

## **Technical Report - Project documentation for Vipava Municipality**

**Project partner:** PP11 (Vipava Municipality)

## Table of contents

1. INTRODUCTION .....	3
2. EXISTING CONDITION.....	3
3. SUBJECT OF EXTERNAL SERVICES .....	8
4. LOCATION AND DESCRIPTION OF PROPOSED INTERVENTIONS .....	10
5. IMPACT OF PROPOSED MEASURES .....	18
6. DESCRIPTION OF THE PROPOSED ARRANGEMENTS IN THE AREA OF MOČILNIK ..	21
7. COSTS AND FINANCING .....	21
8. CONCLUSION .....	22

## 1. INTRODUCTION

This Report is part of the activities of the Work Package 3.2 – Project documentation of the VISFRIM Project (Vipava/Vipacco and Other Transboundary River Basins Flood Risk Management).

The objective of the WP3.2 is to reduce the hydraulic hazard and therefore flood risk in the program area through the elaboration of project documentation/cost-benefit analysis, so to be able to implement small-scale structural investments in next future. In particular, the design of flood risk mitigation measures in selected areas of Vipava will serve as a comprehensive overview of the necessary flood prevention measures to achieve the reduction of flood risk for selected areas. The study is also the basis for determining the necessary order of priority of flood protection measures. The study itself does not include building permits for mitigation measures, however it represents the basis to apply for.

## 2. EXISTING CONDITION

The settlement of Vipava lies in the basin of the Vipava watercourse and the Bela watercourse (Figure 1). Most of the settlement area is located in the area of significant flood impact (OPVP 61 - Vipava), which is caused by both watercourses. In detail OPVPs are specific areas in Slovenia estimated as highest flood risk areas in the framework for EU Flood Directive. Due to the relatively large flood areas, the Vipava settlement is very limited in the desired development goals. Flood zones also pose a threat to the local population: roads are closed, the number of areas for the construction of residential buildings are reduced. Consequently, the municipality decided to carry out a study for the design of some flood risk reduction measures in selected areas of Vipava in order to recover flood-safe areas where development activities/residential could be later placed on.

Such areas are shown in the following and are flooded by the watercourses Vipava, Močilnik, Gacka and the smaller stream Polžarica.

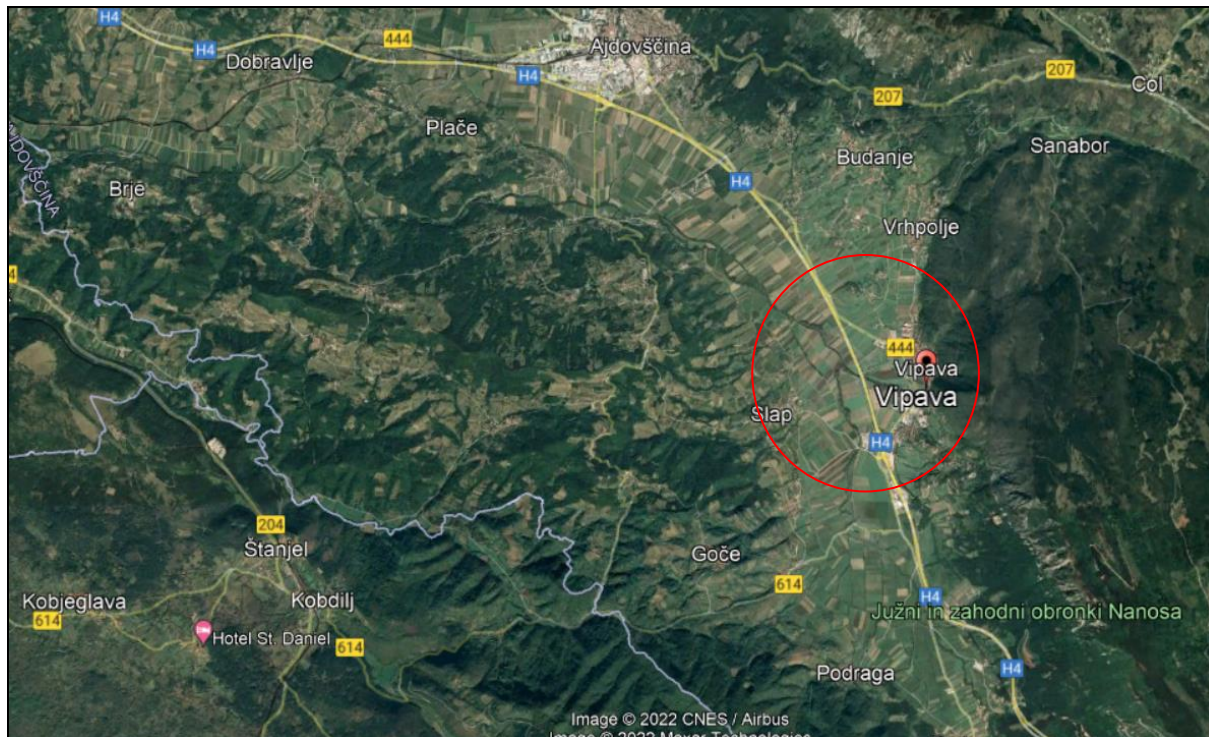


Figure 1: Location of the Vipava settlement (source: Google Maps)

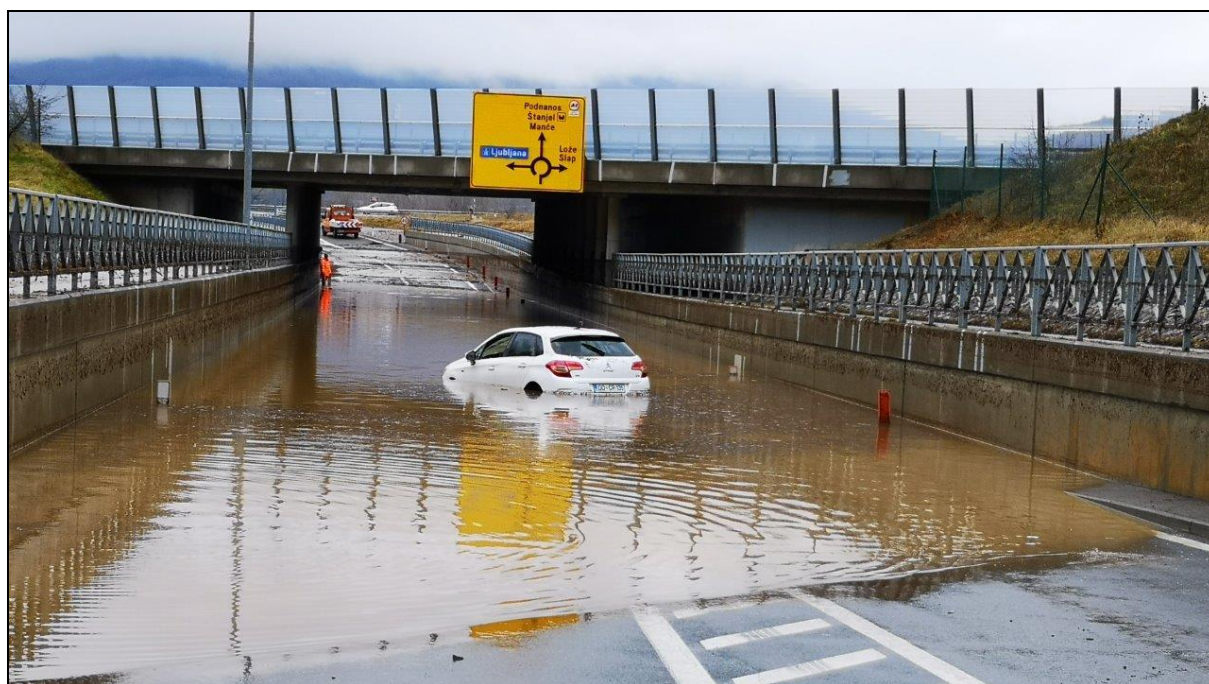


Figure 2: Historical flood event in Vipava settlement (source: Municipality of Vipava)



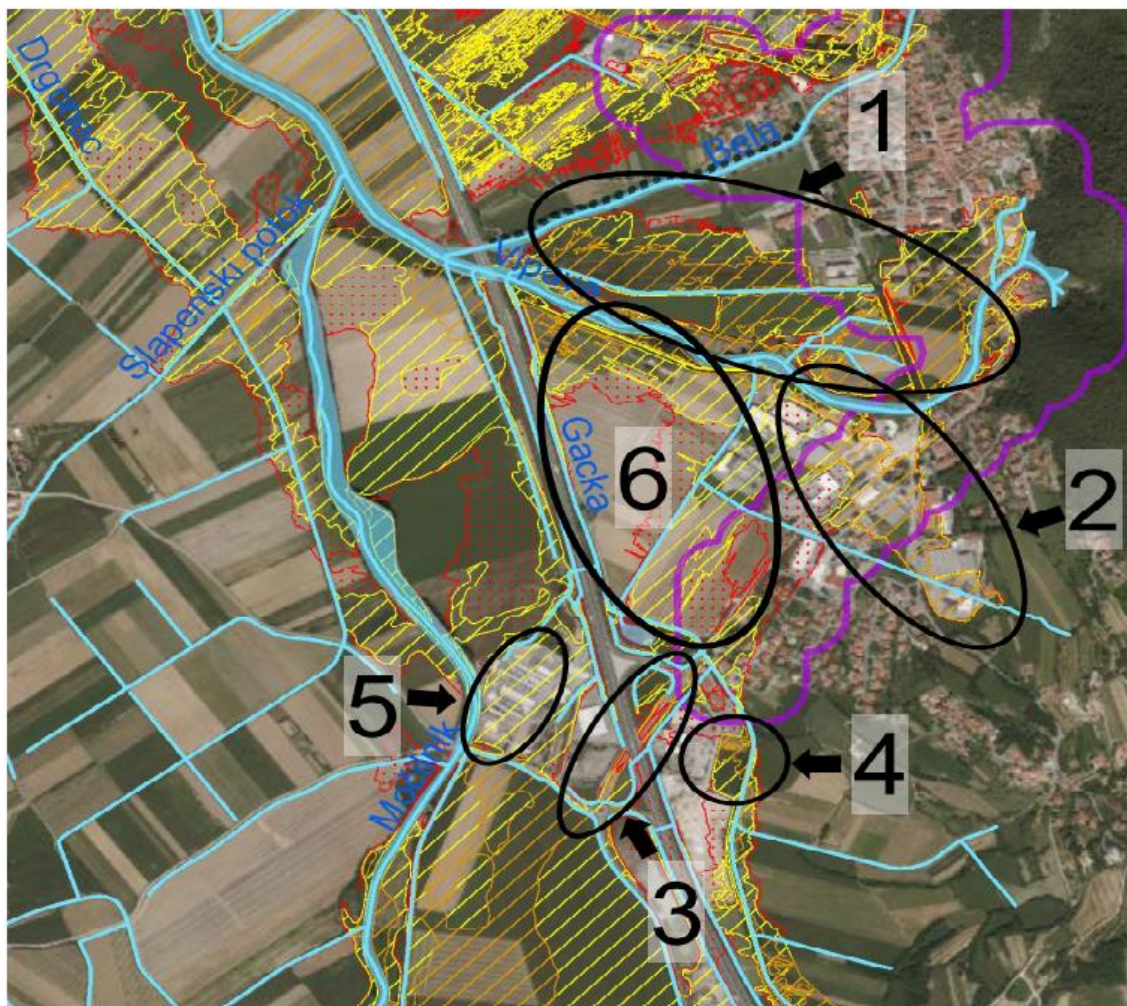
Figure 3: Historical flood event in Vipava settlement (source: Municipality of Vipava)



**Figure 4: Historical flood event in Vipava settlement (source: Municipality of Vipava)**



**Figure 5: Historical flood event in Vipava settlement (source: Municipality of Vipava)**



Legend	
	Area of significant flood impact OPVP 61 – Vipava
	High flood hazard
	Medium flood hazard
	Low flood hazard
	Rest of flood hazard (extreme)
Area	Name
1	Frnaža in police (Vipava)
2	Along the Vinarska road and industrial zone Mlekarna (Polžarica)
3	Underpass of the regional road Manče-Vipava under the H4 expressway
4	Industrial zone V2
5	Industrial zone Fama (Močilnik)
6	Under the villa Ana (Gacka)

Figure 6: Six areas of interventions, including also flood hazard classes according to the IZVOR study, 2012

Maps of flood hazard and flood hazard classes, shown in Figure 6, were prepared for both watercourses and are based on the studies *"Hydrological - hydraulic analysis and flood maps for selected areas of the Municipality of Vipava"* (study no. E45-FR / 12, Izvo-R doo, August 2012; hereinafter IZVOR, 2012) and *"Hydrological-hydraulic assessment and flood risk maps for determining flood areas in the Bela river basin"* (study no. P-GO 76/18, Hidrotehnik dd, April 2019), which pointed out the high level of flood danger that threatens the settlements of Vipava and Vrhpolje.

### 3. SUBJECT OF EXTERNAL SERVICES

#### Geometric or geodetic data

For the needs of the hydrological-hydraulic study, the following data were acquired by a classical geodetic survey (GROMAP, 2021):

- cross-sections of watercourses Močilnik, Vipava, Gacka, Polžarica (cross-sections with a maximum distance of 40 m)
- outflow section Bela
- larger drainage ditches and culverts
- all bridging structures across watercourses
- underpass under the expressway
- existing embankments

The Hydrological Hydraulic Analysis was made on the basis of a new geodetic survey, which was made in 2021.

#### Hydrological starting points

In the phase of preparing the study, there was a need to take into account new hydrological starting points, which are the result of the current hydrological study (Hydrological study of Vipava, March 2021, MOP, Water Agency; hereinafter Water Agency, 2021). Among else, the study results in newly determined high-water flows and waves for watercourses, which are considered in the project task. The table below presents the used high-water flows of watercourses in the considered area.

Table 1: Values of high-water flows of watercourses used in hydrological analysis (Water Agency, 2021):

ID	Name of hydrological cross section	F (km <sup>2</sup> )	Q10	Rainfall duration	Q100	Rainfall duration	Q500	Rainfall duration
			m <sup>3</sup> /s	h	m <sup>3</sup> /s	h	m <sup>3</sup> /s	h
vi_01	Vipava g.s. Vipava	karst (116)	97		130		150	
mo_J10	Močilnik under Mrzli potok	39.2	73	3	139	3	176	6
mo_M09b	Molikovnik until Močilnik	1.01	2.4	3	4.9	3	7.8	3
mo_M09c	Slapenski potok until Žoržev potok	2.6	12	3	21	3	30	3
mo_M09a	Plešivec until Močilnik	3.91	7.3	6	14	3	23	3
pp_J63	Bela until Vipava	30.4	33	12	70	12	95	12
pp_J101	Gacka under retainer	3.57	6.2	6	12	6	14	6
pp_J100	Gacka until Vipava	5.8	11.2	6	22	3	28	3
pp_J110	Potok until Vipava cellar - Polžarica	1.02	1.6	6	3.6	3	4.9	3

The hydrographs used are otherwise entirely summarized according to the DRSV – Water Agency 2021 Hydrological Analysis, where they are also shown graphically.



### Hydraulic analysis

The extent of the hydraulic model is shown in the Figure 7 below and includes a 2 km section of Vipava, a 4.5 km section of Močilnik, a 2.2 km section of Gacka, outflow part of Bela, Polžarica above Vipava wine cellar and flood plains between these watercourses. Downstream, the hydraulic model was completed 300 m downstream from the confluence of the Vipava and Močilnik rivers, above the area where the flood waters of Bela, which flow from the underpass under the expressway, also spilling onto the right bank.

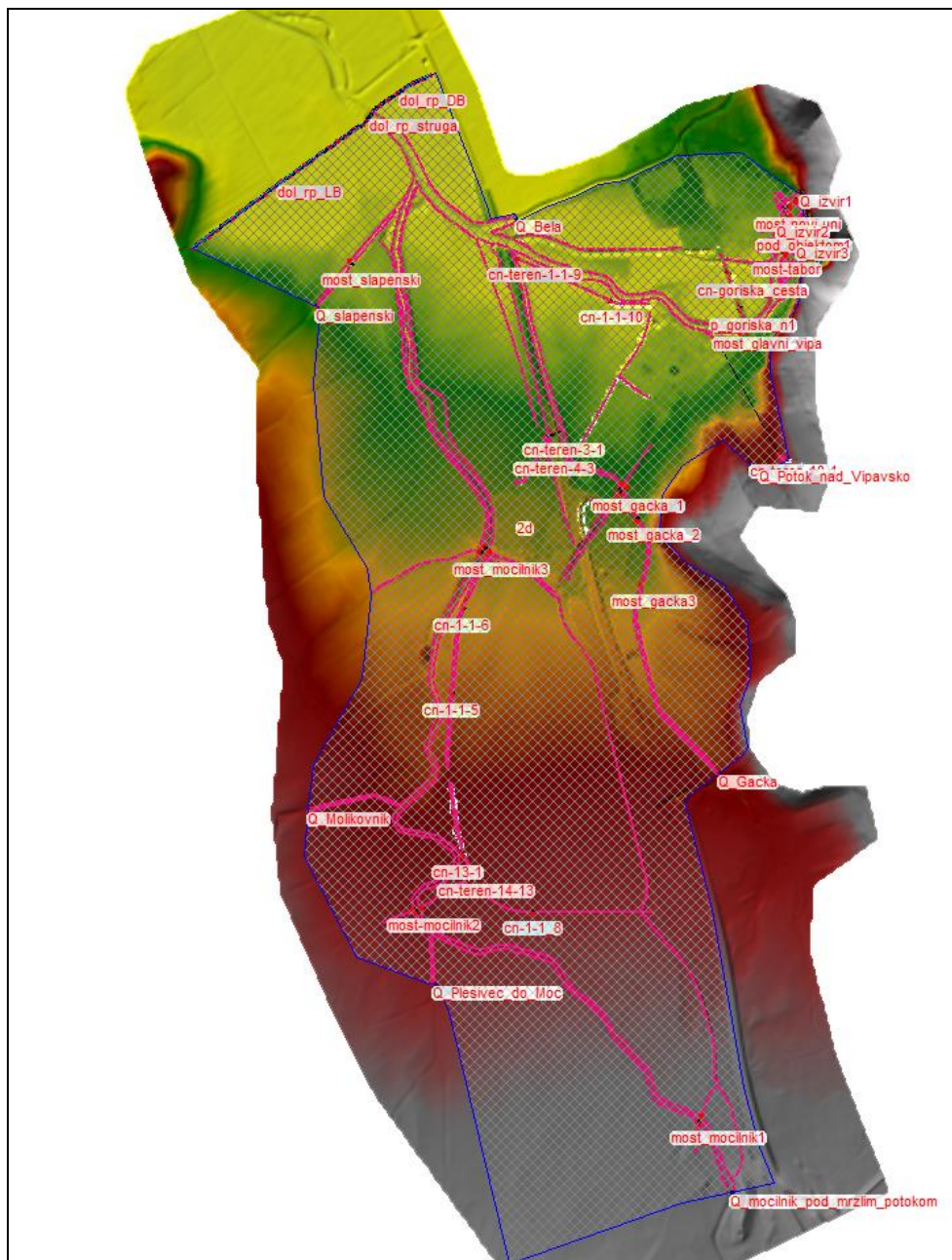


Figure 7: 2D model computational are (source: TEMPOS study, 2021)

#### 4. LOCATION AND DESCRIPTION OF PROPOSED INTERVENTIONS

##### Mitigation measures on Močilnik

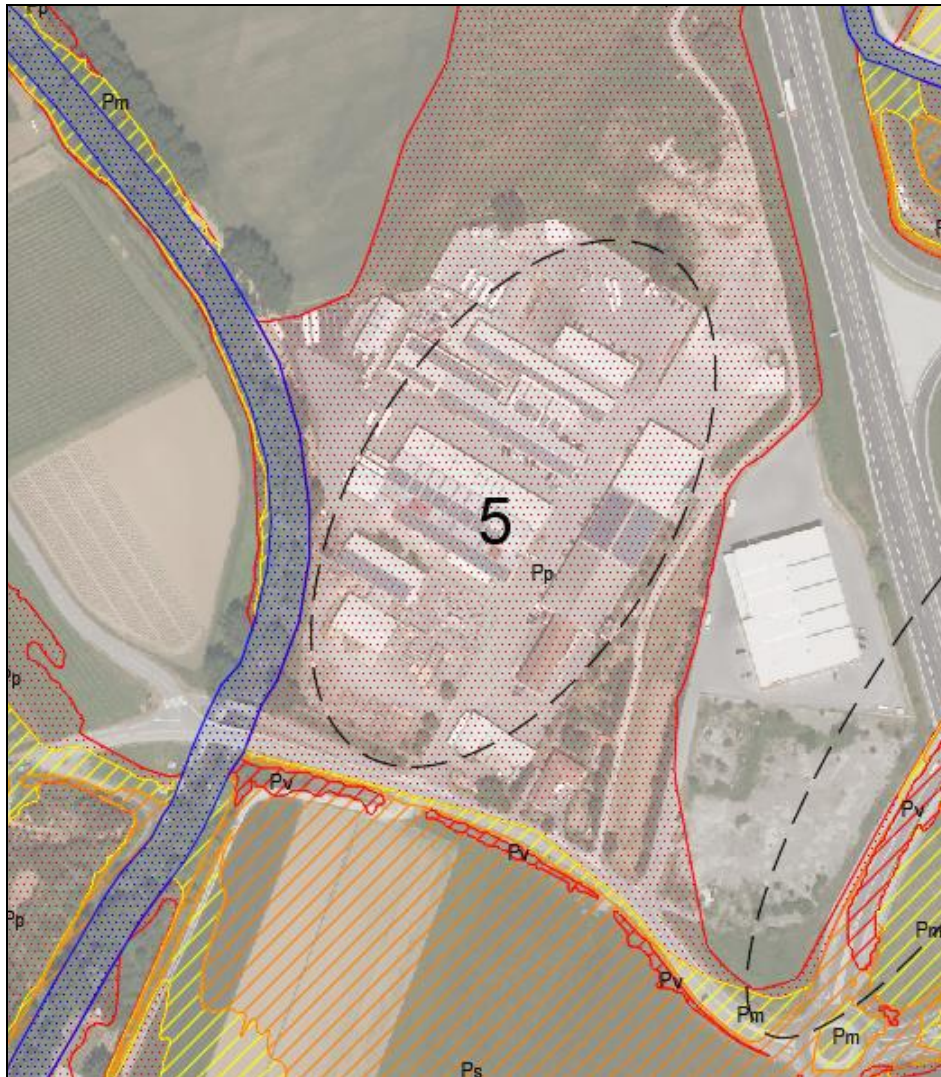


Figure 8: Flood hazard classes map in area no. 5: Fama industrial zone (source: TEMPOS study, 2021)

##### Measures:

##### *-High water embankment*

- length: 2300 m
- height above the ground 1-1.8 m
- crown width = 1.0 m
- slope of banks, n = 2:3
- min. level = H100 + 50cm

- Relocation of the existing reclamation ditch along the regional road Manče – Vipava

- length  $L = 1400$  m
- covers the existing ditch with material for high water embankment
- width of the bottom of the ditch = 1.0 m
- bank slope = 2:3
- intensive grassing

- Construction of access ramps for embankment crossing

- crossing the road Štanjel - Manče
- crossing the road Sv. Urban - Podraga – Podnanos

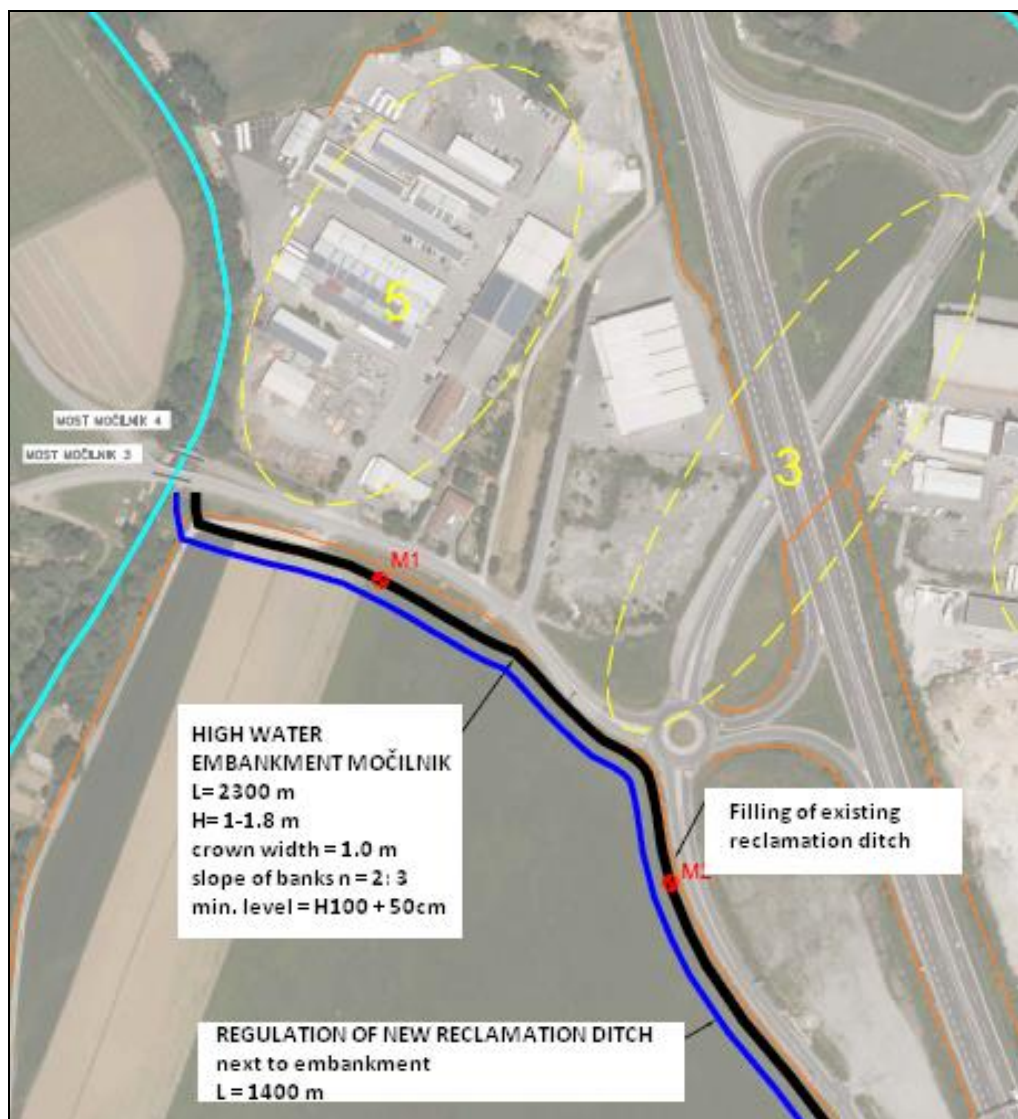


Figure 9: Map showing the main measures planned in area no.5 (source: TEMPOS study, 2021)

## Mitigation measures on the Gacka

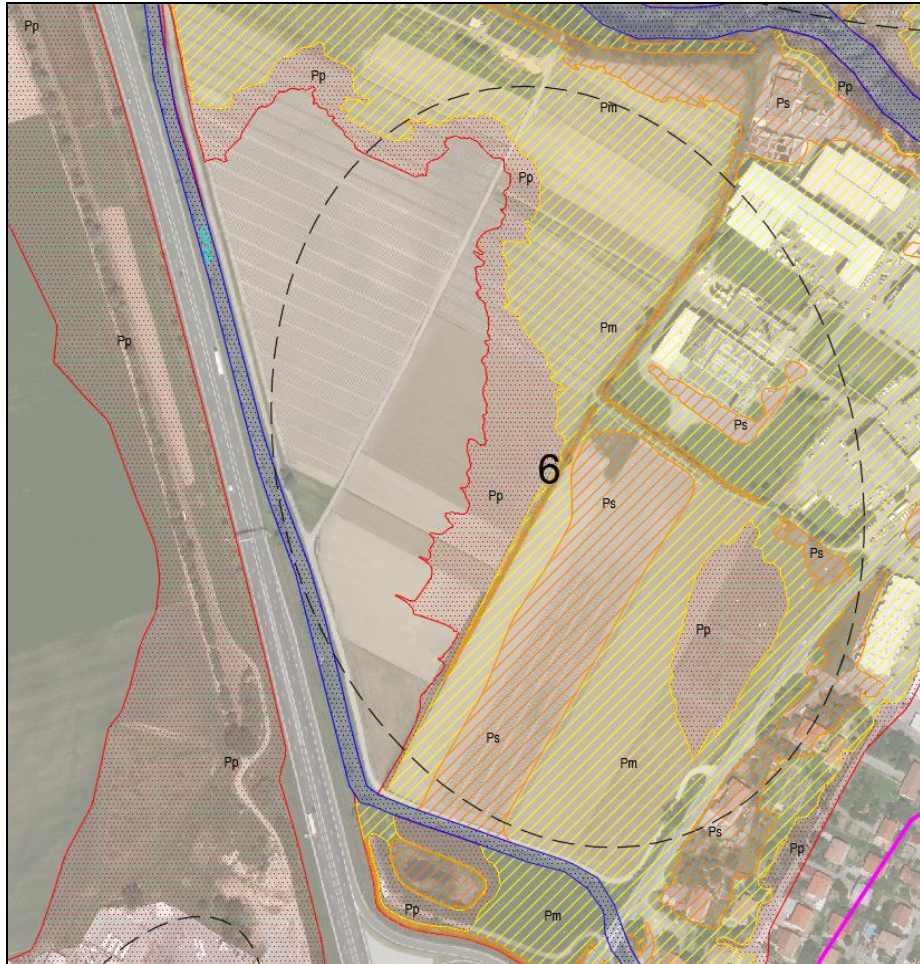


Figure 10: Flood hazard classes map in area 6, under the villa Ana (source: TEMPOS study, 2021)

### Measures:

#### - Flood control reservoir

- highering of the existing embankment at a quota of 116 m above sea level (crown width 3 m, slope of the banks  $n = 2:3$ )
- elevation of maximum level 115 m above sea level
- retention volume  $V = 98,000 \text{ m}^3$
- area of maximum accumulation  $A = 70,000 \text{ m}^2$

#### - Heightening of terrain on the left bank of Gacka - industrial park V2

- $A = 7,000 \text{ m}^2$
- filling of the terrain in the height of 1m
- protection of the bank along the Gacka riverbed with a stone fold in the dry in the length of 120 m

- High water embankment along Gacka stream

- length  $L = 195$  m
- crown width = 4.5 m
- bank slope  $n = 2:3$

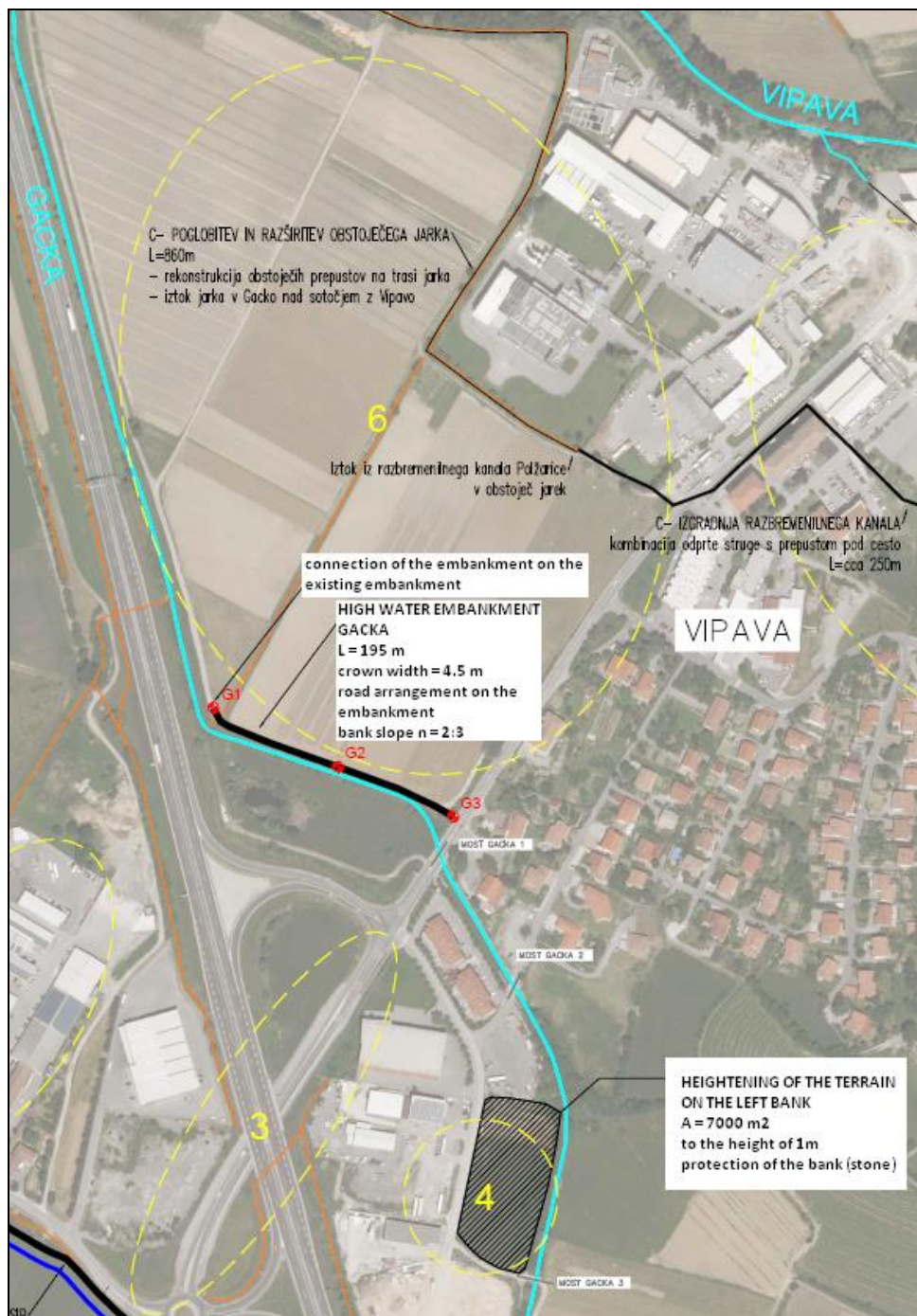


Figure 11: Map with measures in area no.6, except flood control reservoir (source: TEMPOS study, 2021)

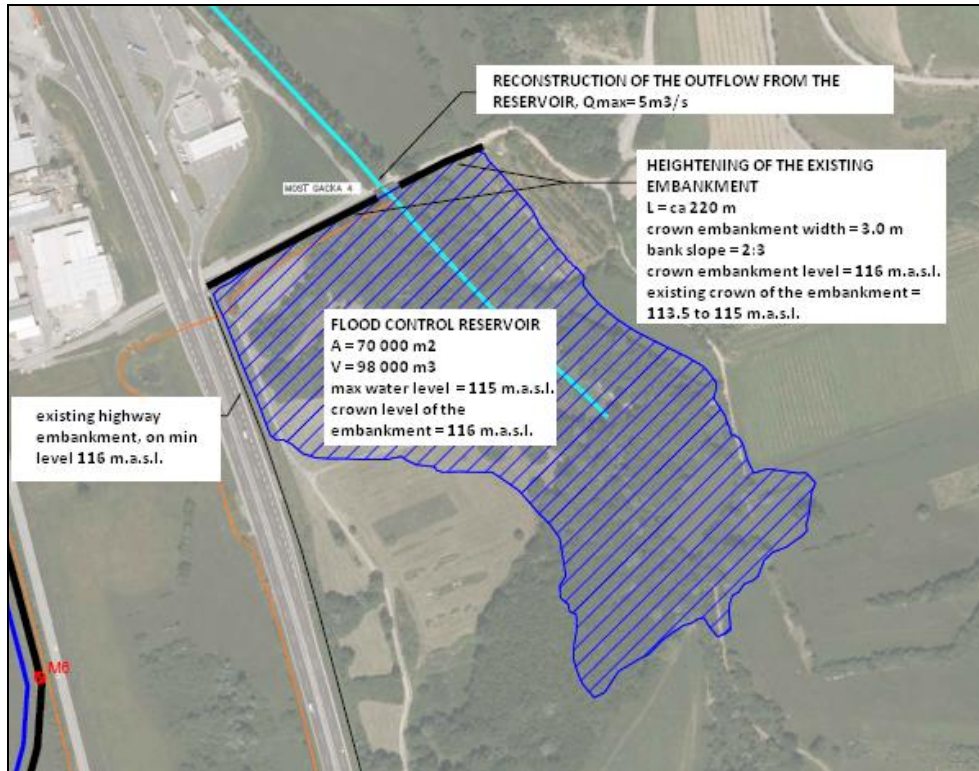


Figure 12: Flood control reservoir (source: TEMPOS study, 2021)

### Mitigation measures on Vipava

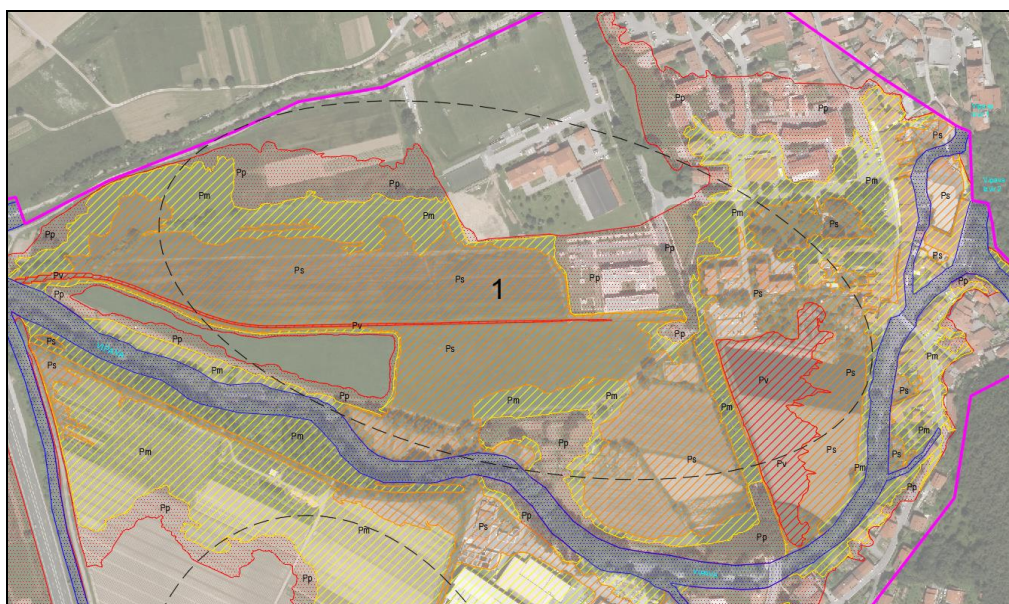


Figure 13: Flood hazard classes map in area no. 1: Frnaža in police (source: TEMPOS study, 2021)

Measures:

- *Relief channel*

- L = 900 m
- channel bottom width = 10 m
- slope of banks, n = 2:3
- bottom slope from 0.1 to 0.2%
- channel depth = average 1 m

- *New bridge*

- opening width = 20 m
- width of the carriageway = the same as the existing Goriška cesta

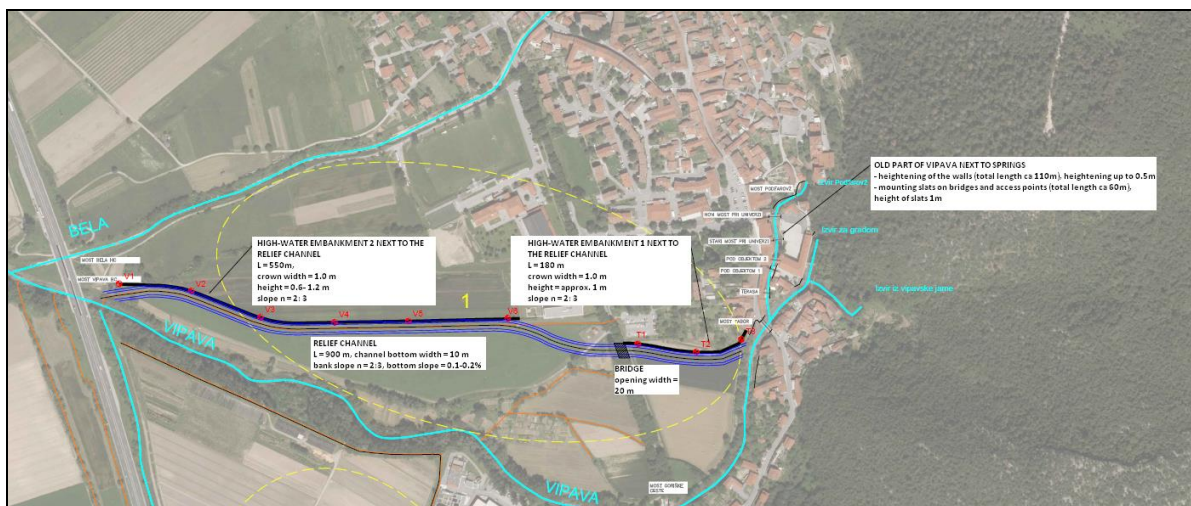


Figure 14: Map with measures in area no.1 (source: TEMPOS study, 2021)

- *High-water embankment 1 (upstream embankment next to the relief channel)*

- L = 180 m
- crown width = 1.0 m
- height = approx. 1 m
- slope n = 2:3

- *High-water embankment 2 (downstream embankment next to the relief channel)*

- L = 550 m
- crown width = 1.0 m
- height = 0.6- 1.2 m
- slope n = 2:3

- *Heightening of the walls along the Vipava river (from the springs to the Tabor bridge)*

- length of existing walls that need to be exceeded = approx. 110 m
- heightening up to 0.5 m

- Prefabricated elements (installation of fixed grooves and bearings and purchase of prefabricated slats)

- required length of mounting slats = approx. 60 m
- height of slats approx. 1m

### Mitigation measures at Polžarica

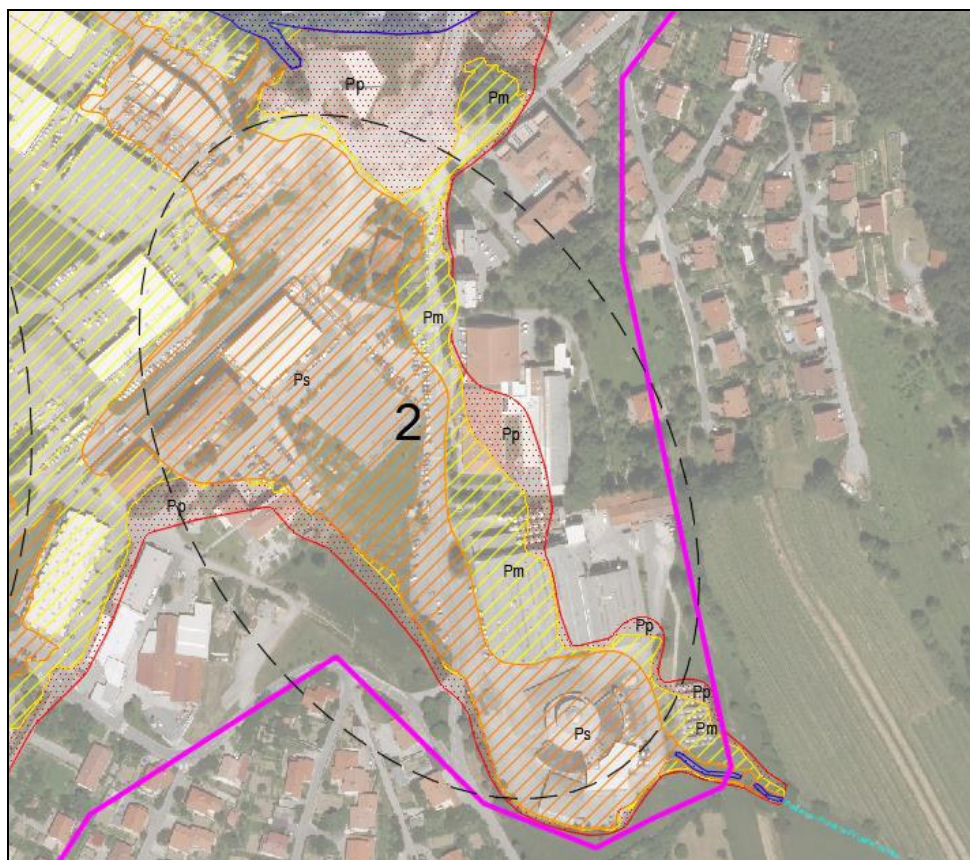


Figure 15: Flood hazard classes map in area no. 2: Along the Vinarska road and industrial zone Mlekarna (source: TEMPOS study, 2021)

#### Measures:

- Stabilization barrier

- above inflow into the existing pipeline
- height = approx. 1.5 m
- forming a small floodplain

- Reconstruction of the existing pipeline

- in length of 245 m
- concrete pipes DN1400
- will translate discharge of Q100 (3.6 m<sup>3</sup>/s)



- Regulation of the riverbed downstream of the stabilization barrier
  - bank protection with stone
- Relief channel
  - length = 250 m
  - starting at the end of reconstructed pipeline until the existing reclamation ditch
- Reconstruction of the existing reclamation ditch
  - in length of 860 m
  - deepening and partial widening of the channel
  - reconstruction until the outflow into Gacka

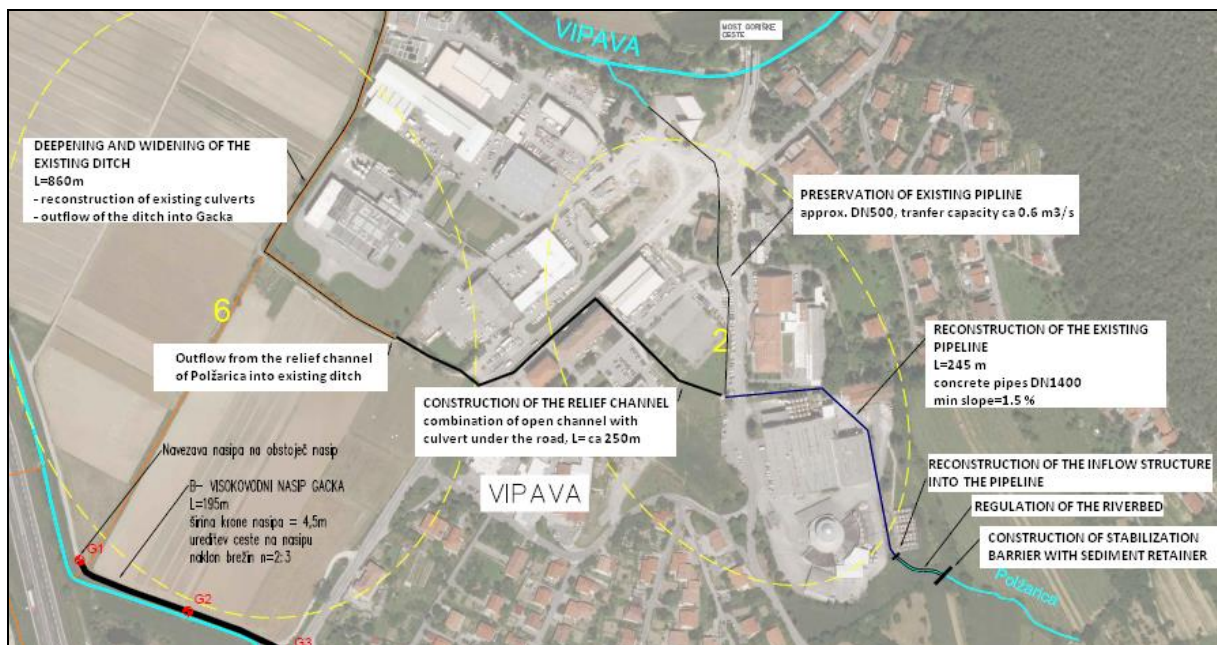


Figure 16: Map with measures in area no.2 (source: TEMPOS study, 2021)

## 5. IMPACT OF PROPOSED MEASURES

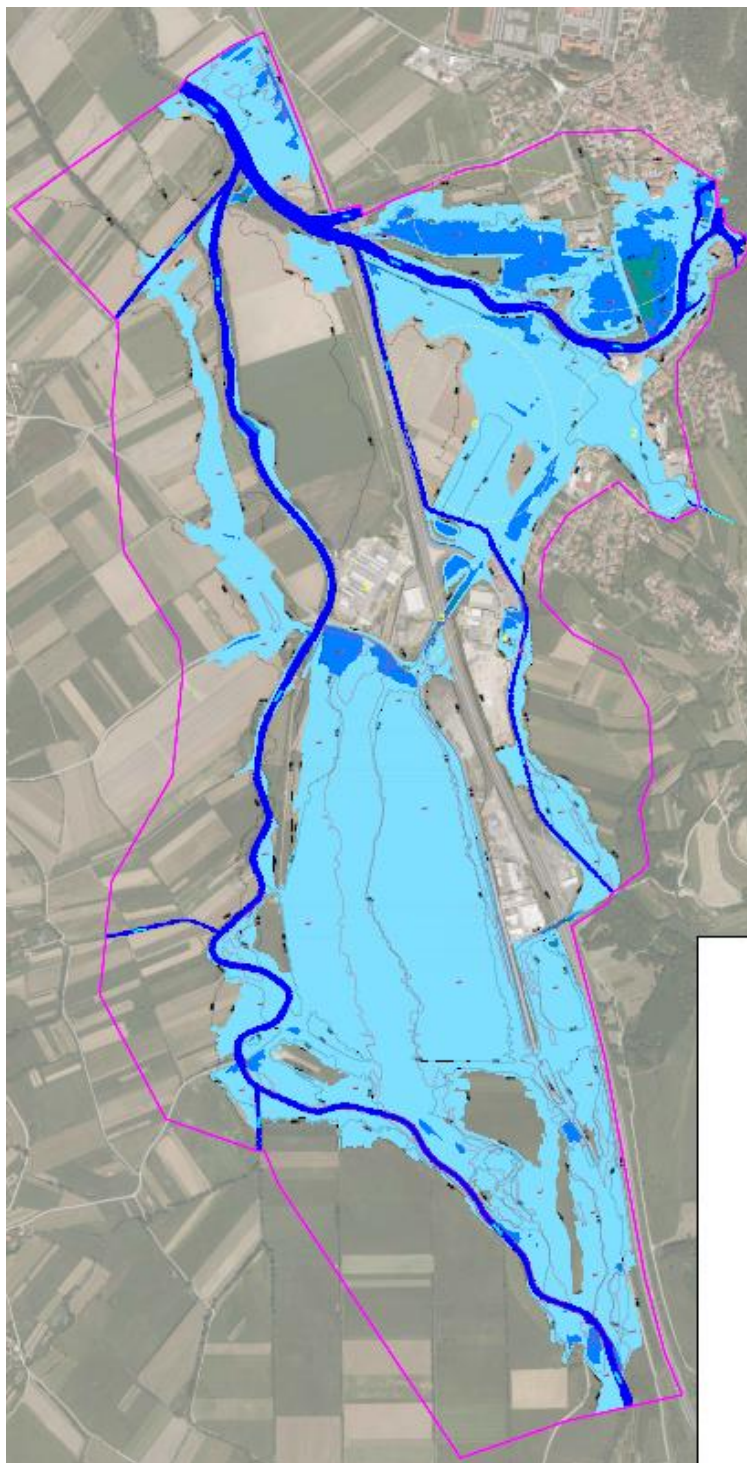


Figure 17: Flood hazard map for Q100 before measures' implementation (source: TEMPOS study, 2021)

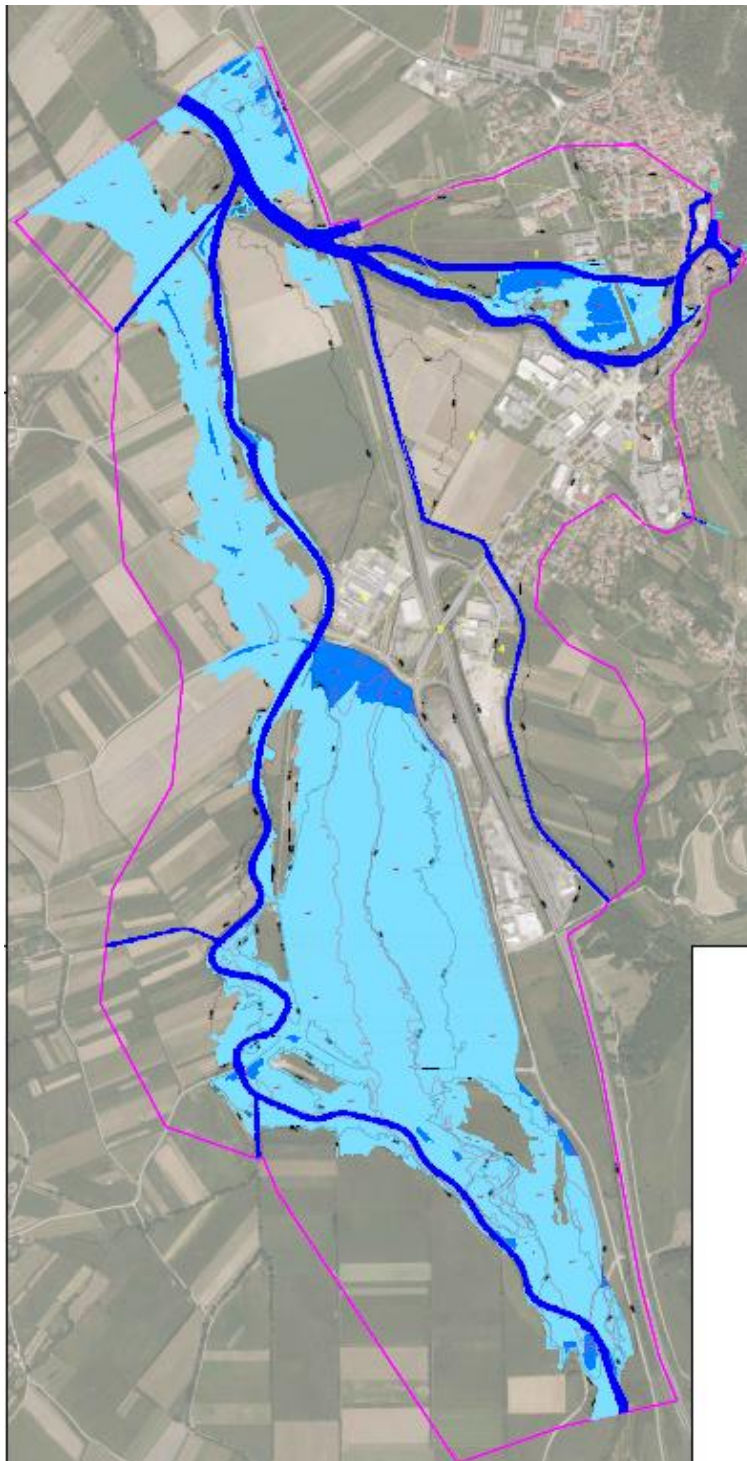


Figure 18: Flood hazard map for Q100 scenario after measures' implementation (source: TEMPOS study, 2021)

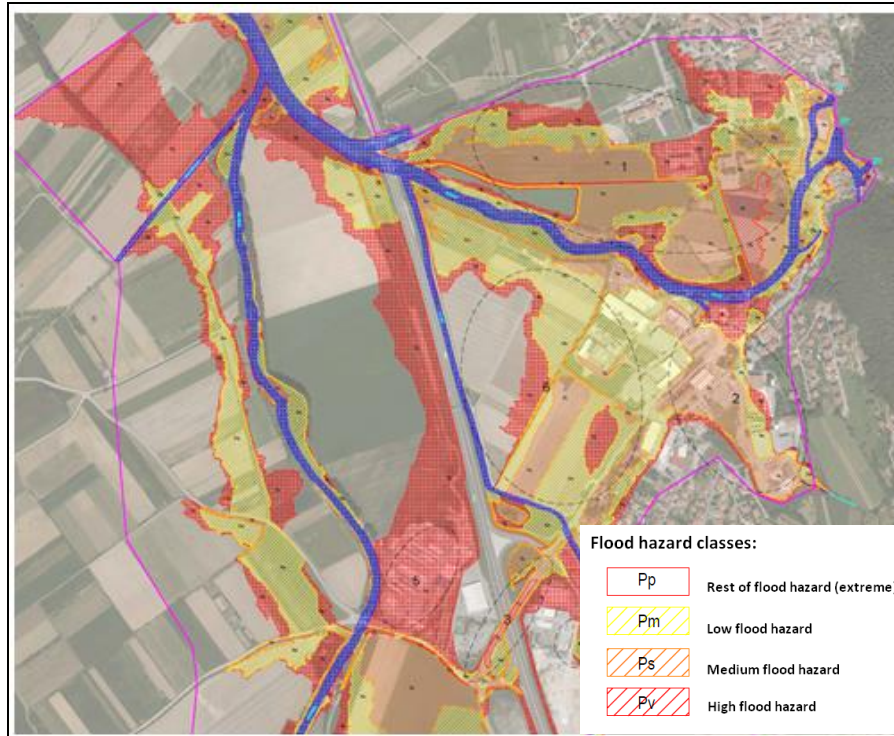


Figure 19: Map with flood hazard classes before measures' implementation (source: TEMPOS study, 2021)

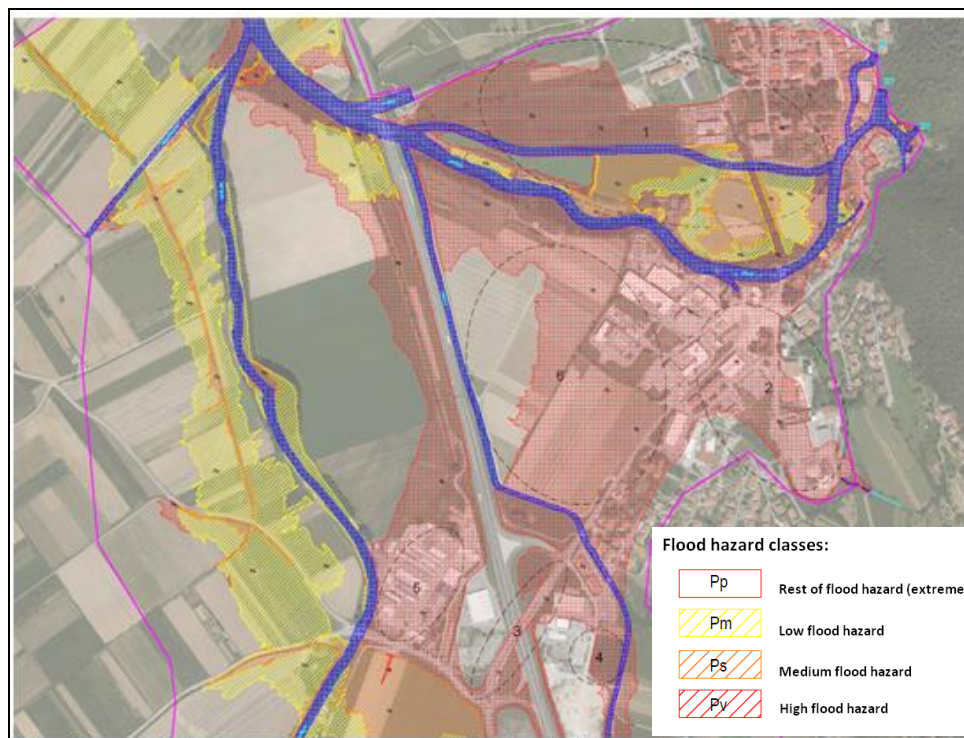


Figure 20: Map with flood hazard classes after measures' implementation (source: TEMPOS study, 2021)

## 6. DESCRIPTION OF THE PROPOSED ARRANGEMENTS IN THE AREA OF MOČILNIK

In November 2021 the study "*Design of measures to reduce the risk of flooding in selected areas of Vipava*" was prepared (No. 145/2021, Tempos Company, November 2021). In the first part of the study the existing flood risk in the wider area of the Vipava Municipality was analysed. In the second part of the study the design of measures to reduce the risk of flooding in selected areas of Vipava was developed. The planned measures were analysed with a hydraulic model: the result of the analysis of the planned measures is the flood hazard maps for the planned situation.

Based on the achieved results, during the 8<sup>th</sup> reporting period, the municipality of Vipava decided to contract further external services aimed at elaborating all the documentation required to get building permit for a 2,340 m long high-water embankment in Močilnik, so that the investment could be built in next future. In detail all the proposed measures minimally interfere in the watercourse riverbeds, thus preserving their habitats and morphology.

## 7. COSTS AND FINANCING

Incurring cost until 7<sup>th</sup> reporting period:

	<i>Provider</i>	<i>Explanation</i>	<i>WP3.2</i>
External assistance	Tempos d.o.o.	Project documentation - geodetic surveys	8.296,00
	Gromap geodetic services	Project documentation - preparation of conceptual designs of the necessary measures to reduce the risk of floods	14.200,15
	Tempos d.o.o.	Project documentation – geodetic surveys	7.198,00
	Tempos d.o.o.	Project documentation – geodetic surveys	9.272,00
Total			38.966,15

Incurring cost during 8<sup>th</sup> reporting period:

	<i>Provider</i>	<i>Explanation</i>	<i>WP 3.2</i>
External assistance	Tempos d.o.o.	Conceptual design to obtain project conditions	3.721,00
	Gromap geodetic services	Supplementing the geodetic plan for the project documentation to obtain opinions and a building permit for the Močilnik area - construction of high-water embankments along the Manče-Vipava and Razdrto-Manče routes in the size of approx. 8.5 ha and updating the recording with the new land cadastre.	6.832,00
	Tempos d.o.o.	Preparation of documentation for obtaining a building permit and project documentation for construction: The guiding plan to demonstrate the consistency of project solutions with spatial acts, the fulfilment of the essential construction requirements, geological geomechanical elaborate, hydrological hydraulic elaborate, preparation of project task for Water Agency – reconstruction of the roads, coordination.	48.373,00
	Public Forest Service	Agricultural land fund consent	61,00
	Total		

## 8. CONCLUSION

For the selected areas in the municipality of Vipava, hydrological and hydraulic analysis and expert bases for the implementation of measures to reduce flood risk were prepared. A full 2D hydraulic model was developed, new hydrological starting points were used (Water Agency, 2021) and flood and erosion maps were prepared for the existing and forecasted condition (with proposed measures). Descriptions are given for all measures, accompanied by the basic characteristics of the proposals (dimensions, geometry, size of the retainer, placement in space). All the proposed measures aim to ensure or improve flood safety in selected areas, while minimally interfering in the watercourse riverbeds, thus preserving the habitats and morphology of existing watercourses.

According to the analyses carried out, during the 8<sup>th</sup> reporting period, Municipality decided to elaborate further documentation by external consultant in order to get building permit for proposed mitigation measures in the selected area of Močilnik. In this way, the proposals of mitigation measures can be later implemented. In detail, in June 2020, an agreement had been signed between Municipality of Vipava and Water Agency of Republic of Slovenia (DRSV) to implement the proposed mitigation measurements to prevent flood events and protect the citizens of Vipava settlement. Water Agency will audit all the project documentation done by Municipality of Vipava related to this task, implement the investment and report to the authorities on the implementation of the investment in collaboration with Municipality of Vipava.

## **Report tecnico - Documentazione progettuale del Comune di Vipava**

Il presente report rientra tra le attività previste dal Work Package 3.2 del progetto VISFRIM. L'obiettivo del WP3.2 è quello di ridurre la pericolosità ed il rischio idraulico nell'area del programma attraverso l'elaborazione di progetti ed analisi costi-benefici, in modo da poter realizzare a breve investimenti strutturali nel territorio.

In particolare, per alcune aree ricadenti nel comune di Vipava, sono state preparate analisi idrologiche e idrauliche per valutare l'impatto di interventi di mitigazione. Tutte le misure proposte sono state progettate col fine di aumentare la sicurezza idraulica, impattando il meno possibile sui corsi d'acqua, in modo da preservare gli ecosistemi e la morfologia degli ambienti fluviali esistenti.

Lo studio elaborato definisce l'ordine di priorità degli interventi, per i quali sono state elaborate delle schede descrittive (dimensioni, geometria, ubicazione, etc). I risultati dello studio consentiranno infine di avviare l'iter procedurale previsto per l'acquisizione del permesso di costruire.

## **Tehnično poročilo - Projektna dokumentacija za Občino Vipava**

To poročilo je del aktivnosti delovnega paketa 3.2 – Projektna dokumentacija VISFRIM projekta. Cilj D.P. 3.2 je zmanjšati hidravlično nevarnost in s tem poplavno ogroženost na programskem območju z izdelavo projektne dokumentacije/analize stroškov in koristi, da bi lahko v prihodnje izvajali manjše strukturne investicije.

Za izbrana območja v občini Vipava sta bili s strani zunanjih svetovalcev izdelani hidrološka in hidravlična analiza o izvajanju protipoplavnih ukrepov. Opisi so podani za vse ukrepe, vključno z osnovnimi značilnostmi predlogov (dimenzije, geometrija, lokacija itd.). Vsi predlagani ukrepi so namenjeni zagotavljanju oziroma izboljšanju poplavne varnosti na izbranih območjih ob minimalnem poseganju v struge vodotokov in s tem ohranjanju habitatov in morfologije obstoječih vodotokov.

Izdelana študija je podlaga za določitev potrebnega prednostnega reda protipoplavnih ukrepov in za vložitev vloge za gradbeno dovoljenje.