure the groundwater tool will be a usefull tool for the municipalities, to ensure all relevant data is captured and the challenges gathered. In advance of the workshop, the municipalities will be consulted to target the workshop.
2. Preperation of a public tender on modelling groundwater levels as described in the action C 6.1.
3. Halfway workshop where a supplier presents preliminary model tool results
4. Educational sessions for staff at municipalities to implement the groundwater tool, understanding results and following consequences.
5. Identification of areas in the region threatened by groundwater flooding by using the groundwater tool (same as action C6.1).
6. Work on using the tool including training sessions to fine tune the tool
7. At the end of each phase, an evaluation and assessment, which focus on the needs on future integrated cross partner actions, will be conducted. This is done to secure the direction and processes of the actions are carried out in the right way.

Where:
CDR

When:
Phase 1: Activity 1, 2 and 7

Phase2: Activity 3, 4, 5 and 7
Phase 3: Activity 6

C3.2 Advanced local adapted investigations and hydrogeological models:

What:

In selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater (e.g. action C8, C10, C12, C17). Models are based on the present data and collections of new data sets e.g geophysical data. In the context of CCA it is rather new to have detailed geological and geophysical mappings and models and the use of them on local scale. There is an interest to examine how precise the tools are, and how they can be used in e.g forecasting planning and involvement of stakeholders. Furthermore, the benefits of running detailed mapping and local scale hydrological models in comparison to the developed tool described in C6.1 will be investigated in order to make recommendations for what type of modelling is preferable in different settings. In addition, the complementary InterReg project "TopSoil" will be investigating the threat of rising groundwater level in an area north of Herning, where this action will draw on the modelling methodology and results of Topsoil.

How:
The action will test and demonstrate tools to map groundwater levels and examine the use of advanced local adapted hydrogeological models by the following activities:

1. Examine the tools available and make test and demonstrations in local areas in corporation with the "Knowledge Committee" and the complimentary project TopSoil.
2. Examination the combined tool (ground- and surface water) in 2-3 subprojects and combine the results with existent data/model results
3. Workshop with a focus to share knowledge in using the tool and compare results/test towards existent data.The workshop will be made together with the TopSoil project
4. Formulate guidelines on when to use the tool and when to use other more detailed model tools.
5. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR, with focus on action C8, C10, C12, C17 and TOPSOIL

When:
Phase 1 Activity 1 and 5
Phase 2: Activity 2, 3, 4 and 5
Phase 3:

C3.3 Reuse of excess groundwater:

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What:
This sub-action will bring in practical inspiration to management of surface-near groundwater from other EU countries (e.g. the Netherlands, Germany or Belgium) and also draw on the results of the complimentary project TopSoil. C3.3. will examine the use of excess groundwater for e.g irrigation, heating or cooling. This is especially relevant in areas where e.g. the heating costs are high and allow for alternative solutions such as the use of excess groundwater, or where the challenges with high groundwater levels are so high, that remedial measures are necessary despite the running costs. This action calls for the involvement of heating utilities, industries, research institutions and municipalities. It is important to note, that this action will primarily deal with the near-surface groundwater, as it is the upper levels which cause challenges of rising groundwater levels. Action C3.3. will thus not have environmental impacts on the groundwater resource extracted for drinking water. Furthermore, the use of excess groundwater may have the potential to store groundwater and discharge to watercourses in periods with normal or low flow capacity (and avoid discharge in periods with high flow capacity).

How:
C3.3. involves the following activities:

1. Gather information on possible conflicts with rules and regulations on use of excess water and related tax systems and make recommendations available for relevant stakeholders.
2. Local workshops in relevant areas to identify win win solutions
3. Regional workshop targeting stakeholders (farmer, energy industry, local citizens) from the region – brainstorming on possible future measures.
4. Gathering material from the e.g. Netherland, Northern Germany, the U.K and southern Denmark on how to tackle present and future groundwater levels in a sustainable way
5. Study tour to relevant countries learning on their management systems releated to groundwater flooding.
6. At the end of phase 2, an evaluation and assessment with focus on the needs on future integrated cross partner actions will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR and study tour to relevant countries

When:
Phase 2: Activity 1 to 3 and 6
Phase 3: Activity 4-6

Reasons why this action is necessary:
Rising groundwater levels are a not well-lit factor in relation to climate change. Cities experience increased challenges with rising groundwater levels e.g. with flooded basements during autumn and winter time. In the countryside rising groundwater levels cause saturated soils, which in case of long-term rains impact the water levels and flow of watercourses and cause flooding

downstream in cities and on agricultural land. There is a great need to define and develop sustainable solutions.

Constraints and assumptions
The constraints of action C3 are mainly related to sub-action C3-1 and C3-3. C3-1 is depended on the developed tool in action C6.1 and whether the requests of the municipalities to the functions of the tool can be technically fulfilled. In regard to action C3-3, solutions to use excess groundwater for alternative and innovative purposes may have possible conflict with the existing tax system on water consumption. C2C CC will in that case be in dialogue with the Danish Ministry of Environment and other relevant ministries in order to change the system.

Expected results:
C3.1: Phase 1: Knowledge on the requests and needs on regional groundwater modeling of the municipalities. Tender specifications on local needs to be implemented in the tool C6.1. Adjustment of Phase 2. Phase 2 and beyond: User feedback from the municipalities to modify the tool to local needs and common tendering material to be used in the individual catchments. Capacity building of municipal officials and training materials. Interactive maps to be used for local adaptation strategies (same as action C6.1). Final modification of the tool to local needs and training in the use of the tool. Ensuring that changes are implemented for future needs. Adjustment of the Phase 3.

C3.2: Phase 1: Identification of relevant tools to use when mapping groundwater levels locally. Adjustment of phase 2. Phase 2: Capacity building of relevant professionals on 'local scale and regional scale groundwater modelling'. Capacity building of at least 25 professionals on groundwater modelling and scale issues. Recommendations on the use of local and regional scale models. Adjustment of phase 3.

C.3.3: Phase 2: Identification of conflicts built in the present tax system on energy and water consumption. Stakeholder input from at least 50 professionals on relevant use of excess groundwater in the region and other areas. Adjustment of phase 3. Phase 3: Regional recommendations to tackle future groundwater flooding challenges based on regional ideas and experiences from other countries. European inspiration on excess groundwater through study tour with 30 professional attending.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 Euros per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Study tour expenses are based on a busrental and the eperiences with similar arrengements

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Deliverables:

Action	Deliverables
C3.1.	Phase 1: 1+2. Minutes from the workshops. Specifications on the tendering of the tool C6.1 7: Phase 1 report Phase 2: 3-6. Minutes and workshop material. Output maps of groundwater flood prone areas distributed in the whole of CDR. Maps are adjusted to the local conditions. Training material made and distributed for the users.
C3.2.	Phase 1: Report on the available tools on groundwater mapping including relevant test and demonstrations 5: Phase 1 report Phase 2: 2+3: Workshop report on the results discovered. General report on the potential needs for local models in groundwater flood prone areas based on the results from the test in 2-3 subprojects. 4: Guideline on local scale and regional scale modeling. 5: Phase 2 report Phase 3:
C3.3.	Phase 2: 1. Report - Identifying conflicts built in the present tax system on energy and water consumption. 2. Local reports containing Ideas for relevant use of excess groundwater in other areas. 3.Report on relevant use of excess groundwater on a regional and local scale. 5. Report on study tour 6: Phase 2 report Phase 3: 4. Report on relevant use of excess groundwater on a regional and local scale. 5. Report on study tour 6: Phase 3 report

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C3.1- C3.3	Phase 1: Specifications on tendering for tool C6.1 developed	01/10/2017
	One tender workshop, 10 participants	01/10/2017
	Description of available tools for groundwater mapping	31/12/2018
	Phase 2: One mapping workshop, 25 participants	01/03/2019
	Outline of groundwater flood prone areas on a regional basis	31/12/2019
	One regional workshop, 25 participants	31/12/2019
	Training material developed for use on groundwater levels	31/12/2019
	Report on local use of excess groundwater	31/12/2019
	Report on conflicts with existing tax system and legislation	31/12/2020

	Workshop on conflicts with existing tax system and legislation, 50 participants	31/12/2020
	Phase 3: Report on relevant use of excess groundwater and the constraints and barriers	31/12/2021
	Study tour with 30 professionals	31/12/2021

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***ACTION C.4*: Rainwater**

Beneficiary responsible for implementation: Central Denmark Region

Budget: 148.094 €

Number of days estimated spent on action in phase 1: 158 Days

Role: C2C CC project management take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plans:
19 of the 21 municipalities' CCA plans as well as one risk management plan mention rainwater as a major problem and the use of SUDS as a means to retain and reduce rainwater run off (cf. Figure 1).

Linked to Complementary Actions
Municipal and Water Utility CCA projects: the municipalities and the region are to mobilize and invest at least 16 mill. € on CCA projects[1] within the project period. Likewise, the Danish utilities are to spend app. 135 mill. €[2] annually on climate investments[3] over the next 25 years. C2C CC will contribute with added value and influence the municipal CCA plans and waste water plans and the utilities' future construction projects [Financed through taxes and water fees]. Tax and water fee financed CCA projects support the overall goal by making the region more climate resilient. However, it is also the aim of C2C CC to influence these projects towards more green and flexible solutions serving more purposes. There is a need for increased knowledge among the utility companies on the possible means and tools to be used when dealing with natural infiltration of rainwater.

Description (what, how, where and when):
Handling rainwater and extreme rainfall occurs mostly locally. However, experiences of problems and solutions can be shared between the municipalities and utilities, on technical as well as on organizational and process implementation challenges. Furthermore, incidents with extreme rainfall is the most experienced effect of climate change in Denmark, and thus also the challenge with the largest knowledge base. A large proportion of the knowledge base is placed in Greater Copenhagen area, were extensive cloud bursts have initiated a climate adaptation strategy incl. hundreds of local initiatives to cope with the heavy rain falls. The activities in this action, therefore, aim at bridging the knowledge gap within urban hydrology (E.g. surface groundwater interactions) and in water quality when rainwater is managed on the surface (instead of in the sewer).

***C4.1 Urban Hydrology* and quantity**

What:
Towns and cities in CDR are planning to use SUDS as a part of the means to deal with cloud bursts. Though there are many unknowns within the use of local infiltration such as: What is the capacity in sealed paving areas? What is the capacity in the surrounding unpaved areas? How does the level of the groundwater table impact the possibility of leaching and infiltration?

[1] Based on: 19 municipalities and 1 regional authority each spending approximately 135,000 EUR per year in 6 years.
[2] Approximately 27 mill. EUR per regional authority per year.
[3] Danish Association of Water Companies (DANVA) (2015). "Dansk Vand Magasin #3 juni 2015", DANVA. p. 32-34. (in Danish).

There is a need to gather and collect the experiences from CDR and other areas like greater Copenhagen to define experiences with hydrological conditions to implement SUDS and the requirements of maintaining the SUDS after installation. Further to identify knowledge gaps within implementation of SUDS seen in a urban hydrological system. The identification will include experience of the setup models (C10, C12, C17) and testing of SUDS within CDR. Related to this action are demo-projects C14, C15, C19 and C23. Cross boundary experiences and guidelines will create a solid base for moving forward in a sustainable way and avoid sub optimization.

How:
C4.1 will include the following activities:

1. Collect and gather knowledge and experiences with capacity and SUDS and required conditions for a successful implementation. Learn from experiences in Greater Copenhagen area on how to tackle the excess rain water and the retention capacity in the natural hydrological system in an urban area.
2. Workshop on the hydrological system based on models setup in CDR and experiences from e.g. Copenhagen area. A special focus on the capacity in the soils and open spaces in the towns and cities.
3. Workshop about SDGs as instrument for choosing sustainable solutions.
4. Gathering information on relevant tools to deal with retention of water in an urban environment based on relevant studies in C2C CC.
5. Workshop on new findings on water retention and water quantity.
6. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Workshops will take place in CDR.

When:
Phase 1: Activity 1, 2 and 6
Phase 2: Activity 3 and 6
Phase 3: Activity 4 and 5

C4.2 Knowledge on SUDS' effectiveness in water treatment and maintenance

What:
SUDS are increasingly implemented by the municipalities and waste water utilities to manage rainwater on surface. The SUDS elements are varied and range from rainwater basins to urban green elements (cf. figure 12). Synergies are many with regard to green infrastructure, urban liveability etc. However, knowledge on discharge of toxic substances such as heavy metals like Ni, Cu and oil components like PAHs are not fully understood. Research is ongoing within this topic. Some research results point to accumulation of most substances in the basin sediments, which through maintenance can be removed and replaced by clean sediments. There is a need to gather existing knowledge from e.g. urban SUDS, rainwater basins along roads and on the demand of SUDS maintenance.

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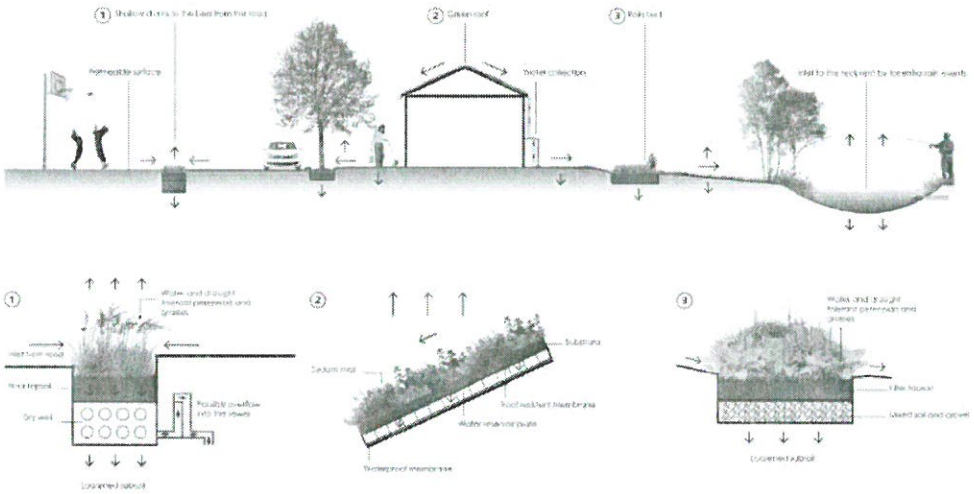

Figure 12: Illustration of SUDS in an urban area (source: NIRAS).

How:
The following activities are part of C.4.2:

1. Gather existing knowledge and practice within the EU e.g. research results, assessment reports and current practice on SUDS, their ability for retaining polluting components and the demand for maintenance. The study will include knowledge gaps, uncertainty and need for further testing and demonstration
2. Workshop on the present knowledge in water quality in relation to SUDS
3. Involve industries and research institutions to bridge knowledge gaps. This activity will focus on the experiences of SUDS, what works and what doesn't, and to facilitate collaboration on improving existing practice. This activity is carried out together with Technological Institute (TI).
4. Arrange workshop in the field of water quality and SUDS inviting stakeholders within industry, research institutions, municipalities, utilities, NGOs as well as citizens (cf. C7). This activity was initiated already in Phase 1, and will be continued with at least one workshop primo 2019. This activity is carried together with Water in Urban Areas and TI.
5. Gather the experiences within C2C CC in the field of permeable pavements (results from C22) and on alternative SUDS constructions (e.g. experience from complementary projects carried out by the utilities) and actions C14, C15, C19 and C23.
6. Test and demonstrate relevant SUDS technologies in corporation with relevant businesses, utilities and authorities. (cf. C7)
7. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Workshops will be arranged in CDR. Workshops will be carried out in cooperation with existing networks like Water in Urban areas and KLIKOVAND. Test and demonstration will be carried out in CDR.

When:
Phase 1: Activity 1, 2 and 7
Phase 2: Activity 3, 4 and 7
Phase 3: Activity 5 and 6

C4.3 Citizen involvement

What:
When rainwater is managed on surface, many actors are involved, including businesses, industries and single house owners, In Denmark these land owners are to pay for handling rainwater (up to a 5 year event) on their private estate, whenever rainwater is to be managed separately from the sewage. This is implemented throughout Denmark, and house owners are involved in two circumstances: 1) decoupling rainwater from sewage by either establishing a two string system (a sewage pipe and a rainwater pipe) or 2) managing rainwater on surface using SUDS. The house owner has to pay for the separation on his/hers property, which is costly and typically around 50,000 DKR (ca. 6,700 €) per property for establishing a two string system. Furthermore, to solve flooding down-stream or in low lying areas, retention is to be implemented up-stream, meaning that house owners, who do not suffer from flooding, are to retain rainwater to secure citizens down-stream.

Traditionally, citizen involvement has been voluntary for people e.g. in urban development projects, CCA adds the dimension of 'must' involvement followed by a requirement of payment. This often results in dissatisfied citizens, complaints and sometimes also conflicts. However, managing rainwater on surface involve possibilities of increasing liveability and urban biodiversity in a neighbourhood, whereas competences in citizen involvement processes is needed by the municipalities and waste water utilities.

How:
1. Collect and gather the experience in CDR and other regions of Denmark on the involvement process in decoupling sewage and rainwater systems. What has been successful and what needs to be adjusted
2. Gathering good and bad examples of SUDS on private estate including experiences from the citizens
3. Workshop arranged with the purpose of evaluating experience on sewage separation and the involvement of stakeholders from different areas. Sessions involving citizens from different areas from CDR and including their views on managing rainwater on their own property. Session will be carried out in the areas in C2C CC working on separation of sewers but involves citizens from different areas within the C2C CC project (Actions C14, C15, C19, C23).
4. Sessions on regional basis to inspire local authorities and utilities on how to deal with rainwater on private property based on results from the pilot studies in C2C CC and experiences from other areas like greater Copenhagen. This activity is concretized to 1

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day course on citizen and stakeholder involvement. Invitations outside the partnership is considered. External participants would pay for participation.

5. Workshops about using the SDGs in co-creating with citizens
6. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR and Horsens (C14), Hedensted (C15, C23) and Samsø (C19).

When:

Phase 1: Activity 1, 2, 3 and 6

Phase 2: Activity 4,6

Phase 3: Activity: 5 and 6

Reasons why this action is necessary:
CCA in Danish towns and cities all have a component of local infiltration and retention. During the last 5 years, wastewater utilities have spent billions on implementing separate sewer systems to manage the increased amount of rainwater to avoid overflow of sewage. There is a need to learn from experiences within the field of SUDS and to identify the knowledge gaps for successful implementation of SUDS, which includes sustainable water quantity and quality in the urban areas. Knowledge within this field needs to be gathered and distributed.
Further innovation in cooperation with the manufacturers of the installations are needed to make solutions fit the demands of the market. A close cooperation and involvement with the citizens is essential to ensure a sustainable implementation of CCA. Further meaningful implementation pushes the society towards more ownership in the field of CCA.

Constraints and assumptions
Collaboration with businesses are needed. These businesses need to be identified in a process. CDR is hosting a lot of manufacturers of water solutions. In the application we assume that the businesses are interested in joining the project and learn from the experiences.

Expected results:
C4.1: Phase 1: Overview on state of the art on dealing with water in urban areas related to water quantity and SUDS. Capacity building and knowledge sharing of app. 50 officials from local authorities.

Phase 2: Capacity building on relevant SUDS systems to be implemented as water retention systems in urban areas (Workshops arranged for 50 partners).
At least half of the partners use SDGs as guideline for integrative planning.

Phase 3: Capacity building of utilities and authorities of SUDS used in C2C CC in urban areas, including specifications and detailed descriptions of the pros and cons. Distribution and implementation of knowledge around the C2C CC findings within SUDS and Water quantity for 200 participants.

C4.2: Phase 1: Overview of experiences and state of the art with SUDS in relation to water quality and the need for more knowledge.Capacity building and knowledge sharing via overview on the challenges and experiences on maintenance of SUDS systems on workshop with 50 professionals attending.

Phase 2: Capacity building of businesses in relation to SUDS via engagement and innovation pull from the experiences on need for development on SUDS systems and demands on maintenance. This will be done via bilaterale meetings and workshops with an estimation of 100 professionals engaged.
At least half of the partners use SDGs as guideline for integrative planning.

Phase 3: Presentation of new tools meeting the demands of a modern SUDS facility on workshop with around 30 professionals attending.

C4.3: Phase 1: Capacity and knowledge sharing via Danish learnings on involvement of stakeholders in work on separation of sewer systems. Citizens learning across boundaries in CDR.

Phase 2: Involvement of and inspiration of local authorities and utilities on how to deal with involvement of stakeholder in cases of dealing with rain water on their own property (Involving 75 professionals)

Phase 3: Capacity building of local authorities and utilities on how to deal with involvement of stakeholders in a sustainable way (Involving 75 professionals)

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	Deliverables
C4.1.	Phase 1: 1. Evaluation report on the capacity of SUDS and the limitations set by the local hydrology, geology and other framing conditions. 2. Minutes and output material from the workshop. Accessible on www.c2ccc.eu 6: Phase 1 report and recommendations for phase 2 Phase 2: 3: Output report and material on relevant SUDS to be used. Accessible on www.c2ccc.eu 6: Phase 2 report and recommendations for phase 2 Phase 3: 4+5. A report on SUDS used in C2C CC and possible SUDS systems to be introduced as means to prevent flooding from heavy rain events. Distributed in the whole of CDR and accessible on www.c2ccc.eu
C4.2.	Phase 1: 1., 2. and 3. Workshop output report on the experiences and state of the art with SUDS in relation to

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	water quality and the knowledge gaps and experiences on maintenance. Accessible on www.c2ccc.eu 5: Phase 1 report and recommendations for phase 2 Phase 2: Engagement of relevant producers of SUDS and giving them relevant learnings to be built in in future products 5: Phase 2 report and recommendations for phase 3 Phase 3: A report on learnings in the field of SUDS in urban areas in relation to water quality and presentation of the newest and most modern SUDS products. Closely linked to 4.1. Accessible on www.c2ccc.eu
C4.3.	Phase 1: 1+2+3: Report on the learnings within stakeholder involvement in relation to sewage separations and SUDS. Accessible on www.c2ccc.eu 5: Phase 1 report and recommendations for phase 2 Phase 2: 4. Training and inspirational material for the authorities and utilities to inspire the citizens on the possible solutions. Accessible on www.c2ccc.eu Phase 3: 5. Report on the learnings in using the the SDGs in co-creating with citizens

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C4.1- C4.3	Phase 1: Evaluation report on use of SUDS quantity	01/03/ 2018
	Workshop on quantity elements and SUDS, 50 participants	01/03/2018
	Overview report on state of the art SUDS knowledge in relation to water qualitative aspects including knowledge gaps. Overview of learnings within SUDS and stakeholder involvement and ownership, 100 participants	31/12/2018
	Phase 2: Report on overview on relevant SUDS as tools for water retention	01/06/2019
	Involvement, engagement and delivery of knowledge gaps and needs to producers and manufacturers of SUDS , 30 participants	01/06/2019
	Training and inspirational material for authorities and utilities on how to involve local land owners in implementing SUDS, 75 participants	31/12/2020
	Phase 3: One report on overview on SUDS experience in C2C CC	01/06/2021
	Distribution of knowledge and implementation	31/12/2021
	Evaluation on the SUDS experiences within C2C CC.	31/12/2021

***ACTION C5*: Governance**

Beneficiary responsible for implementation: CDR

Budget: 190.560€

Number of days estimated spent on action in phase 1: 175 Days
Number of estimated days on action in phase 2: 190 Days

Role: CDR take on the role as a facilitator, coordinator and networking body of the CCA activities.

Relation to CCA plan
14 of the CCA plans and three of the risk management plans mention the importance of cooperation in relation to CCA.

Linked to Complementary Actions

- "Plowing Free Denmark - a green twist of agriculture towards conservation agriculture" Aarhus University The action supplements C5 by changed agricultural practice to reduce flooding. [Accepted for full application in May 2016, VELUX Foundations].
- *"WaterCoG":* A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C2C CC will have strong synergies in relation to water management, planning and stakeholder involvement. Complements C5. [Funded by InterregVB].
- *Citizen awareness:* Outreach and communication to strengthen citizens' awareness to act on climate change. In cooperation with researchers, teaching staff and children. Complements C5. [Funded by Regional Development Funds].

Description (what, how, where and when):

The aim of C5 is building capacity for a new CCA governance paradigm stressing integrated planning and accommodating the entire hydrological cycle. The objective is to increase resilience through capacity-building, strengthened network governance and cross-border coordinated planning.

C5.1 New paradigm and a common regional strategy integrating municipal CCA plans

What:
The aim of this action is to gather best practices related to integrative planning, which may be used as inspiration to develop a new paradigm for integrative CCA planning practice with emphasis on sustainability and capacity development; first of all among the partners of C2C CC, and secondly to feed into the international agenda on integrative CCA planning with state-of-the-art knowledge.

The first part of the action will gather knowledge on integrative planning within the water and environment sector, including experiences from the Danish river basin management plans (under the Water Framework Directive), other EU supported projects (e.g. catchment based approach in Usserød River (Usserød Å[1]), which is a LIFE Environment project).

[1] www.catchmentbasedapproach.org &
http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=4268

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This knowledge is specifically applied in C2C CC through actions C9, C10, C12, C15, C18, C19, C24 and through the C2C CC consortium and network. It is however relevant for all C2C CC actions. It is further applied in the formulation a common regional strategy that supports future coordination and integrative planning of the municipal CCA plans. This strategy will be a voluntary document with no official legal authority. However, as there is a broad mutual understanding between the municipalities of the need for a common approach and strategy, this document may form a strong basis for future collaboration and activities across administrative borders. The strategy will also serve as documentation of the collaborative process and a basis for applying for funding for future integrative projects. Following, the experiences of the review of best practice, state-of-the-art demonstration projects are gathered in a report and will serve to give recommendations for local governments in general.

On the basis of the CDR's decision to use UNs Global Sustainable Development Goals as guidelines for all development work, the same basis is taken for the work on a common strategy in C2C CC.

How:
The following activities will be conducted:

1. Collaboration with research institutions on state-of-the-art in integrative planning
    - Expert consultations to raise awareness on the importance of integrative planning and to motivate programme actions to have a holistic approach and to analyze the opportunities of synergies between CCA, climate change mitigation, biodiversity, nature, tourism/recreation, agriculture, and environmental issues.
    - Review of European reports and project experiences related to integrative planning in the water and environment sector incl. experiences from the EU LIFE IP project Rivers Trust in England.
2. Interviews with Danish Ministry of Environment on the network management of the River Basin Management plans and with Aalborg University, Aarhus University and KLIKOVAND on the experiences on network governance of CCA in Denmark.
3. Study tour to Germany and The Netherlands to study organizational and practical solutions on CCA and coastal challenges.
4. Continue the dialogues from Action A5 with LGDK and other relevant public authorities in order to maintain actual knowledge and ideas about integrative planning and development paradigms. This knowledge will be important in developing the common regional strategy for climate change adaptation
5. Training course in integrative planning processes and network governance for officials in and outside the partnership
6. Workshop: about SDGs as instrument for choosing a sustainable solution. The partnership is invited for introduction to the SDGs, including presentation of best practice from corresponding actors. A process is facilitated, so the partnership is inspired to use the SDGs in future in cross-cutting holistic planning. CDR has a regional development strategy based on the SDGs. This will be the same with municipal development strategies and municipal plans as a basis for a subsequent work to create shared vision and relationships across the partners in C2C CC.
7. The secretariat re-visits action A1. Legal barriers to integrated CCA, current CCA integration and policy recommendations, and updates the knowledge gathered under Action A1. In

addition, the partnership develops best practices in handling barriers and proposals for renewed rules.

8. Common regional strategy:
    - 6 catchment based workshops with C2C CC partners to define cross-cutting issues and activities and to decide on a common framework for integrative planning.
    - Development and formulation of a common regional strategy on CCA with the outset in integrative planning and network governance.
    - At least one of the 6 C2C CC thematic partner seminars (stormøde) has adopted integrative planning as a common theme.
9. At the end of each phase, an evaluation and assessment with a focus on the needs on future integrated cross partner actions within C2C CC will be conducted. This done to secure the direction and processes are carried out in the right way.

Where: CDR and Study tour.

When:
Phase 1: Activities 1-3 and 9
Phase 2: Activity 4-6 and 9
Phase 3: Activity 7-8

C5.2 Networking and knowledge-sharing
What:

CDR's approach to networking and knowledge-sharing is illustrated in Figure 13. The backbone of this approach is dialogue, and CDR invites all relevant stakeholders to participate in networking activities and to contribute to defining mutual challenges in order to create a common understanding of the core matters. Stakeholders are different and have varying interests, and often specific issues must be clarified, analyzed or explained before the network is able to decide on common solutions to the mutual challenges. This foundation for decision making is procured by the CDR by dealing with the best national consultants and international knowledge institutions. On this basis, the network defines a common strategy, and jointly determines who are able to contribute what, in order to reach the common objectives. CDR is able to take on leadership because of the region's impartiality and with point of departure in the regional development strategy (Regional Udviklingsplan (RUP)), which emphasizes sustainable development.

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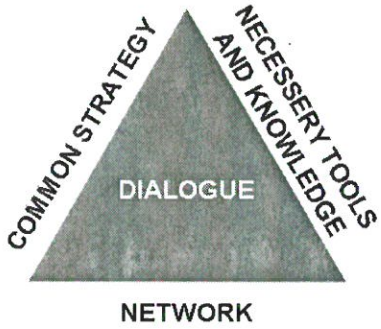

Figure 13: CDR's approach to networking and knowledge sharing.

How:
Activities

1. In corporation with the advisory committee and steering group, a workshop every year will be held with a special focus not covered by the other initiatives and actions.
2. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR and collaborative research institutions

When:
Phase 1: Activities 1-2
Phase 2: Activities 1-2
Phase 3: Activities 1-2

C5.3 Use of the Advisory Committee
What:
The Advisory Committee includes, amongst others, experts in planning processes and network governance. Experts will aid the demonstration actions in how to act in processes with many actors. This action builds upon theoretical schools relating governance theory to the development from government to governance and further to network governance, and it draws on experiences from the projects "Water in urban areas" and "The farmer as a water manager".

Several of the actions of C2C CC are characterized by many partners or many stakeholders e.g. The Western Part of the Limfjord (C9) consist of a partnership between 7 municipalities and 7 utilities, and The River Gudenåen consist of a partnership between 7 municipalities and 1 utility. Furthermore, CCA projects consist many more actors and professionals than public authorities are accustomed to handle. These actors are among others different departments within their own organizations, utility companies, land owners (e.g. citizens and farmers) and NGOs. There is thus a need to build capacity in how to govern integrative development processes in this multi-stakeholder framework.

How:

1. Six individual workshops between the Advisory Committee and the actions C9, C10, C11, C12, C13 and C14.
2. Call service, where the partners can call the Advisory Committee for advice.
3. One half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiences.
4. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Central Denmark Region

When:

Phase 1: Activities 1-4
Phase 2: Activities 1-4
Phase 3: Activities 1-3

C5.4 Capacity-building of officials and water professionals on CCA, stakeholder involvement and civil protection

What:
This action involves many capacity building activities with the aim to improve the prerequisites for implementing the CCA plans among especially the municipalities and their respective utilities and further to learn from these processes to develop new professional practices. Activities are focused on topic specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners. Training courses serve the purpose to provide officials with competences to carry out actual tasks e.g. on how to involve citizens when implementing local SUDS. Workshops will focus on mutual exchange of ideas and experiences between C2C CC actions and related projects. Masterclasses take their point of departure in one or more municipalities' concrete challenges and needs and the possible solutions identified by C2C CC partners.

Some of the challenges already expressed by the partners are among others stakeholder and citizen involvement, issues related to rise in groundwater level, issues related to larger and more frequent storms and coastal management, local contingency planning and cross-border contingency planning.

How:

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Capacity building of government officials aims at value-creating climate adaptation so that the heavy investments in climate adaptation not only creates climate robust solutions but also supportaspects of liveability, sustainability and green growth. A process is being carried out based on university staff to facilitate knowledge generation, learning and development of innovative practices. The approach takes the outset in action learning in which systematic learning processes are integrated in the working with the actual projects. Alongside, we aim at develop and test new forms of teaching material and governance manuals for wider use with value-creating climate adaption. The process includes:

- A survey covering all municipalities in C2C CC, including supportive municipalities will combine a general exploration of experiences and challenges with researchers facilitating the projects in relation to value creation. The survey reveals experienced challenges and opportunities to be addressed as well as the existing experiences in value creation in the municipal project work. This includes exploring identifying the values actually worked with in projects as well as the documentation and assessment methods developed to support the implementation process
- Based on the general survey, 4-5 projects / municipalities will be selected to further investigate and address specific issues and challenges relevant for more municipalities. This will produces in-depth knowledge of implementation dynamics and challenges and from this case description will be produced to disseminate the work of C2CCC.
- Based on the survey and contemporary university research as well as on the teaching of the Municipality of Hedensted in Phase 1, A master class training course will be organized to support the municipalities in their actual work in order to push the projects to reach their potentials. This also aims at supporting systematic learning processes and developing the professional practices for future planning and projects. Alongside a targeted and innovative teaching material / governance manual is developed to support professionals among and besides the participating municipalities and utilities in their effort to support value creating climate adaptions.
- Aalborg University plans to link a research effort to the process and to based on the survey and development of the master class training program produce international research publications.

All workshop and network activities arranged by the project management of C2C CC will be evaluated by the participants (cf. D1), special attention is paid to wishes and needs for training courses within specific subjects. According to the feedback of the C2C CC partners courses may also be arranged on ad hoc basis.

1. CDR develops a capacity development program for the C2C CC partnership to be held in Phase 2 and 3 on the basis of the evaluations and dialogue with partners.
2. Training courses:
   - 1 training course on stakeholder and citizen involvement
   - 1 training course on emergency/contingency planning and roles of citizens and stakeholders during emergencies
   - Training course on Mutual Gain Approach as method to negotiate and make co-creation with stakeholders. Based on actions in C2C CC, the method is introduced and will be implemented among the partners.
   - At least three additional courses according to needs
3. Workshops:

- Evaluation workshop organised as an Experience (ERFA)-meeting on the progress of the municipalities' emergency/contingency plans and activities.

4. Master classes:
   - A master class training course on making added value in corporation with all relevant stakeholders locally and broader as described above.
   - At least 1 masterclass among municipalities and local emergency centres on their respective emergency/contingency plans.
5. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
CDR – location not decided, meeting rooms of CDR, the Municipalities or at the universities, alternatively conference facilities organized through procurement agreements of CDR.

When:
Phase 1: Activity: 1, 2 and 5
Phase 2: Activities 2, 3 and 5
Phase 3: 2, 4 and 5

Reasons why this action is necessary:
As also stated in Form B section 1.1. the present gaps and shortcomings that hinder effective implementation of the plans are at least threefold. Firstly, the cross-sectoral nature of CCA, which demands a new governance paradigm stressing integrated planning accommodating the entire hydrological cycle. Secondly, lack of knowledge, knowledge sharing and capacity building on commonly shared issues and solutions among local authorities hinders integrated CCA planning. Thirdly, the difference in level of ambition and implementation between the prosperous and less prosperous municipalities decrease resilience especially among the less prosperous.

Constraints and assumptions
There are no significant constraints in implementing the mentioned governance actions, as CDR has extensive experience in organizing and facilitating workshop and course activities. However, one constraint may be related to securing the quality of a workshop e.g. that the scope meets the need of the municipalities. CDR has and will continue to have thorough dialogue with the partners of C2C, where expressed needs and wishes for capacity building and knowledge sharing of the partners will be met. It is expected that new needs will occur during the project period. Another constraint may relate to choosing the right lecturers for a course who possess sufficient knowledge and are good facilitators. In this regard CDR will involve the network of the Advisory Board, the partners and CDR itself.

Expected results:
C5.1: Phase 1: Awareness on the importance of integrative planning and motivation for working with multi-functional, sustainable and holistic solutions. Capacity building on international and national experiences with network governance. Participation of at least 100 partners and stakeholders at C2C CC workshops in at least two workshops/networking arrangements.

Phase 2:

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Awareness on the SDGs as instrument in planning sustainable. During interviews, the secretariat will investigate the dissemination of SDGs as a basis for interdisciplinary planning in the partnership.

Participation of at least 100 partners and stakeholders at C2C CC workshops.

That the MGA is implemented in the organizations at least half of the partners.

Phase 3: 1 common CCA strategy to guide the individual CCA plans to incorporate sustainability, whereas at least 15 C2C CC partners have contributed to the development of the common CCA strategy.

C5.2: Networking and knowledge-sharing of at least 200 persons (4 persons from each partner and an additional number of stakeholders) in an annual workshop through phase 1 and phase 2.

C5.3: The Advisory Committee builds capacity among C2C CC partners on how to manage processes with many actors and stakeholders. Improved network governance processes specifically in actions C9, C10, C11, C12, C13 and C14. At least 300 participants from C8-C24 participates in 6 initial workshops between the Advisory Committee and the actions. Call service used twice a month, where the partners can call the Advisory Committee for advice, 1 half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiences.

C5.4: Phase 1: The capacity building development program will ensure that the officials improve their ability to work holistically with CCA and in close collaboration with relevant actors and stakeholders.

Phase 2: The capacity building activities will result in better designed and performed CCA plans and actions. 30 participants per course is expected, corresponding to at least 150 participants in the two courses on stakeholder and citizen involvement and emergency/contingency planning, and additional courses according to needs. At least 60 participants attending the evaluation workshop emergency/contingency plans and activities. At least 50 selected participants attending master classes

Phase 3: The program further develops and test innovative teaching material / governance manual to support professionals among and besides the participating municipalities and utilities to support value creating climate

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 Euros per day for junior employee.

Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	*Deliverables:*
C.5.1.	Program, presentations and evaluations from all meetings/workshop, available at www.c2ccc.eu Newsletter, information at website and press releases for each meeting Inspiration material on experiences and recommendations for future practice in Danish and English. Published in 200 copies and available at www.c2ccc.eu Study tour report
C.5.2.	Program, presentations and evaluations from all annual workshops, available at www.c2ccc.eu
C.5.3.	Phase 1, 2 og 3: Newsletter on the activities of the Advisory Committees available at www.c2ccc.eu Small videos on the experiences, benefits and recommendations of the C2C CC actions available at www.c2ccc.eu Reports on expert consultations Phase 3: Peer reviewed journal article on the experiences of network governance in C2C CC. 1 guideline for network governance based on the experience in C2C CC
C.5.4.	Phase 1: A capacity development program for training courses, workshops and master classes available at www.c2ccc.eu A master class training course on making added value in corporation with all relevant stakeholders locally and broader as described above. Phase 2: Innovative teaching material / governance manual on value-creating climate adaptation. Course and workshop materials available at www.c2ccc.eu One article in a Danish journal for professionals such as 'Teknik og Miljø' 1-2 international research publications Phase 3: Course and workshop materials available at www.c2ccc.eu

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Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C.5.1	Phase 1 Report on Expert consultations and two workshops, 100 participants	31/12/2017;31/12/2018
	Review report of European reports and projects	31/03/2017
	Interviews with Danish ministries, networks and universities, 10 interviews	01/07/2017
	Study tour to Germany and The Netherlands to study organizational and practical solutions on CCA and coastal challenges, 25 participants	31/10/2017
	One evaluation and assessment	31/12/2018
	Phase 2: Training course in integrative planning processes and network governance, , 200 participants	31/12/2019
	Training course on SDG's (45 participants)	31/12/2019
	6 catchment based workshops with C2C CC partners to define cross-cutting issues and activities and to decide on a common framework for integrative planning (all six workshops)	01/07/2019
	Phase 3: Development and formulation of a common regional strategy on CCA with the outset in integrative planning and network governance.	01/01/2021
	At least one of the 6 C2C CC thematic partner seminars (stormøde) has adopted integrative planning as a common theme.	01/01/2022
	One evaluation and assessment report	01/01/2022
C.5.2	Phase 1 Two annual workshops, 200 participants each	31/12/2017; 31/12/2018
	Phase 2 Four annual workshops, 200 participants each	31/12/2019, 31/12/2020;
	Phase 3: Two annual workshops, 200 participants all together	31/12/2021: 31/12/2022
C.5.3	Phase1 Six workshops (all six workshops), 200 participants total	31/12/2018
	Functional call service up and running, where the partners can call the Advisory Committee for advice	01/07/2017
	One half day seminar with expert presentations on theoretical aspects and partner presentation with initial experiences	31/12/2017
	Phase 2 and 3: 2 times six workshops(six workshops every two years), 400 participants total	
	Call service, where the partners can call the Advisory Committee for advice (to be continued from phase 1)	31/12/2020; 31/12/2022
	One half day seminar every two years	31/12/2020; 31/12/2022

C.5.4	Phase1: Capacity development program for the C2C CC partnership Phase 2: A survey among all municipalities to asses and describe the valuation creation A Masterclass on value creation One article in a Danish Publication for professionals 3 training courses, 150 participants all together Evaluation workshop organized every at the end of Phase 2, 60 participants Masterclass , 50 participants Teaching material Phase 3_ Five training courses, 150 participants Evaluation workshop organized at the end og the Phase 3, 60 participants 1-2 international publications in review	31/10/2017 31/12/2020; 31/12/2020 31/12/2020 31/12/2020 31/12/2020 31/12/2020 31/12/2022 31/12/2022 31/12/2022

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ACTION C6: Tools

Beneficiary responsible for implementation: Central Denmark Region

Budget: 655.704€

Number of days estimated spent on action in phase 1: 10 Days
Number of days estimated in phase 2: 30 Days

Role: Central Denmark Region will take on the role as initiator of developing common crosscutting tools which can be used by the 21 municipalities and the water utilities in C2C CC.

Description (what, how, where and when):
The objective of this action is to increase resilience through enhanced decision-making processes.

Relation to CCA plans:
In all the CCA plans there is a demand on an increased level of knowledge, and in particular tools to address specific challenges such as high groundwater tables. During workshops held to prepare the C2C CC project, the municipalities underlined the importance of developing tools to increase the knowledge on groundwater changes locally. Furthermore, there have been a general interest in making a surface/stream water module, which may model the effect of changes.

Linked to Complementary Actions
"WaterCoG": A project around the North Sea involving eight beneficiaries from DK, NL, SE and UK. The focus is on improved water governance in the private and public sector and includes pilots in the region. Testing and demonstrating new management tools. The WaterCoG and C6 will have strong synergies in relation to benefitting from the tools developed. [Funded by InterregVB].
"TOPSOIL": Focusing on issues related to rising groundwater levels and related climate change implications. Includes beneficiaries from DK, DE, NL, BE and UK and will add European aspects on groundwater to C2C CC. Complements C6.1 in relation to produced knowledge on the topsoil. [Funded by InterregVB].

Description (what, how, where and when):
In C6 there is a special emphasis on building up tools to be used across the whole of the CDR region.

C6.1 High resolution groundwater-surface water model for Central Region Denmark

What:
The purpose of this action is to develop a coupled groundwater-surface water model which covers the entire region and provides an integrated description of the entire water cycle in Central Denmark Region with an unprecedented level of detail. The resolution of the model should be high enough to provide a reliable prediction of areas prone to waterlogging and inundation, whether flooding is caused by groundwater or surface water. A model will be able to quantify the effects of adaptation measures, not only at the place where the action is implemented but also on downstream or neighbouring locations. The model will support local activities as it will be the common foundation for analysis of climate change and CCA in local areas, e.g., in urban areas

where even higher resolution is needed, and where special anthropogenic interactions should be considered. Hence, results from the model will be available for all activities undertaken in the actions and will ensure a common basis for all activities. The model will be available for all municipalities. The design of the tendering process and training is worked on in action C3.1

How:
Activities:
Phase 1:

1. A model is developed on the basis of the national water resources model, which has proven to produce reliable results for groundwater resources and protection, but suffers the level of detail to describe the near surface water levels. Hence, the national model (500 m resolution) is further developed in the Central Denmark Region on a number of aspects. The resolution of the model is improved to 100 meters scale. High precision digital elevation data should be used to specify the land surface. A new description of natural and artificial drainage (drainage pipes and channels) should be implemented. All input data to the model should be modified to match the 100 meters discretization.
2. The model should be calibrated against an extended database of hydrological observations including near surface observations of groundwater levels that are specifically collected as part of the project.
3. The model should be forced by results from selected climate models to ensure that the inherent climate projection uncertainty is represented by the model. The climate model data will be downscaled and bias corrected prior to being used as data for implementing physical plans and structures.
4. Subsequently, the model will transfer to an operational phase where it will serve and support the activities in the different actions, predicting results for present and future climate scenarios on e.g. groundwater levels, interaction between groundwater and surface water, and discharge of fresh water from river catchments (e.g. the River Storå, the River Gudenå, and the River Grenå, etc.).
5. Climate sensitivity will be mapped by feeding the model with a number of design storms, each defined by intensity-duration-frequency curves representing specific return periods. Hereby, it is possible to identify areas where the groundwater table will rise above a certain threshold (e.g., 1 meter) for a given design storm.
6. The combined tool (ground- and surface water covering C6.1 and C6.2) will be implemented in the municipalities and utilities in the partnership and other municipalities/utilities in Central Denmark Region
7. The combined tool (ground- and surface water) will be tested in 2-3 of the subprojects and the partnership will be examined in how to use the tool (as described in C3).
8. Maintenance of the tool
9. Climate vulnerability is mapped and partners in the project can obtain results from the model on aspects relevant to local activities
10. In dialog with the users small errors in the tool will corrected.
11. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

DS

Where: Central Denmark Region

When:
Phase 1: Activities 1-5

Phase 2: Activities related to 6-11

Phase 3: 8 and 9

C6.2 Regional screening assessment tool of flood risk from rivers and the sea

What:
Climate changes increase precipitation, every day and extreme rains respectively, and increase the run offs into streams and rivers leaving especially low lying areas in risk of flooding. There is a need for a tool that visualizes and assesses the risk of flooding and illustrate the effect of potential solutions.

By the use of the best available tool (BAT) on the market, an illustrative river model is set up for the streams and rivers of the region. The tool should be developed as a web-based tool developed for screening potential flooding from cloud bursts, rivers and sea level risings. It should be based upon well-known principles for water flow, water level and flooding based on Manning's formula, and specific cross sections (cf. figure 14). The innovativeness of this action is to combine the web-based tool with a river model jointly with a statistical model for combined events of storms and heavy rains in future climate scenarios. The model for the region should be based on existing digital data for streams and rivers inclusive cross sections (cf. Figure 14 (right side)), underpasses and vegetation. The model should include water flow and water level at delta areas, which should make it possible to simulate coupled events by different run off scenarios (defined by water flow) and storm surges (defined by water level). Input data are: existing knowledge on run off in catchment areas, and the implementation of a statistical model. The statistical model should look at future climate time series, where especially coupled events between water flow and sea level are interesting.

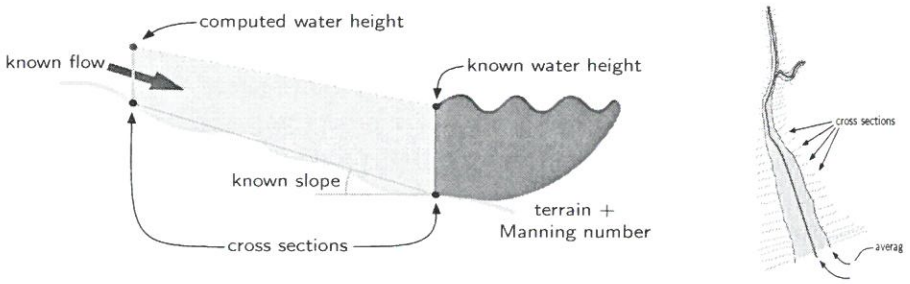

Figure 14: Illustration of the principles of the web-based tool.

How:
Activity:

1. The tool will provide the municipalities with an interactive 3D screening and decision support tool, which gives a knowledge base for a more focused dynamic hydraulic modelling
2. The tool is combined with C6.1 and the activities are described above.

Where: Central Denmark Region

When:
Phase 1: Activity 1

C6.3: Warning systems
What
Early warning systems are in the beginning of being build up in Denmark. The systems can be advanced models coupled to weather and climate scenarios or simple warnings based on the weather forecast. They all have in common that they inforce the resilience capacity via digital warnings. Warnings can be coupled to web pages, mobile phones or other digital platforms. In C2C CC there is a need to increase the use of warning systems.

How:
Activities:

1. Explore the known warning systems in DK and in other countries dealing with water management and warning systems
2. Recommend test and demonstrations
3. Test and demonstrate simple and advanced warning systems
4. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

*Where: Ce*ntral Denmark Region

When:
Phase 2: Activities related to 1, 2 and 4
Phase 3: Activities related to 3

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Reasons why this action is necessary:
Knowing the scale and extension of a flooding event is essential for local and regional contingency plans to become effective. On a regional level, DEMA (The Danish Emergency Management Agency) has a broad range of manpower and equipment ready for preventing flooding from the sea, rivers, groundwater and cloudbursts, and municipalities, utilities and private owners have additional manpower and equipment, but to make the best use of the different resources in a timely manner, it's essential to know where to react in due time. An combination of weather prediction models, hydraulic models and warning systems are important to make the contingency management plans function in practice. The two tools, C6.1 and C6.2, are needed in CRD in order to create the knowledge base for planning for future impacts from rising groundwater level and flooding from rivers. Combined with warning systems these may by relatively small efforts increase the resilience capacity of CDR.

Constraints and assumptions
It is assumed that the existing warning system in Denmark under DEMA may function as a functional platform for the implementation of a flood warning module for the system, and that DEMA's regional staff and municipalities may find an interest in the model and tools developed for predicition.

Expected results:
C6.1: Phase 1: A model is developed, 2 municipalities have applied the tool and use the results in decision making and spatial planning.

Phase 2:All CDR municipalities have applied the combined (C6.1 and C6.2) tool and use the results in decision making and spatial planning.

C6.2: Phase 1: A screening tool is developed and tested.

C6.3: Phase 2 and 3: Known warning systems in DK and in other countries are explored. Simple advanced warning systems with flood prediction are tested and demonstrated. DEMA and 5 municipalities have applied an extended warning system module for flood prediction.

Expected results linked to expected complementary actions
WaterCoG will demonstrate new tools to improve flood resilience and water governance. TOPSOIL's results support C3 and C6.1 on the interlinkages between climate change and groundwater and brings in European experiences.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee.
Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant
Workshops includes preparations in advance and hours spend during workshop and after the

event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km

Deliverables:

Action	*Deliverables:*
C6.1	A High resolution groundwater-surface water model in combination with the interactive 3D decision tool (C6.2) Report on model construction. Report on model calibration. Report on climate projections and climate impacts. User guideline for the model
C6.2	An interactive 3D decision support tool on the water flow in catchment areas across municipal borders in combination with the groundwater-surface water model (C6.1) Technical background report User guideline for the tool.
C6.3	Report on known warning systems in DK and abroad Test and demonstration of warning systems DEMA and 5 municipalities have adapted the new improved system

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C.6.1	Groundwater-surface water model constructed	01/07/2018
	Observation data collected and groundwater-surface water model calibrated	31/12/2018
	Testing af the combined tool in 2-3 sub projects	01/04/2019
	All CDR municipalities have applied the tool and use the results in decision making and spatial planning	01/04/2019
C.6.2.	3D decision support tool/groundwater-surface water model is constructed	01/07/2018
	Testing completed towards existent data	31/12/2018
	All CDR municipalities have tested the tool and use results in decision making and spatial planning	01/04/2019
C6.3	Exploring and testing of warning systems done	31/12/2022
	DEMA and 5 municipalities have tested an extended warning system module for flood prediction	31/12/2022

ACTION C7: Innovation

Beneficiary responsible for implementation: Central Denmark Region

Budget: 438.167€

Number of days estimated spent on action in phase 1: 182 Days
Number of estimated days spent on action in phase 2: 190 Days

Role of Central Denmark Region as main responsible

- Facilitator, coordinator and networking body of the CCA activities.
- Coordinates activities with partners, such as Central Denmark EU Office, and stakeholders, such as private companies, universities and NGO's
- Coordinates with other C actions on innovation such as C.20, C.21, C.22 and C.23

Linked to Complementary Actions
To support C7.4, Central Denmark Region will be applying ERDF (via Growth Forum CDR) for funding to support its efforts to boost export of water solutions globally. The project is called 'Smart Water Cities' and integrates environmental and societal challenges into business opportunities in emerging city markets for water management and water supply solutions. The expected sum is: 1.600.000 €

Description (what, how, where and when):
C2C CC innovation action gathers and makes use of a number of business related activities which take place in C1-C7 and within the actions C8-C24. Besides, this action has a number of own activities to promote sustainability of C2C CC. On the long run, resilience is increased by generating jobs and green investments in the region, and this action takes its point of departure in a strong regional emphasis on business development and public-private cooperation in general and in the water sector in particular. It also promotes the development of sustainable and high-quality coastal, nature and business tourism.

C7.1 Networking and knowledge-sharing as a backbone for innovation

What:
This activity creates a number of informal forums to unite important stakeholders within water businesses serving several purposes. First of all to show case climate change and water technologies. Secondly, to gather useful information and best practices from cross-cutting and demonstration activities - e.g. C.4 on SUDS, C.3 on technological development to solve problems with rising groundwater level incl. means to reuse excess water, C.16 on city development in Randers, C.22 on permeable pavements, C.6 on development of flood models for early warning systems, etc. Furthermore, these forums will set the stage for discussions between public owned water companies and companies to discuss public private cooperation and enhance innovation.

Water clean tech companies e.g. Dansand, Grundfos and Kamstrup, and engineering and consultancy companies such as NCC and NIRAS will be involved in relevant innovation projects and cooperation fora.

How:

1. Informal annual/biannual network meetings where water related companies, universities and relevant NGO´s will be invited to discuss business opportunities as a result of the findings in C2C CC.
2. Master classes, where an organization presents a challenge, instead of presenting the good experiences and results. Presentation of major challenges or dilemmas e.g. issues related to flooding of basements in an urban area due to rising groundwater form the basis of the cross-disciplinary master class. In the master class, companies, experts, municipalities and utilities work together in a workshop-like set-up on how to solve specific "wicked problems". This provides the companies with detailed inside knowledge on already experienced challenges and needs, and it provides the municipalities and utilities with different aspects on proposed solutions. If some private companies see business opportunities in the challenges, their R&D departments should develop further on the findings. Perhaps their work could form the basis of new master classes for knowledge sharing and mutual inspiration. The work will be lead by the two beacons AqualGlobe (C20) and Klimatorium (C21).
3. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Central Denmark Region

When:
Phase 1: Activity 1 - 3
Phase 2: repetition of activity 1 - 3
Phase 3: repetition of activity 1 - 3

C7.2 Counseling of innovative industries on applying for EU funding

Central Denmark EU-Office is responsible on this action.

What:
This activity intends to ease water companies' access to various forms of finance in order to enhance innovation and to secure greater export of water solutions (as identified by EU initiative EIP on Water[1]). Many CDR companies are unaware of EU funding possibilities, the reason why CDR engaged actively in one of the first Action Groups, FINNOWATER[2]. Action C.7.2 builds on two pillars: awareness-raising and support to companies with innovative water solutions.

How:

1. Development of information material on EU support and funding possibilities to be sent to companies, relevant networks (regional as well as national e.g. DANVA (the Danish association of water companies), and municipal business promoters.

[1] EIP on Water Strategic ImplementationPlan
[2] http://www.eip-water.eu/FinnoWater

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2. Individual counseling - and where needed coaching – of companies by Central Denmark EU Office.
3. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Central Denmark Region, locally at companies at times, when they are available

When:
Phase 1: Activity 1 - 3
Phase 2: Activity 1 and 2
Phase 3: Activity 1 - 3

C7.3 Train relevant stakeholders on innovation within ecosystem services

What:
CCA in CDR closely relates to nature restoration, tourism in general as well as business tourism (C20 and C21). Many rivers and lakes will eventually prosper from greater fishing possibilities and change of forestry, and several actions deal with integrating nature based experience and tourism (C.8, C.9, C.11, C.12, C.16). However, Danish companies and authorities are not in the habit of including ecosystem services as part of their business development. But interest is widespread, also in industrial associations, and C2C CC wants to promote this valuation of eco system services further. Experience from other regions show that investments on ecosystem services related to better environment, nature conservation and conditions for e.g. sportsfishing, may have a positive impact on emerging new business, such as the "pike-factories" in Region Zealand[3].

How:
1. Interviews with relevant stakeholders on the potential for evaluation of ecosystem services and develop training material to support them
2. Meeting – virtual or real – with the EIB to assess possible projects for NCFF funding
3. Coaching of stakeholders
4. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Central Denmark Region

When:
Phase 2: 1-4
Phase 3: 1-4

C7.4 Dissemination of Danish Water concepts

[3] http://fishingzealand.dk/en/

What:
C2C CC will be show-casing water solutions and CCA solutions to a Danish,European and global public in order to generate more awareness and sustainable solutions.

How:
1. Strengthen collaboration and coordination between Danish water sector stakeholders
2. Establish and promote a strong Water Hub in Central Denmark Region run by an external player
3. At the end of each phase, an evaluation and assessment with focus on the needs on future integrated cross partner actions within will be conducted. This done to secure the direction and processes are carried out in the right way.

Where:
Central Region Denmark

When:
Phase 1: 1-3
Phase 2: 1-3
Phase 3: 1-2

Reasons why this action is necessary:
In spite of Central Denmark Region having a large share of the water clean-tech companies in Denmark (55 out of 219), due to a lack of coordination, the presence of the newest knowledge and best available technologies (BAT) are not utilized – not in the Region, not in Denmark. According to the Confederation of Danish Industry (DI), Danish BAT within water could double by 2025 compared to the present level. There is thus an unused potential for capacity building and innovation within the region among the municipalities, the utilities, water companies and research institutions.

Constraints and assumptions
There are no significant constraints in implementing this action. CDR has extensive experience in organizing and facilitating workshop and course activities and cooperating with the relevant stakeholders. On their part, the stakeholders will find the offer to get acquainted with EU funding positive and possible financing of innovation projects.
However, a constraint in implementing this action is a new statutory saying that the regions (regional governments) are no longer permitted to perform promotion of trade lawfully as per 1. January 2019.

Expected results:
C7.1: At least three innovation projects arise on the basis of triple helix/quadruple helix approach.

C7.2: 6 workshops on best practices and/or topical issues. Advising 10 companies on EU funding, following 4 applications submitted for EU funding.

C7.3: Contact to 10 potential stakeholders with an interest in ecosystem services, at least 2 applications for funding (EU or national) submitted, Interviews of 30 clean-tech water companies.

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C7.4: Increase exports within Danish BAT within water in Central Denmark Region by at least 25% by 2022.

Cost estimation:
Based on working days with salary of 47 € per Hour and 347,5 € per day per senior employee and 35 € per hour and 259 € per day for junior employee. Workshops and meetings includes budgets for lunch coffee and conference venue 75 € per participant. Workshops includes preparations in advance and hours spend during workshop and after the event for output material
Workshop transport is calculated via an average of 100 km and 0,487 € kr. per km. Subsistence costs are also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	**Trip to DK. Advising of clean tech / water firms.**
Partners / *Cost categories:*	**CDEU**
Hotel cost:	554
Daily allowances/Payment for meals cost:	238
Local transportation costs:	0
Total subsistence cost:	792

Deliverables:

Action	*Deliverables:*
C.7.1	Report with best practice cases
C.7.2	Information material on EU support and funding possibilities Four applications for EU-funding
C.7.3	Two applications for funding (EU og national)
C.7.4	Report describing potentials for Danish Water Hub and a comparison of concept exportsbefore and after C2C CC

Milestones:

Action	*Quantifiable milestones:*	*Date by end of*
C7.1	Annual reports on six workshops on best practice and/or topical issues	31/12/2017 31/12/2018 31/12/2019; 31/12/2020; 31/12/2021 31/12/2022
C7.2	Information material on EU support and funding possibilities available for partners 10 companies have received advice Four applications for EU funding submitted 4 annual status reports	31/12/2017 21/12/2020 31/12/2018; 31/12/2018; 31/12/2019; 31/12/2020; 31/12/2022
C7.3	Interviews of 30 clean-tech water companies performed Two applications for EU funding submitted	31/12/2018 31/12/2018; 31/12/2020
C7.4	Report on support for export	31/12/2029

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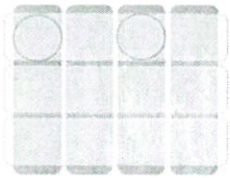

C8: Håb til Håb

Development of the Coastal land between Glud Håb and Håbet

The project focuses on involving stakeholders, politicians, administration, the wastewater utility, etc. in an effort to create a common understanding of the CCA challenges in order to make long-term sustainable choices. It is primarily linked to governance within sea & fjords and rainwater.

Main responsible beneficiary: Hedensted Municipality Budget: 199,393€

Number of days estimated spent on action in phase 1: 94 Days

Beneficiary responsible for implementation: HEDKOM

Role of HEDKOM:

- Is the project manager
- Cooperates with Aarhus University providing climate and culture historical consultation services (financed through C.24) and Hedensted Waste Water Company on the complementary project,
- Engages and involves politicians, citizens, citizens' organizations, etc.
- Reports to C2C CC project-leader and cooperates with other C2C CC partners

Relation to CCA plans

The action is part of Hedensted CCA municipal plan, which aims to prevent the consequences of climate changes, where major exiting assets are threatened (p. 21), taking into consideration guidelines for lowland areas and wetlands, as well as guidelines for technical installations.

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Activity C8 Håb til Håb will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C10, C11, C14 and C18 dealing with the coastal cities of Horsens, Randers and Grenaa. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C9, C10, C11, C14, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g. geophysical data and C8 will benefit from this model. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of Action C8 and other actions.

C24 focuses among other things on innovative communication of the coupling between climate history and culture. Project C8 will function as a pilot where citizen-driven climate adaption will include an environmental and cultural-historical dimension.

Linked to Complementary Actions

C8 is linked to a complementary action by Hedensted Waste Water Company. It is commonly known that sewer systems must be maintained and renovated, but at the same time, there is a fear that solutions will be short-termed and not sufficiently sustainable. Hedensted Waste Water Company is responsible for the maintenance of the sewer, and will inter into cooperation with Hedensted Municipality and involved stakeholders in order to base decisions on the scenarios that are developed during the C2C CC project. In this way, decision on introducing certain sewer systems do not hinder innovative solutions in the long run. 3.4 mio. € has been allocated to this activity.

Description (What, how, where, and when)

What

The C.8. project focuses on involving stakeholders – citizens, politicians, administration, the waste water company, etc. – in an effort to create a common understanding of the CCA challenges in the project area in order to make long-term sustainable choices. Furthermore, the project underlines the need for growth and development and, of course, climate proofing the project area, preparing scenarios for how the area can develop, taking first step(s) from idea to action.

People have lived in the coastal area between Juelsminde and Snaptun since the beginning of the current warm period (Holocene). The coastal settlements are a particular feature of the area, and today the area is one of the most attractive outdoor leisure areas in Hedensted Municipality. Together with Juelsminde, it is the centre for costal tourism in the municipality.

Much of the river valleys are cultivated. The natural areas consist of cliff forests, meadows (mostly peatland) and marshland connected to watercourses. In terms of geology, the area contains moraines, freshwater peats and organic silts, and marine saltwater formations.

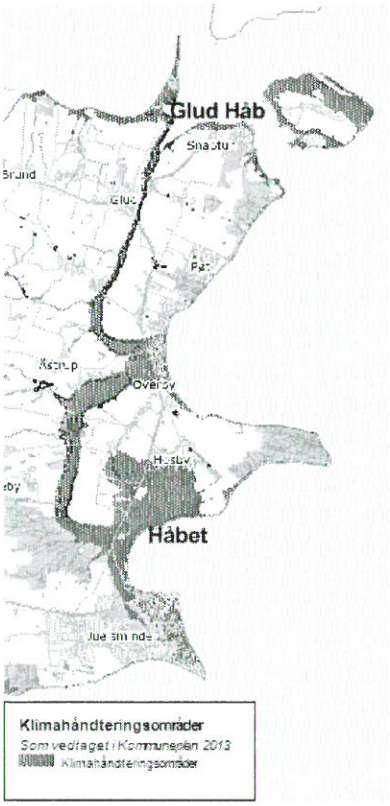

Figure 15: CCA areas in the municipal plan

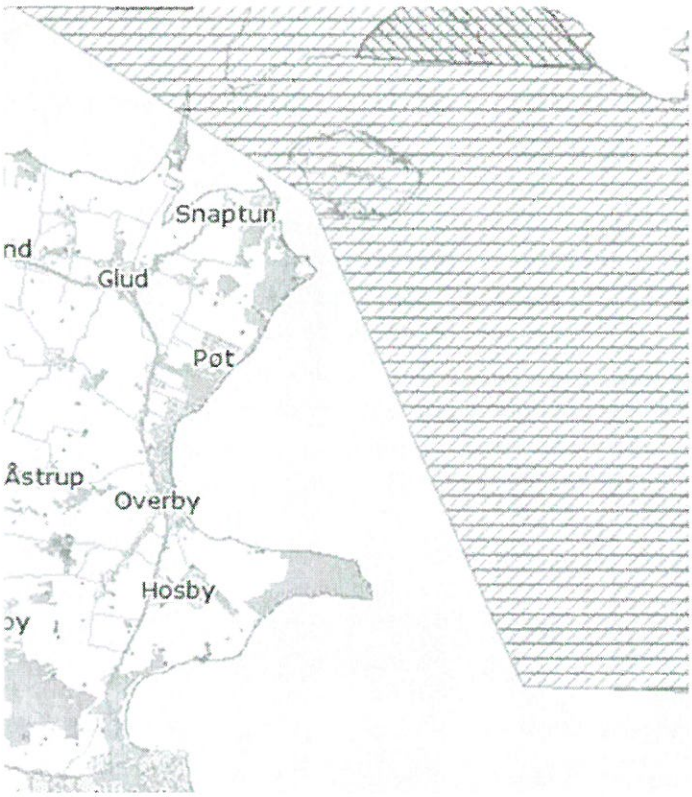

Figure 216: NATURA2000 areas at Horsens Fjord and the sea

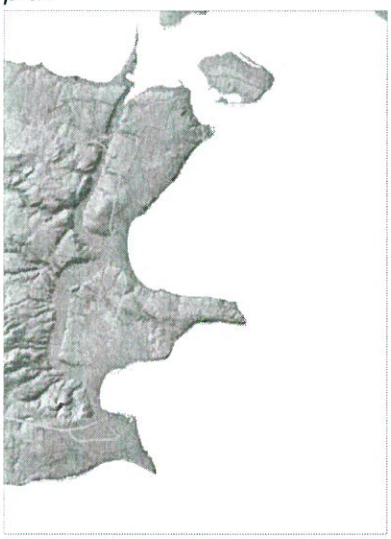

Figure 17: The project area (the area threatened by seawater and freshwater flooding is shown in blue)

The area is close to a migration path for birds following the route along Jutland's coast. The area is close to one of the most important resting grounds for seabirds in Habitat Site no. 52, "Horsens Fjord, havet øst for og Endelave" (Horsens Fjord, the sea to the east and Endelave).

The challenges from changed climate consist of higher sea levels and greater volumes of water being transported from several watercourses in the coastal hinterland. Today, two sluices regulate the relationship between draining fresh water to the sea and the flow of saltwater from the sea to the hinterland.

It has a long-term impact on the assets in the widespread holiday home areas, on the continued possibility for cultivating agricultural areas using crop rotation, and the possibility of maintaining and developing a good ecological condition in the watercourses. There is approx. a 15 km watercourse, which has a base elevation of 0 or lower. It is also a complex task to simultaneously protect settlements from flooding, develop the area as an outdoor leisure and tourist area and ensure good ecological conditions in the watercourse and in the countryside. Taking action also increases the storage of carbon and reduce the emissions of carbon from peatlands, or create new resting and breeding areas for seabirds and wading birds, to compensate for the salt-affected meadows, which might disappear when the sea level rises.

The Hedensted Municipal Plan 2013-2025 fixes guidelines for lowland areas, laying down potential flooding areas as CCA areas. This has been continued in the new municipality plan 2017-29. In the open countryside, these areas may only be changed to nature areas, wetlands and recreational areas. This means that with conversion, it strengthens the area's natural, so that the water environment plan's goals are maintained and that it becomes possible to remove nutrients.

The challenges that the area faces in particular: A more natural interplay between the coast and the coast's hinterland, and optimal cohesion between investments in good water environment and natural assets, in CCA, in CO_2 reduction and in the development of the area. Furthermore existing challenges include for example: finding solutions for the lowest lying holiday homes; dealing with wastewater and rainwater in an area affected intermittently by saltwater and rainfall effects, ensuring a good lifetime for the main traffic routes and other infrastructure, which complement the Municipality Plan 2013–2025 (and the new plan 2017-29), describing that new infrastructure like roads, etc., will be built to withstand raised sea levels; and ensuring accessibility for emergency services to Juelsminde.

C8.1 *Developing of scenarios – descriptive as well as prescriptive*

What

To form the basis for subsequent decision-making and as an important element of the awareness raising and involvement of the citizens, three descriptive challenge based scenarios will be developed: 1) if doing nothing, 2) if the area between sea and watercourse is opened and follow nature's and the climate's developments, or 3) close the area using sluices and dikes, so as to pump fresh water out into the sea. The scenarios are based on historical and Quaternary geological data, as well as on an assessment of the future environmental developments. These scenarios also build on the analysis on climate cultural history, made by Aarhus University, because it mobilizes citizens' interest in the area.

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How:
The action will include the following activities:

Phase 1
Based on previous data, setting up three data loggers in the watercourse system for collecting data on the water level and salinity, as well as a trial with an "open sluice" to get an indication of the effect of any eventual dismantling of the sluices, the three scenarios are prepared.

How:

1. AU and an external consultant is involved in the designing of the descriptive scenarios, securing a continuity of the common knowledge and understanding of the area and is a method to keep focus for the municipal administration.
2. The descriptive scenarios and the climate history are visualized and presented to the public (see C.8.2).

Phase 2
Each scenario will contain: a long-term development goal (What will it look like in the future? How will the area be experienced? What will it mean for selected stakeholder groups? How may tourism be affected and can the cultural heritage narrative make the area more attractive?), project ideas (to test new solutions), detailed proposal for a first stage.

In 2nd phase dialogue continues among stakeholders (cf. C8.2) on the three descriptive scenarios in order to secure consensus about the eventual CCA approach. Knowledge, results, and the project's progress will be disseminated (at the internet, at themed meetings, and field tours with land associations). During this phase, Aarhus University will continue the dialogue on the future cultural environment and the storytelling of the project area. The climate story serves a dual purpose – it mobilizes local interest, and it brands the area and attracts more tourism. During Phase 2, the chosen descriptive scenario will be elaborated into a number of development scenarios with solutions to choose from.

3. 1-3 concrete scenarios for the area's development will be prepared in cooperation with stakeholders.
4. In cooperation with stakeholders at least three project will be visualized.

Phase 3
During Phase 3, the chosen scenario for the area's development will be elaborated into a number of development projects to choose from.

Where: The scenario development shall take place in project area.
When:
Phase 1: Activities 1 and 2
Phase 2 and beyond: Activities 2, 3 and 4

C8.2 *Citizens' engagement*

What:
A number of activities targeted citizens and stakeholders take place during the project period (and beyond). Citizens must be made aware of the consequences of the(ir) choices and empowered to take the right decisions. This activity deals with the proper engagement of citizens stakeholders in the process.

How:
Phase 1
To reach a common understanding of the CCA challenges, stakeholders and citizens are invited to join in discussions and make field trip to areas with similar problems to investigate solutions that may serve as inspiration. In this way, stakeholders get a deeper understanding of the area and learn about the world around them.

Phase 2
Discussions among stakeholders and citizens continue in order to prioritize and to reach the eventual decision on how best to implement CCA. As Phase 1 was very focused on awareness raising, later activities are focused on the proper decisions. In collaboration with AAU, develop interdisciplinary engagement in the CCA work

Concrete activities are:

1. 2 field trips and excursions among stakeholders to investigate best practices of how the challenges are handled elsewhere (e.g. for agriculture, enterprises, summer houses, etc.),
2. 1 – 2 workshops and working groups
3. Based on workshops an citizens engagement a stakeholder analysis and stakeholder mapping will be elaborated
4. workshop aimed at the purpose of inspiring other administrations for activities that support the direction of development. And to develop cross-cutting projects.

Where: destinations of the excursionswithin and outside the project area.Workshops will take place in the project area.
When:
Phase 1: activities 1 and 2
Phase 2 activities 3 and 4

C8.3 *Political discussion and decision-making*
This action deals with the transition from scenarios to concrete decisions on how CCA can be carried out in a complex area in an interplay between knowledge about culture, nature, biodiversity and carbon sequestration. Whereas C8.2 was targeted stakeholders and their interests, this activity involves the political level and broader perspectives.

How:
Political discussions and survey of the challenges.

1. Hold a final conference, where the City Council discusses scenarios with citizens and stakeholders and creates local project groups.

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2. Political deliberations in the City Council, with a choice of the most suitable scenario for the area's development by 2022.

3. Prepare complementary projects based on the proposal for "test projects" and "first stage projects".
4. Initiate the complementary projects with external co-financing, if required.

Where: HEDKOM

When:
Phase 1: no activity
Phase 2 activity 1 and 2
Phase 3: activity 2, 3 and 4

Reasons why this action is necessary:
The action is necessary to handle the complexity of such a large area with so many effects in a municipality, where resources are not plentiful. Furthermore, there are many possibilities and scenarios, and it can be difficult to move from ideas to scenarios and via decisions to concrete actions. In general, to keep up a dialogue on the long run between citizens, politicians, and other stakeholders to take sustainable solutions is difficult, but the C8 method is to involve all parties in an innovative process, empower stakeholders to take part in the right solution, and be part of the story of the local climate history.

Constraints and assumptions
There is a risk that stakeholders do not want to discuss the challenges and options and will not participate in the process. However, this will be dealt with by making the negative outcomes from climate challenges clear – thus, the scenarios. Furthermore, when the City Council has to decide, if stakeholders have not been involved, there is no basis for a decision. This is dealt with by ensuring the selected scenarios are highly clarified and clear. Finally, it must be ensured that the City Council and the stakeholders can endorse the pilot projects, which will be dealt with by creating an open and involving process.

Expected results:
C8.1: Phase 1: Thorough awareness among stakeholders in the project area (and beyond) of the consequences of climate change – on nature, biodiversity, tourism and landowner interests; Knowledge on the climate history of the area. Phase 2 and beyond: Thorough discussion on concrete scenarios, their implications and eventual solution. 800 hectares (net), 3500 hectares (brut) land screened.

C8.2: Thorough knowledge among stakeholders on how CCA is handled in similar areas. Discussion among stakeholders on appropriate – and eventual – solutions to the challenges. 2,000-3,000 stakeholders involved in the process.

C8.3: Phase 2: Political engagement in the climate change challenges – in the City Council and outside. A choice of CCA solution, which is sustainable and takes into consideration the interests of the stakeholders.

Cost estimation:
Expenses for direct personal costs are based on person days for HEDKOM personel based on present salaries and pensions, etc. For HEDKOM the total number of person-days per year is based on the basis of the total working hours/days according to national legislation, collective agreements, employment contracts, etc. – budgeted at 214 days per year. Expenses for external expert help is based on prior experience with external assistance to local projects in HEDKOM. This external help is necessary to investigate the natural values in the area, and to help HEDKOM deliver the modelling. Estimations for expenses in Phase 2 and beyond take the same point of departure. No costs are allocated AU, as C24 will provide analyses etc. to C8 as part of its project.

Deliverables:

Action	Deliverables
C8.1	Phase 1: Report on three descriptive scenarios for the area's development with different actions. Report on Cultural heritage description Report on landscape and natural values Phase 2: Report on recommendations on the area's development for the City Council. Development efforts divided into stages. Visualisation examples. 1-3 scenarios for the area's development. . At least one pilot project, which shows the option for action and the clearness of the effect. Phase 3: Detailed proposal for first stage. Test project, which test new solutions At least one project description ready for execution
C.8.2.	Phase 1: Report of each excursion and minutes Report from workshop
C.8.3.	Phase 1 Phase 2: Report from citizen-politician workshop on descriptive scenarios Minutes on decision from City Council meeting Phase 3: Project ideas selected and deselected Project ready to be executed

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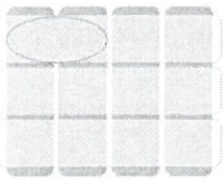
Milestones:

Action	Quantifiable milestones	Date by end of
C8.1	Phase 1:	
	Three overall descriptive scenarios finalised	31/12/2018
	Cultural heritage description finalised	31/12/2018
	One risk and value map finalised	31/12/2018
	Phase 2:	
	1-3 concrete scenarios for the area's development finalised	31/12/2020
	Visualisation of examples of projects from at least three project ready	31/12/2020
	Phase 3:	
	Areas and project ideas selected	31/12/2021
	Pilot project details prepared	31/07/2022
	At least one project ready for physical construction	31/12/2022
C.8.2.	Phase 2:	
	Report on stakeholder analysis and stakeholder mapping ready	31/12/2019
C 8.3.	Phase 2: citizen-politician workshop	31/12/2020
	Phase 3: projects selected and deselected.	30/06/2022



C9: The Thyborøn Channel and the Western Limfjord

The project deals with a major problem at the western part of the Limfjord; rising sea level combined with changes in the Thyborøn Channel morphology leads to a situation in the Western Limfjord in which, within less than 50 years, water levels due to storm surges will increase up to 60 cm higher than equivalent levels of today, having almost insurmountable effects technically and economically. The project has 4 sub-projects: thorough mapping of the area, cooperation models with emergency management, innovative financial plans, and preparation of conceptual design for the project area. This project is primarily linked to governance within sea & fjords an rivers.

Main responsible beneficiary: Lemvig Municipality Budget: 1.158.508€

Number of days estimated spent on action in phase 1: 625 Days

Beneficiaries responsible for implementation: The project engages a total of 14 partners around the western Limfjord, of whom 7 are Municipalities: Lemvig Municipality (LK), Holstebro Municipality (HbK), Morsø Municipality (MK), Skive Municipality (SKK), Struer Muncipality (STK), Thisted Municipality (TK), and Vesthimmerland Municipality (VHK) and 7 are utilities: Lemvig Vand og Spildevand A/S (LVS), Morsø Forsyning A/S (MF), Skive Vand A/S (SKV), Struer Forsyning A/S (STF), Thisted Spildevand A/S (TV), Vestforsyning A/S (VESTF), Vesthimmerland Vand A/S(VV).

Role of LK

- Is the project manager for the implementation of the action
- Is the Secretariat for the project team, consisting of one representative from each of the 7 municipalities and of the 7 utilities. The project team coordinates the activities across municipalities.
- Engages other partners, primary and secondary stakeholders in the project, such as Danish Coastal Authority, The Limfjord Council, CDR, the Fire Department of North West Jutland (Nordvestjyllands Brandvæsen), the Emergency Management Unit North Jutland (Nordjyllands beredskab), Thyborøn Harbour
- Coordinates with complementary projects (to begin with: Lemvig Vand, partner)
- Monitors project progress, reports and cooperates with C2C CC Project Management

Relation til CCA plans

- LK CCA plan p 25
- TK CCA plan p 29
- MK CCA plan p 21
- VHK CCA plan p 12
- SKK CCA plan p 71

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- STK – CCA plan under elaboration
- HbK (indirectly, p 9)

Relation to cross-cutting capacity building actions (C1-C7) and innovative actions (C20-C24)

Action C9 Thyborøn Channel and the Western Limfjord will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C10, C11, C14 and C18 dealing with the coastal cities of Juelsminde, Horsens, Randers and Grenaa. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C9, C10, C11, C14, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C9 will benefit from this knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benfit of action C9. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C9 and other actions.

Linked to Complementary Actions

C9 is linked to a complementary action focusing on sewer system maintenance and innovation in LK. Future investments in renewing sewer systems at the coastal areas are varied, but essentially very expensive. Therefore, LVS is cooperating closely with the C9 action to secure optimal investments. The C2C CC project will feed data and analyses into the decision-making of the wastewater company. 2,9 mio € is allocated to this complementary action.

Description: What, how, where, when

C9. deals with a major problem at the western part of the Limfjord, uniting municipalities, national agencies, NGO's, etc in a common pursuit of greater resilience of the area, multilevel governance and capacity-building. Rising sea level combined with changes in the Thyborøn Channel morphology leads to a situation in the Western Limfjord in which, within less than 50 years, water levels due to storm surges will increase up to 60 cm higher than equivalent levels of today[1]. Such water levels will eventually have a completely destructive effect on the cities, ports, coastal stretches, dykes, etc. of the area. Climate profing the cities and the installations of the western Limfjord will technically and economically be an almost insurmountable task to do locally. The project has four sub-projects: thorough mapping of the area, cooperation models with emergency management, financial plans, and preparation of conceptual design for the project area.

[1] The Danish Coastal Authority: "Thyborøn Channel and Western Limfjord" from august 2012

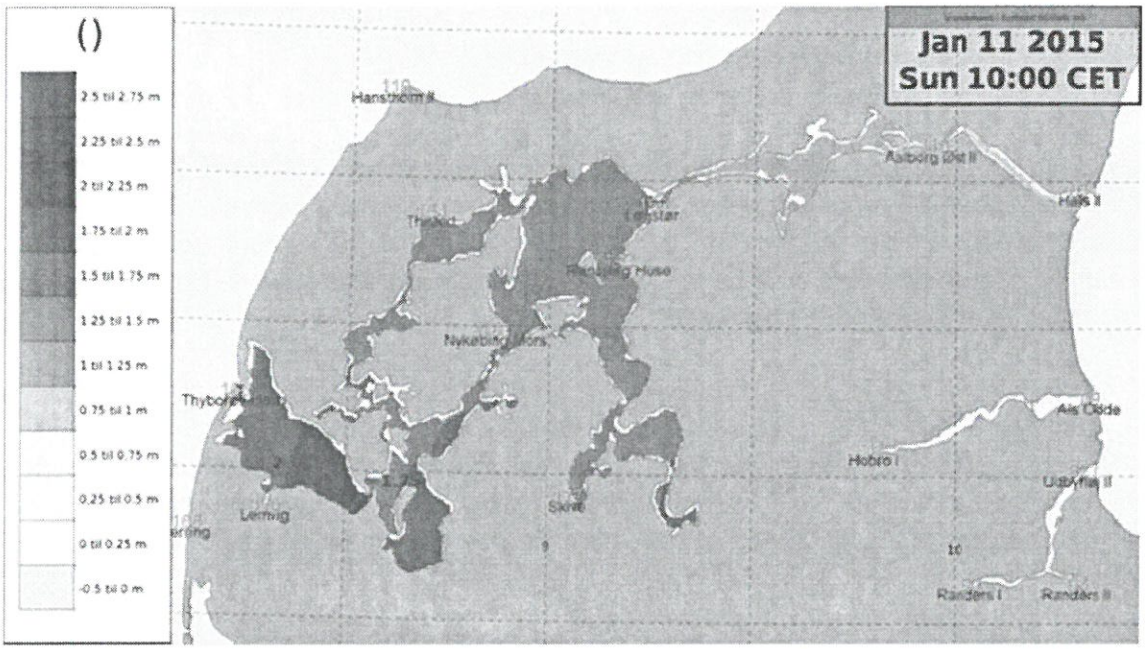

Figure 18: Storm surges of the December Storm 2015 (In Danish Bodil) in the Western Limfjord.

C9.1 *Mapping of (secondary effects of) the project area*

What
Based of the review from 2012 by the Danish Coastal Authority (and as a further investigation into the consequences of the CCA challenges), all significant secondary effects on the marine environment, biodiversity and business development in the Limfjord and its surrounding rural areas are mapped. This mapping, which takes place in Phase 1, feeds into C9.4 as well as for knowledge-sharing among C2C CC partners.

How
Phase 1

1. Analyses of derived effects such as the implications on the marine environment of the Limfjord, the biodiversity of the Limfjord and its catchment areas, the implications for the commercial ports' business opportunities and for the utilities' coastal infrastructure.
2. Identification and engagement of more relevant stakeholders.
3. Based on the mapping, an in-depth analysis of positive and negative secondary effects of the proposed solutions of the Coastal Authority's report will form the basis for the political decision-making of a common, regional solution to the climate challenge. The partnership has ascertained that a number of scenarios (storms) need to be tested in our model. This is necessary to make sure that our results regarding storm surge water level are sufficient.
4. One seminar for the relevant decision-makers to discuss results of analyses and mapping.

Where: The project area
When: Phase 1: activities 1 - 4

C9.2 *New forms of cooperation with emergency management*

What:
CCA is an ongoing balancing act to achieve the optimum level of protection. A permanent protection against extreme events that occur very, very rarely is not cost-effective. A clear plan for preparedness, however, is. The purpose of C9.2 is to identify optimal, permanent protection of the Western Limfjord and at the same time be prepared to deal with extreme events. Both authorities and civilians must be empowered to handle extreme events.

How:
Phase 1

1. In cooperation with the two regional emergency management units (civil protection) - North and South of the Western Limfjord, respectively, a project team will be established and will prepare analyses of the ideal level of protection for urban communities and other areas along the coast.

Phase 2

2. The joint building (the project team and the emergency management units) of a capacity – professional as well as civilian – to handle storm surges.
3. Jointly (the project team and the emergency management units) to build a cross-border emergency management system for handling of storm surge events above the permanent level of protection.

Where: The project area
When: Phase 1 and Phase 2

C9.3. *Financial planning*
CCA projects need agreement on financing. The responsibility for – and the financing of – CCA in coastal areas belongs in principle to the private property owner. However, in case a CCA project is in the public interest, national and local coastal protection authorities can implement and finance it. If a regional CCA solution to Thyborøn Channel is to be found, concrete ideas as how to finance it must be put on the table. Thus, C9.3 is targeted the elaboration of one or more proposals for funding that can be the starting point for political negotiations. This activity takes place in phase 2.

How
Phase 2
In cooperation between municipalities, utilities, the insurance companies, the Danish Coastal Authority, and other parties having an economic interest in climate protection, a number of funding model options will be developed. The development of financial models based on e.g. utility principles can speed up the process and thus the timely CCA across Denmark. Inspiration found in other, similar European regions (e.g. the Netherlands and Northern Germany). These proposals for financial models will be discussed at the 5th seminar for decision-makers and stakeholders.

Where: In the seven municipalities (partners) in the project
When: Phase 2

C9.4. *Requirement specification for conceptual designs*

What:
To secure a possible establishment of the installations at Thyborøn Channel, one or more conceptual designs will be prepared. The requirement specification for the conceptual designs will reflect the work carried out in the preceding sub-actions. This activity takes place after the 1st phase.

How
Phase 2

1. The project team prepares requirement analyses to conceptual design based on C9.1 - C9.3.

Phase 3

2. An architectural competition is held in which architects and consulting engineering firms are invited to deliver conceptual designs that deal with the CCA and, simultaneously, add value in other areas. Conceptual designs may also include ongoing CCA in the form of, e.g. reducing the Channel's cross sectional area as new technology and more knowledge about CCA needs emerge.
3. Against this background, the implemented design competition, which should lead to a number of projects, providing CCA solutions as well as value added in other areas.
4. In the last year, there will be focus on the planning of a possible construction phase.

Where: The project area
When: Phase 2 and Phase 3

Reasons why this action is necessary:
Rising water levels in the Limfjord due to storm surges is a burning platform for municipalities, utilities, and, not least, citizens along the coast of the Western Limfjord. Today, many millions of euros are invested in development projects in coastal towns at the Western Limfjord. The great uncertainties about future water levels due to storm surges lead to individual and thus sub-optimal CCA solutions. Socio-economical gains from a joint regional solution are potentially very large. C9 will help achieving C2C CC overall objective by crafting a regional strategy on CCA of urban communities at the western shores of the Limfjord. The project will support the networking and knowledge sharing across municipalities, utilities and other climate stakeholders regionally, nationally and internationally. The project will build capacity to withstand and manage future storm surges.

Constraints and assumptions
C9.1 presumes cooperation with NGOs, knowledge institutions and leading professionals. To deal with possible resistance, contacts with secundary stakeholders have already been made. The 14 partners also have direct access to professionals in the field of EIA. C9.2 requires close cooperation between the emergency management unit, municipalities, and utilities. Such cooperation already exists. However, due to structural reform (2016), the emergency management units have been merged into larger units. The project team will therefore work to ensure a continued good and even closer cooperation between these new units, municipalities and utilities.

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C9.3 requires a political will to look for alternative funding models. This is dealt with by engaging all of the 7 municipalities as project partners on the basis of political decisions. The Technical Committees and the City Councils as well as the Boards of the utilities will be informed and involved in the subproject on a regular basis. C9.4 requires a political decision-making process, before starting the preparation of conceptual designs. Politicians will be informed and involved throughout the project - right up to the ultimate goal.

Expected results:

9.1: Phase 1: The major stakeholders are investigated as a basis for future action. Insight into significant secondary effects of a regional CCA solution by Thyborøn Channel. The socio-economic review aids decision-making for a political decision on which CCA solution to be worked on with.

9.2: Phase 2: An analysis of the optimal, permanent protection for submission to policymakers and stakeholders. Strengthening of the professional and the civilian capacity to handle storm surge events, and a cross-border emergency and contingency plan for handling storm surge events significantly increase resilience.

C9.3: Phase 2: One or more financial models will support that the optimal CCA project is to be implemented.

C9.4: Phase 3: The conceptual designs address the climate challenge in the Western Limfjord and contribute with added value for the coastal communities and the habitat areas.

Cost estimation:

Expenses for direct personal costs are based on person days for the 7 municipalities' and the 7 utilities' personel based on present salaries and pensions, etc. These expenses are used for in-house analyses and assessments, as far as possible, and for meetings with stakeholders, citizens, national agencies etc. Expenses for external expert help is based on prior experience with external assistance and necessary for all activities. Expenses cover the initial analyses of secondary effects of CCA solutions to the project area as well as the work on better emergency planning in cooperation with stakeholders – primary as well as secondary, etc. During Phase 2 and beyond, expenses will cover partners' and stakeholders' work on the financial model as well as the work on a conceptual design for the eventual CCA solution at Thyborøn Channel.

Deliverables:

Action	Deliverables
C9.1	Phase 1: A survey of major stakeholders and significant secondary effects of a regional CCA solution by Thyborøn Channel. Deadline 31. Dec 2017 a socio-economic review, which may form the basis for a political decision on which climate solution to be worked on with. Deadline 31. Dec 2018
C9.2.	Phase 2: An analysis of the optimal, permanent protection for submission to policymakers and stakeholders. Deadline 30. June 2019 An analysis on the strengthening of the professional and the civilian capacity to deal with the storm surges at the Western Limfjord. Deadline 31. December 2019 A cross-border emergency preparedness plan for handling of storm surges. Deadline 30. June 2020

C9.3.	Phase 2: A review of proposals for financing models that can support that the optimal CCA project can be implemented. Deadline 31. Dec 2020
C9.4	A number of conceptual designs addressing the CCA in the Western Limfjord and add value. Deadline 30. June 2021

Milestones

Action	Quantifiable milestones	Date by end of
C.9.1	Phase 1: Minutes from kick-off Meeting with the entire project team. One agreement with an Advisor on the development of the mapping of key stakeholders and development of socio-economic statement Final stakeholder mapping report. 1st Seminar for the relevant decision-makers. Final statement available. Project team established with the participation of emergency management units North and South of the Western Limfjord.	 31/02/2017 30/06/2017 31/12/2017 31/12/2018 31/12/2018 31/12/2018
C.9.2.	Phase 2: One agreement with an Advisor on the preparation of analysis of the optimal, permanent protection level for submission to policymakers and stakeholders. One agreement with an Advisor on the assistance for building professional and civil capacity to deal with the storm events at the Western Limfjord One agreement with an Advisor on assistance for the preparation of a cross-border emergency preparedness for handling of storm surge events Analysis of the optimal level of protection available. 2nd Seminar for the relevant decision-makers. A review of the strengthening of the professional and the civilian capacity to deal with the storm events are available. 3rd Seminar for relevant decision makers. A cross-border emergency management for handling of storm surge events.	 31/05/2019 31/05/2019 31/05/2019 30/09/2019 31/12/2019 31/12/2019 31/03/2020 30/06/2020.
C.9.3.	Phase 2: The establishment of the project team with the participation of insurance companies' association Conclusion of Advisor agreement on assistance with the preparation of proposals for financing models A number of proposals for funding are available. 31. March 2021. 5th Seminar for relevant decision makers.	 31/03/2019 30/06/2020 31/12/2020
C9.4	Phase 2: Conclusion of Advisor Agreement for assistance with preparation of requirement specifications for climate solution by Thyborøn Channel. Phase 3: Architectural competition published. At least three conceptual designs addressing CCA challenges in the Western Limfjord and contribute with added value are available. 6th Seminar for the relevant decision-makers.	 30/09/2020 30/06/2021 31/12/2021 28/02/2022

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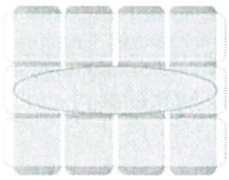

C10: The River Grenaa Catchment

In the towns alongside the watercourses of Kolindsund and Grenaa, climate change have major implications – not least in relation to the areas used for agricultural production and in the meadow areas along the river basins. Taking into account the present land use, future climate changes (more precipitation, greater quantities of water in catchments, rising groundwater, rising water level in Kattegat and – possibly – salt water intrusion), as well as cost-benefit and societal analyses, a number of realistic CCA scenarios will be analysed to provide a robust and valid basis for political decision-making. This action is primarily linked to developing tools within the whole hydrological circle.

Main responsible beneficiary: Norddjurs Municipality Budget: 1.064.250€

Number of days estimated spent on action in phase 1: 285 Days

Beneficiaries responsible for implementation: Syddjurs Municipality (SDK) and Norddjurs Municipality (NDK)

Role of NDK

- Is the project-leader
- Works with stakeholders: Aqua Djurs, Syddjurs Spildevand, other wastewater companies, landowners, drainage associations, NGOs etc.
- Serves a Steering Committee (composed of Syddjurs and Norddjurs project-leaders, technical directors and politicians) and a Monitoring Group (composed of wastewater companies, Kolidsunds Venner, drainage associations, possibly politicians)
- Feeds into homepage and project portal to ensure local ownership and political consensus
- Reports and cooperates with C2C CC PM and other C actions

Relation to CCA plans

- Norddjurs CCA plan: (Kolindsund mentioned pp. 23-24, 26, 30-31, 37)
- Syddjurs CCA plan: http://www.syddjurs.dk/sites/default/files/PDF/KPT07.pdf (Kolindsund mentioned pp. 9, 11 og 12)

Relation to cross-cutting capacity building actions (C1-C7)

Activity C10 The Grenaa Cathment will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C11, C14 and C18 dealing with the coastal cities of Horsens, Randers and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C11, C14, C17, C18 and facilitated by CDR. Under C1 a

workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast.
Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C10 will benefit from this knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benfit of action C10.
Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g geophysical data and C10 will benefit from this model. Under action C3, in selected areas a detailed local model is set up focusing on groundwater, surface and/or seawater. Models are based on the present data and collections of new data sets e.g geophysical data and C10 will benefit from this model.
Under Action C4 Rainwater, C10 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Under action C6, the groundwater-surface water model and screening tool is developed and tested, and known warning systems in DK and in other countries are explored, and simple warning systems with flood prediction are tested and demonstrated, all activities which may benefit C10 directly.

Linked to Complementary Actions

As of now, C10 is not linked to complementary actions, but the preparation of complementary projects are inherent in activities (cf. C10.3).

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Figure19: The catchment area of River Greenaa

Description (what, how, where, when)

What:
When preparing the CCA plans, analyses of the Grenaa Catchment revealed major challenges related to water management: surface water, groundwater and seawater. The project area covers 466km^2. The challenge is particularly complex due to the size of the area, and different – conflicting – interests. The river estuary of the River Grenaa is the city of Grenaa, which is challenged by the future rising sea levels and water flows from the various catchments, leading to floods and problems with water supply.

In the towns alongside the watercourses of Kolindsund (the sound of Kolind) and Grenaa, climate change have major implications – not least in relation to the areas used for agricultural production and in the meadow areas along the river basins (also areas upstream of Kolindsund).

Taking into account the present land use, future climate changes (more precipitation, greater quantities of water in catchments, rising groundwater, rising water level in Kattegat and – possibly – salt water intrusion), as well as cost-benefit and societal analyses, a number of realistic CCA scenarios will be elaborated and analysed to provide a robust and valid basis for political decision-making. Where relevant, these scenarios will be extrapolated 25, 50, and 100 years to take into account future climate developments.
Among others, the following elements will be included:

- Risk assessment
- Climate-proofing of the city of Grenaa, the Kolindsund and other infrastructure in the project area (minimizing flood risk, controlled flooding, unsanitary conditions as a consequence of the overflow of the waste water systems)
- Technical requirements for climate protection in relation to agricultural production
- Implications of possible salt water intrusion for the agricultural production and the supply of drinking water
- Improved CO_2 score due to CO_2 retention from reintroducing wetlands
- Assessments of societal values (existing nature, outdoor recreation, settlement, and other recreational values)

Phase 1 deals with the collection of data for the hydrological model, setting up of expert/citizens forums and the creation of a website, whereas phase 2 and beyond deals with the calibration of the hydraulic model, setting up the solution scenarios, economic assessment of scenarios, qualification of the model and scenarios by organizing workshop, choose solution through economic assessments, and develop a comprehensive proposal for solutions for the project area.

C10.1 *The set-up of a hydrological model*

What:
To understand the hydrological processes in the River Grenaa catchment, to secure common knowledge and understanding of the CCA challenges among stakeholders, and eventually to make the proper decisions, it is necessary to set up a hydrological model. Maximum cohesion and robustness is secured by a number of workshops with experts and stakeholders. The output of this process is a combined groundwater and salt water model to assess the CCA impacts on the River Grenaa catchment and its hinterland able to assess the cumulative effects and impact of the flooding, saltwater intrusion and other water balance considerations. The model is a dynamic 3-D model (surface-ground water incl. full 3D coupled unsaturated-saturated zone) that can handle the time-related variations in the system. The following data will calibrate the model: rainfall, runoff, time-series for groundwater level, salinity, activities in drainage associations, potential evaporation, drainage, wastewater data, nitrogen / phosphorus etc. Especially in relation to groundwater, more data is needed to set up a model. Furthermore, tenders for model setup will be elaborated.

How:
Phase 1:
The following sub-actions are part of the hydrological modeling:

1. Collection of data and preparing the sett up a hydological model
2. Workshop on needs for data to be included in the model. Participants: the C2C CC Advisory Committee, hydrologists, geologists, , , farmers' organizations, NGO's, landusers, local organisations.
3. Elaboration of a tender for a model setup

Phase 2 and beyond:
Subsequent phases deal with modelling, calibration, and scenarios (2019-2020) and impact assessment of selected scenarios (2021-2022), among others:

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4. Continuing datacollection for model set up
5. Model calculations for risk assessments (based on the UN climate scenarios, cumulative impacts of rises of ground water and sea level as well as increased rainfall. Sensitivity analyzes in order to qualify the risk assessments.)
6. Model calculations for the screening of possible scenarios/combinations for CCA of the agricultural interests, Grenaa City, Kolind and Ryomgaard and other infrastructure. Sensitivity analysis will determine the robustness of the scenarios.
7. Initial socio-economic analyzes (to decide upon the scenarios for further screening analysis).
8. Impact assessment of selected scenarios, both technically and economically.

Where: The project area
When:
Phase 1: activities 1-3
Phase 2 and Phase 3: activities 4-7

C10.2 *Public awareness raising: website and citizens meetings, etc.*

What:
To secure widespread awareness on the CCA challenges of the Grenaa catchment, and empowering stakeholders, eventually leading up to a political decision-making, a website and a portal will be created and citizens meetings held. The website (incl. A dialogue portal) is going to be dedicated interested stakeholders and citizens to provide input and engage in dialogue on the project. The website will also regularly present analyses. Citizens meetings will be set up, where there is a need for a more direct dialogue with citizens in the communities of Kolind, Ryomgård and Grenaa.

How:
Phase 1:

1. Launching of a website incl. Life logo and linked to C2C CC website
2. 1 – 2 Citizens meetings to disseminate results. Depending on how many sign up to the citizens' meetings, one will be in the east and one in the west of the project area to secure that all citizens are heard.

Where: Norddjurs and Syddjurs municipalities; the website, which is a local instrument to serve the action, will be linked to the C2C CC website.

When: This activity is an important element of the project and will take place all years and beyond.

Phase 2:
Ongoing meetings with landusers/owners, NGO's, local organisations, and specialist for qualifying model set up and relevant scenarios for the future strategic plan for climate adaption of the area together with landowner and local NGO's

C10.3 *Laying the basis for decision-making*

What:
Finding solutions to the Grenaa catchment CCA challenges not only require thorough analysis and awareness raising, but eventually also a political dialogue – among local stakeholders and across municipal boundaries. A dialogue within the Steering Committee and the Monitoring Group will deal with trade-offs. This dialogue is to create ownership, and continuing discussion and decision on the project and its scenarios. This ensures dialogue with politicians, stakeholders and interest groups represented in either group. And to secure even better basis for decisions, workshops with the participation of representatives from the Advisory Committee will be organised, and findings from C2C CC analyses on the legal and administrative fields will be included. As a result, scenarios to be further investigated in Phase 3 will be chosen.

Phase 1:

1. Public meetings and a conference with representatives from the Norddjurs and the Syddjurs City Councils, discussing scenarios with citizens and other stakeholders to secure political attention and cooperation between the two neighboring municipalities on this issue
2. If need be, local project groups wanting to work deeper on aspects of the project will be established.

Phase 2 and beyond:
In phases 2 and 3, the prioritization tools are supposed to include aspects such as outdoor recreation, recreational, health, tourism, etc apart from the technical assessments, as well as cost-benefit analyzes of the chosen solution. Additional complementary projects will be established.

Where: Norddjurs and Syddjurs Municipalities
When: Phase 1-3 and beyond

Reasons why this action is necessary:
Climate changes put extreme pressure on cities and agricultural areas within the whole project area. CCA must be carried out to the benefit of citizens, society and the area itself. However, within the area, many interests and issues are in conflict, but may eventually complement and match one another. To reach that situation, the landowners, drainage associations, interested companies including wastewater companies and organizations must be engaged, and a thorough modelling and review analysis including analyses of various parameters, the handling of accumulated effects are necessary to involve stakeholders and to include them in defining the possibility of a solution. The models and tools form the basis for a common understanding among the two municipalities and its stakeholders when having to decide on CCA solutions and its impact on e.g. biodiversity, environment CO_2, socio-economic benefit and legal questions. In addition, the project, in combination with the other C2C CC sub-projects, will provide knowledge and generate manuals and initiate innovative elements for handling CCA that can create value locally, regionally, nationally and in general in the EU. The large project area contains many divergent interests to be weighed and lifted to a common strategy for the area's CCA.

Constraints and assumptions
Over the past years, the Grenaa catchment has been subject to much debate and strong interest in maintaining the existing land use for agriculture, or if old landscapes with wetlands should be

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restored. These conflicting interests have often been publicly debated, and political debate and strong attitudes and ideologies have been put to the open. The project intends to clarify and provide answers to questions and solutions to the issues that have flourished for many years. Being holistic, the project will help to balance the various interests. A common platform of knowledge to communicate from a common strategy for the region in the long term shall help in this endeavor. Municipalities prioritize that the project is transparent and call for a great deal of dialogue, based on mutual respect. The Steering Committee and the Monitoring Group shall, as well as an ongoing dialogue in the project phase, shall ensure this.

Expected results:

C10.1: Phase 1: Knowledge and a common understanding of the CCA challenges linked to the Grenaa Catchment and the Kolindsund. Total number of hectares screened: 470.

C10.2: Public awareness and public discussion on CCA and the challenges linked to the Grenaa Catchment and the Kolindsund. Number of citizens reached: around 500.

C10.3: Phase 2: Awareness and knowledge is build at political level and dialogue between politicians of the two municipalities is established, and decisions of 1 or more integrated solutions, incl. costs and proposed financing are presented to politicians of both municipalities to be decided on.

Cost estimation:

Expenses for direct personal costs are based on person days for NDK and SDK personel based on present salaries and pensions, etc. Expenses for external expert help is based on prior experience with external assistance to local projects in the municipalities. External assistance will be used for highly needed expertise in relation to the modeling. During Phase 2 will cover the further development of the model, calibration and calculating various scenarios under various conditions and including socio-economic assessments, incl. environment and nature. During Phase 3 expenses will cover final works on models, comparisons, tools, guidelines, a meeting with citizens.

Deliverables:

Action	***Deliverables***
C10.1	Calibrated hydraulic model for the Grenaa Catchment Idea catalogue with possible solutions and assessments for CCA in the project area Catalogue with selected solutions and their in depth analysis
C10.2	Website incl. a dialogue portal
C10.3	Strategic plan for the area and its climate adaptation

Milestones:

Action	***Quantifiable milestones***	***Date by end of***
C10.1	Phase 1:	
	Workshop held on qualifying data sampling	31/12/2018
	Collection of data for the model and other assessments done	31/12/2018
	Tendering material developed for model and impact assessment	31/12/2018

	Phase 2 and beyond: Elaboration of model and calibrating done Screening and qualifying options incl. risk assessment done Assessment on environment, nature and recreational values done Impact assessment of chosen scenarios and prioritization (2021-2022) Solutions for political decision-making identified	 31/12/2022 31/12/2022 31/12/2022 31/12/2022 31/12/2022
C10.2	Launching of Website incl. a dialogue portal Citizens meetings held, 500 participants	31/12/2018 31/12/2022
C10.3	Public meetings and a conference with representatives from the Norddjurs and the Syddjurs City Councils, 100 participants	31/12/2022

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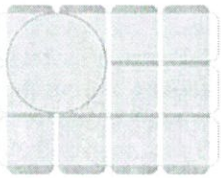

C11: Randers Fjord

Loss of Territory to the Water: Benefit or loss?

According to the Floods Directive, the Randers Fjord is designated a risk area, and risk management plans have been made. The content of this project is to map the areas, and develop a strategy focusing on active integrating CCA, nature, inhabitants, development. and economy. The subsequent implementation of the strategy will lead to a coherent, sustainable, and adequate land use. This action is primarily aligned with governance and tools within seas & fjords and rivers.

Main responsible beneficiary: Norddjurs Municipality Budget: 177.280€

Number of days estimated spent on action in phase 1: 158 Days

Beneficiaries responsible for implementation: Randers Municipality (RK) and Norddjurs Municipality (NDR)

Role of Nordjurs Municipality:

- Is the project manager
- Works with the following dike associations as secondary stakeholders: (at NDR side) Drammelstrup Enges Landvindingslag, Hollandsbjerg-Bode-Stenalt Enges Landvindingslag, Hejbækkens Landvindingslag, Karholme Landvindingslag, Allingåbro Enges Landvindingslag, Vivild-Hevring Enges Landvindingslag, Holbækgård Pumpelag, and (at RK side) Albæk pumpelag, Tjærby- Vestrup pumpelag, Assentoft m.fl. Byers pumpelag, Kristrup enges pumpelag, Dronningborg Tjærby enges landvindingslag, Støvring enges landvindingslag, Udbyneder enges landvindingslag, Romalt enges landvindingslag, Øster Tørslev m.fl. byers, landvindingslag, Råby m.fl. enges landvindingslag, Gjerlev, Ø. Tørslev m.fl. enges landvindingslag, Dronningborg Vestre enges pumpelag,
- Reports and cooperates with PM (CDR) and C12 project manager

Relation to CCA plans

NDR CCA plan pp. 14-16
RK CCA plan p. 35 and risk management plan p. 71.

Relation to cross-cutting capacity building actions (C1-C7)

Action C11 Randers Fjord will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C10, C14 and C18 dealing with the coastal cities of Juelsminde, Horsens and Grenaa. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C10, C12, C14, C17, C18 and facilitated by CDR. Under

C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C11 will benefit from this knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benfit of action C11. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C11 and other actions.

Linked to complementary projects
As of now, no complementary projects have been sought. However, the RK is providing supplementary financing to the C11 action.

Description: What, How, Where, When,
C11 is a cross-border action targeted finding common solutions to a huge CCA risk involving two fjords, a number of cities, of which one is designated flood risk area, and vested interests in dike associations.

According to the Floods Directive, the Randers Fjord is designated a risk area, and risk management plans in both RK and NDK have been made. The content of C.11 is to map the areas, and develop a strategy focusing on active integrating CCA, nature, populations, development and economics. The subsequent implementation of the strategy will lead to a coherent, sustainable, and adequate land use. The strategy must go public and can be used as a manual for other planning authorities in Denmark and the rest of the EU.

The Randers Fjord constitutes the estuary of the River Gudenå and the watercourse Alling Å. A number of communities lie at the fjord e.g. Udbyhøj, Allingåbro, Uggelhuse and Randers, and floodings directly affect around 3,000 people as well as essential infrastructure, values, and large areas of farmland. Finally, Randers Fjord is essential for both tourism and protection of natural areas.

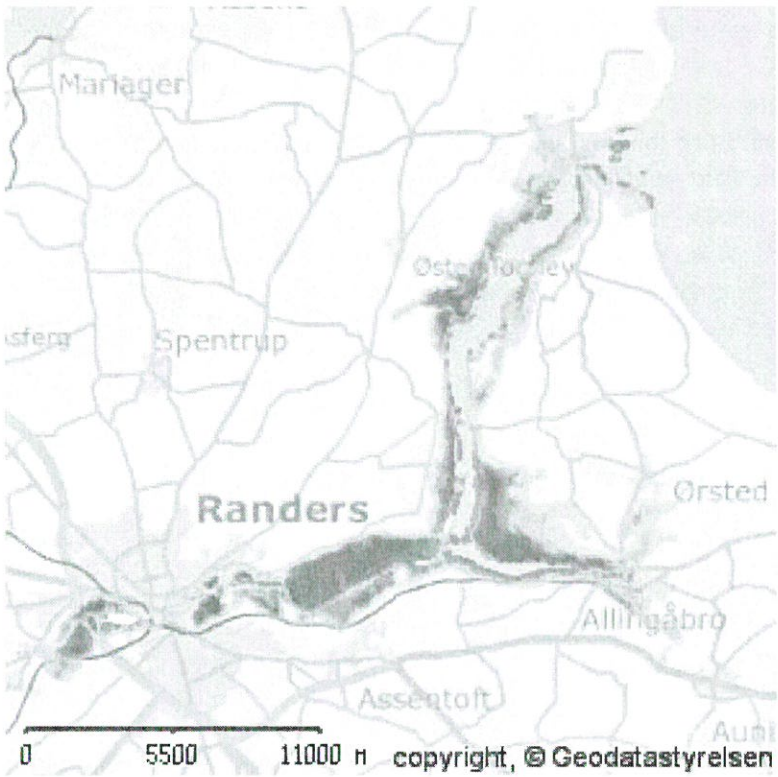

Figure 20. The project area along Randers Fjord, where large values are threatened by extensive flooding in both floods and the term of the term sea level rise.

As a supplement to the river model for the River Gudenåen (C12), a corresponding 'fjord model' calculating the consequences of relationships between runoff from rivers, tides, flooding and air pressure in relation to the topography close to the fjord as well as the urban communities must be developed. The desired set-up of this 'fjord model' is to ensure that future solutions to address flooding in Randers Fjord do not affect ecosystems in the fjord unnecessarily. This is due to the fact that Randers Fjord has several designations (cf. Habitats Directive). Furthermore, since Randers Fjord is the estuary for the River Gudenåen, an altered ecology in the Randers Fjord due to CCA of the fjord may result in ecological impacts upstream in the protected areas.

The project aims at shedding light on this loss of values caused by the floods – both in terms of permanent loss of cultivated areas and acute loss due to flooding.

C11.1 *Development of a 'fjord model' and cost-benefit analyses*

What:
A 'fjord model' is to be developed as a counterpart to the "river model" for the River Gudenå and an interconnection to this. To be coordinated with C.12 relating to illustrate the effects of water retention at field level.
In continuation, a cost-benefit analyses will be conducted focusing on loss of values as well as gains of how climate change solutions may create added value at local level.

How:

Phase 1

1. Survey and analysis of Randers Fjord at different scenarios for rising sea levels, flooding, runoff, flora / fauna and the effects of inlet and meadows. This together form a fjord model which will connect to the many natural and physio-chemical balances in the fjord.
2. Based on the fjord model we will prepare a cost-benefit analysis. This is a holistic value analysis linking the multilateral considerations that the fjord carries today to ensure a long term climate risk assessment and reduction of risk around Randers Fjord. A value analysis will be based on primarily economical considerations evaluating the different CCA solutions of Randers Fjord.

Phase 2

There will be made a fjord model in cooperation with the government Kystdirektoratet, a Mike 21, the Mike 21 will be combined with the Mike 11 from C12 project.

Where: The project area, figure 20

When

Phase 1: activities 1 and 2

C11.2 *Assessment of the consequences of establishing a sluice*

Concurrently with Actions 1 and 2, a project assessing the possibilities of establishing a sluice on the fjord estuary. Impact on the nature and the environment, economy, tourism, etc. must be assessed. The activity leads to a report that will serve as a feasibility study into a possible subsequent EIA for a dam project.

How:

Phase 1

1. Impact assessment of the effects on the nature and the environment, economy, tourism, etc. For the construction of a tilt lock at Udbyhøj. The activity will culminate in a report that serves as a feasibility study into a possible subsequent EIA for a dam project.

Phase 2

2. The fjord model will involve a calculation of a scenario, where establishing a sluice. And alternative scenarios to a sluice due to regulation and legislation from the government.

Where: The project area

When: Phase 1

C.11.3 A *strategy for decision-making*

What:

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Based on C11.1 and C11.2, a fjord model is designed, and a strategy for the choice of the areas to be protected from water and the areas to be converted to other uses such as nature-based tourism is elaborated. It is determined which areas could add value to nature. It is clarified how the loss of value can be turned into value gain - how the area around Randers Fjord might reverse the trend, attaching new values to the estatuary as the old values must be abandoned? This activity mainly takes place in phase 2 and beyond.

How

Phase 3

1. Draw up a model and strategy for land use in and around Randers Fjord and its communities.
2. Coupling of the project to other projects around Randers Fjord including Natural Park Randers Fjord.

Where: The project area
When: Phase 2 and Phase 3

Reasons why this action is necessary:
A flooding in the risk areas of Randers Fjord can cause major damage to urban areas. A storm surge event of a 100 year magnitude will directly affect about 3,000 residents in the towns of Allingåbro, Uggelhuse, Udbyhøj and Randers, as well as a number of buildings in the open countryside, highway embankment E45 (at the passage of the River Gudenåen), as well as the railway embankment (at the River Gudenåen's passage). Randers Fjord is designated as a risk area for EU Floods Directive on the basis of a statement of a potential loss in value by storm surge of up to 5.7 billion. DDK. The action will highlight the possibilities of adaptation of the risk area and create better opportunities to prevent future flooding. Whether adaptation occurs through various combinations of the laying of flood areas or barricades to keep water away from certain areas. This will enhance climate resilience of the Randers Fjord area.

Constraints and assumptions
The important and necessary task of analyzing the fjord landscapes and finding viable answers to questions such as: how can land be given up? which areas should be preserved and protected in relation to business? how can land increase its value and change function? must be done in a mutual effort of both municipalities. The largest constraint is financial, since the municipalities do not have the expertise in-house. There is therefore a risk of delay of a few years. The C2C CC project provides the means to initiate this analysis and hence to provide decision-makers with proper analysis.

Expected results:
11.1: A Fjord Model and scenarios for future CCA of the project area, and a complete list of possible solution scenarios and their cost-benefit analyses make it possible to suggest concrete solutions. 11,000 hectares screned.

C11.2: An independent assessment of the scenario of a sluice solution in relation to CCA of the project area will show whether it is feasible.

C11.3: will result in a future and long term strategy and approach for the project area.

Cost estimation:

Expenses for external expert help is expected to amount to 82,675 € based on prior experience with external assistance to local projects in NDK and RK. Estimation of person days for NDK and RK is based on present salaries + pension. Expenses cover the analyses of the Randers Fjord in order to prepare the 'fjord model' and impact assessments. External assistance is necessary because neither NDK nor RK have enough means to deliver the analyses and assessments in-house. During Phase 2 and beyond, expenses are expected to cover the drawing up of the fjord model and the eventual choice among alternatives, depending on how elements are prioritized.

Deliverables:

Activity	Deliverables
C11.1	Phase 1 Report on mapping and analysis of Randers Fjord at different scenarios for the preparation of the Fjord Model. Technical background report, and a fjord model. Report on cost benefit analysis, a holistic value analysis for climate protection of the fjord, Phase 2 Report assessing the impact on nature, the environment, economy, business mm. the establishment of the sluice at Udbyhøj
C11.2	Phase 2 A feasibility study into a possible subsequent EIA for a dam project
C11.3	Phase 3 Reports on odelling Tools and two municipal strategies for land use in and around Randers Fjord

Milestones

Activity	Quantifiable milestones	Date by end of
C11.1	Phase 1 Data collection for the 'Fjord model'; the preparation of this model done Analyzes of different scenarios for future climate adaptation done Phase 2: Report assessing the possibility of a sluice solution finalised Phase 3 A modelling tool developed for the Randers Fjord, calibrated with respect to the River Gudenå Model.	 31/12/2018 31/12/2018 31/12/20 2020 31/12/2022
C11.2	Phase 3 Strategy developed for future land use around Randers Fjord to climate adapt area Stakeholder meeting held	 31/12/2022 31/122022
C11.3	A model and strategy developed for land use in and around Randers Fjord and its communities. Description of the coupling of the project to other projects around Randers Fjord including Natural Park Randers Fjord	31/12/2022 31/12/2022

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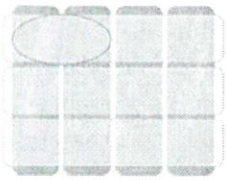

C12: The River Gudenå

The project is a cross-border project involving the 7 municipalities along the River Gudenå and one utility. A hydrological model is developed for the watercourse, the land use is mapped, the possible actions to handle increased volumes of water is identified. Test scenarios for different solutions in the model will be made. This mapping lays the basis for a common understanding of the consequences of climate change in the catchment. Next step is the creation of a vision and a goal for a CCA approach. Furthermore, stakeholders will prepare conceptual designs for physical solutions in the River Gudenå catchment, and identify suitable approaches to dealing with water. This action primarily links to governance within sea & fjords and rivers.

Main responsible beneficiary: Silkeborg Municipality Budget: 801.946 €

Number of days estimated spent on action in phase 1: 618 Days

Beneficiaries responsible for implementation:
Seven partners (municipalities) directly affected by the River Gudenå CCA challenges: Silkeborg (SIK), Hedensted (HEDKOM), Horsens (Horsens), Skanderborg (SK-KOM), Favrskov (FK), Viborg (VK), and Randers (RK). Furthermore, Skanderborg Waste Water Utility (SFV) is partner, since the water level directly affects its operations and systems.

The role of SIK:

- Is the project manager
- Cooperates with the six other municipalities and Skanderborg Waste Water Company
- Works with secondary stakeholders in *each* municipality - such as, in the case of SIK - Vandløbslauget for Gudenåen (Silkeborg til Kongensbro), Grundejereforeningen Sølyst (Silkeborg Langsø), Silkeborg Fiskeriforening, Danmarks Naturfredningsforening (local branch).
- Reports and cooperates with PM (CDR), C11 project manager, and C14 project manager as well as other C2C CC partners

Relation to CCA plans

- HEDKOM: Municipal spatial plan pp. 21-24, 29-30, 61-63, 98-100
- Horsens CCA plan pp. 24 -26 and 30-32
- SK-KOM CCA plan pp. 41-42, CCA action plan pp. 9-18
- SIK CCA plan pp. 21-23 + 37
- FK CCA plan p. 15

- VK Municipal spatial plan p. 14
- RK CCA plan p. 10.

Relation to cross-cutting capacity building actions (C1-C7)

Action C12 River Gudenå will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C10, C11, C14 and C18 dealing with the coastal cities of Juelsminde, Horsens and Grenaa. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C10, C11, C14, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast, of which the River Gudenå is an integrated part. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modeling, interpretations, analysis and data sampling are similar in the different catchments and C12 will benefit from this knowledge sharing. Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C12. Under action C5 specific training courses, workshops and master classes, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C12 and other actions.

Linked to complementary actions

A number of complementary actions to support C12 will be explored during the project. One type of complementary projects are the ones that support nature-based tourism. Another type of project are the ones that focus on CCA at specific areas at the River Gudenå to alleviate high water levels (e.g. at Bjerringbro). Some of these projects amount to 6 mio. €, others are smaller – 250,000 €. Expected source of financing: municipalities.

What

The C12 project is a cross-border project involving 7 municipalities along the River Gudenå hereby launching their practical cooperation on CCA because of the work on the C2C CC project.

The River Gudenå is the longest river in Denmark measuring 146 km, running through large part of eastern Jutland. The catchment area is 3,200 km^2. It runs through seven municipalities and ends at the east coast in Randers Fjord (cf. close cooperation with C10). The River Gudenå and its tributaries pass several cities and towns such as Tørring, Silkeborg, Ry, Bjerringbro, Hadsten and Randers (cf. cooperation with C14 on SUDS). The catchment area comprises nature, of which 11 Natura 2000 areas exist in the catchment[1], urban settlement and – not least – agriculture. The River is important for water drainage from the cities, the highlands and particularly from low-lying agricultural areas.

[1] http://naturstyrelsen.dk/vandmiljoe/vandplaner/vandplaner-2009-2015/hoeringer/hoering/basisanalyser/15-randers-fjord/.

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Part 1 of the project develops a hydrological model for the watercourse, maps the land use, identifies the possible actions to handle increased volumes of water, and tests scenarios for different solutions in the model. This mapping lays the basis for a common understanding of the CCA issues and thus Part 2, which involves a number of stakeholders, develops a vision and a goal for the CCA approach, prepares conceptual designs for physical solutions in the River Gudenå catchment, and identifies suitable approaches to dealing with water. Finally, the above solutions are related to other issues in the seven municipalities CCA plans.

C.12.1 *Models for the scenario descriptions*

What:
Rising volumes of runoff and heavier cloud bursts due to climate change, increasing amounts of vegetation in parts of the River Gudenå, plus requirements of good ecological status due to the river basin management plans, increase the needs for a better knowledge of the relationship between precipitation, runoff, groundwater and flooding, as well as land use mapping in the areas affected by water level in the river. There is thus a need to assess the effects of a number of actions that could potentially minimize conflict over land as result of rising volumes of runoff and heavier rain events.

Some of the tools already known can be extremely costly. In addition, some of the possible actions may be detrimental to national and international nature conservation interests and efforts to achieve good ecological status of water bodies under the EU Water Framework Directive (WFD). On the other hand, floods inflict damage to buildings, roads and private property, cultural heritage and recreational interests.

Impoundment of water may help to meet the objectives of the WFD. Restoring the natural hydrology can thus reduce nitrogen and phosphorus content in streams, lakes and in the Randers Fjord. Moreover, it may increase biodiversity and provide new recreational opportunities, such as more fishing tourism. Therefore, the project should identify the greatest extent possible of CCA while at the same time living up to the environmental objectives of the WFD. In addition, there is a need to evaluate possible actions from a legal and socio-economic point of view.

How:
Phase 1
A key tool for understanding the dynamics of the river is a hydrological model, which takes its point of departure in historical climate events and is used to predict future events. The present model only covers part of the river and needs to be updated and expanded to the entire river in order to describe the effect of different volumes of runoff. An updated model should also be used as one of several support tools to assess the impact on water levels in the different scenarios for compensatory measures as well as for future protection measures.

Concrete actions:
1. Development of hydrological model
2. Development of reports and catchment tool

3. Web portal with warning and exchange of experiences, lessons mm.
4. Model Setup and scenario runs
5. Catalogue of solutions, costs, etc.
6. Mapping of land use
7. Scenario Run measuring the effect of individual measures
8. Legal and social consequences of possible actions

Related to the establishment of the model, the following data common for the entire river is collected: water flow, elevations, discharge areas, submerged vegetation, water level loggers etc.

The model and the analysis of the surface area are used to evaluate the eventual usage of the following compensating scenarios:

- Retention of water in low-lying areas and the tributaries in the form of wetlands, etc.
- Deepening of river cross profiles on parts of the river stretch
- The establishment of a parallel flow on parts of the river
- Removal of any deposits on parts of the river stretch
- Limitation of drainage volumes from fortified and submerged land in the catchment
- Land distribution, acquisitions etc. of low-lying areas
- Intensified watercourse maintenance
- Altered / optimized operation of established barriers in the watercourse
- Other compensatory measures to alleviate the distress due. Elevated water levels

Furthermore, the environmental, legal and societal implications of each scenario will be assessed.

C12 will benefit from two other actions, the C11 Randers Fjord and the C14 Horsens city center. The latter deals with opportunities to retain water in low-lying areas and reducing run-off from paved areas in the catchment as well as from cultivated land.

Where: The entire catchment area

Figure 21: The catchment of River Gudenaa marked with red. The municipal borders are indicated as black lines.

When:
Phase 1 1-8 (section concerning phase 1, page 3-4)
Phase 2 1-7 and 9-11 (section concerning phase 2 and 3, page 6)
Phase 3 8 and 12 (section concerning phase 2 and 3, page 6)

C.12.2 *Stakeholder involvement, choice of projects and the development of vision and goals, etc.*

What:
The water challenges in the River Gudenå catchment involves numerous authorities, businesses and citizens, and stakeholder involvement is vital. The project is based on the regional, catchment scale, as the project focuses on cross-border issues and works to handle the challenges pertinent for the whole catchment area, avoiding sub-optimization. This work involves particularly the 7 local authorities in the catchment area. It takes mainly place during Phase 2 and beyond.

How:
This action creates even closer collaboration between stakeholders and the development of a common vision and goals. Eventually, actions will be selected.

Phase 1
In the spring of 2017 the task was defined and the tender compiled. Meanwhile, the 8 partners created an overview of existing data and collected the data in a database.

After clarification of procurement rules, 5 companies were examined. 3 companies were qualified to make their bids, within a defined financial framework. One of the companies who were not chosen, got associated as client advisor.

2 companies got the opportunity to present their bid. DHI was chosen and a final contract was signed in March 2018.

DHI are working on developing a hydrological model in cooperation with the C12 partners. The hydrological model is expected set and calibrated in 2018. DHI and the project Group (8 partners) cooperate finding scenario and to describe the effect of the scenarios.

In the autumn of 2018 a prototype of the Warning model and web portal will be set up.

During phase 1 the project-group have experienced challenges in cross-municipal co-operation, among other because of different political interests. An analysis which identify challenges in cross-municipal co-operation will be made, which is expected to facilitate the further process.

Phase 2

Citizens meetings to discuss the model will be held, meetings and workshops among partners and stakeholders to discuss scenarios from phase 1 and to put forward proposals for concrete measures, and the 3D simulation model will be presented.

Experience in involving stakeholders will be gathered from the similar projects, for example checking for letter templates and methods in involving stakeholders across municipalities and across the groups. Then a wide stakeholder analysis will be conducted, with all the vital and relevant stakeholders involved. The Gudenå-committee is seen as a vital stakeholder, and the municipalities wish to involve this committee to be the steering committee for creating the vision and involving the public in the project.

Phase 3

The municipalities are agreeing on shared targets to be set for Gudenå river.

Validation of the hydrological model.

Concrete actions:

1. Stakeholder analysis: Broad analysis of who the stakeholders are, and what their stake in the project are: Gudenå committee, shore owners, landowners effected by the water levels in the river system, owners of infrastructure, owners of dams, fishermen, recreational users of the river, authorities, Grønne Råd etc
2. Identify challenges in cross-municipal co-operation
3. Prepare letter templates and methods in involving stakeholders
4. The Gudenå-committee is appointed to govern involving the public in the project.
5. Developing a shared vision for handling the River Gudenå's water. The Gudenå-committee get involved in developing a shared vision
6. integrating various water challenges of the River Gudenå.
7. Adjusting the scenarios and responses (C.12.1).
8. Agreeing on targets to be set among the Gudenå River municipalities
9. Listing of possible projects
10. Setting goals for water coming in and out of the municipalities
11. Preparation of financing models for compensatory actions

12. Validation of the model (trust in the model): Municipal authorities + citizen involvement +political involvement

Moreover, work with the citizens and stakeholders can help to achieve a more robust hinterland where flooding occurs controlled. This is done by building the capacity of those involved and those who can do something about the challenge.

Where
In the seven municipalities along the River Gudenå and STF.

When
Phase 2 1-7 and 9-11
Phase 3 8 and 12

Reasons why this action is necessary:
There is a general need in Gudenå hinterland to adapt to climate change. The pressure on the water system is increasing and wetter winters and dry summers make it worse. There is increased demand among stakeholders to act to avoid flooding and loss of values. With such a large catchment area which Gudenåen and the many authorities, there is a risk of sub-optimization that only benefit locally.

The cooperation between the municipalities of the River Gudenå have cooperated for many years – just not on CCA. C2C CC produces knowledge on how the areas along Denmark's longest river, which is necessary to establish a common understanding of how solutions could be designed to the benefit of all and avoid discussion on data validity etc. Solutions that are holistic and take into account private property and infrastructure, protected natural and recreational interests. Climate resilience is thus enhanced by cooperation, providing data and formulating a common vision on the appropriate solutions.

Constraints and assumptions
C12.1:
Development of models depends on data quantity and quality. The models will have to rely on available data. To meet this challenge and ensure the best possible data quality, external expertise must be involved.
C12.2:
The project's many partners make it vulnerable to disagreement. The success rate also depends on the will of the local politicians to work together to tackle common challenges and allocate resources. The individual municipalities may have different priorities. For example, one municipality prioritizes improving conditions for salmonids while another prioritizes drainage. Conflicting priorities can be solved by strengthening the political level and work on consensus through common data base and common reference that create common understanding. Finally, it is necessary to put on the agenda how to reach an agreement on financing models for subsequent actions.

The involvement of the political stakeholders provides a further challenge due to the few yearly meetings in the Gudenå committee and, in general, the response time from when an agenda item is being produced and the decisions are made.

Expected results

C12.1: Common knowledge on the CCA challenges and the prerequisites for CCA solutions among the River Gudenå municipalities with the objective of formulating a common understanding and eventually a common vision on CCA solutions.

A common tool for shedding light at a variety of scenarios. The tool will be available in the specific actions to be decided in C.12.2. Furthermore, it will be available for future scenario analyzes and compensating actions. The objective is to create a 'common reference' / 'common language' used by the municipalities of the River Gudenå when making decisions that affect water flow across the basin. The tool designates the effects acts in the hinterland will give the water quantity, quality and costs.

Analyses will be described in a report. Number of hectares to be screened: 2.643 km² (catchment area).

C12.2: Thorough involvement of stakeholders and development of the vision and goals will secure that CCA implementation is practically feasible. A number of workshops held by the Gudenaa municipalities looking towards specific initiatives and actions that can be implemented will concretize solution possibilities. Insights on secondary impacts on biodiversity, environmental effects / nitrogen removal /, CO2, economy-cost benefit, legal aspects will aid decision making for holistic solutions.

The development of a series of targeted information for landowners throughout the River Gudenå system will inform them on the following issues: How can I protect myself against water from the river? What does the course of the river mean for the runoff? Why is the river not just being expanded and deepened? Can the drainage system help to keep the water?

A web portal is created for data and for citizens to share ideas and finding good advice on flooding and create community resilience through bottom up means.

Cost estimation:
All partners are expected to contribute man hours to the project and pay for the implementation of the eventual CCA solution after the end of the Life IP. Estimation of person days for the municipalities working on C12 is based on present salaries + pension. For HEDKOM the total number of person-days per year is based on the basis of the total working hours/days according to national legislation, collective agreements, employment contracts, etc. – budgeted at 214 days per year. The other partners use the standard calculation of 1720. The hydrological model to be made is large, and external assistance is necessary. Expenses for this external expert help is expected to amount to 213.374 €.. A contract has been concluded with a consultant. Expenses for external assistance in phase 2 and 3 is expected to remain 161.907 €. The total amount for external assistance is expected to be 375.281 €.

In order to create the necessary consensus, quite a lot of meetings and networking is foreseen. Expenses build on prior experience in holding workshops and meetings. Subsistence costs are

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also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	**Travel for project officers around the region**							
Partners: / *Cost categories:*	**HEDKOM**	**FK**	**Horsens**	**RK**	**SIK**	**SK-KOM**	**SFV**	**VK**
Hotel cost:	100	100	100	100	100	100	100	100
Daily allowances/Payment for meals cost:	25	25	25	25	25	25	25	25
Local transportation costs:	63	63	63	63	63	63	63	63
Total subsistence cost:	188	188	188	188	188	188	188	188

Deliverables:

Action	Deliverables
C12.1.	Phase 1 Report and catchment tool Web portal with warning and exchange of experiences, lessons learned etc. Catalogue of solutions, costs, etc. 3D simulation model developed, Phase 2: Stakeholder analysis Identify challenges in cross-municipal co-operation Adjusting scenarios and responses Developing a shared vision for handling River Gudenå's water Project Costs associated with the demonstration projects Phase 3 Other initiatives in Gudenåen's catchment in local CCA plans

Milestones:

Action	Quantifiable milestones	Date by the end of
C.12.1.	Phase 1	
	One report on data analysis for the model	28/02/2019
	Report on the establishment of a model and calibration of the model	28/02/2019
	Three scenarios developed	28/02/2019
	Phase 2	
	Stakeholder Involvement meeting held	31/12/2020
	Political process initiated. Minutes of municipal board meetings	31/12/2020
		31/12/2020

	Selection of projects done Phase 3 Measures in the municipal climate adaptation plans implemented	 31/12/2022

Deliverables and milestones for C12.2:

Action	Deliverables	
C12.2.1	Development of reports and catchment tool	28/2/2019
C12.2.2	Web portal with warning and exchange of experiences, lessons mm.	28/2/2019
C12.2.3	Scenario Run measuring the effect of individual measures	28/2/2019
C12.2.4	Catalogue of solutions, costs, etc.	28/2/2019
C12.2.5	Mapping of land use	28/2/2019
C12.2.6	Scenario Run measuring the effect of individual measures	28/2/2019
C12.2.7	Assessment of legal and social consequences of possible actions	28/2/2019
C12.2.8	Developing a shared vision for handling the River Gudenå's water	31/12/2020
C12.2.9	Adjusting the scenarios and responses (C.12.1).	31/12/2020
C12.2.10	integrating various water challenges of the River Gudenå	31/12/2020
C12.2.11	Agreeing on targets to be set among the Gudenå River municipalities	31/12/2020
C12.2.12	Listing of possible projects	31/12/2020
C12.2.13	Setting goals for water coming in and out of the municipalities	31/12/2020
C12.2.14	Preparation of financing models for compensatory actions	31/12/2020
C12.2.15	Collecting experience from other Coast to Coast partners in relation to involvement of stakeholders, e.g. Herning/Holstebro og Hedensted.	31/12/2020
C12.2.16	Stakeholder analysis: Wide analysis of who the stakeholders are, and what their stake in the project are: Gudenå committee, shore owners, landowners effected by the water levels in the river system, owners of infrastructure, owners of dams, fishermen, recreational users of the river, authorities, Grønne Råd etc.	31/12/2020
C12.2.17	Identify challenges in cross-municipal co-operation	31/12/2020
C12.2.18	Prepare letter templates and methods in involving stakeholders	31/12/2020
C12.2.19	The Gudenå-committee is involved where this committee appointed steering committee for creating the vision and involving the public in the project.	31/12/2020
C12.2.20	Validation of the model (trust in the model). Municipal authorities + Citizen involvement + Political involvement.	31/12/2020

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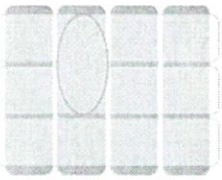

C13: The River Storå

The watercourse system Storå upstream at Holstebro has a catchment area of 830 km^2 shared between three municipalities. This project is a cross-border cooperation to test new ways to detain water and thereby avert flooding in Holstebro, which is designated a risk area according to the Floods Directive. Among the new methods are: disconnection of drainage, establishing mini wetlands, periodic increased drainage, and storage of water during different seasons. The project is carried out in cooperation with famers and a local water utility, and examines the combining of a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients. This action primarily links to governance and tools within rivers.

The project's theme is common with subproject "CCA in the hinterland and in regard to agriculture (C15.2). Parties from this project participate as sparring partners throughout the project. In Phase 2 there will be cooperation with the progress of consultancy assistance to common knowledge processing.

Main responsible beneficiary: Herning Municipality Budget: 161.861€

Number of days estimated spent on action in phase 1: 215 Days

Beneficiaries responsible for implementation: Herning Municipality (HK) and Holstebro Municipality (HbK)

Role of HK:

- Is the project manager
- Cooperates with HbK (partner) and Ikast-Brande Municipality (Primary Stakeholder, participates because the River originates in Ikast-Brande).
- Engages and involves stakeholders such as: Utility companies, landowners, Rådgivningscentret Heden og Fjorden, SEGES (Primary Stakeholder), the local branch of the Danish Society for Nature Conservation, the Danish Nature Agency, etc.
- Enters into special dialogue with a farmer in HK[1] who is being engaged in the project with an area of agricultural land in HK.
- Reports to C2C CC project-leader and cooperates with other C2C CC partners

Relation to CCA plans

[1] The identity of the landowner is known. Negotiations are being held at the moment.

- HbK: CCA plan p. 16 (7.2 – 7.4)
- HK: CCA plan p. 22 (92-93)
- Ikast-Brande: CCA plan p. 27

Relation to cross-cutting capacity building actions (C1-C7)
Action C13 River Storå will gain from actions under C2, where knowledge and experience on CCA and rivers developed under the different actions will be shared and discussed. Modeling, interpretations, analysis and data sampling are similar in the different catchments and C13 will benefit from this knowledge sharing. Scientific aspects currently highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C13. Under action C5 specific training courses, workshops and master classes, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C13 and other actions. Under action C6, the groundwater-surface water model and screening tool is developed and tested, and known warning systems in DK and in other countries are explored, and simple warning systems with flood prediction are tested and demonstrated, all activities which may benefit C13 directly.

Linked to complementary action
C13 is linked to a complementary project on Climate protection in Holstebro. It is focusing on approaches and installations to catch large amounts of water (up to 3 mio m^3 water) upstream, in the river valley, at a very, very short notice. On the basis of prior dialogue between Holstebro and Forsyningsselskabet Vestforsyning A/S, an application will be forwarded on 15 April. The C2C CC (and C13) will constitute an important factor in this retention effort to stop water, before it reaches the city of Holstebro.
In phase 2 of this project, there will be a cooperation between C13.3 and C15.2 including a systematic exchange of knowledge and a common progress with consultancy assistance.

Description (what, how, where and when):

The watercourse system Storå upstream at Holstebro, constitutes a run-off area of 830 km2 shared between Ikast-Brande, HK and HbK. All three municipalities operate with issues with water management in open countryside, as areas that need attention in their CCA plans. In addition, the three municipalities have established a joint experience and collaboration forum[2] related to the Storaa catchment area. Thus, C13 is a genuine cross-border pilot project to investigate how 'theories' on local storing of rain water in the open landscape works in practice. The specific project area is around 25 ha agricultural area, which belongs to the farmer, participating in the project. Agricultural areas close to the watercourses in the whole catchment are potential project areas.

C13 turns the national development and demonstration project "Landmanden som vandforvalter"[3], and the pilot project "Vandet fra Landet"[4], both focusing on how the open countryside can be used as a way to store the continued increasing volume of precipitation, and thus minimise the risk of

[2] Can be found at www.herning.dk and www.holstebro.dk

[3] https://www.landbrugsinfo.dk/miljoe/landmandensomvandforvalter/sider/startside.aspx (network of farmers acting as water managers)
[4] http://www.klimatilpasning.dk/vandet-fra-landet.aspx (Water from the Country, financed by Danish Forest and Nature Agency)

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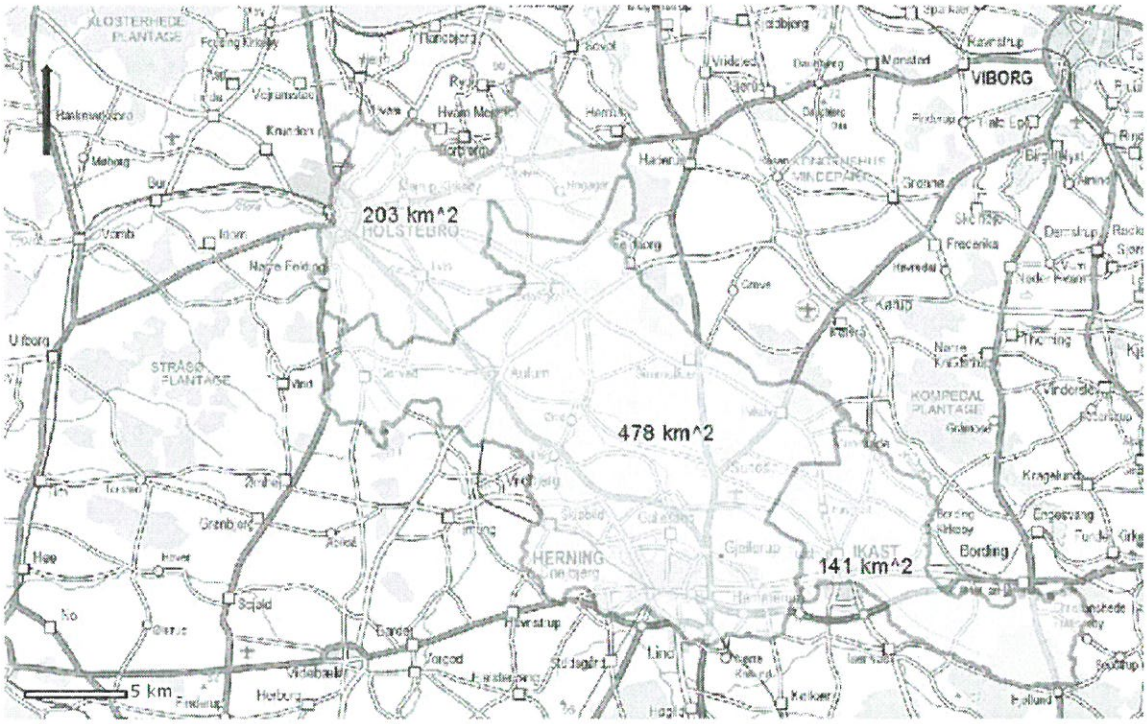
flooding in urban areas, into a concrete pilot. To do this, there is a need to investigate how the project ideas work in practice, and how flooding of open areas influences the use of the areas and existing nature reserves. There is thus a need to establish pilot projects (field projects), testing theories in practice, covering the consequences for the areas and for nature as well.

The possibilities for using the disconnection of drainage, establishing mini wetlands, periodic increased drainage and storage of water during different seasons will be examined in more detail, including the effect on famers' operations and any loss of crops. The project examines combining a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients.



Figur 22: The Store Å catchment

C13.1 *Dialogue with stakeholders, identification of suitable land,*

What
C13 builds on the above two nationally funded projects and engages local stakeholders in a pilot to test its viability in practice. Since 'the solution is not necessarily found, where the problem lies', a dialogue with farmers, landowners, NGOs, etc. is vital to try to avoid flooding in e.g. in Holstebro city further upstream and/or in lowlands. Dialogue with stakeholders takes place in Phase 1, leading up to subsequent testing and the pilot. An important part of this engaging process is a visit to the UK to see how the Rivers Trust has managed to involve farmers in their work. This will also

make a link to the EU funded Life IP 'Integrated water management approach to delivery of the North West England River basin management plan'[5].

How

1. Right after C2C CC has been approved, workshops will be held for partners and interest-groups to launch the concept and explain the need for carrying out the pilot
2. Study trip to the UK with stakeholders to study solutions
3. Negotiations with farmers on allocation of land for the pilot project. Other interested farmers having their land in the wider project area are being contacted through local agricultural associations and their adviser

In subsequent phases, dialogue is continued in order to secure consensus about the CCA approach. Knowledge, results and the project's progress will be disseminated (at the internet, at themed meetings, and field tours with land associations), and articles will be written.

Where: Dialogue shall take place in the agricultural areas close to the River Storå

When:
Phase 1: Activities related to 1-3
Phase 2: Activities related to 1-3
Phase 3: Activities related to 1-3

C13.2 *Data collection and analyses*

What
Prior to the pilot project, there is a need to map and investigate the designated area in order to assess which approaches will work. This mapping takes place with external assistance from SEGES (who is Primary Stakeholder in the project).

How:

1. Concrete areas in a smaller catchment area will be designated through dialogue with stakeholders and negotiation with the farmers
2. The following issues must be clarified: drainage mapped and drainage conditions. Furthermore, soil conditions, potential dissolved-iron areas and flooding mapped.
3. §3 mapping, amphibian mapping and mapping of habitats and invasive species. This is done by in-house biologists and external consultants
4. Registration of cultivation/area use.
5. Studies in biodiversity and infrastructure, choice of crops, distribution of land, conditions concerning ocher and nutrients, drainage techniques, by agricultural advisers together with knowledge institutions.

[5] http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=5439

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During the remainder of the C2C CC project, activities will include: monitoring, presentation of possible solutions and results. The effects of solutions regarding retaining of water, crops, biodiversity, washing and nutrients are being evaluated. In this phase, there will be a cooperation between C13.3 and C15.2 including a systematic exchange of knowledge and a common progress with consultancy assistance. C13 intends to publish results through the C2C CC project.

Where: the project area.

When
Phase 1: activities 1-5
Phase 2: activities 1-5
Phase 3: activities 1-5

C13.3 *Carrying out the pilot and monitoring*
This the core activity of Phase 2 and beyond. C13.3 builds on results of C13.1 and C13.2, laying the ground for the pilot.

During the remainder of the C2C CC phase, activities include the investigation into the possibilities for using the disconnection of drainage, establishing mini wetlands, periodic increased drainage and storage of water during different seasons will be examined in more detail, including the effect on famers' operations and any loss of crops. The project examines combining a number of CCA approaches, which together with a number of other means will increase biodiversity and ultimately, improve the water environment in the sea by reducing the leaching of nutrients. Derived effects with regard to biodiversity and cultivation reliability will be monitored during the project's monitoring phase.

In Phase 2 this project will demonstrate that water can be delayed where it falls, thereby reducing flooding in cities. The project is a pilot, which will demonstrate solutions in the long term at the field level in the open countryside. On its own, water retention in one field will not solve the problem of flooding, but combined with other measures, and with more delaying fields, it can be a long-term way to maintain the effectiveness of other CCA efforts by minimizing increased pressure caused by increasing climate challenges in the future and thus extend the durability of local CCA initiatives. Specifically, this project will realize a dialogue with farmers in the River Storaa catchment area, who are prepared to test techniques that can delay the run-off of water in the open countryside. The project will contain a monitoring measure to cover the consequences to cultivation reliability, biodiversity and improvement in the natural countryside.

Where: the project area
When:
Phase 2: pilot
Phase 3: monitoring, etc.

Reasons why this action is necessary:
The future use of land demands a new approach, for a new practice related to area and water management. The challenge is the changed precipitation patterns, which are a consequence of climate change, and the long-established (years) practice and goal of leading water away quickly

and efficiently. This creates problems with flooding in urban areas. This is the case in Holstebro, which is regularly hit by floodings because of high water flows in the River Storå, causing major and expensive damages (Holstebro is designated risk prone city in accordance with the flooding directive). The project will collaborate with the farming community and research institutions with practical trials of solutions that focus on agriculture and the open countryside. Water retention at field level cannot by itself and individually solve problems with flooding, but several, individual retentions can be a longterm and sustainable solution, providing local CCA more sustainability.

See also this video: https://www.youtube.com/watch?v=A4tUbQgQAxE

Constraints and assumptions
There is a risk of resistance from landowners. This is dealt with through early inclusion. Possible resistance from green organizations will be dealt with by early inclusion and ongoing transfer of knowledge/communication.

Expected results:
This project will demonstrate that water can be delayed where it falls, thereby reducing flooding in cities. The project is a pilot, which will demonstrate solutions in the long term at the field level in the open countryside. On its own, water retention in one field will not solve the problem of flooding, but combined with other measures, and with more delaying fields, it can be a long-term way to maintain the effectiveness of other CCA efforts by minimizing increased pressure caused by increasing climate challenges in the future and thus extend the durability of local CCA initiatives. Specifically, this project will realise a dialogue with farmers in the River Storaa catchment area, who are prepared to test techniques that can delay the run-off of water in the open countryside. The project will contain a monitoring measure to cover the consequences to cultivation reliability, biodiversity and improvement in the natural countryside.

It involves 3-5 farmers, 2 NGOs and 3-5 stakeholders/landowners, 1-2 representatives from NGOs, 6 municipal professionals, 3 utility professionals, 2-3 knowledge persons

Cost estimations:
Expenses for direct personal costs are based on person days for HK and HbK personel based on present salaries and pensions, etc. Expenses for external expert help is based on a dialogue with SEGES. External assistance will be used for highly needed expertise in relation to the modeling. Budget for meetings and fieldwork is allocated. Subsistence costs are also based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	**Inspirational Trip no. 1 to Southhampton (UK)**		**Inspirational Trip no. 2 To Drenthe (NL)**	
Partners: / *Cost categories:*	**HK**	**HbK**	**HK**	**HbK**
Hotel cost:	225	225	225	225

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Daily allowances/Payment for meals cost:	100	100	100	100
Local transportation costs:	175	175	175	175
Total subsistence cost:	500	500	500	500

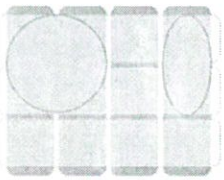
Deliverables:

Action	Deliverables
C.13.1	Phase 1: Workshop material from meetings with stakeholders; Programme for a Study Trip to the UK – Rivers Trust – together with landowners and other stakeholders. List of the activities used to transfer knowledge and present the project's progress and results. Phase 2: List of the activities used to transfer knowledge/present the project's progress and results. Presentations of the project's results on the internet (C2C CC webpage and locally), at themed meetings and field tours with land associations, and to a wider, national audience, previous partner projects "Vandet fra Landet" and "Landmanden som vandforvalter". Transfer of knowledge/presentation in professional journals and at conferences, such as "Natur og Miljø" (Nature and Environment magazine) and Plantekongres (biggest conference on plant production, planning, the environment, etc., in the Nordic Region).
C.13.2.	Phase 1: Report on designation of test areas and mapping of drainage factors; Registration of cultivation/area use. Phase 2: Description of solutions for testing.
C.13.3.	Phase 2: Monitoring report. Results assessment and conclusions.

Milestones:

Action	Quantifiable milestones	
C.13.1	Report on designation of concrete areas in a smaller catchment area. Report on registration of cultivation/area use. Report on Study Trip to the UK – River Trust – together with landowners and other stakeholders, 25 participants Report on possibilities for multi-functionality in the solutions Presentation to webpage done Presentation at thematic meetings done Presentation to other networks done	31/12/2018 31/12/2018 31/12/2018 31/12/2018 31/12/2020 31/12/2020 31/12/2020
C.13.2.	Phase 2: Agreements with farmers Development, establishment and demonstration of solutions Suitable areas designated	 31/12/2020 31/12/2020 31/12/2020
C.13.3.	Phase 2:	

	Description of specific retention solutions, disconnection of drainage, dividers, dikes, wetlands, done.	31/12/2020
	Knowledge transferred of the project's progress and results on the internet, Two thematic meetings held	31/12/2020 31/12/2020
	Two field study tours with land associations held	31/12/2020
	Phase 3: Report on monitoring of the transfer of knowledge of/presentation of possible solutions and results.	31/12/2022
	Report on monitoring of the effect of the solutions on water retention, yields, biodiversity, leaching of nutrients.	31/12/2022



C14: Flood-proofing Horsens Town Centre

The town of Horsens is threatened by floods, because a major part of the town centre is lower than 1.5 meter above the normal sea level in the Horsens Fjord. With rising sea levels and amounts of water from watercourses in the hinterland due to increasing precipitation and more powerful downpours, there is an urgent need for securing the lowest lying parts of the town against flooding. This action analyses and lays out scenarios containing all relevant issues regarding flooding from the fjord, the watercourses and handling of the sewer systems. It also deals with the development of the port area, which is being converted into a residential, recreational and commercial area. This action is primarily linked to governance and tools within most areas of the hydrological cycle apart from groundwater.

Main responsible beneficiary: Horsens Municipality Budget: 709.302€

Number of days estimated spent on action in phase 1: 220 Days

Beneficiary responsible for implementation: Horsens Municipality is the overall project manager.

Role of Horsens Municipality:

- Is project manager
- Has the contact to C2C CC project management
- Coordinates with HEDKOM on exchange of data about diverted water amounts from walled areas and on the possibilities for retaining water in the catchment area as well as with Vejle Municipality on similar information.

Relation to CCA plans

In the municipality's CCA plan, Horsens town centre is designated as focus area 12, cf. Figure 1 (page 34 in the CCA plan). The figure shows that the focus area is the most critical, assessed on the basis of the parameters risk of flooding and highest value, and it is therefore very important to make it flood-proof.

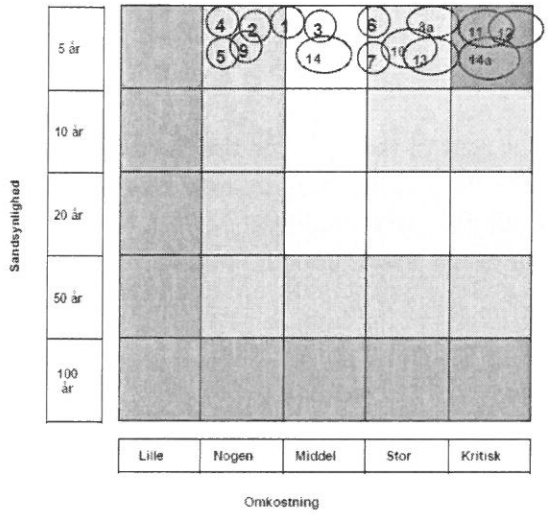


Figure 23: In Horsens Municipality's climate change adaptation plan, Horsens Town Centre is focus area 12, the most critical.

Relation to cross-cutting capacity building actions (C1-C7)

Action C14 Flood-proofing Horsens Town Centre will gain from actions under C1 relating to desk analysis and identification of knowledge gaps and reviews of in the risk maps and planned actions. Experience will be exchanged between demonstration projects C8, C10, C11 and C18 dealing with the coastal cities of Randers, Grenaa and Juelsminde. A common understanding between stakeholders of sustainable solutions (economically, environmentally, socially and long term) with a focus on land use, cost-effective measures, planning, implementation, maintenance and operation will be shared and developed across actions C8, C9, C11, C10, C17, C18 and facilitated by CDR. Under C1 a workshop will be held to assess synergies and possibilities of integrated solutions for the fjords at the East Coast. Under action C2 knowledge on CCA and rivers developed under different actions will be shared. Modelling, interpretations, analysis and data sampling are similar in the different catchments and C14 may benefit from this knowledge sharing in relation to the Bygholm cathment area (figure 25). Scientific aspects currently the highly debated within EU, e.g. on the synergies and trade-offs between CCA and water ecology, the need for warning systems related to flooding of rivers and local contingency planning, and the synergies between farming and wetland restoration will also be shared and discussed for the benefit of action C14. Under Action C4 Rainwater, C14 will gain from the identification and experience of different setup models and testing of SUDS within CDR. Under action C5 specific training courses, workshops and masterclasses, with point of departure in the challenges experienced by the partners will be implemented for the benefit of action C14 and other actions.

Linked to Complementary Actions

C14 will coordinate with Horsens wastewater utility on the integration of an urban hydrological model of the sewer system of Horsens town, which will be completed during 2017.

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Description (What, how, where, and when)

What:

Horsens town is threatened by floods, because a major part of the town centre is lower than 1.5 meter above the normal sea level in Horsens Fjord. With rising sea levels and now with more water from watercourses in the hinterland due to increasing precipitation and more powerful downpours, there is a great need for securing the lowest lying parts of the town against flooding, cf. Figure 24 and 25.

Figure 24: Picture of flooding at the outlet of Bygholm Å and in Bygholm Park in December 2013

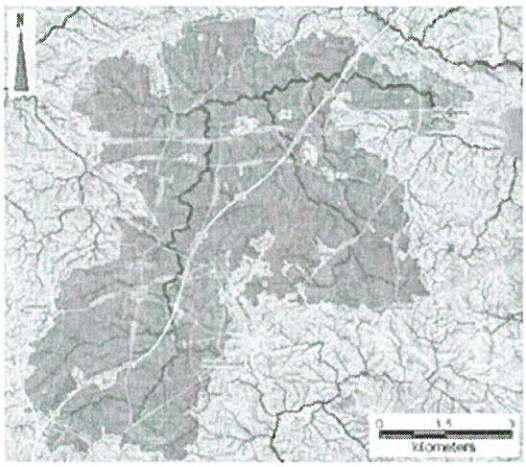

Figure 25: Map of Bygholm catchment area

The aim of C14 is to secure Horsens town centre against flooding when there is a storm surge and/or extreme flows in the three watercourses Dagnæs bæk, Bygholm and Hansted Å, which all run through the town. It requires overall considerations and scenarios of flooding for the fjord, watercourses and sewer systems, and holistic planning and coordination in relation to the port area Nordhaven, which is being converted into a residential, recreation and commercial area. An initial project was carried out by Horsens Municipality (ends April 2016) forms the basis of C14 with the purpose to carry out a detailed project design for flood proofing of Horsens town. The initial project, hereafter the 2016 project, included a simple watercourse model and involves an outline of proposed solutions to prevent flooding from precipitation, watercourses and sea levels under saturated and stationary conditions, respectively. The possible solutions are outlined for short-term flood proofing at a level off 1.8 meter above normal sea level, and a politically adopted long-term flood proofing at a level of 2.6 meter above normal sea level, se example in Figure 24. The results of the '2016 project' proposes water retention in the catchment area and dike solutions using sluices and pumps in Horsens town. However, political reality are likely to change, and there has been discussions on establishing a small-scale barrier solution on the sea floor in Horsens' outer fjord, inspired by the Mose Project in Venice. The '2016 project' sets the basis of C14.
Action C15 supplements action C14 by its nuanced approach to the drainage of water, so that the production potential of farming is developed, and the towns do not end up functioning as delay reservoirs, when the watercourse has high flows. We expect that the two actions can greatly benefit from each other. The aim of C14 is furthermore to provide inspiration to the development of

other solutions in other coastal towns that are threatened by rising sea levels and/or water from the hinterland catchment area.

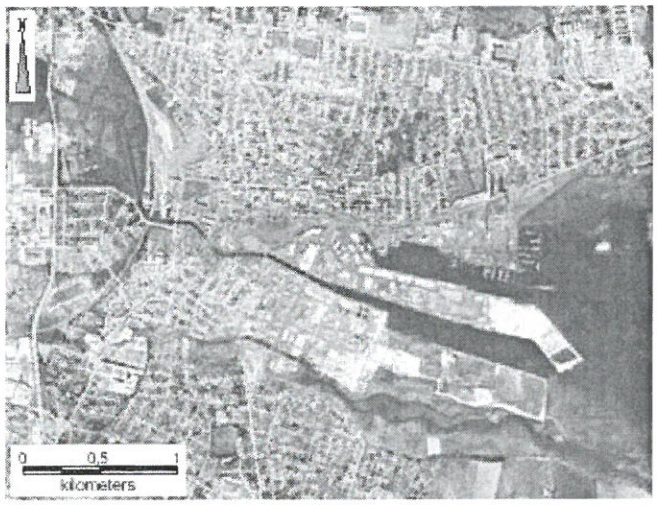

Figure 26: Consequence map for flooding with preliminary outlined proposal that will protect Horsens town in the short term?, equivalent to flood-proofing at a level of 1,8 meter DVR90. The flood proofing will be established using a high tid wall earth dykes and mobile water tubes.

How:

C14 will be contain the following activities: preparation of tender material and tender phase for external expert assistance for step 2 to 5; provision of knowledge in the form of status, data collection and model set-up; scenario calculations and initial stakeholder involvement; preparation of proposals and stakeholder involvement; preparation of project design and invitation to tender material for contractors; flooding related to watercourse Store Hansted Å and the northern part of Horsens town.

C14.1 *Preparation of tender material and tender phase for external expert assistance for activity 2 to 5*

This activity is based upon the above mentioned pilot project and the purpose is to find the most suitable and cost efficient external expert to aid in the following four activities.

Preparation of tender material.

C14.2 *Provision of knowledge in the form of status, data collection and model set-up*

The following sub-activities are involved:

1. A workshop for Horsens Municipality's steering group for CCA, where the status of the pilot project is processed and potential solutions and recommendations to be worked further in C2C CC is decided.
2. The pilot project is based on a simple hydrological model, and it is expected that there is a need for setting up a dynamic model, which can calculate the total flooding for watercourses, the sewer system and seawater. The model will be calibrated at a detailed level and can be used as the basis for the creation of an overall plan for avoiding flooding in Horsens town centre. It may be necessary to conduct further data collection in the form of e.g. water flow measurements, water levels, measurement of the terrain and watercourse, etc.
3. Establishment of an online portal with connection to the portal of C2C CC. The portal will be maintained on an ongoing basis in accordance with the agreement with the C2C CC project

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management. Confidential and unfinished data and analysis, can not be published as a rule. HORKOM has to take this into account.

4. Preparation of a communication plan of C14 involving when and how stakeholders and citizens can be involved and heard in the action on an ongoing basis. Communication may take place for example, via digital media, written material, stakeholder and citizen meetings, e.g. meetings with NGOs in the municipality, etc.

Phase 2:
Activity *C14.3 to C14.5* is based on a tender comprised in the activities below to illuminate the need for climate adaptation and solutions in Horsens. The on going technical analysis will further clarify the need for activities in the tender executed prime 2019.

The tender expected outlines:
Below is expected content in the tender shown, as presented to the steering committee in April 2018 and still expected on steering comitee meeting in September 2018. The tender will among other elements be based on the initial results obtained in phase 1. The content will be adjusted according to performed analysis during autumn 2018.

C14 tender to select main adviser

Advisers deliveries:

Processing Services:

- Interest analysis and communication plan
- preparation of process plan and ongoing maintenance of project
- arrange and facilitate meetings and workshops with partners and stake holders.
- Interaction with other advisors and planning/project leaders towards a comprehensive master plan for climate change adaptation of Horsens City in the long term:
- Combining the need for cloudbursting solutions and high tide protection with other project and planning trails (traffic plan, the river back to the city center, local plots, port plans, urban transformation, etc.).

Proposals for best climate adaptation solutions:

- pump / locking solutions, if any. And in combination with legitimate agreements with the waste water company, of free discharge, for the lower part of the watercourses in relation to rain water run off from the city.
- stream pattern and parking water on terrain during cloud bursts
- Retention of water in river bassins
- Using buffer solution in Bygholm Sø (Bygholm lake), automatic control of run off through the sluice
- terrain regulations, walls, dikes, etc.

Masterplan:

- Gathering and summarize the above for an illustrated master plan for high-water protection of Horsens City
- The plan must be able to be used in wastewater planning, management of discharge permits, municipal plan, local plans and other planning
- Explain the effects of the master plan

Regulatory Treatment:
Develop a plan for governmental management and associated processes with HK departments

Construction program:

- Compile aggregate construction programs with deliveries corresponding to the FRI's (Performance Management Consultants) performance descriptions including catalog work-up visualization of solutions in the light of the process around the ideological site
- The construction program is a coordinated summary of the municipality of Horsens and SAMN's requirements and wishes for the plan
- The facility program is adapted to the construction project organization

Idea presentation and visualization

- Compile ideas for the individual elements of the master plan with services corresponding to a customized version of FRI and the Danish Architects' Outline Descriptions (Planning and Construction) for ideas including a catalog of initial visualization of solutions.

Process of editing ideas to broad acceptance in Horsens Municipality and SAMN F (utility company) and political level, as well as other selected stakeholders eg. Horsens Harbor.

C14.3 *Scenario calculations and initial stakeholder involvement*

1. Scenarios will be calculated for the contemporary climate with a Planning model, which will be used to provide planning and making decisions for the management of floods. Scenarios will be calculated with the clarification of consequences of:
2. Establishing permanent and mobile dike solutions in the town.
3. Establishing permanent sluices and maybe over time, pumps in the outer port, alternatively in the inner port.
4. The scenarios will be carried out as a combination of the above for the purpose of optimizing the most beneficial solution.
5. Pointing out areas for possible storing water and assess retention potential in the catchment area and urban areas – however to a lesser extent than initially expected. Water retention in the catchment area will reduce the risk of flooding in Horsens town and possibly reduce discharge of nitrogen and sulphur into Bygholm Sø and Horsens Fjord, and there by benefit achievement of the WFD goals of obtaining a good environmental state (Synergies with C12 and C15).
6. Dialogue with stakeholders
7. Coordination and knowledge exchange with Action C12 and C15.
1. Dialogue between HEDKOM about the nature values, needs and possible retention of water in their part of the catchment area.
2. If required preliminary dialogue and survey of locations with the affected landowners, e.g. farmers, for the purpose of establishing a broad ownership of the results.
3. If required preliminary dialogue with the affected businesses and citizens in the town centre.
4. If required, inspirational trips for a committee of representatives from the municipalities.
5. Outlining of solutions: based on model scenarios and the effect of different means (permanent high tide walls, earth dikes, mobile water tubes and dikes, sluices and pumps), and visualisation of reduced flooding in the form of a consequence map.

C14.4 *Preparation of proposals and stakeholder involvement*

1. Preparation of proposals:

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2. Decision on the most suitable solution for Horsens town
3. Visualisation of solutions on dispositioning level, and maybe a film sequence illustrating the level of flooding before and after protection.
4. On disposal levels, budgeting of construction costs and calculation of other cost-benefits considerations in relation to prioritised protection of assets.
5. Stakeholder involvement: Visiting other coastal cities in Denmark with politicians, with similar climate adaption challenges.
6. Coordination with the municipality's emergency services and contingency planning team on the use of mobile protection measures.
7. Workshops with HEDKOM on benefits, nature values and retention possibilities in HEDKOM.
8. Continued dialogue with stakeholders.
9. Workshop/seminar with the C2C CC partners with presentation of the results of C14.
10. Stakeholder agreements:
11. Agreements with Horsens waste water utility on overall principles for water management and flooding protection on long term perspective, and for the financing obligations.
12. If needed potential action on a automatic system for smart management of sluices and pumps.

C14.5 *Preparation of project design*

1. Preparation of a construction program and maybe conceptual designs and disposal project for some of the needed solutions.

Phase 3:

C14.6 Flooding risks Store Hansted Å catchment area

1. In year 2021-22 C14 will focus on flooding issues in other parts of the municipality (Horsens CCA plan pp. 25-35) with special attention to floodings related to the watercourse Store Hansted Å, including the northern part of Horsens town, where houses close to the watercourse periodically are flooded.

Where:

The project area covers Bygholm Å catchment area and extends to HEDKOM and Vejle Municipality, cf. Figure 27. Bygholm Å catchment area drains into the watercourses that flow through Horsens town centre and out to Horsens Fjord. The main focus is on Horsens town centre and covers the port, parts of the inner town and Bygholm Park, which will be flooded with a 5-year storm surge event in 2050 (2.4 m DVR90), cf. Figure 28.

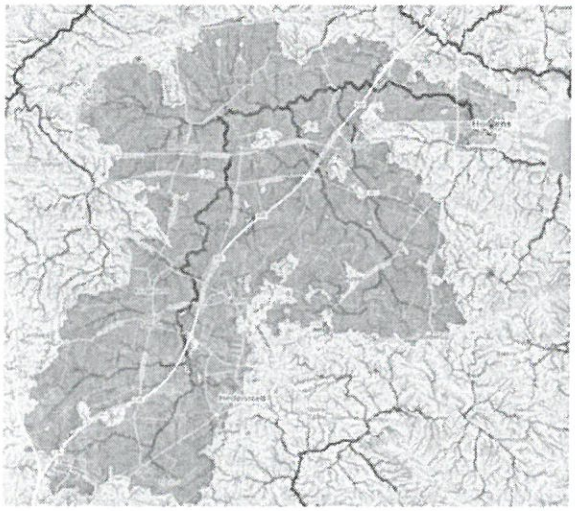

Figure 27 All of the Bygholm Å catchment area with flow paths on terrain.

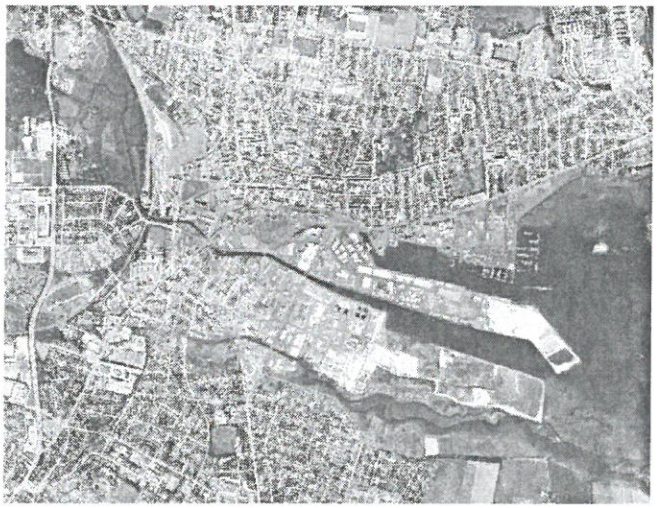

Figure 28 Flooding in Horsens town with a 5-year storm surge event in 2050, equivalent to 2.4 m above normal sea level (Horsens CCA plan p. 34).

When:
Phase 1: Activity C14.1 - C14.2
Phase 2: Activity C14.3 - C14.5
Phase 3: Activity C14.6

Reasons why this action is necessary:
Horsens town center covers central town functions, including homes, companies, technical installations and a town park. The area consist of major economic assets that are at risk (Horsens CCA plan p. 21, cf. risk map). The project benefits the overall aim of C2C CC in creating a climate resilient town by implementing the local CCA plan's most prioritized challenge and in collaboration with the affected parties.

Constraints and assumptions:
C14 will coordinate with Horsens wastewater utility on the integration of an urban hydrological model of the sewer system of Horsens town, which will be completed during 2017.
C14 may be delayed according to the schedule of this model, since it shall be included as an integrated part of C14 model. In relation to the integrated model carried out in C14, it may be necessary to conduct further data collection (see activity 2), which could affect the schedule. The modeling actions is complex and need advanced modelling skills and adviser. It all takes its time.
Initial correspondence with the municipality of HEDKOM on C14 has taken place, however, resistance to upstream solutions may occur if win-win solutions are not defined. This issue is counteracted by including technicians and politicians from the two municipalities in the project.
Uncertainty related to financing implementation of solutions: internally in Horsens Municipality, between Horsens Municipality and Horsens Waste Water utility, and between the municipalities of Horsens and HEDKOM. Early involvement of the established steering group for CCA and

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politicians will aim to find a fair solution for financing. The interest has been shared among technical staff, and there is an mutual understanding of needs according to climate adaptation.
These years Horsens Municipality

During these years, Horsens City grows significantly, and many decisions are made, and projects are implemented in a very short period of time. The project team is working intensively to get climate adaptation and the C14 project incoorporated in projects, but the political agenda is interchangeable and it is difficult to predict which projects are being implemented during the project period. This affects both solutions and progress of the project.

Expected results for Phase 2:
The action will result in basis for decision making on which outlined solution possibilities will be worked further and clarify which additional matters that need to be clarified, whereas it is possible to define long-term solutions for protecting Horsens town centre from flooding that meet the politically adopted level of protection for the municipality (stated in the CCA plan).

The following will be defined: Designated local sites and solutions for retaining water in the catchment area in one or several locations – if needed. Designated most suitable positioning of dike reinforcements that protect Horsens town centre. Calculated filling times for any reservoirs, and calculated dimensioning of pumps and sluices with different scenarios in the current and future climate. A smart pump and sluice control system. Solutions for water flow and for the catchment area that promote biodiversity as much as possible, improve water quality and provide recreational options for local residents. With Nordhavnen under redevelopment, solutions shall be provided for traffic connections to the port area and the central neighbourhood. Dikes, sluices and pumps are designed to be visually inspiring and to provide recreational urban spaces, and integrated into the urban life of Horsens town.

Expected results for Phase 3:

Mapped and estimated flooding risks related to the watercourse Store Hansted Å, and the interaction with Horsens Fjord and the lake like Nørrestrand. Prepare a decision base to determine whether climate mitigation are needed and if necessary, decide which climate adaptation action are to be carried out.

Cost estimations:
Expenses for direct personal costs are based on person days for Horsens personel based on present salaries and pensions, etc. Expenses for external expert help is based on prior experience. External assistance will be used for highly needed expertise in relation to scenario calcultaions.
Subsistence costs are based on prior experience and can be further subdivided into Hotel costs, Daily allowances/Payment for meals and local transportation categories, as shown below for this action's subsistence costs items:

Travels	Trip for project manager	Trip no. 1 for project officer	Trip no. 2 for project officer	Trip no. 3 for project officer	Trip no. 4 for project officer
Partners: / *Cost categories:*	**Horsens**	**Horsens**	**Horsens**	**Horsens**	**Horsens**
Hotel cost:	0	0	0	0	0
Daily allowances/Payment for meals cost:	180	180	180	180	180
Local transportation costs:	120	120	120	120	120
Total subsistence cost:	300	300	300	300	300

Deliverables:

Action	Deliverables
C14.1	**Phase 1** Status report for pilot project Report on model for scenarios for the total flooding
C14.2	A status report of the '2016 project'. Minute stating steering group decision on outlined solution Report with requirements and expectations for the C14 model Online portal connected with C2C CC online platform incl. LIFE Logo Communication plan for stakeholder involvement Scenarios and sensitivity analysis will be calculated for the contemporary climate with a Status 2018 model, which will be used to provide the basis todays challenges, and for planning and making decisions for the management of floods. Mapping of nature values, and prioritize locations for retaining water in Bygholm Å catchment area. Using the lake Bygholm Sø as a reservoir. It is today possible to lower the water level 0.5 m and thus achieve a significant reservoir capacity. The probability of simultaneous contingency between precipitation events, high flow of watercourses and storms is estimated.
C14.3 - 14.5.	**Phase 2** Planning scenarious with technical background report of model methodology and results is delivered Background report with designated local sites and needed solutions Technical report on calculated filling times for reservoirs and dimensioning of pumps and sluices Background report on solutions for water flow and for the catchment area , that if possible improve water quality and provide recreational options for local residents. Proposals for best climate adaptation solutions: Masterplan for long term climate adaptation according to cloud bursts, stream flow and flooding from the fjord A construction program for technical facilities Presentation and visualization The above is part of topics in tender prime 2019 – where use of new infrastructure, recreational urban spaces, sluice, pump solutions is expected to be in focus.
C14-6	**Phase 3** A decision base to determine whether climate adaptation are needed and if necessary, decide what action

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	should be taken.

Milestones:

Action	Quantifiable milestones	Date by end of
C14.1 and C14,2	**Phase 1** Collection of data finalized, A model is set-up to calculate scenarios for the total flooding from the sea, watercourses and sewage systems Consultant for the execution of phase 14.3 and 14.4 is selected, Possible locations identified for retaining water in the Bygholm Å catchment area	June 2018 October 2018 March 2019
C14.3	**Phase 2** Possible locations identified for retaining water in the urban areas. Specific solutions proposed for water retention, dikes, pumps and if required, barriers in the fjord	June 2018 December 2019 June 2020
C14.4	If needed CBA analysis finalized in relation to the assets that shall be protected Involvement of politicians in the development of the solutions done, public involvement is carried out according to assessed needs. Construction programme, and cost estimations for construction solutions finalized, part of tender in prime 2019 Final political approval of the described solutions done.	31/12/2019 June 2020
C14.5	Preparation of a conceptual design and disposal project for the needed solutions.	2020
C14.6	**Phase 3** C14 will focus on flooding issues in other parts of the municipality (Horsens CCA plan pp. 25-35) with special attention to floodings related to the watercourse Store Hansted Å, including the northern part of Horsens town, where houses close to the watercourse periodically are flooded.	2021-2022