

Norwegian policies in ICZM and requirements for data and methods, adapting to climate change

Date: 31.08.2011

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Document history

<i>Revision</i>	<i>Date</i>	<i>Organisation</i>	<i>Initials</i>	<i>Revised pages</i>	<i>Short description of changes</i>
First Draft 0.1	31.3.2010	NCA	JMK		First draft
Draft 0.2	30.6.2010	NCA	JMK		Proofreading
Draft 1.0	31.8.2011	NCA	JMK		Input from Directorate of Fisheries

1 Content

1	Content	3
1	Background	4
2	National Administrative Structure	5
2.1	Three levels of Public Administration.....	5
2.2	Sector agencies participating in ICZM.....	6
3	Legislation on ICZM.....	9
3.1	Planning preconditions	9
3.2	National and regional guidelines	9
3.3	The planning process – The master municipal plan	11
3.4	Planning purposes.....	13
3.5	Coastal Management, the Harbour and Fairway Act	14
3.6	Ocean Planning.....	15
4	Best practises for integrated coastal zone planning	16
4.1	Kristiansand municipal master plan	16
4.2	Bottlenecks and critical issues in the ICZM process.....	19
4.3	Data needed for ICZM.....	23
5	References	25

1 Background

ICZM have a long tradition in Norwegian land-area planning. The Planning and Building Act (PBA) was in 1985 also extended to include sea areas. However few municipalities and Counties used these possibilities very much the first years, but early nineties more and more counties started planning also the sea areas to clarify and give priority to interests also for sea areas in the municipalities.

Specific coastal plans were made for many municipalities, however today most municipalities include the sea and coastal regulations in their overall municipal master plan.

At national level there are two different approaches on coastal zone planning. One approach has gravity in North and West Norway, with emphasis on industrial development and management of sea areas and aquaculture and fisheries management as key players. The second approach with the centre of gravity of the Southern and Eastern parts of Norway, with emphasis on recreation and environmental protection and has environmental management as key players. Within both of these approaches maritime safety and transport plays a major role.

The coastal zone includes both sea and land area. How much of the land area that should be included, depends on which subjects that are of major interest. Ecological or social perspective gives different land appraisal of the coastal zone. In Norway there has been a high focus on the shoreline to ensure public access, recreation activity, and coastal ecology. Special regulations are given for the 100-meter belt in PBA, however land area further from the shoreline is also considered as the coastal zone in most cases, depending on the local situation.

The possible conflicts of interest have definitely increased in the coastal zone of Norway the last decades, with increased use of the coastal areas, for instance aquaculture industry and increased recreation activity. In the last years production of renewable energy in the coastal zone have been put on top of the agenda.

In Norway ICZM is based on two laws, namely the Planning and Building Act (PBA) and the Act of Biological Diversity, together with the national regulations implementing the EU Water Framework Directive. Most plans are based on PBA. Plans implementing the intentions in the EU Water Framework Directive are worked out in a parallel process where the municipalities, County Councils and Ministry of Environment are responsible at the three administration levels (se chap. 2.1). Planning of areas especially focusing on nature conservation are based on the Act of Biological Diversity.

In this project focus will be set on ICZM based on PBA, with a master municipal plan as main example. All municipalities shall have an overall municipal master plan that comprises a social element with an implementation element and a land-use element.

2 National Administrative Structure

2.1 Three levels of Public Administration

Public administration in Norway has a structure with the three elements, all governed by elected boards: central government, county government and municipal government.

The Municipality

Local (municipality) and regional (county) authorities are the leading part in most ICZM-processes according to PBA, and is responsible for the integrating process. Governmental agencies participate to the relevant degree, depending on relevance of planning objectives in the actual municipality or county.

All municipalities shall have an overall municipal master plan that comprises a social element with an implementation element and a land-use element. The overall municipal master plan should be under revision every fourth year. The plan shall have an implementation element for the following four years, which shall be revised each year.

The local municipality is also responsible for regulation of building activities in the coastal zone, regulated in PBA and The Harbour and Fairway Act (HFA). For building activity near shore (the 100 meter belt) the County Governor (central government) has a high influence, to ensure public access to the shore, environmental conservation, and recreational activity.

The County Council

The County Council is the county government, responsible for regional planning. The County Council shall make guidelines for the use of land areas and natural resources in the county with regard to issues that may have considerable effect beyond the borders of a municipality or that the individual municipality cannot solve within its own area and that must be seen in conjunction with several municipalities.

The County Council is given a special responsibility to safe guard recreational interests. However central government, county government and municipal government, all can involve in ensuring important recreational areas, by planning or investing. The County Council also safe guards cultural monuments, landscape values, recreational interests, and the aquaculture industry in ICZM. Cultural monuments also include sub-sea monuments and ship-wrecks. The County Council ensures that the planning processes according to PBA, have the necessary quality.

The County Governor (The Central Government)

The Central Government has a County Governor (Fylkesmannen) in each county. The County Governor is the chief representative of King and Government in the county, and works for the implementation of Storting (Parliament) and central government decisions. In planning-processes according to PBA the County Governor especially represent interests on environment protection, agriculture, emergency planning, climate changes, and to avoid risk of life and health in ICZM.

The County Governor explains central policy documents in the local context, being aware of each municipality's ability to provide. The County Governor's office supervise local activities, advise and instruct, with due respect to the political judgement of the local government.

The different national ministries have different sector agencies responsible for given subjects and areas, participating in ICZM.

2.2 Sector agencies participating in ICZM

A number of governmental agencies represent national and regional interests in the planning processes, together with the municipality and County Council.

The Norwegian Defence Estates Agency (Military interests)

The Armed Forces have major interests in marine and coastal areas and military interests are taken care of by the Norwegian Defence Estates Agency in ICZM, assuring military interests are safe guarded. Military spatial interests include military installations and training areas.

Ministry of Environment

For the interests lying under Ministry of Environment, these are to a large extent safe guarded by the County Council and the County Governor in ICZM in municipalities, however national agencies participate in national and regional processes.

The Directorate for Nature Management

The County Governor together with Directorate for Nature Management is representing national interests on nature management in local, regional and national ICZM. At the regional level the County Governor is representing these interests.

Nature management plans for areas with special natural values are regulated under the Act of biological diversity, and are parallel to coastal zone plans regulated under PBA. The Directorate for Nature Management is responsible for such planning processes. This also includes marine areas, where a list of 37 suggested marine areas in Norway have been given temporary restrictions. Processes of establishing Nature management plans will not be further discussed here.

Ministry	Responsibility	Associated agencies
Ministry of Defence	Responsibility for the formation and implementation of Norwegian security and defence policy	- The Norwegian Defence Estates Agency (no: Forsvarsbygg)
Ministry of Environment	Responsibility for carrying out the environmental policies of the Government	- The Directorate for Nature Management (no: Direktoratet for naturforvaltning) - The Climate and Pollution Agency (no: Klima- og forurensningsdirektoratet) - Directorate for Cultural Heritage in Norway (no: Riksantikvaren)
Ministry of Fisheries and Coastal Affairs	Responsibility for the fisheries and aquaculture industries, seafood safety and fish health and welfare, harbours, infrastructures for sea transport and emergency preparedness for pollution incidents.	- The Directorate of Fisheries (no: Fiskeridirektoratet) - The Norwegian Coastal Administration (no: Kystverket)
Ministry of Petroleum and Energy	Responsibility to achieve a coordinated and integrated energy policy.	- The Norwegian Water Resources and Energy Directorate (Norges Vassdrags- og Energidirektorat)
Ministry of Transport and Communication	Responsible for transport of people and goods, telecommunication and postal services.	- Norwegian National Rail Administration (no: Jernbaneverket) - Norwegian Public Roads Administration (no: Statens vegvesen) - Civil Aviation Authority (no: Luftfartstilsynet) and AVINOR AS
Ministry of Justice and the Police	To provide for the maintenance and development of the basic guarantees of the rule of law. An overriding objective is to ensure the security of society and of individual citizens. Main coordinator of information on climate changes, together with other agencies, chart services, meteorological institutions, research institutions and others.	- Directorate for Civil Protection and Emergency Planning (no: Direktoratet for samfunnssikkerhet og beredskap).
various ministries	Other institutions/agencies with rights to object to coastal zone plans: Bishops: Churches and church yards The Directorate of Mining : Mining Police: Crime Reindeer Administration: Reindeer management Norwegian food Safety Authority: Fish diseases, drinking water The Norwegian Petroleum Directorate: Offshore petroleum activity and pipelines Sametinget: Sami interests	

Tab. 1. A list of the most relevant governmental institutions participating in ICZM (process of a master municipal plan), lying under the central administration:

The Climate and Pollution Agency

The Climate and Pollution Agency participate in national planning processes according to PBA, but to a higher extent in processes with nature management plans at regional and national level.

Directorate for Cultural Heritage in Norway (four regional offices)

Together with the County Council, the Directorate for Cultural Heritage participates to some extent in ICZM for preservation of culture, and cultural monuments.

The Directorate of Fisheries (seven regional offices)

The Directorate of Fisheries safe guards the fisheries in ICZM. They map, categorize, and rank areas of interest for the fisheries, and regulate the fisheries in Norwegian waters. Important areas for fisheries include for example places for gathering fish, spawning areas, living areas for fish, fishing areas for “active” and “passive” equipment, and coral reefs. The Directorate of Fisheries also distributes licenses for trawling of sea kelp, in consultation with Directorate for Nature Management, and safe guards these interests in ICZM.

The aquaculture industry is also regulated under The Directorate of Fisheries, however on a regional and local level the County Council safe guard important locations for this industry in ICZM. The County Council is also giving the licenses of production at each aquaculture location, following an integrated process including several governmental agencies (i.e. local municipality, Directorate of Fisheries, Norwegian Coastal Administration, The County Governor, and Norwegian Food Safety Authority). Aquaculture is dominated by salmon fish farms but include a large diversity of marine biological production (i.e. locations for production of cod, atlantic halibut, turbot, and different species of shell fish).

The Norwegian Coastal Administration (five regional offices)

The Norwegian Coastal Administration is responsible in matters pertaining ports and seaways, included building of fishing harbours. They are the operator of pilotage and VTS's in Norwegian waters, monitor sea traffic, and operate the national preparedness in the event of acute pollution (at sea and on land). They are responsible for coastal management according to Act of Harbour and Fairways, together with the municipalities. Fairways, harbours, places of anchorage for ships and offshore petroleum installations, and routes for underwater cables and pipelines are important areas taken into consideration.

The Norwegian Coastal Administration participates in ICZM-processes according to PBA, assuring safe and efficient sea transport, and appropriate use of sea areas.

3 Legislation on ICZM

The Planning and Building Act of 27.June 2008 (PBA) is the main basis for Norwegian ICZM. The law turned into effect from 1.July 2009, overtaking the former PBA of 1985.

The planning part of PBA (part two, section 3 – 14) set the minimum criteria for the process, and have a high focus of participation from inhabitants, NGO's, governmental offices and agencies.

3.1 Planning preconditions

- The Central Government is with few exceptions the owner of all sea areas deeper than 2 meters.
- Planning of sea areas can be done in three dimensions, and different purposes can be given for sea bed, the water column and the surface. Planning purposes for sea areas are only to some degree exclusive.
- The Ministry of Environment is responsible for PBA. PBA is a law for societal planning and spatial planning, for making decisions at all levels, and for sustainable development and environment.

3.2 National and regional guidelines

A number of governmental documents include guidelines to ICZM. White papers form the different Ministries policies on how different sectors shall be safe guarded. On ICZM mainly The Ministry of Environment give guidelines, on their own or together with other ministries.

Two examples are:

- White paper no. 43 to the Storting (1998-99) Protection and use of the coastal zone. The relation between nature protection, fisheries and aquaculture (Ministry of Environment and Ministry of Fisheries and Coastal Affairs).
- White paper no. 34 to the Storting (2006-07) Norwegian climate policy.

The Central Government can also give national guidelines for ICZM (PBA section 6-2). This have been made for instance on climate and energy in ICZM (stated 4th September 2009).

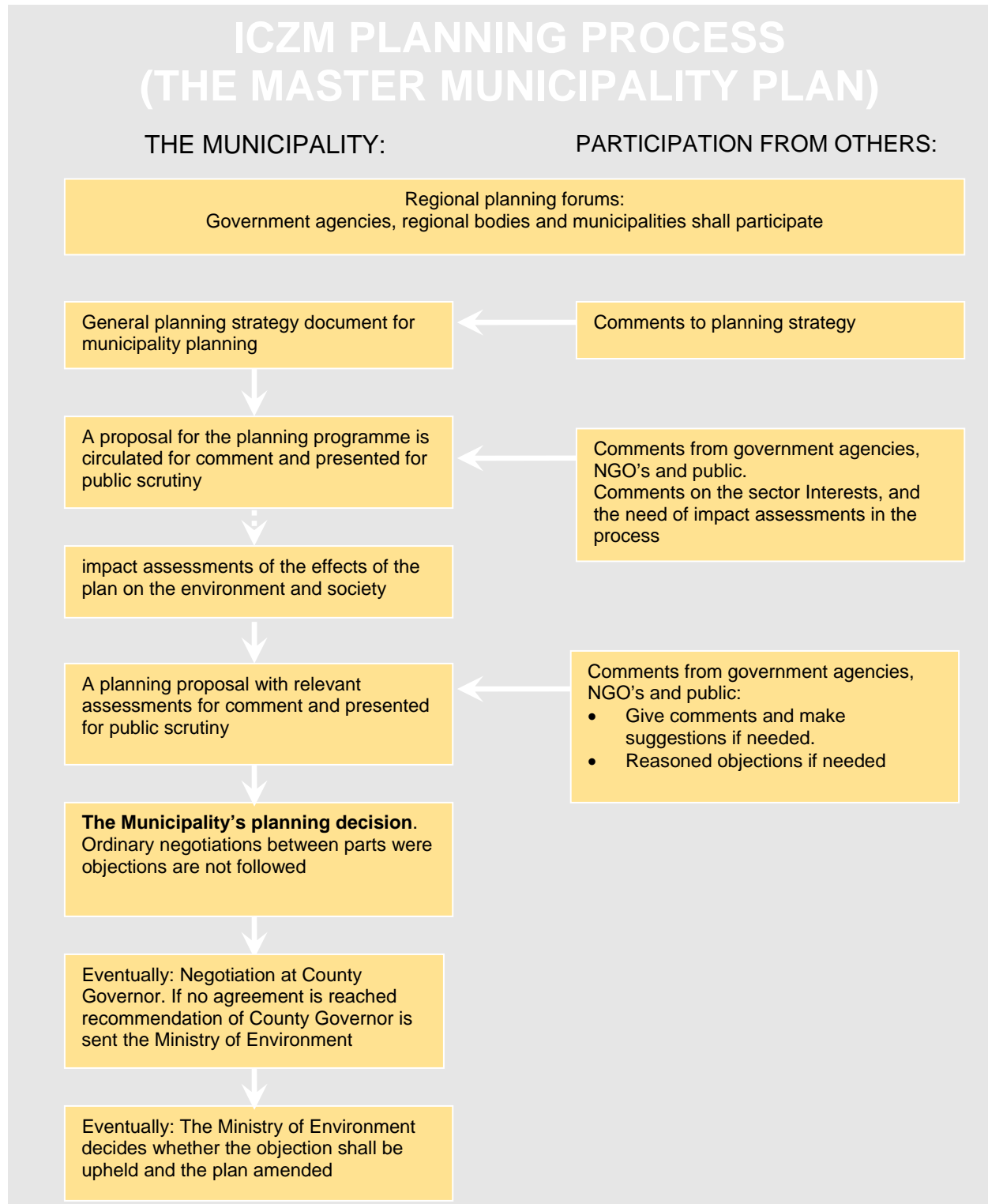


Fig. 1 Decision diagram illustrating the path ways in ICZM for a municipal master plan in Norway.

DSB (Directorate for Civil Protection and Emergency Planning) is the main agency responsible for coordination of information on climate changes, together with chart services, meteorological institutions, research institutions and others. DSB have given out reports on expected climate changes, based on the most relevant climate models (i.e. two reports: *Havnivåstigning*, *Estimater av framtidig havnivåstigning i norske kystkommuner*, and *Klima i Norge 2100*, see references).

3.3 The planning process – The master municipal plan

To illustrate the planning process, a master municipal plan is used. All municipalities shall have an overall municipal master plan that comprises a social element with an implementation element and a land-use element. The municipal master plan shall have an implementation element that indicates how the plan shall be followed up in the following four years or more, and shall be revised each year. (PBA section 11-1).

The local municipality is responsible for the integrated planning process. The process is illustrated in fig. 1. Municipalities shall cooperate where an intermunicipal plan is made. The County Council is leader of the planning process for regional plans, and Agencies under the Ministry of Environment will generally be leader of national, and to some part, regional plans (i.e. Ocean planning). All planning processes after PBA shall integrate relevant agencies and NGO's, and anyone who presents a planning proposal shall facilitate public participation (PBA section 5-1).

The regional planning forum (PBA section 5-3)

In every region there should be a regional planning forum. The planning forum shall identify central government, regional and municipal interests and seek to coordinate such interests in the processes of regional and municipal plans.

Central government and regional bodies and municipalities that are affected by the matter in question shall participate. Other representatives of affected interests may be invited to participate in meetings of the planning forum. The regional planning authority is responsible for the direction and secretariat of the planning forum. The forum is a place to represent and debate interests in ongoing plan processes.

Start up of planning process and planning programme

When planning work start, affected public bodies and other interested parties shall be notified of the objectives of and issues of importance for the planning work (PBA section 11-12).

A proposal for the planning programme shall be circulated for comment and presented for public scrutiny. The planning programme shall be determined by the municipal council.

Planning proposals and objections

Municipal master plans with guidelines or limits for future development shall contain a

separate risk assessment and description of the plan's effects on the environment and society (PBA section 11-13).

The planning proposal shall be publicly announced, and circulated for comments to all relevant national, regional and municipal authorities and other public bodies, private organisations and institutions that are affected by the proposal (PBA section 5-2).

Central government and regional authorities may make objections to proposals regarding the land-use element of the municipal master plan in issues that are of high regional or national importance. Other municipalities may make objections in respect of issues that are of high importance (PBA section 5-4). On which subjects the different parts can make objections are given in guidance to PBA section 5-4. Objections must be given before deadline of public scrutiny.

Approve of the municipal master plan and objections

The municipal council itself approves the municipal master plan, and the plan may not be appealed (PBA section 11-15).

If the municipality does not take account of objections, negotiations between the parties shall be undertaken. The Council Governor will after this undertake negotiations if necessary, and if there still is no agreement, the municipality shall send the plan and the objection, together with the recommendation of the negotiator (Council Governor), to the Ministry. The Ministry decides whether the objection shall be upheld and the plan amended. (PBA section 5-6).

Effect of the municipal master plan

The social element of the municipal master plan shall serve as the basis for the municipality's own activities and for the activities of the central government and regional authorities in the municipality. Coastal management based on sector laws, including PBA and HFA, shall follow regulations made in the municipal master plan (PBA section 11-3).

Zoning plans (PBA chapter 12)

A zoning plan is required for the implementation of major building and construction projects which have substantial effects on the environment and society (PBA section 12-1). The planning process for zoning plans is parallel to the process leading to a municipal master plan, and where an impact assessment is a major part (PBA section 4-2). However a private part can be responsible for most of the process. Coastal management based on sector laws, including PBA and HFA, shall also follow regulations made in the zoning plans (PBA section 8-2).

3.4 Planning purposes

Section 11-7 to 11-11 of PBA gives the possible planning objectives and regulations in a master municipality plan (For zoning plans more detailed planning objectives are given in section 12-5 to 12-7).

Together with specified land-use the municipality can give and show provisions to given “zones” according to PBA section 11-8:

- (a) Safety, noise and danger zones.
- (b) Zone requiring for special infrastructure.
- (c) Zone subject to special consideration for agriculture, reindeer husbandry, outdoor recreation, green structures, landscape or the protection of the natural or cultural environment.
- (d) Zone subject to a time-limited restriction until special decisions according to PBA or other laws are given.
- (e) Zone subject to requirements for joint planning for two or more properties
- (f) Zone where the current zoning plan shall continue to apply.

The possible planning sub-objectives for sea areas are given in PBA section 11-7 no. 6 (see Tab. 2), to be used separately or in combination:

- traffic,
- fairways,
- fishing,
- aquaculture,
- (drinking water),
- Nature, and
- outdoor recreation areas.

Provisions for sea areas may be made regarding use and protection of water surfaces, water columns and seabed (section 11-11 no. 3). This gives a possible three dimensional differentiation in objective at sea areas. A fairway at sea therefore may be combined with other purposes for the seabed and parts of the water column.

Provisions may be made to sea traffic (section 11-11 no. 6). In aquaculture areas, provisions can be made on which aquaculture species may be established (section 11-11 no. 7).

Relevant EU-legislation on ICZM is given in the common description on legislation for the participating regions in this project.

Land-use objectives (PBA section 11-7):

1. Buildings and installations.

Sub-objectives: Housing, holiday homes, city centre functions, shopping centres, shops, buildings for public or private services, recreation and tourism facilities, raw material extraction, commercial buildings, sports facilities, other types of installations, outdoor public areas, cemeteries and cremation gravesites.

2. Transport and communications installations and technical infrastructure.

Sub-objectives: Roads, railways, airports, ports, main bicycle networks, public transport networks public transport hubs, parking places, trench routes for technical infrastructure.

3. Green structures.

Sub-objectives: Nature areas, green corridors, recreation areas and parks.

4. The Norwegian Armed Forces

Sub-objectives: Various types of military objectives

5. Agricultural, nature and outdoor recreation objectives and reindeer husbandry.

Sub-objectives: (a) land for necessary projects for agriculture and reindeer husbandry and arm-related business activity based on the farm's resource base,
(b) land for scattered housing, holiday homes or commercial buildings, etc., see section 11-11, no. 2.

6. Use and conservation of the sea and river systems, with associated shore zones.

Sub-objectives: Traffic, shipping lanes, fishing, aquaculture, drinking water, nature and outdoor recreation areas, separately or in combination.

Tab. 2. Possible land-use objectives in a master municipal plan

3.5 Coastal Management, the Harbour and Fairway Act

All constructions at sea, also temporary, are subject to application for permit to the harbour and fairway authorities, according to the HFA chapter 4. This also includes use of sea areas and constructions on land which have implications for traffic at sea. The HFA regulates activity to ensure safety at sea. The responsibility is shared between the Norwegian Coastal Administration and the local municipalities.

For sea area out to the base line plus one nautical mile the municipalities are responsible authority (the municipality's sea area). The territory outside this border and areas for major fairways within the municipalities (see example fig. 3) are under the Norwegian Coastal Administration's authority. Authorization from The Norwegian Coastal Administration is also necessary for given constructions like fish farms and bridges (Regulation on measures of 3.12.2009 no. 1449), and when constructions are planned in national built fishing harbours and in areas with military interests (HFA section 28).

Coastal management according to the HFA can only open for activity in conflict with planned land-use (plans based on PBA) after dispensation given by the municipality (HFA section 32).

HFA together with The Pilot Law of 1989 regulate many of the governmental measures to safeguard navigation on the long Norwegian coastline, like navigation installations, ship monitoring, Vessel Traffic Services and piloting.

3.6 Ocean Planning

Ocean planning for open Sea outside jurisdiction of the EU Water Framework Directive (base line + 1 nautical mile) is performed by government agencies on a national level.

The Norwegian economic zone and the fishery zone around Svalbard have been divided in three for Ocean Planning purpose, and the Ministry of Environment is responsible for the planning processes.

For the Barents Sea and sea area off Lofoten a process was guided by the Norwegian Polar Institute, ending in the White paper no. 8 to the Storting (2005–2006) *Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands*.

For the Norwegian Sea the process was guided by the Directorate for Nature Management, ending in the White paper no. 37 to the Storting (2008–2009) *Integrated Management of the Marine Environment of the Norwegian Sea*.

For the North Sea, work on an integrated management document has been started recently, and the Climate and Pollution Agency shall guide the planning process.

Integrated Management plans for ocean areas are approved by the central government. Plans are based on a common factual basis on the environment and natural resources; on maritime transport; on petroleum activities; on fisheries activities; and on commercial activities and social conditions in the counties bordering the ocean. The common factual basis is worked out by the relevant governmental agencies, and major contributors are:

- The Climate and Pollution Agency
- The Directorate for Nature Management

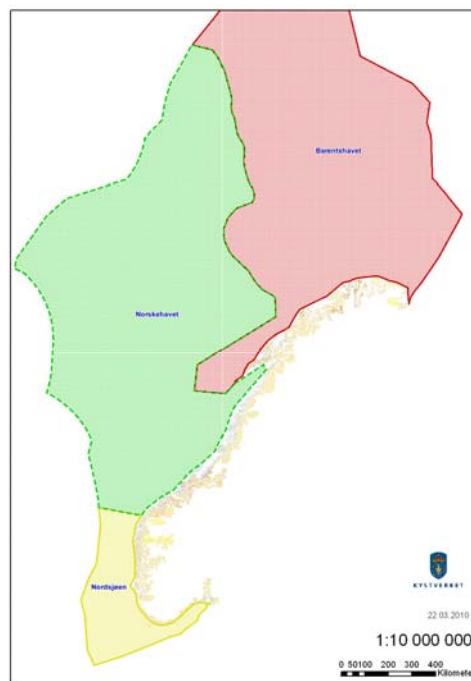


Fig. 2. Ocean Planning areas for Norwegian EEZ and fishery zones: the Barents Sea (red), the Norwegian Sea (green), and the North Sea (yellow)

- The Directorate of Fisheries
- The Institute of Marine Research
- The Ministry of Petroleum and Energy
- The Norwegian Armed Forces
- The Norwegian Coastal Administration
- The Norwegian Maritime Directorate
- The Norwegian Petroleum Directorate.
- The Norwegian Radiation Protection Authority
- The Norwegian Water Resources and Energy Directorate.
- The Petroleum Safety Authority

The common factual basis is used for impact assessments: For the Norwegian Sea impact assessments were conducted in 2007–2008 on fisheries, petroleum activities and maritime transport, and impacts of external pressures such as long-range transboundary pollution, emissions from onshore activities, climate change, ocean acidification and the introduction of alien species.

The new Ocean Energy Law of 2010, put in to force 1.7.2010, will regulate licenses to use open sea, including the continental shelf and eventually the EEZ (Exclusive Economic Zone) for power plants, for instance marine wind mills and wave power plants. The law is governed by the Ministry of Petroleum and Energy.

4 Best practises for integrated coastal zone planning

4.1 Kristiansand municipal master plan

Kristiansand municipality is chosen as best practise case because of the relevance of harbours and fairways in Kristiansand municipality, and the process of the master municipality plan is now close to a planning proposal adjusted to the regulations in the new PBA of 2008.

Kristiansand is the administrative, business and cultural capital of Southern Norway. The Kristiansand region including the municipalities Søgne, Songdalen, Iveland, Vennesla, Birkenes, Lillesand and Kristiansand have a population of 120.000, whereof 79.000 live in Kristiansand (2008). Kristiansand is one of Norway's busiest shipping ports, with international ferries and supply of personnel, equipment and services to the North Sea oil industry.

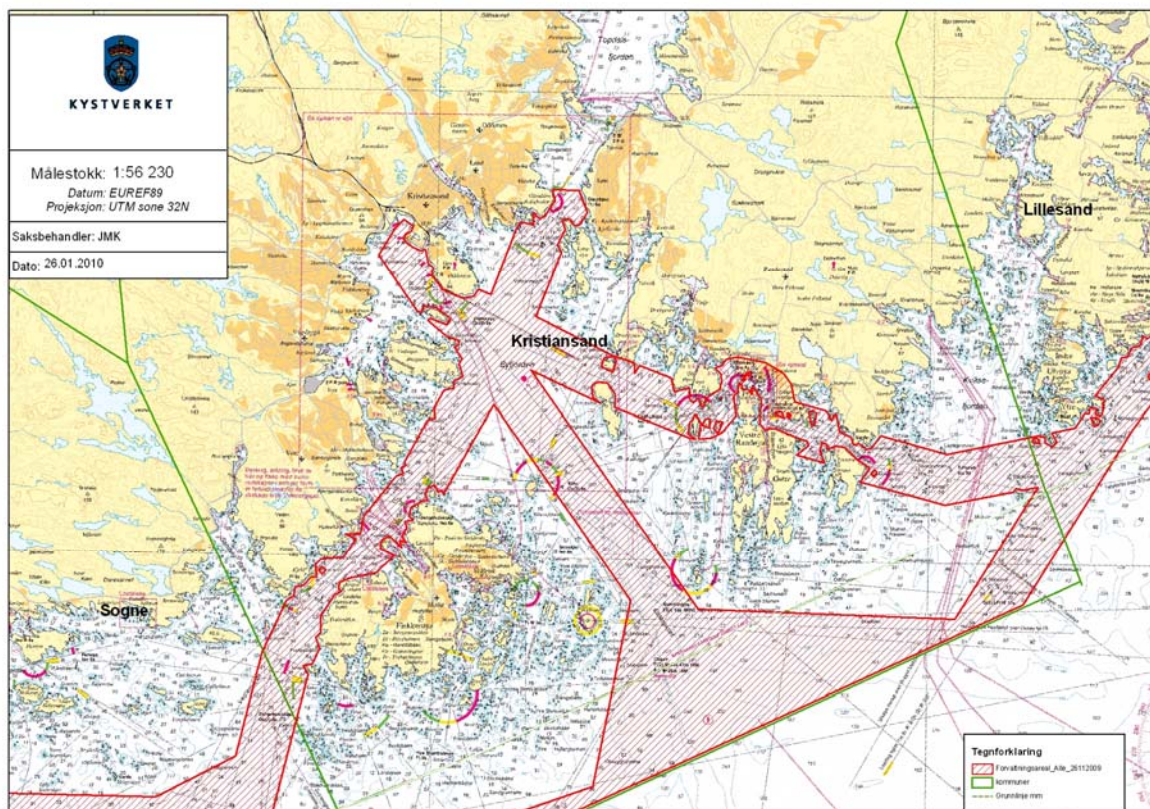


Fig. 3 Coastal part of Kristiansand municipality. The municipality is responsible for coastal management based on the Harbour and Fairway Act for the municipality's sea area out to base line plus 1 nautical mile (within the green border). The Norwegian Coastal Administration is responsible authority for Norwegian territory outside this border and for important fairways (red areas).

Kristiansand is close to completing the proposal of a new municipal master plan. Large part of the work has been dedicated to land use issues closely related to the sea. The coastal management in this part of Norway may be described more or less as a “war zone” – type of conflict. For instance:

- The ferries between Kristiansand and Hirtshals create large waves irritating people bathing nearby and to some degree represent a danger.
- All kinds of boat traffic are crossing the fairways, with peak periods mid summer. However, both ferry traffic and pleasure craft traffic are of unlimited importance, and we have to find ways of ensuring a parallel way of living – and growing.
- Growing need of boat harbours, mooring rights etc, and difficult to find the balance between the value of a piece of undisturbed nature and the benefit of a new boat harbour.
- The urban area with tendency of sprawling into neighbouring summer huts on the coast converting these buildings into family dwellings. The growing negative

consequences are less safe traffic conditions to and from school, expensive handling of waste, increasing use of the sea etc.

- Locations in the fjord of Ålefjær are of exceptional importance as spawn- and growing up areas for the coastal cod stock.
- Locations for aquaculture for shell fish are in conflict with coastal outdoor recreational activity. Because of the high recreational activity, permit for new aquaculture facilities in Kristiansand municipality should not be given.
- Removal of the port functions in central Kristiansand. Today, general cargo, containers and ferries are given the same location, next to each other. General cargo shall in the future be handled at new harbour out of city centre, which will open for urban renewal. Ferries will remain in city centre, and container harbour is moved closer to E39. Kristiansand is in the midst of this formidable restructuring
- Need for the railway into container harbour.

Organisation

The master municipality plan is approved finally by the City Council. The presidency (formannskapet) is a political steering committee for the planning work. Main committees have status as a political reference groups. The Urban Development Board has a special role as a political reference for the land-use element of the municipal master plan. The administrative work with the municipal master plan is organized in projects.

Roles in the project organization are:

- **Steering group** made up of chief committee (rådmannsutvalget). The steering group shall ensure progress and is responsible for central, overriding decisions.
- **The project group** has professional responsibility for part studies and drafts of plan proposals for the steering group. The project group is cross-sectoral and complex consisting of professionals from the administration of the municipality (the cultural sector, health and social services sector and the technical sector). The project group is headed by the plan advisor in the municipality.
- **Resource Groups** to ensure the necessary technical expertise and participation from the organization in relation to the master municipality plan, the municipality plan for Kvadraturen and The Western Port and the regional planning processes. The resource groups consist of key professionals in the sectors and / or external parties / consultants. The groups provide input on the order and mandate from the project group.

Resource Groups:

- A municipality in development
- Living conditions and quality of life
- Societal safety and risk and vulnerability assessments
- Housing

- Business
- Transport and roads
- Blue-green structure, the coastal zone and sea areas, green areas and rivers
- The plan chart giving land-use objects and regulations

Involvement

Early involvement of municipal politicians is facilitated. Especially the presidency must be involved, as a political steering committee, but also by activating the other political committees in internal processes and in meetings with organizations and citizens. Public authorities and bodies should be informed and involved in the planning of milestones. Open theme discussion meetings are arranged to increase public participation.

Local reference groups:

- Youth Committee (and involvement through children schools)
- The Council for Disabled
- Sports Council
- Immigrant Council
- Elderly Council
- Climate Forum (made up of organizations, businesses and government agencies working on sustainability)
- Team for Emergency Response
- Children and Young People Committee.

The plan proposal is now available on the municipality's web-pages:

<http://www.kristiansand.kommune.no/planer-prosjekter/Kommuneplan>

4.2 Bottlenecks and critical issues in the ICZM process

The overall aim of BLAST is to improve ICZM and maritime safety in a broad sense, in the context of climate change. Bottlenecks and critical issues have been pointed out by interviews of Coastal Zone Managers from Norwegian Coastal Administration (regional level) and Kristiansand municipality.

4.2.1 Adaptation to climate change

Rising sea level and increased wave-heights

Most of the Norwegian population live and work near the coast, and most towns are placed near the seashore. This make an eventually increase in sea level of most importance when the municipality and other governmental institutions shall plan activities and building of houses and harbours.

DSB (2009) have given expected sea levels and storm tide for 100-year flood in 2100 based on projection of climate change. For Kristiansand municipality 208 cm above the current normal water level is expected as 100 year-flood in 2010 (uncertainty +35cm/-20cm).

Kristiansand municipality therefore have set a minimum cote of 3 meters above sea level for living, working and public rooms in new buildings to existing development areas. In new development areas minimum cote is 5 meters, but 3 meters if the surrounding areas are allocated for storm surge protection.

Norwegian Coastal Administration are responsible for building new fishing harbours, and repairing after damages on moles and navigational installations. In both cases changes in climate are taken into account.

The 50-year storm or 100-year storm are used for dimensioning of constructions, depending on expected life time of construction. Climate adaption give different responses for different constructions and different parts of the coast. Cost/benefit are also considered before choice of construction and dimensioning.

Examples:

- Repair of Lista mole recently, near Kristiansand. Construction was reinforced, and height of mole protection was increased with 50 cm because of expected climate changes in the next 50 years.
- In Andenes, in north of Norway block weight was increased to take into account increased wave heights because of climate change, and more open sea in the Arctic. However, estimates of changes in wave heights seem very uncertain, and climate models do not give obvious tendencies.
- In Oslofjorden, for instance, ice-drift is a major power on navigational installations, giving need of strong constructions. Climate changes might reduce this danger, and lower cost of constructions. However this is possible changes on a very long term.

Good quality of estimates for expected climate changes are important to make the best decisions in all these cases, including rise of sea level and changes in wind and waves. Information must be available for the entire coast.

Visualisation tools to guide in ICZM, must also include information on which climate models and scenarios the data are based to be able to compare different data, which have

Floods and increase in precipitation

Higher sea level will increase flood expectations, but also a suggested increase of 20 % precipitation for Kristiansand municipality in 2100 will contribute to a higher risk of flooding along rivers (Hanssen-Bauer *et al.*, 2009).

In Kristiansand the municipality plan take a 200-year flood into account to say which areas should not be used for new buildings. Data on flooding in Mosby-area are from 2005 without adjustments for climate change.

If expected climate changes increase, cost of adaptation for Kristiansand municipality will also increase.

It's important that information on flood-scenarios also give details on which climate models and scenarios they are based on.

Other changes

An increase in temperature of 2.3 – 4.8°C as assumed for Kristiansand commune (Hanssen-Bauer *et al.*, 2009) will of course have major impact on vegetation, nature and way of living. Surface temperature in the North Sea can increase 1.7 ° (year average), and the increase seems to be strongest in shallow areas south and east in the North Sea. Together with accelerating increase in acidity in the North Sea this will obviously give changes in the maritime ecosystem. These changes are however, more difficult to plan for in ICZM.

GIS-tools

Kristiansand municipality today use GIS/LINE as major GIS-tool in ICZM. Some data are also available on their web-viewer (http://webhotel2.gisline.no/gislinewebinnsyn_kps)

The Norwegian Coastal Administration use the web-application kystinfo (<http://kart.kystverket.no>) together with other GIS-supporting tools for planning fairway and harbour constructions.

It's important that tools to visualize climate changes and for decision support can work together with existing applications. Major themes to visualize climate changes should as a minimum be available as WMS-services for these applications.

Involvement

To ensure public participation in the planning processes is a major subject, and of most importance. Visualisation of expected climate changes is an important tool, which can make information more easily available and motivate for public participation.

4.2.2 Other critical issues

Planning objectives for sea areas

PBA set the possible planning objectives for sea areas (PBA section 11-7 no.6), with provisions possible (PBA section 11-11 no. 3, 6 and 7). Given objectives are *traffic, fairway, fishing, aquaculture, drinking water, nature and outdoor recreation areas*, separately or in combination.

For many of the activities at sea planning objectives are not obvious, i.e. harbour areas, anchorage places, areas for use to anchorage petroleum installations, harbour for pleasure crafts, sea areas for industrial use, landing places for seaplanes, routes for underwater cables, and for placement of energy producing installations, like wind mills. Guidelines should be given for best practice.

Planning of fairways and harbours

Today most master municipal plans have the fairways given as lines in the land-use plans (also for Kristiansand municipality). This only indicates the interest near these lines, and sea area is not given for the fairways. The new PBA give several possible ways to plan fairways in the land-use element of the master municipality plan, and guidelines should be given.

An interesting option is to define the main fairway-area to be used by the sea traffic as fairway (PBA section 11-7 no. 6) in the municipality plan. This seems most relevant for fairways to the major harbours in Kristiansand (western harbour and Kongsgård), and less necessary for the other fairways. Safety zones with building restrictions should also be considered for sea-area and sea-shore nearby major fairways, where waves and swell could represent a danger (PBA section 11-8 a).

Traffic harbours for shipping of cargo and passengers have implications for land-use of surroundings. On the land-side safe and efficient transport corridors should be given for vehicles and railway. On the sea-side areas for maneuvering, anchoring, and safety zones are important. Harbour activity also implies noise from vehicles, ships and handling of cargo.

Planning of aquaculture

Aquaculture is a big industry in Norwegian Coastal areas. PBA gives the objective “aquaculture” for planning of sea areas, however municipalities use this in different ways. Planned areas for aquaculture can include:

- 1) The surface installation,
- 2) The surface installation and the restricted area of traffic,
- 3) The surface installation, the restricted area of traffic, and restricted area of fishing,

4) Total area including moorings (moorings up to several km long).

Guidelines should be given for best practice.

4.3 Data needed for ICZM

High quality geodata is a necessity for ICZM, both for land and sea areas. Norway Digital (http://www.statkart.no/Norge_digitalt/Engelsk/About_Norway_Digital) is a cooperation between the Norwegian Mapping Authority and governmental institutions with technology to share all relevant information with those participating. Norway Digital is working to make geographical land- and planning-data available in municipalities and counties and thus contributing to a better plan process. The contents of Norway Digital are based on the needs from environmental management and needs for society planning of municipalities and counties. A wide range of sector authorities at national, regional, and municipality levels, are responsible for keeping this information available through Norway Digital (see <http://www.geonorge.no>).

4.3.1 Relevant data for ICZM

- Basic map data
 - Including high scale data, land property register, aerial and satellite photo, bathymetric data, etc.
- Thematic data
 - Population
 - Pollution
 - Cultural heritage
 - Coastal data / fisheries. Including fairways and harbours, anchorage, routes for underwater cables and pipelines, important areas for fisheries, aquaculture, and sea traffic data based on data from AIS (Automatic Identification System) and SafeSeaNet.
 - Agriculture
 - Landscape
 - Nature
 - Reindeer
 - Recreation
 - Civil Protection. Including climate adaptation.
 - Water Supply
 - Transport
 - Plan purpose data (from approved land-use plans).

Relevant data for ICZM are partly given in todays web-based tools:

- <http://www.senorge.no> : Climate data (also good information in English!)

- <http://kart.kystverket.no> : Data especially set up for management according to the Harbour and Fairway Act.
- http://webhotel2.gisline.no/gislinewebinnsyn_kps/: Data for illustrating situation in Kristiansand municipality
- <http://www.temakart-rogaland.no/>: Data for use in ICZM in Rogaland county.
- <http://arcus.nve.no/website/nve/viewer.htm> With licenses of wind power on shore and off shore, etc.

4.3.2 Bathymetry

Bathymetry-data have different quality along the Norwegian coast. The access to detailed bathymetry is also limited because of regulations for national security. Extra effort is necessary to get such data, and then only for smaller areas, when a special reason is given. Good bathymetric data, and eventually new bathymetric measurements, will contribute to better plans for marine areas. These data should also include nature of seabed. When Norwegian Coastal Administration plan projects in fairways and harbours, we need very detailed bathymetry for planning and evaluation.

For modelling of rise in sea level its obvious that bathymetric data and altitude data on land must be combined to show changes both in marine and terrestrial environment.

Climate Adaptation

Climate change data must always be given with reference to which climate models and scenarios are used to predict the future climate, Data must of course also show the year/period the climate have been predicted for (example: <http://www.senorge.no>).

- Sea level rise. Storm high water.
- Change in Significant Wave height (SWH)
- Change in precipitation. Year and seasonal
- Change in temperature. Year and seasonal
- Change in sea temperature. Year and seasonal

Climate Mitigation

Mapping of areas prone to flooding, wind, landslides and sea-level rise, as a result of climate should be basis for good master municipality plans.

Mapping of areas of society exposed for health consequences, including drinking water, and drainage conditions are necessary Risk zones should be worked out for coastal areas, so that land-use plans can facilitate solutions that reduce exposure.

Mapping of possible areas for use of renewable energy production are also of high importance, both for coastal areas and the more open ocean areas outside the municipality's sea area. The Norwegian Water Resources and Energy Directorate has

started a project “HAVVIND” for pointing out good locations for future wind power at sea, both territorial waters and EEZ (Exclusive Economic Zone). The project includes collecting data on most relevant interests at sea, and the project goes until October 2010.

The most relevant data:

- Meteorological information
- Bathymetry
- Environmental and protected areas
- Ship traffic
- Fisheries
- Petroleum activity
- Submarine cables and pipelines, existing and planned
- Military
- Aerial traffic
- Recreational activity
- Cultural heritage

5 References

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Norwegian Hydrographic Service • Aalborg University, Denmark • Agency for Maritime and Coastal Services, Belgium • Danish Coastal Authority • Federal Maritime & Hydrographic Agency, Germany • Hjørring Municipality, Denmark • Jeppesen GmbH, Germany • Local Government, Denmark • Mälardalen University, Sweden • National Space Institute, Denmark • National Survey and Cadastre, Denmark • Natural Environment Research Council, United Kingdom • Norwegian Coastal Administration • Seazone Solutions Limited, United Kingdom • T-Kartor AB, Sweden • TU Delft, the Netherlands • UK Hydrographic Office