



## Assessment of damage to residential infrastructure in Nikopol, Dnipropetrovska Oblast

June 2024 | Ukraine



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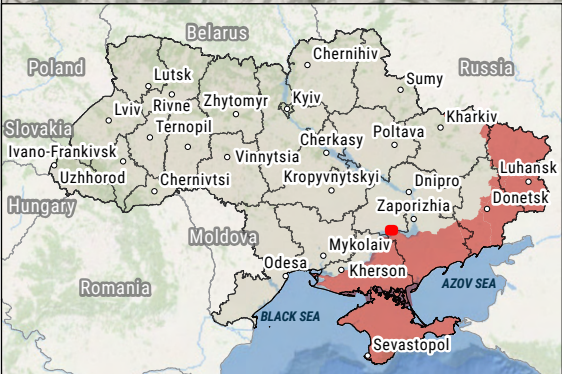
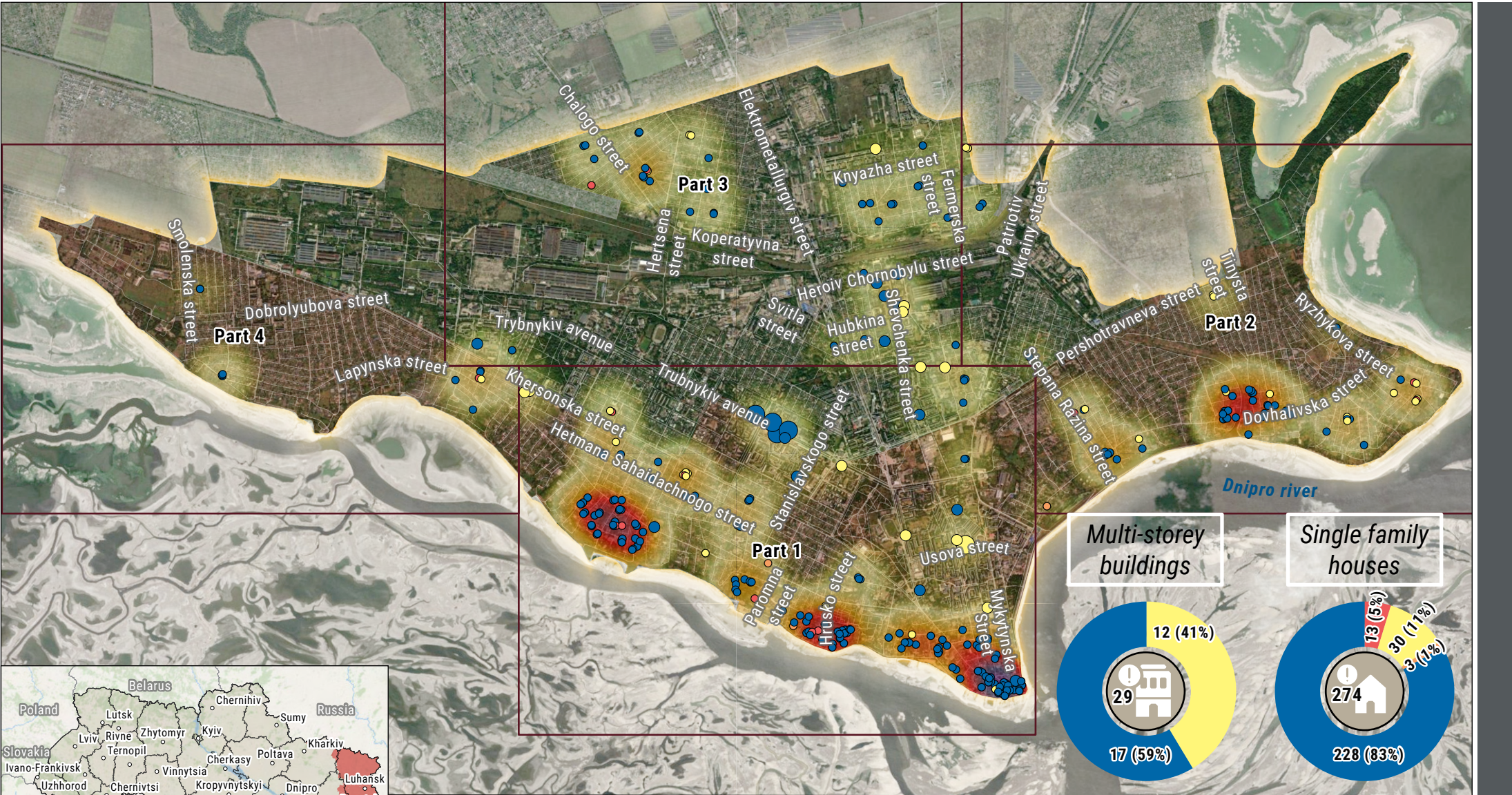
## REACH

REACH is a leading humanitarian initiative providing granular data, timely information and in-depth analysis from contexts of crisis, disaster and displacement. The work of REACH directly feeds into aid response and decision-making by providing accessible and precise information on the humanitarian situation of crisis-affected populations.

Created in 2010, REACH is a joint initiative of IMPACT Initiatives, ACTED and the United Nations Operational Satellite Applications Programme (UNOSAT). REACH activities are conducted in support and within the framework of inter-agency coordination mechanisms at field and global levels to enabling more efficient aid planning and response.

Cover image: *Drained reservoir and part of Nikopol, April 2024.*<sup>14</sup>





**Areas of significant damage according to participatory mapping**

**Damaged residential buildings by number of residents (total 3,977)**

- up to 3
- up to 200
- up to 400

**Density of damaged residential buildings**

Sparse Dense

**Damage classification**

- Moderate damage
- Severe damage
- Destroyed
- Under repair

Data sources:  
 Administrative boundaries - OCHA  
 Imagery background - Esri (Maxar)  
 Damage data - REACH  
 Coordinate System: WGS 1984 UTM Zone 36N  
 Contact: reach.mapping@impact-initiatives.org

*Note: Data, designations and boundaries contained on this map are not warranted to be error-free and do not imply acceptance by REACH partners, associates or donors mentioned on this map.*



# ASSESSMENT OF DAMAGE TO RESIDENTIAL INFRASTRUCTURE IN NIKOPOL

## JUNE 2024 | UKRAINE

This situation overview presents the findings of an assessment of conflict-induced damage to residential infrastructure in Nikopol and surrounding areas conducted by REACH.

## KEY FINDINGS



The area of the city closest to the reservoir bank shows the most intensive damage (48% of the identified buildings overall were within 500 meters of the riverbank).



Temporary repair work is visible throughout the city, indicating that more permanent repairs are not being made.



The emptied Kakhovka reservoir shows signs of ecological transformation, adversely changing the environment and economy for people living in the city.

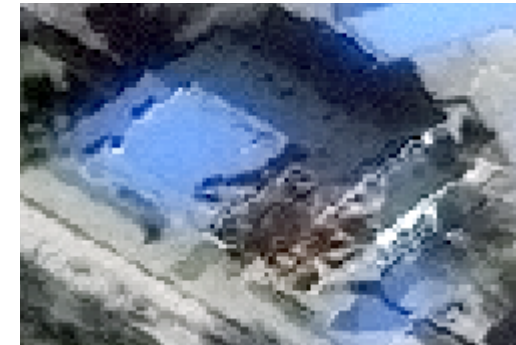
## CONTEXT

Nikopol is a city in the Dnipropetrovsk Oblast, the fourth largest city in the oblast with a population of 105,160 people at the start of 2022.<sup>1</sup> In February 2023, city authorities estimated the population to be “50%” of that figure due to displacement caused by hostilities.<sup>2</sup> It is situated on the right bank of the Dnieper river, with the Armed Forces of the Russian Federation situated on the left.<sup>3</sup> The city has an industrial economy, including the manufacture of steel and pipe.<sup>4</sup>

Nikopol has been intensely affected by the conflict. Regular artillery and drone attacks continue to damage residential areas, public infrastructure, and industries, affecting the local economy.<sup>5</sup> REACH’s Damage Impact Analysis found that economic activity was perceived to be highly impacted by damage, with a contraction in the jobs market.<sup>6</sup> In the ACAPS “Civilian Infrastructure Damages Dataset”, around 75% of the identified damaged objects are economic.<sup>7</sup> As well as facing bombardment, the city has been

affected by the breach of the Kakhovka Dam in June 2023, causing the water level in the Kakhovka reservoir near the city to empty.<sup>8</sup>

In December 2023, Mayor Oleksandr Sayuk reported almost 5000 damaged structures in Nikopol.<sup>9</sup> ACLED (the Armed Conflict Location and Event Database) reported attacks on 244 days throughout 2023.<sup>10</sup> Already by 30 April 2024, there were reports of incidents on 113 days (or more than nine in every ten days).



**Image 1.** Building with damage to the roof, April 2024.<sup>13</sup>

This geo-spatial damage assessment is complemented by an assessment of damage to non-residential infrastructure, and a qualitative “Damage Impact Analysis” reflecting the lived experience of affected people.<sup>6</sup>

Together, these assessments offer a comprehensive understanding of the damage and its impacts to inform strategies for effective response and recovery.

Reports and datasets are available for bi-lateral sharing upon request:  
[impact.ukraine@impact-initiatives.org](mailto:impact.ukraine@impact-initiatives.org)



## METHODOLOGY OVERVIEW

This analysis is based on high-resolution satellite imagery from February, March and April of 2024.<sup>11</sup> It also uses medium-resolution imagery to measure impact on the reservoir.<sup>12</sup> REACH partnered with UADamage to produce an initial AI-assisted damage detection.<sup>13</sup> The results were verified through visual inspection, whereby each building was reviewed to confirm damage severity, and distinguish residential from non-residential buildings.

The city has been targeted by artillery and drones, which cause damage to facades, windows and doors, but may not cause damage visible from a satellite's "bird's eye view".<sup>14</sup> As such, the count in this report is indicative of the distribution of damage, but does not reflect a claim on the total number of damaged buildings.

Single-household and multi-story buildings were counted separately. In the case of multi-story buildings, an estimate of the number of floors and apartments was produced by inspecting publicly available satellite and street-level imagery.<sup>15</sup> After estimating the number of dwellings in a building, a rule-of-thumb was used to calculate the potential number of people affected by damage to this building.<sup>16</sup> Damage severity was assigned to each building using the below categorisation:

- **Moderate damage:** Noticeable but non-critical damage to the building, preserving its overall structural soundness (i.e.: non-structural roof damage such as small holes).
- **Severe damage:** Substantial damage possibly compromising the building's structural integrity (i.e. major portions of the roof or walls have collapsed or are critically compromised)
- **Destroyed:** The building's structural framework is critically compromised or completely failed, likely irreparably (i.e. the roof, walls, or floors have either entirely collapsed or are on the brink of collapse).
- **Under repair:** There are visible signs of repair work, such as temporary building materials or construction plant nearby

Although light damage is difficult to detect, more severe damage in an area can serve as an indicator of the presence of further damage within the vicinity.

Before<sup>17</sup>



After<sup>13</sup>



### Moderate damage

The building on the left of the image shows damage, where the roof changes from blue to brown.



### Severe damage

At the top of the image, a brown roof is visible in the "before," but it is not visible in the "after"



### Destroyed

In the "after", structural elements are visible across the entirety of the building.



### Under repair

In the "after", some roofs are highly reflective, indicating the use of metal sheet.



## DATA ANALYSIS

The high intensity of aerial attacks is reflected in the distribution of damaged buildings across the entirety of the city and in the nearby villages. However, the highest concentration of damage is near to the riverbank. In participatory mapping sessions conducted by REACH in December 2023, people split the city into four zones.<sup>6</sup>

In this assessment, 75% of the visibly damaged buildings were found within the area which participants marked out as at high risk and facing continuous shelling (highlighted pink on the overview map). Furthermore, 189 of the identified buildings (48%) were within 500 meters of the riverbank. By comparison, the remaining buildings showed low clustering, but rather were spread widely across the city.

Although there is evidence of damage across the whole city, the presence of 19 damaged multi-story buildings near to the central Elektrometalurhiv street and park means there is a potentially outsized impact on residents in this area. By contrast, just one multi-story building with visible signs of damage was found within 500 metres of the coast. Most buildings here are single-family houses.

In this analysis, buildings showing signs of initial or temporary repair work were counted amongst the damaged buildings. 73% of buildings were identified as showing signs of temporary repair (312 of 428). The key indicator was the widespread presence of corrugated metal roofing, which had not been there before the conflict. Although confirmation is beyond the scope of this analysis, it is possible that this material is being favoured locally for short-term repairs due to the existing metallurgical industrial capacity in the city.

Using metal sheeting to cover damaged roofs should be considered a coping strategy in the context of continuous attrition of the housing stock, rather than a conclusive resolution of the situation. **In focus group discussions organised by REACH, residents repeatedly mentioned that the frequency of shelling meant that it was difficult to make long-lasting repairs.**<sup>6</sup>

**The reservoir is visibly emptied in the imagery. Where before there would have been open water across to the left bank near Enerdohar, now** there are small lakes interconnected by channels. In the following maps, the city is broken down into four areas according to the concentration of damage. The final page shows an analysis of the extent of water in the reservoir from June 2023 to May 2024.

## PART 1

This part shows central Nikopol. The pink-shaded area near to the river bank shows the “area of significant damage” identified by research participants.

There are clusters of visibly damaged and repaired single-family houses running down the length of the riverbank. Additionally there are damaged multi-story buildings present in this area, for example around Trubnykiv Avenue.

Accounting for the relative capacity of single-family and multi-story buildings, the map indicates how exposure to the effects of damage are potentially concentrated around the larger buildings.

However, the qualitative findings and desk review indicate that in reality, buildings across this region are highly exposed to damage. 88% of single-family houses that were identified showed signs of repair, indicating that people continue to try to maintain connections to the area despite the risk.

## PART 2

The eastern part of the city is characterised more by single-family houses. Again, this area sits within the “area of significant damage”. There are clusters of visible damage or repair close to the river bank.

## PART 3

To the north, there are a mixture of single-family and multi-story buildings. Although this part of the city is outside of the “area of significant damage”, there is still evidence of damage dispersed across the whole area. There were two visibly destroyed buildings in this area, relatively far from the riverbank.

## PART 4

The “areas of significant risk” run right along to the western-most part of the city. Again, this suburban area is characterised by single-family houses.

As in other parts of the city, there are signs that houses are being repaired, suggesting that people are maintaining a connection to the area.





**Damage classification**

- Moderate damage (Yellow dot)
- Severe damage (Orange dot)
- Destroyed (Red dot)
- Under repair (Blue dot)

**Damaged residential buildings by number of residents (total 2948)**

- up to 3
- up to 200
- up to 400

**Estimated population density in areas of detected shelter damage**

Sparse Dense

**Areas of significant damage according to participatory mapping**

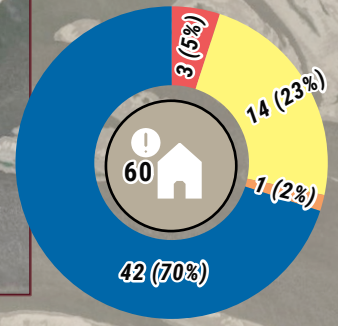
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 Administrative boundaries - OCHA  
 Imagery background - Esri (Maxar)  
 Damage data - REACH  
 Coordinate System: WGS 1984 UTM Zone 36N  
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Single family houses



**Damage classification**

- Moderate damage
- Severe damage
- Destroyed
- Under repair

**Damaged residential buildings by number of residents (total 142)**

- up to 3
- up to 200
- up to 400

**Estimated population density in areas of detected shelter damage**

Sparse  Dense



**Areas of significant damage according to participatory mapping**



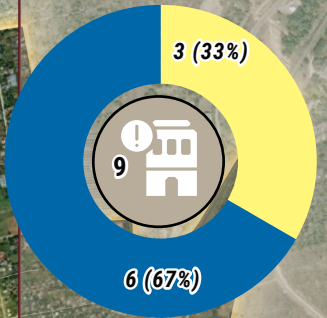
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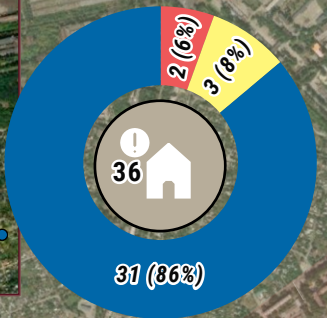




Multi-storey buildings



Single family houses



**Damage classification**

- Moderate damage
- Severe damage
- Destroyed
- Under repair

**Damaged residential buildings by number of residents (total 864)**

- up to 3
- up to 200
- up to 400

**Estimated population density in areas of detected shelter damage**

Sparse  Dense



**Areas of significant damage according to participatory mapping**



Data sources:  
 Administrative boundaries - OCHA  
 Imagery background - Esri (Maxar)  
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**Damage classification**

- Moderate damage
- Severe damage
- Destroyed
- Under repair

**Damaged residential buildings by number of residents (total 24)**

- up to 3
- up to 200
- up to 400

**Estimated population density in areas of detected shelter damage**

Sparse  Dense

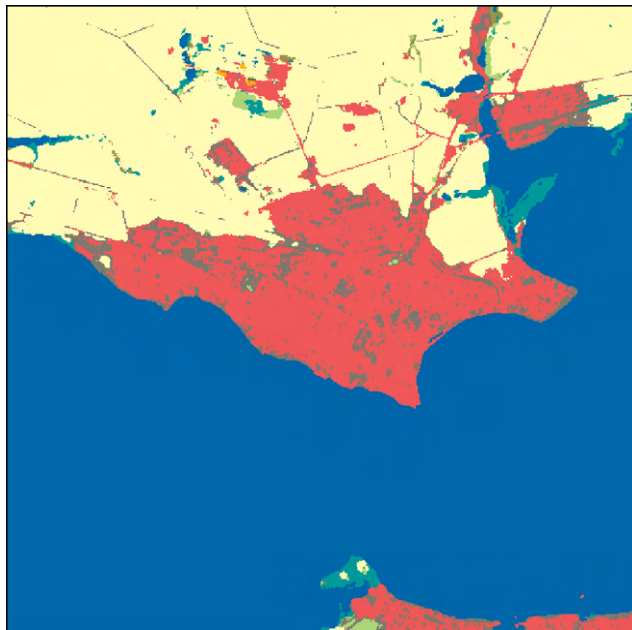
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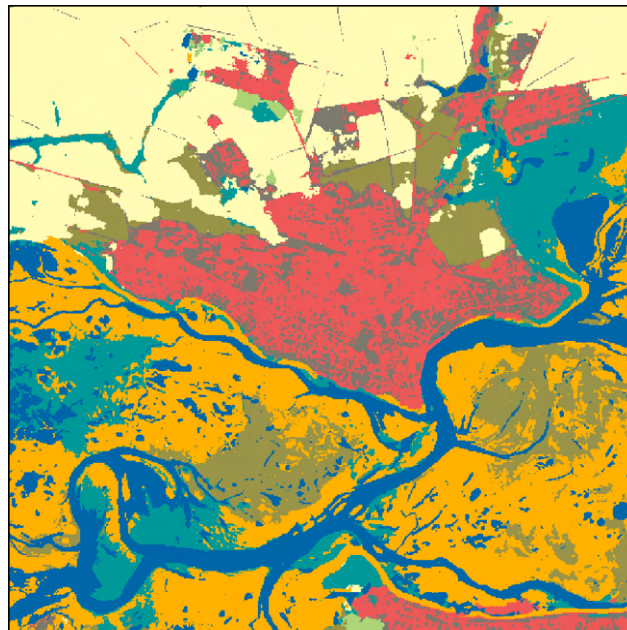
## KAKHOVKA RESERVOIR ASSESSMENT



2 June 2023

The Kakhovka reservoir has all but emptied since the breach of the Kakhovka dam in June 2023.<sup>9</sup> The image on the left shows the extent of the reservoir on 2 June 2023, before the breach.

The reservoir was one of the largest in the Dnipro River cascade. Since its creation in 1955 -1958, the reservoir had been used for shipping, irrigation, water supply, recreation, and fisheries. The reservoir also had a significant impact on the city's climate. Although the steppes are characterised by aridity, dry winds and dust, the reservoir humidified and cooled the air locally. The Zaporizhzhia Nuclear Power Plant cooling reservoir was supplied with water from the larger reservoir.

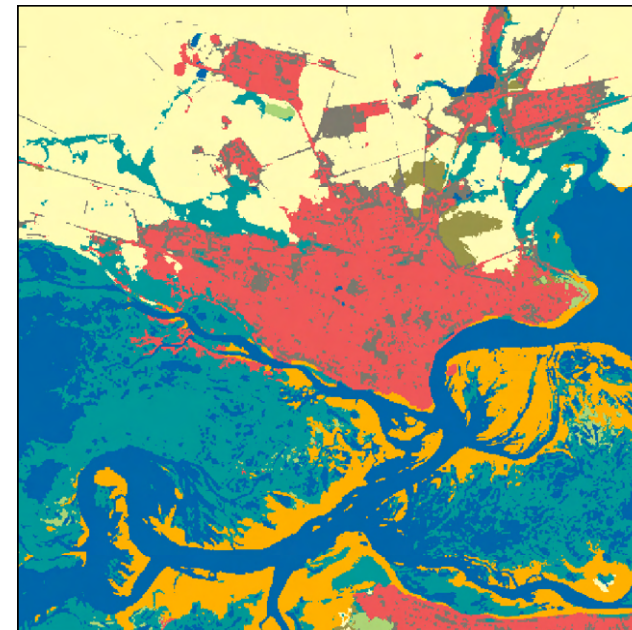


5 August 2023



In August 2023 (central image), two months after the explosion of the Kakhovka Hydro Power Plant, water only remained in the deepest parts of the reservoir.

The city's water supply was affected. In assessing damage, REACH found indications of shelling around water pumping infrastructure on the exposed ground.<sup>18</sup> At this time, the environment was in a state of water stress, and people had limited access to water.<sup>19 6</sup>



22 May 2024

A year after the disaster (in the image on the right), the reservoir remains emptied. Ecologically speaking, the environment now is similar to how it would have been before the reservoir was made.<sup>20</sup>

The sandy and muddy bottom is covered with diverse vegetation, and wetlands have formed on the floodplain; biodiversity has increased.<sup>21</sup>

At the same time, the immediate social impacts have been negative,<sup>22</sup> with the area judged not suitable for economic use.<sup>23</sup>



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- 11 Satellite Imagery: **WorldView2** from 17 February, WorldView3 7 April Copyright: ©2024 DigitalGlobe, Source: US Department of State, Humanitarian Information Unit, NextView Licence; Satellite imagery: Airbus Pleiades-NEO from 23 March 2024.
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- 24 Generic basemap imagery: Worldview2 from June 27 2023 Copyright: © 2024 World Imagery