PRACTICAL GUIDANCE ON INVESTMENT AND MAINTENANCE PROCESSES FOR SMALL-SCALE NUTRIENT REMOVAL TECHNOLOGIES

Pilot watersheds as a practical tool to reduce the harmful inflows to the Baltic Sea (CB50)

Water Chain
Interreg Central Baltic
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This report presents practical guidance on investment and maintenance processes for nutrient removal technologies piloted during WaterChain project. The report was compiled during 5th period (1.10.2017-31.3.2018) by Pyhäjärvi-institute, Finland (PJI), which operated as an activity leader. The report is based on each partner's documents presenting first the properties related to different small-scale nutrient reduction technologies piloted by PJI; Turku University of Applied Sciences, Finland (TUAS); Institute for Environmental Solutions, Latvia (IES) and Ålands Vatten, Åland (ÅV).

When implementing any kind of construction or other actions described here, always check for related laws and other regulations. Project is not responsible for any consequences affected by further use of described methods or procedures.

Small-scale phosphorus reduction technologies

During WaterChain project TUAS, PJI and IES have piloted small scale technologies for phosphorus reduction. TUAS has focused on testing phosphorus precipitation unit with ferric sulphate application using technology presented by Aaro Närvänen et al (2008). PJI and IES has concentrated on testing effectivity of small scale filters, methodology published by Kirkkala 2014. PJI has tested ditch bottom filter and box filter, and IES has tested round box filter applications with Calcium Hydroxide as an adhesive material. ÅV has also build and made construction descriptions for box filter. Main issues concerning investments and maintenance processes for all of these small-scale phosphorus reduction filters can be described together.

Guidance on investments

Planning for investment

Planning of devices, technical drawings and construction works should be always carried out by professional. One of the most important task is to identify hotspots for phosphorus load reduction with selection of the site. Based on the site properties, suitable method for the phosphorus reduction will be chosen. It has to be kept in mind that land properties e.g. lack of elevation in a ditch may restrict establishment. In addition to chosen method, accessibility, catchment area size, and constructability will considerably affect to an investment and maintenance costs.

Permissions needed in installation of filter

It is important to specify clearly to the landowner what is happening, when and who is responsible. Explain how construction work is going to influence to his/her property e.g. disturbance due to the construction process, flooding risks, visits by maintenance crew. Normally constructor or project takes responsibility for maintenance and possible dismantling of constructions. It is recommended to make a written agreement on rights and responsibilities between contracting parties and involved stakeholders.

Finland:

1) Permission from the landowner(s) is needed.

2) Working near roads or in the road area requires a special permit from the Centre for Economic Development, Transport and the Environment. It should be taken into consideration that application for the permit includes fees and takes some time to be processed (several months in the worst cases). Treatment of small size ditches needs no environmental permits. However, for river size flowing water body an environmental permit is presumably required. In any case, it is recommended to inform municipal environmental authority of planned activities in advance.

Latvia:

1) Permission from the landowner(s) is needed.

2) Permission of local Construction Board is needed. All needed forms e.g. agreement with the landowner, technical drawings of the filter, filled application forms needs to be provided to get a building permit.

Tendering

Expenses of constructions actions or materials are highly depending on the situation. Typically, in small constructions, e.g. ferric precipitation unit, no official tendering is needed and supplies can be bought from regular hardware stores. However, if paid excavator services are needed, it is recommended to proceed at least a price comparison. Tendering may be needed if larger or several applications are constructed. It is important to pay attention to your company's funding regulations, national rules or following EU rules and related specified thresholds. It should be kept in mind that also other possible expert services such as monitoring of the efficiency of the method by laboratory analysis, may require tendering.

Possible expert services

For optimal site selection, it is recommended to contact an expert with experience on the method. Worksite supervision by an expert is recommended as well. Need of excavator services varies based on chosen phosphorus reduction method. When a nutrient removal system is situated in rural areas, it is common that landowners have excavators or other suitable heavy machinery. In minor projects, it might be possible to negotiate collaboration with them. However, excavation works are commonly proceeded by service providers. Heavy machinery might be needed also for transporting filtering materials such as sand. Expert services could be needed also for elevation measurements. In some cases, it might be possible to purchase all needed expert services from one service provider as a turnkey project.

Worksite preparations

The scheduling of the work and logistics is crucial to minimize stand by hours in the site. Reservation for a backup date is also recommended as for example weather or discharge situation may at times prevent planned actions. Worksite has to be accessible for all machinery. If additional rock material e.g. sand or gravel is needed, suitable areas unloading cargo must be cleared.

Worksite safety

When working in the road area in Finland: Field investigation of the planned pilot site with road officials is needed. Safety helmets and vests are needed when working in the vicinity of an official road. Worksite supervision must be conducted by project manager or by expert services. When operating in close contact with calcium hydroxide or ferric sulphate, protective clothing, eyewear and respiratory masks are recommended. Country specific safety and working instructions and regulations must be taken into account.

Set up facilities for effectivity monitoring

Work plan should cover instructions for building or leaving suitable facilities for effectivity monitoring. Monitoring is implemented mostly by taking water samples. In some cases, automatic water quality monitoring devices or automatic samplers can be used. Monitoring facilities should be modified upon purpose. Sufficient areas for taking water samples should appear right before and after water entering installed device.

Informing of actions

It is recommended to inform local stakeholders in person. If planned project concerns wide or multiple areas, organizing of a larger informative event can be considered. It is recommended to attach notification close to the device describing what is happening and who is conducting actions.

Guidance on maintenance processes

Following matters are common to all small-scale phosphorus reduction technologies piloted in the project. Properties and operation principles of piloted technologies are presented in project report Validation of piloted nutrient removal technologies.

Effectivity monitoring and surveillance

Monitoring of installed device is a basis for evaluation of phosphorus removal effectivity and usability of piloted methods. Typically, water sampling is proceeded with 1-2 weeks interval. During sampling visits general surveillance of devices and premises is implemented. Typical check includes water level and color, technical condition of devices, other deviations in device or surroundings, e.g. leakages in weir or device. Observations done in the site are saved in field diary. It is important to combine collected date based metadata with water quality results for further effectivity evaluation. Effectivity of pilot actions is evaluated in the latest period of the project. In addition to surveillance operated by project staff, also landowner cooperation may provide extra information on site.

It is important to clarify to landowner that maintenance may take place also outside office hours and agree about parking and suitable passageways. The working principals of the device and possible impacts that it may cause to the ditch e.g. colorings or sedimentation are to be described in detail to the landowner.

Maintenance processes for phosphorus reduction by small scale filters

Phosphorus reduction filters does not need active maintenance after installation. However, active surveillance of operation of devices has to be proceeded as described in previous chapter.

Maintenance processes for phosphorus reduction by ferric sulphate application

Ferric sulphate container needs to be refilled regularly and dry storage space for chemical is needed. Because ferric sulphate is highly irritating to skin and eyes, protective clothing, eyewear and respiratory masks, are recommended. Due to the hygroscopic properties of ferric sulphate and varying environmental circumstances operation of the dosing system has to be checked at the minimum once per month. However, after bigger rain events it is recommended to confirm the level of precipitation chemical. Surveillance of changes in pH values must be carried through.

After the project

All installations made for the pilot site should be easy to take down. Depending on the future situation, the precipitation unit is usually best to dismantle so there won't be any remains of possibly harmful chemicals accessible to public. Small scale phosphorus reduction filters could be dismantled by excavator.

References

Kirkkala, T. 2014. Long-term nutrient load management and lake restoration: case of Säkylän Pyhäjärvi (SW Finland). *Ann. Univ. Turkuensis A II 286, 55.*

Närvänen, A., H. Jansson, J. Uusi-Kämppä, H. Jansson, and P. Perälä¨.2008. Phosphorus load from equine critical source areas and its reduction using ferric sulphate. *Boreal Environment Research* 13: 265–274.