

D.T4.3.2 ACTION PLAN FOR ADAPTION OF MAR INTO RELEVANT NATIONAL POLICIES AND STRATEGIES PREPARED

Slovakia
PP6 Water Research Institute

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INTRODUCTION

The present national Action Plan provides the suggestions for adopting MAR solutions in national water resource management schemes, policy strategic documents, water management legislation, etc. as comprehensive and easy-to-follow document for the decision-makers.

GENERAL INFORMATION

Project	DEEPWATER-CE
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1. BACKGROUND AND APPROACH OF MANAGED AQUIFER RECHARGE SCHEME AND ITS ADOPTION AND / OR INTRODUCTION INTO NATIONAL LEVEL STRATEGIES AND WATER MANAGEMENT PLANS

Managed Aquifer Recharge (MAR) refers to a suite of methods that are increasingly being used to maintain, enhance, and secure the balance and quality of groundwater systems under stress. These methods apply processes for the increasing recharge by which excess surface water is intentionally directed into the subsurface. Several different MAR techniques can be applied in order to replenish an aquifer and store water there (Tab.1, Fig. 1). MAR techniques offer promising solutions for water management, also with regard to tackling future climate change impacts (Casanova et al., 2016; Dillon et al., 2019; Dillon, 2005; Sprenger et al., 2017).

Tab. 1. Selected **6 MAR** types of DEEPWATER-CE project:

	Main MAR Methods	Specific MAR Methods
Techniques referring primarily to infiltrated water	Spreading methods	Infiltration ponds
		Flooding
		Ditches and furrows
		Excess irrigation
	Induced bank filtration	River/lake bank Filtration
		Dune filtration
	Well, shaft and borehole recharge	Aquifer Storage and Recovery (ASR)
		Aquifer Storage, Transfer and Recovery (ASTR)
		Shallow well/shaft/pit Infiltration
	In-channel modifications	Recharge dams
		Subsurface dams
		Sand dams
		Channel spreading
	Runoff harvesting	Rooftop rainwater harvesting
		Barriers and bounds
Trenches		

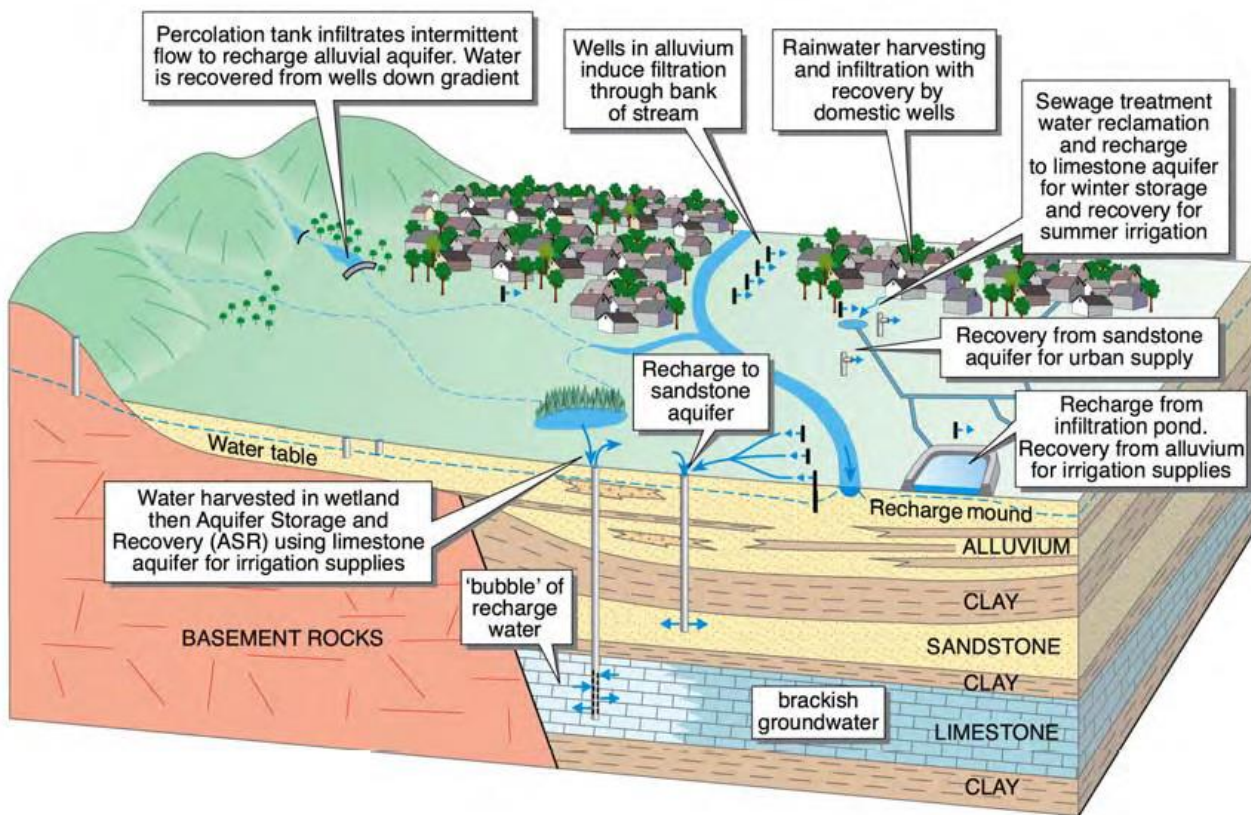


Fig. 1. Example of MAR applications to several contexts (Dillon et al., 2009)

DEEPWATER-CE project's consortium of partners developed a transnational knowledge base on the applicability of MAR in CE; transnational assessment methodology for decision-making on MAR locations in CE and feasibility assessment of establishing MAR schemes in CE including pilot sites investigation. These activities provided a knowledge base to develop policy recommendations and national action plans. This chapter provides short overview of the activities aiming at preparation of Action plan for MAR implementation.

MAR is applied to sustain and augment groundwater quality (e.g. to improve water quality in degraded aquifers, to reduce the concentration of geogenic pollutants like fluoride or arsenic, to reduce effort for water treatment, quantity, etc.); quantity (e.g. to store water in aquifers for future use; to increase groundwater levels in over-exploited aquifers, etc.) and also environmental management (e.g. to prevent storm runoff and soil erosion; to preserve environmental flows in rivers and streams; to mitigate floods and flood damage; to control seawater intrusions; to reduce land subsidence; to provide hydraulic control of contaminant plumes; to increase groundwater levels to maintain or improve the status of groundwater dependent terrestrial ecosystems, etc.) (DEEPWATER-CE, 2020a)

The project partners decided to study deeply selected six MAR types at pilot sites: Ditches and Induced river and lake bank filtration (Poland); Underground dam (Hungary), Infiltration ponds and Aquifer storage and recovery (Croatia) and Recharge dam (Slovakia). The pilot sites were selected based on methodology (Fig.2) developed within Deepwater-CE project (DEEPWATER-CE, 2020b). Following the general and specific selection criteria and sensitivity of MAR sites to extreme climate events were applied in corresponding states to choose proper pilot sites.



Identification of potential MAR application

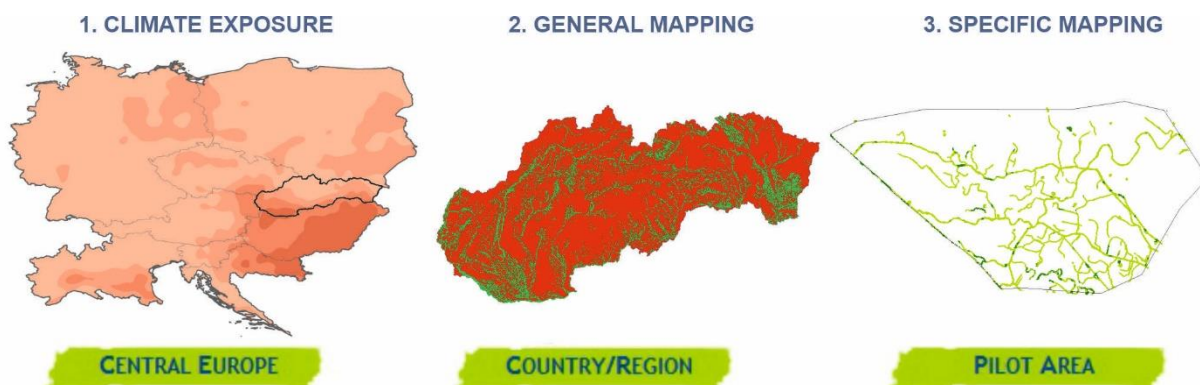
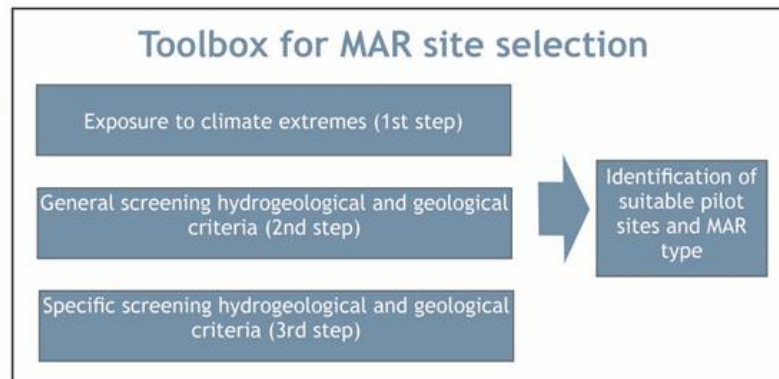


Fig. 2. Scheme for MAR site selection based on Toolbox

At these pilot sites the fieldwork and laboratory research provided the necessary input data in numerical modelling of groundwater recharge or filling the knowledge gaps in further investigation. Furthermore, in each pilot site there was elaborated the preliminary environmental impact assessment (DEEPWATER-CE, 2022a)

Each partner studied at pilot site different MAR scheme for different purpose. In Slovakia, the pilot area is in Žitný Ostrov. From the long-term point of view groundwater regime in pilot area was influenced by the Gabčíkovo Waterworks. The Hrušov water reservoir (part of Gabčíkovo waterworks) fills left-hand seepage channel, which is the water supply source for channel network of the Žitný Ostrov. Pilot area is roughly delineated by the towns of Šamorín, Dunajská Streda and Gabčíkovo, i.e. it is bordered by primary channel S VII (Gabčíkovo-Topoľníky channel) and secondary channels A VII (Vojka-Kračany,) and B VII (Šuľany-Jurová,) (Fig. 3). The dense network of irrigation channels equipped with technical tools (sluices/gates) for regulation of water flow is a crucial point to create recharge dam MAR type, i.e. accumulation of water between closed sluices. The pilot area is agricultural land.

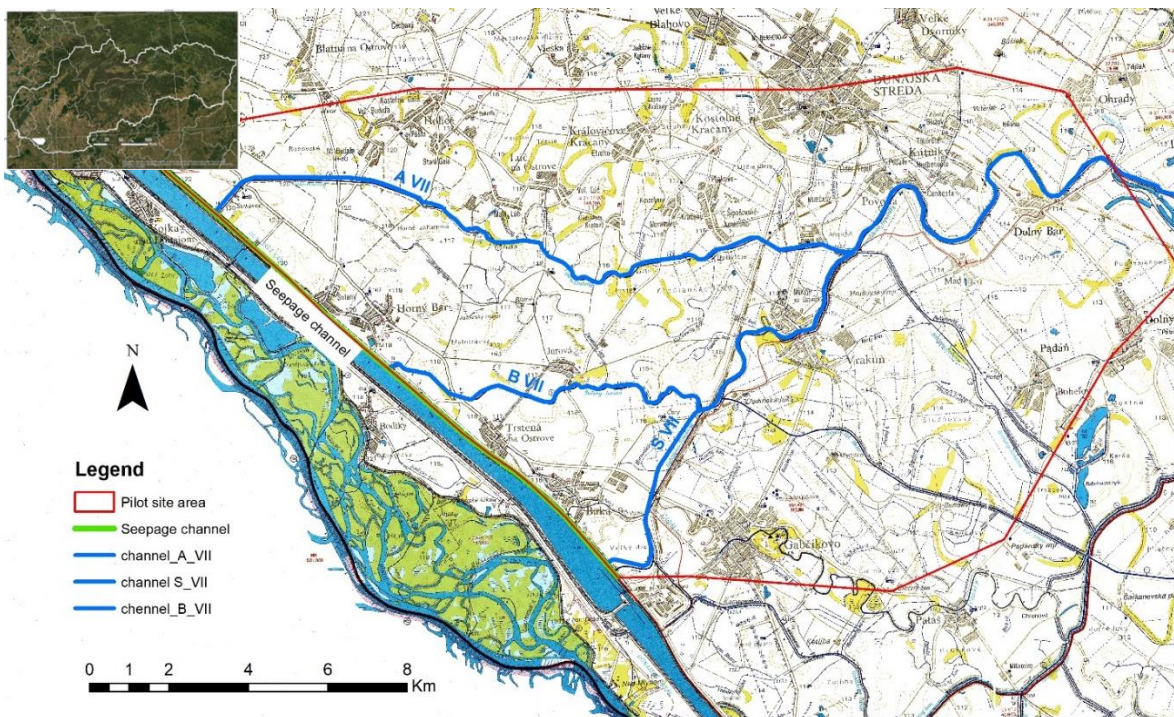


Fig. 3. Pilot site area in Žitný Ostrov

The investigation work in pilot site started by desktop analysis, followed by fieldworks and laboratory measurements and numerical modelling. Modelling by MODFLOW and HYDRUS model enabled to evaluate the potential amount of water infiltrated water into groundwater. The results of modelling showed the potential infiltration amount of surface water to groundwater - in Prognosis 1 (i.e. closed existing weirs in channel Vojka-Kračany) it corresponds to 37910 [m³.d⁻¹] in wet year and 23598 [m³.d⁻¹] in dry year and in Prognosis 2 (i.e. situation in Prognosis 1 + modelled 3 additional weirs in channel Vojka-Kračany) it corresponds to 41213 [m³.d⁻¹] in wet year and 32789 [m³.d⁻¹] in dry year.

The projected water demand in 30 years is evaluated in the range - min 8,699,090 m³ and max 15,004,000 m³ while the expected water supply in dry year is 11,967,985 m³ and in wet year 15,042,745 m³ (data from numerical modelling). Then economic assessment of projects checks whether the net benefit of the project's implementation is positive. Cost-Benefit analysis showed that the MAR scheme is economically feasible; having a positive expected NPV over 30 years of project lifespan.

The risk assessment of MAR schemes recognized possible risks for the MAR system coming from environmental and human health, technical, socio-economic, governance and legislative risks as well as risks related to the sensitivity of MAR to climate-induced extreme situations.

More information about the pilot site investigation and results is available in report O.T3.3 Pilot feasibility study of MAR schemes with integrated environmental approach in porous geological conditions in Slovakia (DEEPWATER-CE, 2022b).

Since Slovak legislation (similar to other Central European countries) doesn't involve MAR solutions as the possible answer to tackle climate change impacts, the project partners prepared set of policy recommendations to include MAR solutions into the legislation ((DEEPWATER-CE, 2022c). The transnational (English) version was translated into national languages and discussed with decision makers in order to gather valuable inputs from these stakeholders how to proceed.



2. VISION OF ACTION PLAN

Managed Aquifer Recharge (MAR) is the method for replenishing groundwater supplies to tackle climate change impacts. Climatic models for upcoming periods in optimistic and pessimistic scenarios showed the “hot” regions in Slovakia which would be attacked by extreme climate events, i.e. droughts and floods. Water retention in wet periods allowing water infiltration into aquifers is studied by DEEPWATER-CE project. The idea to harmonise the investigation of MAR solutions with their transposition into legislation to apply them in practice is one of the objectives of DEEPWATER-CE project. The project activities in Central European states revealed the gaps and in many cases absence of MAR solutions in valid legislation. Therefore, the vision for upcoming periods is to incorporate MAR solutions in binding and executive documents of Central European states.

The aim of Action Plan is to involve the topic of managed aquifer recharge among topical issues and to provide guidelines how to carry it out. The plan will overview objectives, priorities, timeline, potential funding and necessity of institutional background, e.g. stakeholders with influence on policy recommendations, institutional capacity of target group organisations. The important issue is the transferability of Action Plan into Central European countries.

The Action Plan will provide a vision of MAR schemes usage in practice, but its proper implementation needs the changes in legislation and consecutively involvement of this topic into executive documents, e.g. River Basin Management Plans (RBMP). Since the third RBMP in EU countries is currently under finalisation, the MAR schemes can be considered and implemented within the upcoming one. From the legislative viewpoint, in Slovakia, there is no legal framework for MAR. Rules related to water management are established by 2000/60/EC EU Water Framework Directive (WFD) and water related Directives, which are transposed to national legislation in Act No. 364/2004 Coll. (Water Act) and related decrees and Regulations. These are the documents where we can expect the changes towards MAR solutions appliance.

Moreover, on EU level there is under preparation the guidance on Managed Aquifer Recharge implementation by the CIS Working Group on Groundwater. The working group develops practical guidance to understand the general principles of Managed Aquifer Recharge (MAR) and to comply with requirements of EU legislation. The EU Water Framework Directive (WFD) establishes a framework for the protection of water bodies, which inter alia is intended to promote sustainable water use. MAR could support the sustainable use of water resources by increasing the available resource-base, provided that this does not jeopardize the qualitative status of the replenished groundwater body.

However, after completing of MAR guidance and involving MAR solutions into EU binding documents, the member states will have top-down support to implement MAR schemes to ensure sustainable usage of groundwater sources in climate change impacts.

3. OBJECTIVES, PRIORITIES, TIMELINE AND POTENTIAL FUNDING PROGRAMME OF ACTION PLAN, NECESSARY INSTITUTIONAL BACKGROUND

The necessity of Action Plan development originates in DEEPWATER-CE project outcomes as the logical process of putting MAR solutions into practice. The needs for MAR application is obvious from climatological models, social development and demographic growth, which can aim at conflicts among users.



Moreover, the task posed on water management in Slovakia is to re-assess the price of groundwater. At present it is very low and it doesn't correspond to the needs of water sources protection. The necessity to replenish groundwater supplies to be sustainable in the future shall be a key topic soon.

Slovak project partner has identified the following objectives of MAR implementation:

- **Consider MAR solutions in integrated water resources management framework**
The member states recognise an initiative of the EU commission to include MAR schemes into relevant documents and subsequently into EU water related legislation as the crucial step towards implementation of MAR into practice. Even the legislation on EU level is not valid; the states have found gaps and have described steps for MAR adoption.
- **Recognise distinct challenges posed by MAR**
Among challenges of MAR system is the recognition of source water in suitable quality and quantity, the avoidance of groundwater pollution by source water, performing the risk assessment analysis, establishing the effective monitoring system of MAR installation, etc.
- **Identify the most impactful actions**
The most impactful actions on MAR installation will be identified in preparation phase using the risk management (developed in the frame of DEEPWATER-CE project) and in operational phase by evaluation of monitoring data.
- **Protect public health**
In case the MAR type is used for drinking purposes, the system must ensure the corresponding drinking water quality to protect public health. The required water quality limits shall be met also in using water for agriculture.
- **Protect environment and ecosystems**
Replenishment of the groundwater supplies should have a positive impact on biodiversity and sustainability of ecosystems.
- **Promote actions based on partnership and collaboration**
Common understanding of positive impacts of MAR schemes on aquifers recharge and consequently on sustainable water usage shall be supported by establishing strong cooperative group of stakeholders.

These objectives should be supported by following actions, as obvious from Action Plan (Table 2):

1. **Coordinate actions with EU activities to integrate MAR**
2. **Integrate MAR actions at the watershed scale to tackle climate change impacts**
3. **Compile fit-for-purpose specifications**
4. **Improve communication on MAR benefits**
5. **Put into practice pilot/ operational MAR sites**

The corresponding actions including description, timetable, responsible bodies and financing are listed in Table 2.

Prior to include MAR schemes into executive documents, it is necessary to integrate MAR solutions into Slovak legislation, which requires to follow up the national rules in acts preparation. The right to submit acts have the government, the members of the National Council of the SR and the committees of the National Council of the Slovak Republic. The legislative proposal is prepared only in the case of laws with an expected significant economic and financial impact or if the government decides to do so. The legislative proposal approved by the government, is a binding basis for the submitter to draft a bill. Following a bill drafting is public hearing and comment procedure; or only the comment procedure. The aim of the public hearing is to inform the public about the bill before it is submitted for comments. The comment procedure is used to discuss the bill with the relevant authorities and institutions.



The bill, adjusted according to the results of the comment procedure, is submitted to the Legislative Council. If the Legislative Council gives its assent to the bill, the bill shall be submitted to the Government.

The government bill is signed by the Prime Minister and the Minister who submitted the bill and then delivered to the President of the National Council.

The bill comes into three readings in National Council. If no amendments or additional proposals have been approved at the third reading, the vote on the bill as a whole will take place. At least a majority of all Members need to be present when ratifying the bills (76). In order to approve a proposal, it is necessary for at least a majority of the present Members to vote for the proposal (min. 39 Members). To be valid, the law must be signed by the 3 highest constitutional officials - the Prime Minister, the Chairman of the National Council of the Slovak Republic and the President. The Act is effective on the fifteenth day after its publishing in the Collection of Laws, unless a later date of entry into force is provided therein.

The new legislation should tackle the definition of the share of groundwater and surface water abstractions in relation to MAR; regulation of fees for the water use; rules on designation of protection zones, on the quality of the source water and water supplied by the MAR, on risk assessment for MAR schemes and on MAR monitoring.



Table 2: Action Plan

No.	Action	Description	Timetable	Responsible bodies	Financing
1	Coordinate actions with EU activities to integrate MAR	<ul style="list-style-type: none"> to harmonise the activities on EU level with national ones, e.g. Concept of Water Policy in Slovakia, (EU MAR guidance document is expected to be published/adopted soon) start the process to integrate MAR schemes in related legislative documents (e.g. legislation in the field of quantitative relationship of groundwater and surface water; regulation of water use permissions and charges; designation of protection zones; risk assessment and monitoring of quality and quantity of water, etc.) 	<p>expected by 2022 - 2024</p> <p>2024-2027</p>	Ministry of Environment of SR, Ministry of Agriculture and Rural Development of SR	EU financial mechanisms, state budget, local or national financial sources, private investments, etc.)
2	Integrate MAR actions at the watershed scale to tackle climate change impacts	Based on EU documents and valid national legislation focus on incorporating MAR solutions into executive documents, e.g. River Basin Management Plans, Code of Good Agricultural Practice	2026-2027	Ministry of Environment of SR and Ministry of Agriculture and Rural Development of SR through their sectoral institutions	
3	Compile fit-for-purpose specifications	<p>Focus on MAR specifics:</p> <ul style="list-style-type: none"> Design and construction phase - consider climate, hydrogeological and geological conditions; purpose of water usage (drinking, agriculture, ecosystems, industry); source water quantity and quality; MAR technical possibilities, awaited risks, social aspects, etc. Operational phase - monitoring of MAR source water availability; aquifer monitoring (water recharge, source water quality, groundwater level, etc.); monitoring of usage water quality (drinking, agriculture, ecosystems, industry); monitoring of risks, water demand aspects, economic aspects, etc. 	<p>2022-2024</p> <p>2025-2027</p>	Hydromelioracie, Slovak Water management Enterprise, water utility companies, State Geological Institute of Dionyz Stur, Slovak Hydrometeorological Institute, Slovak Agrarian Chamber, Slovak agricultural and Food Chamber, Groundwater Commission, local administration, private companies (engineering, construction, water quality laboratories, etc.), farmers (animal or crop production), ecologists, industrial users	



No.	Action	Description	Timetable	Responsible bodies	Financing
4	Improve communication on MAR benefits	Explain MAR principles and benefits, and promote MAR solutions among experts, decision-makers and general public via leaflets, promotional videos, web information, spots on social media, organisation of related events/meetings, etc.	2022-2027	Ministry of Education, Science, Research and Sport of SR with related institutions; Slovak Environmental Agency; NGOs focused on education; etc.	
5	Put into practice pilot/operational MAR sites	Concentrate on investigation of local climate, geological, hydrogeological, environmental and social conditions, usage requirements, etc. in order to fit suitable MAR types (e.g. ditches, river and lake bank filtration, recharge dam, infiltration ponds, aquifer storage and recovery, etc.) at pilot sites up to operational phase	2024-2030	water management institutions, private sector, water users (water supply companies, farmers, nature protection organisations, etc.); local administrations; technical background companies (engineering, construction, water analysing laboratories, etc.); educational institutions; general public	



4. EXPECTED RESULTS AND TRANSFERABILITY

The final expected result of the Action Plan is involving MAR solutions into practice among the measures to tackle climate change impacts via integration of MAR solutions in relevant legislative documents. Moreover, enabling policy framework for MAR in the targeted countries aims in facilitation of the long-term sustainability of water supplies in the Central Europe region.

These result should be reached by effective and addressed applying of Action plan activities (Chapter 3, Table 2) concentrated on legislation, executive documents, practical use and promotion of MAR solutions.

4.1. Stakeholders and their influence - policy recommendation

To implement the MAR solutions into practice requires wide, efficient and tolerant cooperation of involved stakeholders, target groups and managing bodies. In this case, the stakeholder is every person, group of persons or representative of institution with an interest in DEEPWATER-CE topic. Stakeholders are not legally bound to participate in the project and its activities, but rather voluntarily participate in order to create added value to the project outputs and benefit from its implementation and results. Involvement of the stakeholders is crucial, especially related their roles in settling the MAR schemes in practice.

In Slovakia, the recharge dam MAR type was investigated in pilot site located in Žitný ostrov. The MAR is intended to be used for agricultural purposes. Therefore, the crucial stakeholders, as decision makers and implementers are Ministry of Environment of SR and Ministry of Agriculture and Rural Development of SR with their sectoral institutions. The ministries can prepare the bills for implementing MAR schemes into legislation and also elaborate plans (e.g. River Basin management Plan) and strategies/guidelines (e.g. Code of Good Agricultural Practice; Concept of Water Policy in Slovakia).

Stakeholders, important in design, construction and operational phase of MAR project are:

- Ministry of Environment of SR and Ministry of Agriculture and Rural Development of SR - policy makers
- local administration - MAR planning and permitting
- private companies - engineering, construction, water quality laboratories, etc.
- institutions originated by Ministry of Environment of SR to deal with geological and hydrogeological conditions and water abstraction, e.g. Slovak Water Management Enterprise, State Geological Institute of Dionyz Stur, Slovak Hydrometeorological Institute, Groundwater Commission, etc.
- Hydromelioracie and water utility companies - water supply
- Water users - representative bodies of farmers, e.g. Slovak Agrarian Chamber, Slovak Agricultural and Food Chamber, farmers - animal or crop production, etc., industrial users
- Ecologists
- Promotion and public awareness raising stakeholders, e.g. Ministry of Education, Science, Research and Sport of SR with related institutions; Slovak Environmental Agency; NGOs focused on education; etc.

The list of stakeholders is not exhausted, it could be updated based on applying different MAR method or different purpose of MAR usage. The relevant stakeholders identified by DEEPWATER-CE project consortium are detailed in Transnational Cross-sectoral Stakeholder Group database (DEEPWATER-CE, 2021).

Although the river bank filtration is long-term used in Slovakia for drinking water supplies, this method is not known as managed aquifer recharge (MAR). Therefore, MAR is considered as the new issue, which should be reflected in the legislation and executive documents. The process of

involving MAR as the new method to tackle climate change requires additional institutional capacities and financial sources.

In the first step, the Ministry of Environment of SR and Ministry of Agriculture and Rural Development of SR as managing bodies will need personnel to prepare strategic documents (e.g. Action Plan for MAR adopted by Slovak Government). Capacity building in this field at ministerial level can support the updating the relevant acts (as 364/2004 Coll. Water Act and its Decrees) related to involving MAR schemes into legislation. This process at ministerial level will need the support of sectoral institutions, especially personal capacity of trained personnel in Slovak Water Management Enterprise, State Geological Institute of Dionyz Stur, Slovak Hydrometeorological Institute, Groundwater Commission, Water Research Institute, etc. The supporting institutions will provide the necessary expertise and background knowledge for decision making bodies. This process will demand the additional personal capacity of researchers, technicians and administration covered by financial sources.

4.2. Transferability potentials

The DEEPWATER-CE project observations and outcomes have shown that climate change events will cover wider Central Europe region in the future. Not only Central Europe, but also the whole world is affected by climate change impacts. One of the effective measures to deal with climate change impacts is the proper application of MAR methods summarised in Action Plan. From this viewpoint the Action Plan opens the potentials to be easily applicable, transferable and possible to use in other regions of Slovakia, or moreover, transnationally.

The climatic scenarios have shown that especially western and eastern regions in the South of Slovakia will be highly exposed and extremely exposed to climate change (see Figure 4, 5). Based on climatic scenarios and general and specific screening (geological, hydrogeological conditions and exposure to climate extreme events), there were found several potential locations for 6 selected MAR methods in Slovakia. The construction of MAR schemes depends on water demand and technical possibilities, but we can declare that MAR has a great potential to be applied in many sites in Slovakia.

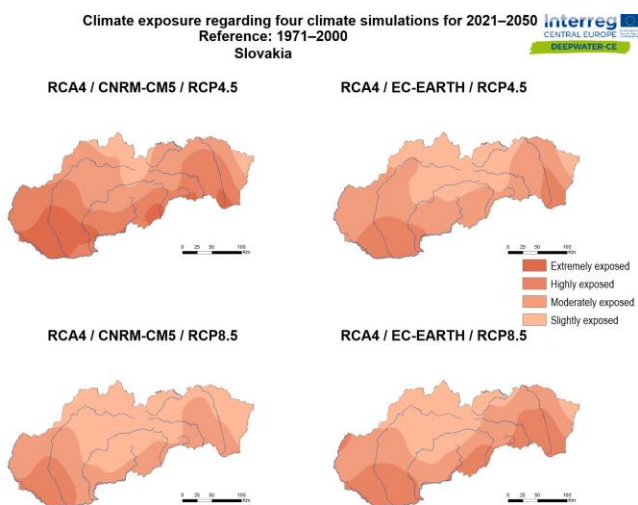


Fig. 4 Scenarios 2021-2050

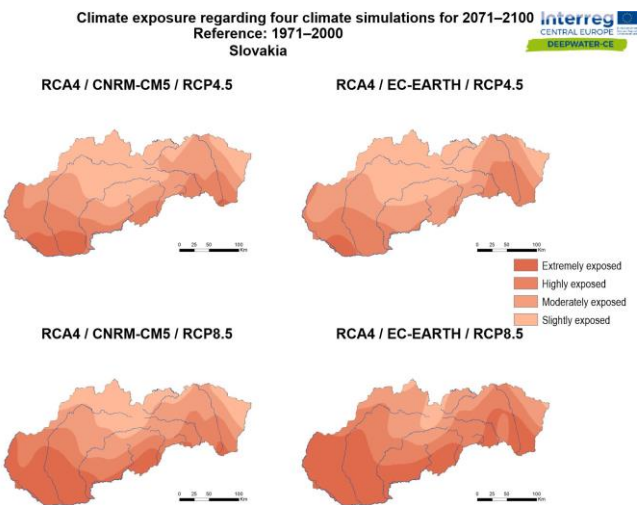


Fig. 5 Scenarios 2071-2100

As mentioned in the previous chapters, the legislative changes (e.g. preparing strategic documents = **Action Plan**, anchoring MAR methods into valid legislation, etc.) should precede its practical implementation and dissemination.



Based on knowledge on climate change recent progress we can note that the information and knowledge on MAR solutions could be applied transnationally with respect to local conditions. Moreover, the transfer of knowledge, outputs and results of DEEPWATER -CE project should allow efficient addressing existing disparities among regions. The developed methodologies and experience gained during the communication with the stakeholders/decision-makers can serve as an added value to other institutions, stakeholders or other regions.

4.3. Influence on the institutional capacity of target group organisations

The body responsible for water management in Slovakia is the Ministry of Environment of the Slovak Republic. The data and technical background is served by its sectoral institutions, which are involved in monitoring of surface water and groundwater bodies, e.g. Slovak Hydrometeorological Institute, Water Research Institute, Slovak Water Management Enterprise. The executive bodies providing licencing and control of water usage are local offices of State Water Administration Authorities, Department of Environment. The water quality and quantity limits compliance is controlled by Slovak Environmental Inspectorate, Department of Water Protection.

The target group of MAR systems in Slovakia were farmers (animal or crop production) and their representative bodies, e.g. Slovak Agrarian Chamber, Slovak Agricultural and Food Chamber. In case of other purpose of water use, the target groups are drinking supply companies, industrial users or ecologists. Promotion and public awareness raising among decision makers, experts, users and public will be demanded in order to utilise MAR methods in practice.

As mentioned above, the MAR methods are new in Slovakia, so the implementation of MAR projects will influence the capacity of target institutions, bodies and individuals. It is worth to mention that water retention measures (to store and infiltrate water to groundwater) in order to tackle the climate change must meet the aims of Water Framework Directive (2000/60/EC). In other words, the taken measures must be ecological friendly, avoiding to build barriers on water courses for water storage.

However, the target groups should benefit from MAR installations. So, the project results and MAR methods advantages should persuade target institutions and users to force these methods into practice. The strategic support provided by the Action Plan (and consequently execution the AP actions) might have an impact to targeted organisations institutional capacity, like influencing their internal protocols, enhancing the knowledge and skills of the employees (e.g. via trainings, instructive videos, web information, etc.).

5. MONITORING OF THE ACTION PLAN

Table 3: An overview of the consultation process of AP preparation

Occasion / event on the AP discussion	Event organisation (date, institution, form)	Aim of discussion	Conclusions / results
Seminar to present project outputs (D.C.5.1)	24.2.2022 Water Research Institute online	To present the results of the project to encourage MAR implementation in Slovakia; to inform about overview of existing water related legislation and gaps in national legislation on MAR solutions.	Supporting MAR implementation in Slovakia



“Roundtable” meeting (D.T4.2.4)	6.4.2022 Water Research Institute hybrid	To present policy recommendation related to MAR implementation to national legislation and Action Plan structure.	Presented five key recommendations with aim to enhance application of MAR into practice
Bilateral meeting (D.C.5.2) with representative of Ministry of Environment of SR	12.4.2022 Water Research Institute personal	To discuss the Action Plan proposal.	Discussing possibilities to involve the AP actions to national Water Policy Concept or to prepare separated AP on MAR solutions.
Bilateral meeting (D.C.5.2) with representative of the Association of Water Companies	22.4.2022 Water Research Institute personal	To discuss the Action Plan proposal.	Discussing the necessity to have valid legislation, which would define qualitative and quantitative parameters for MAR to avoid endangering existing drinking water sources.
Bilateral meeting (D.C.5.2) with representative of Ministry of Agriculture and Rural Development of the Slovak Republic	26.4.2022 Water Research Institute personal	To discuss the Action Plan proposal.	Discussing the preparation of financial support for farmers and guidance to implement MAR schemes for irrigation
Bilateral meeting (D.C.5.2) with representative of the Slovak Association of Hydrogeologists	25.4.2022 Water Research Institute personal	To discuss the Action Plan proposal.	Discussing the threats caused by polluted surface water infiltration to groundwater, quality limits of source water and their control

Within the framework of DEEPWATER-CE project, it is hard to follow the future of the Action Plan. Anyway, the cooperation with stakeholders during the project implementation (trainings, meetings, web information, social media, etc.) should bring results in the way of increasing awareness about benefits of MAR methods and supporting interest of stakeholders and target groups to continue implementation of the MAR solutions in Slovakia.

The outcomes of DEEPWATER-CE project were accepted by Ministry of Environment of the Slovak Republic, the Directorate for Water Protection. The ministry declares that Draft Action Plan, developed by DEEPWATER-CE project partner Water Research Institute, will be the subject of further negotiations with relevant institutions and stakeholders to be adopted by Slovak Government in the future.

6. EXECUTIVE SUMMARY

The present national Action Plan provides the suggestions for adopting MAR solutions in national water resource management schemes, policy strategic documents, water management legislation as comprehensive and easy-to-follow document for the decision-makers.

Managed Aquifer Recharge (MAR) refers to a suite of methods that are increasingly being used to maintain, enhance, and secure the balance and quality of groundwater systems under stress. These methods apply processes for the increasing recharge by which excess surface water is intentionally directed into the subsurface.

The project partners studied selected six MAR types at pilot sites: Ditches and Induced river and lake bank filtration (Poland); Underground dam (Hungary), Infiltration ponds and Aquifer storage and recovery (Croatia)



and Recharge dam (Slovakia). The pilot sites were selected based on methodology developed within Deepwater-CE project (DEEPWATER-CE (2020b)).

In Slovakia, the pilot area was located in Žitný Ostrov in agricultural land. It is roughly delineated by the towns of Šamorín, Dunajská Streda and Gabčíkovo and bordered by channel S VII (Gabčíkovo-Topolňíky channel), channel A VII (Vojka-Kračany,) and channel B VII (Šulány-Jurová,). The network of irrigation channels equipped with technical tools (sluices/gates) for regulation of water flow enabled to create recharge dam MAR type.

The aim of Action Plan is to involve the topic of managed aquifer recharge among topical issues and to provide guidelines how to carry it out. Moreover, on EU level the guidance on Managed Aquifer Recharge implementation is under preparation by the CIS Working Group on Groundwater. However, after involving MAR solutions into EU binding documents, the member states will have top-down support to implement MAR schemes to ensure sustainable usage of groundwater sources as climate change adaptation measure.

In Slovakia, there were identified the following objectives of MAR implementation - i) Consider MAR solutions in integrated water resources management framework; ii) Recognise distinct challenges posed by MAR; iii) Identify the most impactful actions; iv) Protect public health; v) Protect environment and ecosystems and vi) Promote actions based on partnership and collaboration.

These objectives should be supported by following actions with corresponding timetable:

1. Coordinate actions with EU activities to integrate MAR:
 - A/ to harmonise the activities on EU level with national ones (2022-2024);
 - B/ to start the process to integrate MAR schemes in related legislative documents (2024-2027)
2. Integrate MAR actions at the watershed scale to tackle climate change impacts - to focus on incorporating MAR solutions into executive documents (2026-2027)
3. Compile fit-for-purpose specifications:
 - A/ Design and construction phase - to consider climate, hydrogeological and geological conditions; purpose of water usage; source water quantity and quality; MAR technical possibilities, awaited risks, social aspects (2022-2024);
 - B/ Operational phase - monitoring of MAR source water availability; aquifer monitoring; monitoring of usage water quality; monitoring of risks, water demand aspects, economic aspects (2025-2027)
4. Improve communication on MAR benefits - to explain MAR principles and benefits, and promote MAR solutions among experts, decision-makers and general public (2022-2027)
5. Put into practice pilot/ operational MAR sites - to concentrate on investigation of local climate, geological, hydrogeological, environmental and social conditions, usage requirements, etc. in order to fit suitable MAR types at pilot sites up to operational phase (2024-2030)

The plan emphasises the top-down responsibility from Ministry of Environment of SR and Ministry of Agriculture and Rural Development of SR up to public and relates to financing possibilities as EU financial mechanisms, state budget, local or national financial sources, private investments, etc.

The outcomes of DEEPWATER-CE project were accepted by Ministry of Environment of the Slovak Republic, the Directorate for Water Protection. The ministry declares that Draft Action Plan, developed by DEEPWATER-CE project partner Water Research Institute, will be the subject of further negotiations with relevant institutions and stakeholders to be adopted by Slovak Government in the future.



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ANNEX I.



ANNEX I.

Declaration of Intent

On behalf of the decision-making body, Directorate for Water Protection of the Ministry of Environment of the Slovak Republic, I, the undersigned, hereby declare, that the Draft Action Plan designed in the framework of the CE1464 DEEPWATER-CE Project was endorsed by our organisation.

The outcomes of CE1464 DEEPWATER-CE Project were accepted by our organisation.

The Draft Action Plan will be the subject of further negotiations with relevant institutions and stakeholders to be adopted by Slovak Government.

Date: 28. APR. 2022

Roman Havlíček
General Director of the Directorate for Water Protection
Ministry of Environment of the Slovak Republic