8 ENVIRONMENTALISM, RENEWED CONCERN FOR FLOOD SAFETY, AND THE EUROPEANIZATION OF DUTCH WATER POLICIES, 1970–2010

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As the title of this chapter suggests, three major developments characterize the contemporary history of Dutch water management: the environmental wave, the renewed attention for flood safety strategies, and the Europeanization of Dutch water policies. The first development concerns the lasting influence of both the environmental wave and the democratization of Dutch society in the 1960s and 1970s on Dutch water policies. As the increased environmental awareness induced a substantive change of water policies toward integrated water resources management based on a water systems approach, the democratization process in Dutch society would have an impact on the process of decision making on new water policies and projects. Top-down, expert-driven decision making was replaced, at least in part, by more interactive and deliberative modes of governance.

The second important development was renewed attention to flood policies and strategies in the face of climate change. Following the floods of the Rhine and Meuse rivers in 1993 and 1995, flood safety received a high place on the political agenda again. Traditional flood policies aimed at reducing flood probability by the construction of dikes were reconsidered, and new "room for the river" policies were introduced. Furthermore, these latest flood policies were no longer confined to reducing flood probability, but also aimed at reducing flood exposure and flood vulnerability—strategies that the Dutch seem to have unlearned over the past century. To inform the public on these policy changes, the Dutch government at century's end launched a large-scale public campaign, informing the people that they have to learn "to live with water" again.[1] These new flood management strategies of creating room for the river and raising water awareness, however, have not replaced the policies of reducing flood probability by the construction of dikes. Rather, these policies were placed alongside existing ones and by that have broadened the arsenal of flood management strategies the Dutch government is now using. A new Delta Commission advised the Dutch government on flood protection policy for the longer term (up to 2200). This commission, which issued its findings in 2008, emphasized the need for increasing flood safety standards in the long term. Its advice is now being elaborated on through the Delta Program.

The third major trend relevant to understanding recent developments in Dutch water resources management is the ongoing Europeanization of water policies. The European water regime has developed over the past decades and almost any aspect of water management, whether it is groundwater, surface water, water quality, or flood management, is now covered by European directives and policies. Very similar to the development in many other policy sectors, Europe has become a fourth and powerful administrative tier in Dutch water management.

Nineteen ninety-eight represented a milestone in the history of the Rijkswaterstaat as it celebrated its 200th anniversary in presence of Queen Beatrix.[2] Accompanying the celebration was the publication of *Two Centuries Rijkswaterstaat*, (*Twee eeuwen Rijkswaterstaat* in Dutch), an overview of 200 years of technological expertise and societal dynamics.[3] It shows the strong interrelationship of the Rijkswaterstaat with society, which continues to present. The Delft University of Technology (TU Delft) organized a symposium and presented to the Rijkswaterstaat the book *Water Magicians, Delfts' Ideas for Another 200 years Rijkswaterstaat (Water tovenaars, Delftse ideeën voor nog 200 jaar Rijkswaterstaat*).[4] As all faculties of the TU Delft have relations with the Rijkswaterstaat, every faculty contributed one or more chapters. The director-general of the Rijkswaterstaat, Gerrit Blom, received an honorary degree from TU Delft in recognition of his activities in the field of pollution reduction and the large-scale reorganization of the Rijkswaterstaat. To underscore its international ties, the Rijkswaterstaat organized the international conference "Sustainable development of deltas" in Amsterdam in November 1998.[5]

In the 1970s and 1980s a cultural change occurred within the Rijkswaterstaat—increasingly, it could be characterized as a multi-disciplinary organization. These changes were particularly a result of the explosive rise of societal demands for solving environmental issues as well as the democratization within society with more attention for societal demands, openness, and transparency. In the 1980s and 1990s the neoliberal ideology and politics also influenced the organizational culture of the Rijkswaterstaat.[6] In addition to engineering practice, more attention was given to output steering, performance measurement, and public-private partnerships (as discussed below in the section titled "The Environmental Era").

Concerning the national water policy, a fundamental change occurred in 2002. Up to that date, the national policy on water affairs, and particularly flood defense, was developed at the Head Office for Water at the Rijkswaterstaat. This also included responsibility for international water affairs, so to that date the Rijkswaterstaat represented the Netherlands in international water forums. On January 28, 2002, the Water Directorate at the Ministry of Transport, Public Works and Water Management (now called the Ministry of Infrastructure and the Environment) was created and took the leading role in the decision-making process. The Rijkswaterstaat remained a part of the ministry and is responsible for the design, construction, management, and maintenance of the main infrastructure facilities in the Netherlands, including the network of main roads, the network of main waterways, and the main water systems. As outlined in the sections on "Renewed Concern for Safety" and "Europeanization of Water Politics," the Rijkswaterstaat played the leading role until 2002, and after that this role was assigned to the policy departments of the ministry. The background of this shift is a clear distinction between policy and construction/maintenance. In daily practice, there remains a narrow cooperation between the policy departments of the ministry and the Rijkswaterstaat as the executive agency of the ministry.

The separation of policy making and policy implementation led to intensive discussions of how the Rijkswaterstaat should be related to the ministry.

Finally, the decision has been made to transform the organization of the Rijkswaterstaat into an agency (*Agentschap*), through which the organization came to be positioned at a greater distance from the Ministry.[7] In the period 2004–2008, the organization changed significantly under the leadership of the general-director, Bert Keijts. The Rijkswaterstaat developed into the executive organization of the ministry with three main tasks: the management of the main roads, the management of the main waterways, and the integrated management of the main water systems. The organization was modernized by introducing a new business model. First, a high priority was given to a transparent financial system, through which expenditures can be controlled and justified and budget overruns can be avoided. Furthermore, the organization developed itself to a public-oriented network organization with a focus on the users of those networks—the complicated systems of main roads, main waterways, and main water systems. The construction of large infrastructure works remains an important task of the new Rijkswaterstaat. Much attention has been given to internalize this "public-oriented network management" in the minds and working methods of the Rijkswaterstaat employees.[8] At the same time, the challenge was to do more with fewer employees. In the period 1980–1994, the number of employees decreased from 13,700 to 9,700.[9] This number went up again in the subsequent years. The period 2003–2008 showed a comparable decrease: from 11,300 to 9,300.[10]

Another important organizational change came from the national discussion within the Dutch government on the organization of applied scientific research in the Netherlands. On the basis of the Report of the Commission Wijffels, scientific knowledge was concentrated in a few renowned institutes, the so-called Large Technological Institutes (Dutch abbreviation: GTIs).[11] These GTIs are centers of technological expertise for companies and the government. For knowledge of water management, the institute Deltares was founded in 2007. In this organization, WL/Delft Hydraulics, Geodelft, parts of TNO-Bouw, and large parts of the research services of the Rijkswaterstaat were concentrated. At the Rijkswaterstaat these research services changed from knowledge institutes to institutes "externally organizing knowledge," and they developed expertise for advising the networks managed by the Rijkswaterstaat. Repeatedly, the discussion arises as to how much knowledge the Rijkswaterstaat must have within its own organization to fulfill its new role. From 2007 to 2013, the Water Service (*Waterdienst*) has fulfilled this task within the Rijkswaterstaat. Since 2013, the Service for Water, Traffic and the Environment (*Water, Verkeer en Leefomgeving*) has been performing this task. An important task of the Rijkswaterstaat is to provide information about the water system. This effort is now concentrated in the Water Management Centre in the Netherlands (WMCN), which provides daily information for users of the Dutch water systems, including water levels, river discharges, flood risks, water quality, and so on.[12] This information is obtained from the National Water Monitoring Network (*Landelijk Meetmet*).

THE ENVIRONMENTAL ERA

In the 1960s and early 1970s, environmental awareness started to grow in the Western world (as discussed in chapter 6). One of the most influential publications at that time was the *Limits to Growth* report of the Club of Rome (1972). This report clearly demonstrated the limits to exploiting the earth's natural resources by a rapidly increasing population.[13] At that time people began to learn about the unintended consequences of the rapid economic growth and industrialization after World War II. This new perception of the limits to economic prosperity was further strengthened by the oil crisis of 1973. The change of societal mood was reinforced by the

activities of an environmental movement that was at first rather fragmented, but increasingly became better coordinated and more influential.

The 1950s and 1960s had been glorious decades for the Rijkswaterstaat. Both the budgets available for public works and the number of large infrastructure projects (most notably the construction of highways and the Delta Works) were at their height. The new environmental movement, however, would be particularly successful in shaping new images of the large public works that were planned and designed by the Rijkswaterstaat engineers.

The impact of environmentalism on the Rijkswaterstaat and Dutch water management was also strongly influenced by a second main societal development: the democratization of Dutch society. As in many other places around the world, the sixties and seventies were a politically dynamic period in the Netherlands. This was the time of protest marches against the war in Vietnam, student revolts, and the occupation of universities. Support for political parties that were based on religious affiliation declined rapidly. Gaining support were new political parties—such as the Social-Liberal party D66—aimed at a fundamental reform of the political system. This democratization movement attacked all established institutions, including traditional political party structures, universities, and churches. Authority was less accepted and people demanded more openness and possibilities for influencing decision-making processes. Not surprisingly, the Rijkswaterstaat came under attack in that turbulent period. Whereas the Rijkswaterstaat had always received credit for its expertise and contribution to the economic welfare of the country, in the seventies, the very same organization became heavily criticized for its lack of responsiveness to societal demands and environmental issues. Increasingly, the Rijkswaterstaat was labeled as a closed technocratic bulwark, with its road planning destroying nature because of an authoritarian and non-responsive attitude that was out of touch with society.[14]

The organization of the Rijkswaterstaat clearly faced difficulties in responding to the new societal demands for openness and transparency and in incorporating new environmental values in its policies and working practices, but gradually it developed capacities for adapting to the new circumstances. This process was facilitated by the dynamics within the Rijkswaterstaat, induced by the march of new disciplines—ecologists and biologists particularly—into the ministry. This "new vanguard" managed to challenge the policies and working practices of the community of civil engineers that had dominated the organization of the Rijkswaterstaat until then.[15] It is exactly the combination of the external (growth of environmental awareness, democratization of society) and internal pressures (a new vanguard) that accounts for the "ecological turn" in Dutch water management.[16] In spite of important value conflicts, such as safety versus ecology or economy versus ecology, the expertise and concepts of the ecologists were incorporated by the traditional corps of engineers rather smoothly. Some quantifiable concepts of ecology could be integrated into decision-support systems and assessment tools.[17]

Besides the impact of the environmentalists and the democratization of Dutch society, the economic decline after the second oil crisis (1980–1982) put the Rijkswaterstaat under pressure. The budgets for the realization of public works and the number of employees were reduced substantially after the seventies. Later on, this process was reinforced by the global spread of the neo-liberal ideology. This ideology favored market deregulation and promoted the role of the private sector. It was best articulated by Ronald Reagan and Margaret Thatcher (in Thatcher's "there is no alternative") and would influence policies of the successive Dutch governments since that time. Liberalization and the tools of New Public Management became quite

popular during this period. Contracting-out and public-private partnerships became increasingly accepted instruments in Dutch water management. Next to these ideological motives, more substantive changes in water resources management triggered reorganizations of the Rijkswaterstaat as well. After the completion of the Delta Works, the Delta Service became superfluous and was dismantled. Until 1984 water quantity and quality management were organized separately. With the recently developed concept of integrated water resources management, these tasks were combined, and a new organizational distinction between fresh and tidal water was made (National Institute for Inland Waters and National Institute for Coastal and Marine Waters).

Shortly after the celebration of the 200 years of the Rijkswaterstaat, the organization came under fire again. The costs of several large infrastructure projects—most notably the Betuwe Route (Betuwelijn), a new railroad to Germany—exceeded the planned budgets. Even though cost overruns were mainly due to a long list of modifications proposed by local politicians and pressure groups to mitigate negative impacts on the landscape and those living near the railroad, the organization of the Rijkswaterstaat was often blamed for it in the media. Moreover, several cases of corruption in the Netherlands in which a few employees of the Rijkswaterstaat were involved attracted media and political attention. Under pressure from Minister of Finance Gerrit Zalm, and the leadership of the Minister of Transport, Public Works and Water Management Karla Peijs, the organization of the Rijkswaterstaat was fundamentally reorganized by a substantial reduction of the number of civil servants and by the introduction of a sharp distinction between the policy-making task of the ministry and the implementation task of the Rijkswaterstaat, which was given the status of an agency. Recent accounts of the reorganization process by Van den Brink and Metze show that the main objectives of the reorganization (reducing the number of civil servants and a more public-oriented way of working) have been achieved, but some new problems were introduced.[18] Where Metze points to the drawbacks of the loss of expertise, which makes it more difficult to critically supervise projects that are being implemented by market parties, Van den Brink mainly points to the difficulties employees of the Rijkswaterstaat face when they participate in regional planning projects.[19] Since the Rijkswaterstaat was given the status of an implementation agency, its representatives in the region are not allowed to make any policy-sensitive decision without consulting the policy directorate in The Hague. Such problems, however, are not unique to the Rijkswaterstaat organization, as they are faced by any organization undergoing a similar transformation.

These developments in Dutch water management are illustrated by the controversies over three major infrastructure projects: the enclosure of the Eastern Scheldt; the reclamation of the Zuiderzee polder, the Markerwaard; and the strengthening of the dikes along the main rivers. It will be shown how the waves of environmentalism and democratization have influenced Dutch national water policies since the early seventies.

Decision making on the storm surge barrier in the Eastern Scheldt is often considered a major turning point in the history of Dutch water resources management.[20] In the past, coastal engineering projects had been aimed at flood protection and at serving economic interests, but, in the decision-making process on the enclosure of the Eastern Scheldt, environmental issues were seriously addressed for the first time. During the implementation of the Delta Plan most other tidal branches in the southwestern Netherlands had been closed off, and their valuable estuarine ecosystems were destroyed. Because of the influence of the environmental movement and the shift in public opinion, social and political attention to potential ecological damage increased during the construction of the Delta Works.

Rijkswaterstaat

Sea anemone, one of the many species in the Eastern Scheldt

In 1967 the Rijkswaterstaat Delta Department started developing plans for the enclosure of the widest estuary, the Eastern Scheldt. This estuary had a very rich biodiversity and the sandbars were favorite feeding spots for birds. The estuary also had an important shellfishery. According to the engineers working at the Delta Department, a fixed dam would be the only possible option for realizing safety, but a coalition of environmentalists and fishermen argued that strengthening the dikes along the estuary would be a much better alternative. Various accounts of the Eastern Scheldt crisis demonstrate that the Delta Department faced difficulties in incorporating the new environmental values into policy alternatives, and stuck to the proposal for a fixed dam.[21] Only after the installation of the cabinet under Prime Minister Joop Den Uyl, the most leftist cabinet in Dutch history, did the coalition of environmentalists gain access to the decision-making forums on the highest level, and the Dutch cabinet started to put pressure on the Rijkswaterstaat engineers to develop a solution that would take into account the environmental issues raised. This is a clear example of the primacy of politics. It is only due to a change of government that the change of Eastern Scheldt policies became possible. The ministers of the new social-liberal party D66, in particular, played a crucial role in this. These political changes, however, reflected the change in public opinion: many perceived the Rijkswaterstaat as an organization that had no eye for environmental or ecological issues.

An expert committee designed alternatives to the closure and concluded in its report that an open storm surge barrier was technically feasible. The Rijkswaterstaat had to further develop this alternative into a new design that would meet safety standards as well

as ecological standards. Doing so required a radically innovative concept, which the Delta Department developed in cooperation with the involved contractors, a consultant, and the assistance of various knowledge institutes. They managed to design a half-open storm surge barrier on piers. The core idea of this construction was that the barrier can be closed during storm surges, and left open under normal weather conditions, thus maintaining estuarine dynamics.

Decision making concentrated on three policy alternatives: the construction of a fixed dam, the strengthening of dikes along the estuary, and the construction of a semi-permeable dam. The Rijkswaterstaat contracted with the RAND Corporation for comparing these alternatives. The POLANO-study (Dutch acronym for Policy Analysis for the Eastern Scheldt) was an interesting innovation in Dutch water policy analysis, because this study included a wide range of possible criteria, including the potential impact on the environment and ecology. Part of the environmental research carried out for this study was supported by a newly created environmental section of the Delta Department headed by the first university-educated biologist to work for the Rijkswaterstaat, H. L. F. Saeijs.[22] The Dutch Cabinet opted for the construction of a storm surge barrier in 1976, and the Eastern Scheldt Storm Surge Barrier was completed in 1986, at a total cost of 2.5 billion euros (more than the cost of all other Delta Works combined). Numerous innovations were developed during the construction process: a special ship was constructed

Rijkswaterstaat

The Eastern Scheldt Storm Surge Barrier pillar construction dock , 1984

Rijkswaterstaat

Construction ship *Ostrea* lifts a pillar into position

to transport the pillars and a machine was designed to place huge mattresses to stabilize the pillars. Today the Eastern Scheldt Storm Surge Barrier is generally perceived as one of the main achievements in coastal engineering in the world. It served as a test-bed for ecological design, integrated project planning, and stakeholder analysis and communications strategies. As such, it marked a new era in water management and in the Rijkswaterstaat's position: the project enabled the Rijkswaterstaat to repair the rift with society and to partly restore its prestige.[23] In spite of the impressive engineering achievement, and the innovative concept of a storm surge barrier with movable gates, it is now clear that the barrier still has had an enormous impact on the Eastern Scheldt ecosystem, because the tidal volume—and hence estuarine dynamics—has diminished substantially. The reduced tidal volume flowing through the storm surge barrier has caused the estuary sand bars to begin to shrink, threatening the bird feeding spots, and new protective measures had to be

Rijkswaterstaat

The Eastern Scheldt Storm Surge Barrier with the gates closed

undertaken. In the other closed estuaries in the southwestern part of the Netherlands, mineral emissions from farms caused severe water pollution, and here, also, additional projects were undertaken to improve the ecological quality, such as an inlet sluice to refresh the stagnant water in the Veere Lake.

A second model project illustrating the environmental era in Dutch water management is the reclamation of the Markerwaard, a polder in the Zuiderzee (IJssel Lake). Where decision making on the Eastern Scheldt Storm Surge Barrier is generally considered to be a turning point in the implementation of the Delta Works, decision making on the Markerwaard can be considered a similar turning point in the implementation of the Zuiderzee works.[24]

As described in chapter 6, the Afsluitdijk (1932) had reduced flood risks along the IJssel Lake considerably and made possible various land reclamation projects. After the successful reclamation of the Northeast Polder (*Noordoostpolder*), which includes the former islands of Schokland and Urk, the Eastern (1957) and Southern (1968) Flevopolders were reclaimed. Unlike the northeast polder, the Flevopolders were designed as an artificial island with a narrow lake between the mainland and the new polder. This lake was created to maintain access to the sea for certain towns on the mainland and to be able to better manage the water tables.

The next reclamation project planned was the Markerwaard. There are many reasons why the Markerwaard polder has never been created. First and fore-

Rijkswaterstaat

Almere, the main city on South Flevopolder

most, it is important to know that the food self-sufficiency doctrine, which was the main trigger for creating the other polders, was no longer adhered to after the establishment in 1957 of the European Economic Community, predecessor of the EU. In addition, unlike the reclamation of the older polders, the reclamation of the Markerwaard was planned in an era characterized by distrust of the Rijkswaterstaat. A broad coalition of actors opposed to a new land reclamation project in the IJssel Lake successfully challenged the various arguments put forth by the government. They pointed, for example, to the loss of a valuable fresh water ecosystem, an argument that had never played a role in decision making on reclamation projects until then. The opposition also successfully challenged the various economic arguments for creating another polder in the Zuiderzee. In 1972 a new decision-making procedure for large-scale spatial and infrastructure projects was introduced: the Spatial Key Decision (*Planologische kernbeslissing*, or PKB). This procedure allowed for the participation of a wide range of actors in decision making on the Markerwaard. In addition to the end of the food self-sufficiency doctrine, the democratization of decision making and the recognition of new (environmental and landscape) values may explain why decision making on the reclamation of the Markerwaard has been postponed time and again.

Erfgoedcentrum Nieuwland, Lelystad

Rally against the Markerwaard polder project, 1979

Erfgoedcentrum Nieuwland, Lelystad

Farmers' rally supporting the Markerwaard polder project, 1984

Environmentalism and the democratization of Dutch society also influenced decision making on the improvement of dikes along the main rivers. The river

Bart Hofmeester

Towship on the River Waal. Inland navigation is an important cargo mode in the Netherlands

levee strengthening program had made virtually no progress until the 1970s because the Delta Works and sea dike strengthening projects took such a large share of the allocated budgets. In the 1970s, the water boards finally sped up the levee strengthening schemes. By then, however, they faced staunch opposition from conservationist action groups who feared the destruction of the idyllic river landscape and doubted the necessity of the strengthening program. Because of the value conflicts and the ample opportunities opponents had to delay the realization of planned dike improvement projects, the Rijkswaterstaat and the water boards were practically unable to meet the legally defined safety standards and to guarantee safety along the main rivers. Only after the floods of 1993 and 1995 were they able to realize these safety standards.

The developments described above also had an impact on the broader national water policies, which were formulated in a series of policy documents on water management. The first national policy document on water management, issued in 1968, mainly addressed water quantity issues and the economic functions of water, such as water use by households and industry, agricultural water use, and navigation.[25] Environmental issues were not completely ignored—in the 1940s, the Rijkswaterstaat director-general, Ludolf Reinier Wentholt, addressed the problem of salt intrusion, and in the 1950s water quality became a major issue. Salt intrusion worsened, as did chemical pollution, also because of increasing effluents in the Rhine and Meuse basins. The pollution had detrimental effects on the quality of drinking water, since large parts of the Dutch Randstad, the urbanized western part of the Netherlands, use Meuse water as a source for drinking water production.

In 1970, after years of preparation, a water pollution act passed Parliament (*Wet Verontreiniging Oppervlaktewateren*, WVO). The Rijkswaterstaat was assigned the legal task of implementing this water pollution act on the main rivers and lakes, and the provinces had to set

up provincial water quality programs. The WVO introduced a permit system for emissions and a system of fines for violators based on the "polluter pays" principle. Also under the WVO, wastewater purification stations, already developed before 1940, were built on a massive scale. The WVO is often called a prime international example of successful environmental legislation.[26]

The second national report on water management, issued in 1984, broadened the scope of national water policies by more systematically addressing water quality and ecological issues. This was made possible by the PAWN-study (Policy Analysis for Water management in the Netherlands), which, like the POLANO-study for the Eastern Scheldt, was a new type of policy analysis introduced in the Netherlands by the RAND Corporation.[27] Together with the Rijkswaterstaat and Delft Hydraulics, RAND developed computer models that were able to calculate the impact that various water management alternatives would have on specific interests, such as agriculture, navigation, drinking water production, or nature itself. The PAWN-study has been particularly helpful in showing the various interrelationships within a water system and the interdependencies between water users.

Building on the highly influential document "Living with Water" (1985), to which Rijkswaterstaat biologist H. L. F. Saeijs contributed, the third water management policy document of 1989 introduced the concepts of a water systems approach and of integrated water resources management.[28] Water was conceived as an integrated system of subsystems (surface water, groundwater) and functions (transport, drinking water, ecological functions, recreation, etc.) and water management required an integrated approach, balancing these functions, and linking water management, spatial planning, and nature development.[29] This

Peter Mastenbroek, Lelystad

Rijkswaterstaat laboratory researcher investigates oil emissions from a ship that was sailing on the North Sea

Nationale Politie

Oil pollution in the IJmuiden harbor, 1990

concept was implemented by the Rijkswaterstaat for the main rivers and lakes and by the provinces and the water boards for the regional waters. The 1992 Water Boards Act assigned to the water boards—in addition to flood management and water quantity management—water quality management.[30] This act strengthened the position of the water boards within the Dutch state organization. The position of the water boards was further strengthened by the ongoing mergers between water boards. There are currently only twenty-four water boards, many of which cross provincial borders. Although the provinces still play a role in coordinating water policies with spatial and environmental planning, their position in the water sector has weakened considerably over the past few decades.

The fourth water management policy document was released along with the influential document "Water Management in the 21st Century." These documents were issued in the aftermath of the floods on the main Dutch rivers that occurred in 1993 and 1995 and the water troubles in 1998 stemming from intense precipitation. Both of these documents emphasized the urgent need for better coordination between water management and land-use planning.[31] After a few decades in which environmental and ecological issues had gained a prominent place in the political agenda, at the turn of the century water safety issues again started to dominate the Dutch water agenda.

In December 2009 the Dutch Cabinet adopted the National Water Plan, which contains the national water policies for the period 2009–2015. The new national water policy emphasizes the need for climate-proofing the Netherlands and for implementing the Room for the River and Delta programs.[32]

Martijn Beekman

Fish migration research: a transponder is being inserted in a sea trout, 1997

RENEWED CONCERN FOR FLOOD SAFETY

The 1970s showed a continued discussion on the flood safety standards along the major rivers in the Netherlands. This period marked the aftermath of the Report of the Delta Commission (1960), which advised the Dutch government on the safety standards after the flood disaster of 1953.[33] However, these new safety levels would result in significantly increasing the height of the dikes along the river. Much opposition arose within society because of its impact on the landscape. Therefore, the Dutch government installed the Becht Commission in 1975 to evaluate the new safety standards. In 1977 the Becht Commission advised on an exceedance frequency of 1:1,250 years at a river discharge of 16,500 cubic meters per second for the Rhine River at Lobith.[34] This advice was accepted by the government in 1978. However, continuous protest against the dike reinforcements forced the government to install a new commission in 1992: the Boertien Commission. In 1993 the Boertien Commission concluded that a safety level of 1:1,250 years was required, but advised, on the basis of a new statistical analysis, to reduce the representative river discharge to 15,000 cubic meters per second.[35] The commission advised also taking into account the so-called LNC-values (landscape, nature, and culture) and involving citizens and municipalities more in the decision-making process.

However, shortly after the presentation of the report of the commission, the floods of 1993 and 1995 demonstrated that the existing dikes could barely resist the floods with an exceedance frequency of 1:100 years. In 1995 the situation was extremely critical, and about 250,000 inhabitants in a Gelderland riparian zone were evacuated within two days. This situation

made clear that dike reinforcement programs had to be implemented with high priority and in a short period of time. On February 13, 1995, the government—after negotiating agreements with representatives of the provinces, water boards and the Dutch municipalities—presented the Delta Plan Major Rivers.[36] Within one month of the flood of 1995, the emergency law Delta Law Major Rivers, prepared by the Legal Department of the Headquarters of the Rijkswaterstaat, was accepted by the Dutch Parliament. Under this law, procedures could be passed or shortened, and the dikes could be given the required height and strength in 1995 and 1996. According to this law, dikes in areas of a lower urgency had to be completed before 2001.[37]

In the River Meuse, extreme floods occurred in 1993. In December 1993 the river discharge reached a maximum of 3,120 cubic meters per second, resulting in large inundations and much damage. Therefore, in January 1994 the Boertien Commission II was installed with the task of advising the government on the protection of the River Meuse against such extreme floods. The commission presented their report on December 12, 1994.[38] It laid out three possible strategies: building of levees together with deepening of the summer bed of the river; building of levees together with deepening of the summer bed and nature development; and building of levees. The commission advised to deepen the summer bed combined with a limited amount of environmental development and to build levees only for specific areas where other measures are shown to be insufficient. However, in the beginning of 1995 a flood occurred again. Although the maximum Meuse river discharge was lower (2,870 cubic meters per second), in the more downstream areas it had more severe effects because of the longer duration of the flood wave.[39] Under societal pressure, the government decided to start with building the levees to guarantee a protection with an exceedance frequency of 1:50 years. Under the Delta

Rijkswaterstaat

1993 flood at Roermond, Limburg at the river Meuse

Rijkswaterstaat

1995 near-flood: extremely high water levels on the Waal

Law Major Rivers (*Deltawet Grote Rivieren*), these works had already been completed in 1996 and 1997. The next step was to realize a safety level of 1:250 years, which was the mandate of the project De Maaswerken (Meuse Works), and had to be realized at the latest in 2005. For budgetary reasons, this date shifted to 2015, under the condition that seventy to eighty percent of the agreed safety level would be realized by 2005.[40]

The safety standards are legally confirmed in the Flood Defense Act (*Wet op de Waterkering*). This law was first introduced in Parliament in 1989, agreements were obtained in 1994, and it came into force in 1996. Because of the critical flood risk situations in 1993 and 1995, a number of amendments were applied.[41] The safety standards for the coastal areas were in agreement with the proposals of the Delta Commission (1960). For the embanked rivers Rhine and Meuse a safety standard of 1:1,250 years was declared for the upstream parts of these rivers and 1:2,000 years for the downstream parts. Every five years the safety standards are to be evaluated, through which an updated insight is obtained of the natural pressures (water levels, wave attack, river discharge). This occurs for each of the fifty-three dike ring areas. In 2005 the forty-two dike ring areas along the

upstream part of the Meuse also came under this law, with a safety standard of 1:250 years. In 2009 the Flood Defense Act was incorporated in the Dutch Water Act, in which a number of existing water acts were integrated, thus creating a framework for the modernization of Dutch water management.[42]

On the basis of the five-year evaluation, in 2001 the representative river discharges associated with the agreed safety levels changed from 15,000 to 16,000 cubic meters per second for the Rhine and from 3,650 to 3,800 cubic meters per second for the Meuse.[43] In 2006, these safety levels remained unchanged.[44] For the longer term, reconnaissance studies were carried out, for both the Rhine and the Meuse.[45] The objective was to investigate the possibility of guaranteeing the same safety levels in the twenty-first century under the influence of climate change and expected soil subsidence. The representative river discharges, for which these safety levels must be reached, were 18,000 cubic meters per second for the Rhine and 4,600 cubic meters per second for the Meuse.

In fact, all these agreements were reached as a consequence of the implementation of the recommendations of the Delta Commission in the 1950s and its 1960 report. The recommendations and report resulted in the Delta Plan, shortening the coastline by more than 600 kilometers through blocking the estuary mouths of the Haringvliet (Haringvliet Dam, 1971), the Grevelingen (Brouwers Dam, 1971) and the Eastern Scheldt (Storm Surge Barrier, 1986). The estuary mouths of the New Waterway and the Western Scheldt were to remain open because of the shipping routes to the ports of Rotterdam and Antwerp. The height of the dikes along these waterways must be raised to the "Delta level." Around 1980 it was discovered that the dikes in the Rotterdam area were too low to fulfill the determined level of protection. Although they have been raised significantly after World War II, they should be raised by at least 1.60m.[46] However, it was difficult to make these dikes higher, as they were situated in a very densely populated area, involving high costs and having a visual impact on old town centers, some with a history of several centuries. Moreover, the duration of the construction was an important factor, because the reinforcement of the dikes in this area was expected to take more than thirty years. Therefore, there was pressure to find alternatives, particularly a moveable barrier that could be closed under exceptional circumstances, occurring once in ten years. An important requirement of the barrier was that it would not block the shipping route.[47]

The choice was made for two large floating gates on either side of the New Waterway that would move to each other to close the waterway. The construction of the barrier started in 1991, and on May 10, 1997, after six years of construction, Queen Beatrix opened the Maeslant Barrier. The barrier was designed with two "circle segments," each with a length of 210 meters and a height of 22 meters. Each gate rotates around a ball joint with a diameter of 10 meters and a weight of 680 tons. Closing and opening of the barrier is driven by a self-operating computer system, which is linked to meteorological, river discharge, and sea level data. When a storm surge of three meters above normal sea level is anticipated in Rotterdam, the barrier will be closed automatically. The complexity of the closure process requires that decision making be completely automated. To achieve the required level of reliability, a double computing system has been installed; during extreme situations the system is continuously monitored by a team of experts. Well before the actual closing procedures are started, incoming and outgoing ships are warned, and two hours before closure shipping is prohibited. The barrier is designed to withstand a storm situation that is expected to occur once in 10,000 years. It is expected that closing the barrier is needed, on average, once in ten years.[48] On November 8, 2007, the Maeslant Barrier was closed for the first time since its construction because of a strong storm surge.

In 1999 the secretary of state for transport, public works and water management and the president of the Union of Water Boards established the Advisory Committee on Water Management in the 21st Century (WB21). The committee was charged with developing recommendations for desirable changes to the water management policy in the Netherlands, focusing on the consequences of other water-related problems, such as climate change, rising sea level, and land subsidence. In 2001 guidelines were produced for future water management. The Dutch government enacted these guidelines in a new approach to ensure safety and to reduce other water-related problems in the twenty-first century. This approach includes, among other things:

- Awareness: citizens should be more aware of problems associated with water
- Three-step-strategy: retaining, storing, discharging
- Room for the river: more land for occasional storage is required
- Spatial planning: prevent non-river-related human activities in the floodplains
- International cooperation: must be intensified.[49]

The new approach requires land use changes and introduces new scientific research issues and has an impact on the working methods of the responsible water resources agencies. Increased attention is also being given to communication and public participation.

In 2000 the Room for the River concept was adopted as a government policy. Through this concept the Dutch government initiated a shift from "traditional" flood protection policies (i.e., raising the dikes) towards creating increased water discharge capacities. More

Rijkswaterstaat

Maeslant Barrier

than thirty projects were formulated and a variety of measures were developed to implement this policy, such as levee relocation, the construction of bypasses and spillways, and locations for water storage. The main goal is a reduction of high water levels; other goals are nature development and landscape restoration. The development and implementation of these new river policies required intensive cooperation among water managers, spatial planners, nongovernmental organizations (NGOs), and inhabitants of the areas along the main rivers. For that reason, the Dutch national government decided to organize the decision-making process on the new Room for the River policies not as a centralistic top-down process in which the Dutch national government would decide autonomously on the most effective policy program. Instead, the national government demanded that the provinces issue regional guidance on desirable measures to create more room for the river. The provinces were asked to prepare this guidance in close cooperation with the affected municipalities and water boards, and to involve a wide range of NGOs, including agricultural organizations, agencies serving the interest of recreation, representatives of river-related industries, and environmental groups.

Two main policy objectives or conditions were formulated beforehand. First, the final policy program proposed by the Dutch provinces would have to guarantee safety for the approximately four million inhabitants of the areas along the main rivers. Safety standards were defined, which would have to be reached within both the short term (2015) and the long term (2050). Second, it was decided to improve the "spatial quality"

Rijkswaterstaat

A secondary channel, parallel to the main channel in the Waal River, intended to spur nature development and reduce peak water levels

of the river landscape at the same time—for example, considering possibilities to create new nature preserves or for the development of new sites for urban expansion along newly created river branches. Because of the relatively open policy process, parties have been able to combine different perspectives and to develop multi-purpose plans that are acceptable to most of them. The Room for the River project, therefore, is not only a substantive policy innovation, but is generally considered to be an interesting innovation in governance as well.[50]

The Room for the River concept has also had an international resonance. During the flood of 1995, the ministers of land use planning had their regular meeting in Arles. In the communication of this meeting the ministers of the riparian states declared that further measures had to be taken to reduce future river flood risks. They supported an integrated approach: not only water management, but also land use/spatial planning had to be taken in account, leading to river basin management. In 1998 Highwater Action Programs were created on the basis of the Arles Declaration.[51]

To be prepared for record-level river discharges—discharges higher than those related to the agreed safety standards—the Luteijn Commission was installed in April 2001 to advise on the possibilities of "controlled flooding." Although such a catastrophic situation is not expected, a significant reduction of damage and number of casualties is expected when the surplus water is guided to areas with low population densities and relatively low economic investments. In their report of 2002, the commission presented the results of their investigations to look for possibilities of emergency inundation areas along the Rhine and Meuse rivers.[52] Ultimately, they focused on three areas: the Rijnstrangen and the Ooijpolder along the Rhine and Beersche Overlaat along the Meuse. The cabinet was intrigued by the recommendations of the commission and announced in July 2002 that a final decision would follow in the coming years. However, local opposition arose in the potential emergency inundation areas, particularly in the Ooijpolder, because the people and the local political representatives had the feeling that their land would be sacrificed to the benefit of more-downstream areas. Moreover, memories of the evacuations in 1995 were still alive. Amidst all this political turmoil and the scientific debates on uncertainties with respect to the real flood reduction impact of emergency inundation areas, the government decided in 2005 that the use of Ooijpolder and Rijnstrangen would not be cost-effective and that those areas would not be used for controlled flooding. In extreme flood stage, therefore, these areas will be particularly vulnerable. The situation illustrates the gap between policy and politics.[53] It may be expected that this political discussion will return when proposals are presented for further differentiation of the safety standards, based on new insights of the flooding risks within the Netherlands as a result of the newest findings of societal cost/benefit analyses. In the National Water Plan, which came into force in December 2009, it was decided by the Dutch government to also give up the reservation of the Beersche Overlaat as an area for controlled flooding in emergency situations.

At the beginning of the twenty-first century, an American flood event and a former American politician have contributed much to placing the issue of water safety high on the Dutch political agenda again. The devastating Hurricane Katrina raised social and political awareness of the risks involved in occupying low-lying delta areas in the Netherlands. Furthermore, Al Gore's film *An Inconvenient Truth*, and his related visits to the Netherlands, which received a great deal of media attention, contributed much to societal awareness of the seriousness of climate change and the vulnerability of the Netherlands.

In September 2007 the Dutch government installed the new Delta Commission, which was responsible

for giving advice on how to protect the Netherlands against floods for the longer term (specifically to 2100 and generally to 2200). This question was asked in the light of climate change (rising sea level and higher peak discharges of the rivers) and developments within society (demographic shifts and increased investments). In September 2008 the new Delta Commission presented its report to the Dutch Parliament. It was concluded that sea level is probably rising faster than was previously projected, and extreme variations in river flow are expected to increase. It was advised that the flood protection levels of all diked areas must be improved by a factor of ten, and that all measures to increase the protection levels must be implemented before 2050. At the moment there is no serious problem, but the need for being well prepared was strongly emphasized.[54]

An important recommendation of the commission was that a Delta Act should be implemented. This act was discussed in the cabinet in October 2009 and submitted to the Lower House in the spring of 2010. The Delta Act forms the legal basis for a Delta Program, in which measures and provisions for water safety and fresh water supply are developed, including their planning and estimates of their costs. A Delta commissioner is charged with drawing up, updating, and implementing this program on behalf of the cabinet. A ministerial steering group under the authority of the minister of transport, public works and water management includes representatives from the Ministry of Housing, Spatial Planning and the Environment, the Ministry of Agriculture, Nature and Food Quality, the Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs, and the Ministry of Finance.

To finance all the measures and provisions for water safety and freshwater supply, a Delta Fund was proposed. The fund is expected to include the expenditure of the state on the construction, improvement, management, maintenance, and operation of water management structures with a view to water safety and freshwater supply—and the related water quality management. The budget will be allocated annually to the Delta Fund from the general resources. The costs for the implementation of the proposed Delta Program were estimated by the commission at 1.2 to 1.6 billion euros per year in the period 2010–2050 and 0.9 to 1.5 billion per year in the period 2050–2100.

The Delta Program comprises nine sub-programs, three of which are general (safety, freshwater, and new spatial developments and reconstructions) and six are directed to specific regions (Rhine estuary mouth, Southwestern delta, IJsselmeer region, rivers, coasts, and Wadden Sea region). The Delta Program commissioner is responsible for ensuring that the Delta Program is realized.

Proposals for a new system of safety standards against flooding and their differentiation will be prepared in the safety sub-program. Cost-benefit analyses have been made based upon the present situation and combined with assessments of individual risk of death as a result of flooding and group risk (the risk of large numbers of casualties). The new standards are scheduled to be incorporated into the Water Act. Obviously, this fundamental decision will be of great importance for the outcome of the regional sub-programs.

Whereas Dutch water safety policies had almost exclusively focused on reducing flood probability (either by constructing dikes or creating room for the river), floodplain occupancy and the increasing investments made behind the dikes have made it necessary to develop policies aimed at reducing flood exposure and flood vulnerability as well. Therefore, a three-step approach was chosen: giving additional emphasis to prevention, paying attention to risk reduction through sustainable spatial planning, and developing sound evacuation plans.[55] In this new approach to flood management, prevention remains the highest priority,

and its safety levels will not be reduced by secondary risk-reducing measures or provisions. It is expected that the Delta Program will have a profound impact on flood defense policies in the Netherlands for the years to come.

At least as important as the flood management along the rivers is the defense of the country against the attacks from the North Sea. Therefore, coastal defense has a high priority in the Netherlands. The coast itself consists of about 290 kilometers of natural dunes and 60 kilometers of dikes and dams. In the 1970s and 1980s attention focused on the realization of the Delta Works. The Storm Surge Barrier in the Eastern Scheldt and the Maeslant Barrier in the New Waterway also reflected an emphasis on coastal defense. For the coast itself the Rijkswaterstaat was invited by the government to prepare a strategy for the years after 1990. The document "First Coastal Report" (*Eerste Kustnota*) (1990) made a plea for "dynamic preservation," for which strategic and operational objectives have been defined. The strategic objective was to guarantee a sustainable safety level and sustainable preservation of values and functions in the dune area. The operational objective was to maintain the coastline at its 1990 position, for which an ongoing coastal nourishment policy has been developed.

As a standard of reference, the so-called Basal Coast Line (BCL) has been defined as the estimated position of the coastline on January 1st of 1990. This position has been derived from an extrapolation of the linear trend of coastline positions during the years 1980–1989. The choice for a ten-year linear extrapolation is based on being not dependent on incidental erosions.[56] The operational objective is to maintain the Momentary Coastline (MCL) not landward of the BCL. The MCL is calculated from data of the Dutch yearly coastal monitoring program, which has been operational since 1963. In the coastal documents that followed, a plea has been made for sand replenishment at deeper water (1993) and to look for a stronger relation between coastal safety and spatial planning (1995). The expected effects of climate change became of increasing importance in making a new water safety policy. A lot of uncertainty is acknowledged. In the water policy document "National Water Plan" (*Nationaal Waterplan*) (2009) the sea level rise of 0.15 to 0.35 meters is expected for the period 2000–2050 and 0.35 to 0.85 meters for the period 2000–2100.[57] The sand replenishment strategy offers the advantage that the amount of replenished sand can be adjusted easily when the sea level rise is higher or lower than expected.

The role of the state is extensive: overall supervision, flood defense management at the Wadden Isles and at the Delta Dams, and coastline management. As overall supervisor, the state also bears responsibility for strategic policy. Daily management of flood defenses of the sandy Holland and Delta coast is the task of the water boards. For implementation of coastline management, such as the design of annual management schemes, the state seeks advice from provinces, water boards, and municipalities. Since 2002 the water policy and international coordination is the responsibility of the Water Directorate at the Ministry of Infrastructure and the Environment, whereas the Rijkswaterstaat is responsible for the design, construction, management, and maintenance of the main infrastructure facilities.

Toward the end of the first decade of this century an innovative project started in the Dutch coastal zone called "Sand Motor" or "Sand Engine" (*Zandmotor*).[58] The Rijkswaterstaat, the Province of South Holland, universities, research institutes, and the private sector started experiments by depositing large amounts of sand at a specific location near the coast and allowing the natural elements such as wind, waves, tides, and currents to work. As a consequence, a kind of manmade peninsula was formed along the coast, which subsequently contributed to the formation of new beaches and dunes. The purpose is the enhancement of coastal protection in the long term, by widening beaches and

Rijkswaterstaat/Joop van Houdt

The Sand Motor (or Sand Engine) is a huge volume of sand that was deposited along the coast of Zuid-Holland at Ter Heijde in 2011. Forces of nature will spread the sand along the shore, thereby reinforcing the coastline and creating a dynamic area for nature and recreation.

dunes for natural and recreational use, and especially reducing the need for beach replenishment. Much attention is given to the monitoring of the sand movements. Knowledge development, thanks to the Sand Motor project, is co-financed by the European Union's Regional Development Fund. Between March and October 2011, 21.5 million cubic meters of new sand were deposited in the coastal zone. The "Sand Motor Monitoring and Evaluation" program of this project is organized by the Rijkswaterstaat. The first official results will be published in 2016.

EUROPEANIZATION OF WATER POLICIES

BORDER-CROSSING RIVERS

The Netherlands is located in the delta of four international rivers: the Rhine, Meuse, Scheldt, and Ems, of which the Rhine is the largest. The largest portion of these basins is situated in other European countries. Therefore, international cooperation, mutual adjustment, and joint decision making are of utmost importance, and transboundary river commissions have a long and rich history.

The Rhine River is one of the longest and most important rivers in Europe, at about 1,230 kilometers in length and an average discharge of more than 2,000 cubic meters per second. It is Europe's busiest waterway, linking the Swiss Alps to the North Sea, flowing through Switzerland, Germany, France, and the Netherlands. Its basin includes major European industrial areas, such as the Ruhr region in Germany and the Rijnmond region in the Netherlands. The Port of Rotterdam—"The Gateway to Europe," at the mouth of the Rhine—is the largest harbor in Europe.

There is a particularly rich history of cooperation on the Rhine River. Major progress has been achieved

following wars, other manmade and natural disasters, and more recently European Union interventions. Cooperation started in the field of navigation in 1815, just after the Napoleonic Wars, with the creation of the Central Commission for the Rhine Navigation (see chapter 2). The river authorities of the Rhine states succeeded in eliminating obstacles that impeded navigation, which contributed considerably to trade and industry in this part of Europe.

The end of World War II marked the beginning of a new chapter in the Rhine's history. Although pollution from chlorides gained attention at the beginning of the twentieth century, awareness of this problem has grown rapidly since then. Industrial and urban leaders came to realize that they could not continue to dump untreated effluents into the river and still expect it to provide their freshwater needs, and governments realized that the river was no longer capable of fulfilling its multiple functions. On July 11, 1950, upon the initiative of the Netherlands, the riparian countries of the Rhine downstream of Lake Constance—Switzerland, France, Luxembourg, Germany, and The Netherlands—joined forces by establishing the International Commission for the Protection of the Rhine (ICPR). During the first decade of the ICPR, it served as a common forum for discussing questions and seeking solutions relating to pollution in the Rhine. However, in 1963 the ICPR parties concluded that the existing tools for cooperation among the governments should be strengthened. Therefore, on April 29, 1963, they formalized ICPR's existence by signing the Convention on the Protection of the Rhine, which widely became known as the Bern Convention. The Bern Convention gave the commission the authority to hold annual plenary sessions and draft international treaties. In 1972 the commission was given the additional task of organizing regular ministerial-level meetings. These Rhine Ministers' Conferences remain the single most important forum for handling issues of Rhine pollution and ecology.[59]

The first Rhine Ministers' Conference on the pollution of the Rhine was held in 1972 to recommend further actions to reduce pollutant chemicals. In 1976 the Rhine Ministers drafted two important conventions. The first treaty, the 1976 Bonn Convention Concerning the Protection of the Rhine against Pollution by Chlorides, focused on waste salts from industrial production (mostly potash fertilizers). The second, the Bonn Convention for the Protection of the Rhine, addresses all chemical inputs into the river, both those from "point sources" and those from "non-point sources." In fulfillment of the Chloride Convention, the bulk of the discharge reductions fell on the potash industry in the Alsace region in France. The convention obligated France to construct chloride-removal systems at their potash plants and to pump the recovered salts into underground limestone formations. However, due to protests in the Alsace region, the French government refused to submit the Chlorides Convention to Parliament for ratification. In 1985, after finding methods for storing the waste salts more securely, the French ratified the Chlorides Convention. Since then the river's salt load has dropped significantly. Although the convention required a strong reduction of the inputs from France, it was financed largely by the other basin states (Switzerland 6 percent, Germany 30 percent and the Netherlands 34 percent). The official argument was that the other countries must also reduce their inputs, but in reality the French potassium mines were the main contributor. However, it was viewed as a concession to France to come to an agreement. The Chemicals Convention was initially on a faster track but also ran into implementation problems of its own. One of the causes was the lack of suitable technologies for reducing the input of many of the chemicals. Treatment plants often took years to design and construct, especially if the mitigation technologies were new or untested.

International cooperation got a new impetus on November 1, 1986, when a fire broke out in a chemical storehouse by Sandoz in Basel, Switzerland. It was extinguished with large amounts of water which then streamed into the Rhine, heavily polluting the water with pesticides and degradation products. The water in all downstream countries became polluted. Drinking water companies had to stop their intake of water, massive fish kills occurred, and some speculated that the Rhine ecosystem was virtually dead. The ecosystem was restored relatively quickly after the chemicals disappeared, however, because of renewal from tributaries. Nonetheless, the accident had a large impact. Within two weeks, a Rhine Ministers Conference was organized, and in May 1987 a concept Rhine Action Plan (RAP) was ready, which included as central goals the return of salmon to the Rhine and a 50 percent reduction of emissions for many substances.[60] The RAP was helpful in implementing the Chemicals Convention, putting many of the chemicals in the Chemicals Convention on a fast track for reduction and targeting every factory on the Rhine, regardless of size, that produced any testable amount of organic and inorganic substances on the priority list. Improvements in water quality between 1970 and 2000 demonstrate unequivocally that both the Chemicals Convention and the Rhine Action Plan have had an enormously positive impact on the entire Rhine basin.

Rijkswaterstaat

Poisoned fish in the Rhine due to the Sandoz chemical plant explosion, 1986

A part of the 1987 Rhine Action Plan was the Plan Salmon 2000, which aimed to establish self-sustaining populations of Rhine salmon by the first decade of the new millennium. This plan was directed to all of the river's main migratory fish (salmon, sea trout, sea lamprey, and sturgeon), but the spotlight was on the salmon as a key indicator of the river's health. It also has a greater symbolic value than other migratory fish in this river. Many hindrances in the river were removed or made passable, so that these fishes could migrate between the upper river and the North Sea. Examples are changes in the operation procedures of the Haringvlietdam in the mouth of the Meuse-Rhine Delta and modifications at the sluiceways in the Afsluitdijk between the IJsselmeer and the Wadden Sea/North Sea. However, it was not until the Rhine Protection Commission issued its blueprint for riparian restoration, the Ecological Master Plan for the Rhine (1989), that salmon repopulation commenced.[61]

In January 1998 the 12th Conference of Rhine Ministers adopted an Action Plan on Flood Defense to be implemented over twenty years. The floods of 1993 and 1995 were catalyzing events for this plan. The most important aims of the plan were to reduce damage by up to 10 percent by the year 2005 and by up to 25 percent by 2020. Extreme flood levels downstream of the regulated Upper Rhine are to be reduced by up to 30 centimeters by 2005 and by up to 70 centimeters by 2020. These ambitious targets are likely to be reached only through an integrated managerial approach at local, national, regional, and international levels.

The Rhine Action Plan on Flood Defense empowered the Rhine Protection Commission to "compensate for the ecological deficits of the past" by removing "human

interferences with the river regime as far as possible." The plan is conceived in phases. The first phase (1995–2000) was directed to provide a comprehensive overview of flood-prone regions in the Rhine catchment basin. This task was largely accomplished with the publication of the Rhine Atlas in 1998, which identifies polder areas and maps sites where a return to natural conditions is economically feasible and ecologically necessary.[62] The second phase (2000–2005) focused primarily on the establishment of water storage sites. The goal is to reduce the maximum water height under extreme conditions by 30 centimeters. The aim of the third phase (2005–2020) is a reduction of 70 centimeters of the maximum water level for protecting the downstream areas.

Because the 1987 Rhine Action Plan ended in the year 2000, the 13th Conference of Rhine Ministers on January 29, 2001, adopted the new program, Rhine 2020: Program for the Sustainable Development of the Rhine. The Rhine 2020 program focused on the continued implementation of the Ecological Master Plan for the Rhine (1991), the improvement of flood prevention by implementing the Action Plan of Floods (1998), and the further improvement of water quality and groundwater protection. Summarizing, the targets of the Rhine 2020 program are:

- Sustainable development of the Rhine ecosystem
- Secure the use of Rhine water for drinking water production
- Improve sediment quality in order to be able to dispose of dredged material without causing any harm
- Comprehensive flood protection and protection taking into account ecological requirements
- Depollution of the North Sea.[63]

During the 14th Conference of Rhine Ministers held on October 18, 2007, the ministers, together with the representative of the European Commission, made an assessment of the many years of cooperation in protecting the Rhine, its tributaries, and the entire watershed. Above all, they recommended a further reduction of inputs of pollutants, particularly nitrogen inputs of diffuse origin, such as agriculture and micro-pollutions from urban wastewater. They also made agreements for the upstream migration of fish into the Rhine system via the floodgates of the Haringvliet and the construction of a fish passage at the Strasbourg Barrage and decided to work on an "overall strategy for the sediment management of the Rhine." Special attention was given to jointly developing adaptation strategies for water management in the Rhine watershed in order to be able to cope with the challenges of climate change. In this way they actualized the guidelines for future cooperation.

Sixty years of cooperation on the Rhine by a succession of Rhine Conventions and Conferences of Rhine Ministers, and the implementation of numerous measures, resulted in immense improvement of the water quality of the Rhine and along many of its tributaries. Also, the biological state of the Rhine and its tributaries improved substantially and the species numbers continued to rise. Since 2006 migratory fish may again reach the spawning grounds in the Rhine tributaries as far as Strasbourg. Great efforts were made towards improving flood prevention and protection, but also a large number of measures have yet to be implemented. A continued monitoring and updating of the Action Plans is foreseen. In particular, the effects of climate change have garnered a great deal of attention. Increasingly this cooperation is organized on the scale of the entire international river basin.

The Rhine 2020 program is increasingly carried out in direct relation to the European Water Directives, particularly the EU Water Framework Directive (2000). These European developments will be discussed further. Comparable developments occurred in the other major river basins (Meuse, Scheldt, and Ems), but the Rhine River has primary consideration.

EUROPEAN WATER POLICY

The history of Europe has been characterized much more by divisions, tensions, and conflicts than by any common purpose. Rivalry between the states, emerging and declining empires, such as the Roman Empire (27 BC–476 AD), the Frankish Empire (third–tenth century), the Austro-Hungarian Empire (1867–1918), the Ottoman Empire (1293–1922) and so on, are the "ever repeating" picture in the European history. European history is therefore shaped by a long list of conflicts: wars between and within European nations as well as rebellions by groups seeking independence. Examples include the Eighty Years' War (1568–1648), the Thirty Years' War (1618–1648), and the Napoleonic Wars (1799–1815). Political, religious, and economic deviations and differences in language form the basis of these conflicts. The twentieth century showed dramatic explosions in the rivalry between the European powers, resulting in World War I (1914–1918) and World War II (1939–1945).

After the Second World War the political climate favored the unification of Europe. The European Coal and Steel Community (ECSC) was founded in 1951 by the Treaty of Paris. The founding members of the ECSC were Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany. In 1957 two new communities were established: the European Economic Community (EEC), founded by the Treaty of Rome, and the European Atomic Energy Community (Euratom) by yet another Treaty of Rome. These three together were generally known as the European Community (EC). On this basis the European Union (EU) was introduced by the Treaty of Maastricht and came into force on November 1, 1993.[64] Currently (2013) the EU is composed of 28 independent sovereign states, which are known as the Member States (MS). Discussions on joining the EU are going on with some "candidate countries" (Iceland, Montenegro, Serbia, the Former Yugoslav Republic of Macedonia, and Turkey). To join the EU, a country must meet the Copenhagen Criteria, defined at the 1993 Copenhagen European Council. These criteria require a stable democracy which respects human rights and the rule of law, a functioning market economy capable of competition within the EU, and the acceptance of the obligations of the membership, including EU law.[65]

The European Community started its environmental policies with an ambitious program that contained many elements of today's ideas on "sustainable development."[66] After the first United Nations Conference on the Environment in Stockholm 1972 and growing public and scientific concerns on the limits to growth, the commission became active in initiating an original community policy. On the basis of European council commitments in 1972 to establish a community environmental policy, the first Environment Action Program (EAP) was decided upon in November 1972. It was argued that "the protection of the environment belongs to the essential tasks of the Community." The next EAPs have become gradually broader in their scope, reflecting the cross-border nature of many environmental issues as well as the development of the single market, where the freedom of movement of people, goods, services, and capital is guaranteed by a standardized system of laws for all Member States. The sixth EAP (2002–2012) focuses on four priority areas: climate change, nature and biodiversity, environment and health, and sustainable use of natural resources and the management of wastes. Its strategy now is to postpone potentially controversial political decisions to later phases and to rely on more cooperative approaches. The role of small specialist expert communities increased and the commission changed its key role from an initiator of legislation to a manager of policy processes.

Water legislation was one of the first sectors to be covered by the EU environmental policy. Since the beginning of the 1970s water protection has been a subject of

rising concern. It developed in a number of steps. The first period (1973–1988) mainly focused on the protection of water used for human activities. Environmental quality standards (EQS) were specified in a number of directives. Examples are the Surface Water Directive in 1975, the Dangerous Substances Directive of 1976, and the Drinking Water Directive in 1980. This period included quality objectives legislation on fish waters, shellfish waters, bathing waters, and groundwater.

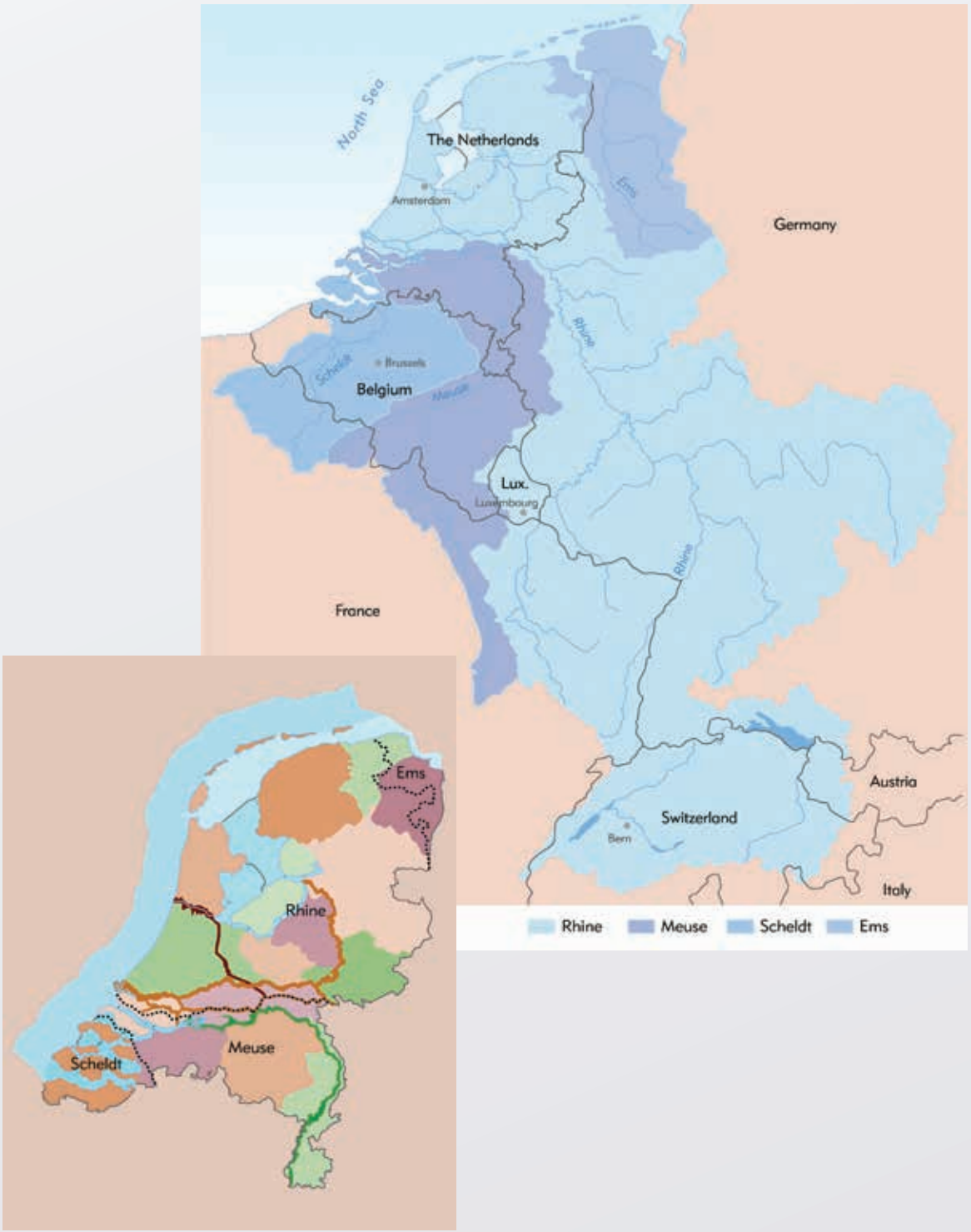
The period 1991–1998 focused more on limitations of particular emissions, both from point sources and diffuse sources. The eutrophication of waters, caused by an abundance of nitrates and phosphates, received particular attention. One of the biggest problems that future water protection is facing is not insufficient legislation, but the fact that basically no directive has been completely implemented and applied by the Member States. Central to this are the high public costs involved. For example, the EU-wide costs for the implementation of the Urban Waste Water Treatment Directive were estimated to be 150 billion euros (1994–1995 value) during the period of 1993–2005. However, this directive was relatively well implemented. Greater problems arose with the implementation of the Nitrate Directive, which created problems in most European countries. The reduction of diffuse pollution and required changes in agricultural production are much more difficult to achieve than the control of the easily identifiable sources of urban waste water pollution.

Pressure for a fundamental rethinking of community water policy came to a head in mid-1995. The commission, which had already been considering the need for a more global approach to water policy, accepted requests from the European Parliament's Environmental Committee and from the Council of Environmental Ministers. The commission agreed to produce a framework for water policy and, if appropriate, devise a legislative proposal to ensure the overall consistency of water policy. The draft legislation of this Water Framework Directive (WFD) was circulated in 1996, with amendments processed in 1997 and 1998. The final text was adopted in October 2000, and the WFD came into force in December 2000. The directive's overriding requirement is that the Member States ensure that a "good chemical status" and a "good ecological status" are achieved in all European waters by the end of 2015. Its aims are a higher quality of aquatic ecosystems and their environment, a sustainable use of water resources, and an improvement of the aquatic environment by reducing pollution and mitigating the impact of floods and droughts. To implement these objectives, river basin management plans have to be outlined for every international river basin. In the Netherlands four river basins have been defined: The Rhine, Meuse, Scheldt, and Ems. The Water Framework Directive marked a new stage in the harmonization and internalization of integrated water management policy. Its implementation also implied a more intensive network-building of all relevant water management actors.

Although the WFD aspires to an integrated water management approach, flood management issues are not covered by the WFD. However, pushed by the extreme summer floods in 2002, the commission made a proposal for a Floods Directive, Reducing the Risks of Floods in Europe, which was adopted in 2007 and came into force in December 2007. The objective of the Floods Directive is to create obligations for Member States to manage the risks of floods to people, property, and the environment by concerted, coordinated action at river basin level and in coastal zones. Such provisions should be undertaken by all European countries in their River Basin Management Plans. In the coming years, a further integration may be expected of the ecological WFD with the EU Floods Directive to an integrated water resources management approach under the EU Common Implementation Strategy (CIS).[67]

Dutch River Basins

The four rivers entering the Netherlands: Rhine, Meuse, Scheldt, and Ems. Lower left, the river basin districts and the sub-basins in the Netherlands.



Rijkswaterstaat

Notwithstanding large differences among the various European countries, such as differences in geography, physical conditions, culture, institutional organization, and politics, this strategy successfully arrived at a coherent and harmonious implementation in accordance with the agreed-upon time scales. The key element is the River Basin Management Plan (RBMP) that Member States have to produce for each river basin management district. The preparation of RBMPs is an important area of influence for all stakeholders, because this is where all relevant issues for the achievement of the WFD objectives are negotiated. Part of this plan is the program of measures (PoM), which should be indicated for all waters at risk, to achieve the objectives of Article 4 of the WFD in good time. The DPSIR-approach (Driver-Pressure-State-Impact-Response), a causal framework for describing the interactions between society and the environment, is used as a logically stepwise approach of driving forces (land use, industry, agriculture, etc.), human pressures, the "state" of the environment, the environmental effects, and the societal response through physical measures, regulations, taxes, and so on. The legally binding timetable with its strict deadlines and powerful sanctions is expected to be a valuable instrument to reach the agreed targets in good time.

In almost all European countries the introduction of the WFD has placed a great deal of pressure on existing institutions. The WFD provides procedural rules and guidelines for organization, planning, and management at the river basin scale. Kallis and Briassoulis (2004) indicate how the WFD recognizes the limits of the top-down "command and control" approach and adopts a more flexible and cooperative implementation strategy.[68] EU working groups, with participation from national delegates, experts, and representatives of NGOs, are preparing nonbinding guidance on the various implementation-related tasks, such as the identification of water bodies, reference conditions, environmental objectives, public participation, and monitoring.

The new European dimension of water management has induced changes in water management practices in the Netherlands. In fact, it is working with a number of new "rules of play."[69] The Netherlands has experience of many centuries in the protection of the country against extreme floods. During the past several decades, water quality, nature conservancy, and landscape ecology received increasing attention, and since the 1980s integrated water management has become a widely accepted practice. The Water Framework Directive builds on this by focusing on the ecological status of the water bodies. Furthermore, the catchment approach forms the basis for the European water management, and this has no long history in the Netherlands because it is situated in a delta and the basins of all major rivers are largely situated outside the country. Furthermore, in the Netherlands the commitments of the water agencies were generally based on agreements to work on the realization of jointly agreed high ambitions. Now commitments must be made on measurable contracted results. No large differences in the final results are expected, but the loss of flexibility should be accepted and the agreed ambitions need to be attuned to the new situation.

Also for the Rijkswaterstaat, this European context and its "new rules of play" implies a change in its working practice. It has the responsibility for the management of the major rivers, which means that it concentrates on the river management between the dikes. However, working with the catchment approach means close coordination with a number of stakeholders, including the water boards and the provinces. It was difficult to see these major rivers as a part of the whole catchment, in which jointly-agreed visions, objectives, and measures must be defined and agreements must be reached about their real implementation. This was all the more difficult because of the

transition from a set of rather independent regional divisions of the Rijkswaterstaat to a more centrally governed organization, where priorities must be made between investments in different river basins. It often resulted in tensions in the decision-making process in sub-basins at the regional level. Setting priorities at the national level requires the balancing of priorities of one river basin over another. The question then arises how joint agreements can be made with regional representatives of organizations in the river basin, in which decisions are taken at a higher (national) level. Nevertheless, these problems have been solved pragmatically during the cooperation of all concerned water authorities in the more than 130 regional working groups, in which joint proposals have been developed for objectives, measures, and actions to arrive at a positive status of all water bodies in such an area. In this way, all contributed to the jointly agreed River Basin Management Plans, which were sent to the European Commission in March 2010.

Not surprisingly, this European cooperation was not restricted to the border crossing rivers and their catchments; also the North Sea has a long international history. In the North Sea a huge number of functions have to be fulfilled, such as shipping, fishing, recreation, oil and gas production, sand and gravel extraction, energy production by wind turbines, pipeline transport, and so on. The challenge is to combine such a large number of functions with a sustainable maintenance of ecological values. Doing so had become a major concern for the Directorate for the North Sea of the Rijkswaterstaat as well. This directorate, since its establishment in 1971, has been responsible for the maintenance of navigation channels to the ports of Rotterdam and Amsterdam, for the management of navigation on the North Sea, and for a monitoring network that produces data for weather forecasts, prediction of storm surges, and other purposes.[70] The directorate became increasingly involved in the implementation and enforcement of international environmental agreements and regulations and the Sea Water Pollution act (*Wet Verontreiniging Zeewater*).[71]

Two important milestones in the 1970s are the Oslo Convention and The Paris Convention. A particular event gave rise to these agreements for protection of the sea area. On July 16, 1971, the Dutch ship *Stella Maris* was sailing from the port of Rotterdam to dump chlorinated waste in the North Sea. Under pressure from public opinion and the governments of several countries, the ship returned to the port without carrying out her mission. On February 15, 1972, in Oslo agreement was reached on the Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft (the "Oslo Convention"). The agreement came into force in 1978. It was felt that such an agreement must not be restricted to marine pollution by dumping but should also prevent marine pollution from discharges of dangerous substances from land-based sources, so a Convention for the Prevention of Marine Pollution from Land-Based Sources (the Paris Convention) was signed on May 4, 1974, in Paris and came into force in 1978. Two commissions were established to administer these conventions: the Oslo Commission and the Paris Commission. In a joint meeting of the commissions in 1992 in Paris, which was attended by the ministers of all concerned states and a representative of the European Union, a new convention was adopted for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention), together with a Final Declaration and an Action Plan to guide the future work of the OSPAR Commission, in which the Oslo and Paris Commissions were united. The OSPAR Convention came into force in 1998. Its activities concentrate on four main areas: protection and conservation of ecosystems and biological diversity, hazardous substances, radioactive substances, and eutrophication. Important steps

forward have been made by the international North Sea Ministers Conferences, which started in 1984 in Bremen. An example of such an important step is the adoption of the precautionary principle at the London Conference in 1987. Until 1995, pollution was the main issue. Since then, increasing attention was given to the North Sea fish stocks and the impact of fisheries on the North Sea ecosystem. Starting from an ecosystem approach, a framework of operative ecological quality objectives (EcoQOs) has been established.

In June 2008 the European Commission adopted an ambitious Marine Strategy Framework Directive (MSFD) to protect more effectively the marine environment across Europe.[72] It aims to achieve "Good Environmental Status" (GES) of the EU's marine waters by 2020. On September 1, 2010, the European Commission adopted a set of detailed criteria and indicators. Major research topics were defined to develop additional scientific understanding for assessing this GES, which include the effects of climate change, the impact of human activities, the ecosystem approach to research management and spatial planning, and a further development of operational oceanography and marine technology. Both through this MSFD and the OSPAR-agreements, intensive cooperation has developed between the countries around the North Sea. The Netherlands is represented by the Rijkswaterstaat as the administrator of the Dutch part of the North Sea area. At the strategic level, the Rijkswaterstaat was the leading actor, but since 2002, the Water Directorate of the Ministry of Transport, Public Works and Water Management (now the Ministry of Infrastructure and the Environment) has assumed this leading role.

CONCLUSION

As described in chapter 6, the period 1900–1970 was a technocratic era, where the required budgets were available and civil engineers had the mandate to design their solutions for water problems within society. This situation changed radically since the 1970s. The economic decline forced the Rijkswaterstaat to work with lower budgets and a severe reduction in the number of employees. From 1980 to 1994 the number of employees was reduced from 13,700 to 9,700. At the same time, the increased environmental awareness, through which water systems are now seen as important ecosystems, as well as the unfolding democratization of Dutch society, had an enormous impact on water management. Water management problems could only be solved by an integrated approach, where hydraulic, environmental, economic, and social aspects were combined, and collaboration with stakeholders and the public has become key to solving many water problems.

The organization of the Rijkswaterstaat clearly had difficulties in responding to the new challenges. Discussions on large infrastructure projects led to severe criticism of the organization of the Rijkswaterstaat, notably the cost overruns of the Betuwe railroad route to Germany. Although other factors contributed to exceeding the project budget, the organization of the Rijkswaterstaat was often blamed in the media. The technocratic approach and not listening to other viewpoints sparked criticism as well. In regard to water management, this is illustrated by the Eastern Scheldt project and the Markerwaard reclamation project.

Particularly the Eastern Scheldt project, but also other discussions in the same period, contributed to a turning point in the organization and working methods of the Rijkswaterstaat, although this was generally a gradual development process. A number of painful reorganizations were needed. During the period 1970–2010 the Rijkswaterstaat developed into a multidisciplinary organization and attempted to become more oriented to the public. Over the past 200 years the Rijkswaterstaat has proved to be a resilient organization, knowing how to adapt and to survive.

Notwithstanding all the criticism, impressive results were achieved during this period, including a number of innovative technological projects, new methodologies, and advanced water management policies. The organization also managed to realize these changes in complex political and societal circumstances. An essential difference with the past is that implementation of new policies and the realization of projects are increasingly accomplished with other actors, such as the provinces, water boards, and private enterprises. Examples include the implementation of the Water Pollution Act (WVO), the construction of the Eastern Scheldt Barrier, the development and implementation of integrated water policies in the 1970s and 1980s, and the River Management Plans in the 1990s after the floods of 1993 and 1995, resulting in the large infrastructure projects Room for the River and Meuse Works. In addition, the Flood Defense Act of 1989 and the emergency Delta Law Major Rivers of 1995 were implemented in cooperation with the provinces and water boards. The coastal zone benefited equally from such achievements, such as the new policies for "dynamic preservation" of the coastline in the 1990s and the application of innovative sand replenishment technologies to guarantee a sustainable safety level and to preserve values and functions in the dune area. Finally, important contributions were made to the international coordination for the Rhine, Meuse, Scheldt, and Ems rivers, resulting, for example, in Rhine Action Plans and Meuse Action Plans and their implementation.

In addition to the "ecological turn" and "societal turn" at the end of the twentieth century, the beginning of the twenty-first century witnessed an "organizational turn" in 2002, as policymaking and international cooperation were transferred to the policy department of the ministry. After that, the Rijkswaterstaat underwent an intensive reorganization process, resulting in a public-oriented network organization. Also impressive is the "knowledge turn" in 2007, when a large number of Rijkswaterstaat specialists switched to the knowledge institute Deltares.

Notwithstanding all these "turns," there is also a great deal of continuity. The basic institutional structure of water management within the Netherlands has hardly changed. The new Ministry of Infrastructure and the Environment, the Rijkswaterstaat, provinces, and water boards are still the crucial governmental actors in Dutch water management, and unlike many other countries, water management and water safety continue to be the exclusive responsibility of these governmental actors. Finally, in spite of the broadened arsenal of flood management strategies, the construction and strengthening of dikes remain the dominant safety strategy to date.

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