A VCA Audit of the Management Plan for the Tullstorp Stream Initiative, Southern Sweden

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A. Overview of the Conservation Area

A1 – Introduction

The Tullstorp Stream area located at the most southern tip of Sweden is an area dominated by very productive farmland. During the late 19th century and the whole of the 20th century the area was almost totally transformed and very little of the earlier wetlands survived. This in combination with agriculture very dependent on artificial fertilizer resulted in a situation where today large amounts of nutrients run into the Baltic Sea through the Tullstorp stream.

Unfortunately, this situation is not unique and the same conditions are present in many other agricultural districts around the southern Baltic Sea.

In 2009 a landowner driven project started to restore the river and reinstall wetlands and a meandering course of the stream. To main goals were to significantly reduce the nutrient flow through the Tullstorp Stream as well as to restore the biodiversity in the area. In 2016 such excellent results had already been achieved so the society behind – the Tullstorp Stream Economic Association ("Tullstorpåns ekonomiska förening") decided to apply for VCA status.

This is an audit report for the existing management plan developed for the southern part of the Tullstorp Stream area in 2016/17.

A2 - Historical background of the Tullstorp area and some socio-economic factors

The Tullstorp area is situated in the southern-most province of Sweden – Scania (Skåne). The south-western part of the province is dominated by clay moraine. This moraine is formed during the last ice age and is extremely good for agriculture.

The most southern part of this area is traditionally called Söderslätt ("the Southern Plain"). The northern section has a rather pronounced topography while the southern part is very flat. Since Neolithic time this area has been quite densely populated due to its capacity to produce high harvests of different types of grain. The whole Tullstorp area is situated both in the northern and southern area. The management plan referred to in this audit report covers mostly the southern flat part and only to a limited extent the northern more undulating part.

Figure 1. *The Tullstorp Stream area is situated in the most south-western section of Sweden being included as part of a larger area, traditionally named Söderslätt*

Even if the Söderslätt area was one of the best bread producing areas in Sweden at the end of the 18th century, the area looked very different from today. Around 20% was the covered by wetlands of different kinds. Also a large proportion of the land was permanent grassland. Due to the farming system only around 2/3 of the arable fields was farmed at one time, and is some areas even less. The farming was totally depending upon manure produced by the domestic animals grazing and eating hay during wintertime produced in the hay-meadows.

Large agriculture reforms took place during the 19th century, generating farms with all their land concentrated in one area. Many farms had to move out of the villages, creating a landscape with single farms spread out in the landscape. Initially the use of the animal's urine and use of nitrogen fixating plants raised the productivity. Large tracts of grassland were now ploughed and transformed into arable fields. During the last decades of the 19th century and in the beginning of the 20th century more or less all wetlands had been drained and transformed into arable fields on Söderslätt. The drainage systems of the arable fields were also made much more efficient.

Finally the introduction of artificial fertilizers in the first half of the 20th century made the agriculture highly productive in combination with new genetically modified types of grain, chemical pesticides, fossil energy and mechanisation. This new agriculture, totally dominated by large agricultural fields, came to form the Söderslätt landscape.

More or less all grasslands and wetlands were gone. Small remnants of more original nature remained as parks around the larger estates, ponds, small groups of trees and some traditionally used grasslands near the coast. The loss of biodiversity during the period 1810-1970 was extremely high.

As an illustration of the change in productivity during the period 1810-2000, the production of grains in 1810 in an arable field was 200-400 kg/ha whilst in the year 2000,10 000 kg/ha can be produced in some of the arable fields in Söderslätt.

One should also understand that much smaller parts of the landscape in 1810 were arable fields compared to 2000. With that perspective 50-100 persons per km^2 could have survived on a rather simple diet in 1810. Should the same simple diet be applied to the year 2000, 3000 persons and even more could survive on one km^2.

The new landscape had also a large impact upon the Baltic Sea south of Söderslätt. In the beginning of the 19th century the small rivers coming from Söderslätt and ending up in the Baltic Sea are estimated to have carried very small amounts of nutrient from the landscape into the sea. This was due to two main reasons: a general lack of nutrients in the agriculture system and the large amount of wetlands and small meandering watercourses in the landscape. Nutrients reaching the watercourses were to a large extent either absorbed by the vegetation or in the case of nitrogen denitrified or transformed to N_2-gas, then unavailable for most plants to take up.

When the small meandering watercourses were transformed to linear ditches and more or less all wetlands were drained, the capacity to “clean up” the water was seriously diminished. At the same time the load of nutrients in the agricultural systems was very much raised during the 20th century.

The prize for the tremendous rise in food production in Söderslätt was high – a very significant loss of biodiversity on land and a polluted sea.

Unfortunately, the Söderslätt area was not unique at all. A lot of other areas around the Baltic Sea were also striped by its biodiversity during the 19th and 20th century, and large parts of the farmland around especially the southern Baltic Sea contribute significantly to the general eutrophication of this inland sea.

As of the beginning of the 1980s there has been a general concern about the health of the Baltic Sea. After 2000, the Swedish Government has begun to stimulate economically different measures to reduce the leakage of nutrients

from agrarian landscapes to the sea. Also some legalisation to reduce the leakage has been introduced. Measures to reintroduce wetlands in the landscape as a mean to reduce nutrient flow to the sea constitute since around ten years ago a fairly large part in the fight to save the Baltic. Parallel to using new wetlands to reduce the nutrient leakage to the sea, wetland restoration for biodiversity reasons has started. Today both nutrient reduction and biodiversity restoration are important reasons for the Swedish Government to economically stimulate the forming of new wetlands.

One very large challenge for wetland restoration in the landscape has been the larger-scale impact. A new wetland on one land property often impacts on surrounding areas of other landowners. The water-legalisation is used to regulate such inter-dependence. It is, therefore, of great importance for successful restoration of wetlands that several landowners get together and agree. The Tullstorp Stream initiative is unique in Sweden as most of the landowners in the river catchment area have come together and formed an economic association. This group manages today the wetland restoration in a significant part of the Tullstorp river basin.

A3 – Tullstorp Stream Management Plan

Although the Tullstorp Stream initiative covers the entire river basin, the current management plan (dated 7 June 2017) only covers the lower part of the stream downstream the Jordberga Property. However, it is very likely that additional management plans for the central and northern part of the Tullstorp Stream area will be elaborated in the near future. The southern section is also the part that has seen most of the restoration efforts so far, which has justified the elaboration of a management plan.

A4 - Basic facts for the Tullstorp Stream

The Tullstorp Stream is the longest watercourse in the Trelleborg municipality. The drainage area is approximately 6 300 ha and the length about 30 km. Tullstorpsån flows from Alstad to Skateholm in the south, where it flows into the Baltic Sea.

The natural structure of the stream has been highly modified, and the ecological status is poor. The majority, about 85% of the catchment area consists of arable land, 9% is forest and 6% urban areas.

The edges of the river has been steeped with an inclination of about 1: 1.5 so that the water will flow to the recipient, the Baltic Sea, as quickly as possible. The natural water retention capacity of the river is therefore depleted and the rapid flow of water causes floods and extensive nutrient leakage from the fields to the sea.

The Tullstorp Stream and a nearby stream - Dalköpingeån, which have the largest catchment areas and flows within the municipality of Trelleborg - account for the largest transports of nitrogen to the Baltic Sea. Tullstorpsån also has the largest outflow of phosphorus. The nutrient transport from

Tullstorpsån to the Baltic Sea is estimated to be approximately 250 tonnes of nitrogen and about 4 tonnes of phosphorus annually.

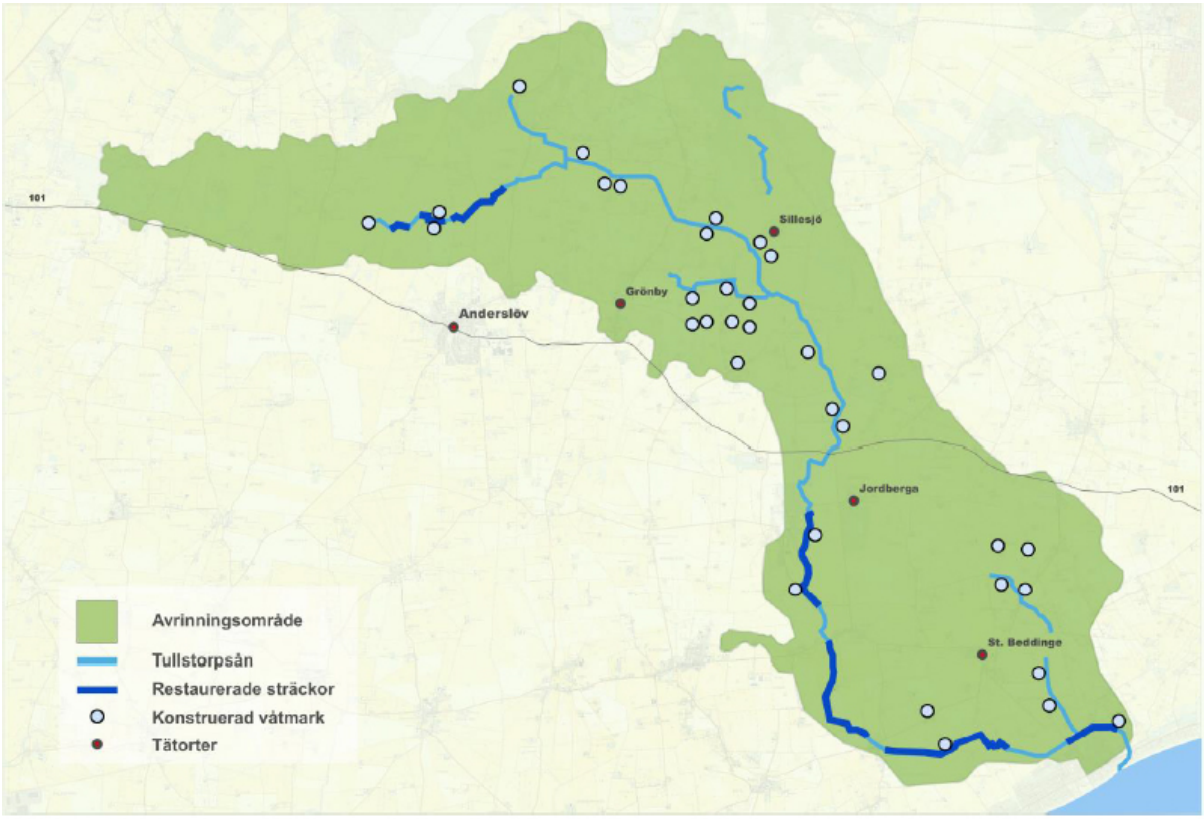

Figure 2. *The Tullstorp area - Green= the drainage area. Light blue = the riverDark blue= restored sectionsof the river, White dots = constructed wetland, and Red dots= urban areas*

A5 - Basic facts for the Tullstorp Stream area below Jordberga

- Area of the total catchment area down streams Jordberga: 2,083 ha;
- Area in the agricultural system: 1,804 ha;
- Built up area, roads and park area: 279 ha;
- Area of the river and wetland area planned for in the Management plan: 25 ha;
- Lengt of the river in the area of the management plan: 7,2 km;
- Land use changes 2013-2016:

Area	2013 (ha)	2016 (ha)	Diff (ha)
Fields	1782,6	1739,8	-42,8
Grazing	54,6	52,8	-1,8
Wetland	9,0	Approx. 26	Approx. 17
Total	1804,1	1846,2	

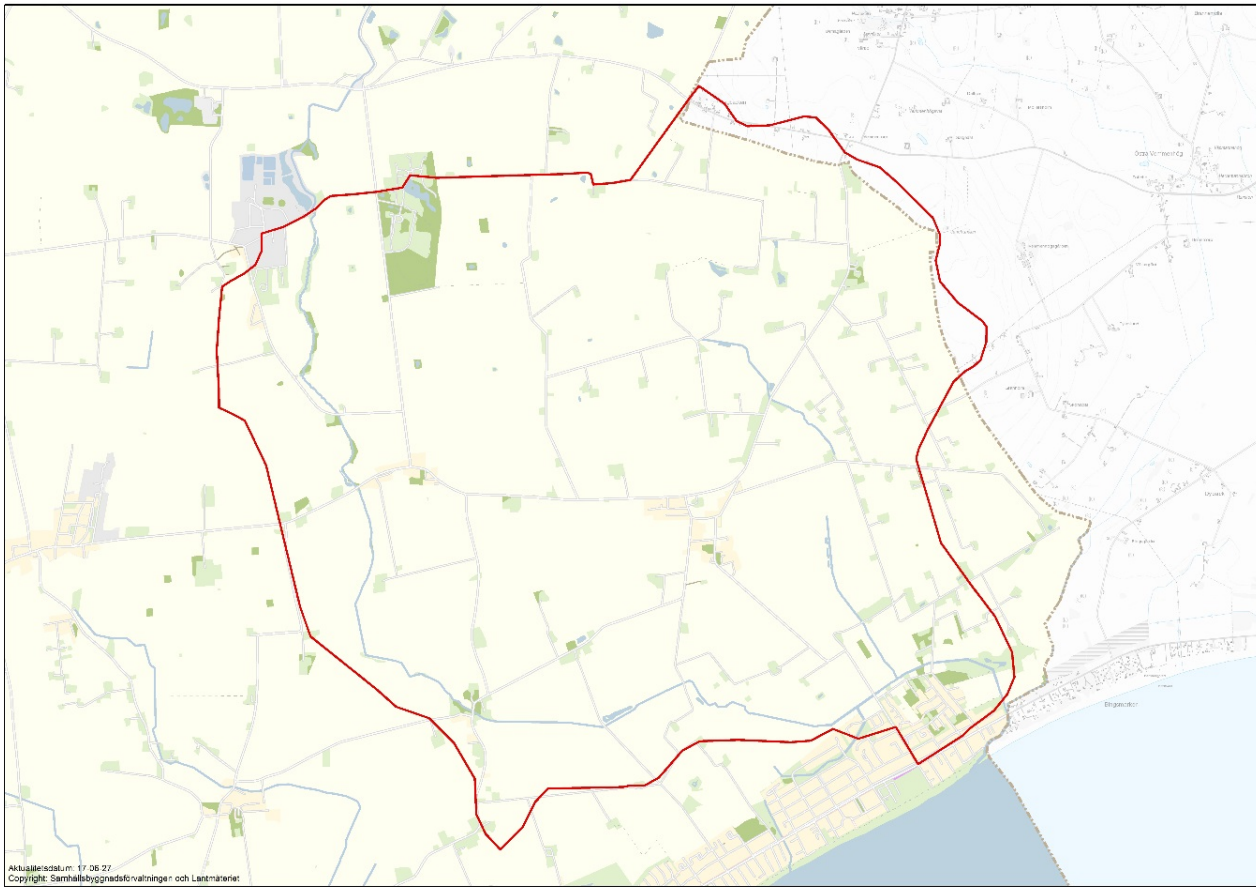

Figure 3. *The area of the Management plan, which the present audit refers to*

B. Biodiversity baseline conditions

Reading through the management plan gives the impression that the knowledge of what has happened to the ecosystems in the Tullstorp Stream area since 2009, when the restoration project begun, is very limited. However, this is not the case, and the authors of the plan have deliberately chosen to concentrate on the coming management rather than reviewing the past.

To get a good impression of what has really happened during the years 2008-2017, a visit to the project's homepage is recommended where the many studies undertaken are available (most of them in Swedish): http://www.tullstorpsan.se/information/rapporter/

Baseline conditions were poorly documented during much of the late 20th century, and for this section the year 2009 is used as a baseline year, since a number of studies then begun, although some restoration measures to improve the biodiversity of the area started earlier.

Here are some key baseline facts:

- The watercourse was totally canalised to fairly deep and linear structures;
- The and-use was totally dominated by agricultural fields and very small areas of wetlands existed;
- The chemical status in the Tullstorp Stream was bad, with heavy loads of nitrogen and phosphorus;
- The bird-fauna was fairly impoverished even if the were some areas with ponds and the park of Jordberga giving the area a slightly more species rich bird fauna compared to some similar areas,
- The fish-fauna was dominated by species with good tolerance for oxygen depleted systems and muddy water. Probably the fish-fauna was even worse of, some decades earlier when large amounts of organic material were let out from a sugar plant at Jordberga. This plant has been closed.
- Other organisms. Fairly little is known about the earlier invertebrate fauna, the fungi and lichens and mosses of the area.
- The flora of vascular plants was fairly well documented and was much depleted as a result of the large-scale agriculture of the area.

C. Conservation impact assessment

C1 - Impact on the ecosystem of the area

As there has been a fairly large amount of studies concerning the ecosystem in the management area (also north of the management area in the Tullstorp area) during the period 2009-2016. Those studies can be related to the different restoration measures that have been carried out during this period.

With general ecological knowledge, but also very much studying the results of those studies it is possible to assess the planned management for the Tullstorp area downstream Jordberga.

But it is important to say that the management area downstream Jordberga is not an isolated area. Different measures planned and carried out north of the area inside the Tullstorp Stream area has probably already had an impact and in the future this would also be the case. Therefore, it is to someway difficult to do assessment of the management plan for the area downstream Jordberga without considering the upstream areas as well.

C2 - Chemical status of the river

The chemical status of the river is since 2009 continuously monitored not far from its mouth at the coast. The results show that the amount of phosphorus has been reduced during the period 2009-2016 with 30%. Further reductions will probably be seen during coming years and it will be well monitored.

Concerning nitrogen no overall reduction has been measured. Reduction with 30% can be seen during the summer months but still the results for the whole year show no significant reduction.

The monitoring scheme will be sufficient during the coming years, but the nitrogen situation will probably not be much better. The winter leakage will still be a problem. This problem will be discussed later in this report.

C3 - Impact on the Baltic Sea

The exact impact on the Baltic Sea by the restoration of the Tullstorp Stream will always be very low as this river contributes with just a tiny amount of nutrients to the overall situation. However, the successful example has already made an impact, so similar projects will be inspired to start in many similar landscapes.

C4 - Fish status of the river

Careful monitoring of the fish fauna has been carried out in the Tullstorp Stream since the start of the restoration programme. A slightly positive impact can be seen now (2016). It is very likely that the ecological quality of the river in the near future will be much better. The fish monitoring will very likely demonstrate that.

C5 – Bird fauna

Birds are well known organisms and the overall knowledge of birds is good. Careful monitoring of the bird fauna concerning the whole Tullstorp area has taken place since 2009. Depending on the initial circumstances and the different types of restoration, the development of the bird fauna differs from area to area along the river. It is clear that a continuous monitoring of the bird fauna will mirror, in a good way, the improvement of different areas in the Tullstorp area.

Already now, there is an obvious increase in the number of breeding birds, both among typical wetland birds but also among other groups of birds.

C6 - Other organisms

Other organism groups, for example vascular plants and terrestrial insects, are not monitored today in the Tullstorp area. With an ambition to improve the ecological quality in the landscape also outside the river specifically, additional monitoring will be recommended to follow the situation.

C7 - Impact on the human society - Landowners, other persons living in the area of the management plan, visitors to the area, and tourism

The Tullstorp Stream project started on the initiative by the landowners along the river. This makes the initiative very special among ecological restoration projects in Sweden. More normally such projects are started on the initiative

of national, regional or local authorities, and NGOs. Sometimes such initiatives make very slow progress or even stops as the acceptance among landowners becomes low. The fact that the Tullstorp Stream project is landowner driven is probably a key factor to its success.

The project has already made a valuable contribution to creating a positive atmosphere in the area, improving the local quality of certain landowners, and has generated new initiative in the cultural area and in the tourist sector. These types of soft values are hard to measure, but it should be interesting if some studies could be undertaken to assess the impact on those.

C8 - Local government, regional authorities and national agencies

The Tullstorp Stream project has been developed in various ways in cooperation with the local municipality of Trelleborg, with a continuous, on-going dialogue. The municipality regards the project as an excellent example of how to restore a river in a farmland district. The municipality of Trelleborg has inside its borders several similar rivers as the Tullstorp Stream. An ambition from the municipality is that restoration of the Tullstorp could inspire replication in other parts of the municipality.

The Scania County Administrative Board (“Länsstyrelsen Skåne”) is the regional representative of the Swedish Government responsible for the governmental financial support of restoration of wetlands. The national responsible authority is the Swedish Agency for Marine and Water Management (“HaV”). Both these authorities have taken an active part in the development of the Tullstorp Stream project. They are also using the project as a good example when they try to promote similar projects in other areas of Sweden.

D. Conservation action & monitoring

D1 - Objectives and actions

The overall conservation action in the lower Tullstorp Stream drainage area has been identified with the aim of transforming the more or less linear watercourses into different types of more natural flowing small river and wetlands.

In the management area a number of quite large transformations of the river has taken place since 2009 and additional wetlands have been created within the border zones. Much of the management plan discusses how those recently restored areas should be managed. Overall the management plan objectives and actions seem realistic and positive for the ecological development.

Two specific challenges are addressed. Three **invasive species** are regarded as a threat to the ecosystem and quite specific plans are planned to take care

of the problems. The management measures look very adequate but a specific time-plan is not included. Probably it is very urgent to take action against the three invasive species mentioned and the problem can grew if not measures are not taken very soon. Grazing is a very important tool for keeping and developing the biodiversity in the area. It is very positive that this type of management is included in the plan.

D2 - Monitoring

(i) Birds

Bird inventories have been done up to 2014 and show some very good results demonstrating that the creation of wetlands have stimulated many species in a positive way. In the plan it is said that the bird inventories should be followed up every 5th year.

Probably that interval is enough but for some key species more frequent inventories could be preferred. Most important is probably the monitoring of the lapwing (*Vanellus vanellus*) and black-headed gull (*Larus ridibundus*) as they can play a key role in the re-colonization of endangered wetland birds to the area. Both species can act like defenders against predators, as crows, badgers and minks.

A problem in many areas where wetland restoration has taken place the last decades is that some of the more endangered species have not returned even if the habitats look ideal. One contributing factor could be the problem of too heavy predation. In earlier times large populations of lapwing and black-headed gull could defend more endangered species but when, for example, the lapwing populations have dropped too much due to insufficient habitats there is no good “defence” in place when the wetlands are restored. Therefore, it is a very promising sign that the lapwing and the black-headed gulls are increasing in numbers in the area. It is worth following that development more in detail and perhaps also, even more, to give those two species “a helping hand”. Grazing is important for the lapwing and for a number of more rare waders breeding together with the lapwing. Predator control should also be enhanced.

(ii) Fish

This monitoring seems enough and can go on as planned.

(iii) Chemistry

This monitoring seems enough and can go on as planned.

(iv) Others

Two types of new monitoring can be of importance: vascular plants and some groups of insects. The expansion of same vascular plants important as food sources for pollinators should be important to follow. Also insect groups with

good pollination capacity and predation capacity on agricultural pests can be included in monitoring schemes.

E. Some important questions

E1 - Efficiency of the measures? Are the measures the "right ones”?

The measures have so far been very good for the bird fauna, probably fairly good for many other organisms in the area, but we do not know for certain as there has not been organism related monitoring programmes except for fish species.

The chemical measurements shows good results for phosphorus but not very good for nitrogen. Especially the winter run-off of nitrogen is still a large problem despite the measures taken. A prioritized question must be to find added measures to bring down the nitrogen levels. Two main strategies can be seen. One is to create a larger water magazine for stopping winter water to reach the sea too fast as today. Another strategy is to look upon the farming systems and find ways to reduce the winter leakage.

Another general idea, which could be combined with developing the farming system for less nitrogen leakage, is to create more small biotopes outside the immediate vicinity of the river. Such actions will probably be very good additional restoration both for biodiversity and nitrogen leakage.

E2 - Is the management plan realistic?

The management plan is realistic. In some parts ambitions could, however, increase, for example concerning grazing and the creation of additional small biotopes.

E 3 - Is the management plan appropriate for the problems in the Tullstorp area?

Yes really! They start with commitment of reducing the impact of nutrients in the sea, and then successively adding other positive measures as well as adding new goals to achieve higher biodiversity values.

E4 - Are there serious ”gaps” in the plan?

The most serious gap in probably that still the wintertime nitrogen run-off and transport to the sea is so high.

E5 - Can the plan be checked in an appropriate way?

Yes, to a very large extent through the proposed monitoring scheme.

E6 - Are there some ideas about strengths and weaknesses in the plan?

A very important strength is that the project is landowner driven. Some weaknesses in the plan are the limited ideas and measurement to reduce wintertime leakage of nitrogen. Also the links to the rest of the landscape are few and ideas about new small biotopes in the wider landscape could paly a role here.

E7 - Have the plan a good support among the stakeholders in the area? What about the relation to the situation “outside the fence”?

The local support for the plan is very good, also outside the landowner group. People living in the area find their landscape more interesting and the recreation capacity is growing. As mentioned before, there is also strong interest and support from local, regional and national authorities. The project is often seen as a good example to learn from.

F. Overall audit assessment

The overall audit assessment for the present management plan is very positive. The large, coordinated landowner involvement is unique. The systematic work with the whole watercourse is very important and basically hard to achieve, but accomplished here. The continuous monitoring of both biodiversity and water chemistry is good. The intention to expand the approach is promising; especially to include biodiversity around the river is promising. The recognition of the cultural heritage in the landscape is a plus as well as the willingness to communicate what the project is doing and its results. The Tullstorp Stream project is situated in a much exploited landscape and therefore serves as a very important example of what can be done in such landscapes to make it much more attractive and well-functioning.