

Emerging conflict in collaborative mapping: Towards a deeper understanding?

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Abstract

In spatial planning and environmental management, maps are found very helpful in many situations, but in other situations they may also deepen conflicts or be ignored. This paper addresses the question what explains such phenomena, with particular emphasis on, and reference to, collaborative policymaking settings in the Netherlands.

We have elaborated the concept of 'frames' and 'framing' to structure and analyze the function of maps in the context of deliberative policymaking. With help of discourse analysis, a method adopted from the policy sciences, we have observed ongoing multi-actor processes and focused on discussions around maps in several case-studies. From the observations of both the maps themselves and the discussions and actions with the maps, we have interpreted the meaning and frames represented 'in' the map images, as well as the various perspectives of actors 'on' the collaborative use of the map. We have

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conceptualized three fundamentally different perspectives or frames on the function of maps in the decision-making process. The cross-frame debate over maps is illustrated with the recollection of one particular map-making example. We conclude that the conflicts observed in a number of case studies can be adequately explained with help of the three identified frames, and provide some recommendations for the profession of mapping.

Key-words: frames, framing, mapping, participatory GIS, map conflicts, collaborative policy making, land use planning.

1. Introduction: Maps source of conflict in collaborative policymaking

Maps and Geographic Information Systems (GIS) have been described as potentially very powerful tool for planners and decision-makers (amongst others Bertin, 1981; MacEachren, 1995; Stillwell et al., 1999; Longley et. al., 2001; Geertman, 2002; Nature editorial, 2006). While large, comprehensive and complex planning and decision support systems were developed during the 1980s, nowadays models must be flexible, modular, contemporary and easy to use in group settings (Geertman, 2002; Geertman and Stillwell, 2003; Riet, 2003; Metzke and Saris, 2004). It sounds as an ideal way of policymaking to let multiple actors collaboratively use GIS and produce policy maps in a participatory way, but in practice, often the maps under study are source of conflict (SPESP Infographic's Group, 2000; Faludi and Waterhout, 2002; Rambaldi et al., 2002; Walker, 2003).

Our drive is to understand why and how maps become subject of debate in a deliberative policymaking setting, and to identify ways how map-makers and map users can deal with such circumstances. In particular, we have wondered how maps sometimes seem to deepen conflict and fuel controversy, while in other but similar situations they are seen as helpful aids for decision-making.

To this end, we have explored three sets of literature. First, we note that most of the research concerning the use of GIS to support decision-making has been about GIS *development* rather than about GIS *use*, 'without a strong theoretical link between the two' (Jankowski and Nyerges, 2001, p. 263). An exception might be the niche in cartography where the social constructivist approach to mapping, also called critical GIS, seems a recurring theme since Harley's "Deconstructing the Map" (Harley, 1989a and 1989b; Pickles, 1995; Harvey, 2000; Brown and Laurier, 2005; Sheppard, 2005; Harvey et al., 2005; Chrisman, 2005; Schuurman, 2005; Duncan and Lach, 2006; Crumplin, 2007).

But in our view, this area seems to be more dedicated to the production of map- and GIS information in the social environment of the 'GIS-room' than about the use of it for regional policymaking and planning.

Second, the recent developments in theory-building labelled as Participatory Geographic Information Systems (PGIS) or collaborative GIS represent an increased interest in the socio-technical nexus between maps (GIS) and collaborative policymaking, and a drive to improve the knowledge about and utilization of maps (GIS) for collaborative policymaking (see for instance Craig et al., 2002; Koti and Weiner, 2006; Rambaldi et al., 2006). This paper builds further on this stream in theory, explicitly taking up the concept of frames for its potential to bridge the socio-technical boundary between disciplinary fields of GIS and the policy sciences.

Third, we have explored a broader set of literature, notably in the field of policy analysis, to find theories and models that could be applicable to the field of map making. Part of the literature concentrates on conflicts of interests, often win-lose situations. Game theory, for example, theorizes about win- and loose configurations between actors, and does explain NIMBY-behavior ('Not In My Back Yard') in spatial planning as a conflict of interests. But it does not explain the emergence of conflict among (professional) map-makers and map users.

A theory that offers a potential explanation of map conflicts beyond the realm of conflicts of interest is the theory about frames and framing. Taking this theory as starting point, we have analyzed the actual *use* of maps in the policymaking process of several cases. (When we use the term maps, we include both spatial information incorporated in GIS and other -hand drawn- maps.) We have adopted the working hypothesis that stubborn conflicts over maps can be explained as frame conflicts, and that from this view we can explain conflicting actor-behavior over the maps as well. From a collection of cases

(Carton, 2005), we have analyzed two cases in-depth, as part of a PhD research project (Carton, 2007). The cases were situated in the field of regional spatial planning and water management in the Netherlands.

In this paper, after explaining the context, our interpretation of the ‘frame’ concept, and how it relates to map use, we elaborate three archetypical frames on the use of maps, and present an illustrative example of the practices of map-making and map use that we studied. We conclude with a brief discussion of the relevance of the theory of frames to deal with emerging mapping conflicts, and add some recommendations for practice.

2. Participatory policymaking and the use of maps

The instances of map use referred to in this paper are cases of participatory policymaking in the Netherlands. Policymaking differs from operational or executable type settings in that the problem is vaguely described and disputed, the scenarios are uncertain and the various goals and objectives are probably irreconcilable, where the policymakers face a variety of ambitions while possessing limited resources. In Dutch spatial planning, nowadays it is usual practice to involve multiple stakeholders in the policy process, what is known as ‘participative policy making’, ‘coproduction’, ‘open planning’ or ‘collaborative visioning’ (See for examples and definitions for instance Healey 1993 and 1997; Hajer and Wagenaar, 2003, Innes and Booher, 2003). The main motives for involving multiple participants in the policy process, i.e. the improvement of democracy, enhancement of support, and quality improvement of the policy outcomes (e.g. Teisman, 1992 p. 25-47; Beierle, 1999; Healey, 2000; Enserink and Monnikhof, 2003), are often frustrated in

practice by problems like miscommunication, information overload, conflict over values and goals, shortcomings of models, and complexity of the interrelated set of issues and problems. Maps, obviously, play an important role in policy processes. However, insight in this role is limited.

A limited set of authors have discussed the use of maps in spatially related policymaking within European countries, where policy is usually produced in a deliberative setting. Vigar and Healey (2002) and Faludi and Waterhout (2002) consider spatial maps as important devices in policymaking not only for presenting and assessing policy alternatives, but also and foremost in instances of problem framing and agenda-setting. Vigar and Healey (2002) point at the strategic, communicative and persuasive power of visual imagery in spatial planning, referring to particular map images and mapped concepts that have become well-known metaphors, e.g. the Dutch 'Green Heart, the Copenhagen's 'Finger Plan' and Lyon's 'Opening Flower' (Vigar and Healey, 2002, p. 524). These metaphors are derived from the curved shapes of urbanized landscapes as seen from above and likewise on maps. Faludi and Waterhout (2002) articulate the potentially conflicting nature of maps in policymaking when they describe the process of the European Spatial Development Perspective, where all policy maps were omitted from the final report. Faludi and Waterhout speak in general of "the problems of the maps".

3. The frame concept and its relation to maps and map use

In search of a theory that could help to better understand the potentially conflicting nature of maps, we first made a distinction between 'simple conflicts' around maps and 'complicated conflicts'. The first category can be explained rather easily by conflicting

interests or unequal information division among different actors. The well-known ‘NIMBY’ conflicts provide a clear example.

For the complicated conflicts, such easy explanations are not available, and we will focus on these in most of the remainder of this paper.

We had a number of reasons for selecting the theory on ‘frames’ and ‘framing’ as an interesting candidate for explanation of complicated conflicts around maps. First, it has been shown that frame theory can adequately explain stubborn conflicts in policymaking (Schön and Rein, 1994; Van Eeten, 1999). Second, the differences in perceptions of actors seemed to play an important role in practice in the observed case studies. Third, the practice of map-use-in-action implies creation and choice of boundaries, legends, layers and graphical variables. As a result, maps are not neutral ‘mirrors’ reflecting what exists and what happens on the ground, but they reflect a culturally, socially and politically shaped view on reality (Harley, 1988; Pickles, 1995). As such, maps frame the world, offering its viewers a particular conceptual lens on spatially related phenomena.

As different actors have their own worldview or ‘frame’ as starting point to analyze, assess and plan for spatial problems, maps may become ‘boundary objects’ between different professionals or disciplinary groups (Star and Griesemer, 1989; Harvey and Chrisman, 1998). As Harvey and Chrisman (1998, p. 1693) put it:

“More than tools to make better decisions with, GIS technological artifacts are the boundary objects which reinforce social agreements about human geography. The contentions surrounding GIS technology revolve around its construction by existing social groups, as part of ongoing institutional and disciplinary processes. The localized involvement of artifacts, groups, and people are the actual crux of contention.”

The theory of framing has different roots. Schön and Rein (1994), who have fuelled the idea of ‘reframing’ in the nineties in the field of policy analysis, describe policy frames as ‘taken-for-granted assumptional structures, held by participants in the forums of policy discourse and by actors in policy-making arenas’ (Schön and Rein, 1994, p. viii). Linguists Lakoff and Ferguson (2006) define frames as: ‘mental structures that allow us to understand the world. They are pre-linguistic – in the realm of concepts, not words. Framing is about characterizing values, concepts, and issues.’ Gamson and Ryan (2005) describe frames as ‘thought organizers’, which ‘put a rim’ around some parts of the world, highlighting some events and facts as important and rendering others invisible, like a ‘picture frame’. Maps do exactly what Gamson and Ryan describe.

A frame can manifest itself through the use of certain names, symbols, metaphors, images and maps. For example, stated policy problems such as “housing blight”, “urban sprawl”, “territorial cohesion” carry their own inherent judgments about what should be considered as problematic (Schön and Rein, 1994), and likewise, contested names on maps (‘East Sea’ or ‘Sea of Japan’) give a clue from whose perspective the place name has been given (Monmonier, 2006). When someone, consciously or unconsciously, puts a problem into perspective, thereby structuring the problem into a specific classification, we speak of an act of framing.

While some use the term ‘framing’ as deliberate manipulation (as in ‘I am being framed’), we see framing not as inherently negative or positive, but rather as a conceptualization of a natural mechanism in human thought and an inherent property of communication. Lakoff and Ferguson (2006):

“... For the most part, the use of conceptual frames is unconscious. Even people who are good at conceptual framing may not be aware they are doing it.”

Map-makers may also not be aware they are educated and trained in a particular way of mapping, and influenced by their locus as serving a particular regime or governing actor. And although in scientific literature map-making is nowadays seen as act of power (Harley, 1988; Pickles, 1995; Harvey, 2000; Monmonier, 1994; Rosseleau, 2005), in practice mapping is still perceived by many as a mainly technical and administrative matter.

4. Three archetypical frames on map use

4.1. Research method: Discourse analysis

For our empirical analysis of map use in practice, we adopted an approach called ‘discourse analysis’ (Rein and Schön, 1994; Van Eeten, 1999; Hajer, 2002). The essence of this approach is to reconstruct the various narrative stories as they are or have been told, which are then compared and (by cross-analysis) evaluated.

In our analysis of empirical cases, we used the explicated expressions of actors as our data of inquiry, either in the form of arguments, statements, questions, personal perspectives, or expressions in the form of symbols and classifications on maps. By comparing and contrasting the various arguments (spoken, written or embedded in maps) about the same issue, we aimed to reconstruct their relative frames of reference (Carton and Enserink, 2006).

Our use of case studies and multiple instances of map use, and the interpretation of observations through discourse analysis are more extensively described in Carton (2007).

Based on a detailed analysis of the discourses around 6 different maps, we formulated three archetypal frames on maps, and concluded that the limited set of three frames was sufficient to explain all the observed conflicts categorized as ‘complicated map conflicts’. In this paper, we will first present these three frames, and subsequently illustrate their relevance using the discussions on one of the maps in our case studies as illustration.

4.2. *Frames in maps and frames on maps*

We distinguish two types of frames related to maps and map use: frames *in* maps and frames *on* maps. The first type is incorporated *in* a map image, as the image is detached from its creators and follows a life of its own. Meanwhile, the image still carries an internal frame, which is the result of craftwork and reflecting how the map-makers have interpreted and conceptualized their spatial environment. The frame in the map can change while the map is being produced and altered. We build further on the plea of MacEachren and Kraak (1997) not only to focus on the communication ‘from the map to its audience’ but to also include in our analysis the type of exploratory map use, when the purpose is yet ill-known and the frame *in* the map is thus contemporary.

The second type of frame is located in the minds of people who use or are confronted with the map. Frames *on* the map are related to the users’ or viewers’ perception of the function, status or meaning of a particular map *in a particular context*, and different frames on the map are associated with different values and may lead to different judgments and conflicts. Maps may be defined as ‘spatial models’ (Kraak and Ormeling, 1987). Publications about the building and use of models in policy contexts have pointed to the importance of the social role of models and actor perspectives towards models (see for instance Wildavsky, 1979; Majone and Quade, 1980; Dunn, 1982; Stone, 1988; Fischer and Forester, 1993; Rouwette, Vennix and Thijssen, 2000; Daalen et al., 2002; Mayer et al.,

2004).

We will elaborate on frames *in* and *on* maps in the illustrated case study. As we are particularly interested in understanding the complicated conflicts around maps, we will concentrate mostly on the frames *on* maps.

4.3. *Three archetypical frames: analysis, design and negotiation*

We have distinguished three different archetypical frames *on* the use of a map. These frames have been formulated on the basis of interpreting and triangulating empirical observations of map use of six maps in the context of two cases (See Carton, 2007).

The *analytic* frame reasons from the ‘rational’ perspective or: ‘to measure is to know’. It is characterized by large amounts of data that need to be collected, organized, monitored, and mapped, before decisions can be made. What data to collect is assumed to be prescribed by a given, formalized problem formulation. The maps are used as an interactive model, but the structure of the map must be logical; each spot on the map should be properly defined and clearly bounded. The essence of the overall policy (preparation) process is seen primarily as a process of analysis, research and assessment. Many GIS-experts that we have interviewed seemed acquainted with and supporter of this view. In theory, we have found resemblances with Stone’s (1988) ‘analytic rationality’ and with the scientific attitude such as referred to in Mayer et.al. (2004), denoted as ‘research and analysis’ perspective.

The *design* frame is associated with creativity and intuition. Maps are considered tools for professionals to consolidate and express their thoughts. The map is used as a visual language and the essence of the overall policy process is seen primarily as a process for creating and presenting options and alternatives. The author designs a structure in space, which did not exist before or was not articulated before. Observations of landscapes –direct

and indirect through photo's, stories etc– and experience are the main sources in the search for patterns. On the map are coherent, abstract and preferably beautiful concepts with eloquent names and metaphoric meanings, like the 'Green Heart' concept of the Netherlands. The frame is related to the craft of urban design and landscape architecture. We have found overlap with study books about creativeness in design and the value of drawing for design by Ching (1990) and De Jong and Van der Voort (2002).

The *negotiation* frame is associated with a strategic attitude. In this frame, maps are seen as political devices in discourses of decision-making; they help communicate ideas, perceptions or claims, and advocate opinions and concerns. Maps are also used as instruments to communicate and consolidate decisions and agreements on space. As such, a map reflects a political agenda. Likewise the political 'game' to get issues on or off the political agenda, it is part of a strategic game to get legend items on or off the map. The presentation of a map is considered as 'showing ones cards' in a card game and thus whether to show or hide legend items on the map is subject to conscious choice rather than coincidence. The information presented consists of symbols or metaphors that make sense of the world, according to a particular political claim. In this frame, meaning of space is and can be negotiated among actors, and maps are one way to come to, fixate and formalize a negotiated agreement. Maps that deliberately 'stretch reality' for rhetoric purposes are denoted as 'propaganda maps' by Monmonnier (1993), but who decides what is propaganda and what is 'legitimate' rhetoric remains a grey area made up by subjective opinions, which can change over time. We have found this frame best represented by Stone's (1988) description of 'political reason', or the strategic logic involved in policy analysis as explained by Wildavsky (1979), De Bruijn et al. (2002) and Mayer et al. (2004).

According to our hypothesis, frame differences explain conflicts over substantive issues in discussions over maps, also in occasions where the ‘simple’ explanation of conflicting interests does not suffice. We assume that we can find conflicts between underlying values that are conceptualised here in the form of three generalized frames. An overview and further elaboration of the three frames is presented in Table 1. We use this distinction between three frames in order to identify arguments over maps and find reasons why conflicts emerge, sometimes seemingly ‘from nowhere’. We do not consider one frame superior over others. In our conceptualization, maps can serve as supportive instrument by fulfilling various functions simultaneously, but as in most multi-actor situations, opinions about the success or failure of a particular map may differ among actors.

5. Illustration: The making of the Suitability Map at waterboard Delfland

We studied the development of a ‘Water Opportunity Map’ (WOM) by the water board Delfland, in the South-western part of the Netherlands. The WOM, in Dutch ‘Waterkansenkaart’, is a relatively new policy instrument aimed at better coordination between water managers and spatial planners in the Netherlands. The need for such coordination has emerged since the combination of climate change, urbanization and other human intervention in the soil has recently led to floods and droughts in many parts of Western Europe, including the low-lying Netherlands.

Currently, water management and spatial planning are separated governmental responsibilities in the Dutch institutional organization. Water management is a task of the ministry ‘Public Works and Water Management’ (national level) and of water boards (regional level). The water boards have a democratically elected board and an independent regional tax system. Spatial planning is in the hands of municipalities (local), provinces

(regional) and the ministry 'Housing, Spatial Planning and the Environment' (national level). While for spatial planning there are legal instruments for regional zoning and planning, for water management no legally binding instrument exists in which water boards can determine their long-term water plan for their territory. The WOM has been introduced in 1998 to overcome this lack of a long-term policy instrument for water management, starting as a policy document without legal status. But quickly after its introduction in one region, the making of WOMs had been requested by regional spatial planners (provinces) and the national government, urging water boards to provide insight and advice to spatial planners about the future spatial needs of the regional water system.

At the time of the WOM-project at water board Delfland, between 2000 and 2004, no exact definition and content of the instrument had yet been defined. Titles, content, approach, and appearance of the WOMs diverged. Delfland was the first water board that decided to make the WOM in a collaborative process approach, in which they invited the municipalities and province in their territory to participate. The aim of the WOM project at Delfland was to explore potential bottlenecks in the regional water system, under circumstances of extreme weather conditions of surplus or lack of rain and run-off water, and to propose potential policy measures for land use planning and water management. Part of this project was to formulate advice where to locate or prohibit urban development from the perspective of the water system, and how to combine efforts in nature development with investments in a better water quality of lakes and canals.

In the project team of the water board, several departments of the water board organization were involved, with experts on subjects of hydrology, ecology, spatial planning, water quality, managing water levels, etc. In order to facilitate the workshops and execute various analyses, a consultancy firm was hired.

In the process, which took two years and over 20 meetings, many intermediate maps have been created, adapted, dismissed, and finalized, both hand-drawn and created by GIS. Some maps were literally created in a multi-actor setting during a workshop; others were produced by individual map-makers in between meetings. But the results were always intensively discussed in the project meetings and workshops. We have observed the meetings, analyzed the documents and maps, and held intermediate interviews with some of the participants. In particular, we focused on and reported about the discussions over the maps. In the project, several conflicts around maps appeared.

In this paper, we describe the coming into being of one map in particular; the Suitability Map. The suitability map serves as advice on land use functions from a water management perspective. This map indicates the suitability of locations for changes in land use, in particular whether an area is considered suitable for urbanization, including the development of houses, industries or greenhouses. The map also indicates which areas would be suitable for water management functions such as the (temporary) storage of excess water.

5.1. Principles of the approach to make a suitability map

The following steps were outlined when planning the development of the suitability map for Oostland, a sub-region of Delfland:

Step I: Set a starting point in time as the baseline for advice

The spatial landscape is in constant change. This raised the question on which moment in time the suitability map should 'step in'. At the moment of developing the WOM, large development sites for housing were being developed in the various

municipalities and for other projects, construction works were already planned in the next coming years. It would seem “too late in the day” if Delfland would advice against these plans at this stage. But somewhere in time, there had to be drawn a line if Delfland wanted to influence these choices in the future. Therefore, the project group had to choose a starting point in time for the suitability advice.

Step II: Develop a set of criteria that specify whether land is suitable for urbanization

The project team developed criteria for suitability for different type of land use changes. There are two types of criteria: a) criteria related to characteristics of the landscape and b) requirements that stem from needs of the water system. These requirements were distilled from the earlier prepared map called Water Wish Map (WWM), which presents the water board’s vision for the future water system. The characteristics of the landscape were mostly ‘hard’ criteria that were obtained from the geo-database of Delfland, such as relative heights of the surface, ground water level and soil type. For each criterion, a scale or threshold value had to be determined. For instance, on the criterion of groundwater level, at which height of the groundwater level is an area not considered suitable for development?

Step III: Apply the criteria and make up the map

The primary project executor took up all criteria and collected and processed the data on these (location-bounded) criteria. Also the WWM map layers were overlaid in order to identify locations where rural areas should be reserved for water-related policy measures. These areas were also marked as unsuitable for urban development.

Step IV: Revision and finalization

The project team (visually) evaluated the resulting map and added explanatory text. Changes and additions were to be processed, including the adjustment or addition of criteria.

5.2. *Description of the actual process how the suitability map came about*

The civil servants of municipalities and the province were invited in various stages of the project. In between, the project group members of various departments of Delfland worked together with the external water consultant on the preparation of documents.

A number of discussions characterized the process of developing the suitability map. For example, whether such a map should be part of the end product or not remained a point of discussion from the early meetings until the concept map was prepared. Eventually it was decided through conversations within Delfland –in between the project meetings– and in a steering group meeting, to proceed with the making of a suitability map, but to keep it a question mark whether and how to incorporate it in the final policy document.

During the early phases of the project, discussion concentrated on questions like what type of advice should be prepared, with what time horizon, relative to what ‘initial state’ and regarding what types of land use changes. A set of criteria was being formulated and deliberated to indicate the level of ‘suitability’ of a currently rural area regarding a potential transformation to an urban function –that is, land use with a ‘built-up’ character where the soil’s surface is covered by rooftops, concrete or glass.

After this set of criteria had been developed, a consultant from an engineering firm produced a concept suitability map based on the criteria that had been formulated for assessing suitability. For this task the consultant was provided with relevant data layers from the GIS room of the water board. The resulting image was made up of different ‘base maps’ that each represented a suitability criterion. On the final map, these criteria were overlaid as separate ‘spatial layers’. When the classification ‘unsuitable’

overlapped on multiple layers, the final suitability map showed an increasingly dark-red color (See Figure 1). From the project group, fundamental critique was raised against the reasoning behind the classification of light till dark red colors. The project group members argued that it does not matter in their eyes on how many criteria an area has scored badly, but how badly an area has scored on the various criteria. If, for example, an area has a very low relative height compared to the local situation, this characteristic can make that area far more 'unsuitable' than a location that scores moderately on all the other criteria. The map-maker defended his approach by stating that his method offered a transparency in the trade-offs made in qualifying areas as suitable or unsuitable. The discussion was settled in favor of the project members and the consultant had to adapt his map.

When the consultant had executed the GIS-based analysis on the whole territory of the water board, the project members were shocked about the resulting map image. The singular nature reservation in this urbanized region called 'Midden-Delfland' remarkably 'stood out' from this map as being suitable for urban development. A project member formulated the dissatisfaction:

"It looks like Delfland gives the signal to go ahead and develop these areas for urban purposes. I am sure that that is not our recommendation to planners. Such an advice would do badly to our reputation."

The consultant defended his position that this 'is what comes out of the analyses'. The project group then came to the conclusion that the system of criteria and assessment should be adapted. A new debate followed: is it acceptable to 'shape' the criteria towards a result that is 'intuitively' desired? Does the spatial land use function of nature

make an area unsuitable for urban development, when considered purely from a water perspective? It was decided to add a separate criterion for assessing areas as unsuitable for urban development, called 'area is reserved as nature'. (On the illustrated map image of Figure 1 this criterion is not shown.)

When the concept map was ready, in the meantime a new WOM of a neighboring water board (Schieland) became available. Two project members of Delfland highly appreciated this other WOM document and the maps in it. They supported the cartographic 'logic' of this other WOM because the legend items were specific and 'hard', the logic followed to assess suitability was clearly articulated in arguments written next to the legend items, the colors and boundaries on the maps were bright and aggregated, and every map image contained a limited set of legend items to keep a clear overview. The two project members advocated to 'redo' the own suitability map according to this method and set of criteria as applied by the neighboring water board. This, however, met with complaints of the project manager. She conceived it as criticism on the project, and refused to abandon the own-developed approach or redo the work in this late phase of the project. A conflict followed about the quality of Delfland's prepared concept maps of the Water Opportunity Map document.

The project evolved in an impasse and a few months no progress was made. The impasse concentrated on the substantive issues –what should be on the map– as well as the cartographic layout. In particular the formulation and mapping of so-called 'water storage basins' and 'calamity polders' was highly contentious. (Calamity polders are areas where surplus water can be stored temporarily in times of heavy rainfall, and water storage basins are lakes where clean water is being stored permanently for usage in periods of long droughts). One part of the project team wanted to get rid of the water storage basin legend item. These experts, a hydrologist and spatial planning expert,

wanted only ‘hard information’ mapped that could be proven to be necessary according to calculations based on existing norms for water. But the underlying meteorological forecasts were very uncertain, while the potential future problem of water shortage might also be resolved by other than spatial measures. Above this, in an internal meeting of the water board, it was stated that water storage basins would be hard to ‘sell’ to municipalities. Another part of the project team strongly disagreed. They felt that the need for water in periods of severe drought might even become a larger problem than the actual problem of water surplus, and they estimated that the solutions to the problem of drought might also be harder to implement than measures to cope with heavy rainfall. Therefore, this part of the project team wanted to anticipate on droughts and formulate an advice to reserve space in terms of potential ‘water storage basins’ on the WOM, so that spatial planners could decide on the basis of the WOM advice whether or not to prevent these areas from being urbanized. These two perspectives on ‘water storage basins’ reflected a different approach to the uncertain developments of droughts and how to cope with them, which became visible when the issue was to be visualized on the map.

The conflict around the calamity polders concentrated on the criteria for selection of areas and the name of the legend item ‘calamity polder’. There was disagreement whether or not to distinguish between different risk levels of being flooded, and a different status in the policy process – polders being claimed by the water board, or wished as possible search location. Some experts wanted to restrict themselves to only give an expert judgment on the question what areas could serve as a calamity polder on the basis of well-defined landscape characteristics. One project member complained that the suitability map was not objective enough. He complained: “Every time negotiations sneak into the map.” Others argued for a different approach; they wanted

to estimate how many polders would be necessary, and make a rough design alternative of a collection of calamity polders that would effectively release pressure of the rest of the water system. In addition to these two opposing positions, the spatial planning expert of the water board objected to select a number of specific locations for calamity polders where, according to her knowledge, it was already inevitable that municipalities would develop houses. In her eyes, that would only emphasize the slow acting and lack of political influence of the water board.

In order to break through the impasse and settle the emerged problems, finally the responsible board member of the water board appointed a new interim process manager. A new consultant, coming from a landscape designers firm, was hired. This consultant used the GIS maps as the substantive analysis information, but redrew the resulting suitability map by means of free (computer aided) drawing as they were more used to working with drawing maps than with GIS. After the set of criteria and the assessment method all had been subject of debate, the cartographic layout of the end product also raised many points of debate. To some, the map was not clear. According to others, the map was ugly. One project member suffered from color blindness, and he could not distinguish red from green contour lines. After deliberation and many adaptations later, it was decided under the authority of the intervening process manager that the water storage basins will not be part of the final suitability map (see Figure 2), but they remain as indicative point symbols on the vision map, another image in the WOM document (see Carton and Enserink, 2006; Carton, 2007). Two variants of the calamity polders are visualized as legend items on the suitability map, the one with the highest status ('claimed by the water board') as a red, filled spots, and the search locations for

calamity polders with a red contour line, to emphasize that these areas are negotiable and subject of further analysis (see Figure 2).

When the new concept document was finally ready, it was presented in a workshop to civil servants of municipalities and province. It comprised text with an explanation of the water system and choices and assessments made, together with various thematic maps –about a vision on the water system, spatial scenarios, and also the suitability map. In contrast to the expectations of the project team members, the actors received the suitability map without a sense of confrontation. The stakeholders expressed they were happy with a clear advice from the side of the water board. With respect to the locations shown as suitable for use as calamity polder or water storage basin, the question was asked *how many of these spots were needed*. The municipalities understood that flexibility was built in the maps, as many areas were designated as *search locations*. The water board answered they would actually claim all territories for the time being, until new research would give more certainty about quantities of water. But multiple municipalities wondered whether that would be fair. The water management measures that should cope with uncertain effects of climate change were considered primary the responsibility of the water board in the eyes of the municipalities. The ‘burden’ of taking painful measures in the water system should not be transferred from the water board to the municipalities unless absolutely necessary.

6. Analysis of frames involved in making the Suitability Map

6.1. *Substantive frames reflected in the map: the final image is the result of articulated values, argumentations and choices on water policy*

The first concept suitability map prepared for the whole territory came for the project members as a surprise, and counter intuitive result. The designation of the unique nature reservation as suitable for urbanization was valid from an analytic point of view, but the project members feared it would lead to a wrong interpretation. The person who executed the GIS-analyses had to change his set of criteria in order to meet with the leading opinion in the project group. In our interpretation, the logic of assessing suitability was adapted in order to let the map match with the intuitive frames of its creators. But in the feeling of the project members, they had good ethical reasons for not wanting to become ‘guilty’ of classifying this unique area as suitable for urban development. The map image was thus not only a result of rigorous analysis, but also of a *reflection on values* and a *search for argumentation*, from which the map image was produced as a form of expert judgment.

In order to build in robustness, the water board had appointed more and wider ‘search areas’ that would be needed for water purposes than what can be proven to be surely and absolutely necessary from the actual quantitative information. By designating these areas as ‘search locations’, the water board safeguarded the status of these areas, so that they cannot be developed in the meantime. In this way, the water board thus ‘bought time’. This raised objection from the municipalities, because they did not trust the proposed search areas on the map to be fair: the water board might buy its time at the cost of the space for maneuvering of municipalities.

As a whole, the suitability map inhibits a particular resulting frame. A frame that reflects the water boards’ negotiated knowledge and their chosen viewpoint of how to cope with the uncertain effects of future climate change and future water run-off through the landscape.

6.2. *Process frames regarding the use of the map: three different perspectives*

Through the classification of arguments in the discussions, we have distinguished three actor-perspectives that were dominant in the discussions, and that, according to us, rely on fundamentally different frames of reference.

1. Actor perspective #S1 (voiced by the hydrologist of the water board)

According to this perspective, the suitability map should not anticipate on future spatial developments; the assessment of suitability should be based on the current state of land use. Otherwise, vision is mixed up with analysis. The suitability map should only be part of the WOM if it can be backed up by unambiguous data and thorough analysis. Criteria should be objective, area-based and accurate.

If the criteria for suitable or unsuitable areas cannot be made 'hard' enough, then it should remain an internal document and not be handed over to municipalities. The map would then serve as internal 'alert tool' or screening instrument, applying existing (national) norms about water management, while more research would be carried out by detailed hydrologic analysis.

In this perspective, the function of the map is to serve as objective advice to external stakeholders and serve as internal 'alerting and screening tool'. The map is seen as analytical instrument. This frame corresponds with our archetypical 'analysis frame'.

2. Actor perspective #S2 (voiced by the first project manager)

In this perspective, the WOM project is supposed to be an open, participative process. For an open communication, the assessment of the water board on suitability of areas for urban development is relevant information for spatial planners. Delfland wants

to be involved in earlier phases of planning processes and not be invited for the technical implementation once the spatial plans are already worked out in detail by municipalities. In order to start a dialogue with spatial planners on suitability of locations, this anticipative advice should be provided by the water board with input and advice from civil servants of municipalities.

According to this perspective, the suitability map should be designed as to encompass a future oriented perspective. Existing norms of water management serve as starting point, but the whole project also serves to give input for adaptation of the existing norms –contrary to perspective #S1, in which new norms and future changes in the water system are considered as ‘soft data’ that should not ‘pollute’ the suitability advice.

The role of the map is to support collaboration, to design a new vision on the region and to make water management considerations transparent. The map is seen as a design language and serves primarily for idea generation and opportunity identification. This corresponds with our archetypical ‘design frame’.

3. Actor perspective #S3 (voiced by the second project manager and spatial planning expert)

Delfland should look pragmatically at the various planned urban developments, as to decide whether to consider those areas as ‘already planned urban area’ or not. The water board would make itself untrustworthy if it would suddenly advice negatively on areas where urban development was already certain, and where Delfland had never advised to stop the planning process before. The method of applying criteria which are then ‘objectively’ assessed would not be fruitful. It would treat the complexity of the matter with a rigor that looks more justified and objective than it actually can be. There are too

many uncertainties due to climate change, lack of data and lack of understanding of the water system on a detailed level. Therefore, the process of planning water and planning lands has to be seen as rolling timelines ('play leapfrog'). The map is considered a strategic artifact. Extra space is built in to claim for "space for water" to anticipate beforehand on the negotiation acts of other actors, who are expected to object against part of the claims.

Putting legend items on the map and adjusting the sizes of the spots is thus not only an act involving mapping the territory, but also of thinking through negotiations with others, considering the reputation (trustworthiness) of the water board and planning for future trade-offs. This perspective corresponds with our archetypical 'negotiation frame'.

6.3. *Why conflicts emerge between perspectives S1, S2 and S3*

In perspective S1, the Suitability Map should not be subject of negotiation. The map should be the result of objective measurement and objective criteria. Where uncertainties are prevalent, no advice for action should be given to outsiders. But in the eyes of the other participants (perspective S2 and S3), uncertainties are part of the problem and should be coped with. In their opinion, only proclaiming further research is no solution.

In perspective #S2, the more transparent Delfland can explicate its concerns why areas should be suitable or not, the more understanding between planners and water managers of each others work can grow, and this offers fruitful ground for combining insights, ideas, problems and solutions. The various criteria for suitability and assessment methods can and should be experimented with. When municipalities would find the resulting advice counter-intuitive, or if they disagree with the resulting advice,

a dialogue about it would be started, and this is the essence what the WOM should be about. Thus, transparency and dialogue about the maps with primary stakeholders should not be avoided, but grasped as opportunity to renew the vision about combined spatial planning and water management in the region.

In the perspective #S3, the view of perspective #S2 is regarded as somewhat naïve. If the internal ‘homework’ of the water board would not be done properly before presenting information, this would weaken the board’s position towards the other stakeholders. If the map development process would be opened up to all other stakeholders it could become a political process, with the suitability map of Delfland as ‘battleground’. Furthermore in this scenario, Delfland as water board would have to make compromises twice instead of once; firstly in making the suitability map, and next in trying to implement its policy. In this perspective, Delfland should keep her end responsibility to produce her own view without prior input or consent of the other stakeholders. This perspective puts the emphasis on the map as a negotiation instrument and questions the level of cooperation with municipalities.

The three perspectives stem from fundamentally different frames. Where the analysis frame prioritizes the finding of truth over the design of new visions and over agreements with other actors, the design frame urges to articulating ambitions and to uncover possibilities over sticking to existing norms. While there is irritation with people holding the analysis frame that others make visions without proper grounding in quantitative analysis, ‘building castles in the sky’, the people with a design frame got irritated that others were reluctant to ‘fill in the blanks’ on alternative planning ideas and contemporary maps on the basis of expert judgment. From the side of the negotiation frame, the map should be handled as a strategic document, and decisions about whether and how spots and

legend items should appear on the map should not only depend on landscape characteristics and hydrologic arguments, but also on maneuvers of (other) actors in the policy process and the chosen strategy on how to defend the own interests. Sometimes these interests are best served by making a creative, compelling vision, at other times by making a map based on hard facts.

7. Conclusions and recommendations

7.1. Functions of the maps perceived differently

Policy maps serve different purposes at different times. Actors have different individual intentions in the process, hold different frames or worldviews and use different strategies to achieve their objectives. All this influences how they use maps and how they perceive the role of maps in policy deliberations.

The concept of frames and framing and its elaboration into three archetypical frames was applicable in explaining emergent conflicts around various maps in the case studies (Carton, 2007).

For the particular case of the suitability map, the choice for a consultant implied a choice what map-making software and style of graphic layout would be employed, and also from what frame of reference on the map the project participants would be approached by the hired map-maker. In the case illustration, the first map (Figure 1) is visualized from an analysis frame of reference, while the end-product (Figure 2) reflects a design frame. The content, logic and shape of both versions of the suitability map appear very different.

The views of people who held a predominant negotiation frame showed a conscious, pragmatic selectiveness about what legend items should be put on the maps and which should be left off, and what boundaries should be emphasized and which others would have to be de-emphasized (different colors, other fill pattern) or replaced by indicative symbols. This could be frustrating to experts who believe in more rigid standards fitting their own professional values, either focusing on evidence-based problem definition and norm-based advice, or on advocating new, visionary solutions and opportunities. In our interpretation, this frustration is an indicator of the conceptual distance between the various frames of reference involved in map-making and map use.

Although this should not be seen as a 'rule' that always counts, we found the pattern of choices in map-making clearly differing between people with a predominant analysis frame and a design frame. The people with a negotiation frame seemed more flexible. They were usually not the people who themselves 'held the pencil' or operated the computer software to make a map, but they formed alternate 'alliances' with people who held a different frame of reference, by coupling their arguments to either those of the analysis frame or the design frame.

Overall, the maps played a number of roles, ranging from a function as model to clarify, and differentiate significant from uncertain knowledge, to strengthening collaboration, and to defend political interests.

7.2. Discussion and recommendations

Our analysis indicates and illustrates that conflicts over maps may emerge for different reasons, such as differences in future orientation (long term or short term), differences in views on the function of the map in the policy process, and differences in perspectives how to cope with uncertainty. As the map images do not reflect everybody's' personal frame of

reference, the various participants in policy processes all verbally ‘push and pull’ the discussions to get their frame of reference *on* the map represented *in* the next version of the map. This transforms the differences of frames of reference into conflicts over the map images.

Some of these conflicts may be very functional from the perspective of clarifying decision making and identifying issues, others however may be rather dysfunctional. Awareness of these different reasons, and identification of underlying frames may be helpful to project managers and process facilitators.

With the presented conceptual framework of three archetypical frames we aim to make map-makers and map users aware of the fundamental values that underlie different frames. The three frames could possibly serve as aid for diagnosis for process facilitators and map users if an emerging conflict seems to appear. He or she may be alerted whether a conflict over a spot on the map is a ‘superficial’ discussion over details, or whether it may be caused by different fundamental views on the function of the map and on the mapping process. In order to make this diagnosis, he or she can reflect on the arguments expressed by the actors, taking into consideration aspects like their view on the nature of the policy process, the value of information and ideas, and the perspective on how to cope with uncertainties.

From the perspective of the mapping profession, we note that many GIS-experts share a frame that is rigorously dedicated to scientific fact finding. This at times submerges room for mediation, creation of innovative alternatives and the arrangement of trade-offs in stubborn policy dilemmas. In our research, both in case studies and interviews, it appeared that both GIS-analysts and designers feel frustrated about their role in collaborative settings more often than accidentally. In this paper we have explained some of the mechanisms that underlie such feelings of frustration. There are multiple ways possible to cope with this.

One option is to add an additional skill to map-makers in GIS- and design curricula: learning to become good listeners and visualizers of (social) concerns. Mediating about maps (their legend items, the cartographic styles chosen, etc) can be helpful in clarifying underlying values and frames of stakeholders, decision-makers but also of the supporting professional map-maker. Such skills would enable map-makers to contribute to conflict resolution and mediation more consciously.

Another option is to leave the mediation with stakeholders the task of the process facilitators and consolidate the making of maps to the map-room or (virtual) GIS-room of an organization. This way, process facilitators would make the link between stakeholders or specialists and map-makers, functioning as 'boundary workers'. Such process facilitators would demarcate responsibilities and attempt to deal with organizational resistance, and the role of the map-maker could remain demarcated, specialist and pure, but not central in the process.

On the side of preparing a future generation of professionals, we recommend to educators, whether centered around analysis, design, GIS/computer-aided or manual drawing, to teach their students about the possible roles of maps and positions of the map-makers in policymaking processes.

On the side of theory development, we recommend further explication of how the current practice of map-making and map use is conceptually and institutionally embedded in spatial planning, and exploration of its effects.

References

- Beierle, T. J., 1999, Using social goals to evaluate public participation in environmental decisions. *Policy Studies Journal* 3(4), 75–103.
- Bertin, J., 1981 *Graphics and Graphic Information-Processing*. De Gruyter, Berlin.
(Original version in French, 1977: *La graphique et le traitement graphique de l'information*)
- Brown, B. and E. Laurier, 2005, Maps and Journeys: An Ethno-methodological Investigation. *Cartographica* 40(3), 17-33.
- Bruijn, H. de, E. ten Heuvelhof and R. in 't Veld, 2002, *Process Management. Why Project Management Fails in Complex Decision-Making Processes*, Kluwer Academic Publishers, Boston/Dordrecht.
- Carton, L.J., 2005, How to cope with map controversies in deliberative policymaking. Paper presented at the international conference “Mapping for Change (PGIS)” Nairobi, September 7-9. Wageningen: CTA. Available at:
<http://www.iapad.org/biblio/2005.htm>
- Carton, L.J. and B. Enserink, 2006, Controversial maps: Spatial visualization as argument in policy discourses. In: Metze, T. and M. van den Brink (eds) *Words Matter in Policy and Planning*, Netherlands Geographical Studies 344, pp. 157-170.
- Carton, L.J., 2007 Map making and map use in a multi-actor context. Spatial visualizations and frame conflicts in regional policymaking in the Netherlands. (PhD thesis, April 20th 2007, TU Delft) Delft.
- Ching, F.D.K., 1990, *Drawing, a creative process*. John Wiley and Sons, New York.
- Chrisman, N., 2005, Full Circle: More than Just Social Implications of GIS. *Cartographica* 40(4), 23-35.
- Craig, W., T. Harris and D. Weiner (eds) (2002). *Community participation and geographic information systems*. London: Taylor and Francis.

- Crumplin, W.W., 2007, Geographic Information Systems as Media and Society: Does GIS Wear a White or Black Stetson? *Cartographica* 42(1), 56-86.
- Daalen, C.E. van, L. Dreesen, and M. Janssen, 2002, The roles of models in environmental policy life cycle. *Environmental Science and Policy*, 221-231.
- Duncan, S.L. and D.H. Lach, 2006, GIS technology in Natural Resources Management: Process as Tool of Change. *Cartographica* 41(3), 201-215.
- Dunn, W., 1982, *Public Policy Analysis, An Introduction*, Prentice Hall, Englewood Cliffs, New Jersey.
- Eeten, M. J.G. van, 1999, *Dialogues of the deaf: defining new agendas for environmental deadlocks.* (dissertation) Eburon Publishers, Delft.
- Enserink, B and R.A.H. Monnikhof, 2003, Information Management for Public Participation in Co-design Processes: Evaluation of a Dutch Example. *Journal of Environmental Planning and Management* 46(3), 315-344.
- Faludi and Waterhout, 2002, *The making of the European Spatial Development Perspective.* No Masterplan. Routledge, London.
- Fischer, F. and J. Forester (eds), 1993, *The Argumentative Turn in Policy and Planning.* Duke University Press and UCL Press Limited, London.
- Gamson, W. and C. Ryan, 2005, Thinking about Elephants. *The Public Eye* 19(2). Available at: http://www.publiceye.org/magazine/v19n2/gamson_elephants.html (last visited September 13th, 2006)
- Geertman, S., 2002, Participatory planning and GIS: a PSS to bridge the gap. *Environment and Planning B: Planning and Design* 29(1), 21-35.
- Geertman, S. and J. Stillwell (eds.), 2003, *Planning Support Systems in Practice*, Springer-Verlag, Berlin.

- Hajer, M. A., 2002, Discourse Analysis and the Study of Policy Making. Part of the Symposium Discourse Analysis & Political Science. *European Political Science* (2)1.
- Hajer, M.A. and H. Wagenaar (eds), 2003, *Deliberative policy analysis : understanding governance in the network society* Cambridge, UK : Cambridge University Press, 2003.
- Harley, J. B., 1988, Maps, knowledge and power. In: Cosgrove, D. and Daniels, S. (eds), *The Iconography of Landscape*. Cambridge University Press, Cambridge.
- Harley, J.B., 1989a, Deconstructing the Map. *Cartographica*, 26(2), 1-20.
- Harley, J.B., 1989b, Cartography, ethics, and social theory. (sequel to 'Deconstructing the map') *Cartographica* 27(2), 1-23.
- Harvey, F. and N. Chrisman, 1998, Boundary objects and the social construction of GIS technology. *Environment and Planning A*, 30(9) 1683-1694.
- Harvey, F., 2000, The social construction of geographic information systems. *International Journal of Geographic Information Science* 14(8), 711-713.
- Harvey, F., M.P. Kwan, M. Pavlovskaya, 2005, Introduction: Critical GIS. *Cartographica* 40(4), 1-4.
- Healey, P., 1993, The communicative turn in planning theory. In: Fischer and Forester (eds), 1993, *The Argumentative Turn in Policy Analysis and Planning*, Duke University Press, London.
- Healey, P., 1997, *Collaborative Planning*. Macmillan, London.
- Healey, P., 2000, Building institutional capacity through collaborative approaches to urban planning. *Environment and Planning A* 30(9), 1531-1546.
- Hoogheemraadschap van Delfland, 2002, *Waterkansenkaart Oostland*. Bestuurlijke samenvatting november 2002, Delft.

- Innes, J.E. and Booher, D.E., 2003, Collaborative policy making: governance through dialogue. In: M.W. Hajer and H. Wagenaar (Eds) *Deliberative Policy Analysis: Governance in the Network Society*. Cambridge: Cambridge University Press, pp. 33–59.
- Jankowski, P. and T. Nyerges, 2001, *Geographic Information Systems for Group Decision Making. Towards a participatory, geographic information science*. Taylor and Francis, London.
- Jong, T. de and T. Van der Voort, 2002, Criteria for scientific study and design. In: De Jong, T.M. and D.J.M. Van der Voordt, 2002, *Ways to study and research urban, architectural and technical design*. DUP Science, Delft.
- Koti, F. and D. Weiner, 2006, (Re-) defining Peri-Urban Residential Space Using Participatory GIS in Kenya. *EJISDC* 28(8), 1-12.
- Kraak, M.J. and F. Ormeling, 1987, *Kartografie. Visualisatie van ruimtelijke informatie*. (Cartography. Visualization of spatial data, English version in 1996). Delft University Press, Delft (Revised edition 1999).
- Lakoff, G. and S. Ferguson, 2006, Crucial issues not addressed in the immigration debate: why deep framing matters. Article published by the Rockridge Institute, available at: <http://www.rockridgeinstitute.org/research/lakoff/imm-response> (last visited July 14th, 2006)
- Longley, P.A., M.F. Goodchild, D.J. Maguire, and D.W. Rhind, 2001, *Geographic Information Systems and Science*. Wiley, Chichester.
- MacEachren, A.M., 1995, *How maps work; representation, visualization, and design*. The Guilford Press, New York.
- MacEachren, A.M. and M.J. Kraak, 1997, Exploratory cartographic visualization: advancing the agenda. *Computers and Geosciences* 23(4), 335-343.

- Majone, G. and E.S. Quade, 1980, *Pitfalls of analysis*, Wiley, Chichester.
- Mayer, I.S., C.E. van Daalen and P.W.G. Bots, 2004, Perspectives on policy analyses: a framework for understanding and design. *Int. J. technology, Policy and Management*, 4(2), 169-191.
- Metze, T. and J. Saris, 2004, *Het ontwerp als verandermakelaar (The design as mediator of transitions)* Report of a series of five round table discussions on “Design as Dialogue”. Amsterdam: Bureau De Stad and Perform, University of Amsterdam.
- Monmonier, M., 1994, *Drawing the Line: Tales of Maps and Cartocontroversy*. Henry Holt & Co.
- Monmonier, M., 2006, *From Squaw Tit to Whorehouse Meadow: How Maps Name, Claim, and Inflammate*, University of Chicago Press, Chicago.
- Nature editorial, 2006, Think global. ‘Virtual globe’ software is transforming our ability to visualize and hypothesize in three dimensions. Educators take note. *Nature* 439(7078), Feb. 16th, 2006.
- Pickles, J., 1995, *Ground truth; the social implications of geographic information systems*. Guilford Press, New York.
- Rambaldi, G., S. Bugna, A. Tiangco and D. de Vera, 2002, Bringing the Vertical Dimension to the Negotiating Table. Preliminary Assessment of a Conflict Resolution Case in the Philippines. *ASEAN Biodiversity*, Vol. 2(1), 17-26.
- Rambaldi et al., 2006, *Mapping for change: practice, technologies and communication*. Special issue Participatory Learning and Action (PLA notes) no 54. London: International Institute for Environment and Development (IIED) and Technical Centre for Agriculture and Rural Cooperation (CTA).
- Riet, O.A.W.T. van de, 2003, *Policy analysis in multi-actor policy settings; navigating between negotiated nonsense & superfluous knowledge*, (PhD-thesis) Eburon, Delft.

- Rocheleau, D.E., 2005, Maps as Power-Tools: Locating “Communities” in Space or Situating People and Ecologies in Place? In: Brosius, J.P., A. Lowenhaupt-Tsing, and C. Zerner (eds) (2005) *Communities and Conservation: History and Politics of Community-Based Natural Resource Management*. Altamira Press.
- Rouwette, E.A.J.A., J.A.M. Vennix, C.M. Thijssen, 2000, Group model building: a decision room approach. *Simulation and Gaming* 31(3) 359-379.
- Schön, D.A., 1983, *The reflective practitioner; how professionals think in action*. Basic Books, New York.
- Schön, D. and M. Rein, 1994, *Frame Reflection: Towards the Resolution of Intractable Policy Controversies*. Basic Books, New York.
- Schuurman, N., 2005, Interoperability as an infrastructural constraint, *Social Perspectives on Semantic Operability; Constraints on Geographical Knowledge from a Data Perspective*. *Cartographica* 40(4), 47-61.
- Sheppard, E., 2005, Knowledge production through Critical GIS: Genealogy and Prospects. *Cartographica* 40(4), 5-21.
- SPESP Infographic's Group, 2000, Policy Images. In: SPEP Final Report (Study Programme on European Spatial Planning 1998-1999), chapter 4. Published on <http://www.mcrit.com/spesp/ESPON.htm> (visited in 2002).
- Star, S.L. and J.R. Griesemer, 1989, Institutional ecology, ‘translation’ and boundary objects: Amateurs and professionals in Berkeley’s museum of vertebrate zoology, 1907 – 1939. *Social Studies of Science* 19, 387-420.
- Stillwell, S. Geertman and S. Openshaw (eds), 1999, *Geographical Information and Planning*. Springer, Berlin.
- Stone, D.A. 1988, *Policy Paradox and Political Reason*. HarperCollins Publishers, USA.

Teisman, G.R., 1992, Complexe besluitvorming: een pluricentrisch perspectief op besluitvorming over ruimtelijke investeringen (Complex decision making: a pluricentric vision on decision making about spatial investments). Vuga, Den Haag.

Vigar, G. and P. Healey, 2002, Developing environmentally respectful policy programs: Five key principles. *Journal of Environmental Planning and Management* 45(4), 517-532.

Walker, B.L.E. 2003, The Politics of Participation in PPGIS: Mapping Marine Protected Areas in French Polynesia, Department of Geography Colloquium, University of California at Santa Barbara, May 22, 2003.

Wildavsky, A., 1979, *Speaking truth to power; the art and craft of policy analysis* . New Brunswick: Transaction Books (edition 1992).

Table 1. Overview of different frames on map use in policymaking

[insert Table 1 from file] :

frames:	Analysis	Design	Negotiation
Context			
Archetypical group or actor	Expert, skilled in research fields like geography, cartography, GIS, economy etc. (metaphor: 'scientist')	Expert, skilled in artistic fields like urban architecture, landscape design and facility of creativity. (metaphor: 'artist')	Stakeholder, experienced in decision-making, acting on behalf of dependency -interests at stake. (metaphor: 'politician')
Focus on policy analytic phase	Emphasis on research and assessment	Emphasis on creation and presentation of options	Emphasis on interaction, problem framing, and arranging trade-offs
Limitations, perceived boundaries	Bounded possibilities by scope and available data	Bounded possibilities by objectives and conditions	Bounded possibilities by institutional constellation and timeframe
Map Use			
Values in coding of information	Objective and valid information	Broad, holistic information	Comprehensible information
Values in presentation of information	Map layout 'correct' according to cartographic rules and heuristics	Visual impression of artistic quality	Map layout sufficient and opportune for the occasion
Preferences in act of thinking	Use of technology; preferring rigid, unambiguous definitions and specified information	Use of imagination, associations, example concepts and heuristics to create innovative ideas	Strengthen arguments, map use according to pragmatic and strategic considerations
Effects			
Dominant functionalities of maps	...Clarify spatial (socio/ physical) mechanisms	...Visualize and articulate imaginative spatial planning concepts	... Agendize problems, create a sense of urgency, and persuade actors about spatial decisions.
	...Synthesize analytic results, providing accurate model information (detailed, precise and reliable)	...Identify, elicit patterns in the landscape; imposing structure by grouping or differentiation	...Move (inactive) tacit and implicit opinions towards an explicated, articulated agenda and policy agreement
The map is seen as research model	... design language	... policy agenda

Table 1. Overview of the three frames that serve as conceptual lens in our analysis of the function of maps in policy processes, based amongst others on Wildavsky (1979), Stone (1988), Schön (1983), Ching (1990), De Jong and Van der Voort (2002), De Bruijn et al. (2002), Mayer et al. (2004) and Carton (2007).

[insert Figure 1 from file] :

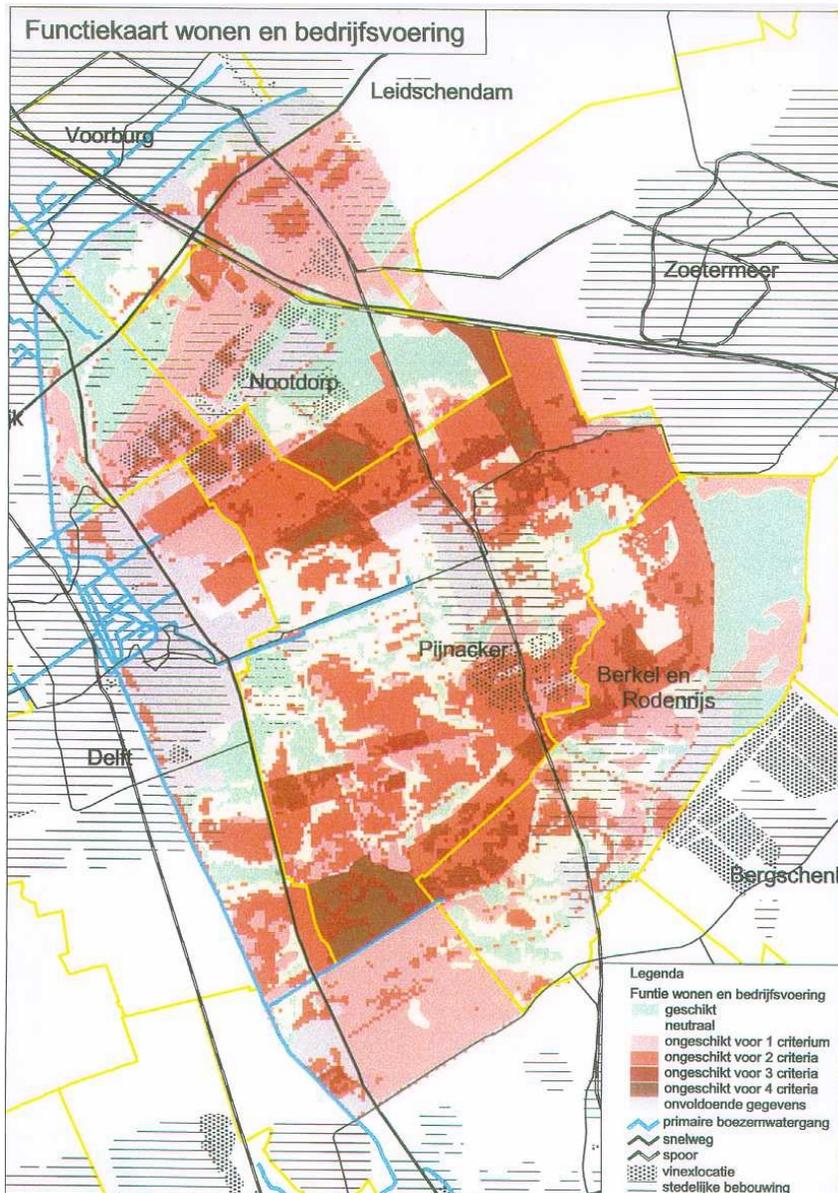


Figure 1. Concept suitability map as prepared by the firstly hired consultant. There are 4 criteria for suitability. The various levels of saturation in the red color indicate whether the area is assessed as unsuitable according to 1, 2, 3 or 4 criteria. The darker the red color in the concept suitability map, the more unsuitable the area according to the logic of the map-maker. (Source: Hoogheemraadschap van Delfland, unpublished).

[insert Figure 2 from file] :

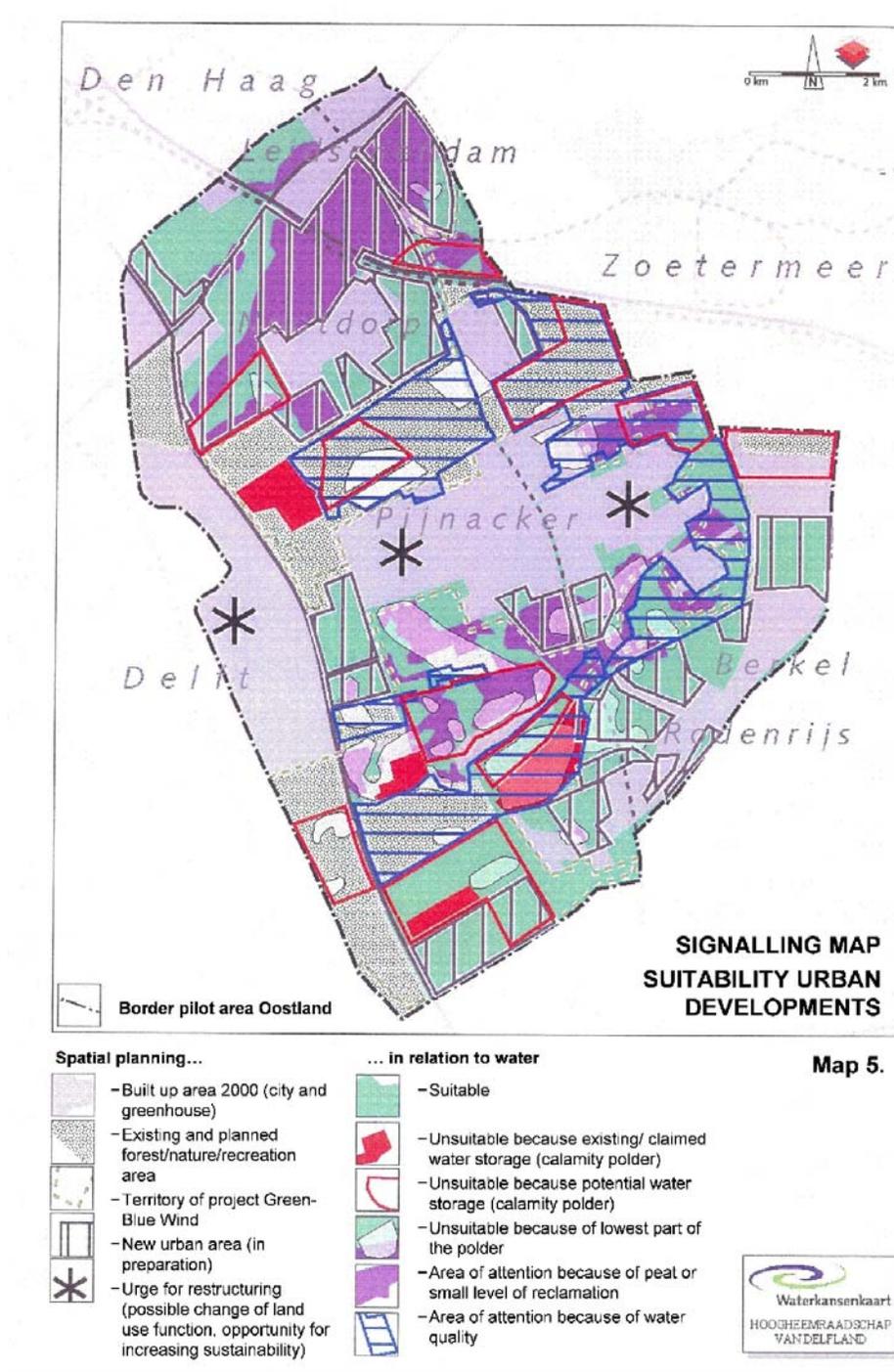


Figure 2. Final suitability map made by second consultant, with explanatory legend items.

(Source: Hoogheemraadschap van Delfland, 2002. Legend items are translated to English)