

Quality of Coastal Boundary Lines in the Cadastral Map – Increased Use of the Cadastral Map Requires Quality Improvements

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SUMMARY

In Denmark, the coastline is constantly changing because of natural growth and withdrawal. The Cadastre contains more than 7.300 km of coastal boundary lines and many of them do not match the actual coastline. This is a problem for users of cadastral data.

Only licensed land surveyors can change coastal boundary lines in the cadastral map. However, it requires a request from the landowner and a signed declaration before a change can be registered. Further, the landowner has to pay all the costs related to the land surveyors work.

The Danish Geodata Agency launched a pilot project in 2018 to provide useful information about improving quality of coastal boundary lines in the cadastral map. One of the objectives was to investigate whether owners of coastal properties were willing to have the cadastral registration corrected if it was free of charge for the owners.

The project included 41.1 km of coastline with 172 real properties. It was not possible to get all of them involved in the project but the landowners of 135 properties (78 percent) accepted to participate. Compared to the cadastral register a total of 60.3 hectare was identified as growth area and 386.9 hectare as withdrawal area.

A conclusion of the test project was, that it is necessary to make changes in the act of subdivision if all coastal boundary lines are going to be corrected without accept from the landowners. Furthermore, the aim is to introduce an administrative coastline in the cadastral map to ensure a better match to the actual coastline.

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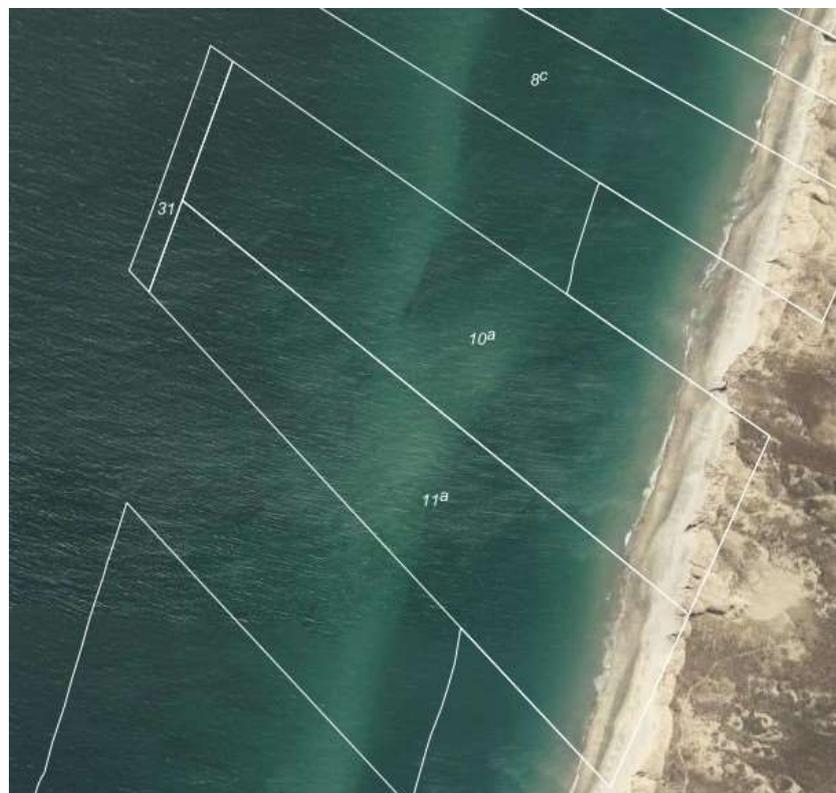
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1. BACKGROUND / INTRODUCTION

Denmark is a small country of approximately 43.000 square kilometers and more than 7.300 km coastline. The coastline is dynamic and constantly changing caused by natural growth and withdrawal, which affects boundaries and sizes of properties. The reason of that is the definition of a property boundary towards the sea as the highest daily water level line.

The coastal zone contains many different interests and the precise location of the boundaries along the coast is an important information in various land management tasks as well as in a number of geographical analysis calculations. An improved and updated coastline in the cadastral map will support a more correct and reliable use in broader non-cadastral contexts. An example is a new model for property assessment, which requires precise and current geographical data. Another example is handling of building application, where the registered size of a property is an element in the calculations of plot ratio.

The quality of coastal boundary lines in the cadastral map compared to the current conditions are very varying (see figure 1). The boundary lines are registered at different times, with some being registered more than hundred years ago and then digitized from cadastral maps on paper while others are newly registered. However, the coastal line is also changing with varying paces. Overall, the users of cadastral data request an updated coastline in the cadastral map.



*Figure 1: A view from the cadastral map with orthophoto as background
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2. LEGISLATION AND PRACTICE

In Denmark, the definition of a property boundary towards the sea is the line of the highest water level under normal weather conditions (high-tide line) (see figure 2). Therefore, this kind of boundaries are dynamic (labile) and constantly changing. However, it is optional for the property owner to decide, whether the registered boundaries in the Cadastre are going to be changed or not.

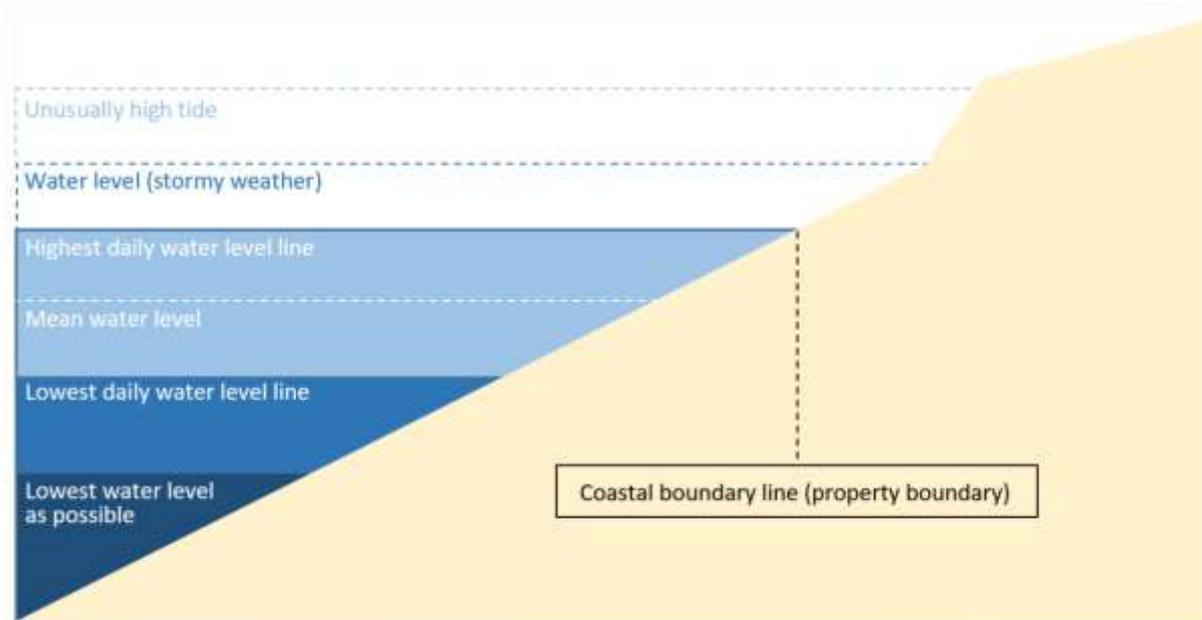


Figure 2: Illustration of the property boundary line towards the sea. [Inspired by Kruse, 1952]

Registration of new or changed boundaries is cadastral work, which requires a licensed land surveyor in practice. The land surveyor prepares and sends a digital cadastral case with necessary documents, documentation and data for updating the Cadastre to The Danish Geodata Agency. After performing checks of contents in the cadastral case, the requested cadastral changes are registered in the Cadastre.

According to the Subdivision Act and the Statutory Order on cadastral work, change of registered boundaries due to natural coastal growth or withdrawal may be registered through rectification of boundaries. This requires a signed declaration from the owner of the coastal property with approval of the new boundaries. Furthermore, the property owner has to declare that the new boundaries are due to natural changes of the coastline.

In case of changing registered boundaries caused by natural coastal growth, the adjacent properties have to be involved because it is necessary to determine new boundaries between the coastal properties in the growth area. Generally, the owner of an adjacent property also have to approve the new boundaries in a growth area. However, The Danish Geodata Agency

can deviate from this requirement in case it is impossible for the land surveyor to achieve the approval. In this kind of situation, the boundary line between the properties must be set in accordance with the principle of proximity. Otherwise, determination of the boundary line in the growth area can be done by agreement between the owners.

According to the order on cadastral work determination of a new boundary must be set by measurements in the field. However, since 2018 it has been possible for land surveyors to use orthophotos to determine the coastal boundary line. The land surveyor decide in each specific situation which of these two methods there are going to be used to determine the highest daily water level line. However, the measurement sheet must contain boundary points with coordinates from the coastal boundary line.

3. PILOT PROJECT

The Danish Geodata Agency launched a pilot project in 2018 to provide useful information about improving quality of coastal boundary lines in the cadastral map. One of the objectives was to investigate whether owners of coastal properties were willing to have the cadastral registration corrected if it was free of charge for the owners. Typically, the cost to a licensed land surveyor to change registered boundaries towards the sea due to natural coastal growth or withdrawal amounts to € 670-1340. The average cost for each participating parcel in the pilot project was calculated to about € 400 or € 1500 per kilometer coastline.

Another objective with the pilot project was to identify any challenges or potentials for improvements with the legislation according to achieve better quality in the Cadastre.

The Danish Geodata Agency established a collaboration with two municipalities in North Jutland in order to identify and select relevant parts of the coastline for the project. Relevant parts of the coastline was large areas where the coastline in the cadastral map did not have a good correlation with the actual conditions because of natural changes. The result was seven different areas, which included 41.1 km of coastline and 172 real properties.

Three land surveyor companies were requested to change the registered coastal boundary lines to the actual property boundary if possible. The Danish Geodata Agency provided information about the pilot project to the property owners before the land surveyors started their work. The aim was to achieve the highest participation rate as possible.

An overview of outcome from the pilot project is shown in Table 1.

	Total	Percent
Number of test areas	7	
Number of real properties within a test area	172	
Number of parcels within a test area	194	
Total length of test areas (km)	41,1	
Correspondence with property owners		
- Participating properties	135	78 %
- No response	23	13 %
- Do not want to participate	7	5 %
- Changed opinion (not participating)	8	4 %
Number of participating parcels	153	79 %
- Parcels with natural coastal withdrawal	86	56 %
- Parcels with natural coastal growth	46	30 %
- Parcels with natural coastal withdrawal and growth	21	14 %
Principle for determination of new boundary lines between properties in coastal growth areas		
- Extension of existing boundary line	49	82 %
- The principle of proximity	11	18 %
Total size of area registered as:		
- Natural coastal growth (hectare)	60,3	13 %
- Natural coastal withdrawal (hectare)	386,9	87 %
Method of measurement (parcels)		
- GPS/GNSS	109	71 %
- Orthophoto	44	29 %

Table 1: Some results from the pilot project.

3.1 Declaration from property owner

Declarations signed by the owners of the properties are mandatory in the matter of changing registered boundaries through rectification of boundaries. Therefore, obtaining correct declarations are necessary and crucial for the land surveyor to complete a cadastral case.

The land surveyors in the pilot project experienced, that about 60 percent of their project time were spend on contact with the property owners. Especially lack of returning declarations and incorrect declarations were the reason of that. This also included properties with special ownership compositions, e.g. properties owned by: a company, an association, a community of other property owners or properties without an existing owner. An example from the pilot project is a common area owned by 24 different properties. Rectification of the coastal boundary line for this property would require a declaration from every single owner.

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The total participation rate in the pilot project was 78 percent of the possible coastal properties (see figure 3).

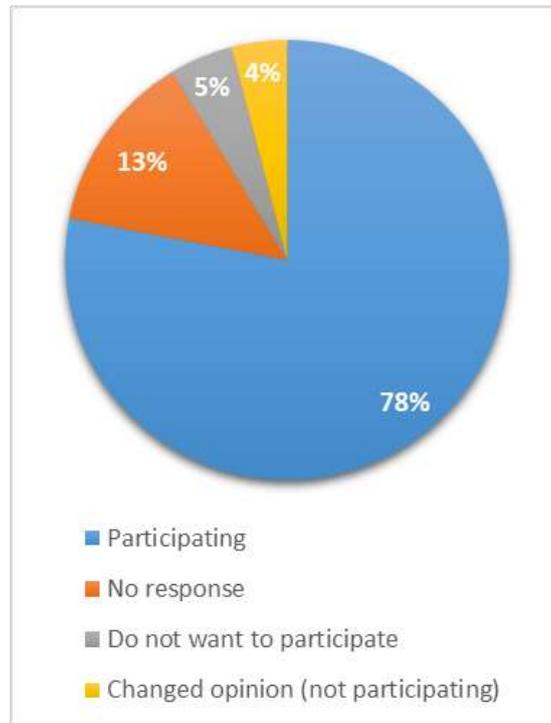


Figure 3: Participating rates in the pilot project.

Even though the change of coastal boundaries were without any costs for the participants, it was not possible to include all the properties in the project areas. There was no response from 13 percent of the property owners. A fact is that some of the owners and properties were non-existing as the properties for many years has been under waters. However, it is also interesting to explore why 9 percent have chosen not to participate. The following reasons from property owners were identified:

- Concern about losing the possibility to lease out hunting right if the registered size of the property was going to be less than 5 hectare,
- Disagreement among owners of a property (4 out of 7 owners of the same property did not want to sign the declaration),
- Concern about property tax due to the property size has increased,
- Difficult to return signed declaration by letter or to sign it digitally (expressed by an elderly man),
- Meaningless to participate since the coastal line is changing again,
- Concern about a new beach protection zone if the registered coastal boundary line is changed,
- The board of an association did not have the authority to sign the declaration,
- Ownership of a property was not registered in the Land Register

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Possible solutions

Based on the results from the pilot project, the Danish Geodata Agency assumes that a nationwide rectification of all coastal boundaries, due to natural changes, will not take place in accordance with the applicable rules. This is a fact, even though registration of the cadastral changes are without any costs for the property owners. Furthermore, expenses for the state would be enormous for a nationwide solution.

Considerations about a possible solution is to introduce administrative and technical changes of registered coastal boundary lines made by the cadastral authority and without declarations from the affected property owners. In this way, it would be possible to achieve a better match between the coastal boundary lines in the cadastral map and the actual coastline, because it no longer would be the individual owner who decides, whether the registered boundaries are going to be corrected or not. However, it requires a legal basis in the Subdivision Act to make this possible and data to determine an administrative coastline.

The Danish Geodata Agency is continuing to work on this as a possible solution.

3.2 Determination of the coastal boundary line

Determination of the coastal boundary line as the highest daily water level line can be affected by uncertainty. First, the line can be difficult for the land surveyor to define with high accuracy in the field. Secondly, determination of the coastal boundary line will probably cause different results depending on the used method and the current situation at the time of the measurement. As a result, the quality of coastal boundary lines in the cadastral map will always be of varying accuracy. In addition, the land surveyors from the pilot project experienced, that the definition of property boundary towards the sea was difficult to understand among the property owners.

Introduction of an administrative coastline in the cadastral map raises a number of questions. Would it be possible to determine this administrative coastline based on the existing definition of boundaries towards the sea? Alternatively, would it be necessary to look into another definition of the coastal boundary line? And how often is this administrative coastline going to be updated?

A special situation occurs in areas with natural coastal growth because it is necessary to determine new administrative boundary lines between the coastal properties. A possible solution is to extend the existing boundary lines as straight lines until they meet with the administrative coastline. Another solution is to determine the boundary lines in accordance with the principle of proximity.

Possible solutions

The questions raised above are still unresolved. However, the Danish Geodata Agency is currently analyzing these complex issues to obtain the best solutions as possible.

4. CONCLUSION

An important purpose with the applicable rules is to ensure property rights in the best possible way. However, the broad use of the cadastral map in many different contexts calls for quality improvements. The pilot project was seeking for possible solutions to serve both purposes.

The results of the pilot project demonstrate that it is impossible to change all coastal boundary lines in the cadastral map through rectification of boundaries, even though it was free of charge for the property owners. In this context, declarations from the property owners were crucial to improve the quality of the coastal boundary lines in the cadastral map.

There seems to be no quick shortcuts to achieve a nationwide quality improvement of the coastal boundary lines in the cadastral map. A possible solution is to introduce an administrative coastline, which can be determined without declarations from the property owners. However, this requires a legal basis in the Subdivision Act to make this possible and data to determine an administrative coastline.

The Danish Geodata Agency is continuing the work to obtain good solutions in this matter.

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BIOGRAPHICAL NOTES

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