GUIDELINE

Integrated River Basin Analysis Model

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF ENVIRONMENT AND WATER
THE REPUBLIC OF BULGARIA

Study on Integrated Water Management in the Republic of Bulgaria

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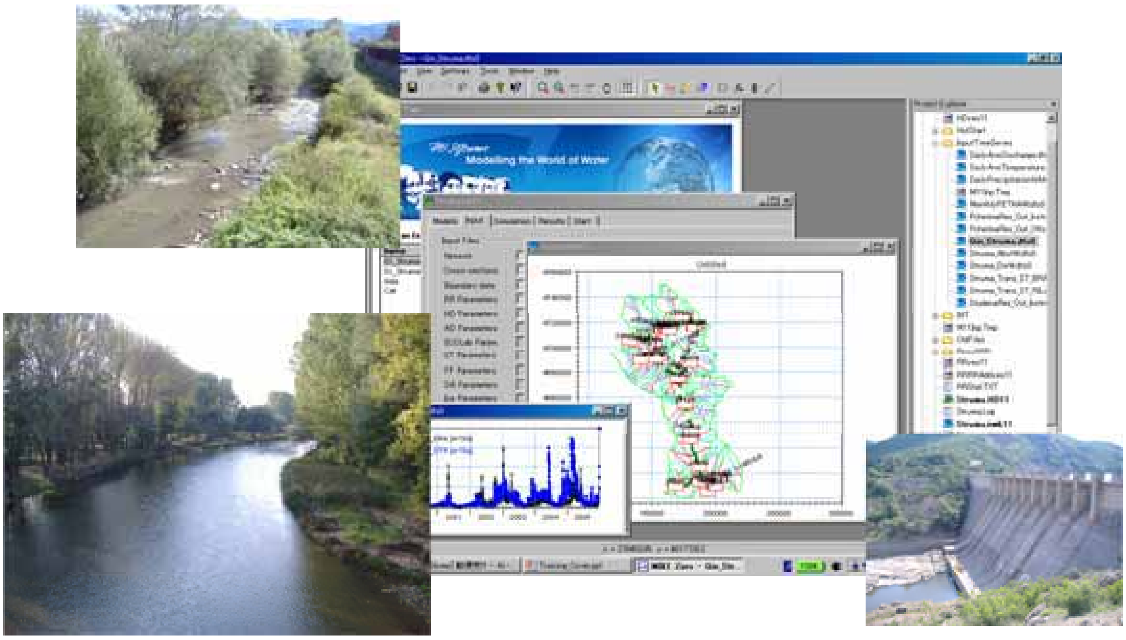

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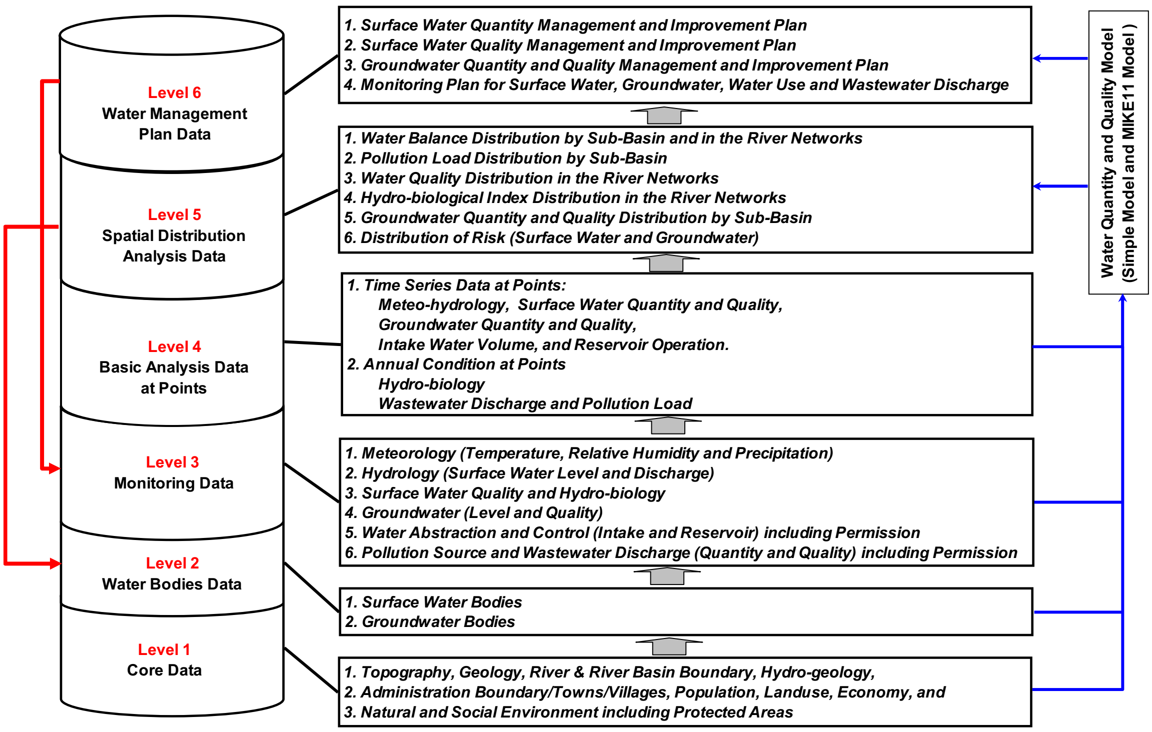
1. Purpose of the Model Developed in the Study

The model developed in the study can be utilized for the following purposes.

- Assessment for existing condition
- Planning such as long term strategy for water management, program measures

The following figure shows the data for preparation of river basin management plan and its implementation. There are several kinds of data to be handled as follows.

- Level 1: Core Data
- Level 2: Waterbodies Data
- Level 3: Monitoring Data
- Level 4: Basic Analysis Data
- Level 5: Spatial Distribution Analysis Data
- Level 6: Water Management Plan Data



Data for Preparation of River Basin Management Plan and Its Implementation

The model developed in the study will be mainly used to produce the Level 5 and Level 6 data using the other level data. In other words, the model can be utilized for the following purposes.

- Assessment for existing condition
    - Observed point data to spatially distributed presentation with some assumptions
- Planning such as long term strategy for water management, program measures
    - Checking effectiveness of some of program measures
    - Reference for permission based on long term strategy for water management

The model developed in the study is ***not*** suitable for the following purposes <u>due to insufficient data and information so far</u>.

- Operational decision such as daily reservoir operation and flood warning
    - It requires additional data, information and model development with additional modules and so on (or different types of model might be required).

There are general notes regarding a model as follows.

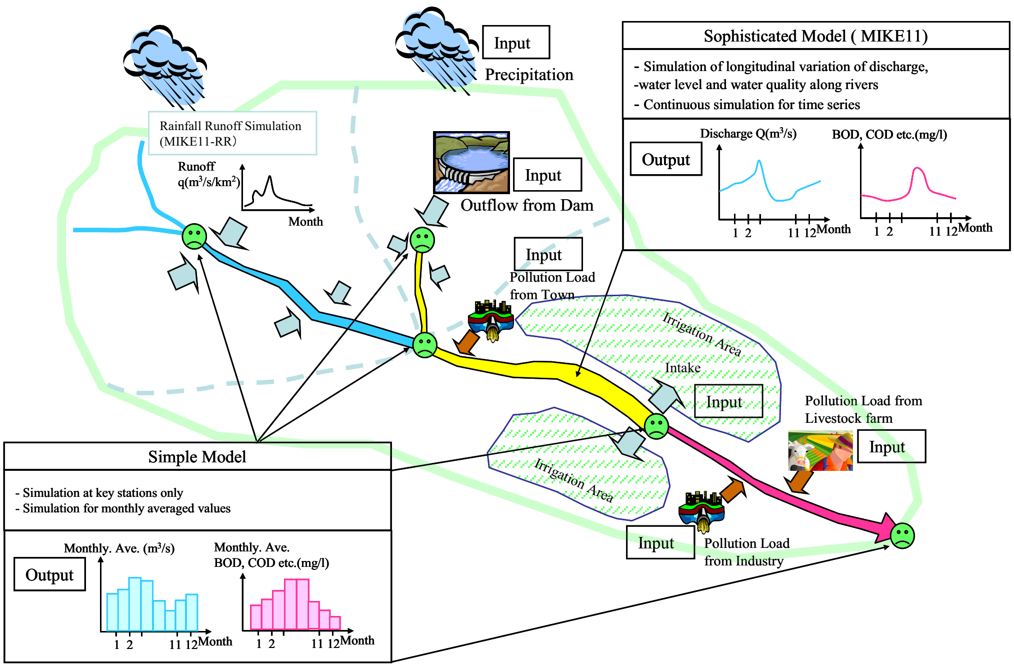
- Model is not perfect. It is simplified representation of actual world. However, it can help thinking of what happens and what will happen.
- If a model is used for decision support, it is not necessary for the model to be perfect. However, it should be transparent in its assumption and methodology. Conesus on the model is important.

The present study proposes the model that will be directly handled by Basin Directorates and will support their river basin management activity. Transparency of the model with clear explanation on assumptions for the model will be important for this purpose.

2. MIKE11 Model and Simple Model

The following two different types of model can be utilized for river basin management.

- Simple Model
- MIKE11 Model



Simple Model and MIKE11 Model

In the present study, two different types of model are proposed. One is "Simple Model", which is based on basically simple mass balance and can be working in general software such as MS-Excel. Another one is "MIKE11 Model" which is well-known but requires specific software for implementing the simulation. MIKE11 is software provided by Danish Hydraulic Institute (DHI). Characteristics of the two models are summarized as below.

- Simple Model
  - No specific modeling software
  - Spread sheet calculation only
  - Point representation at key points for management
  - Time scale: Monthly or Average in whole year and/or summer time
  - Reference for permission
  - Scenario setting for improvement plan
- MIKE11 Model
  - Specific software (MIKE11& MIKE BASIN)

- Physical process-based model
- Spatio-temporal representation along river network
- Time scale: Daily
- Detailed simulation for confirming effects of improvement plan

As for MIKE11 model, the following modules are introduced in the present study.

- Rainfall-Runoff Module (MIKE11-RR)
  - Conversion of Precipitation *to* Runoff in Catchment
  - NAM model has been selected.
- Hydro Dynamic Module (MIKE11-HD)
  - Conversion of Inflow (Runoff in Catchment) *to* Flow Condition along River
- Water Quality Module (MIKE11-AD & Eco-Lab)
  - Conversion of Flow Condition and pollution load in River *to* Water Quality Condition along River

It is noted that MIKE11 can run the above components simultaneously.

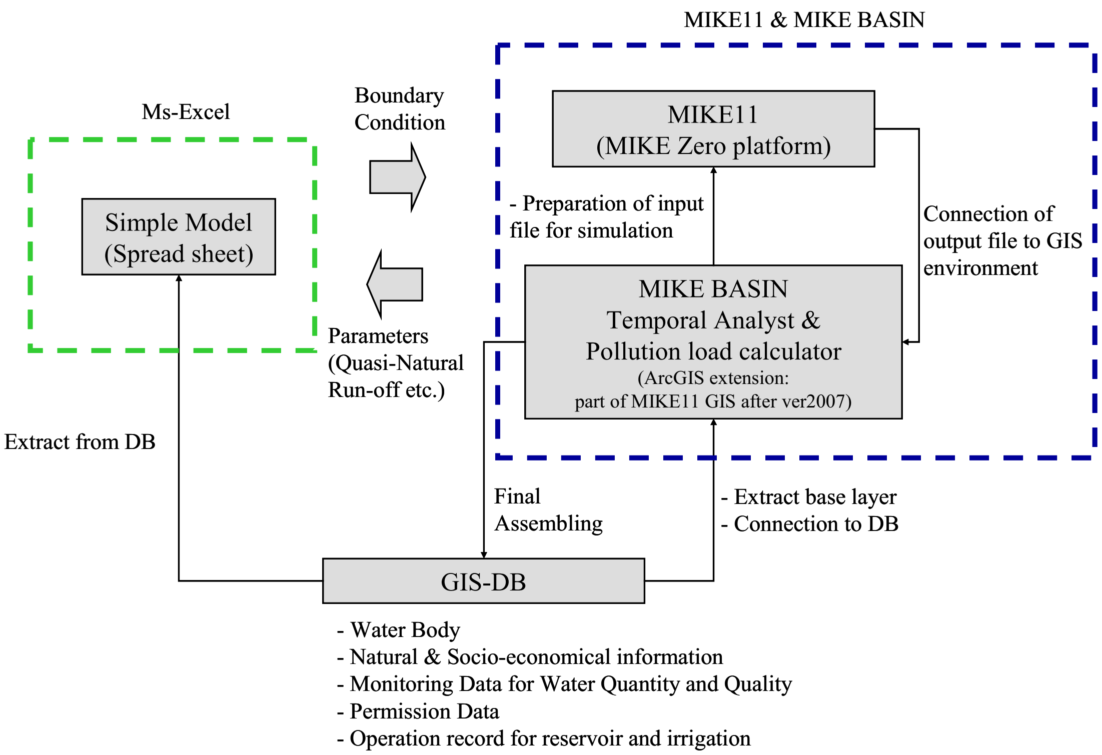
Target users for Simple model and MIKE11 model are proposed as shown in the following table. There will be two kinds of users. One is the users who will run the model for different scenarios only. Another is the users who will maintain the model. Model run for MIKE11 model and model maintenance for both models require detailed knowledge on the model. It is thus recommended that Basin Directorate keep a few responsible persons for model maintenance, who will conduct model maintenance and model run for MIKE11 model, and model maintenance for Simple model.

Target Users

User	Simple Model	MIKE 11 Model
Model Run	Planning & Monitoring & Permission Dept.	Responsible person for model maintenance in RBD with discussion among Planning & Monitoring & Permission Dept.
Model Maintenance	Responsible person for model maintenance in RBD with discussion among Planning & Monitoring & Permission Dept.	Responsible person for model maintenance in RBD with discussion among Planning & Monitoring & Permission Dept.

3. Modeling Environment

Proposed Modeling environment consists of GID-DB developed in the study, MIKE Zero platform, which is provided by DHI as a native platform for MIKE11 model, and ArcGIS extension for MIKE11 model.



Proposed Modeling Environment

MIKE11 model development and simulation are implemented within MIKE ZERO platform, which is provided by DHI as a native platform for MIKE11 model. For development of a model, some layers in the GIS-DB such as river network and catchment can be imported to MIKE ZERO platform.

MIKE11 model requires a lot of time series data for input, although format of input file is special format for MIKE11 model. For smooth implementation of the simulation using the GIS-DB, MIKE BASIN Temporal Analyst and Pollution Load Calculator, which are extensions of ArcGIS, as well as Excel sheet, are utilized for preparing input files for MIKE11 simulation. Conversion of .xls file, .txt file and/or Geodatabase (.mdb) to .dfs0 (MIKE11 time series format) will be easily implemented by using the Temporal Analyst.

MIKE View on MIKE ZERO platform can be used for visualization of the simulation result of MIKE11 model. However, output files can also be imported to ArcGIS using

MIKE BASIN Temporal Analyst, and then result presentation and analysis would be conducted in GIS environment. For example, linear reference system in ArcGIS may be utilized for the analysis and presentation on the result of the simulation in GIS environment.

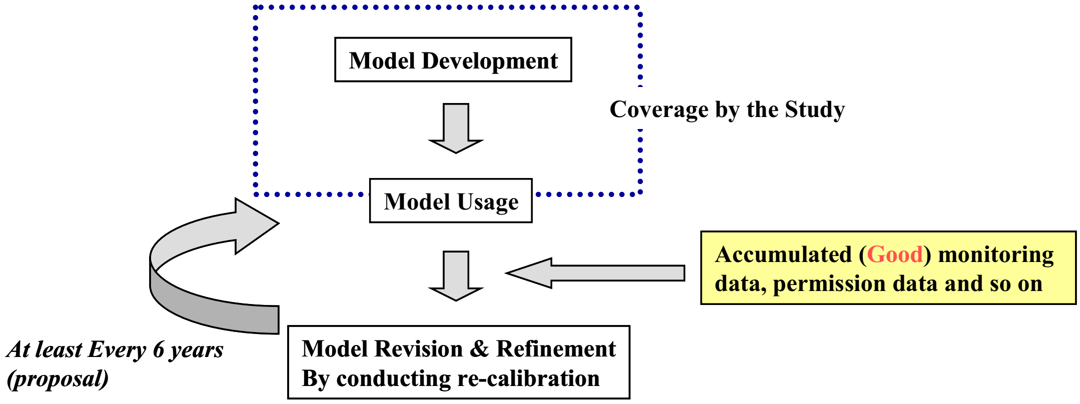
As for Simple model, input data for the model are extracted from the GIS-DB. Some model parameters such as runoff volume are set using the result of MIKE11 model. Simple model is rather independent from GIS software so that user can use it without any knowledge of specific GIS software.

DHI Home page

4. Modeling Cycle

There are three stages for the modeling, which consists of modeling cycle, as follows.

- Model development stage
- Model usage stage
- Model revision and refinement stage



Modeling Cycle

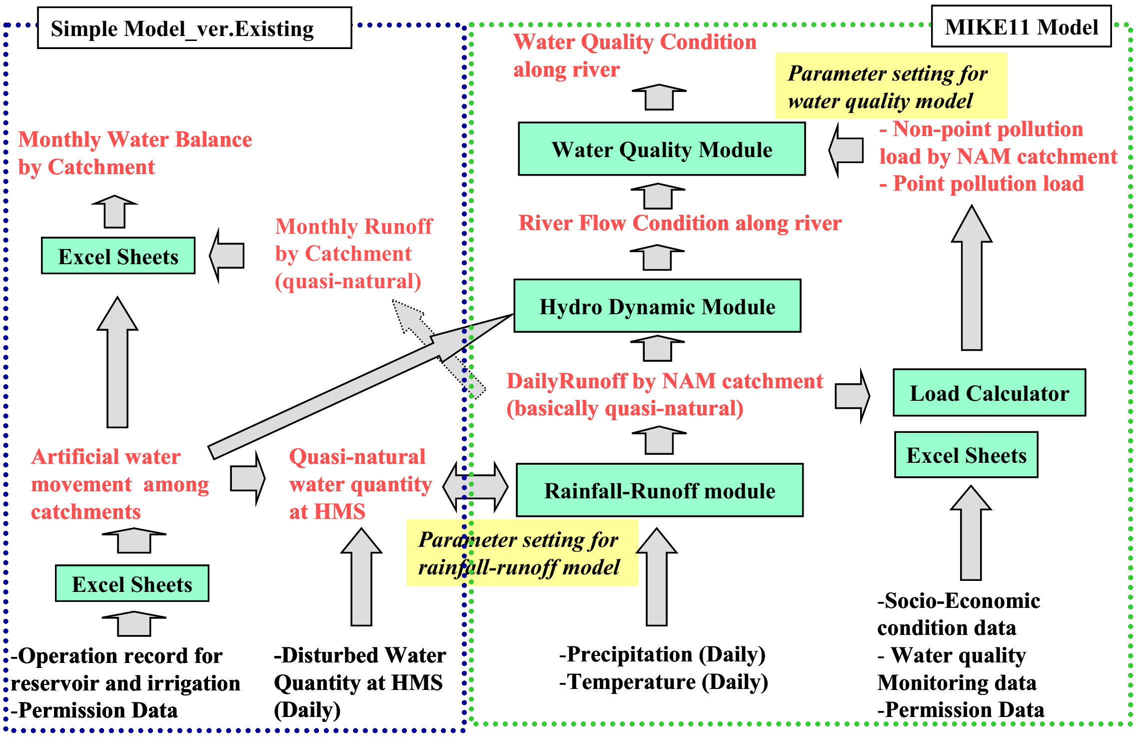
The present study covers model development stage and a part of model usage stage. It is expected that model usage will be continued by Basin Directorate after the study. Model revision and refinement is proposed to be conducted after sufficient data and information will be accumulated in future. The best timing for model revision and refinement seems to be just before the river basin management plan will be revised.

The following table summarizes the activities which have been conducted in the model development and usage stages in the present study and which are expected to be conducted in the model revision and refinement stage after the study.

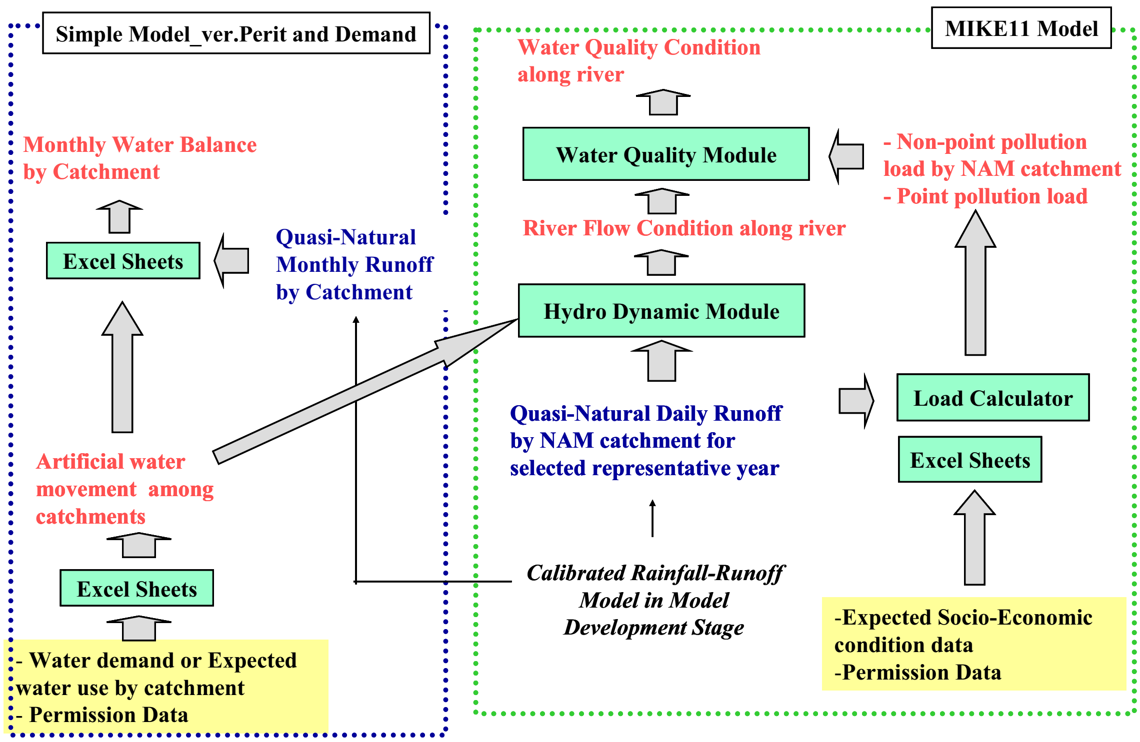
Activities in Each Modeling Stage

Stage	MIKE11 Model	Simple Model
Model development stage	-Calibration of parameters for rainfall-runoff module for MIKE11 model (2001 – 2005: 5 years) -Setting river-network for hydro dynamic module for MIKE11 model -Calibration of parameters for water quality module for MIKE11 model (2004: a representative year)	-Preparation of Excel sheets (incl. Macros) as templates
Model usage stage	-To run the developed model by changing water use, pollution load based on scenarios	-Checking of water balance for different water use conditions -Examination on effect of pollution load reduction on water quality
Model revision and refinement stage (after the study)	-Re-calibration of model parameters using accumulated data and information.	-Re-input of calibrated model parameters and reservoir operation pattern using accumulated data and information.

The following figures demonstrate typical input and output of the Simple model and MIKE11 model in model development stage and



Typical Input and Output of the Simple Model and MIKE11 Model in Model Development Stage

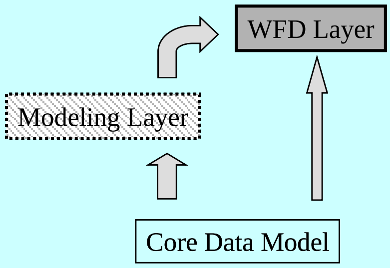


Typical Input and Output of the Simple Model and MIKE11 Model in Model Usage Stage

5. Modeling Layer

Modeling layer is prepared as one of supporting layers beside core data model and WFD layer. The modeling layer will be utilized for:

- Reference for preparing WFD layer, and
- Base for preparing basin management plan.



Modeling layer has been prepared as one of supporting layers beside core data model and WFD layer discussed in GIS-DB as shown in the following figure and Table. The modeling layer will be utilized for:

- Reference for preparing WFD layer, and
- Base for preparing basin management plan.

Each object in the modeling layer has its ID for modeling purpose. To avoid confusion with WFD code for waterbodies, the ID is a random number, which is different from the WFD code.

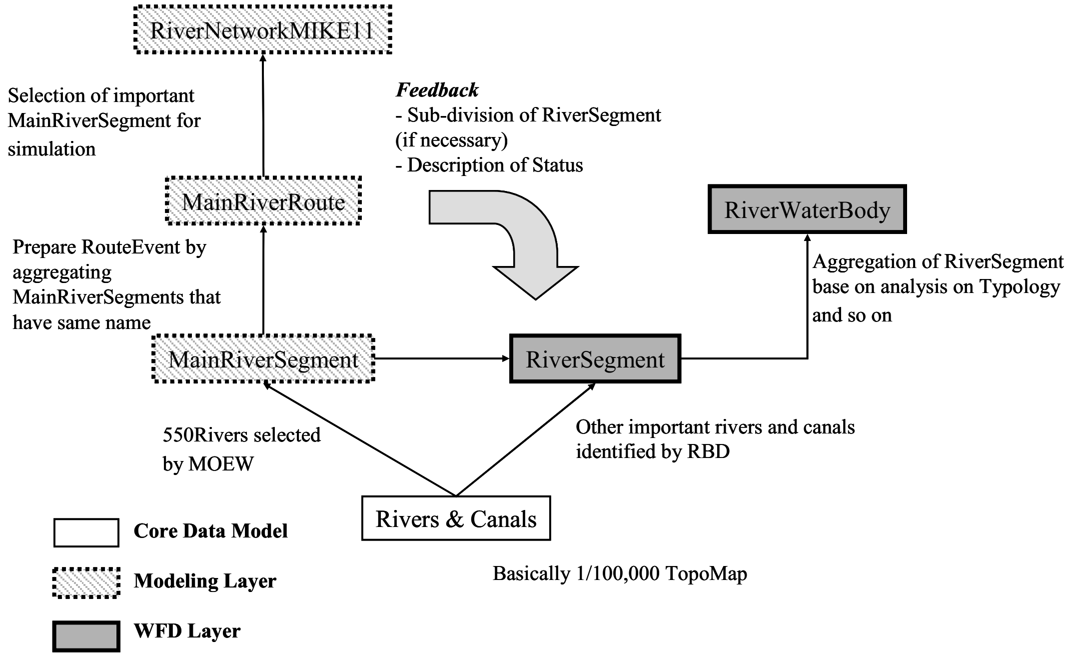
Prepared Modeling Layer

Layer	Explanation
Catchment	Base unit for modeling, same as Core data, but has unique ID for modeling
NAMCatchment	Base unit for Rainfall-Runoff modeling, which is prepared by aggregation of Catchment
MainRiverSegment	Selected river segment corresponding to Catchment. One Catchment has one MainRiverSegment basically.
SignificantLake	Selected reservoir and lake for modeling purpose, Significant reservoirs specified by Water Act and lakes whose surface area is more than 5km^2 are selected.

See **Annex 1** for Catchments and those IDs and Codes

(1) River

The following figure shows the relationship among core data model, modeling layer and WFD layer for river.



Relationship among Core Data Model, Analysis Layer and WFD Layer on River

Core data for rivers is basically based on 1/100,000 topography map, which includes many small rivers and canals. 550 Rivers selected by MoEW are extracted as MainRiverSegment from the core data model for analysis purpose. MainRiverRoute that uses linear reference system and has same geometry with MainRiverSegment is also prepared, which is a part of Core Data model. Important MainRiverSegment is selected for MIKE11 modelling.

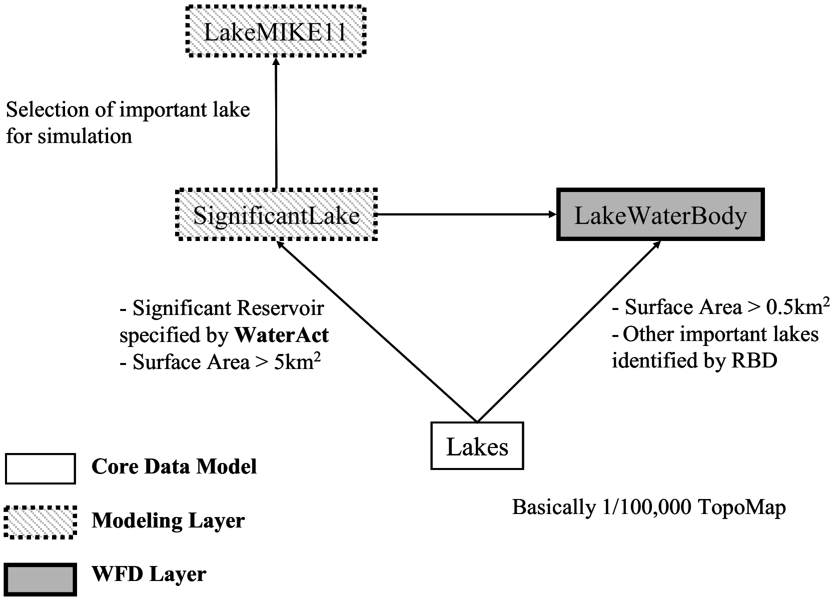
RiverSegment for WFD layer may include more rivers and canals, according to judgement by Basin Directorate on importance of the rivers and canals.

(2) Lake

The following figure shows the relationship among core data model, modeling layer and WFD layer for lakes.

Core data for lakes is basically based on 1/100,000 topography map, which includes many small lakes. Significant reservoirs specified by Water Act and a lake whose surface area is more than 5km^2 are extracted as SignificantLake for analysis purpose. Among the SignificantLake, important ones are selected for MIKE11 simulation.

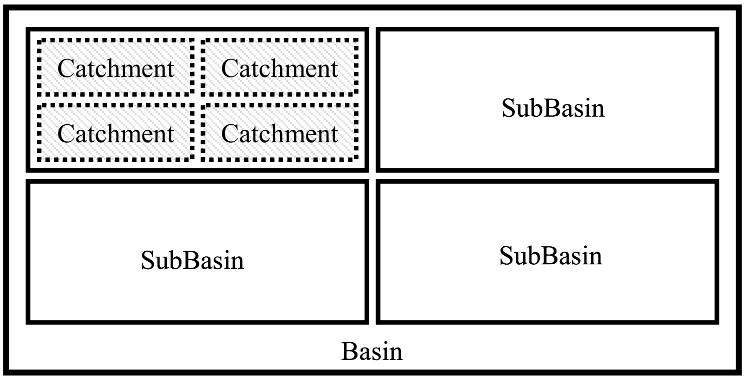
LakeWaterBody for WFD layer may include more lakes, according to judgement by Basin Directorate on importance of the lake.



Relationship among Core Data Model Analysis Layer and WFD Layer on Lake

(3) Catchment

The following figure shows the relationship among catchment, sub-basin and basin. Catchment is not WFD layer. It is determined by only hydrological point of view. On the other hand, Basin and SubBasin are WFD layers. Both SubBasin and Basin can be prepared by aggregating catchments.

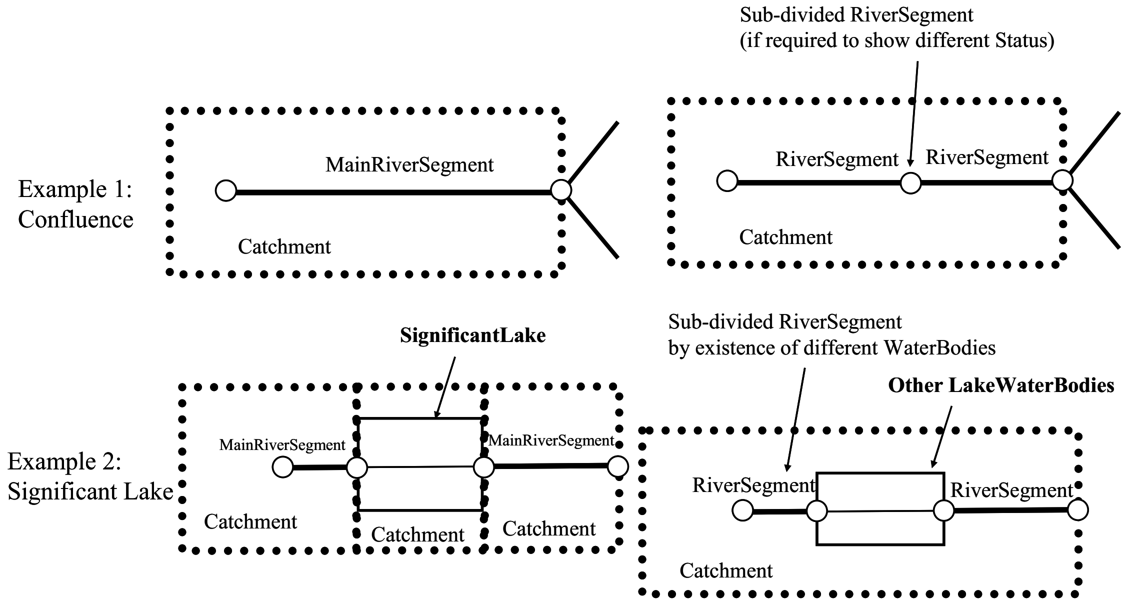


Relationship among Catchment, SubBasin and Basin

Criteria on delineation of catchment are as follows.

- Confluence of MainRiverSegment
- Junction between MainRiverSegment and SignificantLake

Examples for delineation of catchment are shown in Figure E.2.8.



Examples of Delineation of Catchment

Watershed (Catchment) for 550 rivers which has been delineated by NIMH is basically utilized for catchment after verified using 1/100,000 and 1/25,000 topographic map. However, it has been modified considering own-catchment for SignificantLake.

Catchment may be a basic unit for analysis and modelling. Spatially-distributed parameters can be basically represented as one parameter or pivot table (matrix) in a catchment. Spatially-distributed parameter may include the followings.

- Precipitation
- Evapo-transpiration
- Water resources potential
- Water user & water demand
- Pollution load (Non-point source and point source)
- Other natural and socio-economical conditions related to modeling
    - Land use, Soil condition, Geology, Population etc.

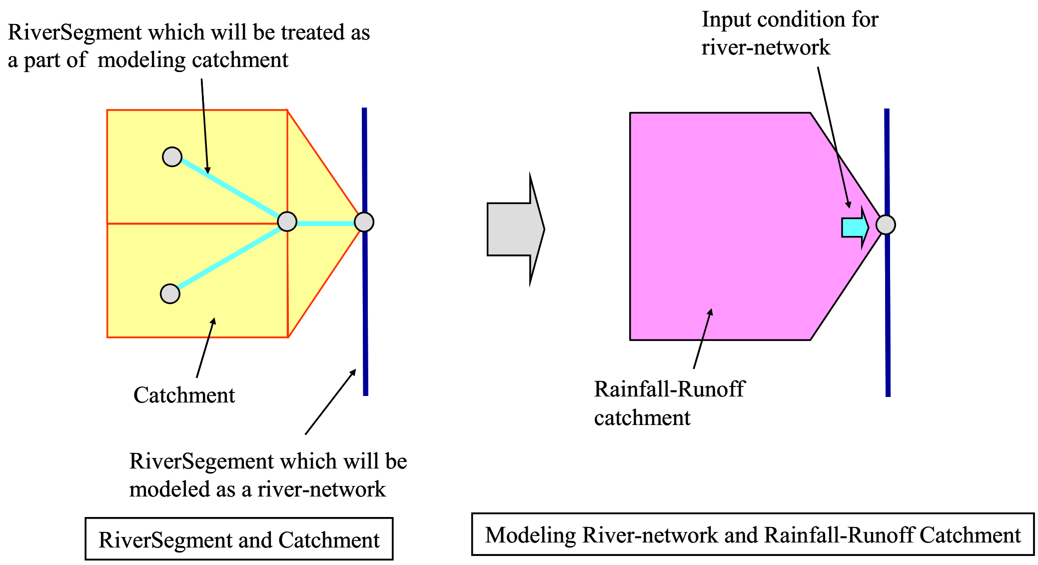
Some characteristics on small rivers and lakes within a catchment could be also summarized as one parameter or pivot table (matrix) in a catchment.

(4) Rainfall-Runoff Catchment (NAM Catchment) for MIKE11 Modeling

To model for all MainRiverSegment and those catchments is possible. It is however time-consuming. It is better to select important MainRiverSegment for the modeling from view point of management. The selected MainRiverSegment will be modeled as a river-network. The non-selected MainRiverSegment will be treated as a part of modeling catchment.

In the present study, NAM model is used for rainfall-runoff model as a part of MIKE11 model. NAM model assumes that hydrological property is similar within a modelling catchment which is called as NAM catchment. NAM catchment will be prepared by aggregating catchments.

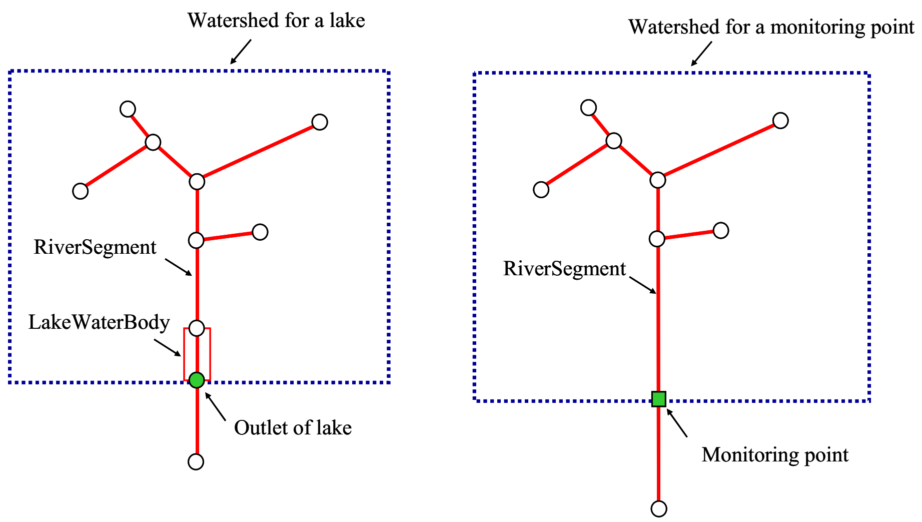
It is noted that hydrological process related to small lakes, reservoirs and local rivers in NAM catchment is represented by model parameters of NAM model.



Aggregation of Catchment to prepare Rainfall-Runoff Catchment

(5) Watershed for Specific Point

Watershed is here defined as total upstream area for a specific point. For assessment of pressure & impact for the specific point such as a lake, a monitoring point (HMS, Physco-Chemical St, HydroBiological St) along a river, watershed will be delineated as one of analysis layers beside Catchment, when necessary.



Watershed for Specific Point

6. Definition of Terms Related to Flow Conditions

In the model, the following terms related to flow conditions are used.

- Quasi-Natural Flow
- Potential Flow with Significant Reservoir
- Disturbed Flow

In Bulgaria, many of observed water quantity are heavily affected by human activities such as water transfer, abstraction and discharge. Considering this situation, in the model, the following terms that are related to water quantity are defined to avoid any misunderstandings.

- Quasi-Natural Flow
    - Flow without human disturbances such as abstraction, discharge, transfer
    - Likely natural, however, not exactly natural.
    - In the model, regime change of local reservoir is not taken into account.
- Potential Flow with Significant Reservoir
    - Flow with influence of significant reservoir, but no abstraction from reservoir
    - Potentially usable water amount after regime change by significant reservoir
- Disturbed Flow
    - Existing condition
    - It can be expressed as follows
        - (Potential Flow) – (Total abstracted water) + (Total discharged water)

7. Input Data for the Model

The following data are necessary for the **water quantity** model.

- Meteo-Hydrological Data
  - Precipitation
  - Potential evapo-transpiration (PET)
  - Air Temperature
  - Water quantity at key HMSs
- Water Transfer, Abstraction, Discharge Data
  - Reservoir operation (for significant reservoir)
  - Water abstraction
    - Irrigation water use
    - Domestic & Industrial water use
  - Water discharge (waste water)
- River Condition Data
  - Cross-section data

The detail of input data for the model is explained below.

(1) Meteo-Hydrological Data

(a) Precipitation

Daily precipitation data at 253 NIMH precipitation station in Bulgaria during 2000-2005 are available without missing duration in MoEW. Theissen Polygons of the precipitation stations are prepared, and are used for estimating spatially-averaged precipitation.

Long-term data are available only from Statistical Year Book issued by NSI, which includes 13 meteorological stations during 1990-2005 and 8 meteorological stations during 1960-2005.

Average precipitation over a catchment is estimated by the following equations.

$$P_{ave} = C_{elc} P_{ave0} \tag{1}$$

$$C_{ele} = exp\left[0.0003\left(E_{ave} \quad E_{ave\_P}\right)\right] \tag{2}$$

$$P_{ave0} = \sum C_{pn} P_n \tag{3}$$

$$E_{ave\_p} = \sum C_{pn} E_n \tag{4}$$

where P_{ave} = average precipitation (mm), P_{ave0} = average precipitation before correction for elevation difference (mm), C_{ele} = correction coefficient for elevation difference between average elevation of catchment and one for precipitation sts. (-), E_{ave} = average elevation of catchment (m), E_{ave_p} = average elevation of precipitation stations (m), P_n = precipitation at station "n" (mm), C_{pn} = Thiessen coefficient for station "n" (-), E_n = elevation at station "n" (m).

Equation (2) is an empirical curve based on observation data. Average elevation of catchment is derived from digital elevation model.

(b) Potential Evapo-Transpiration (PET)

To get enough amount of meteorological data at NIMH climatic sts. is difficult, because of high cost of the data. Alternative freely available source, WORLDCLIM database, in which includes 1km mesh monthly averaged air temperature for whole world, is used. WORLDCLIM database shows average value during 1950-2000 based on observed data at several climatic stations considering altitude distribution. Thornthwaite equation is used for converting air temperature to PET.

When NIMH data will be available in future, they may be utilized to increase the accuracy of estimation of PET.

(c) Daily Air Temperature

To simulate melting process of snow, it is necessary to give daily air temperature. It is again very difficult to get daily temperature for a lot of meteorological stations, because of their high cost. Data for daily temperature during 2000-2005 for the following five meteorological stations are obtained and were utilized.

- Kustendil
- Sandanski
- Kazanlak
- Haskovo
- Pazardjik

(d) Water Quantity at Key HMSs

Daily discharge data at 204 NIMH HMSs in Bulgaria during 2000-2005 are available in MoEW.

As for long-term data, monthly data before 1975 are available in well-known Hydrological Reference Book. Monthly data in 1975 - 1983 are available in Bulletin issued from NIMH. However, it is not possible to get the data in 1983 – 1999 from NIMH, except that the other studies, such as previous JICA study for Maritsa river basin, have already collected the data and they are opened to public.

(2) Water Transfer, Abstraction, Discharge Data

(a) Reservoir Operation (for Significant Reservoir)

MoEW receives and stores monthly water balance data for some of significant reservoirs. The monthly water balance data include the followings.

- Reservoir Volume
- Total Inflow
- Total Outflow
- Used water amount for HPP, Irrigation, domestic & industrial use
- Release to downstream river (discharge pipe and/or overflow)

Under the permission by MoEW, it is possible to utilize the data for 2000-2005.

Monthly water balance data for irrigation reservoirs are also got from Irrigation Systems Ltd.

However, there are many difficulties for utilizing the data. The followings are assumed in the model.

- Even in the data stored to MoEW, there is lack of information for water use condition for 2000-2001. For 2000-2001, the condition of water use is assumed referring the water use condition of 2002-2005.
- Some reservoirs gather water through feeder channels from neighboring river basins. However, the data in MoEW show only total inflow volume. Based upon the available information on the design scheme of significant reservoirs, how the feeder channels contribute to inflow to the significant reservoirs in EABD and WABD are assumed.
- One of unclear factors when one considers the water balance is how the used water for Hydroelectric power plant (HPP) is re-used for another purpose. It is not always clearly shown in the records submitted to MoEW. Considering possible water balance based upon the available information such as water quantity measured at hydrometric stations, re-used water is assumed. There are two patterns assumed as follows.
    - *Pattern 1*: All of used water for HPP is re-used for irrigation purpose and does not come back to downstream reach of the river that HPP locates.
    - *Pattern 2*: All of used water for HPP comes back to downstream reach of the river that HPP locates. Only the water for irrigation that is specified in the records is used for irrigation purpose.
- Another unclear factor is share of industrial water supply and domestic water supply. The records in MOEW show only total water use for industrial and domestic water. In the model, the share between industrial and domestic water supply is assumed based on permitted water volume.

For accurate estimation of water balance for water management purpose, it is highly recommended to use more solid and reliable information to make clear all of the above-mentioned points, so that one can avoid applying many assumptions.

(b) Water Abstraction

Irrigation Data

The following data are obtained from Irrigation Systems Ltd.

- Annually abstracted water volume for each irrigation branch (2000-2005)
- Monthly used water volume for each irrigation branch (2000-2005)

The Following data are obtained from Basin Directorates.

- Permission data for irrigation use

Actually abstracted water volume by Irrigation Systems Ltd. is much smaller than the amount described in the Permission in general. In the model, actually abstracted water amount by Irrigation Systems Ltd. is used for analysis (except in case that water is abstracted from significant reservoirs). Spatial distribution of water abstraction within each irrigation branch is estimated by permission data for assessment of existing condition. .

Domestic and Industrial Data

Permission data for domestic and industrial use are obtained from Basin Directorates. Annual permitted water volume is used for analysis for assessing existing condition.

(c) Discharge (Waste water)

Permission and monitoring data for domestic and industrial discharge are obtained from Basin Directorates. On the other hand, population equivalent (PE) is also calculated based on population data. In the model, PE for domestic discharge and permission data for industrial discharge are utilized, respectively.

(3) River Condition Data

(a) Cross-section

MIKE11-HD requires cross-section data of the rivers to be modelled. In the present study, the following cross-section data are available.

- NIMH HMS sts. data (Purchased by the Study Team): 20 sections
- Data used in the previous JICA Maritsa River Basin Study: 61 sections
- Surveyed data in the present study: 25 sections

The cross-section data are stored in MIKE11 model set-up.

In addition to the actual cross-section data, simplified version of cross-section data will also be utilized in MIKE11-HD modelling, based on the width and elevation of the river that will be estimated by other sources such as Google Earth and DEM.

It should be remind that considering the currently available cross-section data, the simulation result of water level may **not** be reliable for assessment of flood condition.

(b) Hydraulic Structure

There exist many hydraulic structures such as weir along the rivers to be modelled. However, the existence of such hydraulic structure will be basically ignored in MIKE11-HD, because of lack of the detailed information.

The following data related to pollution load are necessary for the **water quality** model.

- Agricultural sources
  - From domestic live stock
  - From use of fertiliser
- Urban point sources
  - Out flow from WWTP (may include industrial wastewater)
  - Sewered but not treated sewage (may include industrial wastewater)
- Urban non-point sources
  - Sewered small settlements
- Non severed settlements and individual houses/farms
  - Industries point sources:
  - directly discharge (including big animal breeding farms)

The detail of input data for the model is explained below.

(1) Domestic Pollution

For including domestic pollution in the MIKE 11 Water Quality Model there has been distinguished between towns above 2000 person equivalents (PE) and towns and villages below 2000 PE. The towns above 2000 PE have been included as individual point sources. Towns below 2000 PE have been included as distributed sources flowing into the rivers equally distributed along the river branched within each NAM-Catchment.

For the estimation of the pollution load for the domestic pollution sources is used the unit load representing one person equivalent (PE) shown in the following table.

Unit load (PE) that is Assumed to Reach the Rivers from Domestic Pollution Sources (WWTP:Waste Water Treatment Plants)

g/day/person	BOD	NH4-N	NO3-N	PO4-P	Part P	TP	Org. N	TN	l/day
Raw Sewage	60	8	0	1.7	0.1	1.8	3	11	200
Severed without treatment	60	8	0	1.7	0.1	1.8	3	11	200
With secondary WWTP	10	1	2.5	0.9	0.1	1	0.5	4	200
With primary WWTP	35	9	0	1.7	0.1	1.8	2	11	200
Without sewage system	15	1	2	0.9	0.1	1	0	3	200

From the Table it can be seen that the pollution per PE that reach the river is assumed lower in case no sewage system exist compared to the situation where all are severed. The argument for this is that a significant amount of especially BOD and Ammonium is depredated on its way to the river through drains, ditches and infiltration through soil matrices.

(2) Industrial Pollution

Industrial pollution sources with separate discharges directly into the river have been included as separate point sources in the MIKE 11 WQ model setup. The pollution has been estimated based on data made available from EABD and WABD. The data originate partly form monitoring programs and partly from license (information card) data. In several cases that only data for discharge have been available, concentration of pollution variables was roughly estimated based on data from other industrial sources of the same general type. The industrial pollution load estimates is highly uncertain and it is highly recommendable to improve this part of the model input data.

A part of the industrial pollution has not been possible to describe separately and has been included in the person equivalent form urban area. This part of the industrial pollution is discharged into the MIKE 11 model together with the above mention domestic sources.

(3) Livestock Farm Pollution

Two different groups of livestock pollution sources have been include in the MIKE11 model setup.

- Livestock Farms – included as point sources
- Distributed livestock spread in the catchments - includes as non-point sources

The pollution form Livestock Farm has been based on information collected from the EABD and WADB.

Estimation of the non-point livestock sources have been based on statistical information about animals in each municipality. For further description, see below in section (4).

(4) Non-Point Load using the LOAD CALCULATOR

Non-point pollution load from fertilizers and livestock spread in the catchments have been quantified and input data for the modeling have been created using the MIKE BASIN / MIKE 11 LOAD CALCULATOR. This section describes the input data used for this purpose. Additional description of the use of this facility is given in *Annex 6.*

The MIKE LOAD CALCULATOR is a tool for assisting in determining the pollution loads within river basins. The tool can be applied as a stand-alone tool for calculating average mass fluxes of pollutants for individual sub-catchments (e.g. kg/catchment/year) or on a raster grid basis (e.g. kg/grid/year). Optionally the tool can provide the pollution load input data for the MIKE BASIN Water Quality model and for MIKE 11 ECOLab models.

Pollution loads may include both point and non-point sources. All loads are initially calculated as constant mass fluxes for each sub-catchment, e.g. kg/year, however when applying the Load Calculator together with the MIKE BASIN WQ or the MIKE 11 RR (Rainfall-Runoff/NAM) model there are several options for translating the constant mass fluxes into mass flux time series depending on e.g. runoff time series or any other known temporal variations.

The main LOAD CALCULATOR dialog consists of three parts:

- Sources - for specifying pollution sources,
- Transport - for specifying the transport and retention of pollutants
- Output - for specifying how the output is to be stored

Within these model set-up the source part and the output part are utilized. The transport in the modeling area is described in the MIKE 11 model and the retention of the non-point pollution in the catchment before ending up in the river is described using a runoff coefficient.

In the Sources section all pollution sources are defined and specified individually. An unlimited number of sources can be specified. Each source can have a unique set of required input data or groups of sources may have similar input data. In any case the data input is very similar in all four cases. The sources input data is divided into

- a Shape file attributes section
- a Time distribution (alfa time series) section, and
- a source specific section that in three of the four methods includes a Runoff Coefficients.

Sources are divided into four different groups:

- Fertiliser Sources
- Livestock Sources
- Domestic Sources
- Point Sources.

In the model set-up used in this study only the facilities for pollution estimates from the use of fertilizers and from livestock spread in the catchments have been utilized. The pollution load from different kind of point sources (domestic, industrial, livestock farms) have been included in the model set-up based on calculation carried out in different Excel sheets. For more details on this please consult *Annex 6.*

(a) Fertilizer Sources

The Fertilizer source type typically represents artificial fertilizers, such as nitrogen and/or phosphorous. Other pollutant components may also be included as a fertilizer source. This have however not been utilized in the specific set-up for the rivers in question.

For these model set-ups it assumed that the used of fertilizers result in a runoff to the rivers of

- Nitrate-Nitrogen (NO_3-N)

- Phosphate - Diluted Ortho Phosphate (PO_4-P)

A fertilizer sources must be specified individually for each type of pollutant. For example, to simulate both nitrogen and phosphorus two fertilizer sources are required - one called "Fertilizer Nitrogen" and the other called "Fertilizer Phosphorous".

The input data has been stored in a polygon shape file with field(s) in the associated attribute table representing the amount of fertilizer applied per polygon (e.g. farm, district or county). Data used in these setups are achieved from statistical information stored in ArcGIS in a directory named: *"Bulagria_fertilser-byDistrict"*. The statistical information about the average use of fertilizers district by district for the period 1999-2005 have been utilized for the estimation of the non-point pollution from this source. These values are found in the attribute table for the shape file (ArcGIS-layer) named "Bg_District" within the directory *"Bulagria_fertilser-byDistrict"*.

For the calculation of the pollution input to the rivers a runoff coefficient of 10 % has been assumed.

The concentrations in the input to the modeled rivers have been assumed constant through the year. However the transport to the river is not constant as this non-point pollution follows the runoff of water described by the Rainfall-Runoff (NAM) model.

(b) Livestock Sources

The Livestock Source type typically represents pollutants derived from manure or slurry from cattle, bovines, pigs, sheep, goats, horses, poultry, etc.

For each livestock source several different types of pollutants can be specified via a *Source Load per Head*. For each pollutant component a value must be specified representing the average production or field application of manure or slurry, e.g. kg N /year/animal head. Available components for livestock sources in the LOAD CALCULATOR are:

- BOD - Biological Oxygen Demand
- Ntot - Total Nitrogen
- NH4 - Ammonia-Nitrogen
- NO3 - Nitrate-Nitrogen
- Ptot - Total Phosphorous (or PO_4-P)
- EColi - E-Coli Bacteria
- User Def - User defined substance

In this model set-up the pollution from non-point pollution from livestock contribute with

- BOD - Biological Oxygen Demand
- NH_4-N - Ammonia-Nitrogen
- PO_4-P – Diluted Ortho Phosphate

This mean that all nitrogen contribution from this source is assume to reach the rivers as Ammonium and all phosphorus contribution is assumed to reach the rivers as phosphate (PO_4-P). The Total Phosphorous component of the LOAD CALCULATOR is redefined (or interpretated) in the MIKE 11 ECOLab models as Phosphate (PO_4-P).

Input data are stored as an ArcGIS layer of the type polygon shape file with field(s) in the associated attribute table representing the number of heads per polygon (e.g. farm, district or county). Data have been made available from the statistical year book 2005 /Agricultural census of Bulgaria 2003/.

The pollution produced by each animal has been calculated using unit load per hear as outlined in the following table.

Levels of Pollution per Head from Different Domestic Animals

Species	BOD kg/year/head	TN kg N/year/head	TP kg P/year/head
Milk producing (Dairy) cows	360	118	17.5
Bovine cows / cattles	55	27.5	17.5
Mother pigs (sows)	33	5.8	4.0
Slaughter pigs (up to100 kg)	8.6	2.8	1.6
Sheeps /goats	7.3	3.25	2.0
Poultry (average)	0.7	0.25	0.18

It is assumed for the calculation of the pollution to the rivers that only 5% of the produced pollution load for livestock spread in catchment will reach the rivers. The rest of the pollution produced is assumed to be retained and turned over within the catchments areas before washed out into the rivers. This assumption is rather rough and the correct level of retention is difficult to estimate and very uncertain.

(5) Inflow with Groundwater

The MIKE 11 Hydrodynamic (HD) model used for describing the water quantity (water levels, discharges and velocities) receive inflow from the Rainfall Runoff model (MIKE 11 RR). The MIKE 11 RR describes the Surface or Overland Flow, the Rootzone or Interflow and the Baseflow.

The Baseflow is the water flowing into the river from the Groundwater. In case no specification of concentration or temperature is made for this inflow the model will regard it as pure water with no constituents and zero degree.

Periodically an important part of the flow in some river is generated by the Baseflow.

The condition in the inflowing groundwater is described based on available data on groundwater concentration from the different NAM Catchments. For some NAM Catchments no information has been available and a global average from neighboring catchments has been used.

8. MIKE11 Water Quantity Model

MIKE11 model for water quantity consists of MIKE11-RR (Rainfall-Runoff module) and MIKE11-HD (Hydrodynamic module).

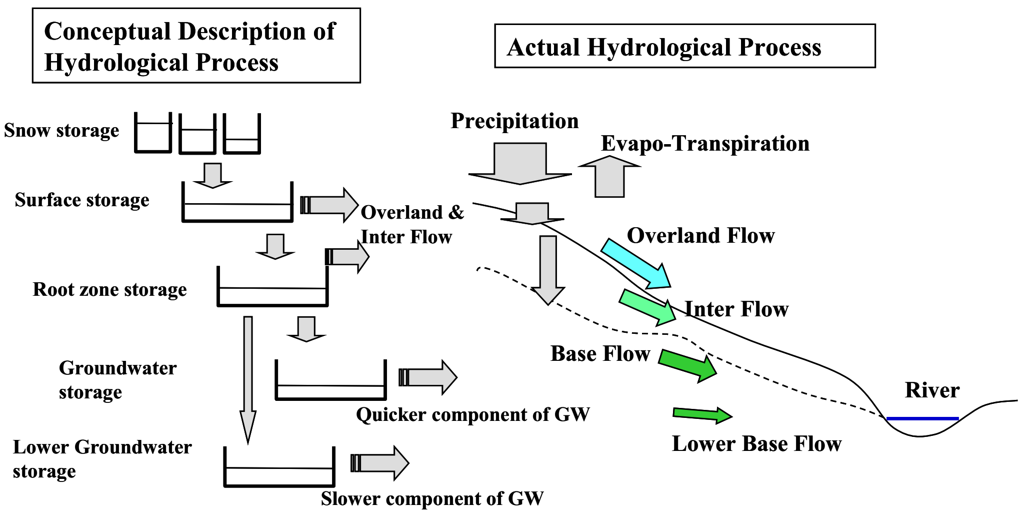
- NAM model is selected for MIKE11-RR. Snow routine for MIKE11-RR is considered, because snow melting process in mountain region is one of key hydrological processes.
- MIKE11-HD module is to simulate river flow process. Dynamic wave model is selected for solver option.

(1) MIKE11-RR

Several different rainfall-runoff models are prepared for MIKE11-RR. Among those, NAM model is selected. NAM model is one of the most suitable and handy model for long-term simulation. NAM model is lumped conceptual hydrological model, which represents spatially averaged phenomena within a rainfall-runoff catchment.

NAM model simulates rainfall-runoff processes by continuously accounting for the water content in four different and mutually interrelated storages that represent different physical elements of the catchment. These storages are:

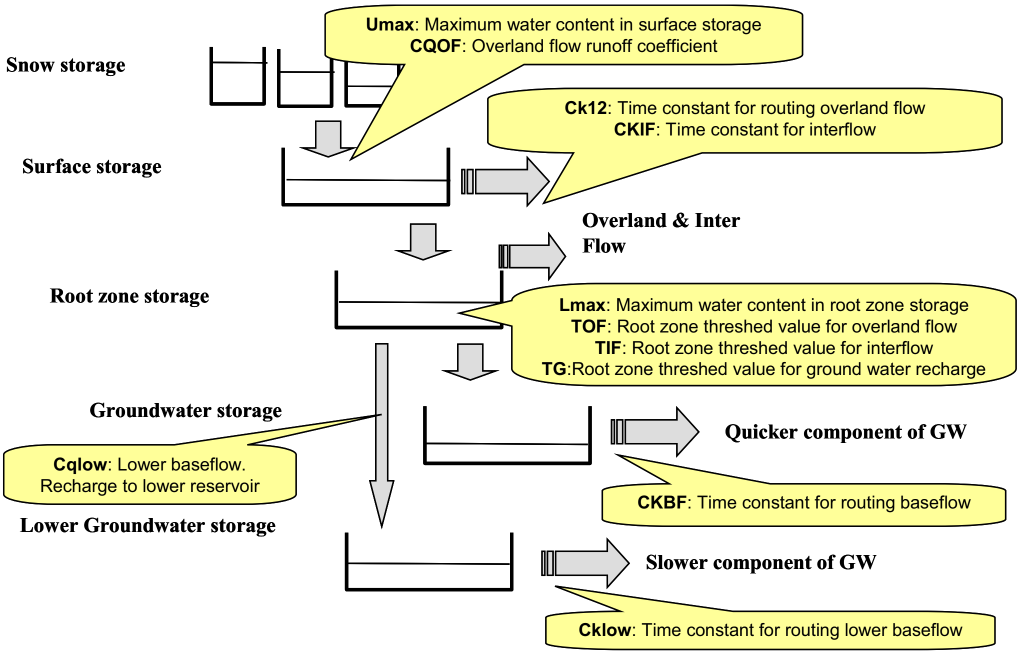
- Snow storage
- Surface storage
- Lower or Root Zone storage
- Groundwater storage
- Lower groundwater storage



NAM Model for Rainfall-Runoff Process

The meteorological input data to the model are precipitation, PET and temperature (only if the snow routine is used). On this basis, it produces, as its main results, catchment runoff and groundwater level values as well as information about other elements of the land phase of the hydrological cycle, such as the temporal variation of the soil moisture content and the groundwater recharge. The resulting catchment runoff is split conceptually into overland flow, interflow and baseflow components.

The primary model parameters in NAM model are shown below. It is necessary for the parameters to be calibrated using observed data.



Primary Model Parameters in NAM Model

Snow routine for MIKE11-RR is considered, because snow melting process in mountain region is one of key hydrological processes. In the snow routine, totally 15 elevation zones were considered.

NAM model has additionally the following two options.

- Irrigation routine
- Ground water abstraction routine

However, these additional routines are not used. The reasons are as follows.

- Irrigation routine introduces different model parameters. To keep model structure simple, it was judged for the irrigation module not to be included.
- The ground water abstraction module in NAM model is too simple to express the effect of abstraction of ground water on ground water behavior in the study area.

See **Annex 2** for Practical Exercise for NAM Model

(2) MIKE11-HD

MIKE11-HD module is to simulate river flow process. One dimensional version of governing equations for momentum transfer and continuity of fluid flow is basic equations for MIKE11-HD.

(a) Solver Option

There are three options to solve the basic equations in MIKE11-HD as follows.

- Dynamic Wave Model
  - Momentum equations for water flow are fully solved.
  - Mainly for flat area and low slope channel

- Diffusion Wave Model
  - Simplified expression of momentum equations for water flow
  - Mainly for mountain area and high slope channel

- Kinematic Wave Model
  - No momentum equation is considered. Only resistance law is considered, instead of momentum equations

In the model, dynamic wave model is selected. For time and space steps, dx = 2,000m, dt =3 -10 min (mostly 5min) are selected, considering necessary resolution, calculation time and stability of the model.

(b) Resistance Law

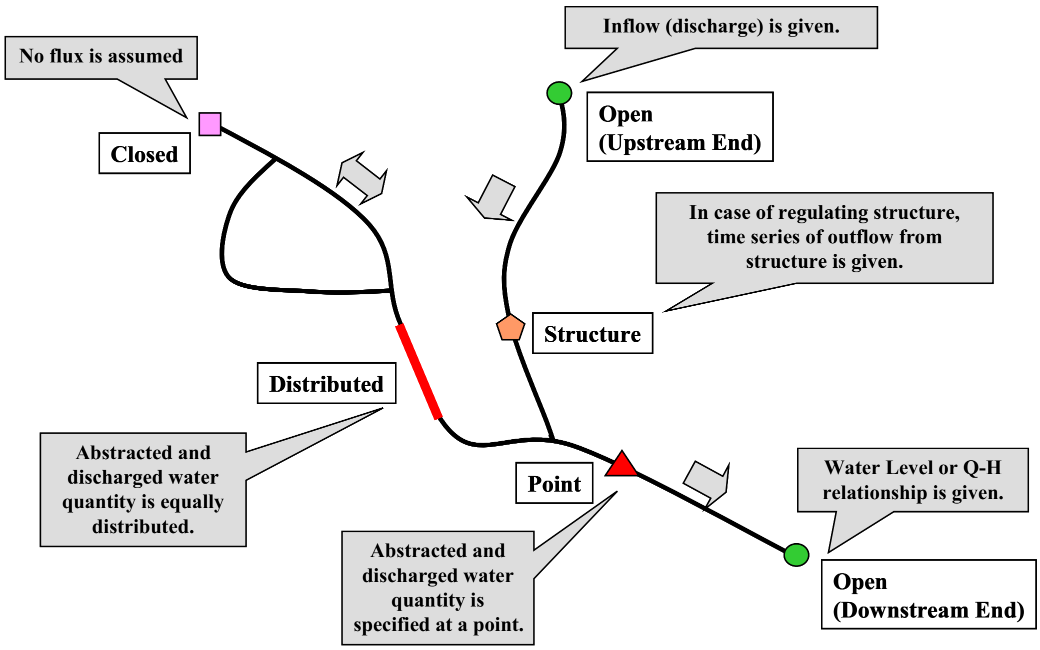
Constant roughness for entire cross-section was assumed. Manning's n was set as 0.04 for entire reach basically. There are exceptional cases as follows.

- Reservoir
  - To avoid high frequency fluctuation with time-step by time-step, which is not suitable for AD calculation, relatively high Manning's n within a reservoir was given to damper out the high frequency fluctuation.

- Small and high slope channel
  - To prevent drying -up of channel during dry period, relatively high Manning's n was given to the bottom portion of river bed. The high Manning's n at the bottom of river bed is interpreted as transition zone to porous layer composed of gravel or pebble.

(c) Boundary Conditions

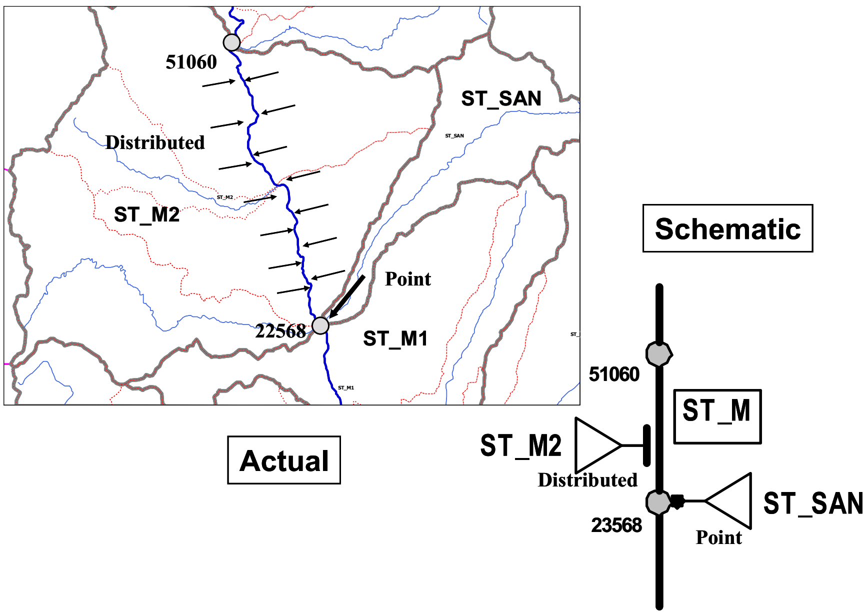
MIKE11-HD has several kinds of boundary conditions as shown below.



Primary Model Parameters in NAM Model

(d) RR-HD Link

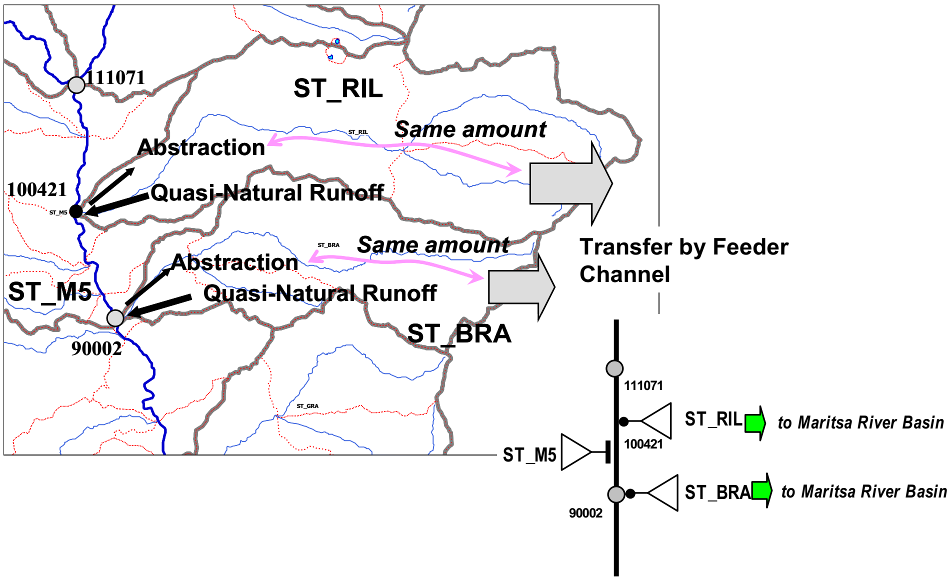
Rainfall-runoff model (MIKE11-RR) is linked with MIKE11-HD. There are two options for the link. One is distributed link. Another one is link at a point. The following figure shows an example of RR-HD link. In case of distributed link, runoff amount from rainfall-runoff catchment is equally distributed along river network specified. Link at a point is used when outlet of rainfall-runoff catchment connect to river network at a point.



Example of RR-HD link

(e) Transfer by Feeder channel

When there are feeder channels in rainfall-runoff catchment, quasi-natural runoff without influence of the feeder channels is firstly given as a input for river network by RR-HD link. Then, abstracted water amount by feeder channel is subtracted as point or distributed source, one of boundary condition types, with negative value. The following figure shows an example of model for transfer by feeder channels.



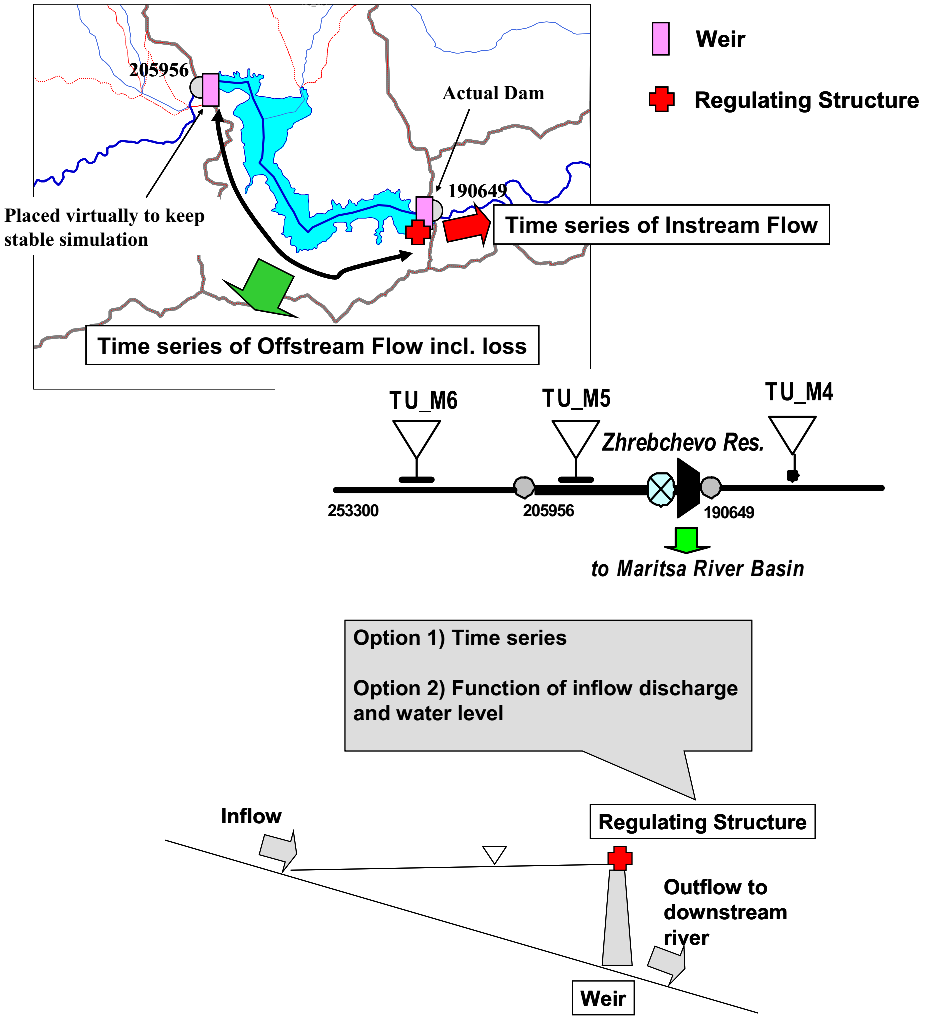
Example of Model for Transfer by Feeder Channels

(f) Reservoir

There are two options for dealing with reservoirs in MIKE11-HD.

- Option 1
  - Simulation model is disconnected at a reservoir. The reservoir is treated as only boundary condition.
- Option 2
  - Continuous simulation with reservoir. The water retention in a reservoir is also solved.

In case of option 2, reservoir is modelled as shown below. A weir is put on dam with actual dimension and a virtual weir which has very low height is put on the upstream end of the reservoir to get stable HD solution. Regulating structure is set on the dam to control released water amount from dam. Abstracted water amount from reservoir is given by distributed source, one of boundary condition types, with negative value.



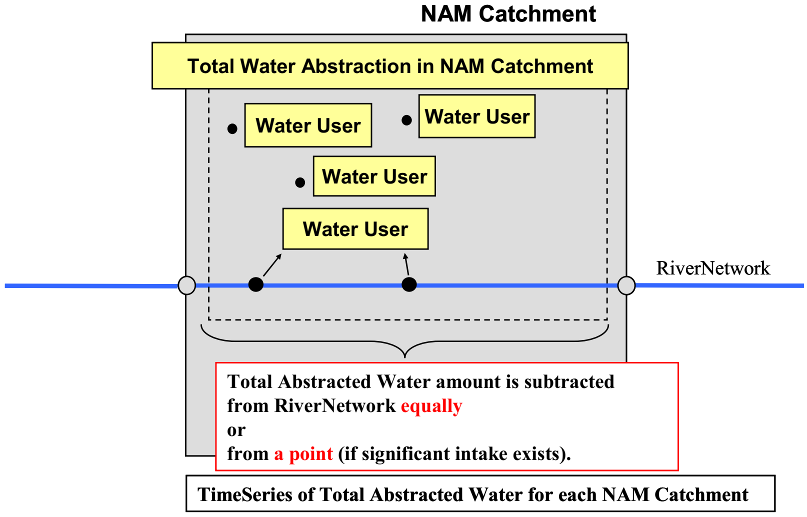
Example of Model for Reservoir

(g) Water Abstraction and Discharge

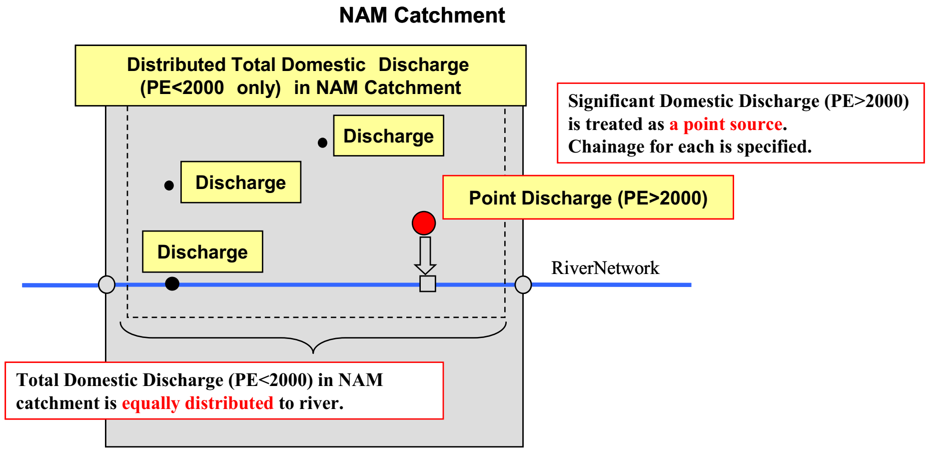
The permission data includes the transferred water from reservoir. The effect of reservoir operation including water transfer is considered as reservoir operation in MIEK11-HD. To avoid double account for the amount of abstracted water, permission data whose source is reservoir that is treated in MIKE11-HD are excluded. The permission data are aggregated in each catchment and/or NAM Catchment, and then the aggregated amount is subtracted from the adjoining river segment.

For domestic discharge, the discharge from settlements whose PE is more than 2000 are treated as point sources. The discharge from smaller settlements are aggregated in a catchment and treated as distributed source.

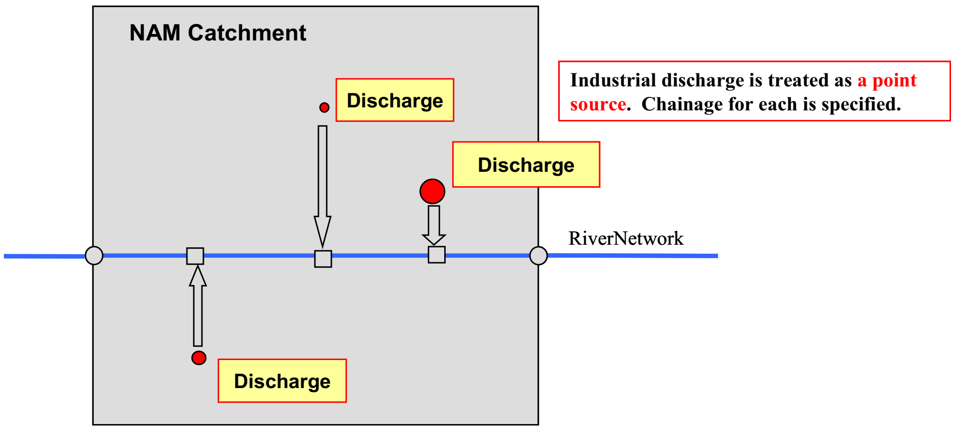
For industrial discharge, all of permissions are treated as point sources.



Water Abstraction from Rivers and Catchments



Domestic Discharge



Industrial Discharge

See **Annex 3** for Practical Exercise for MIKE11-HDModel

(3) MIKE11 Water Quantity Model Setup for EABD and WABD Rivers

The outline of the model setup for EABD and WABD rivers is shown below.

Outline of MIKE11 River Network and Rainfall-Runoff (NAM) Catchment

River Basin	Total Modeling Catchment Area (km^2)	Number of Rainfall-Runoff (NAM) Catchment	Total Length of Modeling River Network (km)	Number of Branch
Struma	8667.18	25	343.14	6
Mesta & Dospat	3397.71	14	141.80	3
Arda & Biala	5811.84	12	332.10	5
Tundzha	7890.93	20	409.46	5
Maritsa	21272.27	34	954.98	20

See **Annex 4** for the detail model setup on MIKE11 Model

See **Annex 5** for Practical Guideline for Use of MIKE11 Water Quantity Model

9. MIKE11 Water Quality Model

A MIKE 11 Water Quality Model (MIKE 11 EcoLab) is set up for all the water bodies described by the MIKE 11HD Hydraulic Model for water quantity.

The water quality and environmental models in MIKE 11 consist of a transport model for dissolved substances (the AD module) and various processes modules describing the biological and chemical processes in the water and bed sediments (the ECOLab).

The WQ-module describes the following concentration (State Variables):

- BOD (Biological Oxygen Demand ~Organic matter)
- Diluted Oxygen (DO)
- Total Ammonium (NH_4-N)
- Nitrate (NO_3-N)
- Phosphate (PO_4-P)
- Phosphor bound to particulate material (Particulate –P)
- Temperature

MIKE 11 AD and MIKE 11 EcoLab utilize and depending on the result from the MIKE 11 HD and are fully integrated. Building on a calibrated hydrodynamic model ensures that the dilution of pollutant and other substances discharged into the rivers is described in as sound way. Dynamic variation over time created by changes in water level, velocity and discharges can therefore be described correctly by the model complex.

The MIKE 11 AD module is based on the one-dimensional equation of conservation of mass of a dissolved or suspended material (e.g. salt or cohesive sediments). The behaviour of conservative materials that decay linearly can be simulated. The module runs in parallel with the hydrodynamic module.

The MIKE 11 system includes a well-proven water quality module. It is coupled to the advection-dispersion (AD) module and simulates the reaction processes of multi-compound systems. The mass balances for the parameters involved are calculated for all grid points at all time steps using a rational extrapolation method in an integrated two-step procedure with the AD module.

In addition to the AD-module the water quality/environmental modules of the MIKE 11 system consist of several types of modules describing the bio-chemical turnover processes. These modules are in the modelling system called EcoLab Templates. This is predefined water quality models to be used for different purposed and water quality problems. There exist EcoLab templates for impact of organic pollution (WQ Templates), nutrient and algae growth problems (Eutrophication Templates), heavy metal pollution (HM Templates) and others. These predefined module or templates can be modified by the user according to the specific study. The use can also defined a complete new and local specific type of water quality model. This is done through a relative user friendly menu system.

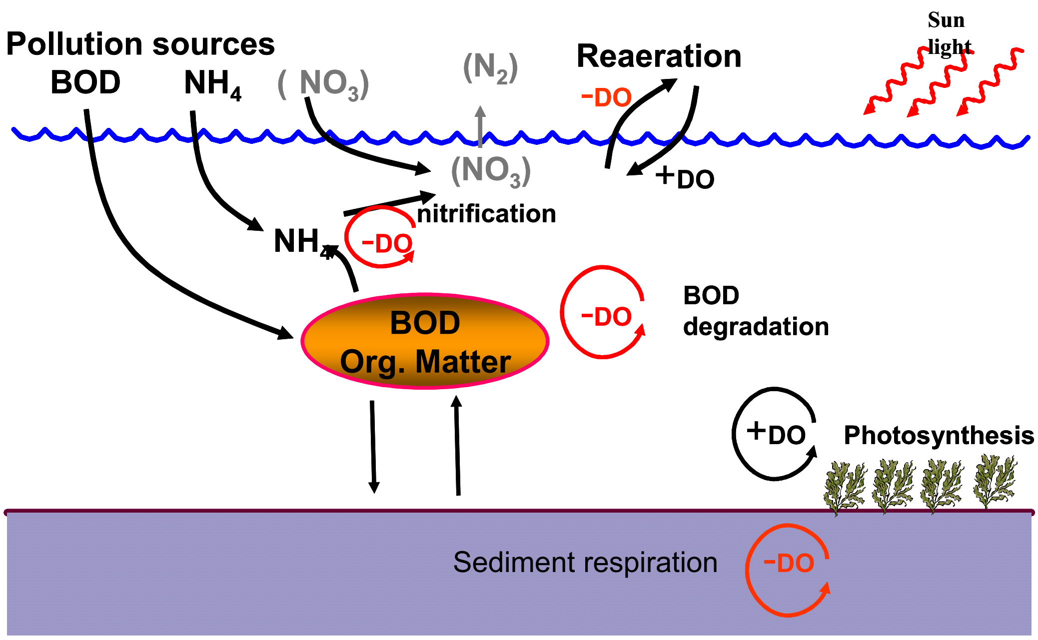
The Ecolab Template that has been selected for use under this project is a

- WQ-Template including BOD oxygen and nutrients

The selected template is basic the so-called MIKE 11 WQ level 4 Template (for details see the MIKE 11 Manual). The templates have been slightly modified to meet the exactly need for this study. The modification concerns primarily that the template are simplified only to include the below mention variable. This has been done to reduce the calculation time for the models. Further more is included a post-processing of result data to calculated Total N and Total P concentrations, which were not included in the original template. Finally the templates have for some of the rivers been modified to include local re-aeration processes (the exchange of oxygen with the atmosphere).

The selected module is designed for the study of the water quality in the rivers where the focus is on degradation of organic matter, transformation of N-components and the consequences for the oxygen concentrations. The selected model includes in addition phosphorus compounds.

The BOD, oxygen and N-transformation processes is outlined in the following figure. Form the figure it can be seen that the model include both the transformation processes for the substances flowing in to the rivers as well as processes as photosynthesis and respiration of plants animals and sediment.

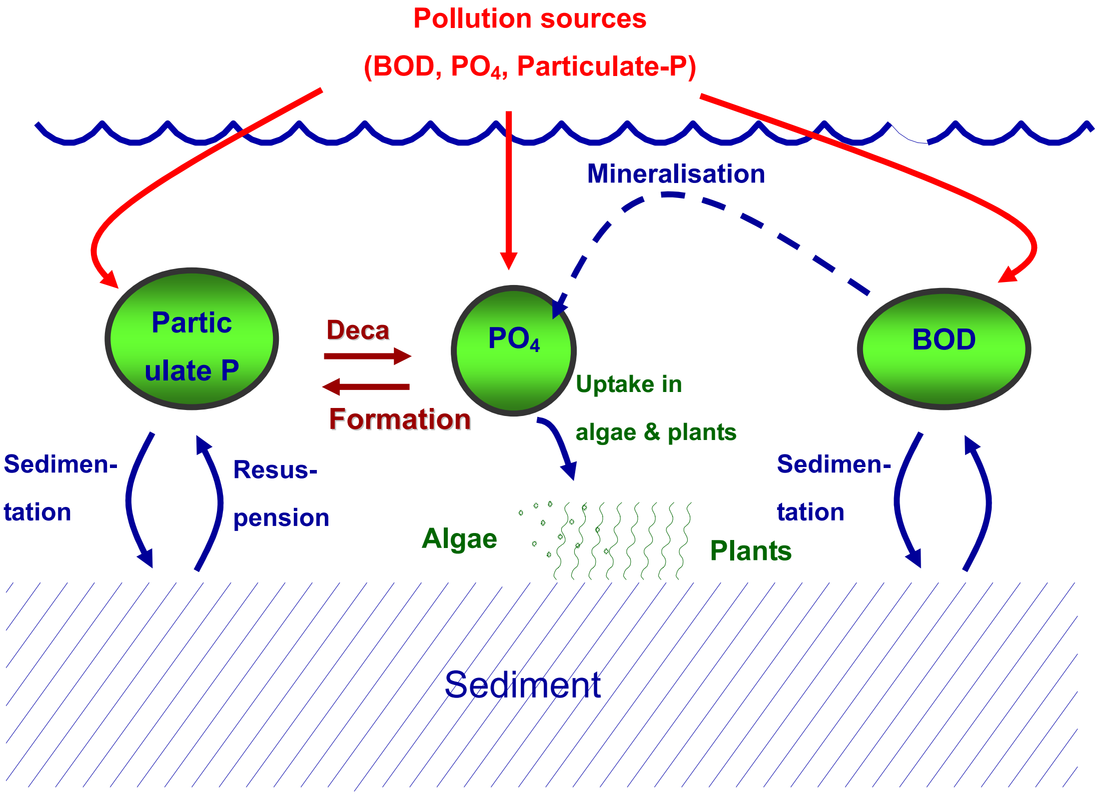


Basic Processes with Respect to BOD, N-Component and Oxygen (DO) Included in the MIKE 11 WQ Model Used

The Phosphorus processes are outlined in the following figure. The Phosphorus Model is a relative simple absorption-desorption model expanded with relevant processes related to plant, animal and sediment.

The WQ-module describes the following concentration (State Variables):

- BOD (Biological Oxygen Demand ~Organic matter)
- Diluted Oxygen (DO)
- Total Ammonium (NH_4-N)
- Nitrate (NO_3-N)
- Phosphate (PO_4-P)
- Phosphor bound to particulate material (Particulate –P)
- Temperature



Basic Processes with Respect to Phosphorus Included in the MIKE11 WQ Model Used

The most important processes included concerns:

- BOD degradation and following oxygen consumption
- Re-aeration processes, (the exchange of oxygen with the atmosphere)
- Ammonification, (ammonium production during BOD degradation)

- Nitrification, (transformation of ammonium to nitrate under oxygen consumption)
- Denitrification (transformation of nitrate into free atmospheric nitrogen- N_2)
- Phosphate adsorption/desorption to particles.
- Phosphate production during BOD degradation, (mineralization).
- Oxygen production and consumption from the ecosystem (sediment, plants, animals)
- Nutrient (N and P) uptake and exchange by the ecosystem (sediment, plants, animals)
- Sedimentation and resuspension processes.

See **Annex 6** for Practical Guideline for Use of MIKE11 Water Quality Model

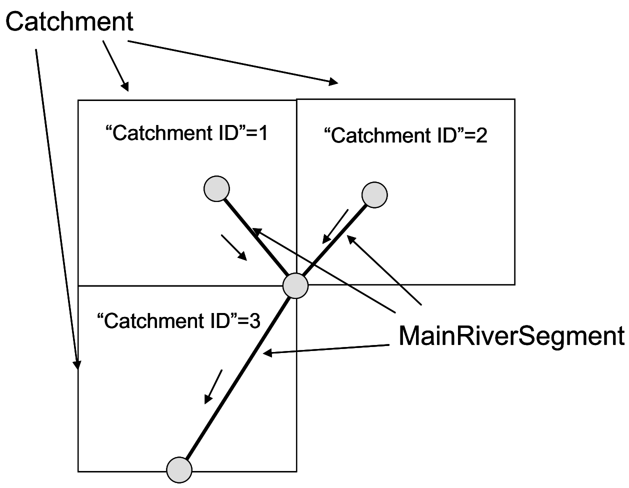
10. Simple Model

The Simple model is basically based on monthly and/or long-term averaged mass balance calculation and empirical relationship between total load and water quality. The calculation is implemented on spread sheet such as Ms-Excel. It can be used for water management activities more simply.

(1) Water Quantity Model

(a) Basic Ideas of Model

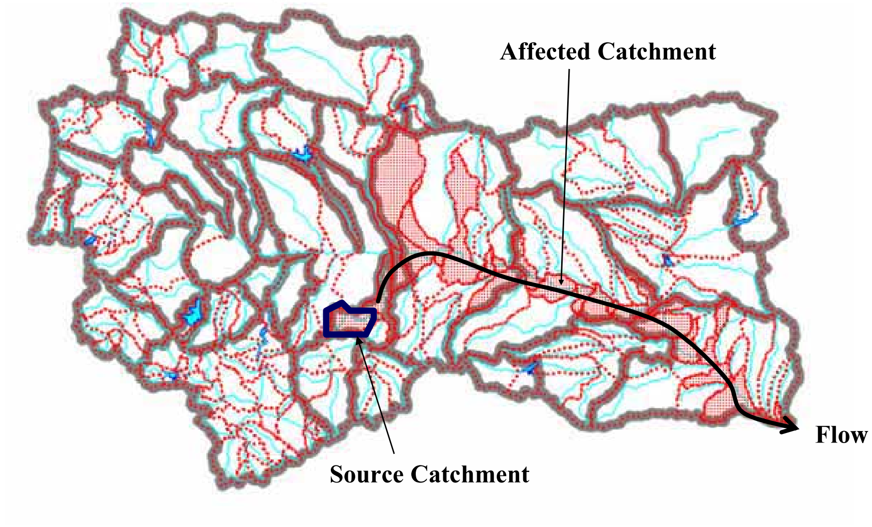
Unit of analysis in space for the simple model for water quantity is a catchment. Water movement and balance among the catchments are analyzed by the simple model. To develop the simple model for water quantity, connectivity of the catchments is examined and an additional attribute for modeling catchment layer is recorded using GIS environment as shown below.



Catchment ID	FlowTo
1	3
2	3

Catchment Connectivity

The additional attribute for the catchment connectivity allows analyzing easily affected catchments by a source catchment. An example of the affected catchments is shown below.



Example of Affected Catchments by a Source Catchment

"Matrix for contribution" can also be prepared based on the additional attribute table. An example of the "matrix for contribution" is shown below. Using this matrix, one can easily calculate the total accumulated value at an observation point from all of upstream catchments. The matrix of contribution for each river basin has been prepared and stored in the Excel sheet as a part of the simple model.

	ST_ARK	ST_ARK	ST_ARK	ST_BRA	ST_BRA	ST_BRA	ST_DRA	ST_DRA
JICA_ID	342	547	560	397	414	419	331	338
342	1	0	1	0	0	0	0	0
547	0	1	1	0	0	0	0	0
560	0	0	1	0	0	0	0	0
397	0	0	0	1	1	0	0	0
414	0	0	0	0	1	0	0	0
419	0	0	0	0	1	1	0	0
331	0	0	0	0	0	0	1	0
338	0	0	0	0	0	0	1	1
341	0	0	0	0	0	0	1	0
369	0	0	0	0	0	0	0	0
556	0	0	0	0	0	0	0	0
597	0	0	0	0	0	0	0	0
343	0	0	0	0	0	0	0	0
349	0	0	0	0	0	0	0	0
362	0	0	0	0	0	0	0	0
364	0	0	0	0	0	0	0	0

Source from "397" contributes "397" and "414".

Summation

Total accumulated amount

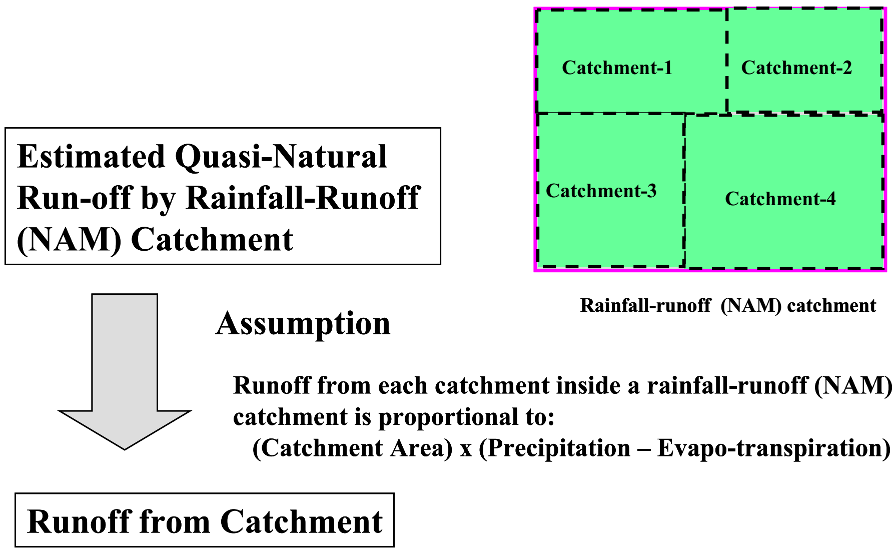
Example of Matrix for Contribution

In a catchment, the following sources are estimated.

- Catchment Area
- Run-off from Catchment
- Abstraction from Catchment
- Discharge from Catchment
- Transfer from Catchment

For example, the simple model of water quantity utilizes the results of calibrated rainfall-runoff (NAM) model. To estimate quasi-natural runoff from each catchment, the following is assumed.

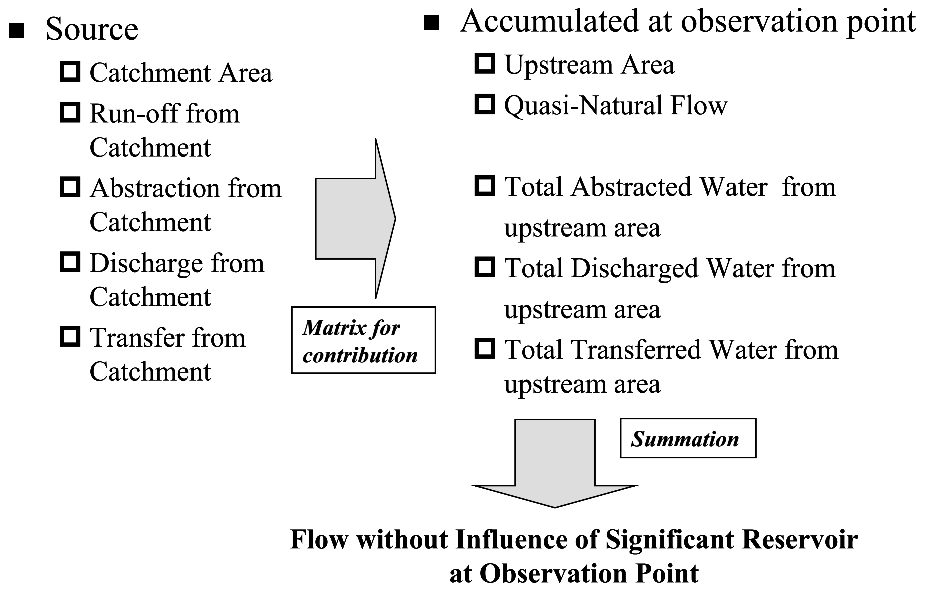
- Runoff from each catchment inside a rainfall-runoff (NAM) catchment is proportional to: (Cacthment Area) x (Precipitation – Evapo-transpiration)



Estimation of Quasi-Natural Runoff from Catchment

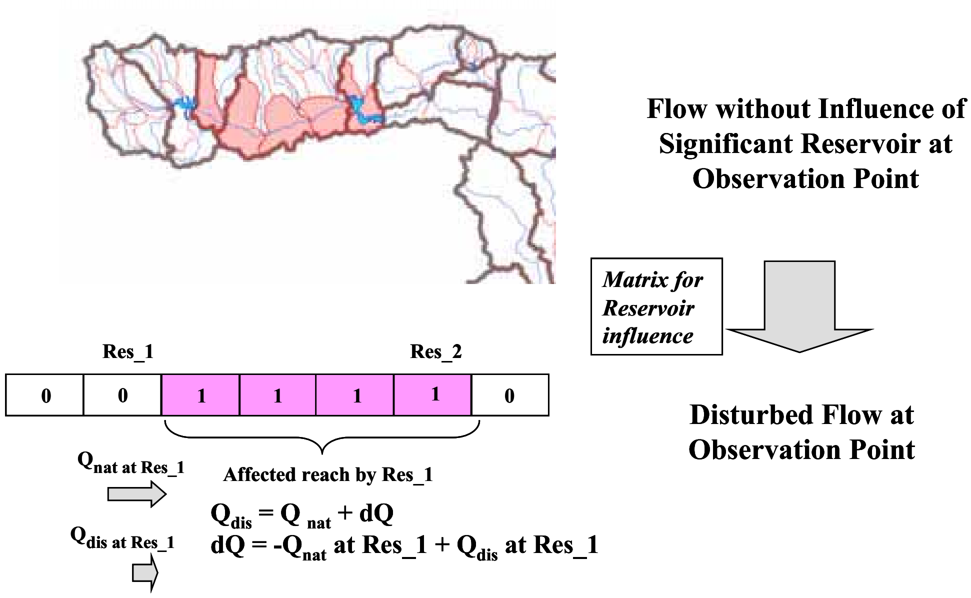
The other sources such as abstraction, discharge and transfer from a catchment are estimated by using same methodology for MIKE11 water quantity model.

When the sources from catchments are given, accumulated values without influence of significant reservoir such as quasi-natural flow and total abstracted water at an observation point are calculated using the matrix of contribution as shown below.



Calculation of Accumulated Values at Observation Points

Influence of operation of significant reservoir is taken into account by introducing "matrix for reservoir influence". At the catchments which are affected by specific reservoir, modified water quantity by the operation of the reservoir is substituted by quasi-natural water quantity to get disturbed water quantity as show in the following figure.



Modification of Water Quantity considering Operation of Significant Reservoir

All of the calculation is implemented in Excel sheet with Macros which have been prepared in the present study.

(b) Versions of Simple Model for Water Quantity

The simple model for water quantity has the following four versions.

Versions for Simple Model for Water Quantity

Version	Purpose
SimpleModel_ver_Existing	-To estimate existing condition -Developed in the study (No need to change until RR model will be revised.)
SimpleModel_ver_Potential	-To estimate probable water quantity for quasi-natural and potential flows -Developed in the study (No need to change until RR model will be revised.)
SimpleModel_ver_Permit	-To examine the effect of permitted water amount -Local + Existing water abstraction by Significant Reservoir -Local + Permitted water abstraction for Significant Reservoir
SimpleModel_ver_Demand	-To estimate water demand with several scenarios

The simple model_ver_Permit and ver_Demand have been prepared rather for Decision Support Tools for proper water management by Basin Directorate itself. Main features for each version are as follows:

- Ver_Permit
  - Entering permission data for hydropower, irrigation, drinking water supply and industrial water supply.
  - Selection of reference points for management
  - Summary table for annual average and average during summer time (Jul. to Sep.) for year 2001 -2005 for each catchment/segment and reference point
  - Longitudinal plot of the summarized results along main channel
  - Time series plot for each reference point and/or catchment/segment
  - Globally and locally changeable coefficient for permitted water amount
  - Preparation of an input file related to local water abstraction for each NAM catchment for MIKE11 water quantity model

- Ver_Demand
  - Entering parameters for estimation of water demand for IRR, DWS, IWS
  - Selection of reference points for management
  - Summary table for annual average and average during summer time (Jul. to Sep.) for each catchment/segment and reference point
  - Longitudinal plot of the summarized results along main channel
  - Time series plot for each reference point and/or catchment/segment
  - Preparation of an input file related to local water abstraction for each NAM catchment for MIKE11 water quantity model

See **Annex 7** for Manual for SimpleModel_ver_Permit

See **Annex 8** for Manual for SimpleModel_ver_Demand

(2) Water Quality Model

(a) Basic Concept of Simple Model for Water Quality (WQL Simple Model)

- The WQL Simple Model will simulate the effect of reducing pollution loads to the river water quality in terms of BOD5.
- The simulation will be done at key calculation points along the rivers.
- The calculation will be done by MS-Excel.
- The model can be utilized for quick review of the conditions of BOD loads in the river basins comparing the future required BOD loads to attain good status of water (such as Class II with BOD5 3.0 mg/l).

(b) Procedure of Developing the WQL Simple Model

The procedure for developing the WQL Simple Model is shown below.

- First to check the general co-relation between the present accumulated catchment BOD loads from the upstream of the calculation points and the river BOD loads at the calculation points. If there is junction of tributary, the calculation points are set at the upstream side of the main stream. If there is no tributary, the calculation point is just on the main stream at that point. There are clear co-relation between the accumulated catchment BOD loads and the river BOD loads.
- The existing sewer networks in EABD and WABD have significant loss of pollutants such as at least 50 % loss for the Maritsa and Tundzha River Basin, 40 % in the Arda River Basin, and 60 % in the Struma and Mesta River Basin. The current loss percentage to the domestic BOD load and industrial BOD load discharged into the sewerage system is applied for calculating their inflow BOD loads to the river. This assumption is more or less acceptable because the domestic loads without sewerage system are calculated with smaller unit loads (15 g/day/PE) compared to the generated unit load of 60 g/day/PE, and it may reach to the river through ditch or gulley.
- Ratios between the inflow BOD loads and river BOD loads are calculated at every calculation point.
- Under the assumed condition of reducing the loss from the sewer networks up to 10 % in the long time future, inflow BOD loads based on the Near Future BOD load including under constructed WWTPs or committed for constructing WWTPs in EABD and WABD are calculated. Corresponding to this, River BOD load and the BOD concentration in the near future condition with loss of sewerage with 10% are calculated.
- In order to attain the good status of water, which is better than Class II with BOD5 of 3.0 mg/l, required inflow BOD load and corresponding accumulated catchment BOD load is calculated.
- Setting the pollution reduction plan such as construction of WWTPs in the future, future accumulated catchment BOD load is calculated, and compared with the required accumulated catchment BOD load.

1. Present Catchment BOD Load by NAM Catchment

1) Domestic load and industrial load discharged into sewerage system
2) Livestock load
3) Industrial load directly discharged into rivers and water bodies

2. Present Accumulated Catchment BOD Load and Inflow BOD Load Upstream from the Calculation Points

3. Present BOD5 Concentration and Discharge in the River

1) BOD5 of normal maximum values
2) Average discharge quantity in the river during summer season

4. Present River BOD Load at the Calculation Points

5. Co-relation of the Present Accumulated Catchment and Inflow BOD Loads and River BOD Load

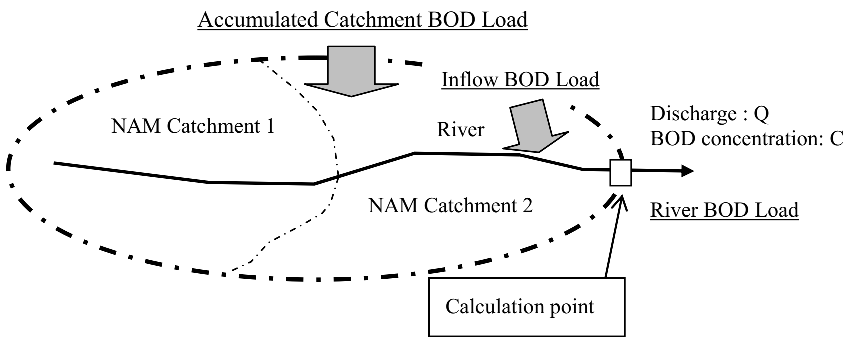
1) General co-relation from upstream to downstream for accumulated catchment BOD load and river BOD load.
2) Ratios at each calculation point between inflow BOD load including current pollutant loss from sewer networks to the river BOD load.

6. Near Future Catchment BOD Load and Inflow BOD Load with 10 % Loss from Sewer Networks

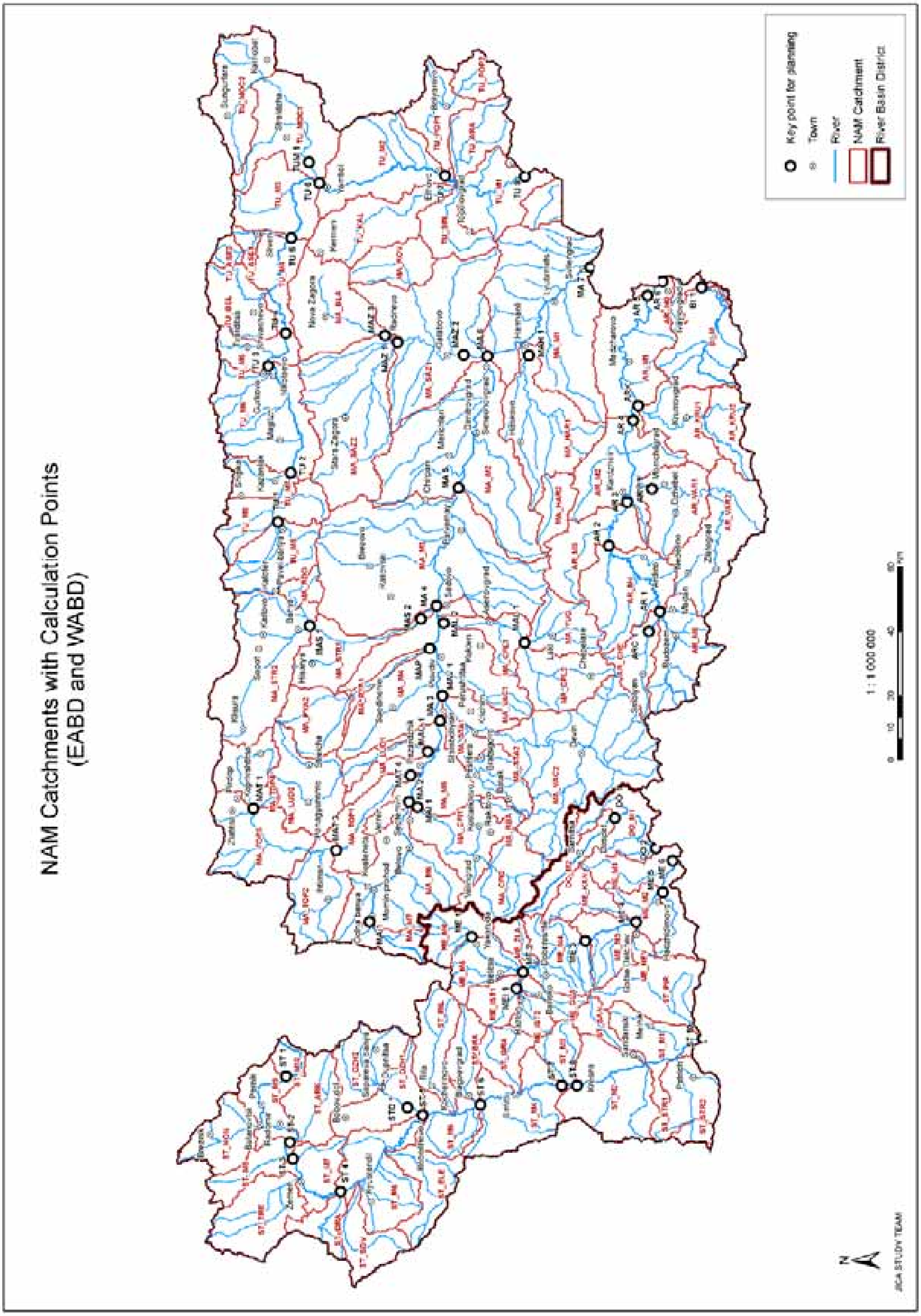
7. Near Future River BOD Load and BOD Concentration with 10% Loss from Sewer Networks

8. Required Accumulated Catchment BOD Loads

1) BOD5 in the river to be better than Class II (3.0 mg/l).
2) Required river BOD Load with BOD5 of 3.0 mg/l.
3) Required accumulated catchment BOD load with 10 % loss from sewer networks.



Procedure of Developing the Simple Model for Water Quality



Calculation Points for EABD and WABD with NAM catchments

Annex 1

List of Catchments

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Aheloy	AHELOY RESERVOIR - CHERNO MORE	78.14	678	AH01	983	0	
Aheloy	SPRING - AHELOY RESERVOIR	63.14	1248	AH03	982	981	
Aheloy	AHELOY RESERVOIR	11.11	676	AHL1	981	983	
Archar	SALASHKA-DANUBE	144.16	635	AC01	907	1128	
Archar	SPRING-ARCHAR	122.24	414	AC02	926	907	
Archar	SPRING-SALASHKA	99.35	411	AC03	923	907	
Arda	IVAYLOVGRAD RESERVOIR-BOUNDARY	83.18	1752	AR01	244	0	AR_M0
Arda	SPRING-IVAYLOVGRAD RESERVOIR	91.23	1771	AR02	283	584	AR_M1
Arda	KULIDZHIYSKA-IVAYLOVGRAD RESERVOIR	58.02	1460	AR03	222	584	AR_M1
Arda	SPRING-ARDA	76.27	1750	AR04	241	222	AR_M1
Arda	KRUMOVITSA-KULIDZHIYSKA	147.83	1462	AR05	225	222	AR_M1
Arda	DYUSHUNDERE-ARDA	17.54	1774	AR0601	286	225	AR_KRU1
Arda	SPRING-KRUMOVITSA	69.33	1779	AR0602	291	286	AR_KRU1
Arda	KESEBIR-DYUSHUNDERE	303.64	1776	AR0603	288	286	AR_KRU1
Arda	SPRING-KESIBIR	157.38	1766	AR0604	258	288	AR_KRU2
Arda	SPRING-KRUMOVITSA	125.48	1763	AR0605	255	288	AR_KRU2
Arda	STUDEN KLADENETS RESERVOIR-KRUMOVITSA	33.14	1465	AR07	233	225	AR_M1
Arda	SPRING-STUDEN KLADENETS RESERVOIR	211.66	1457	AR08	214	583	AR_M2
Arda	SPRING-STUDEN KLADENETS RESERVOIR	122.71	1753	AR10	245	583	AR_M2
Arda	DERMENCHAYI-STUDEN KLADENETS RESERVOIR	238.64	1756	AR1201	248	583	AR_VAR1
Arda	SPRING-VARBITSA	118.10	1782	AR1202	294	248	AR_VAR1
Arda	KAZALACH-DERMENCHAY	110.71	1757	AR1203	249	248	AR_VAR1
Arda	SPRING-VARBITSA	216.99	1768	AR1204	260	249	AR_VAR2
Arda	UZUNDERE-KAZALACH	201.84	1760	AR1205	252	249	AR_VAR2
Arda	SPRING-VARBITSA	136.16	1669	AR1206	305	252	AR_VAR2
Arda	SPRING-UZUNDERE	167.52	1761	AR1207	253	252	AR_VAR2
Arda	KYOSHDERE-STUDEN KLADENETS RESERVOIR	3.50	1747	AR13	237	583	AR_M2
Arda	SPRING-ARDA	41.05	1755	AR14	247	237	AR_M2
Arda	KARDZHALI RESERVOIR-KYOSHDERE	44.50	1459	AR15	219	237	AR_M2
Arda	BOROVITSA RESERVOIR-KARDZHALI RESERVOIR	181.42	1456	AR1601	196	582	AR_M3
Arda	SPRING-BOROVITSA RESERVOIR	88.52	1578	AR1603	579	580	AR_M3
Arda	BOROVITSA RESERVOIR	19.37	1579	AR16L1	580	196	AR_M3
Arda	DAVIDKOVSKA REKA-KARDZHALI RESERVOIR	18.45	1461	AR17	224	582	AR_M4
Arda	SPRING-ARDA	233.31	1458	AR18	217	224	AR_M4
Arda	ARDINSKA-DAVIDKOVSKA REKA	20.89	1746	AR19	236	224	AR_M4
Arda	SPRING-ARDA	43.64	1754	AR20	246	236	AR_M4
Arda	MALKA ARDA-ARDINSKA	22.41	1749	AR21	240	236	AR_M4
Arda	SPRING-ARDA	141.87	1463	AR22	228	240	AR_M4
Arda	UVADZHIK-MALKA ARDA	15.40	1772	AR23	284	240	AR_M4
Arda	SPRING-ARDA	58.11	1777	AR24	289	284	AR_M4
Arda	BOROVINSKA-UVADZHIK	40.83	1775	AR25	287	284	AR_M4
Arda	SPRING-ARDA	35.50	1773	AR26	285	287	AR_M4
Arda	CHERNA REKA-BOROVINSKA	15.68	1783	AR27	295	287	AR_M4
Arda	BYALA-ARDA	84.80	1751	AR2801	243	295	AR_CHE
Arda	SPRING-CHERNA REKA	67.72	1464	AR2802	231	243	AR_CHE
Arda	SPRING-BYALA	117.20	1748	AR2803	238	243	AR_CHE
Arda	MADANSKA-CHERNA REKA	0.46	1788	AR29	300	295	AR_M5
Arda	SPRING-ARDA	68.67	1665	AR30	301	300	AR_M5
Arda	ELHOVSKA REKA-MADANSKA	41.68	1786	AR31	298	300	AR_M5
Arda	CHEPINSKA REKA-ARDA	0.88	1573	AR3201	311	298	AR_M5
Arda	SPRING-CHEPINSKA REKA	84.12	1574	AR3202	312	311	AR_M5
Arda	RIBNISHKA-ELHOVSKA REKA	3.47	1575	AR3203	313	311	AR_M5
Arda	SPRING-CHEPINSKA REKA	11.21	1576	AR3204	314	313	AR_M5
Arda	SPRING-RIBNISHKA	44.81	1759	AR3205	251	313	AR_M5
Arda	TEKIRSKA REKA-ELHOVSKA REKA	63.42	1784	AR33	296	298	AR_M5
Arda	SPRING-ARDA	56.05	1569	AR34	307	296	AR_M5
Arda	ESENISHKA-TEKIRSKA REKA	24.88	1780	AR35	292	296	AR_M5
Arda	SPRING-ARDA	12.14	1778	AR36	290	292	AR_M5
Arda	CHERESHOVSKA REKA-ESENISHKA	2.63	1667	AR37	303	292	AR_M5
Arda	SPRING-ARDA	33.86	1781	AR38	293	303	AR_M5
Arda	BORIKOVSKA-CHERESHOVSKA REKA	15.57	1668	AR39	304	303	AR_M5
Arda	SPRING-BORIKOVSKA	28.45	1571	AR40	309	304	AR_M5
Arda	SPRING-ARDA	24.22	1787	AR41	299	304	AR_M5
Arda	IVAYLOVGRAD RESERVOIR	309.05	1582	ARL1	584	244	AR_M1
Arda	STUDEN KLADENETS RESERVOIR	220.23	1581	ARL2	583	233	AR_M2
Arda	KARDZHALI RESERVOIR	185.75	1580	ARL3	582	219	AR_M3
Aterinska	SPRING-BOUNDARY	59.39	1568	AT01	306	0	
Aytoska	SADIEVSKA - BURGASKO EZERO	99.97	733	AY03	913	612	
Aytoska	SPRING - AYTOSKA	60.57	700	AY04	1005	913	
Aytoska	ALANSKO DERE - SADIEVSKA	68.37	701	AY05	1006	913	
Aytoska	SPRING - AYTOSKA	133.84	695	AY06	1000	1006	
Aytoska	SPRING - ALANSKO DERE	29.05	697	AY07	1002	1006	
Azmak	SPRING - DERMENDERE	76.70	705	AZ03	1010	1159	
Batovska	IZVORSKA - CHERNO MORE	229.47	20	BA01	618	0	
Batovska	SPRING - BATOVSKA	84.54	53	BA02	651	618	
Batovska	SPRING - IZVORSKA	47.56	60	BA03	658	618	
Batovska	SPRING - BATOVSKA	81.73	16	EK01	614	0	
Boundary	SPRING-BOUNDARY	0.51	1125	DB01	1126	9999	
Boundary	KANAGIOL-SUHA REKA	163.86	623	DB11	895	9999	
Boundary	SUHA REKA-CHERNO MORE	559.68	626	PA01	898	0	
Boundary (Kanagiol)	BOUNDARY (KANAGIOL)	20.98	573	DB09	882	9999	
Boundary-Cherno more	BULGARO-RUMENSKATA GRANITSA - BATOVSKA	1638.19	419	BS01	931	8888	
Byala	YURUKLERSKA-LUDA REKA	225.40	1572	BI01	310	250	BI_M
Byala	SPRING-BYALA	51.27	1769	BI02	261	310	BI_M
Byala	ARPADERE-YURUKLERSKA	42.31	1764	BI03	256	310	BI_M
Byala	SPRING-BYALA	72.68	1785	BI04	297	256	BI_M
Byala	HAMBARDERE-ARPADERE	3.99	1765	BI05	257	256	BI_M
Byala	SPRING-BYALA	32.61	1767	BI06	259	257	BI_M
Byala	KOKARDZHADERE-HAMBARDERE	4.41	1762	BI07	254	257	BI_M
Byala	SPRING-BYALA	34.81	1666	BI08	302	254	BI_M
Byala	SPRING-KOKARDZHA DERE	131.29	1570	BI09	308	254	BI_M
Byala	BOUNDARY	1.31	1577	EB04	340	9999	
Byala	BYALA-BOUNDARY	18.94	1758	LU01	250	0	
Byala	BOUNDARY-BYﾀLA	18.30	1770	LU03	274	250	
Chukarska	SANARDERE - BURGASKO EZERO	0.14	1193	AY0201	1035	612	
Chukarska	SPRING - CHUKARSKA	49.81	799	AY0202	1021	1035	
Chukarska	SPRING - SANARDERE	127.64	703	AY0203	1008	1035	
Danube	DUNAV	361.39	1127	DA99	1128	0	
Dermendere	SPRING - AZMAK	24.08	704	AZ04	1009	1159	

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Diavolska	ZELENIKOVSKA - CHERNO MORE	37.15	863	DY01	1085	0	
Diavolska	SPRING - DYAVOLSKA	27.52	865	DY02	1087	1085	
Diavolska	YASNA POLYANA RESERVOIR - ZELENIKOVSKA	18.68	859	DY03	1081	1085	
Diavolska	SPRING - YASNA POLYANA RESERVOIR	36.79	1282	DY05	914	984	
Dospat	ZHIZHOVSKA-BOUNDARY	4.37	1348	DO01	496	0	DO_M1
Dospat	SPRING-DOSPAT	49.14	1364	DO02	525	496	DO_M1
Dospat	OSIKOVSKA-ZHIZHOVSKA	12.92	1370	DO03	532	496	DO_M1
Dospat	SPRING-DOSPAT	82.04	1377	DO04	571	532	DO_M1
Dospat	KARADZHADERE-OSIKOVSKA	48.89	1368	DO05	530	532	DO_M1
Dospat	SPRING-DOSPAT	161.17	1375	DO06	569	530	DO_M1
Dospat	SHIROKA POLYANA RESERVOIR	22.76	1379	DO06L1	592	569	
Dospat	DOSPAT RESERVOIR-KARADZHADERE	17.10	1374	DO07	562	530	DO_M1
Dospat	SPRING-DOSPAT RESERVOIR	149.73	1373	DO09	561	572	DO_M2
Dospat	DOSPAT RESERVOIR	87.33	1378	DOL1	572	562	DO_M2
Dospat	BOUNDARY	0.47	1347	WB01	495	9999	
Drashtela	SPRING - CHERNO MORE	28.34	691	DR01	996	0	
Dvoynitsa	KOMLUDERE - CHERNO MORE	7.07	271	DV01	869	0	
Dvoynitsa	SPRING - DVOYNITSA	24.60	232	DV02	830	869	
Dvoynitsa	VELIKOVSKA - KOMLUDERE	1.04	279	DV03	877	869	
Dvoynitsa	KARAGYOLGENSKA - DVOYNITSA	23.50	672	DV0401	977	877	
Dvoynitsa	DENIZLERSKA - VELIKOVSKA	0.65	683	DV040201	988	977	
Dvoynitsa	SPRING - KARAGYOLGENSKA	15.13	673	DV040202	978	988	
Dvoynitsa	SPRING - DENIZLERSKA	33.63	684	DV040203	989	988	
Dvoynitsa	SPRING - KARAGYOLGENSKA	26.86	267	DV0403	865	977	
Dvoynitsa	ERKESHKA - VELIKOVSKA	54.00	229	DV05	827	877	
Dvoynitsa	SPRING - DVOYNITSA	49.81	246	DV06	844	827	
Dvoynitsa	SPRING - ERKESHKA	107.61	220	DV07	818	827	
Dyavolska	YASNA POLYANA RESERVOIR	15.04	679	DYL1	984	1081	
Erma	SPRING-ERMA	149.55	210	ER02	808	0	
Erma	LISHKOVITSA-YABLANITSA	68.10	200	ER03	798	0	
Erma	SPRING-ERMA	92.68	237	ER04	835	798	
Erma	BOUNDARY-LISHKOVITSA	125.52	209	ER05	807	798	
Fakiyska	DAREDERE - MANDRA RESERVOIR	49.69	831	SR0401	1053	611	
Fakiyska	SPRING - FAKIYSKA	91.62	848	SR0402	1070	1053	
Fakiyska	KONDACHKA - DARADERE	2.03	846	SR0403	1068	1053	
Fakiyska	SPRING - FAKIYSKA	15.37	847	SR0404	1069	1068	
Fakiyska	MALKATA REKA - KONDACHKA	15.75	840	SR0405	1062	1068	
Fakiyska	SPRING - FAKIYSKA	33.96	853	SR0406	1075	1062	
Fakiyska	SARPASAN - MALKATA REKA	95.91	849	SR0407	1071	1062	
Fakiyska	SPRING - FAKIYSKA	31.03	868	SR0408	1090	1071	
Fakiyska	BELEVRENSKA - SARPASAN	19.93	873	SR0409	1095	1071	
Fakiyska	TIKENDZHANSKA - FAKIYSKA	13.81	878	SR041001	1100	1095	
Fakiyska	SPRING - BELEVRENSKA	32.00	879	SR041002	1101	1100	
Fakiyska	SPRING - TEKENDZHANSKA	43.47	883	SR041003	1105	1100	
Fakiyska	OLUDZHAK-BELEVRENSKA	73.68	877	SR0411	1099	1095	
Fakiyska	SPRING - FAKIYSKA	22.09	880	SR0412	1102	1099	
Fakiyska	SPRING - OLUDZHA	130.03	1177	SR0413	1094	1099	
Fandakliyska	SPRING - CHERNO MORE	77.94	196	FA01	794	0	
Gaberska	SPRING - BOUNDARY	194.12	170	GA01	768	0	
Hadzhidere	BYALA - CHERNO MORE	20.47	702	HA01	1007	0	
Hadzhidere	SPRING - HADZHIDERE	91.58	274	HA02	872	1007	
Hadzhidere	POROY RESERVOIR - BYALA	5.27	269	HA03	867	1007	
Hadzhidere	SPRING -POROY RESERVOIR	234.96	1234	HA05	912	679	
Hadzhidere	POROY RESERVOIR	10.47	81	HAL1	679	867	
Iskar	GOSTILYA-DUNAV	421.23	422	IS01	934	1128	
Iskar	SPRING-ISKAR	349.13	651	IS02	956	934	
Iskar	ZLATNA PANEGA-GOSTILYA	605.04	1187	IS03	1158	934	
Iskar	SPRING-ISKAR	354.42	61	IS04	659	1158	
Iskar	MALAK ISKAR-ZLATNA PANEGA	341.39	62	IS05	660	1158	
Iskar	BEBRESH-ISKAR	131.87	131	IS0601	729	660	
Iskar	SPRING-MALAK ISKAR	495.17	164	IS0602	762	729	
Iskar	SUHA REKA-BEBRESH	535.22	154	IS0603	752	729	
Iskar	SPRING-MALAK ISKAR	71.56	236	IS0604	834	752	
Iskar	SPRING-SUHA REKA	57.58	262	IS0605	860	752	
Iskar	GABROVNITSA-MALAK ISKAR	644.66	78	IS07	676	660	
Iskar	SPRING-ISKAR	99.21	144	IS08	742	676	
Iskar	ISKRETSKA-GABROVNITSA	259.48	124	IS09	722	676	
Iskar	PERACHKA-ISKAR	64.49	158	IS1001	756	722	
Iskar	SPRING-ISKRETSKA	127.11	130	IS1002	728	756	
Iskar	SPRING-PERACHKA	89.48	159	IS1003	757	756	
Iskar	BATULIYSKA-ISKRETSKA	91.83	173	IS11	771	722	
Iskar	ELESHNITSA-ISKAR	59.72	189	IS1201	787	771	
Iskar	SPRING-BATULIYSKA	79.06	223	IS1202	821	787	
Iskar	OGOYSKA-ELESHNITSA	9.60	212	IS1203	810	787	
Iskar	SPRING-BATULIYSKA	43.22	191	IS1204	789	810	
Iskar	SPRING-OGOYSKA	63.87	215	IS1205	813	810	
Iskar	BLATO-BATULIYSKA	90.86	211	IS13	809	771	
Iskar	KOSTINBRODSKA-ISKAR	253.55	190	IS1401	788	809	
Iskar	SPRING-BLATO	111.17	251	IS1402	849	788	
Iskar	SLIVNISHKA REKA-KOSTINBRODSKA	24.53	221	IS1403	819	788	
Iskar	SPRING-BLATO	172.29	199	IS1404	797	819	
Iskar	SPRING-SLIVNISHKA REKA	115.60	192	IS1405	790	819	
Iskar	BANKENSKA-BLATO	0.33	264	IS15	862	809	
Iskar	SPRING-ISKAR	105.54	268	IS16	866	862	
Iskar	STARI ISKAR-BANKENSKA	8.53	260	IS17	858	862	
Iskar	MATNITSA-ISKAR	395.22	230	IS1801	828	858	
Iskar	SPRING-STARI ISKAR	145.62	247	IS1802	845	828	
Iskar	MAKOTSEVSKA-MATNITSA	81.90	698	IS1803	1003	828	
Iskar	SPRING-STARI ISKAR	189.98	682	IS1804	987	1003	
Iskar	OGNYANOVO RESERVOIR-MAKOTSEVSKA	157.31	1204	IS1805	1137	1003	
Iskar	SPRING-OGNYANOVO RESERVOIR	61.00	1137	IS1807	1138	889	
Iskar	OGNYANOVO RESERVOIR	67.51	582	IS18L1	889	1137	
Iskar	VLADAYSKA-STARI ISKAR	13.57	270	IS19	868	858	
Iskar	PERLOVSKA-ISKAR	0.22	685	IS2001	990	868	
Iskar	SLATINSKA-VLADAYSKA	2.53	687	IS200201	992	990	
Iskar	SPRING-PERLOVSKA	55.76	694	IS200202	999	992	
Iskar	SPRING-SLATINSKA	45.64	693	IS200203	998	992	
Iskar	SUHODOLSKA-PERLOVSKA	3.89	686	IS2003	991	990	
Iskar	SPRING-VLADAYSKA	49.61	688	IS2004	993	991	

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Iskar	SPRING-SUHODOLSKA	91.44	690	IS2005	995	991	
Iskar	PANCHAREVO RESERVOIR-VLADAYSKA	78.06	1138	IS21	1139	868	
Iskar	SPRING-PANCHAREVO RESERVOIR	45.91	708	IS22	1013	1140	
Iskar	EGULYA-PANCHAREVO RESERVOIR	11.13	1140	IS23	1141	1140	
Iskar	SPRING-ISKAR	73.56	800	IS24	1022	1141	
Iskar	PLANSHTITSA-EGULYA	6.02	801	IS25	1023	1141	
Iskar	SPRING-ISKAR	38.53	802	IS26	1024	1023	
Iskar	PLANSHTITSA-KOKALYANE RESERVOIR	9.59	713	IS27	1015	1023	
Iskar	ISKAR RESERVOIR-KOKALYANE RESERVOIR	54.42	36	IS29	634	1016	
Iskar	SPRING-ISKAR RESERVOIR	54.96	1281	IS30	1030	1136	
Iskar	PALAKARIA-ISKAR RESERVOIR	18.50	1276	IS31	1033	1136	
Iskar	SPRING-ISKAR	411.42	804	IS32	1026	1033	
Iskar	BISTRITSA(MUSALENSKA)-PALAKARIYA	45.48	816	IS33	1038	1033	
Iskar	SPRING-ISKAR	55.24	833	IS34	1055	1038	
Iskar	CHERNI ISKAR-BISTRITSA(MUSALENSKA)	6.61	832	IS35	1054	1038	
Iskar	LEVI ISKAR-BELI ISKAR	4.70	839	IS3601	1061	1054	
Iskar	SPRING-CHERNI ISKAR	56.66	845	IS3602	1067	1061	
Iskar	LAKATITSA-LEVI ISKAR	16.53	844	IS3603	1066	1061	
Iskar	SPRING-CHERNI ISKAR	63.29	837	IS3604	1059	1066	
Iskar	LOPUSHNITSA-LAKATITSA	16.46	851	IS3605	1073	1066	
Iskar	SPRING-CHERNI ISKAR	14.01	856	IS3606	1078	1073	
Iskar	PRYAKA-LOPUSHNITSA	9.30	854	IS3607	1076	1073	
Iskar	SPRING-CHERNI ISKAR	11.89	860	IS3608	1082	1076	
Iskar	MALYOVITSA-PRYAKA	4.55	855	IS3609	1077	1076	
Iskar	MALYOVITSA-PRYAKA	9.96	861	IS3610	1083	1077	
Iskar	URDINA-MALYOVITSA	1.12	858	IS3611	1080	1077	
Iskar	SPRING-CHERNI ISKAR	15.55	862	IS3612	1084	1080	
Iskar	SPRING-URDINA	13.47	857	IS3613	1079	1080	
Iskar	SPRING-CHERNI ISKAR	90.54	841	IS38	1063	1054	
Iskar	ENITSA RESERVOIR	24.91	715	ISL1	1017	1158	
Iskar	PANCHAREVO RESERVOIR	4.52	1139	ISL2	1140	1139	
Iskar	KOKALYANE RESERVOIR	8.09	714	ISL3	1016	1015	
Iskar	ISKAR RESERVOIR	120.77	1135	ISL4	1136	634	
Izvorska	SPRING - MANDRA RESERVOIR	102.98	1258	SR02	1051	611	
Kamchia	KOMLUDERE - CHERNO MORE	106.97	142	KA01	740	0	KA_M1
Kamchia	SPRING - KAMCHIA	77.06	140	KA02	738	740	KA_M1
Kamchia	ELESHNITSA-KOMLUDERE	342.44	148	KA03	746	740	KA_M1
Kamchia	SPRING - KAMCHIA	185.55	179	KA04	777	746	KA_M2
Kamchia	LUDA KAMCHIA - ELESHNITSA	19.50	157	KA05	755	746	KA_M2
Kamchia	GEORGI TRAYKOV RESERVOIR - KAMCHIA	4.03	1236	KA0601	776	755	KA_M3
Kamchia	SPRING - GEORGI TRAYKOV RESERVOIR	70.30	218	KA0602	816	1154	KA_LUD1
Kamchia	KAZANDERE -GEORGI TRAYKOV RESERVOIR	114.67	1243	KA0603	793	1154	KA_LUD2
Kamchia	SPRING - LUDA KAMCHIA	51.54	235	KA0604	833	793	KA_LUD2
Kamchia	GOLIAMA REKA - KAZANDERE	4.97	245	KA0605	843	793	KA_LUD2
Kamchia	SPRING - LUDA KAMCHIA	112.14	254	KA0606	852	843	KA_LUD2
Kamchia	BYALA REKA - GOLIAMA REKA	24.95	238	KA0607	836	843	KA_LUD2
Kamchia	SPRING - LUDA KAMCHIA	75.99	1175	KA0608	859	836	KA_LUD2
Kamchia	POTAMISHKA - BYALA REKA	63.76	231	KA0609	829	836	KA_LUD2
Kamchia	SPRING - LUDA KAMCHIA	76.56	258	KA0610	856	829	KA_LUD2
Kamchia	KAMCHIA RESERVOIR - POTAMISHKA	104.91	217	KA0611	815	829	KA_LUD2
Kamchia	SPRING - KAMCHIA RESERVOIR	41.70	1286	KA0612	814	1153	KA_LUD3
Kamchia	SADOVSKA - KAMCHIA RESERVOIR	100.89	735	KA0613	915	1153	KA_LUD3
Kamchia	SPRING - LUDA KAMCHIA	69.41	224	KA0614	822	915	KA_LUD3
Kamchia	MEDVENSKA - SADOVSKA	45.15	272	KA0615	870	915	KA_LUD4
Kamchia	SPRING - LUDA KAMCHIA	60.53	225	KA0616	823	870	KA_LUD4
Kamchia	KOTLENSKA -MEDVENSKA	54.35	680	KA0617	985	870	KA_LUD4
Kamchia	NEYKOVSKA - LUDA KAMCHIA	20.47	278	KA061801	876	985	KA_LUD4
Kamchia	SPRING - KOTLENSKA	83.60	259	KA061802	857	876	KA_LUD4
Kamchia	SPRING - NEYKOVSKA	127.33	227	KA061803	825	876	KA_LUD4
Kamchia	SPRING - KOTLENSKA	126.12	277	KA0619	875	985	KA_LUD4
Kamchia	GEORGI TRAYKOV RESERVOIR	115.48	1153	KA06L1	1154	776	KA_LUD1
Kamchia	KAMCHIA RESERVOIR	59.05	1211	KA06L2	1153	815	KA_LUD3
Kamchia	TOKATDERE - LUDA KAMCHIA	148.85	155	KA07	753	755	KA_M3
Kamchia	SPRING - GOLIAMA KAMCHIA	81.58	181	KA08	779	753	KA_M3
Kamchia	SELSKA REKA - TOKATDERE	126.51	139	KA09	737	753	KA_M3
Kamchia	BRESTOVA - KAMCHIA	0.71	162	KA1001	760	737	KA_M3
Kamchia	SPRING - SELSKA REKA	174.53	168	KA1002	766	760	KA_M3
Kamchia	SPRING - BRESTOVA	50.37	161	KA1003	759	760	KA_M3
Kamchia	ZLATARSKA - SELSKA REKA	11.86	153	KA11	751	737	KA_M4
Kamchia	SPRING -KAMCHIA	87.90	138	KA12	736	751	KA_M4
Kamchia	STARA REKA - ZLATARSKA	12.48	143	KA13	741	751	KA_M4
Kamchia	SPRING - KAMCHIA	130.16	72	KA14	670	741	KA_M4
Kamchia	BOKLUDZHADERE - STARA REKA	18.65	137	KA15	735	741	KA_M4
Kamchia	SPRING - KAMCHIA	72.64	77	KA16	675	735	KA_M4
Kamchia	VRANA - BOKLUDZHADERE	74.22	96	KA17	694	735	KA_M4
Kamchia	KALAYDZHI - KAMCHIA	117.45	899	KA1801	1121	694	KA_VRA
Kamchia	KRALEVSKA - VRANA	1.74	98	KA180201	696	1121	KA_VRA
Kamchia	OTEKIDERE - KALAYDZHI	8.94	106	KA18020201	704	696	KA_VRA
Kamchia	SPRING - KRALEVSKA	31.37	112	KA18020202	710	704	KA_VRA
Kamchia	SPRING - OTEKIDERE	25.67	121	KA18020203	719	704	KA_VRA
Kamchia	SPRING - KRALEVSKA	93.07	85	KA180203	683	696	KA_VRA
Kamchia	CHIRADZHI - KALAYDZHI	0.08	898	KA1803	1120	1121	KA_VRA
Kamchia	SPRING - VRANA	161.57	34	KA1804	632	1120	KA_VRA
Kamchia	KERIZBUNAR - CHIRADZHI	42.39	67	KA1805	665	1120	KA_VRA
Kamchia	SAEDINENIE RESERVOIR-VRANA	26.11	32	KA180601	630	665	KA_KER1
Kamchia	SPRING - SAEDINENIE RESERVOIR	125.94	1262	KA180603	629	801	KA_KER2
Kamchia	SAEDINENIE RESERVOIR	60.78	203	KA1806L1	801	630	KA_KER2
Kamchia	SPRING - KERIZBUNAR	243.51	63	KA1807	661	665	KA_VRA
Kamchia	TICHA RESERVOIR - VRANA	118.38	1287	KA19	724	694	KA_M5
Kamchia	SPRING -TICHA RESERVOIR	83.93	1225	KA20	773	800	KA_M6
Kamchia	SPRING - TICHA RESERVOIR	125.94	1218	KA22	731	800	KA_M6
Kamchia	SPRING - TICHA RESERVOIR	96.35	1214	KA24	781	800	KA_M6
Kamchia	CHERNA - TICHA RESERVOIR	267.47	1212	KA25	744	800	KA_M7
Kamchia	SPRING - KAMCHIA	32.92	180	KA26	778	744	KA_M7
Kamchia	SPRING - CHERNA	87.83	187	KA27	785	744	KA_M7
Kamchia	TICHA RESERVOIR	281.43	1294	KAL1	800	724	KA_M6
Kanagiol	HARSOVSKA-BOUNDARY	4.30	579	DB10	888	9999	
Kanagiol	SPRING-HARSOVSKA	752.74	577	KG01	886	882	
Kanagiol	RUZHICHKA REKA-KANAGIOL	857.63	624	KG0201	896	888	

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Kanagiol	SPRING-RUZHICHKA REKA	138.90	657	KG0202	962	896	
Kanagiol	SPRING-HARSOVSKA	31.93	655	KG0203	960	896	
Karaagach	UZUNCHAIRSKA - CHERNO MORE	6.81	869	KR01	1091	0	
Karaagach	SPRING - KARAAGACH	76.20	867	KR02	1089	1091	
Karaagach	TRIONSKA - UZUNCHAIRSKA	7.45	871	KR03	1093	1091	
Karaagach	SPRING - KARAAGACH	65.37	876	KR04	1098	1093	
Karaagach	SPRING - TRIONSKA	64.99	875	KR05	1097	1093	
Kurbardere	SPRING - ATANASOVSKO EZERO	65.49	706	AZ0203	1011	1155	
Lisovo dere	SPRING - CHERNO MORE	27.37	881	LI01	1103	0	
Lom	NECHINSKA BARA-DUNAV	178.40	638	LO01	910	1128	
Lom	SPRING-LOM	233.08	420	LO02	932	910	
Lom	STAKEVSKA-NECHINSKA BARA	235.35	413	LO03	925	910	
Lom	CHUPRENSKA-LOM	3.02	644	LO0401	949	925	
Lom	SPRING-STAKEVSKA	119.48	646	LO0402	951	949	
Lom	SPRING-CHUPRENSKA	206.90	431	LO0403	943	949	
Lom	KRASTAVICHKA-STAKEVSKA	94.80	645	LO05	950	925	
Lom	SPRING-LOM	32.03	666	LO06	971	950	
Lom	LYAVA-KRASTAVICHKA	13.67	2	LO07	600	950	
Lom	SPRING-LOM	20.20	6	LO08	604	600	
Lom	SPRING-LYAVA	22.70	7	LO09	605	600	
Marinka	SPRING-CHERNO MORE	30.59	823	MR01	1045	0	
Maritsa	SPRING-BOUNDARY	19.73	1645	BD01	204	0	
Maritsa	BOUNDARY	0.08	1299	EB03	590	9999	
Maritsa	KALAMITSA-BOUNDARY	2.25	1298	MA01	589	0	MA_M1
Maritsa	SPRING-MARITSA	58.83	1638	MA02	193	589	MA_M1
Maritsa	CHENGENEDERE-KALAMITSA	10.74	1854	MA03	218	589	MA_M1
Maritsa	SPRING-MARITSA	38.58	1821	MA04	195	218	MA_M1
Maritsa	LEFCHENSKA REKA-CHENGENEDERE	1.69	1858	MA05	226	218	MA_M1
Maritsa	SPRING-MARITSA	144.11	1847	MA06	167	226	MA_M1
Maritsa	GOLYAMA REKA-LEFCHENSKA REKA	5.81	1856	MA07	221	226	MA_M1
Maritsa	SPRING-MARITSA	164.91	1844	MA08	164	221	MA_M1
Maritsa	LOZENSKA REKA-GOLYAMA REKA	130.21	1640	MA09	199	221	MA_M1
Maritsa	SPRING-MARITSA	93.22	1653	MA10	213	199	MA_M1
Maritsa	KAUSHKA REKA-LOZENSKA REKA	2.29	1652	MA11	212	199	MA_M1
Maritsa	SPRING-MARITSA	48.57	1623	MA12	177	212	MA_M1
Maritsa	BISERSKA REKA-KAUSHKA REKA	59.27	1631	MA13	186	212	MA_M1
Maritsa	SPRING-MARITSA	88.83	1841	MA14	161	186	MA_M1
Maritsa	AZMAKA-MARITSA	51.01	1637	MA1601	192	186	MA_M1
Maritsa	SPRING-BISERSKA REKA	65.15	1632	MA1602	187	192	MA_M1
Maritsa	SPRING-AZMAKA	297.45	1642	MA1603	201	192	MA_M1
Maritsa	SELSKA REKA-BISERSKA REKA	63.60	1837	MA17	156	186	MA_M1
Maritsa	SPRING-MARITSA	54.73	1846	MA18	166	156	MA_M1
Maritsa	HARMANLIYSKA REKA-SELSKA REKA	62.78	1850	MA19	170	156	MA_M1
Maritsa	UZUNDZHOVSKA REKA-MARITSA	58.28	1621	MA2001	175	170	MA_HAR1
Maritsa	SPRING-HARMANLIYSKA REKA	80.97	1848	MA2002	168	175	MA_HAR1
Maritsa	HASKOVSKA REKA-UZUNDZHOVSKA REKA	42.44	1622	MA2003	176	175	MA_HAR1
Maritsa	BALAKLIDERE-HARMANLIYSKA REKA	26.97	1851	MA200401	172	176	MA_HAR1
Maritsa	SPRING-HASKOVSKA REKA	44.77	1625	MA200402	180	172	MA_HAR1
Maritsa	SPRING-BALAKLIDERE	108.68	1852	MA200403	173	172	MA_HAR1
Maritsa	YURUKDERE-HASKOVSKA REKA	63.49	1629	MA2005	184	176	MA_HAR1
Maritsa	KODZHADERE-HARMANLIYSKA REKA	0.38	1641	MA200601	200	184	MA_HAR1
Maritsa	SPRING-YURUKDERE	116.02	1646	MA200602	205	200	MA_HAR1
Maritsa	SPRING-KODZHADERE	129.37	1643	MA200603	202	200	MA_HAR1
Maritsa	TRAKIETS RESERVOIR-YURUKDERE	90.46	1633	MA2007	188	184	MA_HAR1
Maritsa	SPRING-TRAKIETS RESERVOIR	124.68	1634	MA2009	189	581	MA_HAR2
Maritsa	TRAKIETS RESERVOIR	76.39	1296	MA20L1	581	188	MA_HAR2
Maritsa	KOLUFARDERE-HARMANLIYSKA REKA	110.81	1845	MA21	165	170	MA_M1
Maritsa	SPRING-MARITSA	34.09	1842	MA22	162	165	MA_M1
Maritsa	SAZLIYKA-KOLUFARDERE	32.58	1838	MA23	157	165	MA_M1
Maritsa	GLAVANSKA REKA-MARITSA	5.27	1836	MA2401	155	157	MA_SAZ1
Maritsa	SPRING-SAZLIYKA	80.77	1828	MA2402	143	155	MA_SAZ1
Maritsa	SOKOLITSA-GLAVANSKA REKA	158.70	1815	MA2403	103	155	MA_SAZ1
Maritsa	SPRING-SAZLIYKA	333.87	1617	MA2404	114	103	MA_SAZ1
Maritsa	ELEDZHIK-SOKOLITSA	50.04	1711	MA2405	550	103	MA_SAZ1
Maritsa	ROZOV KLADENETS RESERVOIR	14.17	1300	MA2405L1	594	550	MA_SAZ1
Maritsa	MUSTAKOVA-SAZLIYSKA	14.42	1615	MA240601	110	550	MA_SAZ1
Maritsa	SPRING-ELEDZHIK	71.23	1810	MA240602	92	110	MA_SAZ1
Maritsa	SPRING-MUSTAKOVA REKA	29.07	1817	MA240603	105	110	MA_SAZ1
Maritsa	OVCHARITSA-ELEDZHIK	0.12	1619	MA2407	116	550	MA_SAZ1
Maritsa	OVCHARITSA RESERVOIR-SAZLIYSKA	355.28	1797	MA240801	76	116	MA_SAZ1
Maritsa	SPRING-OVCHARITSA RESERVOIR	41.38	1798	MA240802	77	585	MA_ROV
Maritsa	SPRING-OVCHARITSA RESERVOIR	60.94	1799	MA240803	78	585	MA_ROV
Maritsa	OVCHARITSA RESERVOIR	189.27	1297	MA2408L1	585	76	MA_ROV
Maritsa	DURDARLYA-OVCHARITSA	87.46	1811	MA2409	95	116	MA_SAZ1
Maritsa	SPRING-SAZLIYKA	62.68	1809	MA2410	91	95	MA_SAZ1
Maritsa	BLATNITSA-DUNDARLIYA	26.11	1808	MA2411	90	95	MA_SAZ1
Maritsa	SPRING-SAZLIYKA	642.00	1673	MA2412	56	90	MA_BLA
Maritsa	KUMRUDZHA-BLATNITSA	0.20	1813	MA2413	97	90	MA_SAZ2
Maritsa	SPRING-SAZLIYSKA	342.22	1677	MA2414	60	97	MA_SAZ2
Maritsa	AZMAKA-KUMRUDZHA	88.43	1796	MA2415	75	97	MA_SAZ2
Maritsa	SPRING-SAZLIYKA	134.33	1679	MA2416	63	75	MA_SAZ2
Maritsa	AZMAKA-BEDECHKA REKA	1.97	1803	MA2417	84	75	MA_SAZ2
Maritsa	SPRING-SAZLIYKA	142.10	1793	MA2418	72	84	MA_SAZ2
Maritsa	SPRING-AZMAKA	434.00	1681	MA2419	65	84	MA_SAZ2
Maritsa	YURUCHKA-SAZLIYKA	40.33	1824	MA25	132	157	MA_M2
Maritsa	SPRING-MARITSA	46.86	1658	MA26	121	132	MA_M2
Maritsa	ARPADERE-YURUCHKA	45.46	1867	MA27	266	132	MA_M2
Maritsa	SPRING-MARITSA	69.16	1814	MA28	102	266	MA_M2
Maritsa	MARTINSKA-ARPADERE	9.02	1868	MA29	267	266	MA_M2
Maritsa	SPRING-MARITSA	343.15	1804	MA30	85	267	MA_M2
Maritsa	MERICHLERSKA REKA-MARTINSKA	67.01	1831	MA31	147	267	MA_M2
Maritsa	SPRING-MARITSA	117.85	1816	MA32	104	147	MA_M2
Maritsa	BANSKA REKA-MERICHLERSKA REKA	29.84	1832	MA33	148	147	MA_M2
Maritsa	SPRING-MARITSA	333.30	1833	MA34	152	148	MA_M2
Maritsa	STARATA REKA -BANSKA REKA	74.03	1826	MA35	137	148	MA_M2
Maritsa	SPRING-MARITSA	155.77	1802	MA36	82	137	MA_M2
Maritsa	KAYALIYSKA-STARATA REKA	61.92	1819	MA37	108	137	MA_M2
Maritsa	SPRING-MARITSA	209.81	1827	MA38	140	108	MA_M2
Maritsa	TEKIRSKA REKA-KAYALIYSKA	89.52	1664	MA39	131	108	MA_M3

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Maritsa	SPRING-MARITSA	105.67	1806	MA40	87	131	MA_M3
Maritsa	MECHKA-TEKIRSKA REKA	15.46	1661	MA41	124	131	MA_M3
Maritsa	CHINARDERE-MARITSA	82.03	1825	MA4201	133	124	MA_M3
Maritsa	SPRING-MECHKA	92.75	1834	MA4202	153	133	MA_M3
Maritsa	SPRING-CHINARDERE	101.23	1835	MA4203	154	133	MA_M3
Maritsa	OMUROVSKA REKA-MECHKA	23.72	1618	MA43	115	124	MA_M3
Maritsa	AZMAKA-MARITSA	0.03	1663	MA4401	129	115	MA_M3
Maritsa	SPRING-OMUROVSKA REKA	62.66	1812	MA4402	96	129	MA_M3
Maritsa	NOVOSELSKA REKA-AZMAKA	104.46	1805	MA4403	86	129	MA_M3
Maritsa	SPRING-OMUROVSKA REKA	118.74	1790	MA4404	69	86	MA_M3
Maritsa	SPRING-NOVOSELSKA REKA	84.54	1789	MA4405	68	86	MA_M3
Maritsa	RAHMANLIYSKA REKA-OMUROVSKA REKA	243.74	1794	MA45	73	115	MA_M3
Maritsa	SPRING-MARITSA	373.46	1682	MA46	66	73	MA_M3
Maritsa	CHERKEZITSA-RAHMANLIYSKA REKA	108.57	1801	MA47	81	73	MA_M3
Maritsa	MULDAVSKA REKA-MARITSA	79.42	1659	MA4801	122	81	MA_M3
Maritsa	SPRING-CHERKEZITSA	96.85	1829	MA4802	144	122	MA_M3
Maritsa	SPRING-MULDAVSKA REKA	89.48	1830	MA4803	146	122	MA_M3
Maritsa	STRYAMA-CHERKEZITSA	386.36	1683	MA49	67	81	MA_M3
Maritsa	KAVARDZHIKLIYSKA REKA-MARITSA	259.41	1674	MA5001	57	67	MA_STR1
Maritsa	SPRING-STRYAMA	87.44	1675	MA5002	58	57	MA_STR1
Maritsa	BYALA REKA-KAVARDZHIKLIYSKA REKA	70.59	1680	MA5003	64	57	MA_STR1
Maritsa	SVEZHENSKA REKA-STRYAMA	12.30	1678	MA500401	61	64	MA_STR2
Maritsa	DOMLYAN RESERVOIR-BYALA REKA	20.81	1671	MA50040201	52	61	MA_STR2
Maritsa	SPRING-DOMLYAN RESERVOIR	62.84	1672	MA50040203	53	553	MA_RDO
Maritsa	DOMLYAN RESERVOIR	41.68	1712	MA500402L1	553	52	MA_RDO
Maritsa	SPRING-SVEZHENSKA REKA	99.71	1585	MA500403	29	61	MA_STR2
Maritsa	STARA REKA-BYALA REKA	118.41	1587	MA5005	37	64	MA_STR2
Maritsa	SPRING-STRYAMA	98.30	1586	MA5006	30	37	MA_STR2
Maritsa	SPRING-STARA REKA	619.53	1583	MA5007	3	37	MA_STR2
Maritsa	CHEPELARSKA REKA-STRYAMA	52.20	1616	MA51	113	67	MA_M4
Maritsa	LUKOVITSA-MARITSA	96.96	1656	MA5201	119	113	MA_CPL1
Maritsa	SPRING-CHEPELARSKA REKA	90.58	1843	MA5202	163	119	MA_CPL1
Maritsa	YUGOVSKA REKA-LUKOVITSA	54.29	1849	MA5203	169	119	MA_CPL1
Maritsa	SUSHITSA-CHEPELARSKA REKA	18.18	1624	MA520401	179	169	MA_YUG
Maritsa	SPRING-YUGOVSKA REKA	62.25	1628	MA520402	183	179	MA_YUG
Maritsa	BELISHKA REKA-SUSHITSA	15.61	1635	MA520403	190	179	MA_YUG
Maritsa	SPRING-YUGOVSKA REKA	74.50	1639	MA520404	194	190	MA_YUG
Maritsa	DZHURKOVSKA-BELISHKA REKA	2.42	1823	MA520405	198	190	MA_YUG
Maritsa	SPRING-YUGOVSKA REKA	76.33	1648	MA520406	207	198	MA_YUG
Maritsa	SPRING-DZHURKOVSKA	84.60	1650	MA520407	209	198	MA_YUG
Maritsa	ORESHITSA-YUGOVSKA REKA	94.28	1853	MA5205	174	169	MA_CPL2
Maritsa	SPRING-CHEPELARSKA	70.10	1626	MA5206	181	174	MA_CPL2
Maritsa	CHUKURKYOYSKA-ORESHITSA	21.48	1636	MA5207	191	174	MA_CPL2
Maritsa	SPRING-CHEPELARSKA	85.38	1647	MA5208	206	191	MA_CPL2
Maritsa	SPRING-CHUKURKYOYSKA	170.44	1649	MA5209	208	191	MA_CPL2
Maritsa	PYASACHNIK-CHEPELARSKA REKA	414.06	1792	MA53	71	113	MA_M4
Maritsa	PYASACHNIK RESERVOIR-MARITSA	86.19	1795	MA5401	74	71	MA_PYA1
Maritsa	SPRING-PYASACHNIK RESERVOIR	102.18	1676	MA5402	59	563	MA_PYA2
Maritsa	SPRING-PYASACHNIK RESERVOIR	131.91	1670	MA5403	47	563	MA_PYA2
Maritsa	PYASACHNIC RESERVOIR	132.90	1713	MA54L1	563	74	MA_PYA2
Maritsa	PARVENETSKA REKA-PYASACHNIK	133.27	1800	MA55	80	71	MA_M4
Maritsa	DORMUSHEVSKA-MARITSA	125.88	1662	MA5601	125	80	MA_M4
Maritsa	SPRING-PARVENETSKA REKA	58.11	1840	MA5602	160	125	MA_M4
Maritsa	SPRING-DORMUSHEVSKA	52.53	1839	MA5603	158	125	MA_M4
Maritsa	POTOKA-PARVENETSKA REKA	59.28	1818	MA57	106	80	MA_M4
Maritsa	SPRING-MARITSA	412.57	1791	MA58	70	106	MA_M4
Maritsa	VACHA-POTOKA	4.24	1620	MA59	117	106	MA_M4
Maritsa	KRICHIM RESERVOIR-MARITSA	182.65	1657	MA6001	120	117	MA_VAC1
Maritsa	VACHA RESERVOIR-KRICHIM RESERVOIR	9.45	1721	MA6003	577	578	MA_VAC2
Maritsa	SPRING-VACHA RESERVOIR	48.80	1689	MA6004	457	576	MA_VAC2
Maritsa	SPRING- VACHA RESERVOIR	14.68	1627	MA6006	182	576	MA_VAC2
Maritsa	LYASKOVSKA-VACHA RESERVOIR	65.22	1630	MA6007	185	576	MA_VAC2
Maritsa	SPRING-VACHA	44.39	1822	MA6008	197	185	MA_VAC2
Maritsa	GASHNYA-LYASKOVSKA	5.30	1644	MA6009	203	185	MA_VAC2
Maritsa	SPRING-VACHA	54.01	1691	MA6010	463	203	MA_VAC2
Maritsa	DEVINSKA REKA-GASHNYA	73.30	1651	MA6011	211	203	MA_VAC2
Maritsa	KATRANDZHI-VACHA	97.55	1695	MA601201	481	211	MA_VAC2
Maritsa	SPRING-DEVINSKA REKA	40.79	1701	MA601202	494	481	MA_VAC2
Maritsa	KARLASHKA-KATRANDZHI	26.48	1700	MA601203	491	481	MA_VAC2
Maritsa	SPRING-DEVINSKA REKA	50.13	1692	MA601204	467	491	MA_VAC2
Maritsa	TOSHKOV CHARK RESERVOIR-KARLASHKA	30.77	1698	MA601205	487	491	MA_VAC2
Maritsa	SPRING-TOSHKOV CHARK RESERVOIR	27.43	1693	MA601206	468	568	MA_VAC2
Maritsa	KRIVA-TOSHKOV CHARK RESERVOIR	2.97	1697	MA601207	485	568	MA_VAC2
Maritsa	BEGLIKA RESERVOIR-KRIVA REKA(CHERNO DERE)	0.07	1687	MA60120801	452	485	MA_VAC2
Maritsa	SPRING-BEGLIKA RESERVOIR	78.45	1688	MA60120803	453	575	MA_VAC2
Maritsa	BEGLIKA RESERVOIR	9.85	1719	MA601208L1	575	452	MA_VAC2
Maritsa	GOLYAM BEGLIK RESERVOIR-DEVINSKA REKA	0.13	1696	MA601209	484	485	MA_VAC2
Maritsa	SPRING-GOLYAM BEGLIK RESERVOIR	19.50	1699	MA601210	488	567	MA_VAC2
Maritsa	SPRING-GOLYAM BEGLIK RESERVOIR	23.47	1694	MA601211	479	567	MA_VAC2
Maritsa	TOSHKOV CHARK RESERVOIR	10.03	1718	MA6012L1	568	487	MA_VAC2
Maritsa	GOLYAM BEGLIK RESERVOIR	22.60	1717	MA6012L2	567	484	MA_VAC2
Maritsa	SHIROKOLASHKA REKA-DEVINSKA REKA	2.95	1702	MA6013	508	211	MA_VAC2
Maritsa	BREZENSKO DERE-VACHA	37.65	1855	MA601401	220	508	MA_VAC2
Maritsa	SPRING-SHIROKOLASHKA REKA	16.61	1654	MA601402	215	220	MA_VAC2
Maritsa	OSLENSKA REKA-BREZENSKO DERE	106.45	1655	MA601403	216	220	MA_VAC2
Maritsa	SPRING-SHIROKOLASHKA REKA	19.33	1864	MA601404	235	216	MA_VAC2
Maritsa	MALKATA REKA-OSLENSKA REKA	0.03	1863	MA601405	234	216	MA_VAC2
Maritsa	SPRING-SHIROKOLASHKA REKA	7.58	1857	MA601406	223	234	MA_VAC2
Maritsa	SUHARSKA REKA-MALKATA REKA	14.10	1859	MA601407	227	234	MA_VAC2
Maritsa	SPRING-SHIROKOLASHKA REKA	4.04	1861	MA601408	230	227	MA_VAC2
Maritsa	SPRING-SUHARSKA REKA	15.92	1862	MA601409	232	227	MA_VAC2
Maritsa	CHAIRDERE-SHIROKOLASHKA	58.33	1703	MA6015	509	508	MA_VAC2
Maritsa	TENESDERE-VACHA	2.01	1706	MA601601	519	509	MA_VAC2
Maritsa	MALKA-CHAIRDERE	65.95	1860	MA60160201	229	519	MA_VAC2
Maritsa	SPRING-TENESDERE	8.74	1871	MA60160202	281	229	MA_VAC2
Maritsa	SPRING-MALKA	16.13	1866	MA60160203	242	229	MA_VAC2
Maritsa	TRIGRADSKA REKA-TENESDERE	18.97	1707	MA601603	523	519	MA_VAC2
Maritsa	VODNI PAD-CHAIRDERE	11.41	1709	MA60160401	528	523	MA_VAC2
Maritsa	SPRING-TRIGRADSKA REKA	14.68	1710	MA60160402	533	528	MA_VAC2

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Maritsa	SPRING-VODNI PAD	32.95	1872	MA60160403	282	528	MA_VAC2
Maritsa	SPRING-TRIGRADSKA REKA	37.35	1865	MA601605	239	523	MA_VAC2
Maritsa	CHITAKDERE-CHAIRDERE	8.02	1705	MA6017	517	509	MA_VAC2
Maritsa	SPRING-VACHA	45.08	1704	MA6018	513	517	MA_VAC2
Maritsa	SPRING-CHITAKDERE	97.49	1708	MA6019	524	517	MA_VAC2
Maritsa	KRICHIM RESERVOIR	20.28	1295	MA60L1	578	120	MA_VAC2
Maritsa	VACHA RESERVOIR	79.09	1720	MA60L2	576	577	MA_VAC2
Maritsa	STARA REKA (PESHTERSKA)-VACHA	45.15	1820	MA61	109	117	MA_M4
Maritsa	RAVNOGORSKA REKA-MARITSA	124.77	1660	MA6201	123	109	MA_STA1
Maritsa	SPRING-STARA REKA (PESHTERSKA)	73.16	1555	MA6202	424	123	MA_STA2
Maritsa	ZVEZDITSA-RAVNOGORSKA REKA	13.77	1554	MA6203	420	123	MA_STA2
Maritsa	SPRING-STARA REKA (PESHTERSKA)	42.91	1559	MA6204	431	420	MA_STA2
Maritsa	NOVOMAHALENSKA-ZVEZDITSA	9.17	1557	MA6205	428	420	MA_STA2
Maritsa	SPRING-STARA REKA (PESHTERSKA)	27.96	1560	MA6206	434	428	MA_STA2
Maritsa	SPRING-NOVOMAHALENSKA	104.17	1556	MA6207	425	428	MA_STA2
Maritsa	LUDA YANA-STARA REKA (PESHTERSKA)	92.70	1807	MA63	88	109	MA_M5
Maritsa	STRELCHANSKA LUDA YANA-MARITSA	150.49	1890	MA6401	347	88	MA_LUD1
Maritsa	SPRING-LUDA YANA	175.87	1588	MA6402	45	347	MA_LUD2
Maritsa	SPRING-STRELCHANSKA LUDA YANA	348.07	1881	MA6403	326	347	MA_LUD2
Maritsa	TOPOLNITSA-LUDA YANA	357.66	1891	MA65	348	88	MA_M5
Maritsa	TOPOLNITSA RESERVOIR-MARITSA	341.20	1888	MA6601	339	348	MA_TOP1
Maritsa	VENKOVSKA-TOPOLNITSA RESERVOIR	242.29	1884	MA660201	333	564	MA_TOP2
Maritsa	SPRING-MATIVIR	43.43	1887	MA660202	337	333	MA_TOP2
Maritsa	KRIVA REKA-VENKOVSKA	23.27	1886	MA660203	335	333	MA_TOP2
Maritsa	SPRING-MATIVIR	15.71	1883	MA660204	332	335	MA_TOP2
Maritsa	SPRING-KRIVA REKA	87.00	1882	MA660205	329	335	MA_TOP2
Maritsa	SPRING-TOPOLNITSA RESERVOIR	33.85	1885	MA6604	334	564	MA_TOP2
Maritsa	BUNOVSKA REKA-TOPOLNITSA RESERVOIR	173.13	1879	MA6605	324	564	MA_TOP3
Maritsa	SMOLSKA-TOPOLNITSA	2.60	1880	MA660601	325	324	MA_TOP3
Maritsa	SPRING-BUNOVSKA REKA	67.97	1875	MA660602	318	325	MA_TOP3
Maritsa	MIRKOVSKA REKA-SMOLSKA	25.68	1876	MA660603	319	325	MA_TOP3
Maritsa	SPRING-BUNOVSKA REKA	30.37	1873	MA660604	316	319	MA_TOP3
Maritsa	SPRING-MIRKOVSKA	56.39	1869	MA660605	277	319	MA_TOP3
Maritsa	TSARKVESHTENSKA-BUNOVSKA REKA	138.46	1874	MA6607	317	324	MA_TOP3
Maritsa	SPRING-TOPOLNITSA	113.24	1870	MA6608	279	317	MA_TOP3
Maritsa	MEDETSKA-TSARKVESHTENSKA	1.22	1877	MA6609	321	317	MA_TOP3
Maritsa	SPRING-TOPOLNITSA	30.79	1878	MA6610	322	321	MA_TOP4
Maritsa	SPRING-MEDETSKA	306.90	1584	MA6611	6	321	MA_TOP4
Maritsa	TOPOLNITSA RESERVOIR	41.68	1714	MA66L1	564	339	MA_TOP2
Maritsa	CHEPINSKA REKA-TOPOLNITSA	156.17	1533	MA67	356	348	MA_M5
Maritsa	MATNITSA-MARITSA	239.35	1545	MA6801	380	356	MA_CPI1
Maritsa	BATAK RESERVOIR-CHEPINSKA	149.98	1552	MA680201	416	380	MA_CPI1
Maritsa	SPRING-BATAK RESERVOIR	9.15	1551	MA680203	415	566	MA_RBA
Maritsa	BATAK RESERVOIR	61.18	1716	MA6802L1	566	416	MA_RBA
Maritsa	LUKOVITSA-MATNITSA	21.68	1550	MA6803	413	380	MA_CPI1
Maritsa	SPRING-CHEPINSKA REKA	30.78	1553	MA6804	418	413	MA_CPI1
Maritsa	ABLANITSA-LUKOVITSA	22.35	1558	MA6805	429	413	MA_CPI1
Maritsa	SPRING-CHEPINSKA REKA	119.56	1549	MA6806	411	429	MA_CPI2
Maritsa	SPRING-CHEPINSKA REKA	83.06	1561	MA6808	436	429	MA_CPI2
Maritsa	GRANCHARITSA-ABLANITSA	55.40	1562	MA6809	438	429	MA_CPI2
Maritsa	SPRING-CHEPINSKA REKA	49.29	1563	MA6810	441	438	MA_CPI2
Maritsa	ALANDERE-GRANCHARITSA	1.90	1684	MA6811	448	438	MA_CPI2
Maritsa	SPRING-ALANDERE	60.32	1686	MA6812	451	448	MA_CPI2
Maritsa	KRIVA-CHEPINSKA REKA	13.53	1685	MA6813	450	448	MA_CPI2
Maritsa	SPRING-SOFAN DERE	24.33	1690	MA6814	458	450	MA_CPI2
Maritsa	SPRING-KRIVA	35.70	1564	MA6815	444	450	MA_CPI2
Maritsa	YADENITSA-CHEPINSKA REKA	143.64	1539	MA69	365	356	MA_M6
Maritsa	SPRING-MARITSA	138.04	1546	MA70	381	365	MA_M6
Maritsa	KRIVA-YADENITSA	56.14	1543	MA71	376	365	MA_M6
Maritsa	CHAIRSKA-MARITSA	31.92	1544	MA7201	378	376	MA_M6
Maritsa	CHAIRA RESERVOIR-KRIVA	11.46	1548	MA720201	388	378	MA_M6
Maritsa	SPRING-CHAIRA RESERVOIR	12.64	1302	MA720203	596	595	MA_M6
Maritsa	CHAIRA RESERVOIR	5.46	1301	MA7202L1	595	388	MA_M6
Maritsa	BELMEKEN RESERVOIR-CHAIRSKA	23.44	1547	MA7203	382	378	MA_M6
Maritsa	BELMEKEN RESERVOIR	19.90	1715	MA72L1	565	382	MA_M6
Maritsa	KOSTENETSKA REKA-KRIVA	58.50	1536	MA73	360	376	MA_M6
Maritsa	SPRING-MARITSA	91.87	1542	MA74	372	360	MA_M6
Maritsa	OCHUSHNITSA-KOSTENETSKA REKA	23.36	1535	MA75	359	360	MA_M6
Maritsa	SOLUDERVENSKA-MARITSA	1.61	1538	MA7601	363	359	MA_M6
Maritsa	SPRING-OCHUSHNITSA	28.73	1531	MA7602	350	363	MA_M6
Maritsa	SPRING-SOLUDERVENSKA	115.72	1889	MA7603	344	363	MA_M6
Maritsa	GUTSALSKA-OCHUSHNITSA	96.08	1534	MA77	357	359	MA_M6
Maritsa	SPING-MARITSA	43.76	1532	MA78	353	357	MA_M7
Maritsa	IBAR-GUTSALSKA	33.44	1537	MA79	361	357	MA_M7
Maritsa	SPRING-MARITSA	46.70	1541	MA80	371	361	MA_M7
Maritsa	SPRING-IBAR	49.52	1540	MA81	370	361	MA_M7
Mesta	BISTRITSA-BOUNDARY	87.21	1349	ME01	497	0	ME_M1
Mesta	SPRING-MESTA	198.80	1376	ME02	570	497	ME_M1
Mesta	MATNITSA-BISTRITSA	22.49	1371	ME03	535	497	ME_M1
Mesta	SPRING-MESTA	176.96	1372	ME04	537	535	ME_M1
Mesta	DABNISHKA-MATNITSA	122.91	1367	ME05	529	535	ME_M2
Mesta	SPRING-MESTA	28.14	1361	ME06	518	529	ME_M2
Mesta	NEVROKOPSKA-DABNISHKA	49.53	1365	ME07	526	529	ME_M2
Mesta	SPRING-MESTA	52.12	1369	ME08	531	526	ME_NEV
Mesta	KANINA-NEVROKOPSKA	27.20	1366	ME09	527	526	ME_M3
Mesta	VISHTERITSA-MESTA	64.11	1357	ME1001	507	527	ME_KAN
Mesta	SPRING-KANINA	81.23	1338	ME1002	475	507	ME_KAN
Mesta	SPRING-VISHTERITSA	91.06	1345	ME1003	490	507	ME_KAN
Mesta	BREZNISHKA REKA-KANINA	25.13	1360	ME11	516	527	ME_M3
Mesta	KORNISHKA-MESTA	8.67	1363	ME1201	522	516	ME_M3
Mesta	SPRING-BREZNISHKA REKA	53.96	1362	ME1202	521	522	ME_M3
Mesta	SPRING-KORNISHKA	61.71	1359	ME1203	512	522	ME_M3
Mesta	KOSTENA REKA-BREZNISHKA REKA	72.30	1353	ME13	501	516	ME_M3
Mesta	SPRING-MESTA	23.75	1358	ME14	510	501	ME_M3
Mesta	KAMENITSA-KOSTENA REKA	14.90	1355	ME15	504	501	ME_M3
Mesta	SPRING-MESTA	32.71	1356	ME16	506	504	ME_M4
Mesta	LAKENSKA-KAMENITSA	17.88	1351	ME17	499	504	ME_M4
Mesta	SPRING-MESTA	25.83	1354	ME18	503	499	ME_M4
Mesta	GRADNISHKA-LAKENSKA	5.24	1303	ME19	273	499	ME_M4

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Mesta	SPRING-MESTA	37.80	1342	ME20	480	273	ME_M4
Mesta	RETIZHE-GRADNISHKA	0.07	1352	ME21	500	273	ME_M4
Mesta	SPRING-MESTA	45.06	1346	ME22	493	500	ME_M4
Mesta	MATAN-RETIZHE	23.07	1344	ME23	486	500	ME_M4
Mesta	SPRING-MESTA	56.99	1332	ME24	462	486	ME_M4
Mesta	BEZBOZHKA REKA-MATAN	24.26	1337	ME25	474	486	ME_M4
Mesta	SPRING-MESTA	23.79	1343	ME26	482	474	ME_M4
Mesta	DOBRINISHKA REKA-BEZBOZHKA REKA	5.85	1336	ME27	473	474	ME_M4
Mesta	SPRING-MESTA	57.13	1341	ME28	478	473	ME_M4
Mesta	ZLATARITSA-DOBRINISHKA REKA	14.65	1333	ME29	465	473	ME_M4
Mesta	SPRING-MESTA	112.48	1323	ME30	440	465	ME_ZLA
Mesta	RAZHDAVITSA-ZLATARITSA	1.41	1335	ME31	472	465	ME_M4
Mesta	SPRING-MESTA	21.01	1334	ME32	469	472	ME_M4
Mesta	ISTOK-RAZHDAVITSA	18.65	1328	ME33	455	472	ME_M4
Mesta	GLAZNE-MESTA	13.27	1324	ME3401	443	455	ME_IST1
Mesta	DEMYANITSA-ISTOK	44.40	1330	ME340201	460	443	ME_GLA
Mesta	SPRING-GLAZNE	37.78	1340	ME340202	477	460	ME_GLA
Mesta	SPRING-GLAZNE	37.46	1339	ME340203	476	460	ME_GLA
Mesta	BACHEVSKA-GLAZNE	90.13	1317	ME3403	422	443	ME_IST1
Mesta	SPRING-ISTOK	92.50	1320	ME3404	433	422	ME_IST1
Mesta	BELA REKA-BACHEVSKA	3.58	1327	ME3405	454	422	ME_IST1
Mesta	SPRING-ISTOK	79.23	1326	ME3406	449	454	ME_IST2
Mesta	SPRING-BELA REKA	50.36	1331	ME3407	461	454	ME_IST2
Mesta	BABESHKA-ISTOK	1.77	1329	ME35	456	455	ME_M5
Mesta	SPRING-MESTA	34.04	1321	ME36	437	456	ME_M5
Mesta	BELISHKA REKA-BABESHKA	8.29	1325	ME37	446	456	ME_M5
Mesta	VOTRACHKA-MESTA	11.94	1322	ME3801	439	446	ME_M5
Mesta	TORISHKA-BELISHKA REKA	47.65	1313	ME380201	407	439	ME_M5
Mesta	SPRING-VOTRACHKA	13.88	1311	ME380202	403	407	ME_M5
Mesta	SPRING-TORISHKA	7.11	1312	ME380203	404	407	ME_M5
Mesta	SPRING-VOTRACHKA	54.75	1309	ME3803	399	439	ME_M5
Mesta	CHESTNA-BELISHKA REKA	97.24	1314	ME39	408	446	ME_M5
Mesta	SPRING-MESTA	9.97	1315	ME40	409	408	ME_M5
Mesta	GRAMADNA-CHESTNA	2.09	1319	ME41	426	408	ME_M5
Mesta	SPRING-MESTA	6.00	1316	ME42	410	426	ME_M6
Mesta	CHERNA MESTA-GRAMADNA	12.75	1318	ME43	423	426	ME_M6
Mesta	SPRING-MESTA	84.12	1305	ME44	391	423	ME_M6
Mesta	LEEVESHTITSA-BELA MESTA	93.94	1308	ME45	398	423	ME_M6
Mesta	SPRING-CHERNA MESTA	16.49	1306	ME46	393	398	ME_M6
Mesta	SOFAN-LEEVESHTITSA	0.65	1310	ME47	400	398	ME_M6
Mesta	SPRING-SOFAN	10.33	1307	ME48	394	400	ME_M6
Mesta	SPRING-DAUTITSA	37.25	1304	ME49	389	400	ME_M6
Mesta	BOUNDARY	0.45	1350	WB02	498	9999	
Nishava	BOUNDARY	3.97	166	DB02	764	9999	
Nishava	SPRING-BOUNDARY	1.79	1126	DB03	1127	9999	
Nishava	SPRING-BOUNDARY	389.55	100	NI01	698	0	
Ogosta	SKAT-DUNAV	34.66	415	OG01	927	1128	
Ogosta	BARZINA-OGOSTA	208.92	42	OG0201	640	927	
Ogosta	BARZITSA-SKAT	60.55	648	OG020201	953	640	
Ogosta	SPRING-BARZINA	76.89	665	OG020202	970	953	
Ogosta	SPRING-BARZITSA	109.40	663	OG020203	968	953	
Ogosta	MRAMORSHTITSA-BARZINA	487.23	656	OG0203	961	640	
Ogosta	SPRING-SKAT	37.78	51	OG0204	649	961	
Ogosta	SPRING-MRAMORCHITSA	88.89	58	OG0205	656	961	
Ogosta	RIBENE-SKAT	566.18	418	OG03	930	927	
Ogosta	SPRING-OGOSTA	266.64	664	OG04	969	930	
Ogosta	BOTUNYA-RIBENE	238.04	658	OG05	963	930	
Ogosta	VARTESHNITSA-OGOSTA	117.28	5	OG0601	603	963	
Ogosta	SPRING-BOTUNYA	288.49	29	OG0602	627	603	
Ogosta	CHERNA-VARTESHNITSA	104.10	28	OG0603	626	603	
Ogosta	SPRING-BOTUNYA	90.31	71	OG0604	669	626	
Ogosta	BYALA-CHERNA	9.10	73	OG0605	671	626	
Ogosta	SPRING-BOTUNYA	39.09	83	OG0606	681	671	
Ogosta	SPRING-BYALA	84.80	82	OG0607	680	671	
Ogosta	SHUGAVITSA-BOTUNYA	109.47	667	OG07	972	963	
Ogosta	SPRING-OGOSTA	220.11	10	OG08	608	972	
Ogosta	OGOSTA RESERVOIR-SHUGAVITSA	58.83	9	OG09	607	972	
Ogosta	BERKOVSKA-OGOSTA RESERVOIR	37.68	26	OG1001	624	1134	
Ogosta	SPRING-BARZIA	60.34	64	OG1002	662	624	
Ogosta	VRESHTITSA-BERKOVSKA	1.29	65	OG1003	663	624	
Ogosta	SPRING-BARZIA	29.26	69	OG1004	667	663	
Ogosta	SRECHENSKA BARA RESERVOIR	2.23	1134	OG1004L2	1135	667	
Ogosta	DESNA BARA-VRESHTITSA	25.99	70	OG1005	668	663	
Ogosta	SPRING-BARZIA	12.35	92	OG1006	690	668	
Ogosta	DOGANOVA BARA-DESNA BARA	3.79	97	OG1007	695	668	
Ogosta	SPRING-BARZIA	4.84	102	OG1008	700	695	
Ogosta	SPRING-BARZIA	2.00	101	OG1010	699	695	
Ogosta	GOLYAMA SADINA BARA-DOGANOVA BARA	1.04	105	OG1011	703	695	
Ogosta	MALKA SADINA BARA-BARZIA	0.37	109	OG101201	707	703	
Ogosta	SPRING-GOLYAMA SADINA BARA	2.74	110	OG101202	708	707	
Ogosta	SPRING-MALKA SADINA BARA	4.22	113	OG101203	711	707	
Ogosta	RIBNA BARA-GOLYAMA SADINA BARA	6.03	108	OG1013	706	703	
Ogosta	SPRING-BARZIA	4.25	114	OG1014	712	706	
Ogosta	SPRING-RIBNA BARA	12.14	120	OG1015	718	706	
Ogosta	SPRING-OGOSTA RESERVOIR	137.15	27	OG12	625	1134	
Ogosta	DALGODELSKA-OGOSTA RESERVOIR	51.96	1160	OG13	1161	1134	
Ogosta	LOPUSHANSKA-OGOSTA	60.75	21	OG1401	619	1161	
Ogosta	SPRING-DALGODELSKA	59.69	30	OG1402	628	619	
Ogosta	SLATINSKA-LOPUSHANSKA	25.07	46	OG1403	644	619	
Ogosta	SPRING-DALGODELSKA	35.99	50	OG1404	648	644	
Ogosta	SPRING-SLATINSKA	70.61	56	OG1405	654	644	
Ogosta	PREVALSKA-DALGODELSKA	54.64	4	OG15	602	1161	
Ogosta	SPRING-OGOSTA	91.67	668	OG16	973	602	
Ogosta	MARTINOVSKA-PREVALSKA	42.86	257	OG17	855	602	
Ogosta	SPRING-OGOSTA	36.54	23	OG18	621	855	
Ogosta	SPRING-CHIPROVSKA	41.93	11	OG19	609	855	
Ogosta	OGOSTA RESERVOIR	66.11	1133	OGL1	1134	607	
Osam	MECHKA-DUNAV	165.03	427	OS01	939	1128	
Osam	SPRING-OSAM	110.59	662	OS02	967	939	

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Osam	LOMYA-MECHKA	556.45	660	OS03	965	939	
Osam	SPRING-OSAM	168.95	38	OS04	636	965	
Osam	PELISHATSKA BARA-LOMYA	52.61	39	OS05	637	965	
Osam	SPRING-OSAM	142.36	37	OS06	635	637	
Osam	DRIPLYA-PELISHATSKA BARA	828.23	57	OS07	655	637	
Osam	SPRING-OSAM	62.87	147	OS08	745	655	
Osam	SUHA-DRIPLYA	88.87	163	OS09	761	655	
Osam	SPRING-OSAM	66.89	186	OS10	784	761	
Osam	KOMANSKA-SUHA	30.16	188	OS11	786	761	
Osam	SPRING-OSAM	71.49	205	OS12	803	786	
Osam	BELI OSAM-KOMANSKA	30.93	206	OS13	804	786	
Osam	KRAYOVITSA- OSAM	89.67	219	OS1401	817	804	
Osam	SPRING-CHERNI OSAM	57.24	275	OS1402	873	817	
Osam	SPRING-KRAYOVITSA	77.10	681	OS1403	986	817	
Osam	SPRING-OSAM	238.58	226	OS16	824	804	
Otmanli	SPRING - CHERNO MORE	18.79	821	OT01	1043	0	
Panairdere	SPRING - CHERNO MORE	59.33	228	PD01	826	0	
Provadiyska	SPRING - BELOSLAVSKO EZERO	202.05	1184	PR02	639	916	
Provadiyska	GLAVNITSA - BELOSLAVSKO EZERO	190.28	107	PR03	705	916	
Provadiyska	ANNADERE - PROVADIYSKA	45.52	128	PR0401	726	705	
Provadiyska	SPRING - GLAVNITSA	74.93	117	PR0402	715	726	
Provadiyska	SPRING - ANNADERE	263.69	99	PR0403	697	726	
Provadiyska	YASTEPENSKA - GLAVNITSA	60.67	115	PR05	713	705	
Provadiyska	SPRING - PROVADIYSKA	123.42	48	PR06	646	713	
Provadiyska	ZLATINA - YASTEPENSKA	17.86	88	PR07	686	713	
Provadiyska	SPRING - PROVADIYSKA	147.63	35	PR08	633	686	
Provadiyska	KRIVA REKA - ZLATINA	217.99	45	PR09	643	686	
Provadiyska	SPRING - PROVADIYSKA	218.47	8	PR10	606	643	
Provadiyska	MADARA - KRIVA REKA	16.23	66	PR11	664	643	
Provadiyska	SPRING - PROVADIYSKA	174.77	44	PR12	642	664	
Provadiyska	SPRING - MADARA	370.78	12	PR13	610	664	
Rezovska reka	BOUNDARY - CHERNO MORE	184.37	895	RZ01	1117	0	
Ropotamo	MEHMEDZHENSKA - CHERNO MORE	56.78	838	RO01	1060	0	
Ropotamo	SPRING - ROPOTAMO	92.69	826	RO02	1048	1060	
Ropotamo	SPRING - MEHMEDZHENSKA	96.97	850	RO03	1072	1060	
Rusenski Lom	BELI LOM-DUNAV	123.53	408	RU01	920	1128	
Rusenski Lom	BANSKI LOM-RUSENSKI LOM	157.76	643	RU0201	948	920	
Rusenski Lom	KURUKANARKA-CHERNI LOM	124.67	3	RU020201	601	948	
Rusenski Lom	SPRING-BANSKI LOM	95.35	24	RU020202	622	601	
Rusenski Lom	KAYADZHIK-KURUKANARKA	19.56	22	RU020203	620	601	
Rusenski Lom	SPRING-BANSKI LOM	120.60	33	RU020204	631	620	
Rusenski Lom	DYULGERDERE-KAYADZHIK	63.40	25	RU020205	623	620	
Rusenski Lom	SPRING-BANSKI LOM	24.57	47	RU020206	645	623	
Rusenski Lom	SPRING-DYULGERDERE	156.61	52	RU020207	650	623	
Rusenski Lom	POPOVSKI LOM-BANSKI LOM	376.44	671	RU0203	976	948	
Rusenski Lom	SPRING-CHERNI LOM	88.66	40	RU0204	638	976	
Rusenski Lom	YALMA (SEYACHENSKA REKA)-POPOVSKI LOM	0.64	55	RU0205	653	976	
Rusenski Lom	SPRING-CHERNI LOM	39.14	59	RU0206	657	653	
Rusenski Lom	KAZALARSKA REKA-YALMA (SEYACHENSKA REKA)	98.51	54	RU0207	652	653	
Rusenski Lom	SPRING-CHERNI LOM	48.49	68	RU0208	666	652	
Rusenski Lom	SPRING-KAZALARSKA REKA	140.44	79	RU0209	677	652	
Rusenski Lom	MALKI LOM-RUSENSKI LOM	19.26	640	RU0401	945	920	
Rusenski Lom	SPRING-BELI LOM	334.75	649	RU0402	954	945	
Rusenski Lom	DOLAPDERE-MALKI LOM	61.36	641	RU0403	946	945	
Rusenski Lom	SPRING-BELI LOM	96.54	647	RU0404	952	946	
Rusenski Lom	NALOVSKA REKA-DOLAPDERE	223.62	429	RU0405	941	946	
Rusenski Lom	SPRING-BELI LOM	95.98	670	RU0406	975	941	
Rusenski Lom	BELI LOM RESERVOIR-NALOVSKA REKA	353.35	1151	RU0407	1152	941	
Rusenski Lom	SPRING-BELI LOM RESERVOIR	64.59	1266	RU0409	1151	615	
Rusenski Lom	BELI LOM RESERVOIR	57.52	17	RU04L1	615	1152	
Rusokastrenska	HADZHILARSKA - MANDRA RESERVOIR	114.13	1196	SR0601	1031	611	
Rusokastrenska	SPRING - RUSOKASTRENSKA	77.54	709	SR0602	1014	1031	
Rusokastrenska	PAPAZLESHKA -HADZHILARSKA	38.46	807	SR0603	1029	1031	
Rusokastrenska	SPRING - RUSOKASTRENSKA	95.15	806	SR0604	1028	1029	
Rusokastrenska	BARGANSKA - PAPAZLESHKA	29.97	805	SR0605	1027	1029	
Rusokastrenska	SPRING - RUSOKASTRENSKA	34.25	798	SR0606	1020	1027	
Rusokastrenska	SPRING - BARGANSKA	70.55	797	SR0607	1019	1027	
Senkovets	YASENKOVETS-DUNAV	503.18	569	SE01	878	1128	
Senkovets	SPRING-SENKOVETS	11.96	1	SE02	599	878	
Senkovets	SPRING-YASENKOVETS	42.14	669	SE03	974	878	
Silistar	SPRING - CHERNO MORE	21.40	896	SI01	1118	0	
Skomlya	SPRING-DUNAV	161.30	406	SK01	918	1128	
Spring Cherno more	BELOSLAVSKO EZERO	88.21	736	PRL2	916	1162	
Spring-Cherno more	BURGASKO EZERO	7.83	803	AY01	1025	0	
Spring-Cherno more	BURGASKO EZERO	101.35	1195	AYL1	612	1025	
Spring-Cherno more	DERMENDERE-CHERNO MORE	10.51	1158	AZ01	1159	0	
Spring-Cherno more	ATANASOVSKO EZERO	48.12	1154	AZ0201	1155	1159	
Spring-Cherno more	EKRENSKA-VARNENSKO EZERO	61.56	15	BS03	613	8888	
Spring-Cherno more	CHERNO MORE	1.00	1162	BS05	1163	8888	
Spring-Cherno more	VARNENSKO EZERO - KAMCHIA	97.09	127	BS07	725	8888	
Spring-Cherno more	KAMCHIA - FANDAKLIYSKA	5.71	185	BS09	783	8888	
Spring-Cherno more	FANDAKLIYSKA - PANAIRDERE	33.16	213	BS11	811	8888	
Spring-Cherno more	DVOYNITSA - VAYA	18.95	674	BS13	979	8888	
Spring-Cherno more	VAYA - DRASHTELA	22.76	699	BS15	1004	8888	
Spring-Cherno more	DRASHTELA - HADZHIDERE	60.92	692	BS17	997	8888	
Spring-Cherno more	HADZHIDERE - AHELOY	8.17	707	BS19	1012	8888	
Spring-Cherno more	AHELOY - ATANASOVSKO EZERO	28.88	810	BS21	1032	8888	
Spring-Cherno more	POMORIYSKO EZERO	29.47	1155	BS23	1156	1032	
Spring-Cherno more	MANDRA RESERVOIR-MARINKA	3.65	818	BS25	1040	8888	
Spring-Cherno more	MARINKA - OTMANLI	0.90	822	BS27	1044	8888	
Spring-Cherno more	OTMANLI - ROPOTAMO	100.11	817	BS29	1039	8888	
Spring-Cherno more	ROPOTAMO -DYAVOLSKA	16.46	842	BS31	1064	8888	
Spring-Cherno more	DYAVOLSKA - KARAAGACH	4.29	866	BS33	1088	8888	
Spring-Cherno more	KARAAGACH - LISOVO DERE	39.65	870	BS35	1092	8888	
Spring-Cherno more	LISOVO DERE - VELEKA	45.14	882	BS37	1104	8888	
Spring-Cherno more	VELEKA - SILISTAR	17.25	892	BS39	1114	8888	
Spring-Cherno more	SILISTAR - REZOVSKA	4.74	897	BS41	1119	8888	
Spring-Cherno more	VARNENSKO EZERO	225.93	1161	PRL1	1162	0	
Spring-Cherno more	MANDRA RESERVOIR-CHERNO MORE	27.55	828	SR01	1050	0	

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Spring-Cherno more	MANDRA RESERVOIR	130.41	13	SRL1	611	1050	
Spring-Danube	SENKOVETS-BOUNDARY	1141.64	1122	DA01	1123	1128	
Spring-Danube	TSARATSAR-SENKOVETS	411.37	1128	DA03	1129	1128	
Spring-Danube	RUSENSKI LOM-TSARATSAR	1558.86	575	DA05	884	1128	
Spring-Danube	YANTRA-RUSENSKI LOM	449.40	410	DA07	922	1128	
Spring-Danube	OSAM-YANTRA	780.84	424	DA09	936	1128	
Spring-Danube	VIT-OSAM	9.15	425	DA11	937	1128	
Spring-Danube	ISKAR-VIT	215.99	417	DA13	929	1128	
Spring-Danube	OGOSTA-ISKAR	178.65	416	DA15	928	1128	
Spring-Danube	TSIBRITSA-OGOSTA	208.81	407	DA17	919	1128	
Spring-Danube	LOM-TSIBRITSA	61.49	636	DA19	908	1128	
Spring-Danube	SKOMLYA-LOM	67.46	637	DA21	909	1128	
Spring-Danube	ARCHAR-SKOMLYA	8.95	639	DA23	911	1128	
Spring-Danube	VIDBOL-ARCHAR	40.17	631	DA25	903	1128	
Spring-Danube	VOYNISHKA-VIDBOL	1.48	629	DA27	901	1128	
Spring-Danube	TOPOLOVETS-VOYNISHKA	9.67	621	DA29	893	1128	
Spring-Danube	TIMOK-TOPOLOVETS	270.32	1208	DA31	891	1128	
Sredetska	KARAKYUTYUCHKA - MANDRA RESERVOIR	38.53	824	SR07	1046	611	
Sredetska	SPRING - SREDETSKA	67.74	834	SR08	1056	1046	
Sredetska	GOSPODAREVSKA - KARAKYUTYUCHKA	28.67	830	SR09	1052	1046	
Sredetska	SELSKA - SREDETSKA	106.08	819	SR1001	1041	1052	
Sredetska	SPRING - GOSPODAREVSKA	93.66	827	SR1002	1049	1041	
Sredetska	MALKATA REKA -SELSKA	87.18	815	SR1003	1037	1041	
Sredetska	SPRING - GOSPODAREVSKA	47.73	812	SR1004	1034	1037	
Sredetska	VOYNISHKA - MALKATA REKA	25.10	820	SR1005	1042	1037	
Sredetska	SPRING - GOSPODAREVSKA	36.14	825	SR1006	1047	1042	
Sredetska	SPRING - VOYNISHKA	87.32	814	SR1007	1036	1042	
Sredetska	TAGAREVSKA - GOSPODAREVSKA	96.11	836	SR11	1058	1052	
Sredetska	SPRING - SREDETSKA	77.17	852	SR12	1074	1058	
Sredetska	PARAKYOYSKA - TAGAREVSKA	49.41	843	SR13	1065	1058	
Sredetska	SPRING - SREDETSKA	76.45	864	SR14	1086	1065	
Sredetska	SPRING - PARAKYOYSKA	130.30	835	SR15	1057	1065	
Struma	PETROVSKA-STRUMA	6.00	1565	ST0201	271	0	ST_PIR
Struma	PIRINSKA BISTRITSA-BOUNDARY	58.14	1502	ST0202	544	271	ST_PIR
Struma	KALIMANSKA REKA-PETROVSKA	55.62	1383	ST0203	272	271	ST_PIR
Struma	SPRING-PIRINSKA BISTRITSA	109.51	1498	ST0204	540	272	ST_PIR
Struma	SPRING-KALIMANSKA REKA	279.02	1490	ST0205	511	272	ST_PIR
Struma	MELNISHKA REKA-BOUNDARY	58.28	1496	ST03	538	0	ST_M1
Struma	SPRING-STRUMA	96.12	1493	ST04	520	538	ST_M1
Struma	STRUMESHNITSA-MELNISHKA REKA	9.94	1500	ST05	542	538	ST_M1
Struma	PETRICHKA-STRUMA	14.99	1499	ST0601	541	542	ST_STR1
Struma	SPRING-STRUMESHNITSA	49.87	1503	ST0602	545	541	ST_STR1
Struma	GRADESHNITSA-PETRICHKA	235.09	1497	ST0603	539	541	ST_STR1
Struma	SPRING-STRUMESHNITSA	60.73	1495	ST0604	536	539	ST_STR1
Struma	BOUNDARY-GRADESHNITSA	76.60	1501	ST0605	543	539	ST_STR2
Struma	BISTRITSA SANDANSKA-STRUMESHNITSA	200.32	1382	ST07	270	542	ST_M1
Struma	SPRING-STRUMA	140.50	1488	ST08	502	270	ST_SAN
Struma	LEBNITSA-BISTRITSA SANDANSKA	0.17	1494	ST09	534	270	ST_M2
Struma	SPRING-STRUMA	196.50	1492	ST10	515	534	ST_M2
Struma	TSAPAREVSKA REKA-LEBNITSA	172.99	1491	ST11	514	534	ST_M2
Struma	SPRING-STRUMA	77.65	1489	ST12	505	514	ST_M2
Struma	VLAHINSKA REKA-TSAPAREVSKA REKA	253.20	1486	ST13	489	514	ST_M2
Struma	SPRING-STRUMA	107.59	1485	ST14	483	489	ST_M3
Struma	DYAVOLSKA REKA-VLAHINSKA REKA	9.00	1487	ST15	492	489	ST_M3
Struma	SPRING-STRUMA	77.88	1484	ST16	471	492	ST_M3
Struma	SUSHICHKA REKA-DYAVOLSKA REKA	128.19	1480	ST17	459	492	ST_M4
Struma	POTOKA-STRUMA	8.84	1481	ST1801	464	459	ST_M4
Struma	SPRING-POTOKA	54.11	1483	ST1802	470	464	ST_M4
Struma	SPRING-SUSHICHKA REKA	21.28	1482	ST1803	466	464	ST_M4
Struma	GRADEVSKA REKA-SUSHICHKA REKA	54.13	1479	ST19	447	459	ST_M4
Struma	OSENOVSKA REKA-STRUMA	68.70	1476	ST2001	435	447	ST_GRA
Struma	SPRING-GRADEVSKA REKA	88.17	1473	ST2002	427	435	ST_GRA
Struma	SPRING-OSENOVSKA REKA	78.79	1478	ST2003	445	435	ST_GRA
Struma	STARA REKA-GRADEVSKA REKA	18.38	1477	ST21	442	447	ST_M4
Struma	SPRING-STRUMA	96.14	1517	ST22	587	442	ST_M4
Struma	LOGODASHKA REKA-STARA REKA	69.66	1474	ST23	430	442	ST_M4
Struma	SPRING-STRUMA	169.51	1470	ST24	417	430	ST_M4
Struma	BISTRITSA BLAGOEVGRADSKA-LOGODASHKA REKA	1.89	1475	ST25	432	430	ST_M4
Struma	HARSOVSKA REKA-STRUMA	26.99	1469	ST2601	414	432	ST_BRA
Struma	SPRING-BISTRITSA BLAGOEVGRADSKA	31.49	1471	ST2602	419	414	ST_BRA
Struma	SPRING-HARSOVSKA REKA	172.57	1427	ST2603	397	414	ST_BRA
Struma	DRENOVSKA-BISTRITSA BLAGOEVGRADSKA	7.95	1472	ST27	421	432	ST_M5
Struma	SPRING-STRUMA	36.93	1468	ST28	412	421	ST_M5
Struma	LISIYSKA-DRENOVSKA	29.62	1466	ST29	401	421	ST_M5
Struma	SPRING-STRUMA	39.88	1426	ST30	396	401	ST_M5
Struma	RILSKA REKA-LISIYSKA	19.81	1467	ST31	402	401	ST_M5
Struma	ILIYNA-STRUMA	201.98	1418	ST3201	383	402	ST_RIL
Struma	KALIN RESERVOIR	1.63	1519	ST3201L1	593	383	ST_RIL
Struma	SPRING-RILSKA REKA	82.85	1425	ST3202	395	383	ST_RIL
Struma	SPRING-ILIYINA	98.44	1421	ST3203	386	383	ST_RIL
Struma	KOPRIVLEN-RILSKA REKA	61.32	1423	ST33	390	402	ST_M5
Struma	SPRING-STRUMA	88.36	1422	ST34	387	390	ST_M5
Struma	DZHERMAN-KOPRIVLEN	18.19	1424	ST35	392	390	ST_M5
Struma	BISTRITSA-STRUMA	314.71	1510	ST3601	556	392	ST_DZH1
Struma	SPRING-DZHERMAN	56.48	1454	ST3602	369	556	ST_DZH1
Struma	KARAGYOL RESERVOIR	0.32	1455	ST3602L1	597	369	ST_DZH1
Struma	GYUBRENA-BISTRITSA	33.67	1411	ST3603	367	556	ST_DZH2
Struma	TOPOLNITSA-DZHERMAN	1.24	1409	ST360401	364	367	ST_DZH2
Struma	SPRING-GYUBRENA	116.25	1399	ST360402	343	364	ST_DZH2
Struma	DYAKOVO RESERVOIR	16.03	1518	ST360402L1	591	343	ST_DZH2
Struma	SPRING-TOPOLNITSA	120.25	1402	ST360403	349	364	ST_DZH2
Struma	SPRING-GYUBRENA	111.30	1408	ST3605	362	367	ST_DZH2
Struma	LYAVA REKA-DZHERMAN	82.36	1414	ST37	374	392	ST_M6
Struma	SPRING-STRUMA	65.62	1511	ST38	557	374	ST_M6
Struma	ELESHNITSA-LYAVA REKA	0.64	1413	ST39	373	374	ST_M6
Struma	RECHITSA-STRUMA	45.18	1415	ST4001	375	373	ST_ELE
Struma	SPRING-ELESHNITSA	104.10	1420	ST4002	385	375	ST_ELE
Struma	TSARNA-RECHITSA	166.52	1416	ST4003	377	375	ST_ELE
Struma	SPRING-ELESHNITSA	19.76	1417	ST4004	379	377	ST_ELE

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Struma	SPRING-TSARNA	21.64	1419	ST4005	384	377	ST_ELE
Struma	GRASHTITSA-ELESHNITSA	59.93	1513	ST41	559	373	ST_M6
Struma	SPRING-STRUMA	63.35	1412	ST42	368	559	ST_M6
Struma	BERSINSKA-GRASHTITSA	26.26	1404	ST43	352	559	ST_M6
Struma	SPRING-STRUMA	17.27	1410	ST44	366	352	ST_M6
Struma	NOVOSELSKA REKA-BERSINSKA	62.72	1403	ST45	351	352	ST_M6
Struma	SPRING-STRUMA	79.13	1407	ST46	358	351	ST_M6
Struma	BANSHTITSA-NOVOSELSKA REKA	0.83	1406	ST47	355	351	ST_M6
Struma	SPRING-STRUMA	95.00	1405	ST48	354	355	ST_M6
Struma	BISTRITSA SOVOLYANSKA-BANSHTITSA	19.79	1512	ST49	558	355	ST_M6
Struma	SPRING-STRUMA	302.12	1401	ST50	346	558	ST_SOV
Struma	DRAGOVISHTITSA-BISTRITSA SOVOLYANSKA	38.12	1400	ST51	345	558	ST_M6
Struma	LOMNICHKA-STRUMA	117.99	1394	ST5201	331	345	ST_DRA
Struma	SPRING-DRAGOVISHTITSA	43.63	1397	ST5202	341	331	ST_DRA
Struma	BOUNDARY-LOMNICHKA	15.38	1396	ST5203	338	331	ST_DRA
Struma	TREKLYANSKA-DRAGOVISHTITSA	102.40	1395	ST53	336	345	ST_M7
Struma	YAVOR-STRUMA	34.80	1392	ST5401	328	336	ST_TRE
Struma	SPRING-TREKLYANSKA	187.16	1387	ST5402	280	328	ST_TRE
Struma	SPRING-YAVOR	306.55	1384	ST5403	275	328	ST_TRE
Struma	ORLACHKA-TREKLYANSKA	80.88	1509	ST55	555	336	ST_M7
Struma	SPRING-STRUMA	91.47	1508	ST56	554	555	ST_M7
Struma	PCHELINA RESERVOIR-ORLACHKA	4.57	1393	ST57	330	555	ST_M7
Struma	SPRING-PCHELINA RESERVOIR	183.50	1385	ST58	276	573	ST_M8
Struma	ARKATA-PCHELINA RESERVOIR	11.70	1391	ST59	327	573	ST_M9
Struma	ZAESHKI DOL-STRUMA	246.12	1514	ST6001	560	327	ST_ARK
Struma	SPRING-ARKATA	30.17	1398	ST6002	342	560	ST_ARK
Struma	SPRING-ZAESHKI DOL	83.81	1505	ST6003	547	560	ST_ARK
Struma	KONSKA REKA-ARKATA	94.06	1390	ST61	323	327	ST_M9
Struma	MESHTICHKA-STRUMA	23.13	1389	ST6201	320	323	ST_KON
Struma	SPRING-KONSKA REKA	92.35	1388	ST6202	315	320	ST_KON
Struma	BREZNISHKA-MESHTICHKA	147.50	1386	ST6203	278	320	ST_KON
Struma	SPRING-KONSKA REKA	42.04	1381	ST6204	269	278	ST_KON
Struma	SPRING-BREZNISHKA	66.82	1380	ST6205	268	278	ST_KON
Struma	STUDENA RESERVOIR-KONSKA REKA	211.78	1507	ST6301	549	323	ST_M9
Struma	SPRING-STUDENA RESERVOIR	54.42	1506	ST6303	548	574	ST_M10
Struma	STUDENA RESERVOIR	47.70	1516	ST63L1	574	549	ST_M10
Struma	PCHELINA RESERVOIR	58.87	1515	STL1	573	330	ST_M8
Struma	BOUNDARY	3.65	1504	WB03	546	9999	
Struma	BOUNDARY	0.03	1567	WB04	598	9999	
Suha reka	TOLBUHENSKA REKA-BOUNDARY	705.80	574	SU01	883	0	
Suha reka	SPRING-SUHA REKA	540.87	409	SU02	921	883	
Suha reka	KARAMAN-TOLBUHINSKA REKA	225.90	412	SU03	924	883	
Suha reka	SPRING-SUHA REKA	627.79	659	SU04	964	924	
Suha reka	SPRING-KARAMAN	321.27	654	SU05	959	924	
Timok	BOUNDARY	1.76	426	DB04	938	9999	
Timok	BOUNDARY	10.38	634	DB05	906	9999	
Timok	BOUNDARY	3.84	633	DB06	905	9999	
Timok	BOUNDARY	7.58	578	DB07	887	9999	
Timok	BOUNDARY	27.99	620	DB08	892	9999	
Timok	TIMOK	80.99	618	TI01	890	0	
Topolovets	DELEYNSKA-DANUBE	151.16	571	TO01	880	1128	
Topolovets	SPRING-TOPOLOVETS	90.19	1121	TO02	1122	880	
Topolovets	RABROVSKA-DELEYNSKA	58.90	1123	TO03	1124	880	
Topolovets	POLYANSKA-TOPOLOVETS	20.96	1124	TO0401	1125	1124	
Topolovets	SPRING-RABROVSKA	49.45	570	TO0402	879	1125	
Topolovets	SPRING-POLYANSKA	66.95	572	TO0403	881	1125	
Topolovets	RABROVSKA-KULA RESERVOIR	67.21	1131	TO05	1132	1124	
Topolovets	SPRING-KULA RESERVOIR	51.14	1130	TO07	1131	1130	
Topolovets	KULA RESERVOIR	7.81	1129	TOL1	1130	1132	
Tsaratsar	CHAIRLAK-DUNAV	711.65	576	TT01	885	1128	
Tsaratsar	SPRING-TSARATSAR	166.50	421	TT02	933	885	
Tsaratsar	LUDNYA-CHAIRLAK	20.28	423	TT03	935	885	
Tsaratsar	SPRING-TSARATSAR	111.79	428	TT04	940	935	
Tsaratsar	SPRING-LUDNYA	63.23	430	TT05	942	935	
Tsibritsa	TSIBAR-DUNAV	616.51	405	TS01	917	1128	
Tsibritsa	SPRING-TSIBRITSA	139.60	642	TS02	947	917	
Tsibritsa	SPRING-TSIBAR	166.27	653	TS03	958	917	
Tundzha	BOUNDARY	0.31	1449	EB01	406	9999	
Tundzha	BOUNDARY	2.47	1443	EB02	210	9999	
Tundzha	SPRING-BOUNDARY(TUNDZHA)	126.29	1453	KB01	178	0	
Tundzha	SPRING-BAUNDARY(TUNDZHA)	8.03	1442	PR01	171	0	
Tundzha	MANASTIRSKA-BOUNDARY	145.96	1441	TU01	159	0	TU_M1
Tundzha	SPRING-TUNDZHA	133.50	1439	TU02	150	159	TU_M1
Tundzha	VODENICHNA-MANASTIRSKA	37.25	1438	TU03	149	159	TU_M1
Tundzha	SPRING-TUNDZHA	79.83	1440	TU04	151	149	TU_M1
Tundzha	KURUDZHA-VODENICHNA	8.79	1437	TU05	145	149	TU_M1
Tundzha	SPRING-TUNDZHA	52.44	1433	TU06	138	145	TU_M1
Tundzha	SINAPOVSKA REKA-KURUDZHA	11.72	1432	TU07	136	145	TU_M1
Tundzha	KALNITSA-TUNDZHA	0.71	1430	TU0801	134	136	TU_SIN
Tundzha	SPRING-SINAPOVSKA	575.86	1606	TU0802	62	134	TU_KAL
Tundzha	SPRING-KALNITSA	292.58	1566	TU0803	107	134	TU_SIN
Tundzha	ARAPLIYSKA REKA-SINAPOVSKA REKA	2.72	1429	TU09	130	136	TU_M2
Tundzha	KURUDZHADERE-TUNDZHA	22.82	1530	TU1001	13	130	TU_ARA
Tundzha	SPRING-ARAPLIYSKA REKA	42.86	1428	TU1002	128	13	TU_ARA
Tundzha	BOYALASHKA - KURUDZHADERE	9.11	1529	TU1003	12	13	TU_ARA
Tundzha	SPRING-ARAPLIYSKA REKA	159.22	1448	TU1004	405	12	TU_ARA
Tundzha	SPRING-BOYALASHKA	116.14	1434	TU1005	139	12	TU_ARA
Tundzha	POPOVSKA-ARAPLIYSKA REKA	95.12	1608	TU11	83	130	TU_M2
Tundzha	KOSHUDERE-TUNDZHA	204.11	1740	TU1201	101	83	TU_POP1
Tundzha	SPRING-POPOVSKA	41.83	1741	TU1202	111	101	TU_POP1
Tundzha	BALAKLIA-KOSHUDERE	3.78	1743	TU1203	118	101	TU_POP1
Tundzha	SPRING-POPOVSKA	50.99	1742	TU1204	112	118	TU_POP1
Tundzha	MALKO SHARKOVO RESERVOIR-BALAKLIA	45.39	1745	TU1205	127	118	TU_POP1
Tundzha	SPRING-MALKO SHARKOVO RESERVOIR	60.92	1431	TU1206	135	586	TU_POP2
Tundzha	SPRING-MALKO SHARKOVO RESERVOIR	97.79	1436	TU1207	142	586	TU_POP2
Tundzha	MALKO SHARKOVO RESERVOIR	28.81	1452	TU12L1	586	127	TU_POP2
Tundzha	KOYUNBUNAR-POPOVSKA	37.40	1610	TU13	93	83	TU_M2
Tundzha	SPRING-TUNDZHA	55.48	1613	TU14	99	93	TU_M2
Tundzha	DEREORMAN-KOYUNBUNAR	24.65	1612	TU15	98	93	TU_M2

River Basin	Name	Area (km2)	OBJECTID	JICA_Code	JICA_ID	Flow_To	NAM
Tundzha	SPRING-TUNDZHA	75.07	1609	TU16	89	98	TU_M2
Tundzha	BOA-DEREORMAN	20.40	1611	TU17	94	98	TU_M2
Tundzha	SPRING-TUNDZHA	104.14	1607	TU18	79	94	TU_M2
Tundzha	MOCHURITSA - BOA	384.72	1447	TU19	265	94	TU_M2
Tundzha	MARASH-TUNDZHA	169.03	1605	TU2001	55	265	TU_MOC1
Tundzha	SPRING-MOCHURITSA	230.92	1732	TU2002	24	55	TU_MOC1
Tundzha	SIGMEN-MARASH	303.42	1593	TU2003	39	55	TU_MOC1
Tundzha	RAKLI DOL-MOCHURITSA	66.55	1731	TU200401	23	39	TU_MOC2
Tundzha	SPRING-SIGMEN	137.38	1725	TU200402	17	23	TU_MOC2
Tundzha	SPRING-RAKLI DOL	46.24	1524	TU200403	7	23	TU_MOC2
Tundzha	SPRING-SIGMEN	340.70	1520	TU2005	1	39	TU_MOC2
Tundzha	OVCHARITSA - MOCHURITSA	61.31	1446	TU21	264	265	TU_M3
Tundzha	SPRING-TUNDZHA	283.67	1734	TU22	26	264	TU_M3
Tundzha	ASENOVSKA REKA-OVCHARITSA	162.28	1445	TU23	263	264	TU_M3
Tundzha	NOVOSELSKA REKA-TUNDZHA	11.10	1594	TU2401	40	263	TU_ASE1
Tundzha	SPRING-ASENOVSKA REKA	29.15	1735	TU2402	27	40	TU_ASE1
Tundzha	ASENOVETS RESERVOIR-NOVOSELSKA REKA	47.63	1614	TU2403	100	40	TU_ASE1
Tundzha	SPRING-ASENOVETS RESERVOIR	28.44	1527	TU2404	10	126	TU_ASE2
Tundzha	SPRING-ASENOVETS RESERVOIR	25.45	1523	TU2405	5	126	TU_ASE2
Tundzha	ASENOVETS RESERVOIR	21.30	1744	TU24L1	126	100	TU_ASE2
Tundzha	BELENSKA REKA-ASENOVSKA REKA	229.48	1444	TU25	262	263	TU_M4
Tundzha	BLYAGORNITSA-TUNDZHA	11.00	1592	TU2601	38	262	TU_BEL
Tundzha	SPRING-BELENSKA REKA	131.31	1733	TU2602	25	38	TU_BEL
Tundzha	SPRING-BLYAGORNITSA	228.93	1521	TU2603	2	38	TU_BEL
Tundzha	ZHREBCHEVO RESERVOIR-BELENSKA REKA	73.43	1596	TU27	42	262	TU_M4
Tundzha	SPRING-ZHREBCHEVO RESERVOIR	112.30	1528	TU28	11	551	TU_M5
Tundzha	RADOVA REKA-ZHREBCHEVO RESERVOIR	4.08	1739	TU29	33	551	TU_M6
Tundzha	LAZOVA REKA -TUNDZHA	2.21	1595	TU3001	41	33	TU_M6
Tundzha	SPRING-RADOVA REKA	54.49	1722	TU3002	14	41	TU_M6
Tundzha	LESHTOVA REKA-LAZOVA REKA	71.70	1730	TU3003	22	41	TU_M6
Tundzha	SPRING-RADOVA REKA	54.71	1522	TU3004	4	22	TU_M6
Tundzha	SPRING-LESHTOVA REKA	56.37	1526	TU3005	9	22	TU_M6
Tundzha	POPOVSKA REKA-RADOVA REKA	112.50	1435	TU31	141	33	TU_M6
Tundzha	MAGLIZHKA REKA-POPOVSKA REKA	144.50	1597	TU33	43	141	TU_M6
Tundzha	SPRING-TUNDZHA	91.06	1728	TU34	20	43	TU_M6
Tundzha	SLIVITOVSKA REKA-TUNDZHA	4.35	1601	TU3401	49	141	TU_M6
Tundzha	SPRING-POPOVSKA REKA	45.76	1589	TU3402	34	49	TU_M6
Tundzha	SPRING-SLIVITOVSKA REKA	73.35	1724	TU3403	16	49	TU_M6
Tundzha	ENINSKA REKA-MAGLIZHKA REKA	177.48	1591	TU35	36	43	TU_M6
Tundzha	SPRING-TUNDZHA	100.20	1729	TU36	21	36	TU_M7
Tundzha	KOPRINKA RESERVOIR-ENINSKA REKA	115.23	1727	TU37	19	36	TU_M7
Tundzha	SPRING-KOPRINKA RESERVOIR	95.63	1600	TU38	48	552	TU_M8
Tundzha	SPRING-KOPRINKA RESERVOIR	61.73	1525	TU40	8	552	TU_M8
Tundzha	SPRING-KOPRINKA RESERVOIR	76.99	1723	TU42	15	552	TU_M8
Tundzha	EDROVITSA-KOPRINKA RESERVOIR	2.41	1599	TU43	46	552	TU_M9
Tundzha	SPRING-TUNDZHA	88.88	1738	TU44	32	46	TU_M9
Tundzha	SPRING-TUNDZHA	83.32	1603	TU46	51	46	TU_M9
Tundzha	TAZHA-EDROVITSA	19.51	1598	TU47	44	46	TU_M9
Tundzha	BABSKA-TUNDZHA	68.92	1590	TU4801	35	44	TU_M9
Tundzha	SPRING-TAZHA	6.53	1737	TU4802	31	35	TU_M9
Tundzha	SPRING-BABSKA	44.16	1726	TU4803	18	35	TU_M9
Tundzha	SAPLAMA-TAZHA	21.93	1602	TU49	50	44	TU_M9
Tundzha	SPRING-TUNDZHA	62.35	1604	TU50	54	50	TU_M9
Tundzha	SPRING-SAPLAMA	70.80	1736	TU51	28	50	TU_M9
Tundzha	ZHREBCHEVO RESERVOIR	133.33	1450	TUL1	551	42	TU_M5
Tundzha	KOPRINKA RESERVOIR	173.26	1451	TUL2	552	19	TU_M8
Vaya	SPRING - CHERNO MORE	41.41	689	VA01	994	0	
Veleka	ELENITSA-CHERNO MORE	67.04	887	VE01	1109	0	
Veleka	SPRING - VELEKA	24.17	885	VE02	1107	1109	
Veleka	TRASHKA - ELENITSA	67.63	890	VE03	1112	1109	
Veleka	SPRING - VELEKA	20.75	889	VE04	1111	1112	
Veleka	DYAVOLSKI DOL - TRASHKA	2.73	894	VE05	1116	1112	
Veleka	SPRING - VELEKA	20.69	888	VE06	1110	1116	
Veleka	AYDERE - DYAVOLSKI DOL	132.32	884	VE07	1106	1116	
Veleka	SPRING - VELEKA	82.55	893	VE08	1115	1106	
Veleka	MLADEZHKA - AYDERE	6.08	891	VE09	1113	1106	
Veleka	SPRING - VELEKA	235.14	874	VE10	1096	1113	
Veleka	SPRING - MLADEZHKA	132.81	886	VE11	1108	1113	
Vidbol	GRAMADSKA-DANUBE	19.76	627	VB01	899	1128	
Vidbol	SPRING-VIDBOL	97.13	630	VB02	902	899	
Vidbol	SPRING-GRAMADSKA	209.56	632	VB03	904	899	
Vidbol	RABISHA RESERVOIR	5.49	1132	VBL1	1133	904	
Visochka	KURATSKA-BOUNDARY	49.26	125	VS01	723	0	
Visochka	SREDNA-VISOCHKA	1.10	119	VS0201	717	723	
Visochka	SPRING-KURATSKA REKA	4.96	103	VS0202	701	717	
Visochka	SPRING-SREDNA REKA	14.34	104	VS0203	702	717	
Visochka	KAMARSKA-KURATSKA REKA	8.20	93	VS03	691	723	
Visochka	SPRING-VISOCHKA	4.52	95	VS04	693	691	
Visochka	SPRING-KAMARSKA	5.64	90	VS05	688	691	
Visochka (Srebarna)	SPRING - BOUNDARY	23.51	135	RE01	733	0	
Vit	TUCHENITSA-DUNAV	595.73	432	VI01	944	1128	
Vit	SPRING-VIT	211.05	19	VI02	617	944	
Vit	KAMENKA-TUCHENITSA	687.96	1189	VI03	1001	944	
Vit	KATUNETSKA-VIT	10.32	80	VI0401	678	1001	
Vit	SPRING-KAMENKA	208.01	89	VI0402	687	678	
Vit	SPRING-KATUNETSKA	273.57	91	VI0403	689	678	
Vit	KALNIK-KAMENKA	205.56	76	VI05	674	1001	
Vit	LESIDRENSKA-VIT	102.58	156	VI0601	754	674	
Vit	SPRING-KALNIK	81.49	176	VI0602	774	754	
Vit	SOPOT RESERVOIR-LESIDRENSKA	1.66	1156	VI0603	1157	754	
Vit	SPRING-SOPOT RESERVOIR	50.99	1142	VI0605	1143	1142	
Vit	SOPOT RESERVOIR	25.94	1141	VI06L1	1142	1157	
Vit	CHERNI VIT-KALNIK	166.71	145	VI07	743	674	
Vit	KOSTINA REKA-VIT	167.23	194	VI0801	792	743	
Vit	SPRING-BELI VIT	40.07	249	VI0802	847	792	
Vit	CHERNA REKA-KOSTINA REKA	52.33	244	VI0803	842	792	
Vit	SPRING-BELI VIT	45.89	234	VI0804	832	842	
Vit	SPRING-CHERNA REKA	43.44	266	VI0805	864	842	
Vit	SVINSKA-BELI VIT	68.50	208	VI1001	806	743	

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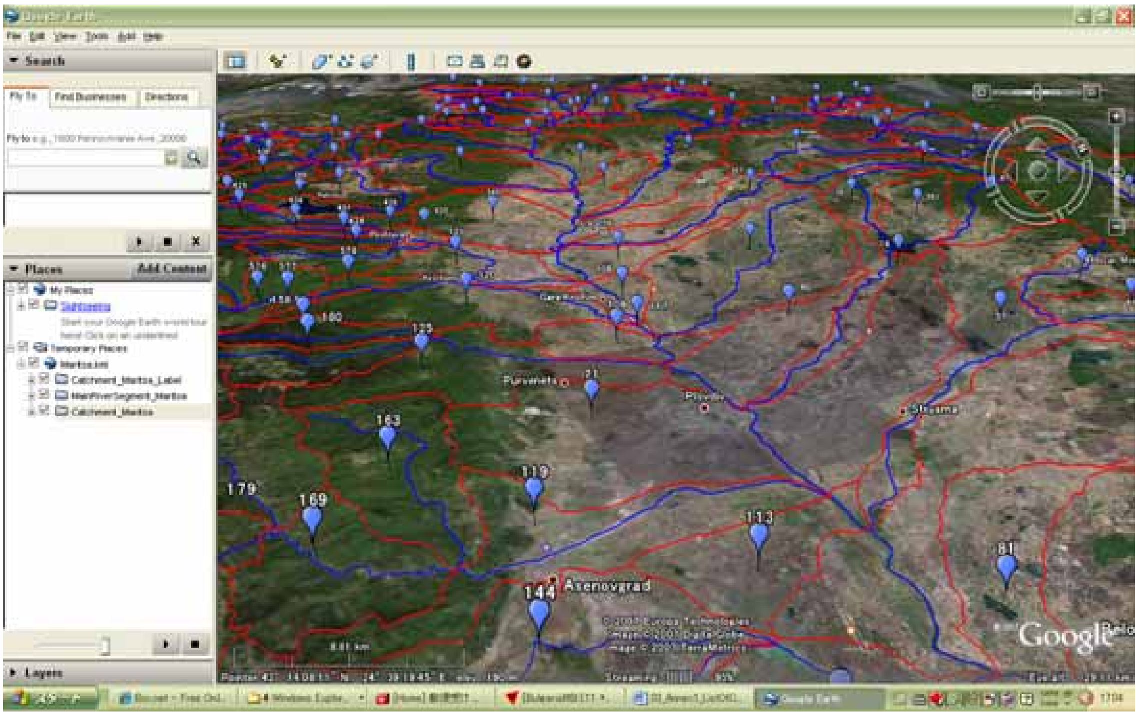
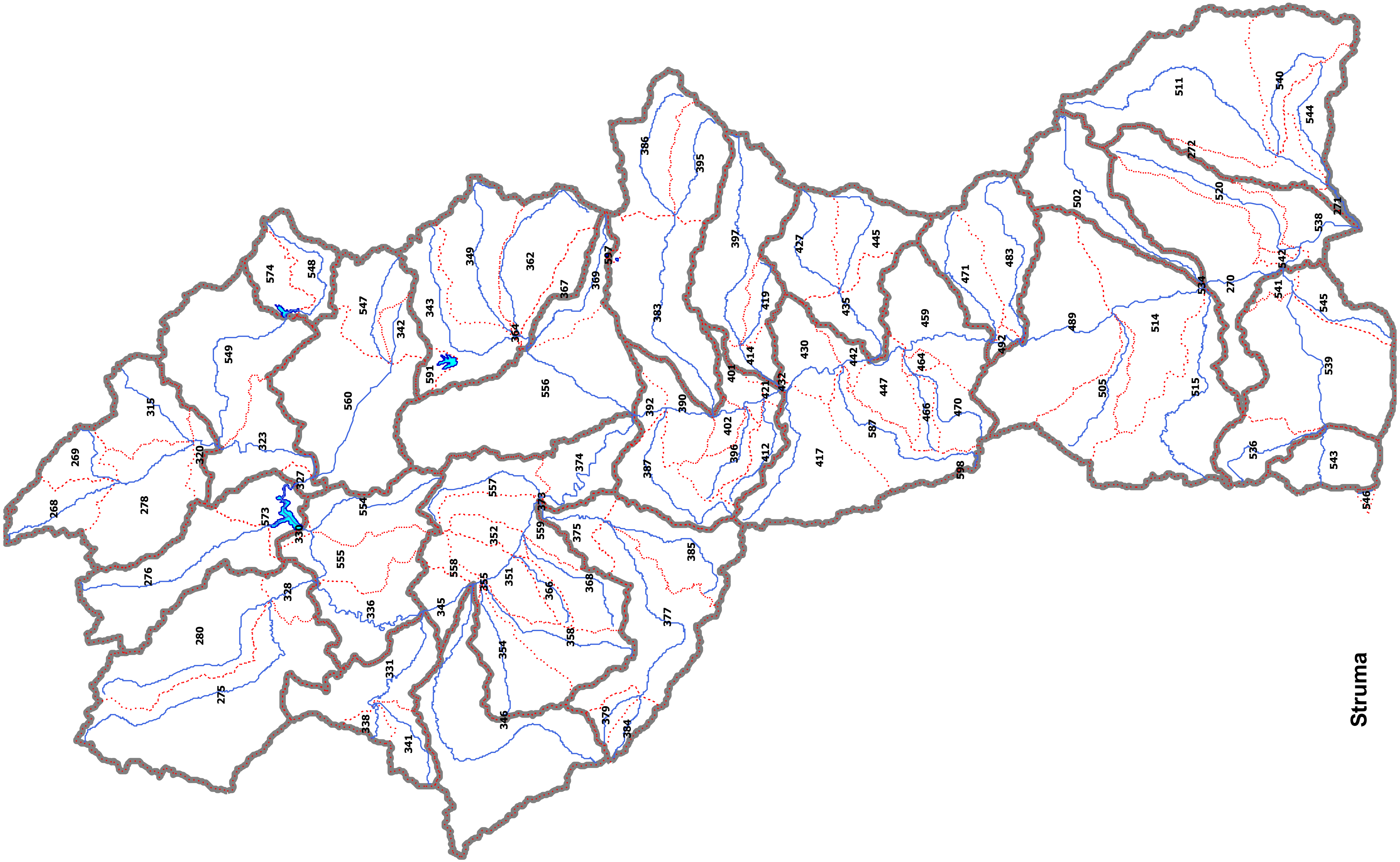
Vit	SPRING-CHERNI VIT	24.44	250	VI1002	848	806	
Vit	SPRING-SVINSKA	90.08	242	VI1003	840	806	
Vit	GORNI DABNIK RESERVOIR	74.02	716	VIL1	1018	1001	
Voynishka	KORMANITSA-DANUBE	35.86	622	VO01	894	1128	
Voynishka	SPRING-VOYNISHKA	99.49	628	VO02	900	894	
Voynishka	SPRING-KORMANITSA	137.91	625	VO03	897	894	
Yantra	STUDENA-DUNAV	5.57	1200	YA01	955	1128	YA_M1
Yantra	SPRING-YANTRA	423.02	661	YA02	966	955	YA_M1
Yantra	ELIYSKA-STUDENA	566.53	652	YA03	957	955	YA_M1
Yantra	SPRING-YANTRA	261.74	43	YA04	641	957	YA_M2
Yantra	ROSITSA-ELIYSKA	182.69	1203	YA05	647	957	YA_M2
Yantra	BOHOT-YANTRA	75.44	84	YA0601	682	647	YA_ROS1
Yantra	SPRING-ROSITSA	97.70	116	YA0602	714	682	YA_ROS1
Yantra	NEGOVANKA-BOHAT	35.86	87	YA0603	685	682	YA_ROS1
Yantra	SPRING-ROSITSA	173.49	118	YA0604	716	685	YA_ROS1
Yantra	ALEKSANDAR STAMBOLIYSKI RESERVOIR-NEGOVA	393.15	18	YA0605	616	685	YA_ROS1
Yantra	SPRING-ALEKSANDAR STAMBOLIYSKI RESERVOIR	89.07	1271	YA0606	727	1147	YA_ROS2
Yantra	SPRING-ALEKSANDAR STAMBOLIYSKI RESERVOIR	140.69	141	YA0608	739	1147	YA_ROS2
Yantra	CHUPARATA-ALESKSANDAR STAMBOLIYSKI RESER	90.18	151	YA0609	749	1147	YA_ROS2
Yantra	SPRING-ROSITSA	66.44	165	YA0610	763	749	YA_ROS2
Yantra	VIDIMA-CHUPARATA	26.20	177	YA0611	775	749	YA_ROS2
Yantra	GRADNISHKA-ROSITSA	87.81	184	YA061201	782	775	YA_VID
Yantra	SPRING-VIDIMA	86.25	204	YA061202	802	782	YA_VID
Yantra	ZLA REKA-GRADNISHKA	222.58	174	YA061203	772	782	YA_VID
Yantra	SPRING-VIDIMA	23.44	255	YA061204	853	772	YA_VID
Yantra	OSTRESHKA-ZLA REKA	6.38	252	YA061205	850	772	YA_VID
Yantra	SPRING-VIDIMA	57.66	241	YA061206	839	850	YA_VID
Yantra	SPRING-OSTRESHKA	78.10	256	YA061207	854	850	YA_VID
Yantra	LOPUSHNITSA-VIDIMA	12.71	193	YA0613	791	775	YA_ROS3
Yantra	SPRING-ROSITSA	149.63	182	YA0614	780	791	YA_ROS3
Yantra	NEGOYCHOVITSA-LOPUSHNITSA	84.42	207	YA0615	805	791	YA_ROS3
Yantra	SPRING-ROSITSA	48.45	239	YA0616	837	805	YA_ROS3
Yantra	BAGARESHTITSA-NEGOYCHOVITSA	87.54	240	YA0617	838	805	YA_ROS3
Yantra	SPRING-ROSITSA	32.49	276	YA0618	874	838	YA_ROS3
Yantra	SPRING-BAGARESHTITSA	16.55	675	YA0619	980	838	YA_ROS3
Yantra	ALEKSANDAR STAMBOLIYSKI RESERVOIR	78.85	1146	YA06L1	1147	616	YA_ROS2
Yantra	LEFEDZHA-ROSITSA	117.80	75	YA07	673	647	YA_M3
Yantra	DZHULYUNITSA-YANTRA	41.57	111	YA0801	709	673	YA_LEF1
Yantra	BEBROVSKA-LEFEDZHA	46.38	134	YA080201	732	709	YA_DZH
Yantra	SPRING-DZHULYUNITSA	152.98	160	YA080202	758	732	YA_DZH
Yantra	ZLATARISHKA-BEBROVSKA	24.03	150	YA080203	748	732	YA_DZH
Yantra	YOVKOVTSI RESERVOIR-DZHULYUNITSA	163.92	1149	YA08020401	1150	748	YA_VES1
Yantra	SPRING-YOVKOVTSI RESERVOIR	166.18	1253	YA08020403	1149	1148	YA_VES2
Yantra	YOVKOVTSI RESERVOIR	51.11	1254	YA080204L1	1148	1150	YA_VES2
Yantra	MARYANSKA-DZHULYUNITSA	129.80	167	YA08020601	765	748	YA_DZH
Yantra	SPRING-ZLATARISHKA	88.33	214	YA08020602	812	765	YA_DZH
Yantra	SPRING-MARYANSKA	70.82	222	YA08020603	820	765	YA_DZH
Yantra	GOLYAMA REKA-DZHULYUNITSA	9.51	132	YA0803	730	709	YA_LEF1
Yantra	KAZALDERE-LEFEDZHA	80.89	86	YA080401	684	730	YA_GOL1
Yantra	SPRING-GOLYAMA REKA	63.97	94	YA080402	692	684	YA_GOL1
Yantra	YASTREBINO RESERVOIR-KAZALDERE	301.82	1159	YA080403	1160	684	YA_GOL1
Yantra	SPRING-YASTREBINO RESERVOIR	119.35	1275	YA080405	672	799	YA_GOL2
Yantra	YASTREBINO RESERVOIR	106.25	201	YA0804L1	799	1160	YA_GOL2
Yantra	KARADERE-GOLYAMA REKA	108.71	122	YA0805	720	730	YA_LEF2
Yantra	SPRING-LEFEDZHA	152.05	136	YA0806	734	720	YA_LEF2
Yantra	SPRING-KARADERE	548.74	152	YA0807	750	720	YA_LEF2
Yantra	BELITSA-LEFEDZHA	330.19	123	YA09	721	673	YA_M4
Yantra	DRYANOVSKA-YANTRA	1.18	169	YA1001	767	721	YA_BEL
Yantra	PLACHKOVSKA-BELITSA	259.49	171	YA100201	769	767	YA_DRY
Yantra	SPRING-DRYANOVSKA	59.14	265	YA100202	863	769	YA_DRY
Yantra	SPRING-PLACHKOVSKA	18.80	263	YA100203	861	769	YA_DRY
Yantra	ENYOVITSA-DRYANOVSKA	103.18	172	YA1003	770	767	YA_BEL
Yantra	SPRING-BELITSA	59.29	197	YA1004	795	770	YA_BEL
Yantra	RAYKOVSKA-ENYOVITSA	71.07	198	YA1005	796	770	YA_BEL
Yantra	SPRING-BELITSA	77.57	248	YA1006	846	796	YA_BEL
Yantra	SPRING-RAYKOVSKA	89.85	233	YA1007	831	796	YA_BEL
Yantra	KOZYATA-BELITSA	311.81	149	YA11	747	721	YA_M5
Yantra	PANICHARKA-YANTRA	14.76	253	YA1201	851	747	YA_KOZ
Yantra	HRISTO SMIRNENSKI RESERVOIR-KOZYATA	9.29	1231	YA120201	1146	851	YA_KOZ
Yantra	SPRING-HRISTO SMIRNENSKI RESERVOIR	34.55	1228	YA120203	1145	1144	YA_RPA
Yantra	HRISTO SMIRNENSKI RESERVOIR	18.91	1143	YA1202L1	1144	1146	YA_RPA
Yantra	SPRING-HRISTO SMIRNENSKI RESERVOIR	34.53	273	YA1203	871	851	YA_KOZ
Yantra	SPRING-KOZYATA	123.44	243	YA13	841	747	YA_M6

Note:

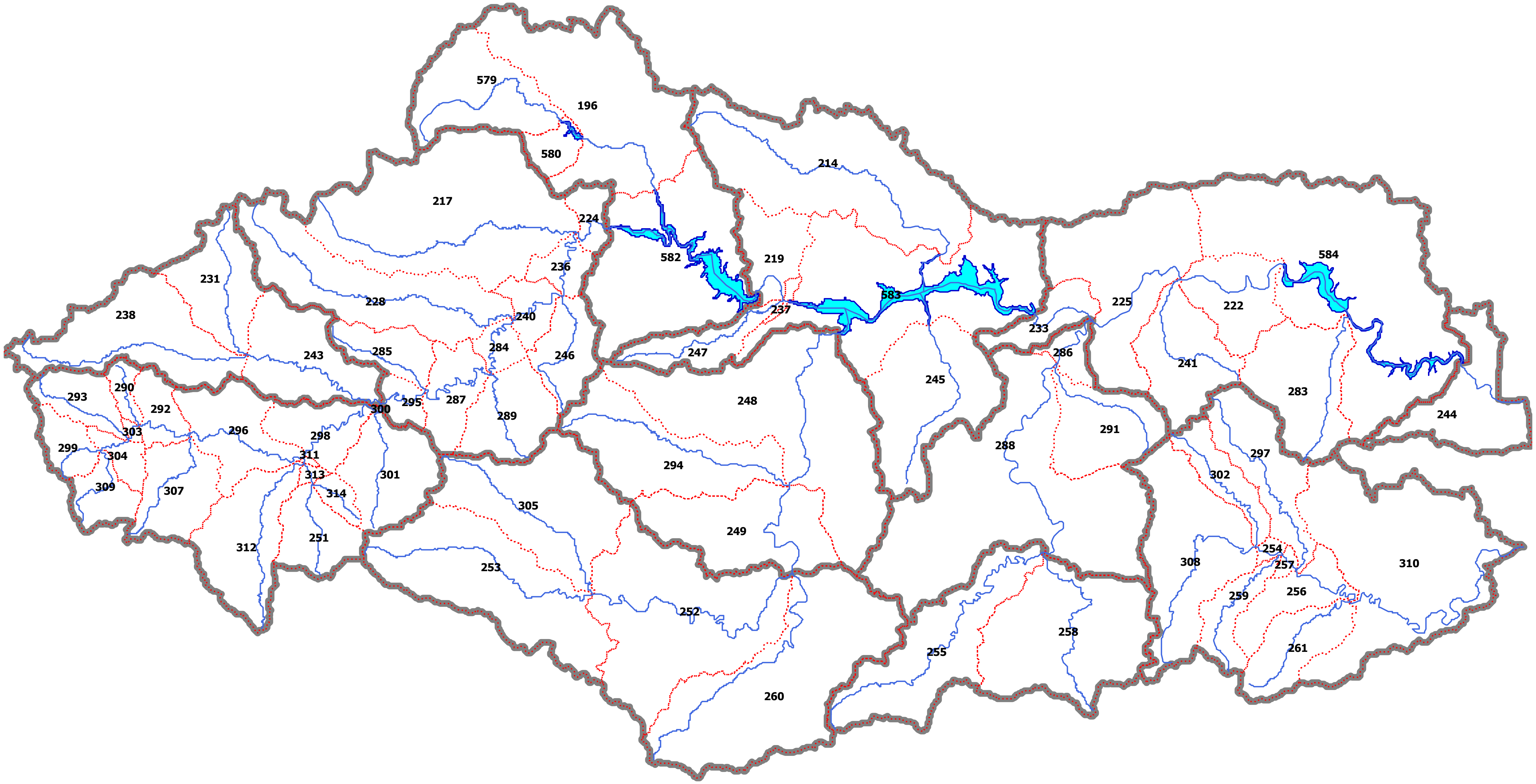
1) OBJECTID:	This is same as Core Data model
2) JICA_Code:	Unique Code for each catchment considering structure of watershed
3) JICA_ID:	Unique Code for each catchment with random number
4) Flow_To:	Catchment ID to which flow connects
0:	Flow to the most downstream of International River
1128:	Flow to Danube
9999:	Directly flow to border of the country (Land)
8888:	Directly flow to border of the country (Sea)
4) NAM:	Short name of Rainfall-Runoff (NAM) Catchment



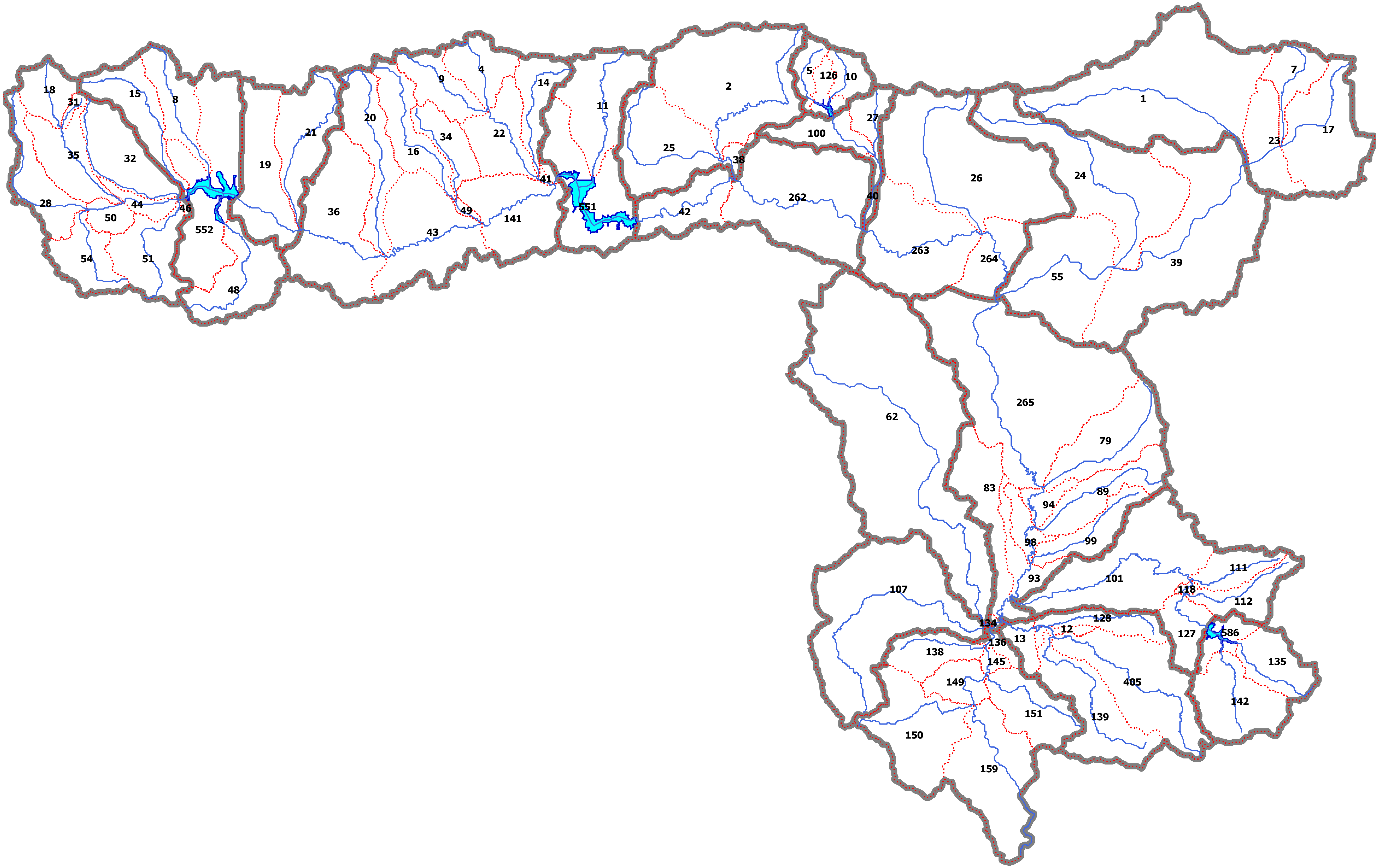
KML file for Catchments is prepared, which can be viewed in Google Earth


Struma

Mesta and Dospat



Arda and Biala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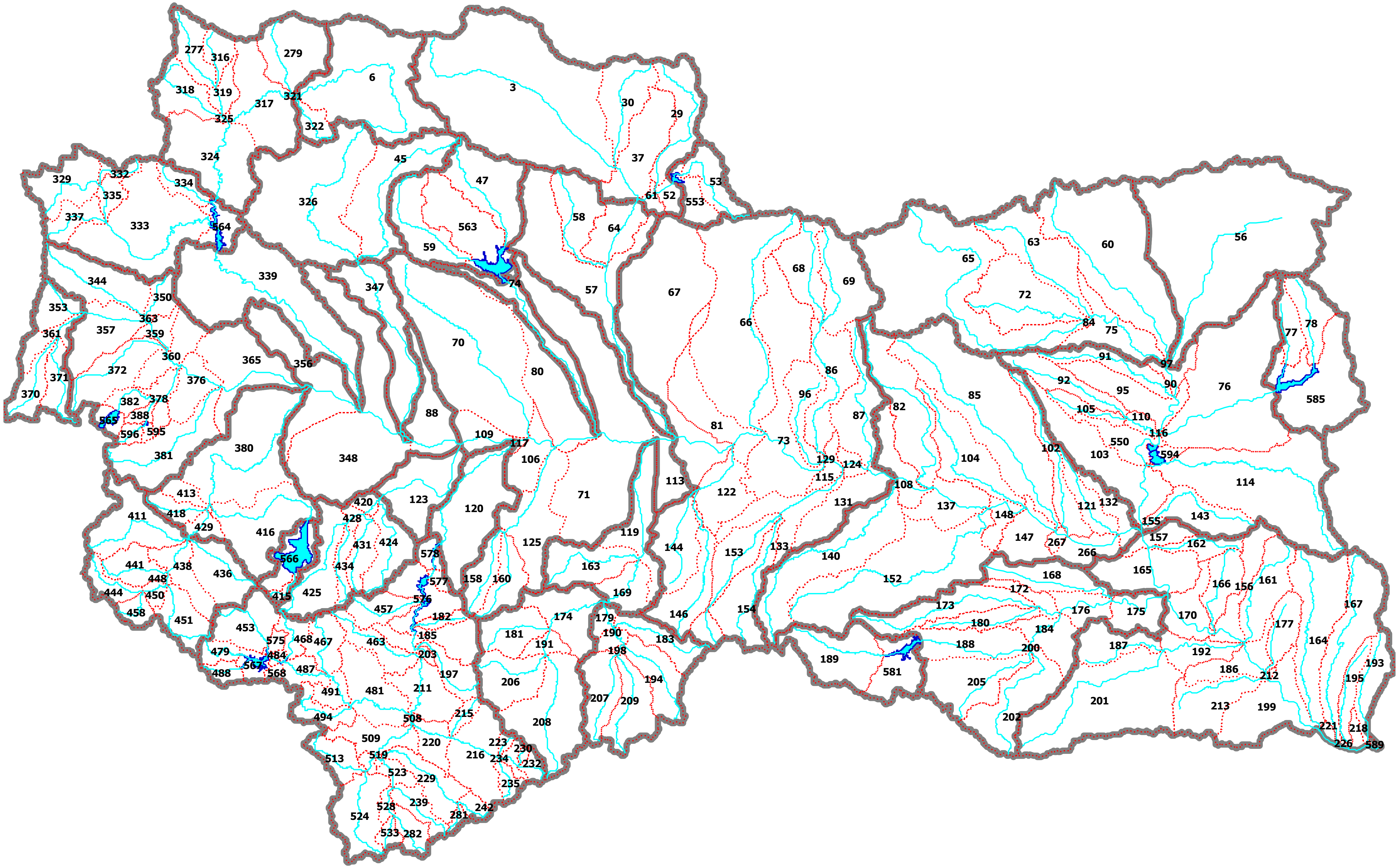

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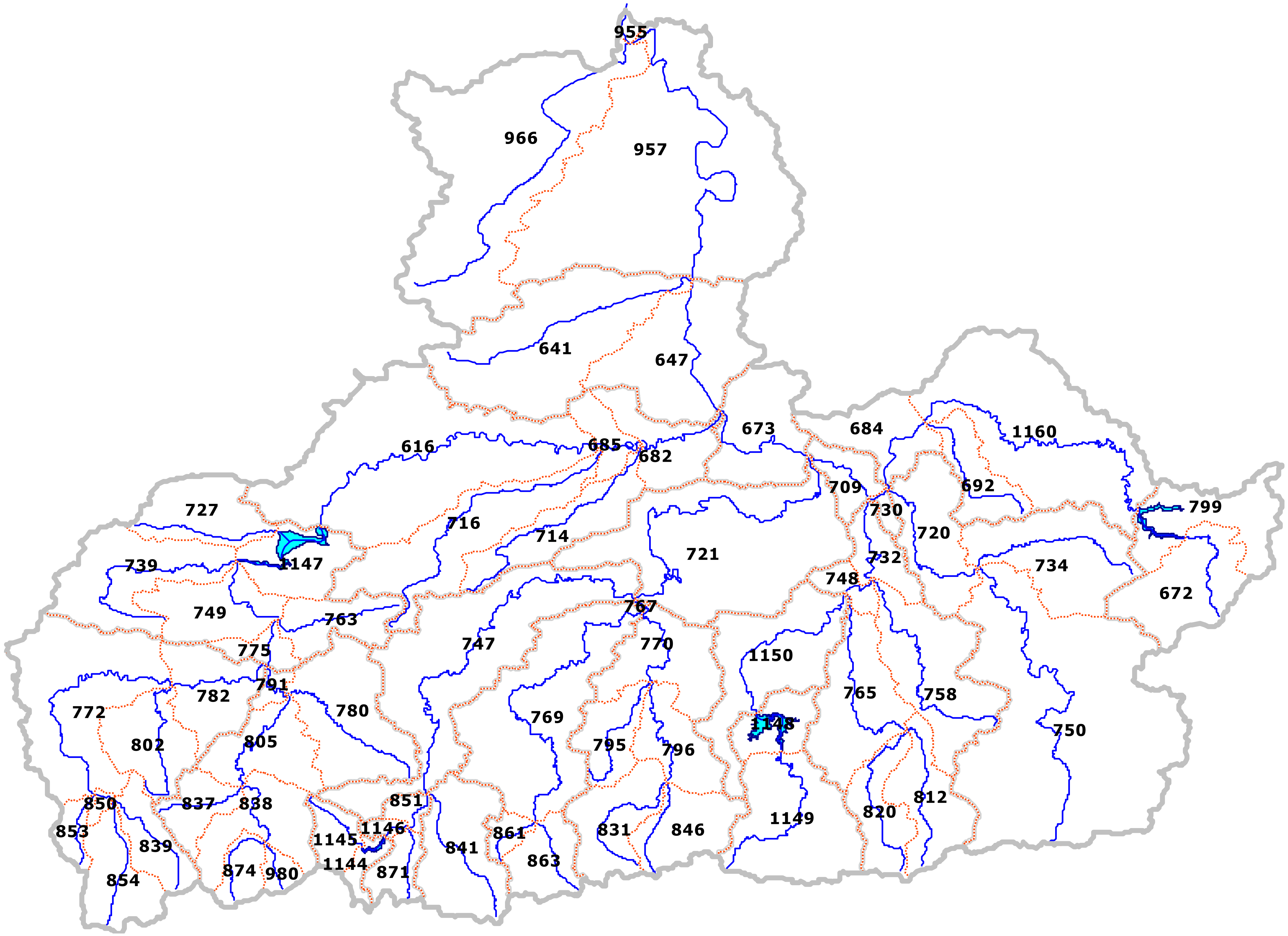
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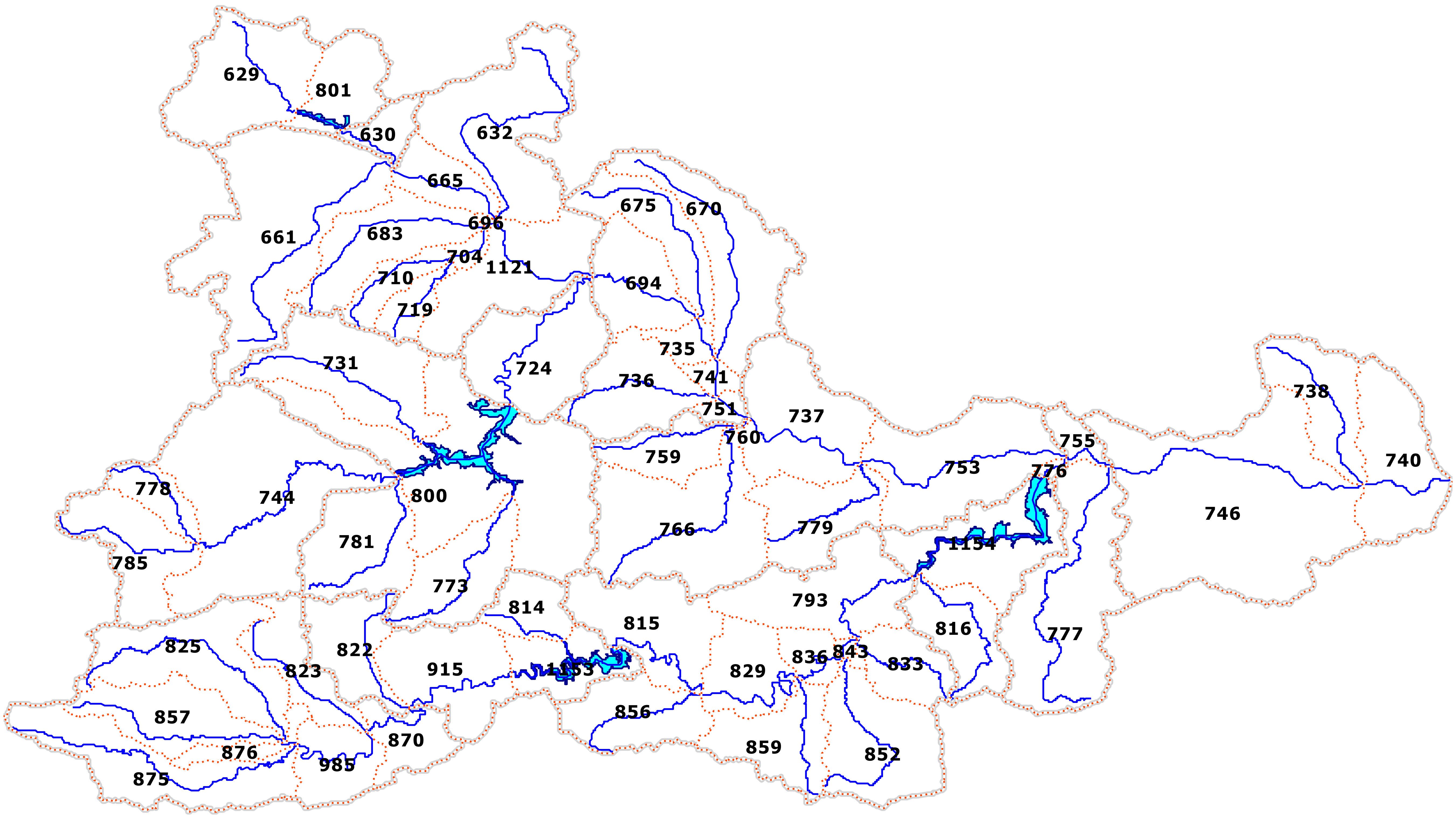
Yantra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Kamchia