StaticTool method
and the StaticTool.xlsm application

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1 Introduction

The purpose of developing the StaticTool method and the computer application **StaticTool.xlsm** is to enable the estimation of the effects of the implementation of a program of natural, small water retention measures (PoNSWRM) in a simplified way, which does not require the time-consuming and costly development of detailed models, hydrological or / and hydraulic, of the analysed area (catchment). This estimate is a grading, based on expert knowledge and is used to compare variants of the NSWRM program.

The StaticTool method and the StaticTool.xlsm application were developed as part of the project FramWat, Work Package T2 (*Effectiveness of the Natural Small Water Retention Measure*), activity A.T2.2 (*Developing the GIS based method to assess cumulative effect of N(S)WRM at the river basin scale*), deliverable D.T2.2.1 (*Static method to assess cumulative effect of N(S)WRM in the river basins*). It was assumed that, as in the valorisation of the needs to improve retention capacities of the catchment area (FramWat, Work Package T1, Activity A.T1.1 *Developing landscape valorisation method for Natural Small Water Retention Measures*), **Spatial Planning Units** (**SPU**) are the units in which NSWRM are defined and evaluation of their effects is carried out. Because the expected effects of individual NSWR measure may vary, depending on climatic and physiographic conditions (e.g. slopes, soil permeability), the method parameters should always be adapted to local conditions (climate type, landscape type).

The StaticTool method is universal in terms of the size of the analysed area and the types of climatic and geographical conditions, however the entire analysed area should have rather similar conditions. The choice of NSWRM and determination of parameter values require the participation of experts who know local conditions and have experience in the planning and implementation of small retention measures, representing the fields of hydrology, hydrogeology, agriculture, drainage, hydrotechnics, forestry, ecology.

The computer application **StaticTool.xlsm** is dedicated for estimating the effects of the small retention program by the StaticTool method. The application is divided into two modules. The first module is designed to support the process of determining parameters of the StaticTool method for local conditions of the analysis area (**Parameters Module**). The second module assesses the effects of implementing a small retention program (**Grading Module**). The estimation of the effects of the program implementation is a grading and is primarily used to compare the proposed variants for the concept program.

The computer application **StaticTool.xlsm** includes small retention activities analysed in the FramWat project and parameter values developed based on experience from the Kamienna river catchment (pilot catchment in Poland). The parameter values correspond to the upland landscape in Poland.

The StaticTool method is presented in Chapter 2. Chapter 3 describes the **StaticTool.xlsm** application, the functions of individual sheets, the rules for determining method parameters and how to prepare input data. Annexes include measures listed in the local catalogue, and aggregated measures as well, definitions of measures' intensity criteria and assessment of measures' effects agreed by the team of experts, taking into account modelling results.

2 The concept of the StaticTool method

The purpose of developing the StaticTool method and the computer application **StaticTool.xlsm** is to enable the estimation of the effects of the implementation of a program of natural, small water retention measures (PoNSWRM) in a simplified way, which does not require the time-consuming and

costly development of detailed models, hydrological or / and hydraulic, of the analysed catchment. This estimate is a grading, based on expert knowledge and is used to compare variants of the NSWRM program.

The potential effects of individual NSWR measures may be different, depending on the climatic and physiographic conditions (e.g. slopes, ground permeability) of the analysed area, so the method parameters should be adapted to local conditions (climate type, landscape type). The StaticTool method thus consists of two parts:

i) developing method parameters for local conditions and
ii) estimation of the effects of activities planned under the Natural Small Water Retention Program.

The StaticTool method assumes that the expected effect of the PoNSWRM is to improve catchment retention properties, which is understood as increasing low flows (LowQ), reducing high flows (HighQ) and / or limiting the load of pollutants yielded from the catchment area (Qual). This effect depends on the planned measures, in particular: i) their type and ii) the level of intensity. The measures included in the StaticTool method are summarized in the local catalogue of measures. For each measure, an intensity criterion is formulated, and threshold values are defined that correspond to the characteristic intensity levels (low, medium, high). Each measure is also assigned the expected improvement of retention properties of the SPU, expressed on a point scale (0-5 points). The greatest improvement that can be achieved (maximum points for a given measure) corresponds to the implementation of the measure with maximum intensity. For lower intensity levels, the assigned grades are proportional to the level of intensity of planned measure. Hence, developing parameters of the StaticTool method means defining a set of functions that make grade assessment dependent on the type of planned measures and their intensity for each measure from the local catalogue. Examples of such functions – the relationships of the expected improvement in the retention properties of the area, expressed on a grade scale, on the type and intensity of measures are shown in Figure 1.

The development of method parameters for the catchment area under study includes:

1. Preparation of the local catalogue of measures;
2. Defining measures intensity criteria and threshold values for characteristic intensity levels (low, medium, high);
3. Determining the grades of the impact of measures on the retention properties of the catchment.

After preparing the method parameters, the effects of programs of measures can be estimated. The method makes it possible to determine the global assessment, for the entire analysed catchment area, and assessments in individual planning units (SPU, differential catchments). The effect of implementing the variant of the PoNSWRM in the entire catchment is assessed by the weighted sum of grades obtained in the SPUs, where the weight is the share of the SPU area in the total area of the catchment. In addition to the method parameters representing local conditions, the necessary input data includes a list of SPUs area and a summary of the type and intensity of measures planned within the program.
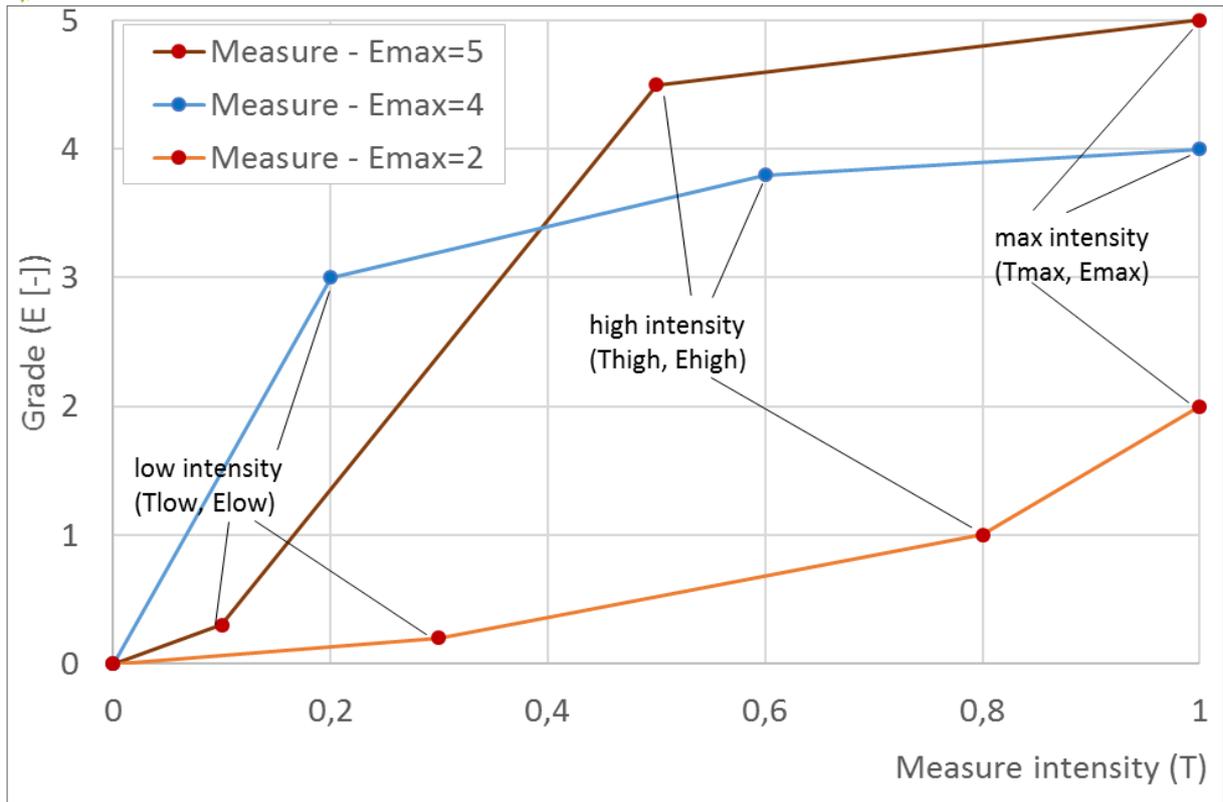
Figure 1. Relationships of the grade assessment on the type and intensity of measures

Three different measures are shown. A measure of the highest maximum grade (Emax=5) has the greatest impact on catchment retention properties. Shape of the lines indicates how sensitive catchment properties are deemed to be to measures; a measure of Emax=4 has strong impact even when applied with low intensity, still intensity increase, if already high, does not give significant effects

2.1 Preparation of the local catalogue of measures

The basis of the local catalogue of measures are the measures analysed under the FramWat project, which are widely applied to improve the retention of catchments and can be used in the study area (catchment, landscape, region, country). Measures can be defined as **individual measures** (e.g. conversion of arable land to meadows on a specific area, construction of a polder, small retention reservoir or ponds, restoration of a lake with a specific surface area) or as **aggregate measures** (e.g. implementation of agricultural practices leading to increased field water retention, including mulching, intercropping, catch crops, permanent pathways etc.; or restoration activities, such as wetland or floodplain restoration, reconnection of seasonal streams or side-arms). Aggregated measures include a group of measures whose implementation in a similar way improves the retention properties of the catchment area, and assessment of the effects of individual activities, without detailed field or model studies at the current level of knowledge, is not possible.

The local catalogue of measures should be prepared by an interdisciplinary team of experts who have experience in the planning and implementation of small retention measures. The local catalogue of measures, included in the computer application **StaticTool.xlsm**, was developed by Polish experts for the upland landscape, including the pilot catchment of the Kamienna River. In addition to universal

activities that can be used in various regions and landscapes, specific activities are listed that may be of limited use in another type of landscapes.

2.2 Defining measures intensity criteria and threshold values for characteristic intensity levels

According to the assumptions of the StaticTool method, the expected improvement in the catchment retention properties depends on the type and level of intensity of planned measures. Three levels of measures' intensity were distinguished: low, medium and high. They correspond to three levels of the expected improvement in the catchment retention properties (e.g. small, average and large).

For each of the measures included in the local catalogue, a definition of the intensity criterion for this measure should be formulated, e.g. the share in the SPU area of arable land transformed into permanent meadows or pastures. Moreover, threshold values (**T**) separating individual levels of intensity should be determined. There will be 4 such values for each of the measures: **T0** – no action, **Tlow** – the limit between low and medium intensity, **Thigh** – the limit between medium and high and **Tmax**, which corresponds to the maximum possible intensity of measure. In the case of conversion of arable land to grassland, the **Tmax** value corresponds to the situation where 100% of the SPU is occupied by arable land and all will be converted into meadows or pastures. So, this is a very rare situation in practice, although physically possible.

The threshold values of intensity of measures are local and may be different in different countries and in different types of landscape. These values, together with grading of the expected improvement in the catchment's water retention capacity, which is described in the next chapter (part 2.3), constitute the key parameters of the StaticTool method. Their determination should be carried out with the participation of an interdisciplinary team of experts.

The description of the sheet containing the definitions of intensity criteria and threshold values of intensity levels developed for pilot catchment conditions in Poland is presented in Part 3: Description of the StaticTool.xlsm application.

2.3 Grading of the impact of measures on the catchment's water retention properties

Grading is a way of assessment of the expected improvement of water retention properties of the SPU area where the measure will be implemented, at a given level of intensity. The improvement of retention properties is seen as increasing low flows (LowQ), decreasing high flows (HighQ) and / or limiting the load of pollution exported from the SPU area (Qual).

Not every action has a similar impact on these three components of water retention properties of the area (catchment, SPU). Dry flood control reservoirs have a significant impact on high flows, while on pollutants – to a small extent (during floods they may contribute to sedimentation of suspended solids), and on low flows – not at all. Riparian vegetation buffer zones reduce the amount of pollutants reaching surface waters, but do not change the amount of high flows, and may even reduce low flows.

The concept of grading the impact of measures on the water retention properties of a catchment includes three stages:

i) evaluation of measures' impact on the three components of water retention properties (LowQ, HighQ and Qual) separately, assuming the implementation of measures with the highest possible intensity;

ii) assigning general grade to measures (for maximum intensity);

iii) defining proportionality factors for lower than maximum intensity of measures.

The StaticTool method adopts a 6-grade scale, from 0 – no impact or negative impact to 5 – very high favourable impact of the measure, both for assessing the impact of measures on the catchment retention components as well as for general grading.

Stage i – impact of max intensity measures on components of water retention properties

This stage is a preparatory stage, supporting the determination of general grade of the measures' impact on the retention properties of the area (stage ii). At stage i, each measure listed in the local catalogue should be graded in terms of its impact on all three considered components of the catchment retention properties: increasing low flows (LowQ), reducing high flows (HighQ) and limiting the load of generated pollution (Qual). During this evaluation it is assumed that the measure will be implemented with the highest possible level of intensity in the SPU.

Stage i is not obligatory, but it is recommended stage, because it facilitates the comparison of potential impacts of measures on various components of the hydrological regime in an orderly manner. The general grade of the impact of measure on the water retention properties of SPUs (stage ii) should be proportional to the average of the partial grades determined at this stage.

Stage ii – impact of max intensity measures on water retention properties – general grade

In stage ii, a general grade should be assigned to each measure, which corresponds to the maximum intensity of this measure (Emax). It represents the broad improvement in water retention properties of the catchment, covering the three components mentioned above – LowQ, HighQ and Qual. As in step i, a 6-grade scale was assumed (Emax = {0, 1, 2, 3, 4 or 5}). To determine the general grade, it is recommended to use the results from stage i (average of the grades for the considered components of retention properties of the area). The general grade can be determined by expert decisions or by scaling the average of the stage i grades. The latter approach is used in the **Parameters Module** of **the** StaticTool.xlsm computer application.

Due to the key importance of grading carried out in stages i and ii for determining the parameters of the StaticTool method, these tasks should be performed by an interdisciplinary team of experts who know conditions of the analysed area.

Stage iii – lower intensity of measures

The final stage is determining the grades for measures implemented with less than maximum intensity. The StaticTool method assumes that the grades assigned to planned measures with less than maximum intensity are a fraction (percent) of the maximum grade for this measure (see Figure 1). This fraction is hereinafter referred to as the effect coefficients (**E%**). Effect coefficients are constant for three levels of intensity: low, medium and high (cf. 2.2). These coefficients represent the knowledge of experts about the catchment sensitivity to small retention measures. In the example presented in Fig. 2, Measure 1 causes a rapid increase in the retention capacity of the catchment, the impact of Measure 2 at low intensities increases very slowly and is only visible above a certain, high intensity of implementation, and Measure 3 causes a gradual, uniform improvement in the catchment's properties.

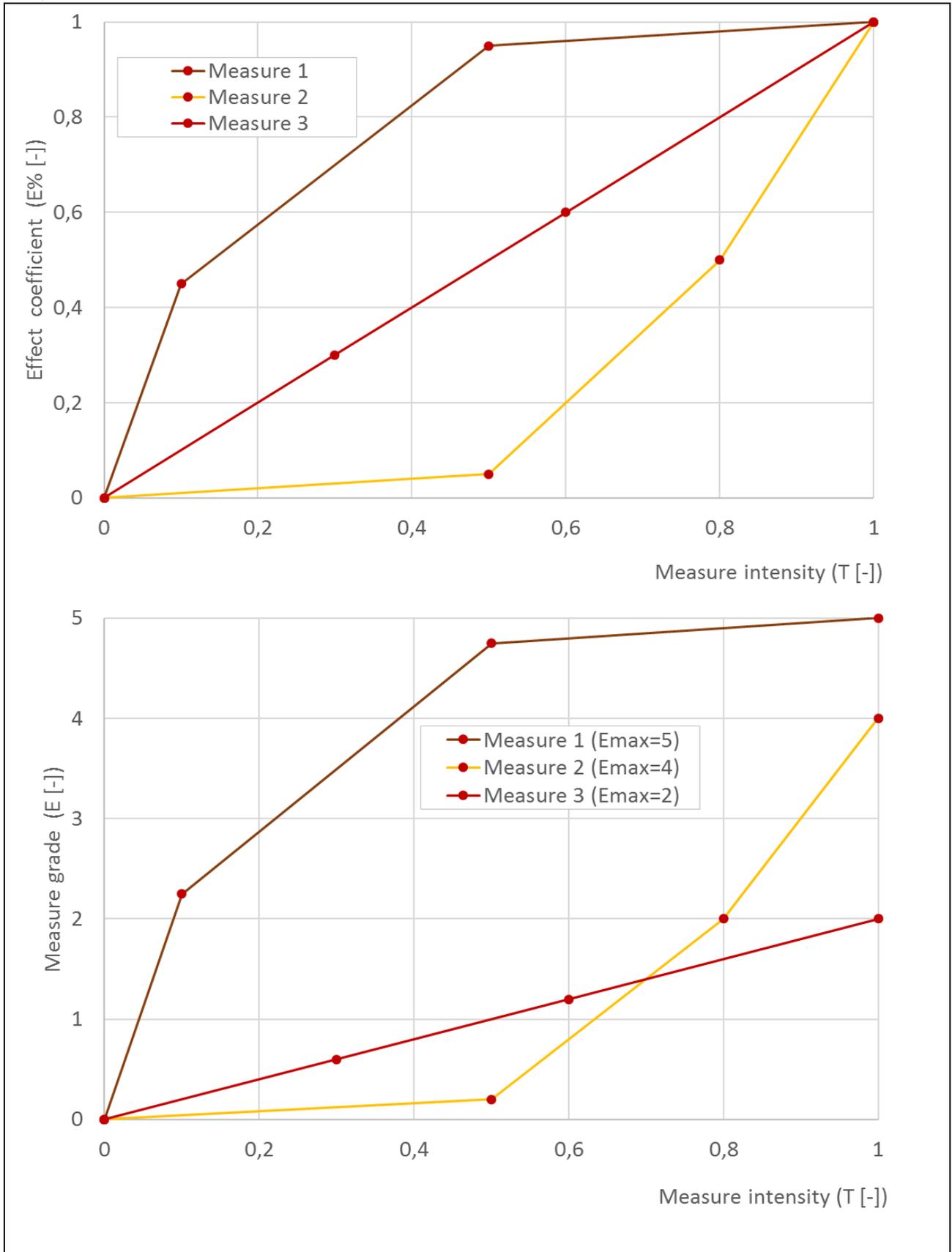Figure 2. Effect coefficients and grading of measures

The intensity levels are determined by 4 threshold values: **T0**, **Tlow**, **Thigh** and **Tmax**. Therefore, the effect coefficients corresponding to these values (**E%0**, **E%low**, **E%high**, **E%max**) should be determined, but the coefficient corresponding to the inaction is 0 (**E%0** = 0) and the coefficient for the maximum intensity of measure is 100% (**E%max** = 100% = 1). Effect coefficients for the **Tlow** and **Thigh** thresholds are critical for assessing lower intensity measures. The grades (**E**) for the intensity thresholds are calculated on the basis of the effect coefficients: **Elow** = **E%low** · **Emax**; **Ehigh** = **E%high** · **Emax** and **E0** = **E%0** · **Emax** = 0. Between the thresholds, the dependence of the grade on the intensity of measure is linear (fixed proportionality factor).

Different effect coefficients may be specified for each measure from the local catalogue. You can also take the same coefficients for different measures, e.g. groups with the same grade for maximum intensity.

In the example of the relationship between the intensity of measures and gradings presented in Figure 1, the measure with the maximum grade Emax = 5 is assumed to cause a much greater improvement in SPU retention capacity than the measure with Emax = 2 and – in accordance with the adopted assumptions – receive a much higher grade. At the same time, the measure with Emax = 4 causes a great improvement in the catchment's properties already at a low intensity level, greater than the measure with a higher maximum grade at a comparatively low intensity.

The parameters of the StaticTool method described above, i.e. the maximum grades assigned to individual measures, intensity thresholds and corresponding effect coefficients, as well as the way of aggregation of measures, are of key importance for the results of evaluation of natural small water retention program variants. Therefore, setting parameters of the method should be carried out by an interdisciplinary team of experts who know the local conditions of the analysed catchment.

2.4 Grading of the variants of the natural small water retention program

In estimating the effects of the analysed variant of the natural small water retention measures program (PoNSWRM), on the scale of the studied catchment, the developed relationships of the grades of individual measures on their type and intensity (E = f (T)) and a list of measures proposed under the program are used. The assessment of the PoNSWRM effects is a grading, aggregated within the catchment. The SPUs areas are necessary for aggregate grading. The list of planned measures can only contain measures that belong to the local catalogue and each measure must be assigned to individual SPU of the analysed area. For each planned measure, its intensity should be given, expressed in accordance with the adopted intensity criterion definitions (see section 2.2). Therefore, the analysed PoNSWRM variant has the form of a table with the following dimensions: the number of rows is equal to the number of SPU (**nSPU**), the number of columns is equal to the number of measures in the local catalogue (**nMeasures**). In addition, the area of the individual SPU must be known. For each SPU in the columns corresponding to individual measures, provide their intensity, with the value 0 meaning no measure in the given SPU, and 1 – planning the measure with the maximum possible intensity. You should prepare as many separate PoNSWRM tables as there are analysed variants of the program of measures (e.g. expert variant and local preferences variant).

The calculation of the resulting grade, representing an improvement in the retention properties of the catchment, consists in determining the assessment of each planned measure, based on the planned intensity, calculating the sum of grades of all measures in each SPU, and then calculating the weighted sum for the entire catchment, where the weights are the shares of the SPU area in the total area catchments. In the StaticTool.xlsm application, after entering the planned measure table

(ProgramOfWRM) and accepting the parameters of the StaticTool method, the assessment of the catchment area for a given PoNSWRM variant is calculated automatically by calling the VBA procedure.

3 **StaticTool.xlsm** Application

The **StaticTool.xlsm** application was developed for two tasks:

i) supporting the process of determining StaticTool parameters for the local conditions of the area for which the small retention program is being developed; this task is carried out in the **Parameters Module**;

ii) estimation of the effects of the implementation of the small retention program, expressed in grades, which can be obtained as a result of program implementation (**Evaluation Module**).

The application includes small retention measures analysed within the FramWat project. To determine the value of the StaticTool method parameters, experience from model analyses carried out in the Kamienna river basin (pilot basin in Poland) as well as expert assessments were used. The parameter values correspond to the upland landscape in Poland.

The **StaticTool.xlsm** application was developed in an MS Excel workbook with the Visual Basic Application macro support function enabled. The tool functions are implemented through MS Excel formulas and programs saved as VBA macros. Data entry and parameter values are determined in the MS Excel environment.

VBA macros refer to cell addresses in prepared sheets, so you must not change the structure of the sheets, i.e. add or remove rows or columns in the area used by the application or change the names of the sheets.

3.1 Organization of the **StaticTool.xlsm** application

There are 7 sheets in the **StaticTool.xlsm** application. To calculate the PoNSWRM grade on the catchment scale, parameters and data compiled in **CheckParameters** and **ProgramOfWRM** sheets are used. Assessment results for the entire catchment and individual SPUs are recorded in the **StaticAssessment** sheet. The three sheets mentioned above form the **Evaluation Module**. The **Parameters Module** of the method contains 4 sheets. The parameters should be determined sequentially, in the following order, in sheets:

i) **MeasuresFramWat**,
ii) **SelectedMeasures**,
iii) **Intensity**,
iv) **MaxIntensityImpact**.

The following colour markings were used in the sheets compiling the input data, tool parameters and results:

green – user defined input values and parameters; contain values for the conditions of the Polish pilot catchment, considering the adopted assumptions;

blue – formulas in XLS or the use of VBA macros;

beige – calculation results for SPU;

yellow – highlighted or control values;

grey – headers (description of the contents of cells / columns / rows).

The sheets store three sets of application parameters:

i) current parameters that the user views or changes on an ongoing basis; this set of parameters is used in the calculations;

ii) parameters from the previous calculation session – parameters saved **before the current execution of VBA procedures**; the user can copy this set of parameters in place of the current parameters, thus facilitating editing; These parameters are saved in the right part of the sheets; the beginning of this part is marked with the comment *A copy of the previous session*;

iii) initial parameters developed for the Polish pilot catchment; saved on the right side of the sheet; the beginning of this part is marked with the commentary *A copy of the Kamienna river parameters*.

3.2   MeasuresFramWat

The **MeasuresFramWat** sheet contains a list of small retention measures that can be used in agricultural and forestry areas. The table in this spreadsheet currently contains small water retention measures (WRM) taken from the NWRM.eu website or proposed by experts from the FramWat project. However, you can add your own measures not included in the original list. A maximum of 100 measures are foreseen (*MaxMeasuresN* = 100).

In the **MeasuresFramWat** worksheet, you should select measures that are used in the analysed catchment area as individual or aggregate measures (see 3.3). The selection of the measures to be included in the next sheet is made by entering '1' in the *SELECT (0/1)* column in the row corresponding to the measure. You must select at least all activities that have been enabled in PoNSWRM. Entering "0" will remove the measure from further analyses. The number of measures contained in the table (*CurrentN*) and the number of measures selected (*SelectedN*) are displayed in the sheet header.

In the sheet, you can also choose an additional language (*Select language*) in which the names of WR measures and – after entering the relevant data – some descriptions will be displayed.

Saving selected measures and moving to the next sheet is done by pressing the   **Accept selection and NEXT** key. At this time, the following activities are also implemented:

i) saving the current version of the **MeasuresFramWat** sheet in the designated area on the right side of the sheet (**MeasuresFramWat** sheet, from column AA),

ii) saving the previous version of the **SelectedMeasures** sheet in the designated area on the right side of the sheet (sheet **SelectedMeasures**, from column AA),

iii) rewriting the currently selected measures from **MeasuresFramWat** to **SelectedMeasures**,

iv) clearing the contents of columns intended for aggregating measures in **SelectedMeasures**.

3.3 SelectedMeasures

The sheet contains a list of measures selected from the **MeasuresFramWat** worksheet, relevant for the analysed catchment (after eliminating measures that will not be considered, e.g. naturalization of offshore polders in Poland) and allows aggregation of some of them.

Small retention measures can be defined as individual measures, such as conversion of arable land to meadows on a specific area, construction of a polder, small reservoir or ponds, or reclamation of a lake with a given area. At the same time, it is also possible to define aggregate measures, e.g. implementation of agricultural practices leading to water retention, which include, among others mulching, simultaneous cultivation, catch crops, permanent lead tracks; or restoration measures, e.g. wetland restoration, restoration of river and oxbow connections, revitalization of floodplains. Aggregated measures include a group of measures which implementation improves in a similar way the retention properties of a catchment, and assessment of the effects of individual measures, without detailed field and model studies at the current level of knowledge, is not possible.

A maximum of 100 measures (**MaxAggregN** = 100) can be distinguished, i.e. the same as for individual measures. This means that aggregation of measures may or may not be used.

Aggregation of measures is carried out by completing columns F-G and optionally column H: **Aggregated measure ID** and **Aggregated measure in English**. For single measures in the **Aggregated measure ID column**, enter the measure ID the same as the measure code in the **MeasuresFramWat** sheet. For measures that will form an aggregate measure, provide a unique identifier for the aggregate measure (e.g. WRAL). The aggregate measure identifier should be repeated for each individual measure included in the aggregation. For the first measure that is included in aggregation, enter the name of the aggregate measure (the **Aggregated measure in English** column). Providing this name enables the introduction of this measure to the list of analyzed measures. The name should be entered only once. You can also enter the name of the aggregate measure in the selected secondary language (column H).

After pressing the key **Accept and create Aggregated Measures** follows:

i) creating a list of individual and aggregated measures (J-M columns, **SelectedMeasures** sheet) that will be included in subsequent stages of analysis; they will hereinafter be referred to as aggregate measures;

ii) displaying in the header of the spreadsheet the number of aggregates (**AggregN**) accepted for further analysis.

You can now check the list of aggregate measures to see if it contains all the measures you have planned. If necessary, you can modify the aggregation of measures (in columns F, G and optionally H) and recreate the list of aggregated measures (**Accept and create Aggregated Measures**).

Pressing the key **NEXT** causes:

i) saving the version of the **Intensity** sheet from the previous session in the designated area on the right side of the sheet (**Intensity** sheet, from the column AA),

ii) rewriting identifiers of aggregated measures from **SelectedMeasures** to **Intensity**,

iii) clearing the contents of columns intended for defining intensity criteria for aggregate measures and threshold values of these criteria for low, medium and high intensity levels in the worksheet **Intensity**.

3.4 Intensity

The sheet **Intensity** is intended to define the criteria for the intensity of aggregate measures and to define threshold values that separate low, medium and high intensity. Four threshold values are used: **T0** – no action, **Tlow** – the boundary between low and medium intensity, **Thigh** – the limit between medium and high intensity and **Tmax**, which corresponds to the maximum (hypothetically) possible intensity of measure. For example, in the analyzes for Kamienna for measure A01 (meadows and pastures) the following intensity criterion was formulated: the ratio of arable land area transformed into permanent meadows or pastures and the total area of SPU. In this case, the value of **Tmax** corresponds to the situation when 100% of the SPU is occupied by arable land and all will be converted into meadows or pastures. This is a very rare situation in practice, although physically possible. The value of **T0** is 0.0 and corresponds to the lack of action A01.

Definitions of intensity criteria and intensity thresholds should be provided for each aggregate measure.

The formulated intensity criteria must be countable! To assess the Small Water Retention Program in the StaticTool method, the size of each of the planned measures will have to be expressed in the form corresponding to the adopted intensity criterion.

The next part of determining the StaticTool method parameters is followed by pressing the key **Accept definitions, Threshold values and NEXT**. At this time:

i) the **MaxIntensityImpact** sheet version from the previous session is saved in the designated area on the right side of the sheet (the **MaxIntensityImpact** sheet, from the column BA);
ii) the current list of the aggregated measures together with the definition of intensity criteria from the worksheet **Intensity** is copied to the **MaxIntensityImpact** sheet;
iii) the columns for entering expert assessment of the impact of individual measures on three elements of the catchment retention properties (low flows, high flows and erosion) are cleared (the **MaxIntensityImpact** sheet);
iv) the columns for subsequent operations on the worksheet **MaxIntensityImpact** are cleared.

3.5 MaxIntensityImpact

The **MaxIntensityImpact** sheet is intended for: i) determining expert assessments of the impact of aggregated measures on three elements of the catchment retention properties (low flows, high flows and erosion), with maximum intensity of measures' application, ii) formulating a general assessment of measures (3 above-mentioned elements together) and iii) defining effect coefficients for lower than maximum intensity of measures.

Various small retention measures can affect the retention properties of a catchment in different ways. Measures such as restoring floodplains affect primarily high flows. Measures supporting the infiltration of precipitation into groundwater have the strongest effect on low flows. Buffer zones around watercourses and some agricultural activities contribute to reducing the erosion of the catchment and the sediment load from the area. For this reason, the measures are assessed in terms of their impact on the three elements of the catchment retention properties: low flows, high flows and erosion. From these three component assessments, an average value is determined, which forms the basis for formulating the general grading proposal for each of the aggregated measures. For partial grading, on the elements of catchment properties as well as for general grading, a 6-grade scale was adopted, 0 - 5, where 0 means no positive impact on the retention of the catchment area, and 5 – very high positive impact.

The grading of measures is carried out by providing expert assessment of the impact of the measure on each component of the retention properties of the catchment. When specifying these grades, experts assume that the given activity is carried out with the maximum possible intensity. Therefore, they give 3 grades that correspond to the Tmax intensity threshold, with the criterion of the intensity of the considered measure being defined in the previous stage (**Intensity** sheet).

After specifying the expert partial grades, pressing the **Save grades, compute average (AVG), sort and RIGHT** key will calculate the average value in these grades (AVG) and sort the measures by the determined mean values. The effects of this procedure will be saved in the **MaxIntensityImpact** worksheet, from the R column, under the heading *Sorted by AVG*.

It is now possible to check the assigned grades of individual aggregated measures and whether the relationship of measure ratings relative to each other is rational (whether the measure perceived as the stronger has a higher rating). If necessary, you can modify partial grades, recalculate the average, and sort measures.

After checking that the assigned grades are correct, you should create suggestions for the maximum general grade of each aggregated measure and proposals for effect coefficients for lower than the maximum intensity of the measures. Use the **Suggest GradeMax & Effect coefficients E%** key. The proposals are formulated on the basis of the average of partial expert gradings and threshold values of intensity levels for individual measure. Three assumed shapes of relationship between effects and intensity levels are used to formulate them. They are: linear relationship, steep and flat relationship. An example of the shape of such relationships is shown in the **Graph** sheet.

StaticTool parameter values proposed by the program and saved under the heading *Proposal of GradeMax & Effect coefficients E%* can be changed by experts according to their own judgment. Moving to the next sheet is done by pressing the **Save changes & NEXT** key. Then all the parameters of the tool are saved to the **CheckParameters** sheet. At this point the work in the **Parameter Module** ends.

3.6   CheckParameters

The **CheckParameters** worksheet is used to summarize the parameters of the StaticTool method with which the effects of the Small Water Retention Program will be evaluated. The parameters contained here are initially transferred from earlier stages of work with the application, in the **Parameters Module**. Parameter values can be changed by a user. Changes made to the **CheckParameters** sheet do not affect the values contained in the **Parameters Module** worksheets. The parameters are accepted for calculations by pressing the **Save Parameters & GO TO ProgramOfWRM** key. At this point, the previously analyzed variant of the small retention program is also saved in the **ProgramOfWRM** sheet (from column DD).

For the convenience of comparing variants, it is worth saving subsequent analyzed variants in a separate xls file.

3.7   ProgramOfWRM and StaticAssessment

The **ProgramOfWRM** worksheet contains a summary of planned measures in individual SPUs. The planned measures should be described by the appropriate value of the intensity criterion, in accordance with the adopted criteria definitions. The prepared program of measures must contain exactly the same number of measure types as the number of aggregate measures declared in the tool and in the same order as on the aggregate measures list. This does not mean that every measure must have non-zero intensity

values. There may be actions not yet planned in the current program but envisaged in the near future or in the neighboring catchment.

The table of planned measures has the following dimensions: number of **SPU** x number of aggregated measures + 3 (**AggregN** + 3). The three additional columns (B-D) contain the SPU identifiers, the SPU names and the area of individual SPUs (**F_SPU [km²]**) necessary for determining the grade for the entire analyzed catchment area.

In the **ProgramOfWRM** worksheet, you can check the correctness of preparation of data on planned measures in formal terms with the use of **Check number of measures & measures' IDs** key. The number of planned measures (**Number of measures – User**) and their identifiers will then be compared with the aggregated measures prepared in the StaticTool application (**AggregN - xls application**). In case of a lack of compliance, error messages will be displayed: '**ERROR !!! PoWMR includes NN measure types, but it should be AggregN = MM measures**' or '**Wrong ID**'.

After verifying the formal correctness of the program and possible elimination of non-compliance, the evaluation of the given program variant may be calculated. The calculations will use the parameters listed in the **CheckParameters** sheet and the measures from the **ProgramOfWRM** sheet. After pressing the **Assess ProgramOfWRM & GO TO StaticAssessment** key, calculations are performed, the results of which are recorded in the **StaticAssessment** sheet:

i) grading of each measure in each SPU where the measure is planned; written in the table area in the yellow cells;

ii) the sum of the grades for each of the measures; recorded in the table header, in the row above the measure identifiers;

iii) the sum of the grades obtained in each SPU; recorded in the last column of the table;

iv) summary evaluation of the analyzed variant of the small retention program for the entire catchment, in the form of a weighted sum of grades of individual SPUs, where the weight is the share of the area of a given SPU in the total area of the analyzed catchment; saved in the table header, in the last column.

In addition to calculating the evaluation (grading) of the current variant of the program of water retention measures, the results obtained for the previously analyzed variant are recorded in the designated area, on the right side of the **StaticAssessment** sheet (from the DD column).

For the ease of comparing the results of grading variants, it is worth saving the results of successively analyzed variants in a separate xls file.