

# The Makhoul Dam and its Environmental, Cultural and Social Impact



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Save the Tigris is a civil society advocacy platform aiming to promote water justice in the Mesopotamian basin. Save the Tigris seeks to link groups and movements from Iraq, Turkey, Syria and Iran concerned with the protection of the Tigris and Euphrates Rivers. Our platform provides international solidarity and supports the exchange of knowledge. We advocate for policies that secure ecological justice including the equitable and democratic use of water for all who live in the Mesopotamian region, promoting water as a tool for peace.

[www.savethetigris.org](http://www.savethetigris.org)

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## 1. Introduction

The water resources of Iraq are today under heavy pressure. Political and economic instability<sup>1</sup> have resulted in serious neglect of water management, water infrastructure and the agricultural sector.<sup>2</sup> This has made it difficult for Iraq's water supply to recover from nearly three decades of sanctions, armed conflicts and war,<sup>3</sup> especially in cases where water infrastructure has been one of the direct targets.<sup>4</sup> Today climate change and high levels of water pollution, combined with the dam activity of neighboring countries, have led to a severe water crisis.<sup>5</sup> The water flow of the Tigris and Euphrates have decreased by 30 per cent in the last 40 years. At the same time Iraq's overall water supply is anticipated to decrease by up to 60 per cent between 2015 and 2025. Moreover, Iraq's water crisis is further expected to worsen along with the rapid population growth.<sup>6</sup>

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<sup>1</sup> UN Environment (2019). Global Environment Outlook 6. <https://www.unep.org/resources/global-environment-outlook-6>

<sup>2</sup> Rubaie, A. (2019). Why Iraq's great rivers are drying, online video, Eliis Sam. <https://www.arabamericannews.com/2019/07/04/iraqs-great-rivers-are-dying-as-government-struggles-to-fix-failing-infrastructure/>

<sup>3</sup> Von Lossow, Tobias. (2018). More than infrastructures: Policy Brief water challenges in Iraq. [https://ia801804.us.archive.org/32/items/lossow-pb-psi-water-challenges-iraq/Lossow%20-%20PB\\_PSI\\_water\\_challenges\\_Iraq.pdf](https://ia801804.us.archive.org/32/items/lossow-pb-psi-water-challenges-iraq/Lossow%20-%20PB_PSI_water_challenges_Iraq.pdf)

<sup>4</sup> Rubaie, A. (2019). Why Iraq's great rivers are drying, online video, Eliis Sam. <https://www.arabamericannews.com/2019/07/04/iraqs-great-rivers-are-dying-as-g-overnment-struggles-to-fix-failing-infrastructure/>

<sup>5</sup> United Nations (2013). Water in Iraq Factsheet. Un Iraq Joint Analysis and Policy Unit. <https://www.iraqicivilsociety.org/wp-content/uploads/2014/02/Water-Factsheet.pdf>

<sup>6</sup> Von Lossow, Tobias. (2018). More than infrastructures: Policy Brief water challenges in Iraq. [https://ia801804.us.archive.org/32/items/lossow-pb-psi-water-challenges-iraq/Lossow%20-%20PB\\_PSI\\_water\\_challenges\\_Iraq.pdf](https://ia801804.us.archive.org/32/items/lossow-pb-psi-water-challenges-iraq/Lossow%20-%20PB_PSI_water_challenges_Iraq.pdf)

To deal with the water scarcity Iraq is facing, the federal government of Iraq started in May 2021 the construction of the Makhoul Dam. The planned dam on the Tigris River,<sup>7</sup> was originally planned in 2000 and is Iraq's largest infrastructure project since 2003.<sup>8</sup> It is further expected to create a water reservoir of three billion cubic meters where water could be stored for use in times of drought and water scarcity. While the dam is planned to be completed in 2024<sup>9</sup>, the construction has been paused at the moment of writing due to challenges with the terrain and financial delays.<sup>10</sup> If the Makhoul Dam is completed, it threatens to flood the nearby archaeological sites<sup>11</sup> and displace people in three administrative units between the governorates of Kirkuk and Salahaldin.<sup>12</sup> It will also cause large-scale change to the fine ecosystems of the Tigris River. Apart from this, several experts have warned that the geological foundation of the dam site will cause structural problems for the Makhoul Dam.<sup>13</sup>

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<sup>7</sup> Marchetti, Nicolò at al. (2018). A multi-scalar approach for assessing the impact of dams on the cultural heritage in the Middle East and North Africa. *Journal of Cultural Heritage*.  
<https://doi.org/10.1016/j.culher.2018.10.007>

<sup>8</sup> France 24 (2020). "As neighbours build dams, Iraqis watch twin rivers dry up".  
<https://www.france24.com/en/20200826-as-neighbours-build-dams-iraqis-watch-twin-rivers-dry-up>

<sup>9</sup> Upper Euphrates Basin Developing Center University of Anbar (2014). Studies of Makhoul Dam project were completed 2021-06-14.  
[https://www.uoanbar.edu.iq/UEBDC/English/News\\_Details.php?ID=131](https://www.uoanbar.edu.iq/UEBDC/English/News_Details.php?ID=131)

<sup>10</sup> Shafaq. (2021). Financial and technical difficulties decelerate the construction of the Makhoul dam.  
<https://www.shafaq.com/en/Iraq-News/Financial-and-technical-difficulties-decelerate-the-construction-of-the-Makhoul-dam>

<sup>11</sup> Marchetti, Nicolò at al. (2018). A multi-scalar approach for assessing the impact of dams on the cultural heritage in the Middle East and North Africa. *Journal of Cultural Heritage*.  
<https://doi.org/10.1016/j.culher.2018.10.007>

<sup>12</sup> Shafaq. (2021). Three years to complete Makhoul Dam, Official.  
<https://www.shafaq.com/en/Economy/Three-years-to-complete-Makhoul-Dam-Official>

<sup>13</sup> Istepanian, Harry and Raydan, Noam. (2021). Iraq Energy. How Iraq's Race for Water Security Impacts Cultural Heritage and Environment. <https://iraqenergy.org/2021/05/05/how-iraqs-race-for-water-security-impacts-cultural-heritage-and-environment/>

Despite this, the Makhoul Dam has been presented as a strategic project. The Ministry of Water Resources has argued that the main reason for the resumption of the dam construction is the concern regarding Iraq's severe water shortage<sup>14</sup>. Today, Iraq is suffering from extreme temperatures and drought. In a 2019 report by the United Nations Development Programme (UNDP), the country was classified as the world's fifth-most vulnerable to the impact of climate change.<sup>15</sup> For the past 60 years, the construction of dams has been carried out as a climate adaptation strategy in Iraq and especially within the Kurdish Region of Iraq (KRI).<sup>16</sup> The ongoing implementation of the Makhoul Dam is another step within this strategy.

Existing literature on the Makhoul Dam is so far limited and focuses mostly on the potential effects on the nearby archaeological sites. Moreover, most scholarly sources are decades old, since the Makhoul Dam was first planned in the 2000s. By presenting a detailed and comprehensive report on the environmental, cultural and social effects of the Makhoul Dam, including technical aspects, this report aims to contribute to filling that literature gap. The report is further written for the purpose of adding to a knowledge base on the Makhoul Dam, which could serve as a ground for decision- and policymakers and civil society organizations. It could also be beneficial for local and international media, the scientific community or the general public.

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<sup>14</sup> Ibid

<sup>15</sup> UN Environment (2019). Global Environment Outlook 6. <https://www.unep.org/resources/global-environment-outlook-6>

<sup>16</sup> Save the Tigris Campaign (2020). Damming the Kurdistan Region of Iraq Structural gaps in the KRG dam construction policies. <https://www.savethetigris.org/wp-content/uploads/2020/07/Damming-the-Kurdistan-Region-of-Iraq-1.pdf>

## 2. Research question

The report will be guided by the following research question:

Do the benefits of the Makhoul Dam outweigh the environmental, cultural, and social costs of the dam?

The following operational questions will help address the research question:

- How will the Makhoul Dam affect the environment around the dam reservoir and the Iraqi Marshes?
- How will the Makhoul Dam affect the archaeological sites around the reservoir and the ancient City of Ashur?
- How will the Makhoul Dam affect local communities situated around the reservoir and what is their view of the dam?

## 3. Methodology

The report is primarily based on interviews and has been backed by official documents and scholarly- and popular sources. The research focuses on local viewpoints and the opinion of local and international experts within the fields of water engineering, archaeology and geology. The interview method used for the data collection is a combination of structured and semi-structured interviews. The majority of the interviews took place within a 12-day field study between October and November 2021, while some interviews were carried out online prior to the field research. The total number of interviews carried out were 16, including 6 experts within the aforementioned fields and 10 residents from the dam-affected villages, Al-Zawiya in Sherqat within Salahaldin governorate and Al-Zab in Kirkuk governorate. The interview participants were chosen through a combination of random- and snowball sampling.

## 4. Profile of the Makhoul Dam, and its stated purpose

The Makhoul Dam was first planned in the year 2000 by the Iraqi government led by Saddam Hussein to increase the water storage.<sup>17</sup> At the time the United Nations Educational, Scientific and Cultural Organization (UNESCO) objected to the dam because of the important archaeological sites put at risk.<sup>18</sup> Due to the regime shift and the following period of wars, the dam project, which was supposed to be completed in 2007 was postponed.<sup>19</sup> The Iraqi government has since then confirmed the cancellation of the Makhoul Dam construction several times, the last of which was in 2011. This among others, because of the complicated geology of the dam site and a sulphur seepage at the area. The suspension of the dam project was welcomed in an official letter by UNESCO.<sup>20</sup>

However, in 2020 Mahdi Rashid Al-Hamdani, Iraq's minister of water resources at the time, announced that the Makhoul dam project would be revived. This took other ministers inside the Iraqi government by surprise, as well as international agencies such as UNESCO. The Makhoul Dam project was once again objected to by UNESCO, as well as criticized and opposed by the Ministry

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<sup>17</sup> Miglus A, Peter and Mühl Simone. (2011). Between the cultures the central Tigris region from the 3rd to the 1st millennium bc. Conference at Heidelberg. 2009. HEIDELBERGER STUDIEN ZUM ALTEN ORIENT.  
[https://www.researchgate.net/publication/264402244\\_Between\\_the\\_Culture\\_The\\_Central\\_Tigris\\_Region\\_from\\_the\\_3rd\\_to\\_the\\_1st\\_Millennium\\_BC](https://www.researchgate.net/publication/264402244_Between_the_Culture_The_Central_Tigris_Region_from_the_3rd_to_the_1st_Millennium_BC)

<sup>18</sup> NAS NEWS (2021). " أسباب لـ 'عدم جدوى' مشروع سد مكحول10لجنابي يقدم رؤية مغايرة: " <https://www.nasnews.com/view.php?cat=62749>

<sup>19</sup> Miglus A, Peter and Mühl Simone. (2011). Between the cultures the central Tigris region from the 3rd to the 1st millennium bc. Conference at Heidelberg. 2009. HEIDELBERGER STUDIEN ZUM ALTEN ORIENT.  
[https://www.researchgate.net/publication/264402244\\_Between\\_the\\_Culture\\_The\\_Central\\_Tigris\\_Region\\_from\\_the\\_3rd\\_to\\_the\\_1st\\_Millennium\\_BC](https://www.researchgate.net/publication/264402244_Between_the_Culture_The_Central_Tigris_Region_from_the_3rd_to_the_1st_Millennium_BC)

<sup>20</sup> NAS NEWS (2021). " أسباب لـ 'عدم جدوى' مشروع سد مكحول10لجنابي يقدم رؤية مغايرة: " <https://www.nasnews.com/view.php?cat=62749>



of Culture, Tourism and Antiquities at the time, Abdulameer Al-Hamdani. It was also objected to by the former minister of water resources Hassan Al-Janabi,<sup>21</sup> and Azzam Alwash, Professor in Geotechnical Engineering at the American University of Iraq, Sulaimani and was the personal adviser to the president of Iraq on environmental and climate issues. Alwash criticized the technical basis and lack of transparency, arguing the three billion dollars should be spent on modernizing the irrigation system of the country instead.<sup>22</sup>

Located in the eastern Tigris area about 230 kilometers north of Baghdad,<sup>23</sup> the Makhoul Dam is situated between the estuary of the Tigris River and Qaryat al Khaḍrānīyah, north of the Al-Shirqat district.<sup>24</sup> The planned site of the dam and its boundaries extend over 6 km southwest of Kirkuk governorate and 600 meters inside Salahaldin governorate. It will hence cover Al-Zawiya district north of Baiji to Al-Shirqat district and include large areas of Al-Abbasi sub-districts and Al-Zab southwest of Kirkuk.<sup>25</sup> The construction of the dam on the Tigris River<sup>26</sup> is planned to create a 3227- to 3600-meter-long dam reservoir. The

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<sup>21</sup> Ibid

<sup>22</sup> Alwash, Azzam; Professor in Geotechnical Engineering at the American University of Iraq, Sulaimani and previously personal adviser to the president of Iraq, on environmental and climate issues. Interview 2021-10-20.

<sup>23</sup> Istepanian, Harry and Raydan, Noam. (2021). Iraq Energy. How Iraq's Race for Water Security Impacts Cultural Heritage and Environment. <https://iraqenergy.org/2021/05/05/how-iraqs-race-for-water-security-impacts-cultural-heritage-and-environment/>

<sup>24</sup> Miglus A, Peter and Mühl Simone. (2011). Between the cultures the central Tigris region from the 3rd to the 1st millennium bc. Conference at Heidelberg. 2009. HEIDELBERGER STUDIEN ZUM ALTEN ORIENT. [https://www.researchgate.net/publication/264402244\\_Between\\_the\\_Culture\\_The\\_Central\\_Tigris\\_Region\\_from\\_the\\_3rd\\_to\\_the\\_1st\\_Millennium\\_BC](https://www.researchgate.net/publication/264402244_Between_the_Culture_The_Central_Tigris_Region_from_the_3rd_to_the_1st_Millennium_BC)

<sup>25</sup> Shafaq. (2021). Three years to complete Makhoul Dam, Official. <https://www.shafaq.com/en/Economy/Three-years-to-complete-Makhoul-Dam-Official>

<sup>26</sup> Marchetti, Nicolò et al. (2018). A multi-scalar approach for assessing the impact of dams on the cultural heritage in the Middle East and North Africa. Journal of Cultural Heritage. <https://doi.org/10.1016/j.culher.2018.10.007>

reservoir is supposed to hold a storage capacity of three billion cubic meters,<sup>27</sup> and cost \$3 billion.<sup>28</sup> According to the Iraqi government, the dam will have several functions such as water storage, use for irrigation purposes, as well as helping the prevention of flooding<sup>29</sup> and generating electricity.<sup>30</sup>

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<sup>27</sup> Shafaq (2021). Iraqi authorities to start constructing the Makhoul dam by the end of January. <https://www.shafaq.com/en/Iraq-News/Iraqi-authorities-to-start-constructing-the-Makhoul-dam-by-the-end-of-January>

<sup>28</sup> Istepanian, Harry and Raydan, Noam. (2021). Iraq Energy. How Iraq's Race for Water Security Impacts Cultural Heritage and Environment. <https://iraqenergy.org/2021/05/05/how-iraqs-race-for-water-security-impacts-cultural-heritage-and-environment/>

<sup>29</sup> Republic of Iraq, Ministry of Planning. (2020). The Ministers of Planning and Water Resources discussed the possibility of implementing the Makhoul Dam. The Ministry of Planning [https://mop.gov.iq/en/activities\\_minister/view/details?id=1247](https://mop.gov.iq/en/activities_minister/view/details?id=1247)

<sup>30</sup> France 24 (2020). "As neighbours build dams, Iraqis watch twin rivers dry up". <https://www.france24.com/en/20200826-as-neighbours-build-dams-iraqis-watch-twin-rivers-dry-up>

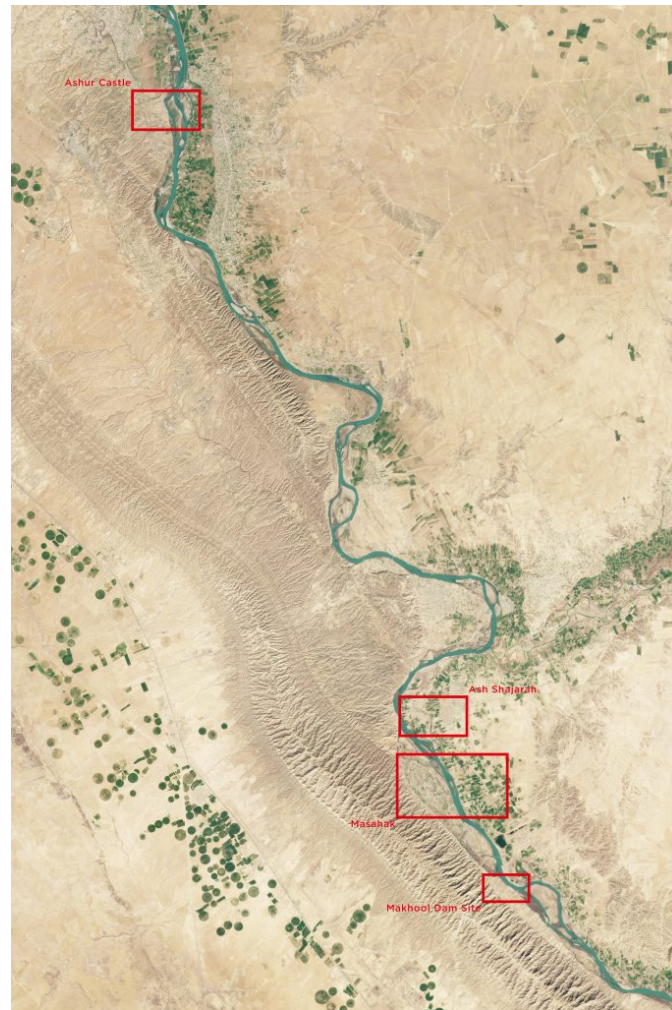


Figure 1. Satellite image of the location of Ashur and the proposed location for the Makhoul Dam, and some of the areas that will be affected. (Source Harry Istepanian and Noam Raydan, Planet Labs 2021).

Securing the water supply, especially under seasons of drought, has further been laid out as the main purpose of the dam.<sup>31</sup> The government has also argued that the dam will support agriculture by providing water for two-thirds of agricultural land in the areas between Baiji, Al-Shirqat, and Al-Hawija districts in Kirkuk.<sup>32</sup> At the same time, flood protection of the districts of Salahaldin and Kirkuk but

<sup>31</sup> Upper Euphrates Basin Developing Center University of Anbar (2014). Studies of Makhoul Dam project were completed 2021-06-14.

[https://www.uoanbar.edu.iq/UEBDC/English/News\\_Details.php?ID=131](https://www.uoanbar.edu.iq/UEBDC/English/News_Details.php?ID=131)

<sup>32</sup> Shafaq (2021). Iraqi authorities to start constructing the Makhoul dam by the end of January.

<https://www.shafaq.com/en/Iraq-News/Iraqi-authorities-to-start-constructing-the-Makhoul-dam-by-the-end-of-January>

also of Baghdad has been outlined as another reason for the construction of the dam.<sup>33</sup>

Desertification affects nearly 40 per cent of Iraq's territory at present and another 54 per cent of the land is threatened by increased salinization.<sup>34</sup> Due to the water shortage Iraq is facing, Iraq's agriculture minister announced that it will reduce its 2021-2022 winter crop planting area by 50%. The current water available in dams and reservoirs in Iraq can only cover the use for irrigation of approximately 250,000 hectares of land.<sup>35</sup> At the same time, studies from the Iraqi water ministry indicate that Iraq doesn't need more water storage capacity, but more efficient and sustainable water management, including a modernization of the agricultural sector.<sup>36</sup> Today Iraq's agricultural sector consumes about 75% of the country's overall water resources, and large quantities of water used for agricultural and irrigation purposes are squandered due to outdated irrigation techniques.<sup>37</sup>

According to the Iraqi Ministry of Water Resources, the Makhoul Dam would further, supply hydropower electricity. Currently, more than 30 per cent of Iraq's

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<sup>33</sup> Republic of Iraq, Ministry of Planning. (2020). The Ministers of Planning and Water Resources discussed the possibility of implementing the Makhoul Dam. The Ministry of Planning [https://mop.gov.iq/en/activities\\_minister/view/details?id=1247](https://mop.gov.iq/en/activities_minister/view/details?id=1247)

<sup>34</sup> Ibid

<sup>35</sup> Reuters (2021). Iraq to reduce winter crop area by 50% due to water shortage - ministry statement. [https://www.reuters.com/world/middle-east/iraq-reduce-winter-crop-area-by-50-due-water-shortage-ministry-statement-2021-10-17/?taid=616c80e435a2610001add75e&utm\\_campaign=trueAnthem:+Trending+Content&utm\\_medium=trueAnthem&utm\\_source=twitter](https://www.reuters.com/world/middle-east/iraq-reduce-winter-crop-area-by-50-due-water-shortage-ministry-statement-2021-10-17/?taid=616c80e435a2610001add75e&utm_campaign=trueAnthem:+Trending+Content&utm_medium=trueAnthem&utm_source=twitter)

<sup>36</sup> Alwash, Azzam; Professor in Geotechnical Engineering at the American University of Iraq, Sulaimania and previously personal adviser on environmental and climate issues to the president of Iraq. Interview 2021-10-20.

<sup>37</sup> Fanack Water (2016). Water Uses in Iraq. <https://water.fanack.com/iraq/water-uses-in-iraq/>

annual consumption of electricity is imported,<sup>38</sup> while 96 per cent of Iraq's electricity comes from fossil fuels.<sup>39</sup> However, the development of hydropower affects the environment of the rivers exploited. Hydropower dams have a negative impact on the water, soil and air of the dammed river, as well as the natural flora and fauna.<sup>40</sup> Many large-scale water infrastructure projects have had disastrous outcomes on the environment. At the same time as contributing to an increase in the global share of renewable energy, hydropower dams often irreparably damage the river that they are built upon.<sup>41</sup>

## 5. Environmental impact

Dams are often portrayed as green and clean and are continuously being constructed throughout Iraq,<sup>42</sup> as a strategy to cope with climate change. However, studies show that dams and dams for hydropower, in particular, often have an irreversible impact on the dammed rivers and can instead accelerate climate change.<sup>43</sup> Naturally, the larger a dam is, the larger footprint it will have on the riverine ecosystem.<sup>44</sup> Unfortunately, there is a lack of available data on

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<sup>38</sup> Worldometer (2016). Iraq Electricity. <https://www.worldometers.info/electricity/iraq-electricity/>

<sup>39</sup> Ritchie, Hannah and Roser, Max (2020). Energy. Our World in Data. <https://ourworldindata.org/energy/country/iraq>

<sup>40</sup> Stille, Håkan. Balfors, Berit and Bergh, Hans (2006). Dams for power generation. Dams can tame water. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>41</sup> Save the Tigris Campaign (2020). Damming the Kurdistan Region of Iraq Structural gaps in the KRG dam construction policies. <https://www.savethetigris.org/wp-content/uploads/2020/07/Damming-the-Kurdistan-Region-of-Iraq-1.pdf>

<sup>42</sup> Ibid

<sup>43</sup> Save the Tigris Campaign (2020). Damming the Kurdistan Region of Iraq Structural gaps in the KRG dam construction policies. <https://www.savethetigris.org/wp-content/uploads/2020/07/Damming-the-Kurdistan-Region-of-Iraq-1.pdf>

<sup>44</sup> Ibid

the environmental effect of the Makhoul Dam, but the environmental impact of dams can generally be divided into upstream and downstream effects.

### 5.1 Upstream effects

The upstream effects of dams are caused by the impounded water.<sup>45</sup> Through dam construction, the level of water is determined by human water needs instead of natural conditions, which causes more extensive fluctuations in the water level.<sup>46</sup> Upstream areas of reservoirs are usually flooded for long periods or permanently. This often leads to fragmentation of valuable habitats<sup>47</sup> and in some cases, it can affect such large territories, that habitats of entire species are drowned. For this reason, the riparian zones of reservoirs often become impoverished of life and the areas periodically placed under water are emptied of benthic wildlife.<sup>48</sup>

Moreover, it has been noted that riparian plants living along dam reservoirs could be reduced by up to 80 per cent in coverage degree, in comparison to plants along undammed riverbanks. With the ageing of a water reservoir, biodiversity tends to decrease additionally. One possible reason for this is that the sediment on the bank gradually erodes.<sup>49</sup>

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<sup>45</sup> Ibid

<sup>46</sup> Ibid

<sup>47</sup> Diehn, Sonya (2020). Five ways mega-dams harm the environment. DW. <https://www.dw.com/en/five-ways-mega-dams-harm-the-environment/a-53916579>.

<sup>48</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>49</sup> Ibid

## 5.2 Downstream effects

The effects of dams downstream are caused by changes in the flow and quality of water.<sup>50</sup> During transits, when the water is moved to another catchment area, water is frequently lost, affecting the downstream flows. Also, when the reservoir is full at the beginning of a growing season and during drought periods, the flows downriver are very low.<sup>51</sup> Ecosystems downstream are reliant on the natural water flow and the sediment the river carries with it. As the water is diverted away for irrigation purposes or power generation, the flow of rapids and waterfalls decreases or fully ceases to exist. This in turn, may lead to the disappearance of species which naturally occur near waterfalls and the humid microclimate associated with rapids.<sup>52</sup>

Besides the reduced water flow, large dams can lead to a 30-40 per cent loss of sediments, which feed the fish and the whole vegetation along the river. When the sediments and organic material normally carried along by the flowing water is prevented from passing, they are instead deposited on the banks of the reservoir or sink to the bottom. Furthermore, when solid materials build up in a dam reservoir, the area downriver becomes less fertile and the riverbeds often become deeper and could in some cases erode.<sup>53</sup> In the long run, this causes

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<sup>50</sup> Ibid

<sup>51</sup> Bengtsson, Lars and Berndtsson, Ronny (2006). Conflicts regarding dams with several functions. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>52</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>53</sup> Diehn, Sonya (2020). Five ways mega-dams harm the environment. DW. <https://www.dw.com/en/five-ways-mega-dams-harm-the-environment/a-53916579>.

alteration of habitats along the river downstream, and the local species richness to seriously diminish.<sup>54</sup>

A downstream area in Iraq particularly vulnerable to the effect of dams, is the Mesopotamian Marshlands (Al-Ahwar), one of Iraq's most important ecosystems. The marshes, once the largest wetland ecosystem in Asia,<sup>55</sup> used to cover over 20,000 km<sup>2</sup> of interconnected lakes and wetlands within Iraq and Iran. They are of crucial importance for migratory birds and endangered species,<sup>56</sup> and have been the home for the indigenous population Ma'dan Marsh Arabs for thousands of years. With a unique culture and lifestyle inherited by the ancient Sumerians, the Marsh Arabs' livelihood depends on fishing and water buffalo breeding. These activities in turn rely on a functioning marsh ecosystem.<sup>57</sup> Due to drainage projects within Iraq, and upstream dam activities of Turkey and Syria, the Marshes were reduced to 90 per cent of their original

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<sup>54</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>55</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch [https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)

<sup>56</sup> Alwash, Azzam, Alwash, Suzanne and Cattarossi, Andrea (2004). Iraq's Marshlands - Demise and the Impending Rebirth of an Ecosystem; Conference: World Water and Environmental Resources Congress (2004). [https://www.researchgate.net/publication/269199366\\_Iraq's\\_Marshlands\\_-\\_Demise\\_and\\_the\\_Impending\\_Rebirth\\_of\\_an\\_Ecosystem](https://www.researchgate.net/publication/269199366_Iraq's_Marshlands_-_Demise_and_the_Impending_Rebirth_of_an_Ecosystem)].

<sup>57</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch [https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)



size in the 2000s.<sup>58</sup> After the 2003 war, parts of them were restored.<sup>59</sup> Today they are 86 per cent of their original size,<sup>60</sup> but are constantly threatened by a further decrease in size, as they are regularly subjected to severe droughts,<sup>61</sup> and increased levels of water salinity.<sup>62</sup>

Moreover, the Iraqi marshes are highly reliant on balanced and specific amounts of water flows. Therefore, their unique flora and fauna is highly sensitive to human intervention in the natural water cycle of the Tigris and Euphrates rivers.<sup>63</sup> A lack of coherence in Iraq's water policies have further resulted in the continued construction of dams built in upstream provinces and regions within Iraq, as well as by neighboring countries, decreasing the water flow downstream,<sup>64</sup> and

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<sup>58</sup> Alwash, Azzam, Alwash, Suzanne and Cattarossi, Andrea (2004). Iraq's Marshlands - Demise and the Impending Rebirth of an Ecosystem; Conference: World Water and Environmental Resources Congress (2004). [https://www.researchgate.net/publication/269199366\\_Iraq's\\_Marshlands\\_-\\_Demise\\_and\\_the\\_Impending\\_Rebirth\\_of\\_an\\_Ecosystem](https://www.researchgate.net/publication/269199366_Iraq's_Marshlands_-_Demise_and_the_Impending_Rebirth_of_an_Ecosystem)].

<sup>59</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan. (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch [https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)

<sup>60</sup> Bijmens, Toon. and Khairalla, Salman (2021). The Ahwar of Iraq: Persisting Threats and Paths to Protection. World Heritage Watch Report 2021. Doempke, Stephan, Tournillon, Louise and Turne, Michael. World Heritage Watch. Berlin.

<sup>61</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan. (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch [https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)

<sup>62</sup> Al Abid (2021). The Iraqi Marshes facing existential challenges. The Marshes. <http://www.themarshes.org/#Skills>

<sup>63</sup> Ibid

<sup>64</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch

affecting the entire ecological cycle of the Marshes. According to Azzam Alwash, the biodiversity of the Marshes was naturally dependent on the flood cycle of the Tigris and Euphrates rivers. Because of the dam activity upstream, the floods that used to supply the Marshes are no longer existing.<sup>65</sup> To preserve the biodiversity values of the Marshes, the main challenge is to ensure they receive minimum amount of water in order to sustain them.<sup>66</sup>

For this reason, the completion of the Makhoul Dam will worsen their already fragile situation. Similar to any upstream dam, it will affect the quality and fluctuation of the water levels downstream to the wetlands. This would pose a serious threat to the environment, water and food security in the marshes,<sup>67</sup> which would imperil the long-term future of the Marshlands and their socio-economic sustainability.<sup>68</sup>

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[https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)

<sup>65</sup> Alwash, Azzam; Professor in Geotechnical Engineering at the American University of Iraq, Sulaimani and previously personal adviser to the president of Iraq, on environmental and climate issues. Interview 2021-10-20.

<sup>66</sup> Bijmens, Toon (2019). The Mesopotamia Marshes in Peril. (2019). Heritage Dammed Water Infrastructure Impacts on World Heritage Sites and Free Flowing Rivers. <https://www.transrivers.org/pdf/2019HeritageDammedFinal.pdf>

<sup>67</sup> Al Abid (2021). The Iraqi Marshes facing existential challenges. The Marshes. <http://www.themarshes.org/#Skills>

<sup>68</sup> Bijmens, Toon. (2017). Civil Society in Iraq: Advocating for the Protection of the Iraqi Marshes. Proceedings of the International Conference Istanbul 2016; Doempke, Stephan (2017). Civil Society and Sustainable Development in the UNESCO World Heritage. World Heritage Watch [https://world-heritage-watch.org/wp-content/uploads/2018/06/2016\\_istanbul-report-WHW-conference-Eng.pdf](https://world-heritage-watch.org/wp-content/uploads/2018/06/2016_istanbul-report-WHW-conference-Eng.pdf)

### 5.3 Wildlife

Furthermore, a dam reservoir is usually much more species-poor than the natural ecosystem of the river it replaces.<sup>69</sup> One reason for this is that dams cut off migratory corridors.<sup>70</sup> Migration is essential for animals and aquatic insects, they need to make use of distinct parts of the river system during different periods of their life cycles. Since the environments of a river are frequently destroyed and rebuilt, riverine species must be able to colonize and spread to newly created areas. For vegetation, especially the distribution of plants with fruits and seeds with poor floating quality, are impacted by the barrier effect of dams. These are often only found on one side of the dam.<sup>71</sup> Also, other aquatic species, such as fish are extremely vulnerable to the impacts of dams.

Several fish species are reliant on moving freely in the river, both to return to their birthplace to spawn and to seek forage.<sup>72</sup>

Another cause for the decrease of riverine biodiversity is the upstream flooding of dam reservoirs, which drowns animals and plants. To temporarily move animals from the upstream areas without securing or integrating them into new habitats, only leads to delaying their extinction.<sup>73</sup> Changes in the environment surrounding dams can also promote the spread of alien species, often at the

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<sup>69</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>70</sup> Diehn, Sonya (2020). Five ways mega-dams harm the environment. DW. <https://www.dw.com/en/five-ways-mega-dams-harm-the-environment/a-53916579>.

<sup>71</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>72</sup> Diehn, Sonya (2020). Five ways mega-dams harm the environment. DW. <https://www.dw.com/en/five-ways-mega-dams-harm-the-environment/a-53916579>.

<sup>73</sup> Jansson, Roland (2006). The effect of dams on biodiversity. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

expense of native species. Since dams affect the temperature of the river's water, it changes downstream environments to the detriment of native species. An example has occurred in the Colorado River in North America, which was transformed into a cold-water river, from originally a turbid warm water river. This resulted in 68 alien species becoming established in the river, while the majority of native species decreased or disappeared entirely.<sup>74</sup>

According to Jansson, to mitigate the environmental effects of dams, comprehensive knowledge needs to be developed on the specific environment of the affected river.<sup>75</sup> The World Commission on Dams (WCD) also recommends an extensive Environmental Impact Assessment (EIA) of the river's ecosystem, to avoid harming endangered plants and animals.<sup>76</sup> In the case of the Makhoul dam, as of today there is no officially published EIA from the government.

## 5.4 Evaporation

Naturally, as the Makhoul Dam will increase the water access, it will also increase the amount of water evaporating.<sup>77</sup> The size of a reservoir is a factor that plays a crucial role for how much water will be lost to evaporation. The larger the water reservoir is, the larger the evaporation loss will be.<sup>78</sup> According to the Iraqi Ministry of Science and Technology, massive volumes of water from reservoirs, agricultural fields and other surface water sources are lost each year

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<sup>74</sup> Ibid

<sup>75</sup> Ibid

<sup>76</sup> The World Commission on Dams Framework - A Brief Introduction (2008). International Riveres <https://archive.internationalrivers.org/resources/the-world-commission-on-dams-framework-a-brief-introduction-2654>

<sup>77</sup> Sissakian, Varoujan; Geologist, the University of Kurdistan Hewler, Erbil, Iraq. Interview. 2021-10-11.

<sup>78</sup> Save the Tigris Campaign (2021). Into Thin Air. <https://www.savethetigris.org/wp-content/uploads/2021/11/Save-the-Tigris-Into-Thin-Air-Report-2021-1.pdf>

through water evaporation. Especially in arid regions evaporation accounts for a critical part of the water budget.<sup>79</sup> In Iraq, 61 per cent of the precipitation is estimated to be lost to evaporation every year, while evaporation from reservoirs decreases more than 10 per cent of Iraq's total water supply annually.<sup>80</sup> Also, looking at evaporation rates from water reservoirs in Turkey and Iran, the main riparian countries of the Tigris and Euphrates rivers, an additional 7 billion m<sup>3</sup> is estimated to be lost each year.<sup>81</sup>

## 5.5 Geology of the site

According to Nadhir Al-Ansari, Professor in Water Resources Engineering at Luleå University of Technology in Sweden, the geological foundation is an important factor that needs to be considered closely. The site of the Makhoul Dam is about 35 kilometers long and 4 kilometers in width, it is a doubly-plunging anticline area, where the plunge in the southeastern part is connected to Hamrin anticline.<sup>82</sup> A plunging anticline is a type of fold where the fold plunges into the earth along its length, while the doubly-plunging anticline at the Makhoul site, plunges at both ends.<sup>83</sup>

The site of the dam is located a few kilometers upstream from the point where the Tigris River breaks through the mountain chains of Makhoul Mountain and

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<sup>79</sup> Dawood, Khudair. Lafta, Farhan. Hashim, Ahmed (2013). REDUCE EVAPORATION LOSSES FROM WATER RESERVOIRS. European Centre for Research Training and Development. <https://www.eajournals.org/wp-content/uploads/Reduce-Evaporation-Losses-from-Water-Reservoirs.pdf>

<sup>80</sup> Save the Tigris Campaign (2021). Into Thin Air. <https://www.savethetigris.org/wp-content/uploads/2021/11/Save-the-Tigris-Into-Thin-Air-Report-2021-1.pdf>

<sup>81</sup> Al-Ansari, Nadhir; Professor in Water Resources Engineering at Luleå University of Technology in Sweden. Interview 2021-10-05

<sup>82</sup> Al-Ansari, Nadhir; Professor in Water Resources Engineering at Luleå University of Technology in Sweden. Interview 2021-10-05.

<sup>83</sup> Ibid

Hamrin Mountain.<sup>84</sup> According to Al-Ansari, the area is composed of layers of sedimentary rocks or strata. The formation is important because it will make up the bulk of the area of the dam. The depth of the stratum at the western side of the anticline approaches at least 80 degrees, while the stratum's depth on the eastern side is about 40 degrees. This means that the anticline is asymmetrical.<sup>85</sup> This unstable formation will hence cause the dam to rest on non-identical surfaces, which would mean serious structural issues for the dam.<sup>86</sup>

According to Varoujan Sissakian, a geologist at the University of Kurdistan Hewler, the structural complexity at the site decreases the safety factors of the dam, while increasing the economic cost. Another main risk at the site are gypsum beds that are exposed. This has led to the karstification of the subsurface.<sup>87</sup> Moreover, according to Alwash the construction of the Makhoul Dam is going to increase the amount of water circulating under pressure, which will eventually dissolve the gypsum underneath the dam site, causing a problem of water seepage into the ground.<sup>88</sup> Also, a sulphur seepage downstream from the site of the Makhoul Dam has caused divided opinions among experts. According to Sissakian, the construction of the Makhoul Dam will lead to an increase in the head of the water behind the dam. This will cause the dissolution rate of the sulphur to increase, which will affect water quality. Al-Ansari and

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<sup>84</sup> Hausleiter, Arnulf. (2003). Report on the UNESCO Assessment Mission to Iraq. The Carsten Niebuhr Institute of Near Eastern Studies University of Copenhagen.

<sup>85</sup> Al-Ansari, Nadhir; Professor in Water Resources Engineering at Luleå University of Technology in Sweden. Interview 2021-10-05.

<sup>86</sup> Istepanian, Harry and Raydan, Noam. (2021). Iraq Energy. How Iraq's Race for Water Security Impacts Cultural Heritage and Environment.

<https://iraqenergy.org/2021/05/05/how-iraqs-race-for-water-security-impacts-cultural-heritage-and-environment/>).

<sup>87</sup> Sissakian, Varoujan; Geologist, the University of Kurdistan Hewler, Erbil, Iraq. Interview. 2021-10-11.

<sup>88</sup> Alwash, Azzam; Professor in Geotechnical Engineering at the American University of Iraq, Sulaimani and previously personal adviser to the president of Iraq, on environmental and climate issues. Interview 2021-10-20.

Sissakian further place great weight on the need for an exact geological investigation.<sup>89</sup> According to Al-Ansari, samples along the axes of the dam should be taken, and satellite images should be used to detect features that cannot be found in the field.

“They should do proper geological investigation so that when they hand the information over to the designer they will apply the correct design, otherwise we will face the same problem as they faced in Mosul. Because the design of the Mosul Dam doesn't suit the geology of the area. The same thing will happen to the Makhoul Dam if they do a bad geological investigation, then we will have the same problem or even worse.”<sup>90</sup>

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<sup>89</sup> Ibid

<sup>90</sup> Al-Ansari, Nadhir; Professor in Water Resources Engineering at Luleå University of Technology in Sweden. Interview 2021-10-05.

## 6. Cultural impact of the Makhoul Dam

The site of the planned Makhoul Dam lies 40 km downstream the city of Ashur and is within a location known for its richness in archaeological remains.<sup>91</sup> According to a 2018 study published in the *Journal of Cultural Heritage*, at least 184 archaeological sites are endangered by the dam construction, among them the ancient city of Ashur.<sup>92</sup>

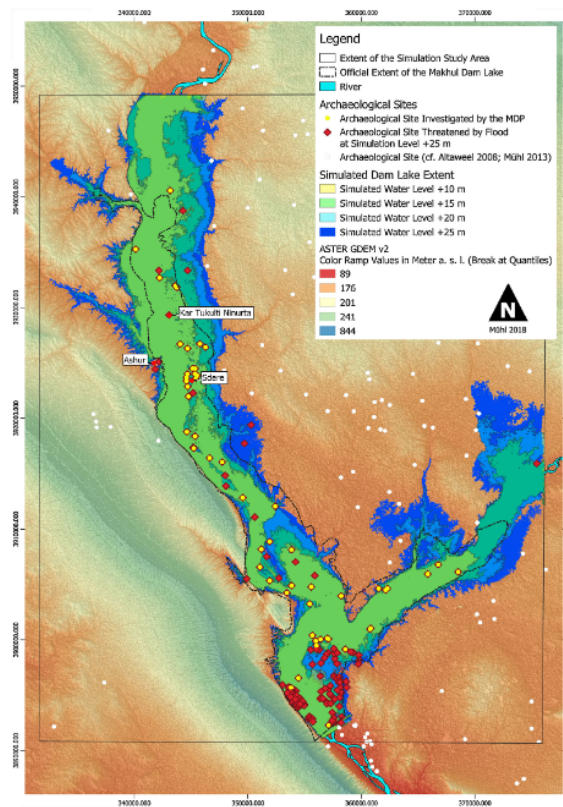


Figure 2. Simulation of the flood zone of the Makhoul Dam, and its impact on the archaeological sites, based on ASTER GDEM data from 2011. (Source N. Marchetti et al. *Journal of Cultural Heritage* 2018).

<sup>91</sup> Altaweel, Mark; Professor, Reader in Near East Archaeology at the Institute of Archaeology, Gordon Square. Interview 2021-10-24.

<https://iraqenergy.org/2021/05/05/how-iraqs-race-for-water-security-impacts-cultural-heritage-and-environment>

<sup>92</sup> Marchetti, Nicolò et al. (2018). A multi-scalar approach for assessing the impact of dams on the cultural heritage in the Middle East and North Africa. *Journal of Cultural Heritage*.

<https://doi.org/10.1016/j.culher.2018.10.007>



## 6.1 The City of Ashur



Figure 3. Tabira Gate, part of the World Heritage site of Ashur (Source Emily Garthwaite, INSTITUTE 2022).

The ruins of the ancient city of Ashur (Qal'at Shirqat), date back to the third millennium BC and has, since 2003, been listed on the UNESCO list of World Heritage. Due to the planned Makhoul Dam, the site is also included in the list of World Heritage in Danger. Located in a unique geo-ecological area,<sup>93</sup> the city of Ashur was a city-state of great importance. It served as the first capital of the Assyrian empire<sup>94</sup> and an international trading platform.<sup>95</sup> It was also the

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<sup>93</sup> UNESCO (2004). Ashur (Qal'at Sherqat) UNESCO, World Heritage List. <https://whc.unesco.org/en/list/1130>

<sup>94</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>95</sup> UNESCO (2004). Ashur (Qal'at Sherqat) UNESCO, World Heritage List. (<https://whc.unesco.org/en/list/1130>)

religious center of the Assyrian state,<sup>96</sup> where the crowning and burial of kings took place.<sup>97</sup> The site with its unique temple of the supreme god Ashur, could, according to the director of the Assyrian city, Salim Abdullah, be seen as the seed to all Assyrian origins. He explains that even when the center of power was moved later to the cities of Nimrud and Nineveh, Ashur remained the religious capital and a pilgrimage destination.<sup>98</sup>



Figure 4. Part of the temple dedicated to the supreme god Ashur. (Source Emily Garthwaite, INSTITUTE 2022).

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<sup>96</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>97</sup> UNESCO (2004). Ashur (Qal'at Sherqat) UNESCO, World Heritage List. (<https://whc.unesco.org/en/list/1130>)

<sup>98</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

At the site, portals, Ziggurats and temples have been found and more than 65 different obelisks,<sup>99</sup> while more than 80 per cent of the site remains unexplored.<sup>100</sup> In its description, UNESCO states that the Makhoul Dam poses a risk of seepage and partial flooding to the site, which was made of a fragile mud-brick structures.<sup>101</sup> According to Dr Khalil Aljbory, Head of Archaeology at Tikrit University, the reservoir of the Makhoul dam would reach 50 km north of the Fatha area to the walls of the city of Ashur. Hence, the process of ebb and flow would damage parts of it.<sup>102</sup> The dam would additionally flood the southern part of the site for several months of the year, exposing archaeological remains to water infiltration.<sup>103</sup> According to Aljbory 30 per cent of the site is estimated to be affected.<sup>104</sup> Mark Altaweel, Professor and Reader in Near East Archaeology at the Institute of Archaeology Gordon Square in England, comments that the loss of the property would be a major blow for global heritage:

“We know the Assyrians contributed greatly to the global heritage through arts, sciences, literature, and other areas. The site of Ashur was among the most important sites that contributed to this great heritage [...]. Sure flooding and inconsistent water were frequent problems in this part of the world but ancient Mesopotamians had adapted such a life for thousands

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<sup>99</sup> Ibid

<sup>100</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>101</sup> UNESCO (2004). Ashur (Qal'at Sherqat) UNESCO, World Heritage in Danger. <https://whc.unesco.org/en/soc/3854/>

<sup>102</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>103</sup> Save the Tigris (2021). “Threats to Ashur and Ahwar World Heritage Properties – Civil Society Concerns and Requests”. Received by UNESCO World Heritage Centre. 2021-05-19

<sup>104</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

of years, so I don't understand why can't the modern world. Destroying heritage for the sake of controlling Mother Nature is a terrible idea and I hope the Iraqi authorities can change their mind.”<sup>105</sup>

Furthermore, it is hard to determine the exact number of archaeological sites at the location without a careful and detailed excavation,<sup>106</sup> where today only 20 per cent of the area has been excavated. In a field study carried out by Aljbory, 202 different sites could be found.<sup>107</sup> Further, Khalid Ali Khatab, professor and cuneiform specialist on Kar-Tukulti-Ninurta at Tikrit University, estimates that there are at least 200-250 archaeological sites only at the western bank of the Tigris. These sites are among the oldest in the history of the country, while on the eastern side of the river is a crucial archaeological site, the city of Kar-Tukulti-Ninurta.<sup>108</sup>

## 6.2 Kar-Tukulti-Ninurta

The city of Kar-Tukulti-Ninurta (Telul al-Aqr) was founded between 1243–1207 BC<sup>109</sup> and was the fifth capital of the Assyrian empire.<sup>110</sup> The city was established by the Assyrian king Tukulti-Ninurta I, who ruled the Assyrian state from 1244 BC.<sup>111</sup> From an unfinished German excavation in 2000, a whole town was

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<sup>105</sup> Altaweel, Mark; Professor, Reader in Near East Archaeology at the Institute of Archaeology, Gordon Square. Interview 2021-10-24.

<sup>106</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

<sup>107</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>108</sup> Khatab, Ali Khalid; Cuneiform specialist at Kar-Tukulti-Ninurta. Interview 2021-10-26.

<sup>109</sup> Karlsson, Mattias. (2015). The theme of leaving Ashur in the royal inscriptions of TukultiNinurta I and Ashurnasirpal II. Academia.Libris. <https://libris.kb.se/bib/20186325>

<sup>110</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

<sup>111</sup> Khatab, Ali Khalid; Cuneiform specialist at Kar-Tukulti-Ninurta. Interview 2021-10-26.

discovered including a number of castles and two Ziggurats.<sup>112</sup> The temple of the sun-god Shamash has also been found there, as well as the only temple of the Assyrian god Ashur built outside the capital of Ashur.<sup>113</sup> According to Abdullah the location of Kar-Tukulti-Ninurta falls within the direct area of the reservoir of the Makhoul Dam, which would mean that the whole site would be put under water.<sup>114</sup> Aljbory confirms that the city of Kar-Tukulti-Ninurta is one of the sites that will be completely flooded if the construction of the Makhoul Dam is completed.<sup>115</sup>

Besides the dominant Assyrian remains, excavations have revealed archaeological sites from more than 17 different layers of civilizations at the location.<sup>116</sup> Some of these date back to the Late Neolithic period (c. 7000 BCE) and to the Islamic Period (c. 1300 CE).<sup>117</sup> Also, ancient villages and cities were discovered that could be traced back to the civilization of Sumer (4100-1750 BCE) and the Akkadian civilization (ca. 2300-2159 B.C),<sup>118</sup> two of the earliest civilizations in the world. According to Khatab, the amount of water the dam reservoir will hold determines the size of the damage it will pose to the historical

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<sup>112</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>113</sup> Khatab, Ali Khalid; Cuneiform specialist at Kar-Tukulti-Ninurta. Interview 2021-10-26.

<sup>114</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

<sup>115</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>116</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

<sup>117</sup> Marchetti, Nicolò et al. (2018). A multi-scalar approach for assessing the impact of dams on the cultural heritage in the Middle East and North Africa. *Journal of Cultural Heritage*.  
<https://doi.org/10.1016/j.culher.2018.10.007>

<sup>118</sup> Aruz, Joan and Wallenfels, Ronald (2003). *Art of the First Cities: The Third Millennium B.C. from the Mediterranean to the Indus*. Metropolitan Museum of Art New York.  
[https://books.google.se/books?id=8l9X\\_3rHFdEC&pg=PA64&redir\\_esc=y#v=onepage&q&f=false](https://books.google.se/books?id=8l9X_3rHFdEC&pg=PA64&redir_esc=y#v=onepage&q&f=false)

area. The more the water level rises, the more it will affect the sites.<sup>119</sup> With a capacity of 3 billion cubic meters, Aljbory argues that the majority of all 250 archaeological sites will be flooded.<sup>120</sup>

“If these sites would be excavated, we would find non-documented history that affects the whole Mesopotamia region, and if they are flooded a large part of a buried history will be lost forever.”<sup>121</sup>

According to Khatab, in order to protect the archaeological sites, comprehensive excavation must be carried out and followed by preservation work, making use of local knowledge and expertise.<sup>122</sup>

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<sup>119</sup> Khatab, Ali Khalid; Cuneiform specialist at Kar-Tukulti-Ninurta. Interview 2021-10-26.

<sup>120</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>121</sup> Ibid

<sup>122</sup> Khatab, Ali Khalid; Cuneiform specialist at Kar-Tukulti-Ninurta. Interview 2021-10-26.

## 7. Social-economic impact

Different social impacts of a dam become apparent during its construction phase, impounding of the reservoir and operations phase.<sup>123</sup> For instance, when a dam is first set in operation, the benefits successively become apparent, irrigation systems start to operate, electricity is generated, and water is being stored. But the social consequences of a dam are among the most painful of a dam's negative impact. These are often connected to resettlement and loss of livelihood, and typically include ethnic and cultural confrontations.<sup>124</sup>

### 7.1 Social-cultural impact

Conversations with residents from the villages of Al-Zawiya and Al-Zab indicates that apart from the historical significance, the archaeological sites also are highly valued by the locals. According to Aljbory, these communities are born and brought up with the archaeological sites. He explains that from early age all local tourism is to the city of Ashur, Kar-Tukulti-Ninurta and to Qasr Al-Benet, which allows people to develop a spiritual relationship with them.<sup>125</sup> Abdullah adds that the residents have a strong relationship to the city of Ashur, and view it as their grandmother.<sup>126</sup>

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<sup>123</sup> Varis, Olli (2006). Social consequences of dams. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>124</sup> Ibid.

<sup>125</sup> Aljbory, Khalil; Dr in Islamic History and former Head of Archaeology at Tikrit University. Interview 2021-10-06.

<sup>126</sup> Abdullah, Salem; Archaeological director of the ancient city of Ashur. Interview 2021-10-26.

“Being born and raised in Al-Zawiya, the archaeological sites, such as Qasr Al-Benet, are always in front of you. I can see the site of Qasr Al-Benet from my house. Every morning I wake up and look out over the Tigris and this site, it gives me inner peace. I have it as a background on my phone. It is not only viewed as an archaeological site here, but as a person, it is one of us. [...] If I have to leave my house and this place, I might get sick.” (Respondent 3, a 50-year-old man from Al-Zawiya, working at Baiji oil refinery).

“We would be really sad if the archaeological sites were lost. This is the area of our parents’ graves.” (Respondent 4, 41-year-old woman from Al-Zawiya, housewife).

“I would be very upset if the archaeological sites were be flooded, and they will be flooded [with the dam construction]. Our parents and ancestors are buried there, it is a crime. We reject the dam.” (Respondent 5, a 38-year-old man from Al-Zawiya, employee at a local education agency).

“Of course, I would be upset if the archaeological sites were lost, I am forty years old and since I was brought to this world, they [the sites] have been in front of me, and before that in front of my father and grandfather.” (Respondent 9, a 39-year-old man from Al-Zab, farmer, and vegetable seller.)



## 7.2 Economic and agricultural impacts

The rapid population growth globally has further emphasized the need for increased amounts of irrigation water for food production. If the water from the Makhoul Dam reservoir is used for irrigation, it could provide 3 billion cubic meters of water for agriculture downstream.<sup>127</sup> Forty per cent of the world's agricultural production comes from irrigated agricultural land and 50 per cent of all large dams are constructed with the main aim to provide water for irrigation.<sup>128</sup> However, the water gain of these dams usually benefits large-scale economic units such as commercial farms and industries, rather than local farmers, fisheries or local livelihoods. The positive impact of dams also tends to be more advantageous for middle- and upper-class people living in urban settlements, while less so for those living in economically deprived rural areas.



Figure 5. Sheep grazing at the site of the Makhoul Dam. (Source Emily Garthwaite, INSTITUTE 2022).

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<sup>127</sup> Al-Ansari, Nadhir; Professor in Water Resources Engineering at Luleå University of Technology in Sweden. Interview 2021-10-05.

<sup>128</sup> Varis, Olli (2006). Social consequences of dams. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

Further, the Makhoul area is a rural area and several of the affected communities are farming communities. This means that many of the households rely on agriculture and animal husbandry or local shops for livelihood.<sup>129</sup> The implementation of the dam, therefore threatens to give rise to extensive livelihood implications for these communities:

“The dam will affect us and our farms, we have a lot of land here, we are a farming community. [...] I have four farms and they can't replace them.”  
(Respondent 3).

“The biggest issue is the displacement and if you have animals, if you have farms or land, all that will be lost.” (Respondent 8).

### 7.3 Displacement

The construction of larger dams often means that reserves are built in the middle of populated areas. If there is no well-organized resettlement programme for the dam-affected communities, the dam could cause incomprehensible suffering and hardship for the local population.<sup>130</sup> The WCD highlights that dam construction has resulted in the displacement of 40-80 million people worldwide.<sup>131</sup>

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<sup>129</sup> Shafaq (2021). Iraqi authorities to start constructing the Makhoul dam by the end of January. <https://www.shafaq.com/en/Iraq-News/Iraqi-authorities-to-start-constructing-the-Makhoul-dam-by-the-end-of-January>

<sup>130</sup> Cederwall, Klas. (2006). Dam safety and climate change. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>131</sup> The World Commission on Dams Framework - A Brief Introduction (2008). International Riveres <https://archive.internationalrivers.org/resources/the-world-commission-on-dams-framework-a-brief-introduction-2654>



Figure 6.

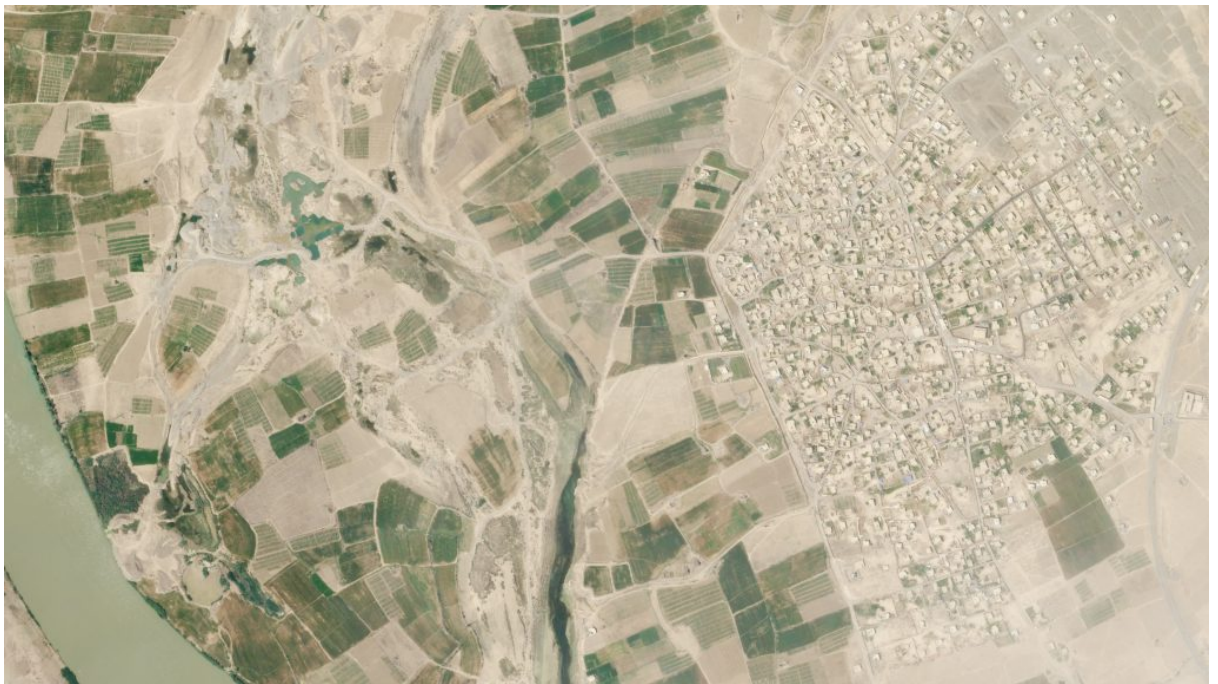


Figure 7. Satellite images of two areas along the Tigris River that will be affected by rising water if the Makhoul dam is constructed. (Source Harry Istepanian and Noam Raydan, Planet Labs 2021).

The implementation of the Makhoul Dam will displace people in three administrative units within Salahaldin and Kirkuk, including the sub-districts of Ashur, Al-Sahl Al-Akhdar, Al-Zawiya, Al-Abbasi and Al-Zab. A study from Liwan

shows that 40 villages, with a total population size of 118412 people will be displaced.<sup>132</sup> For most of the locals interviewed, the dam construction caused anxiety and concerns over the future and having to leave their homes.

“Al-Zawiya is the history of our grandparents and our parents; we were born here. When we leave Al-Zawiya the history of it will be erased, and so will the civilization of Al-Zawiya and the name Al-Zawiya. We firmly refuse this because this area is from 1568, it has an old history. Al-Zawiya has a population of 20 000 - 25000 residents, 5000-6000 households, it is an area not easy to transfer.” (Respondent 3, a 50-year-old man from Al-Zawiya, working at Baiji Oil Refinery).

“When they previously said that the project of the Makhoul Dam was cancelled, we were really happy and we thanked God. I don’t know where we will go now, we will be split up as a community, and here we are all very close to each other. The dam will destroy our lives.” (Respondent 5, a 38-year-old man from Al-Zawiya, employee at a local education agency).

“I do not have a house except for the one I live in, and I will have to leave it. I do not have employment or anything, where would I go? It would hurt us economically.” (Respondent 9, a 39-year-old man from Al-Zab, farmer, and vegetable seller).

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<sup>132</sup> Zaaimi, Sarah and Kathem, Mehiyar. (2022). THE SOCIAL AND CULTURAL REPERCUSSIONS OF MAKHOUL DAM: Iraq’s Next Humanitarian Crisis. Liwan. <https://img1.wsimg.com/blobby/go/df7b5465-4ad8-4601-8bfa-156dff0348a1/Makhouldamreport.pdf>.

**While some of the respondents saw opportunities in the planned Makhoul Dam:**

“I am one of the supporters of the dam because I want to live in the city. That's better than living in a village, if you get compensated then you can buy a new house someplace else.” (Respondent 1, 36-year-old man from Al-Zawiya, employee within the public sector).

“I am with the dam because it will benefit the area, while a lot of people will be displaced, and they need to be sufficiently compensated by the government.” (Respondent 7, 42-year-old man from Al-Zawiya, employee at the Ministry of Water Resources).

**Several respondents brought up concerns over public interest and the acute water situation of Iraq when talking about the Makhoul Dam:**

“When it comes to the public interest, Tigris is lost and the water resources have decreased in Iraq, but at a personal level, we reject it. [...] We don't reject public interest, because Iraq suffers from water scarcity, but we wish, or prefer it to be a reservoir instead of a dam, so Al-Zawiya with its history, culture and roots could remain and not be erased. We refuse the dam ... and agree to it at the same time. We refuse it because we cannot leave Al-Zawiya.” (Respondent 3).

“I am with the dam if it is in the interest of Iraq and if we will get sufficiently compensated. The most important thing is that it is in the interest of Iraq.” (Respondent 6, a 43-year-old man from Al-Zawiya).

“The dam is both good and bad, it is positive in the long run, generating hydroelectricity and expanding agriculture, but at the same time it will displace people from the areas of Al-Zab, the Msahaq and Sherqat, so my opinion is that the negative impact of it is more than the benefits.”

(Respondent 8, a 35-year-old man from Al-Zab, teacher).

“There are positive aspects and negative aspects, the positive is that it will be useful for us in the future. The negative is that we will have to leave our homes, our land and our farms, everything.” (Respondent 9).

According to the respondents, if they are forced to leave their homes, migration will mainly be to Tikrit in Salahaldin and cities within Kirkuk governorate. Today these cities are already failing to support their existing population in terms of economics and infrastructure. Therefore, this migration might increase levels of insecurity in the area, as people are unable to find employment to support themselves and their families. Moreover, between 2014-2017, Salahaldin governorate and most parts of Kirkuk were under the control of Daesh (so-called Islamic State (IS)), and districts such Al-Zab were among the latest to be liberated.<sup>133</sup> The majority of the dam-affected communities are hence previously displaced people, who have recently returned to their hometowns and villages to rebuild their lives. For many of the participants, this experience has left a strong mark, which they recalled when speaking about the risk of being displaced again:

“We have not accepted the dam. I have built a new house and our community is benevolent. We had to flee and were displaced for three years at the time of IS and we really suffered. Cancel the dam project, I want our area.” (Respondent 2, a 42-year-old woman from Al-Zawiya).

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<sup>133</sup> Balanian, Pierre (2016). Asia News. Islamic State begins deportation of residents from al-Zab. <https://www.asianews.it/news-en/Islamic-State-begins-deportation-of-residents-from-al-Zab-38059.html>

"We reject it, where would we go? Everyone has built houses and shops. We didn't know where to go when IS displaced us, [the dam] will affect our jobs and our area, the area of our parents and grandparents, I don't know where to go, no one has offered us a place." (Respondent 4, a 41-year-old woman from Al-Zawiya, housewife).

"Our area is precious to us, [the dam] would strongly harm us. The displacement from IS felt like it took 20 years of our lives, and now we will be displaced because of the dam, where would we go?" (Respondent 5).

"I can live here but nowhere else, at the time of [IS] displacement I lived for a year in Kirkuk, that was mentally exhausting for me." (Respondent 9).

According to Professor Klas Cederwall, at the Department of Land and Water Resources Engineering at the Royal Institute of Technology, Stockholm, a well-prepared resettlement plan is of great importance. This resettlement plan should be worked out together with the people affected by the dam project.<sup>134</sup> Also, the WCD emphasizes that large dam projects should entail the opportunity of informed participation in the decision-making process for all stakeholders. They further advise that the decisions affecting the local population need to be taken with their free and informed consent. Those affected by the dam, both those directly situated around the reservoir and those downstream, should be provided with entitlements and the priority share of the dam's benefits beyond compensation for their losses.<sup>135</sup>

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<sup>134</sup> Cederwall, Klas. (2006). Dam safety and climate change. Chapter in edited book: Dams under Debate. Johansson, Birgitta and Sellberg, Björn. Swedish Research Council Formas. Elanders Gotab, Sweden.

<sup>135</sup> The World Commission on Dams Framework - A Brief Introduction (2008). International Riveres <https://archive.internationalrivers.org/resources/the-world-commission-on-dams-framework-a-brief-introduction-2654>

As the time of writing, there has not been any official statement by the Iraqi Government on a resettlement plan or how the residents will be compensated. Both local researchers and residents have tried to contact and begin discussion with the government about the impact of the dam on their areas, without any response. To compensate the residents of the dam-affected communities, Aljory points out that the government needs to replace land and accommodation for residents in 40 communities. Also, health centers and at least 40 schools need to be replaced before the completion date of the dam in 2024. The people within the displacement-threatened communities hold different opinions on compensation:

“... If they would compensate us with a billion it still couldn't compensate us, the most important is our well-being.” (Respondent 5).

“I cannot imagine what would be enough compensation because you will move people, lives, generations, their graves, their heritage, and their history. All that is within the area represents us - the river, the mountains. We have lived here for a thousand years, our fathers and grandfathers before us. Large sums, twice of what we will leave behind, will be needed for compensation.” (Respondent 6).

“If I get housing and income I will benefit. If you just displace me, I will not benefit [...]. Yes, for sure we will be affected because we have no income. Our livelihood is in this area. If we have to go somewhere else, how will we eat, drink and live?” (Respondent 10. 43-year-old woman from Al-Zab, housewife).



## 8. Conclusion

This report has examined whether the benefits of the Makhoul Dam would outweigh the costs of the dam by outlining the environmental, cultural and social impacts of the dam, taking into account the technical aspects. As discussed in the report, if the federal government of Iraq continues the construction of the Makhoul Dam, it will put the ecosystems and environment around the Makhoul Dam out of balance. By flooding upstream areas and decreasing the water flow downstream, it will affect the water quality. It will also diminish the biodiversity along the whole course of the Tigris River and within the Marshes of southern Iraq. The Makhoul Dam will, moreover, damage parts of the world heritage site of the city of Ashur and place the whole city of Kar-Tikulti-Ninorta under water. It will also wipe out the majority of more than 250 archaeological sites. At the same time, the Makhoul Dam will cause loss of livelihoods and displace more than 100000 people from 40 communities within Salahaldin and Kirkuk governorate. The majority of whom have recently returned to rebuild their lives after years of displacement. Even if it is hard to measure the positive and negative effects of dams, on the ground, the future cost of the Makhoul Dam can be perceived as much higher than the potential benefits of the dam.

As with all dams, the Makhoul Dam could increase the accessibility of water and according to the government, this water would be used for water storage, irrigation purposes, flood prevention and hydroelectricity. However, in practice, the complex geology of the dam site decreases safety factors, while increasing the economic cost of the dam. The structural complexity further means that any mistake in the geological investigation, technical plan or design could make the Makhoul Dam a more dangerous dam than the Mosul Dam. Furthermore, while the Makhoul Dam could on paper provide an increased volume of water storage, it will also increase the amount of water evaporating from the country's total freshwater resources. In an arid region like the Middle East, and with the increased drought and extreme temperatures of Iraq, this fact should be taken into close consideration.

Moreover, the planned Makhoul Dam and its devastating impact is a severe symptom of a vicious circle of poor water management in combination with a serious water crisis, within Iraq. It reflects further, the hydropolitics of the whole Middle East and North Africa region, where changes in the quantity and quality of the water, caused by climate change and population growth, push national and regional actors towards destructive water management. This desperate competition over increasingly scarce freshwater resources is often embodied by large-scale dam projects.

With these considerations in mind, the following recommendations can be made:

1. Halt the construction of the Makhoul Dam due to the aforementioned negative environmental, cultural and social-economic impacts;
2. Consider alternatives to dam construction, including modernization of irrigation techniques and use of non-conventional water resources, such as rainwater harvesting, wastewater recycling and other similar technologies;
3. Prioritize negotiations with neighboring countries to agree on fair shares of water resources in the Tigris-Euphrates basin;
4. Prioritize better coordination between the Iraqi federal government and the Kurdistan Region in Iraq and work out a long-term protection plan to preserve Iraq's rivers;
5. Make use of local knowledge and expertise to carry out and complete a comprehensive excavation of the archaeological sites at the dam area, regardless of whether the dam will be constructed.

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