Watershed Safety Plan – a new tool for water protection

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Abstract. It is the known fact that increasing number of areas will face water stress in the future. We have to take even smallest water sources in use, we have to reuse waters more often and we have to save fresh water as much as possible. All this requires more attention to so called diffuse pollution as well. We have to reduce water pollution caused not only by big industry and by centralized wastewater services but by every single source/activity no matter how small it is also.

This paper describes the differences between point source and diffuse pollution and how the legislation in Finland has developed to remove some diffuse pollution sources into the category of point source pollution. It is most evident that the development will continue when water analyses are getting more accurate and specific and when we are able to get on-line data from watersheds due to advanced digital solutions.

A new tool called Watershed Safety Plan (WSSP) to eliminate even the smallest diffusion pollution sources is now under piloting in Finland. WSSP approach can be seen as a follower to Water Safety Plans and Sanitation Safety Plans implemented by water utilities. The idea is to research watersheds in detail - like using a magnifying glass - to find critical points threatening water quality and to plan actions to get rid of them or diminish risks at least. WSSP toolbox can be used to reduce risks related to water quantity as well.

Keywords: water protection, diffuse pollution, watershed

1 Water resources and diffuse pollution

Four billion people experience severe water scarcity for at least one month each year. And an estimation is that by 2025 roughly half of the world's population could be living in areas facing water scarcity. [8] At the same time, water pollution is worrying all around the world. In many countries, even point source pollution is incompletely controlled. Anyhow, the text below is dealing with diffuse pollution which is the main reason for example eutrophication of many lakes in Finland. Finland is taken as an example because of a new tool called Watershed Safety Plan (WSSP) approach to fight against diffuse pollution. WSSP approach is currently piloted in Finland.

1.1 The need for diffuse pollution control

There are enough water resources in Finland – precipitation is 660 mm/a, and total amount of water is more than 2000 km^3/inhabitant. When talking about water resources, Finland is number one in European Union [4]. Anyhow, the climate change will bring some challenges to Finland as well. While in many parts of the world severe droughts are worrying, in Nordic Countries predictions are showing increment in annual precipitation. In Finland, the growing season for vegetation is roughly four months per year only. When temperature is becoming higher, instead of snow cover and frost during winters the country will face more rain and thus, more diffuse pollution from agricultural areas mainly but from forests and urban areas as well. [10]

So far, mitigation of diffuse pollution has been depending on single actions placed more or less randomly in catchment areas. For example, the agri-environmental program in Finland has been supporting farmers in implementing sedimentation ponds, wetlands, etc. according to their own interests and naturally in their own farms – without considering the catchments as whole. This has not been efficient way of reducing nutrient loads causing eutrophication in waters. Actually, very little or no reduction has been measured. [7]

European Union Water Framework Directive (2000) has been noticed to be the most ambitious piece of EU environmental legislation. Its aim is to restore European waters but results are not reached so far. The main objectives were – and still are – non-deterioration of water status and achievement of good status for all EU waters. It seems that some new tools are needed to fulfil directive's targets. [11]

Implementation of EU's Drinking Water Directive is to ensure healthy drinking water for all. One important task in this work is so called risk assessment taking into account the entire water production and distribution system. Thus, water utilities producing drinking water should have risks assessed in the catchments as well. [2]

There are many other reasons to be listed in supporting the need for new approaches in water protection. One regional document to be mentioned is the Road Map for Circular Economy in Kanta-Häme. Kanta-Häme is a region of 11 municipalities in South Finland. The road map which was published in the beginning of 2022 includes five sub-areas the one being Water use and water bodies. An ambitious goal under this sub-area is to reach the diffuse pollution free region by 3035. One important tool to work for this goal is mentioned to be Watershed Safety Plan (WSSP) approach. [6]

2 The difference between point source pollution and diffuse pollution

The word *responsibility* has quite an interesting and important role when considering The Constitution of Finland (731/1999) [9]. In the Section 20 of the constitution, it is written: *"Nature and its biodiversity, the environment and national heritage are the responsibility of everyone."* This is underlined in the Environmental Protection Act (86/2000) [1]. In this act, there are several principles that people and organizations should follow in their daily operations. All should be aware about their effects on the environment, risks should be minimized, best available technology and best available practices should be taken in use, etc.

Now, when considering the word responsibility and the mentioned legislation, one could answer: Who is to mitigate for example pollution seen in the Figure 1?

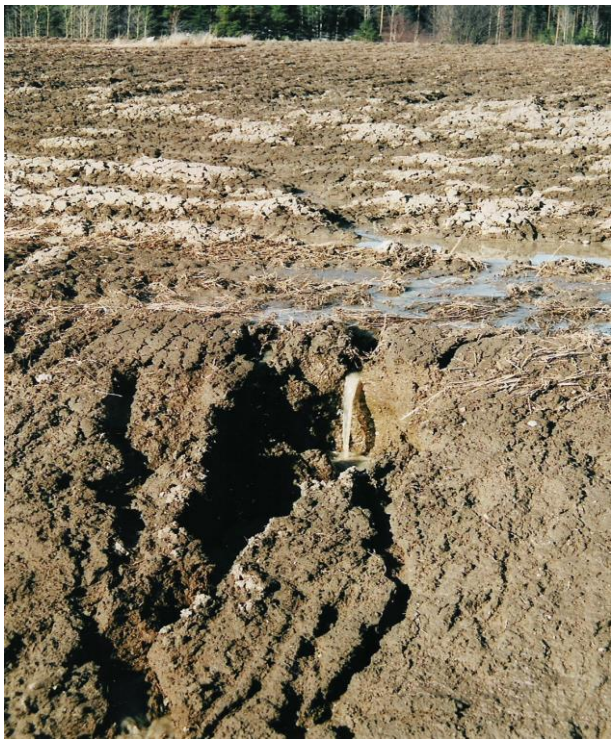


Figure 1. Diffuse pollution originates quite often from a visible point.

Actually, when looking at various pollution sources and legislation carefully one can notice that the only difference is control. Point source pollution is (or it should be) under control. Small but numerous pollution sources which are not controlled are considered

under the concept of diffuse pollution. A good example is on-site sanitation (Figure 2). Finland got new legislation for household level wastewater treatment in the beginning of this century. Thus, on-site sanitation was taken from the category of diffuse pollution into the category of point source pollution.

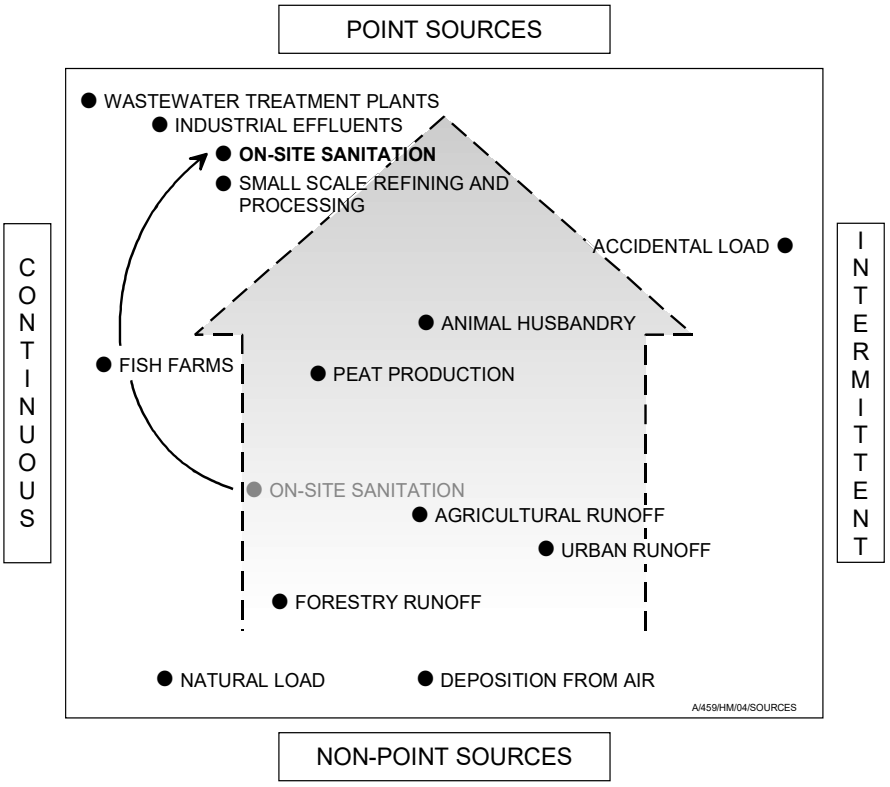
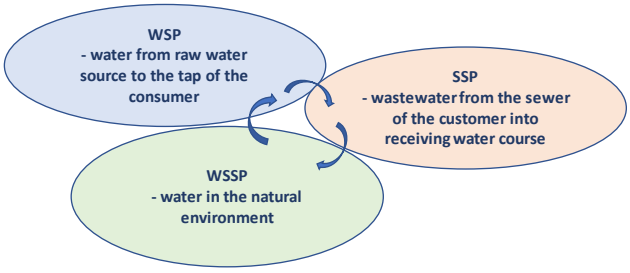


Figure 2. When legislation and technology are advancing more diffuse pollution sources will be removed into the category of point source pollution. [5]

How to tackle small pollution sources effectively with existing limited resources? This is the question the WSSP approach tries to bring a practical solution. The approach is nothing complicated but just working systematic and using so called common sense.

3 Watershed Safety Plan approach

The WSSP approach is now in piloting phase in Finland. The idea is based on Water Safety Plans (WSP) [12] and Sanitation Safety Plans (SSP) [13] promoted by WHO. WSP and SSP are meant to secure human health by investigating the whole water service chains to find and mitigate all possible risks. WSSP is to do the same in the catchment areas. The only difference is that WSSP is concentrating not only human health aspects but all kinds of risks – ecological, environmental and even economical risks as well. By utilizing WSSP together with WSP and SSP the whole water circle (not the atmospheric water) is becoming secured (Figure 3).



. W approach will complete the safety of water circulation.

3.1 How to implement WSSP

There is no fixed way to utilize WSSP approach yet. The first ever piloting is on-going in Finland in 2021- 2022. The pilot is implemented by following the steps of WSP like in the Figure 4.

To make sure that limited human resources are needed as little as possible all available open data and various GIS-tools are utlized first. After getting various maps of the catchment - land use, ditches, networks for wastewater and run-off waters, point source pollution sites, etc. - and researching them one above each other, possible 'hot spots' (= points where probability of diffuse pollution is obvious) can be located. The steps onward are depending on the catchment itself. Tools to be utilized are different when working in agricultural areas or in forests or in urban catchments. In some cases the next tool to be considered might be drone, in some other cases it might be set of meetings with land owners, and so on. And naturally, when talking about mitigation actions the variety of tools is really manifold. That is why instead of WSSP one should

use the concept WSSP toolbox. From the toolbox the most appropriate tools are to be utilized and the whole process is tailormade depending on the local circumstances.

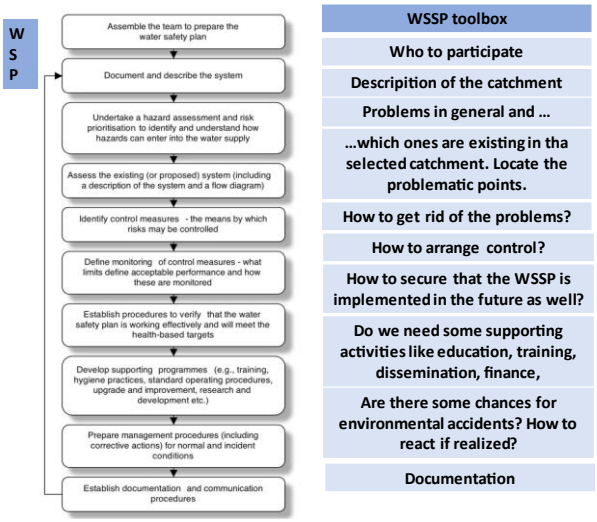


Figure 4. In the first piloting of WSSP approach the steps in WSP are followed to some extent.

So far in the pilot case, the catchment, land use and various networks in the area are defined. An example of the catchment area map is in the Figure 5. Today, detailed investigations are on-going.

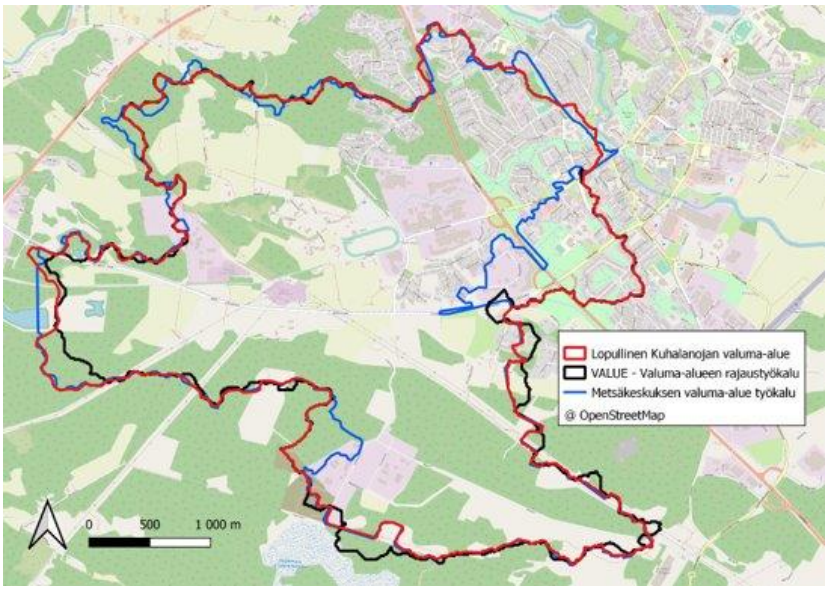


Figure 5. The WSSP approach is piloted in the Kuhalanoja catchment area in Forssa, Finland

When applying WSSP approach in some other area, one could use much simpler chain of actions than given in the Figure 4. There are just few principles to take into account:

- Use first open data and tools which limit the need for human resources.
- In most cases, investigations in private estates are needed. Thus, communication is inevitable to avoid conflicts and drawbacks in water protection.
- Be systematic – it is the only way all important diffuse pollution sources can be found and sustainable results gained.

3.2 Development of WSSP approach

It is evident that more of the pollution sources which today are considered diffuse are going to be tackled as point source pollution (see the big arrow in the Figure 2). Thus, either the WSSP approach or something similar must be developed. There are several initiatives where the WSSP approach is involved today and the development work is advancing.

There are many advantages when using the WSSP approach and not water quality improvements only. For example, flooding in big cities is causing extremely expensive damages and WSSP could be used in finding most risky places to cause flooding problems and tools for mitigating those.

4 Conclusions

While there are plenty of work to do to control point source pollution worldwide, in most parts of Europe fight against diffuse pollution is on the top of the list. This is seen for example from the chapter 1.1. So far, the actions taken have been not that promising. Thus, new more efficient tools are required. The WSSP approach is investigating catchments like with magnifying glass and even the smallest pollution sources are found and mitigation measures planned, designed, implemented, monitored and reported.

The challenge to create diffuse pollution free catchments and regions is really ambitious. The WSSP approach is one of the tools under piloting. More tools are invited to get experiences and make actual progress in water protection work.

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