TERMS OF REFERENCE

For producing technical documentation of Conceptual Design, Design for Construction Permit and Detailed Design for Protection from Erosion and Torrents in the Pcinja river basin.

1. INTRODUCTORY NOTES AND ISSUES

River Pčinja is made of several tributaries on the west slope of Dukat mountain, near the village Radovnica from where it flows westwards under the name of Tripušnica. The river valley creates a micro-region with the centre in Trgovište where Tripušnica is joined by Kozjedolska River and Lesnička river from the south. Downstream from this the formed watercourse represents the Pčinja river. The surface of the river basin is A = 3140 km², out of which 1247 km^2 is on the territory of Serbia while the remaining 1893 km^2 is on the territory of Macedonia where it flows into the Vardar river.

- Typical discharge is:
  - For river Pčinja
    - $Q_{1\%}$ = 340.0 m^3/s
    - $Q_{2\%}$ = 265.0 m^3/s
    - $Q_{cp\%}$ = 3.15 m^3/s
  - For river Tripušnica, with river basin surface area of 198 km^2
    - $Q_{1\%}$ = 212.0 $^{m3}/s$
    - $Q_{2\%}$ = 163.0 m^3/s
    - $Q_{cp\%}$ = 1.83 m^3/s
  - For Kozjedolska river, with river basin surface area of 72 km^2
    - $Q_{1\%}$ = 181.0 m^3/s
    - $Q_{2\%}$ = 141.0 m^3/s
    - $Q_{cp\%}$ = 1.32 m^3/s
  - For Lesnička river, with river basin surface area of 77 km^2
    - $Q_{1\%}$ = 104.0 m^3/s
    - $Q_{2\%}$ = 81.0 m^3/s
    - $Q_{cp\%}$ = 0.68 m^3/s

Upper part of the Pčinja river basin (river basins of Tripušnica, Kozjedolska and Lesnička river) is characterized by mountainous land, with large decline, gorge-like valley and numerous rapids i.e. tributaries with torrential features. The characteristics of the river Pčinja are changed downstream from Trgovište and it flows through the wide and shallow valley with small declines in the river-bed that form numerous meanders. River Pčinja, together with its tributaries represents an extreme torrent that carries large quantities of sediments. The river-bed does not dry up. In the summer period with low water level it has a steady and relatively even discharge.

Flooding of river Pčinja occurs frequently after abundant rainfall. Flooding in 2010 is especially important since there was outflow of Pčinja, Kozjedolska and Lesnička rivers. Trgovište and its

surrounding were particularly affected by this flood. Infrastructure was greatly damaged and the river-bed deepened even by 1.5 m. Banks and fortified embankments were demolished. Arable agricultural land in the valley was flooded. Erosion of river banks resulted in the changing of Pčinja watercourse.

1.2. Works executed on development of the Pčinja river-bed and river basin

Pčinja river was known in the past for frequent torrential floods and that is why in the second half of 20th century anti-erosion works were performed to protect the river basin. Afforestation was conducted as well as the reorientation of cultures and plots for contour farming. Works were also performed to develop torrents in order to protect the corridor but the works only consisted of partial regulation of Tripušnica and Pčinja rivers. Technical works on tributaries were not executed.

- River Pčinja was regulated at the length of 430 m in order to protect the inhabited part of Trgovište. The regulation was performed according to the "Main design for the regulation of the lower flow of river Tripušnica on the section that passes through Trgovište", designed by the company for civil and electromechanical engineering designs "Hidroprojekat" from Belgrade in 1977.
- Along the right bank a protective quay wall was built out of concrete. The river-bed is with one inundation on the left bank, with minor river-bed 18 m wide and major river-bed 24.5 m wide. The bottom of the regulation is made of rock in cement mortar. At the beginning and end of the regulation there are inflow and outflow structures with 8 layers along the regulated river-bed. The inclination of the river-bed slope is 1:1.
- Ovčarski stream was regulated in the Radovnica settlement. Regulation was performed according to the "Main design of anti-erosion works and measures in the Ovčarski stream bed and basin", designed by VO "Erozija" from Vladičin Han in 1973. The works involve landfill barrier of 4 m useful height, with absorption basin and stone respond in cement mortar around 200 m long, 2 m wide at the bottom and inclination of the river-bed slope of 1:1. The width at the top of the regulation is 4 m.
- After the floods in May 2010 the "Main design of urgent works on the regulation of river Pčinja, Tripušnica and Kozjedolska river in the zone of Trgovište settlement" was produced by the design company "Hidroprojekt" from Zrenjanin in 2013 as well as the "Main design of rehabilitation" consisting of three phases:
  - Phase 1: "Reconstruction of the demolished retaining wall on the right bank of the Pčinja river downstream from the bridge and reinstating the river Pčinja river bed in the bridge zone with additional protection for the bare pillars of the bridge"
  - Phase 2: "Regulation of rivers Pčinja, Tripušnica and Kozjedolska river, 1 km in length – encompassing the inflow location for Tripušnica and Kozjedolska river"

- Phase 3: “Regulation of 249 m of Kozjedolska River from the river-bed and execution of works on the regulation of Lesnička river, 320 m upstream from the inflow into the Kozjedolska river”.

The works have been executed according to the designs from Phase 1 and Phase 2.

3. GOAL AND TERMS OF REFERENCE

- The designed works aim to protect the river basin from erosion and prevent the torrential floods with the application of the *Concept of Integral Development of Torrential Sub-river Basins*. The designed works should include biological, bio-technical and technical works.
- The biological works should involve the combination of the basic elements of vegetation: grass, shrubs and tall vegetation in order to prevent the erosion of the surface layer, reduce the surface runoff and increase the forest coverage coefficient.
- Bio-technical works, depending on topographic conditions and geo-mechanical characteristics, should involve the possibility to terrace the sides of valleys, to make steps, contour trenches, wattle-works etc.
- Technical works should involve the construction of stockpiling-consolidation barriers, gabion barriers, thresholds, cascades, line regulation structures etc. In case there is a need to design technical works in the river bed itself, the planned structures should be tied up to the existing regulations and structures, and the project documentation should be harmonized with the existing technical documentation for the development of the Pčinja river-bed.
- Terms of reference involve the production of technical documentation for the Detailed Design for Protection from Erosion and Torrents in the Pčinja river basin. Before the Detailed Design there should be the production of technical documentation for the Conceptual Design in order to obtain the location requirements and then comes the Design for Construction Permit for Protection from Erosion and Torrents in the Pčinja river basin in order to get the construction permit.

4. MAPS FOR DESIGN

4.1. Existing technical documentation

- “Main design for the regulation of the lower flow of river Tripušnica on the section that passes through Trgovište”, designed by the company for civil and electromechanical engineering designs “Hidroprojekat” from Belgrade in 1977.
- “Main design of anti-erosion works and measures in the Ovčarski stream bed and basin”, designed by VO “Erozija” from Vladičin Han in 1973.
- “Main design of urgent works on the regulation of river Pčinja, Tripušnica and Kozjedolska river in the zone of Trgovište settlement” produced by the design company “Hidroprojekt”

from Zrenjanin in 2013 as well as the "Main design of rehabilitation" consisting of three phases:

- Phase 1: "Reconstruction of the demolished retaining wall on the right bank of the Pčinja river downstream from the bridge and reinstating the river Pčinja river bed in the bridge zone with additional protection for the bare pillars of the bridge"
- Phase 2: "Regulation of rivers Pčinja, Tripušnica and Kozjedolska river, 1 km in length – encompassing the inflow location for Tripušnica and Kozjedolska river"
- Phase 3: "Regulation of 249 m of Kozjedolska River from the river-bed and execution of works on the regulation of Lesnička river, 320 m upstream from the inflow into the Kozjedolska river".

4.2. Survey maps

Survey maps should be made in accordance with the current regulations in order to provide the data for the design and execution of works on the structures. For production of technical documentation in question the cadastral and topographical plans will be used at the appropriate scale, to show the position of the structures: technical, bio-technical and biological and the detailed layout drawings for the design of structures.

4.2.1. *Survey maps for designing technical works*

For desing of technical works (transverse and longitudinal) the following is required:

- To set up an operational polygon along the right or left bank (according to the situation in the field) of the treated river section and its breakpoints should be linked to the state survey network.
- To survey the cross sections from the polygon points, approximatively perpendicularly to the existing flow, at a distance of 20 m by terrain breakpoints, water breaches, highest depths of the river-bed and high banks, encompassing the width of around 40 meters (20 meters left and 20 meters right from the axis of the existing course).
- To make a layout drawing based on the data of the surveyed detailed points i.e. to map the surveyed detailed points and form a detailed location plan showing the river-bed by water breaches and banks for positions, of all structures on the riverbanks.
- The layout drawing must contain cadastral land plots. Water soil should be separately marked on the drawing. All points should be connected to the state survey network.
- The layout drawing and the cross sections must have the marked water supply network, sewage, postal cables with their elevations and all other installations if they exist. The existing structures like local and forest road, gaps etc. should be surveyed in detail.

4.2.2. *Survey maps for designing bio-technical works*

While designing the bio-technical works it is necessary to provide the exact location (xy coordinates) of the planned structures on the layout drawing (cadastral-topographic map).

4.2.3. *Survey maps for designing biological works*

While designing the biological works it is necessary to show the surface area on which the protective biological works of afforestation and grass cultivation are planned on the layout drawing (cadastral-topographic map). For designing the biological works on the state-owned land (forest and agricultural land) the planning documents should be used (The Fundamentals of Forest Management and Agricultural Land Management Plans).

4.4. Geological maps

For the purposes of producing technical documentation, a borehole or an open pit should be made in places of future barriers 3 meters deep from the existing bottom of the river-bed. For separate sections -layers, samples should be taken and tested in the laboratory. Interpretation of obtained results on geotechnical characteristics of the sections that appeared should be shown in a separate study that is the integral part of technical documentation for protection from erosion and torrents in the Pčinja river basin. The geotechnical study should contain:

- overview and explanation of the investigative works programme,
- detailed overview of results obtained through laboratory testing,
- overview of geological and hydro-geological features of terrain,
- overview of geo-technical features of terrain on locations of designed structures,
- calculation of static and filtration stability of soil and defining the conditions for foundation engineering and construction of technical structures for protection from erosion and torrents.

4.5. Hydrological maps

For the purposes of producing technical documentation, it is necessary to perform hydrological calculation of high waters from different return periods for watercourses within Pčinja river basin. This calculation should be done with the newest methods for un-investigated river basins using a solid series of data from the closest rain gauge stations for $Q_{1\%}$, $Q_{2\%}$ and $Q_{5\%}$. For calculated water $Q_{1\%}$ should be adopted. The opinion of Republic Hydro-meteorological Service of Serbia is required for the obtained results.

4.6. Hydraulic maps

Based on the completed geodetic, geological and hydrological mapping as well as the obtained required opinions, requirements and consents from the competent institutions, a hydraulic calculation should be done with the previous analysis of the existing terrain and structures on the said sections, with calculated high water. Based on the calculated water level and longitudinal falls, the structures for retaining the eroded sediments should be designed as well as the stabilization of the bottom of the river –bed, having in mind the characteristics of the Pčinja River, the damage caused by torrential watercourses and sediments.

5. ACTIVITIES ON DRAFTING DESIGNS AND THE CONTENT OF DESIGNS

5.1. Conceptual design

Conceptual design for protection from erosion and torrents in the Pčinja river basin should contain:

- The main notebook of conceptual design consisting of the basic content from Annex 1, *Rulebook on content, manner and procedure for producing and manner of performing control of technical documentation by class and purpose of the structure* ("Official Gazette of RS", number 23/2015):
  - Data on name and address of the Investor for the building of structure
  - Excerpt from the court registry for the company that developed the design
  - Authorizations for designing for persons participating in the design development
  - Decision on determining the main and responsible designer

- General documentation of Conceptual Design consists only of the mandatory content specified in Article 28 of the *Rulebook*, from Annex 9.
  - Textual documentation of Conceptual Design contains the technical description of designed structures
  - Numerical documentation of Conceptual Design contains the overview of structures with their use and number of functional units
  - Graphic documentation of Conceptual Design contains the graphic annexes at appropriate scale:
    - layout drawing with the position of structures on the location, shown outline, dimensions, characteristic elevation points, distance from the neighbouring plots and neighbouring structures (1:1000–1:200),
    - plans, characteristic cross-sections and appearance of structures (1:500–1:200).
  - Graphic documentation of Conceptual Design for line regulation structures contains the graphic annexes at appropriate scale:
    - layout drawing and longitudinal profile of the route (1:25000–1:2500),
    - general dispositions of larger structures,
    - characteristic cross sections (1:100–1:25).
- Conceptual Design for engineering structures contains only those parts that are necessary for issuing of location requirements, according to the rules of profession.
- Obtaining the complete documents (information on location, copies of plans, certificate of title, topographic - cadastral mapping etc.) necessary for issuing location requirements.
- Obtaining of location requirements.

5.2. Design for Construction Permit and Detailed Design

Design for construction permit is developed in order to obtain the decision on construciton permit. The design for construction permit has to contain the statement of the main designer, responsible designer and the person executing technical control, confirming that the design was done in accordance with the location requirements, regulations and rules of profession.

Main project is developed for executing the construction works. The detailed design is a set of harmonized designs determining construction, technical, technological and exploitation features of the structure with equipement and installations, technical, technological and organisational solutions for the construction of structure, investment value of the structure and conditions for maintenance of the structure. The detailed design has to contain the statement of the main designer and responsible designers confirming that the design was done in accordance with the location requirements, construction permit, design for construction permit, regulations and rules of profession.

Design for Construction Permit and Detailed Design for Protection from Erosion and Torrents in the Pčinja river basin should contain:

- General documentation for the design,
- Terms of reference verified by the Investor,
- Textual documentation:
  - Technical report:
    - Description of river basin and river bed
    - Basic parameters of the river basin
    - Overview of the main problems in the river basin, on the main watercourse and tributaries
    - Hydrographic features of the river basin (hydrograpic map)
    - Geological features of the river basin (geological map)
    - Pedologic features of the river basin (pedologic map)
    - Manner of soil usage (Map of soil usage)
    - Erosion in river basin (Map of erosion)
  - Bill of quantities - BoQ
  - Estimated BoQ
  - Technical conditions for execution of works
- Numerical documentation:
  - Coordinates and levels of geodetic points that will be used during the construction
- Workplace safety measures
- Measures for prevention of negative impacts on the environment in the period of works execution
- Survey maps (topographic - cadastral maps)
- Clear map of the area at the scale of 1: 25 000
- Hydrologic calculation (maximum water discharge)
- Calculation of production and carrying through the sedimentation
- Concept of designed solutions with explanation for adopted solutions for protection from sedimentation
- Order of executing works
- Graphic annexes:
    - Layout drawing, scale of 1:1000
    - Longitudinal section, scale of 1:100/1000
    - Cross section, scale of 1:100
    - Drawings of transverse structures scale of 1:100
    - Structure details, scale of 1:20

NOTE:

- The Investor does not have at his disposal other technical documentation specified in the part 4.1. The existing technical documentation. The Investor had insight into the stated technical documentation during the work on individual cases. It is presumed that technical documentation is to be found at local governments or competent public enterprises that were entrusted with the tasks from this area.
- All necessary requirements for design stipulated in the Law on Planning and Construction, will be obtained by the designer on behalf of Public Water Management Company "Srbijavode" at his own expense, which involves the preparation and submission of request and production of offprints and documents needed to get the requirements, opinions and consents that they will obtain with authorization (proxy) issued by the PWMC "Srbijavode". The costs of the document preparation will be calculated in the price of production of technical documentation through the specification of works compliant with the terms of reference.
- The financier is obliged to engage the technical control of project documentation after the production of technical documentation for the Design for Construction Permit so that after the commission for technical control provides a positive opinion the designer may continue to obtain other acts (water consent) and construction permits and start with production of the Detailed Design.

The Design is made in 6 printed copies and 2 digital copies on CDs. The digital copies are submitted so that one copy is in PDF format and the other contains the text in Word, tables in Excel, databases in Access, drawings in DWG and spatial data in Shape format. The design is accompanied by submitted originals of all collected requirements, consents, opinions, solutions and maps (copies of plans and certificates of title) during the production of technical documentation.

Deadline for the production of design is one year from the day of mutual signing of the contract for the production of design.

Niš,
December, 2015

Investor
Public Water Management Company
"Srbijavode", Belgrade

_____