INTERNATIONAL COURT OF JUSTICE

CASE

CONCERNING THE GABČÍKOVO-NAGYMAROS

PROJECT

(HUNGARY/SLOVAKIA)

COUNTER-MEMORIAL

OF THE REPUBLIC OF HUNGARY

ANNEXES

COLOUR PLATES

VOLUME 5

5 DECEMBER 1994

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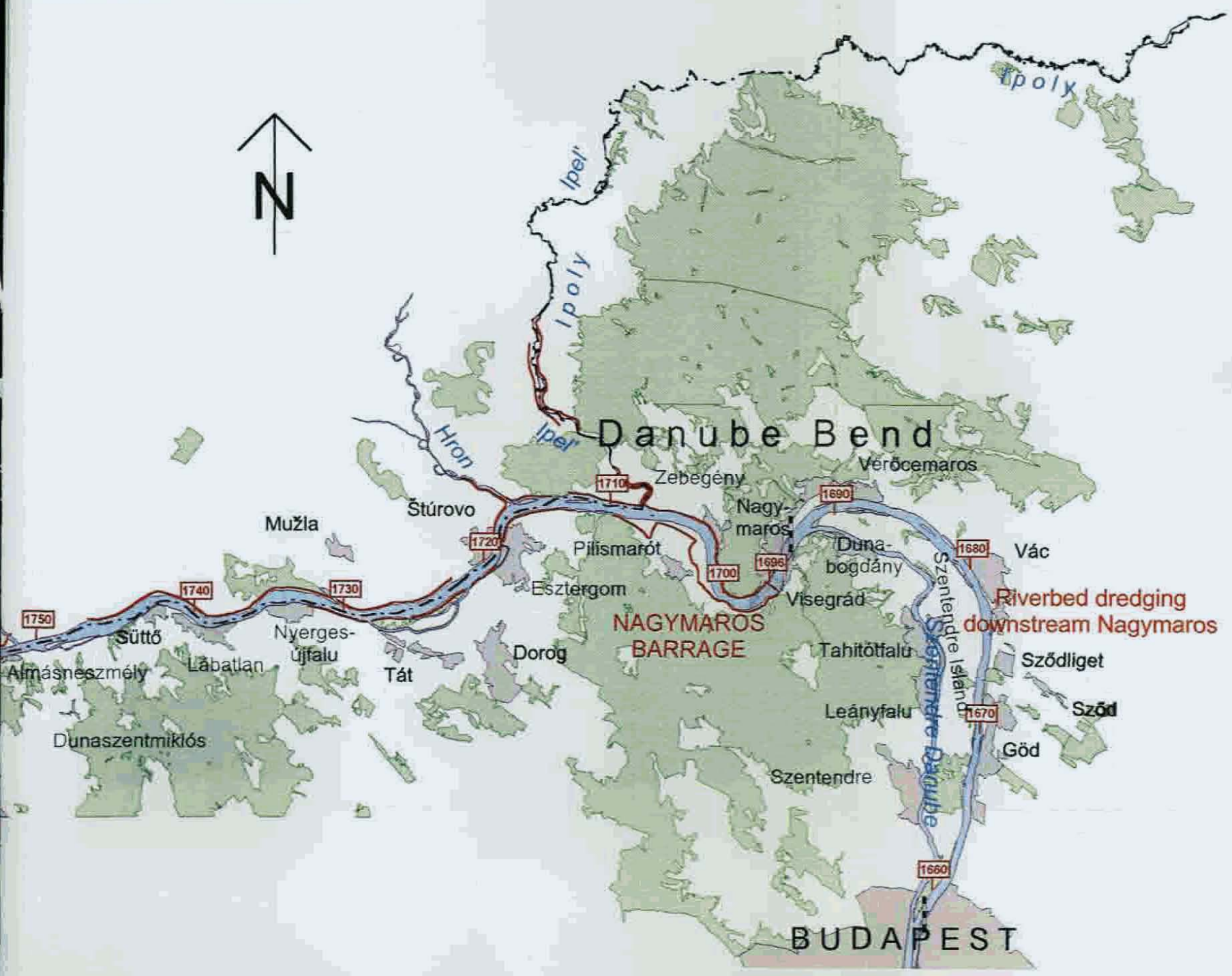
River Section
os Barrage System

Environmental Impact Area

Original Plan

Scale: M = 1:300.000

0 10 km



Legend

- *Power canal, reservoir*
- *Inundation dike*
- *Settlement*
- *Danube*
- *Forest*
- *River gauging station*
- *River km*
- *State border*
- *Barrage*
- *Embankment*

Plate 1.1

Upper Danube
Gabčíkovo-Nagymaros

BRATISLAVA

AUSTRIA

SLOVAKIA

HUNGARY

Dunajská Lužná

Šamorín

Čunovo

Dunakiliti-Hrušov Reservoir

Rajka

DUNAKILITI WEIR

Dunakiliti

Dobrohošť

Vojka n. Dunajom

Dunajská Streda

Headrace Canal

Vrakún

Dunasziget

Bodíky

GABČÍKOVO BARRAGE

Kisbodak

Gabčíkovo

Dunaremete

Tailrace Canal

Čalovo

Lipót

Mosonmagyaróvár

Hédervár

Ásványtáró

Sap

Čiližská Radváň

Medved'ov

Mosoni-Duna

Dunaszeg

Vámos-szabadi

Čičov

Nagybajcs

Kisbajcs

Győrújfalu

Gönyű

Komárno

Komárom

Almásfüzitő

Ács

Győr

Naszály

Mocsa

Rába

Malý Dunaj

Váh

Vážsky Dunaj

Žitný ostrov

Szigetköz

1850 1840 1830 1820 1811 1810 1800 1790 1780 1770 1760

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Data:

FDKIR

Danube Environmental Monitoring and Information System

River Section
ros Barrage System

Environmental Impact Area

Variant C

Scale: M = 1:300.000

0 10 km

N

Ipoly

Ipel'

Hron

Ipel'

Danube Bend

Zebegény

Verőcemaros

Štúrovo

Mužla

Nagy-maros

Pilismarót

Duna-bogdány

Vác

Esztergom

Visegrád

Szentendre Island

Süttő

Nyerges-újfalu

Tát

Dorog

Tahitótfalu

Sződliget

Almásneszmély

Lábatlan

Leányfalu

Szöd

Dunaszentmiklós

Göd

Szentendre

Szentendre Danube

BUDAPEST

1750 1740 1730 1720 1710 1700 1696 1690 1680 1670 1660

Legend

- *Power canal, reservoir*
- *Inundation dike*
- *Settlement*
- *Danube*
- *Forest*
- *River gauging station*
- *River km*
- *State border*
- *Barrage*
- *Embankment*

Plate 1.2

Upper Danube
Gabčíkovo-Nagymar

BRATISLAVA

AUSTRIA

SLOVAKIA

HUNGARY

Žitný Ostrov

Szigetköz

Malý Dunaj

Váh

Vázsky Dunaj

Mosoni-Duna

Rába

Čunovo Reservoir

Čunovo

ČUNOVO DAM

Rajka

Dunakiliti

Dunasziget

Kisbodak

Dunaremete

Mosonmagyaróvár

Hédervár

Lipót

Ásványráró

Dunajská Lužná

Šamorín

Dobrohošť

Vojka n. Dunajom

Headrace Canal

Zátonyi-Duna

Bodíky

Vrakún

GABČÍKOVO BARRAGE

Gabčíkovo

Tailrace Canal

Čalovo

Sap

Čiližská Radvaň

Medveďov

Dunaszeg

Vámos-szabadi

Nagybajcs

Kisbajcs

Győrújfalu

Dunajská Streda

Čičov

Gönyű

Győr

Komárno

Komárom

Ács

Almásfüzitő

Naszály

Mocsa

1850 1840 1830 1820 1811 1810 1800 1790 1780 1770 1760

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Danube Environmental Monitoring and Information System

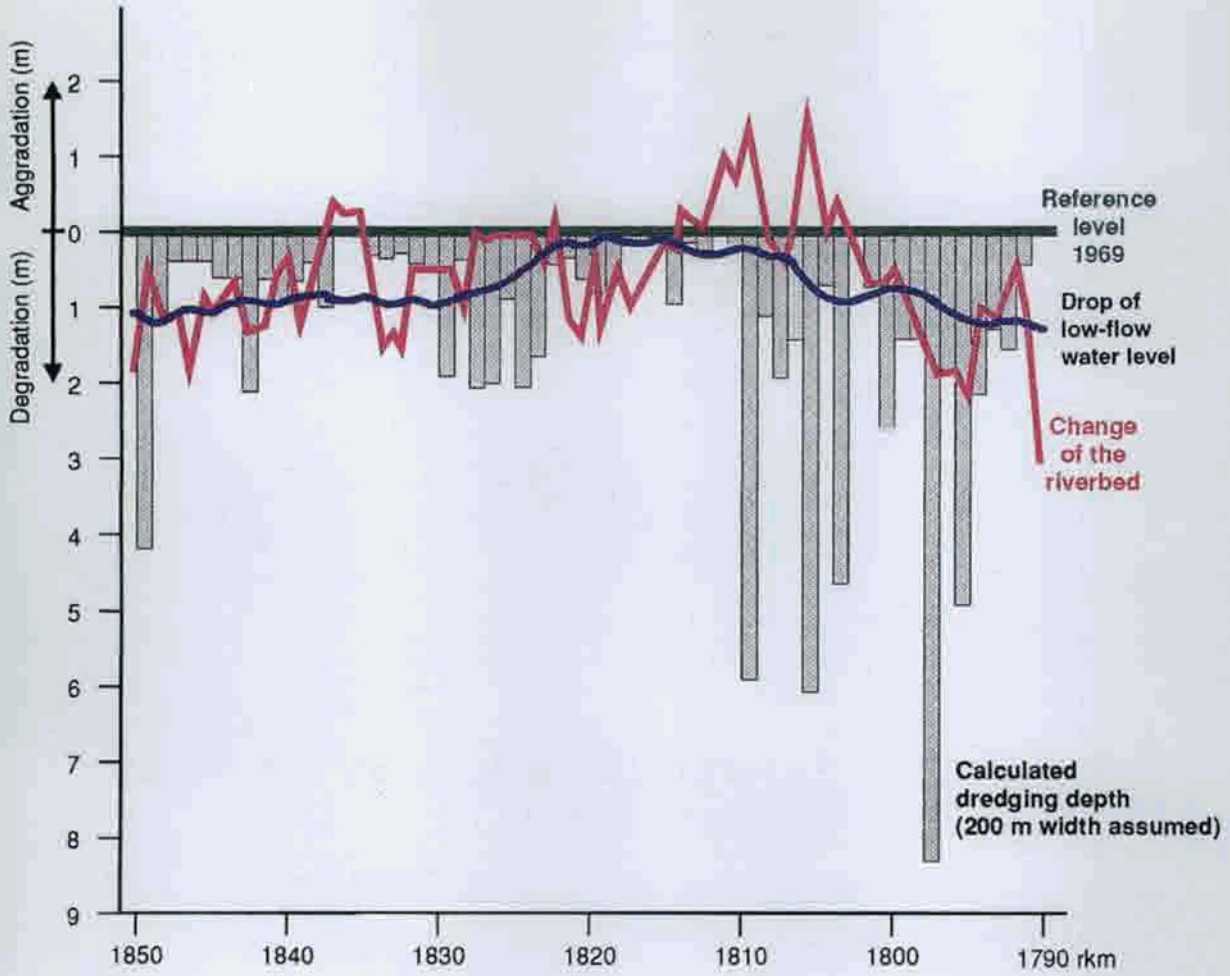


Plate 2.1 Changes of the Danube riverbed, waterlevel and dredging depth

Relative changes of the riverbed, drop of low-flow water levels and average depth of dredging since 1969 in the Danube between Rajka (rkm 1850) and Gönyü (rkm 1791)

(after K. Kern, 1994, Impact of the Gabčíkovo-Nagymaros Project on river morphology, fluvial hydraulics and habitats)

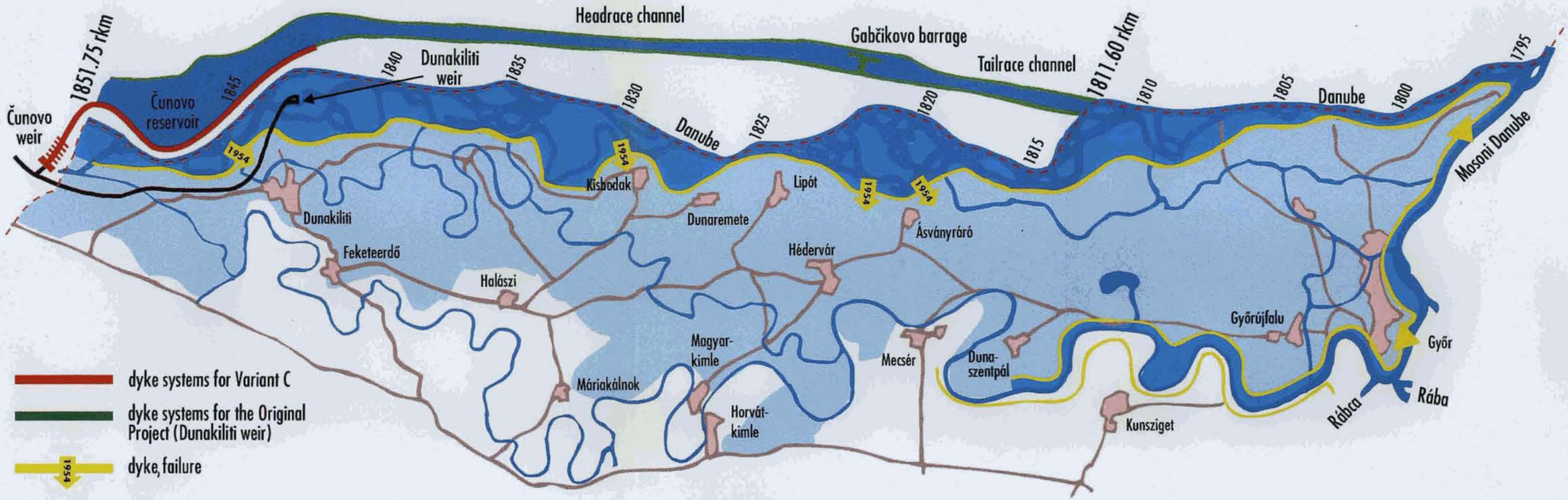
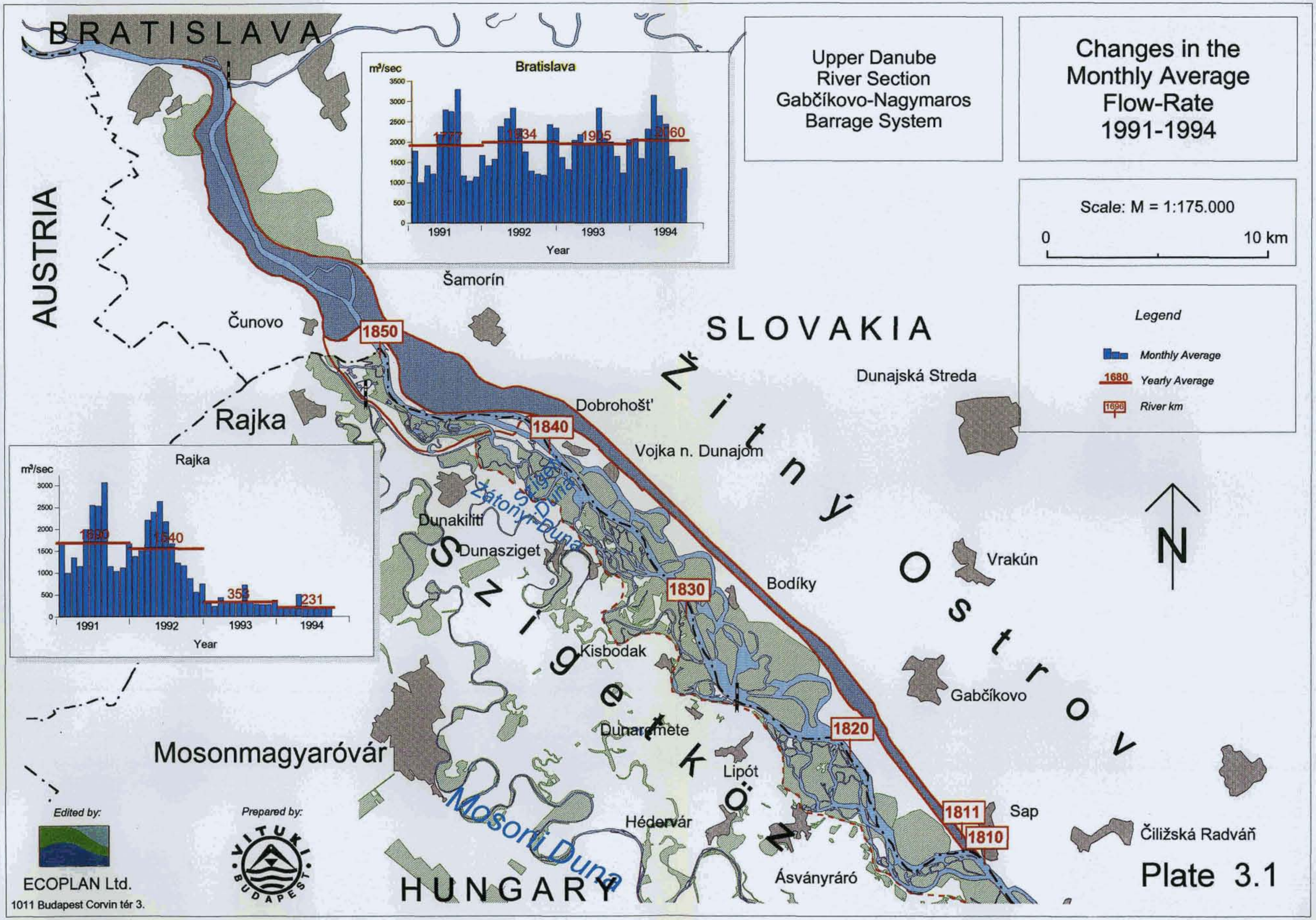


Plate 2.2

Dyke Systems
in the Szigetköz



Upper Danube
River Section
Gabčíkovo-Nagymaros
Barrage System
Changes in the
Monthly Average
Flow-Rate
1991-1994
Scale: M = 1:175.000
0
10 km
Legend
Monthly Average
1680 Yearly Average
River km
Bratislava
m³/sec
3500
3000
2500
2000
1500
1000
500
0
1934
1905
2160
1991
1992
1993
1994
Year
Rajka
m³/sec
3000
2500
2000
1500
1000
500
0
1540
231
1991
1992
1993
1994
Year
BRATISLAVA
AUSTRIA
SLOVAKIA
HUNGARY
Žitný Ostrov
Szigetköz
Šamorín
Čunovo
Rajka
Dobrohošť
Vojka n. Dunajom
Dunajská Streda
Dunakiliti
Dunasziget
Bodíky
Vrakún
Kisbodak
Gabčíkovo
Dunaremete
Lipót
Mosonmagyaróvár
Hédervár
Ásványráró
Sap
Čiližská Radvaň
Mosoni Duna
Zátonyi-Duna
1850
1840
1830
1820
1811
1810
N
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1011 Budapest Corvin tér 3.
Prepared by:
VITUKI
BUDAPEST
Plate 3.1

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Thickness of the Near-surface Aquifer

Data from the DANREG project by geoscientists of GEOKOMPLEX (Bratislava) and ELGI (Budapest)

Scale: M = 1:300.000

0 10 km

Legend

Thickness of the coarse gravel deposit:

- *more than 300 m*
- *200 - 300 m*
- *100 - 200 m*
- *50 - 100 m*
- *less than 50 m*

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Plate 3.2

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Founded in 1919

Upper Danube River Section
Gabcíkovo-Nagymaros Barrage System

Thickness of the Main Aquifer

Data from the DANREG project by geoscientists of GEOKOMPLEX (Bratislava) and ELGI (Budapest)

Scale: M = 1:300.000

0 — 10 km

Legend

Thickness of the Quaternary gravel compound:

- *more than 600 m*
- *500 - 600 m*
- *400 - 500 m*
- *300 - 400 m*
- *200 - 300 m*
- *100 - 200 m*
- *50 - 100 m*
- *30 - 50 m*
- *10 - 30 m*

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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Thickness of the Fine Grained Sediments

Scale: M = 1:175.000

0 — 10 km

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Legend

Thickness of the Fine Grained Sediments

- *more than 5 m*
- *4 - 5 m*
- *3 - 4 m*
- *2 - 3 m*
- *1 - 2 m*
- *less than 1 m*

Plate 3.4

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GEOLOGICAL INSTITUTE
OF HUNGARY

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Average Regional Groundwater Level Measured in 1990

Scale: M = 1:300.000

0 — 10 km

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Legend

direction of flow

Groundwater level in meters asl.:

- *above 129 m*
- *126 - 129 m*
- *123 - 126 m*
- *120 - 123 m*
- *117 - 120 m*
- *114 - 117 m*
- *111 - 114 m*
- *108 - 111 m*
- *below 108 m*

Plate 8.5

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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Average Groundwater Depth Measured in 1990

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Scale: M = 1:175.000

0 — 10 km

Legend

Average Groundwater Depth:

- *more than 6 m*
- *5 - 6 m*
- *4 - 5 m*
- *3 - 4 m*
- *2 - 3 m*
- *1 - 2 m*

Plate 3.6

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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Average Groundwater Depth and Fluctuation Measured between 1956-1960

Scale: M = 1:175.000

0 — 10 km

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HUNGARY

N

Legend

Average Groundwater Depth:

- *more than 6 m*
- *5 - 6 m*
- *4 - 5 m*
- *3 - 4 m*
- *2 - 3 m*
- *1 - 2 m*
- *less than 1 m*

-1.0- *Average Fluctuation in meters*

Plate 3.7

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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Bankfiltered Wells in Gönyü-Nagymaros Reach

Scale: M = 1:300.000

0 10 km

Legend

Bankfiltered wells

River km

Plate 3.8

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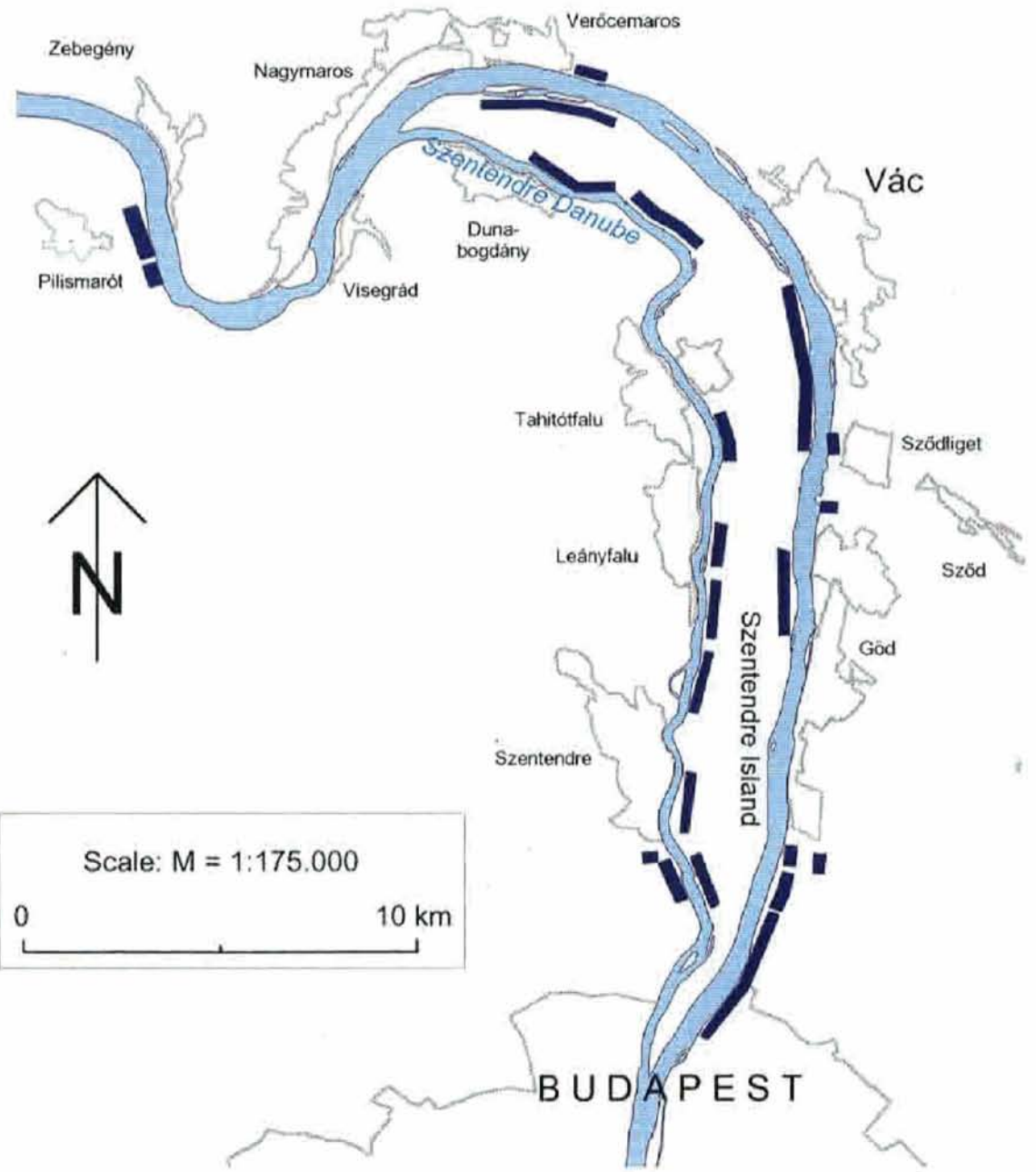
Bank-filtered Well Fields Downstream of Nagymaros

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System



Legend

Well fields

Plate 3.9

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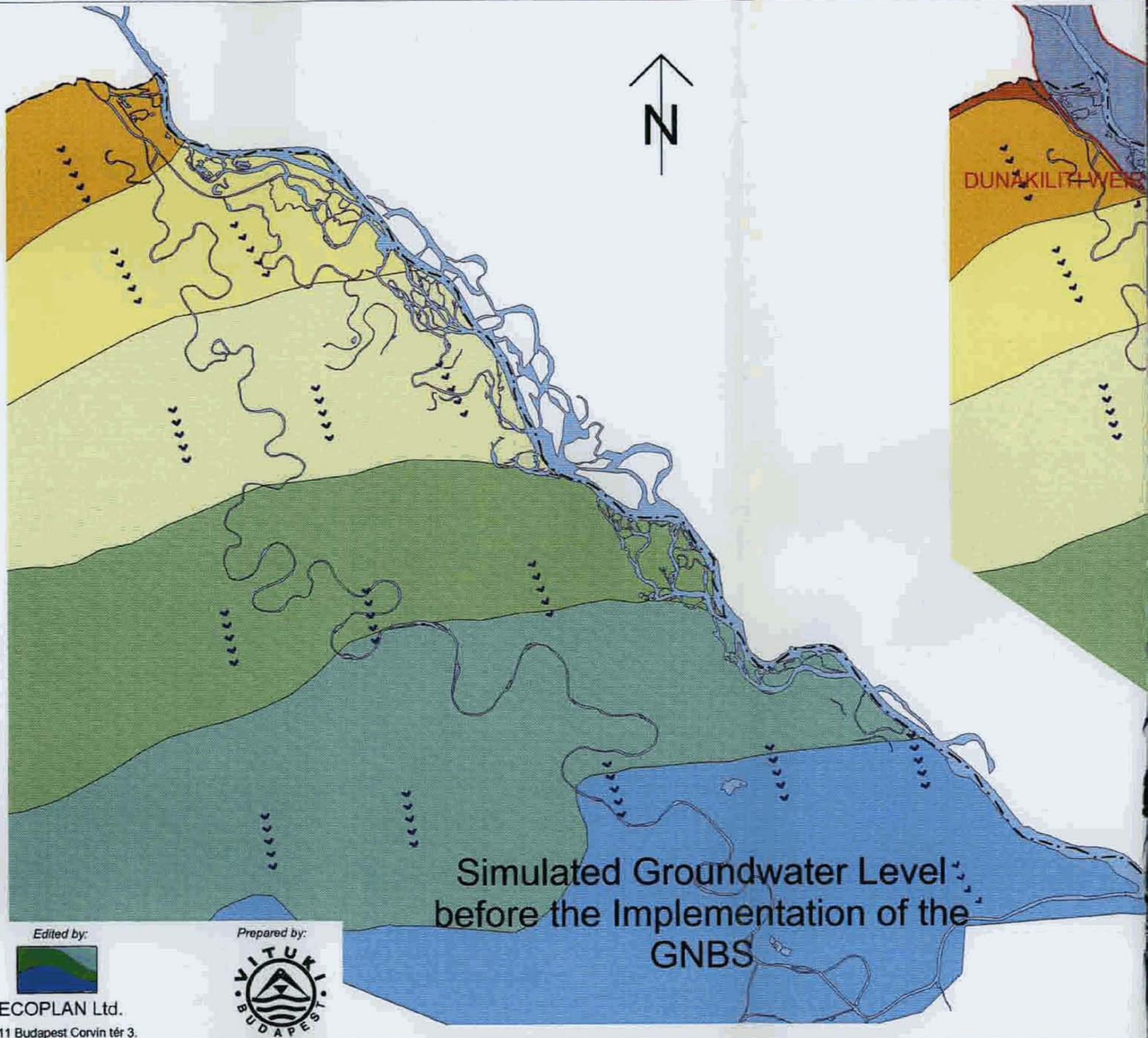

Simulated Groundwater Level before the Implementation of the GNBS

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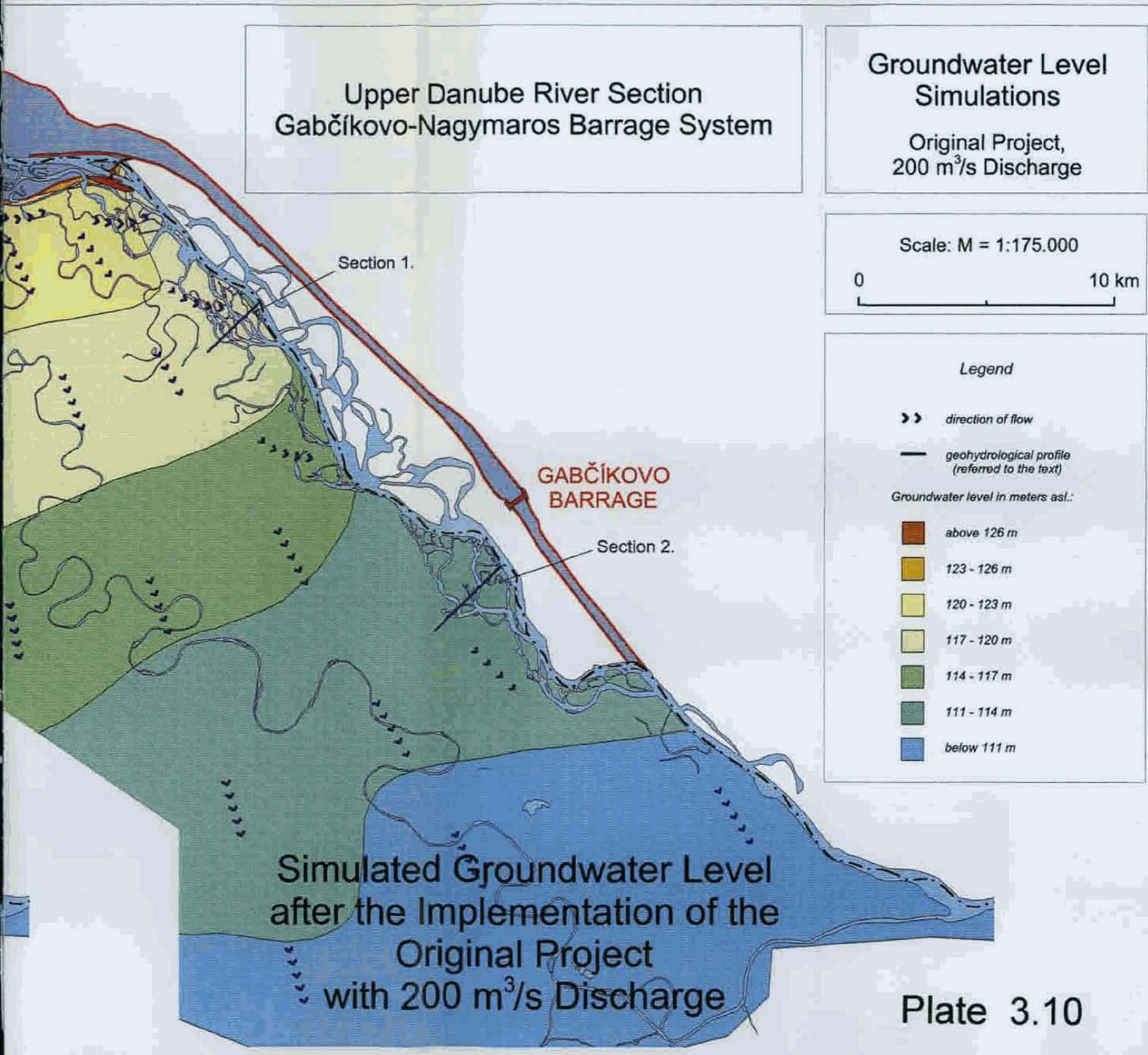
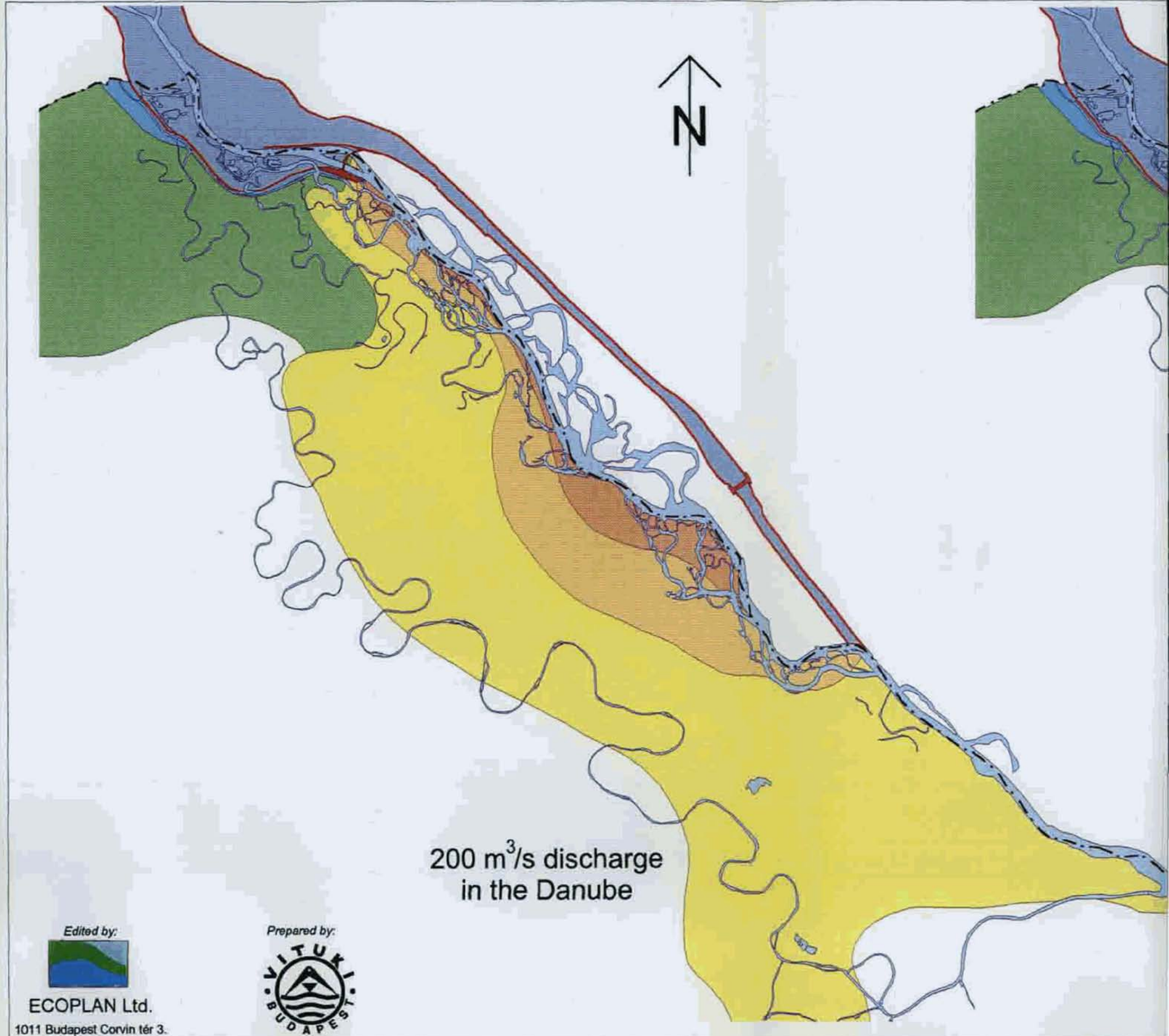

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System
Groundwater Level Simulations
Original Project,
200 m3/s Discharge
Scale: M = 1:175.000
0
10 km
Section 1.
GABČÍKOVO BARRAGE
Section 2.
Legend
direction of flow
geohydrological profile (referred to the text)
Groundwater level in meters asl.:
above 126 m
123 - 126 m
120 - 123 m
117 - 120 m
114 - 117 m
111 - 114 m
below 111 m
Simulated Groundwater Level after the Implementation of the Original Project with 200 m3/s Discharge
Plate 3.10



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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Predicted Changes in Groundwater Level due to the Implementation of the Original Project

Scale: M = 1:175.000

0 — 10 km

Legend

Changes of groundwater level:

- *decrease greater than 3 m*
- *decrease between 2 and 3 m*
- *decrease between 1 and 2 m*
- *decrease less than 1 m*
- *no impact*
- *increase less than 1 m*
- *increase between 1 and 3 m*

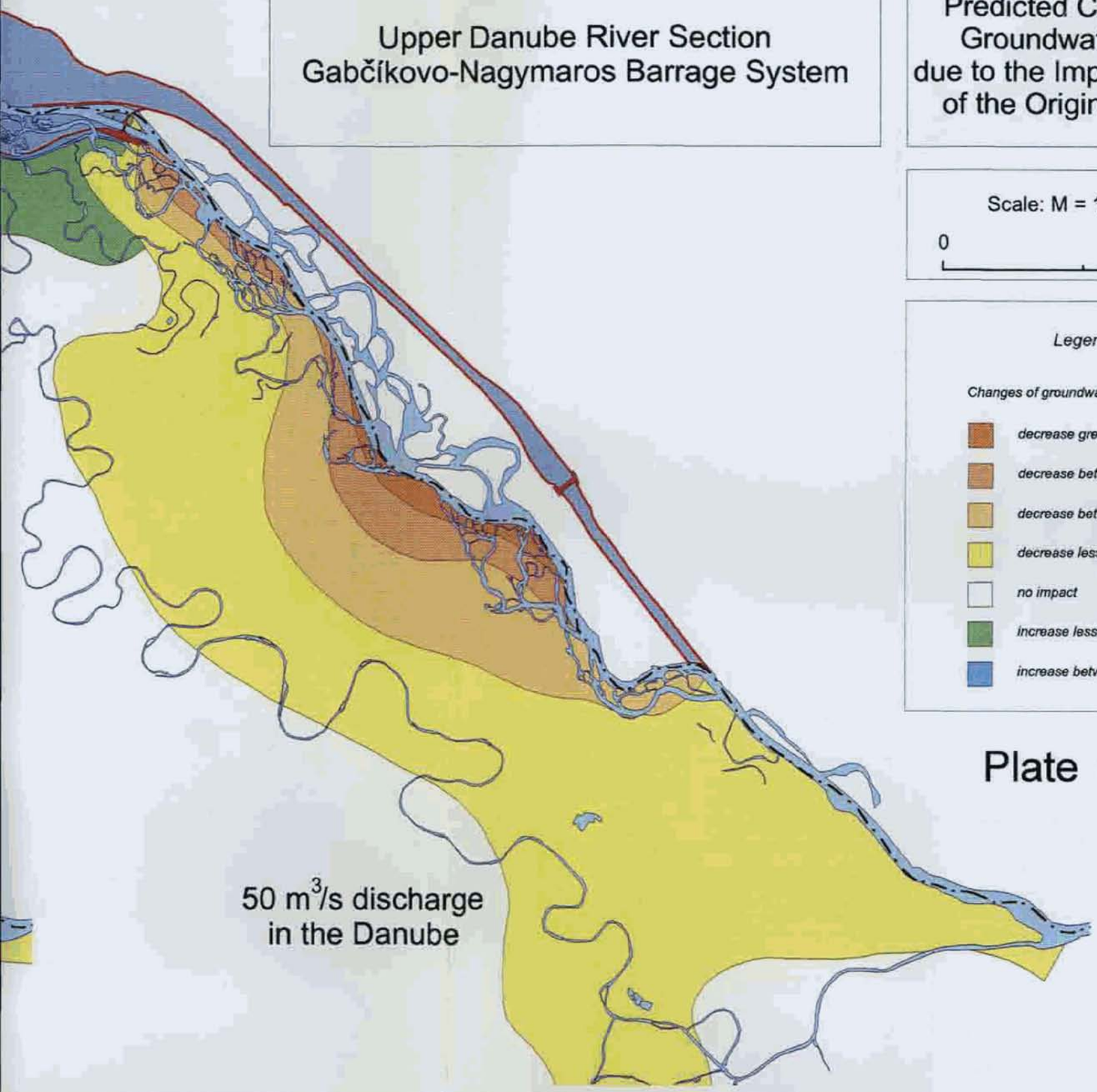
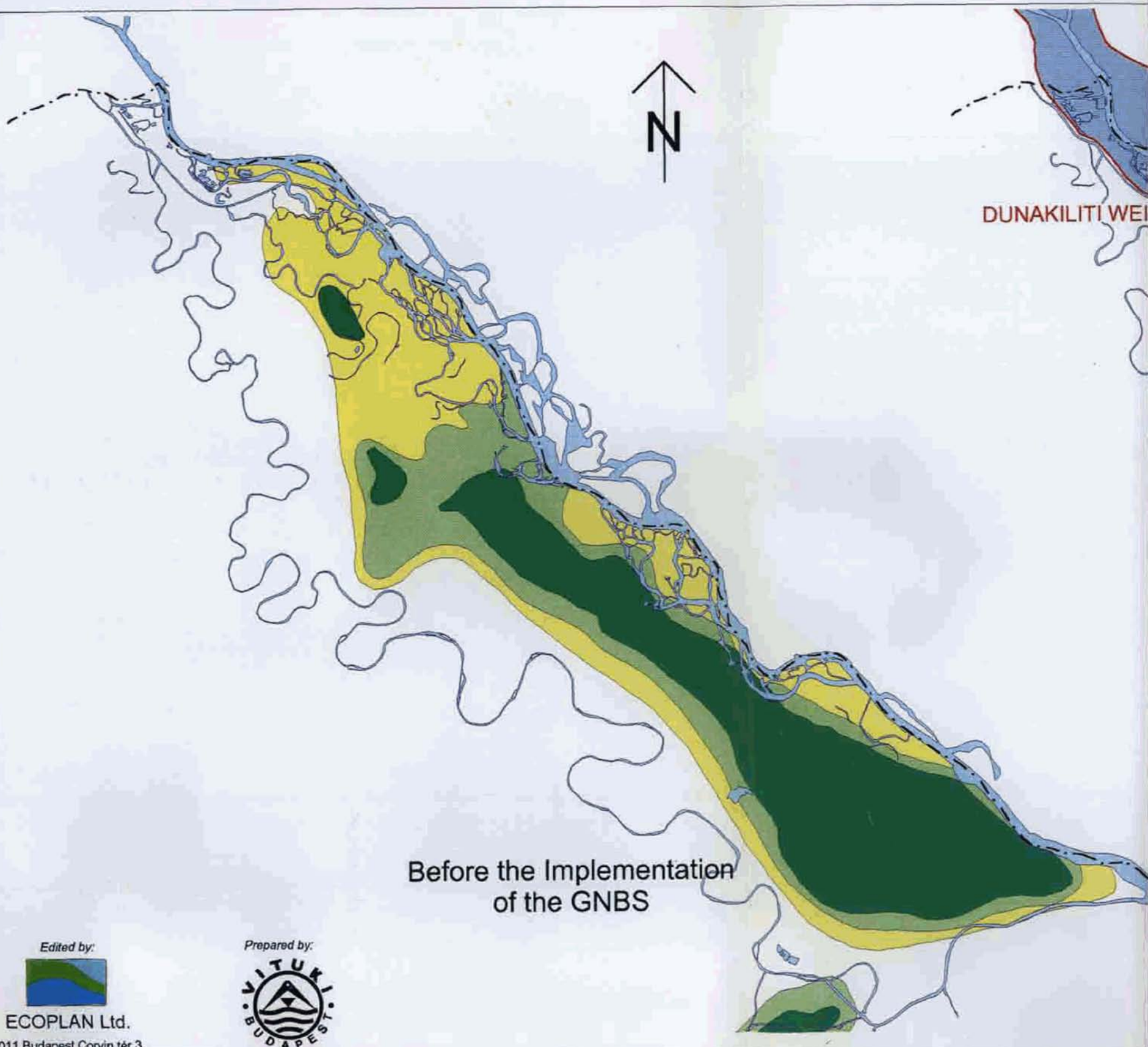


Plate 3.11



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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Condition of Sub-irrigation of the Covering Layer

Simulation before and after the Implementation of the Original Project

Scale: M = 1:175.000

0 — 10 km

Legend

Types of sub-irrigation:

- *continously wetted*
- *wetted under average condition*
- *temporarily wetted during high Danube water level*
- *no sub-irrigation*

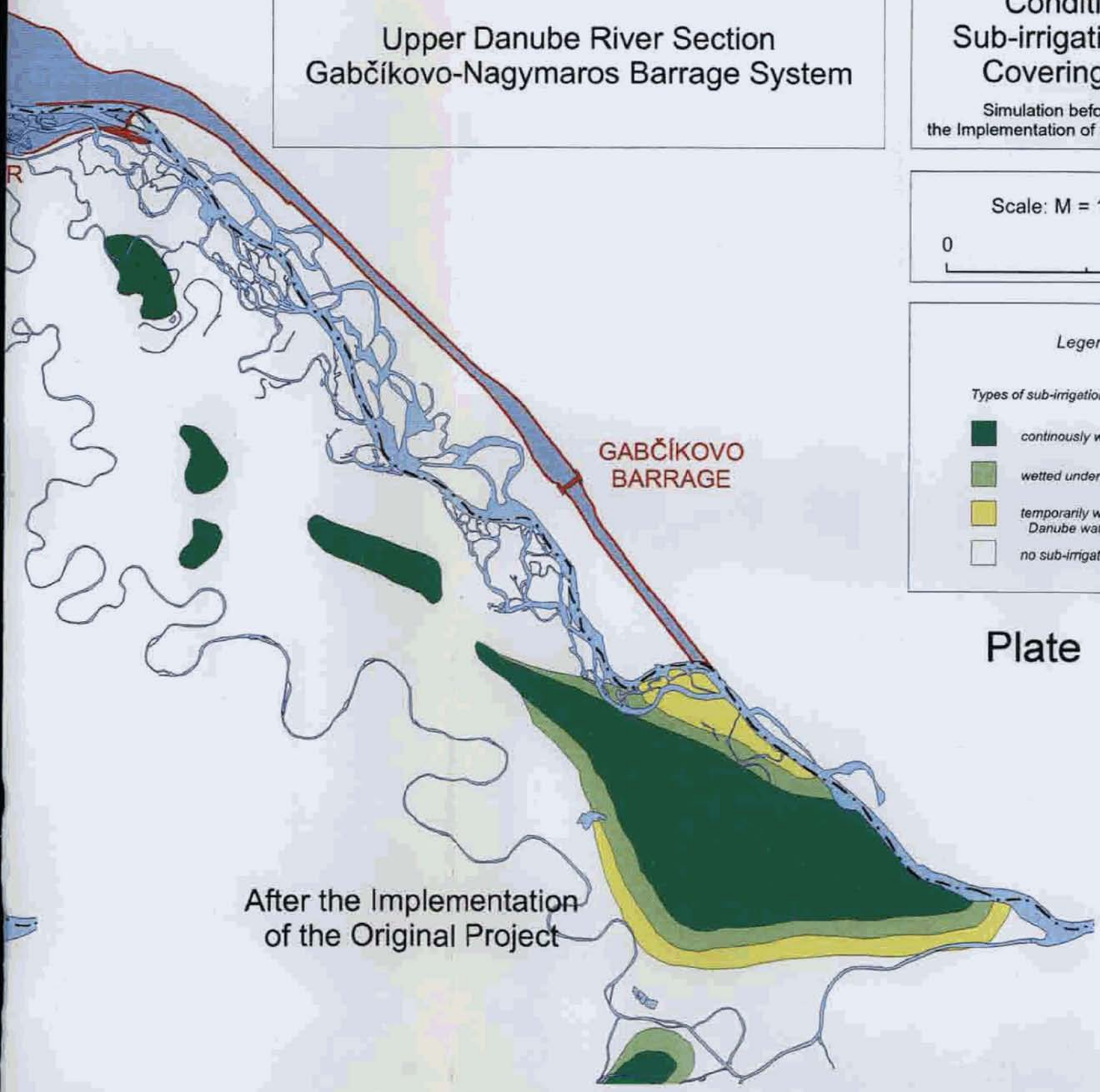
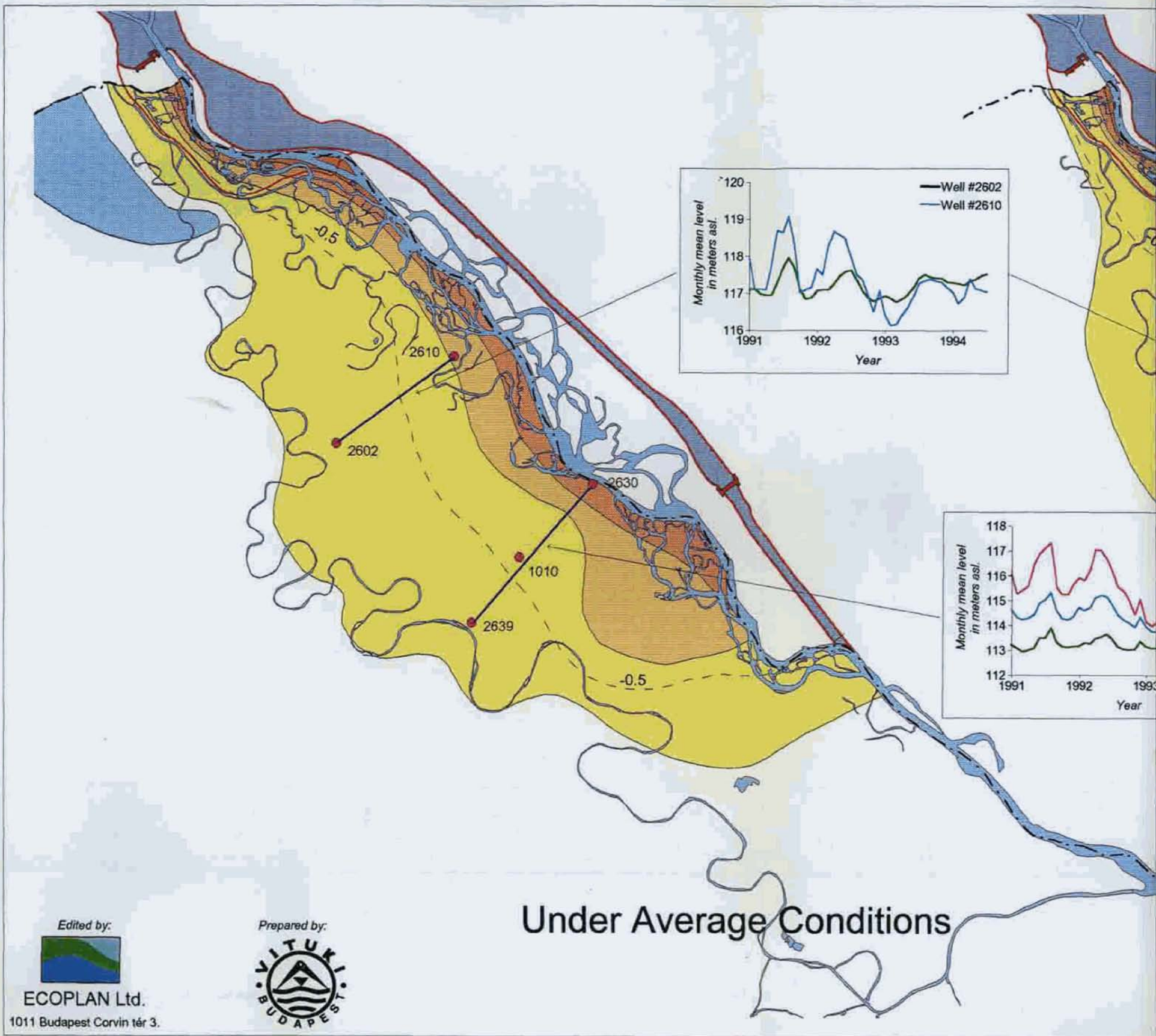


Plate 3.12



Under Average Conditions

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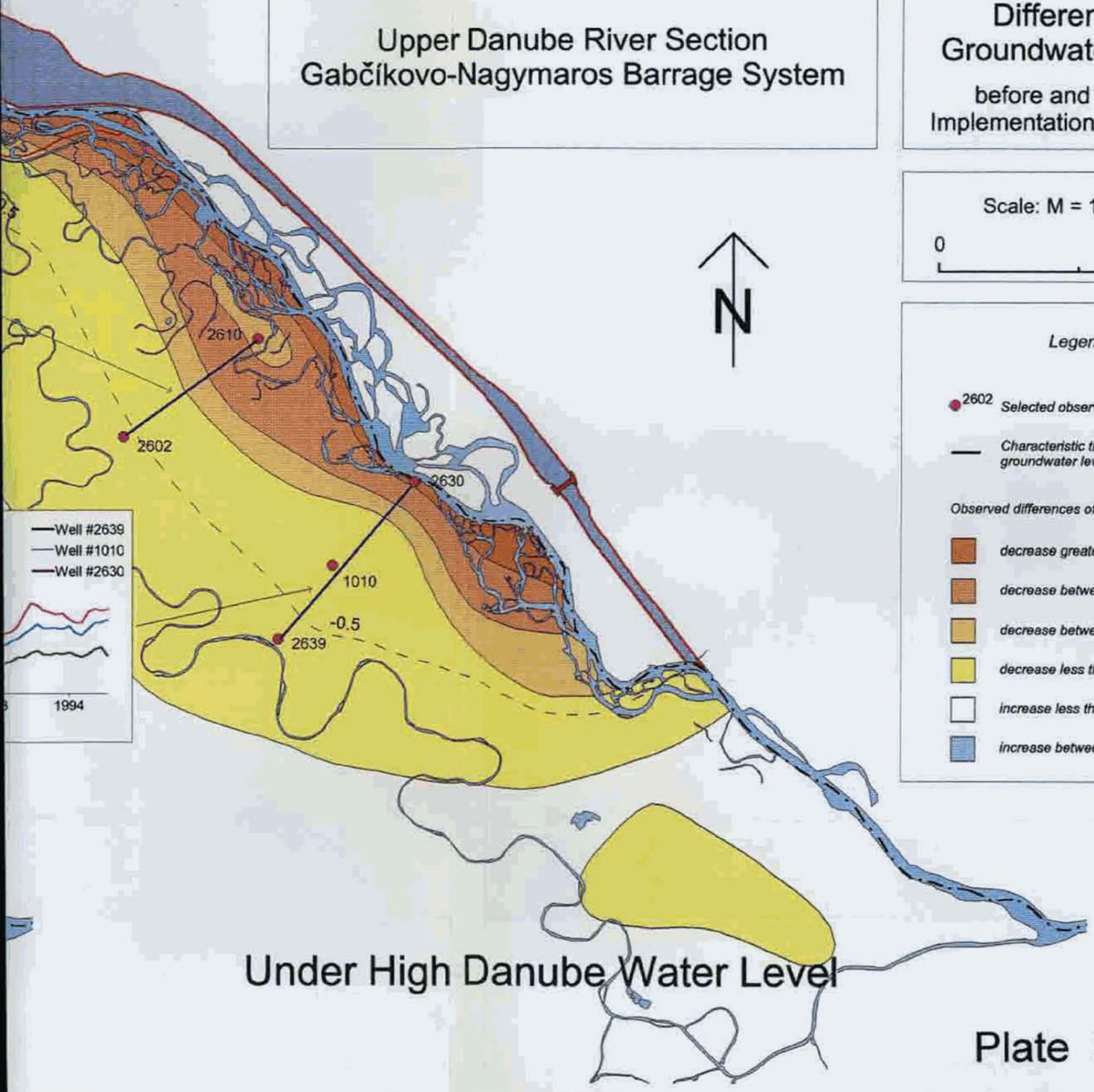
Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Difference in Groundwater Levels

before and after the Implementation of Variant C

Scale: M = 1:175.000

0 — 10 km



Legend

- 2602 *Selected observation well (numbered)*
- *Characteristic time series of groundwater level*

Observed differences of groundwater level:

- *decrease greater than 3 m*
- *decrease between 2 and 3 m*
- *decrease between 1 and 2 m*
- *decrease less than 1 m*
- *increase less than 0.2 m or no impact*
- *increase between 0.2 and 0.5 m*

Under High Danube Water Level

Plate 3.13

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Groundwater Level Measured in 1993. 08. 12. (Average Situation)

Scale: M = 1:175.000

0 — 10 km

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N

Legend

Groundwater level in meters asl.:

- *above 123 m*
- *120 - 123 m*
- *117 - 120 m*
- *114 - 117 m*
- *111 - 114 m*
- *108 - 111 m*
- *below 108 m*

Plate 3.14

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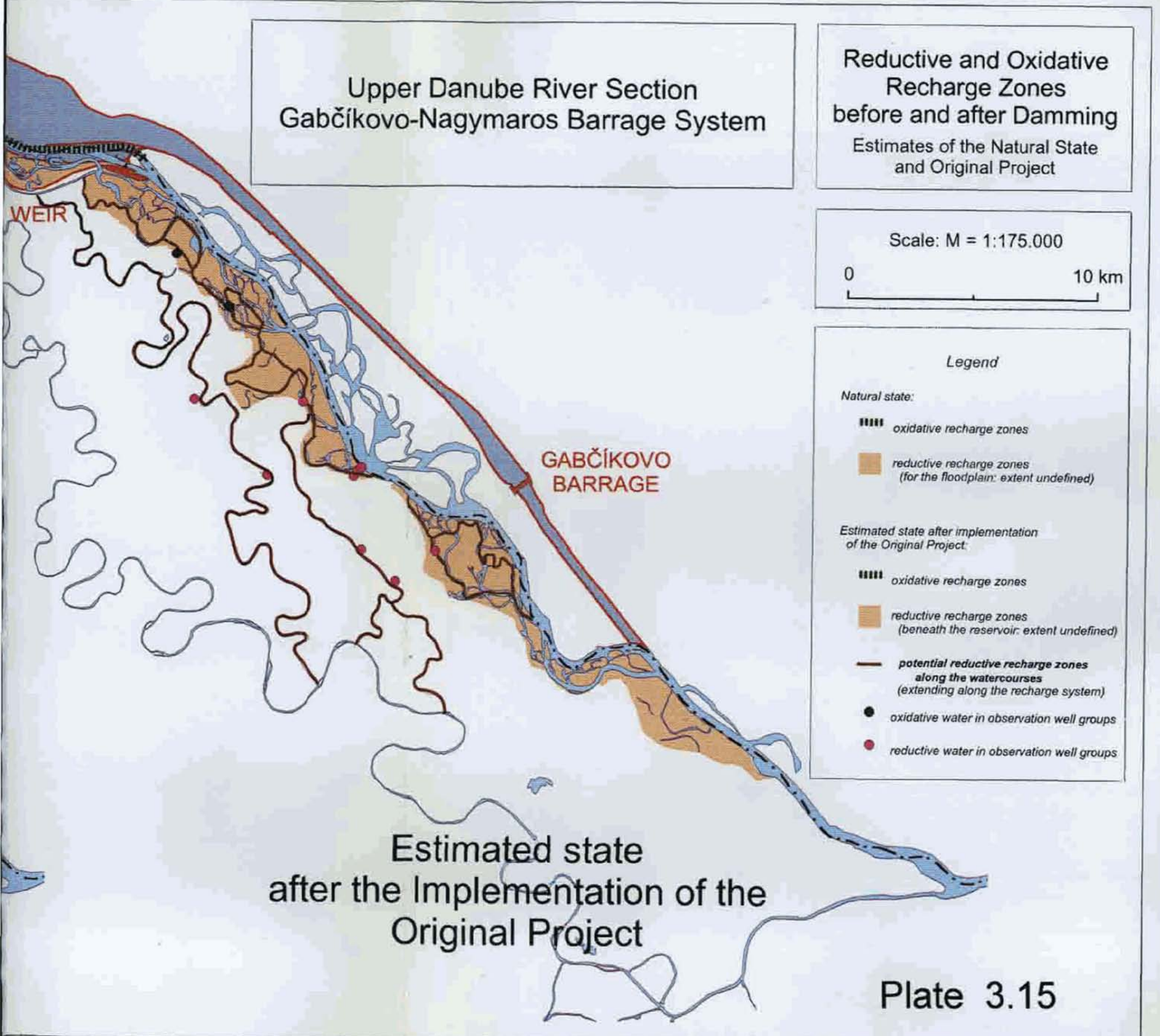
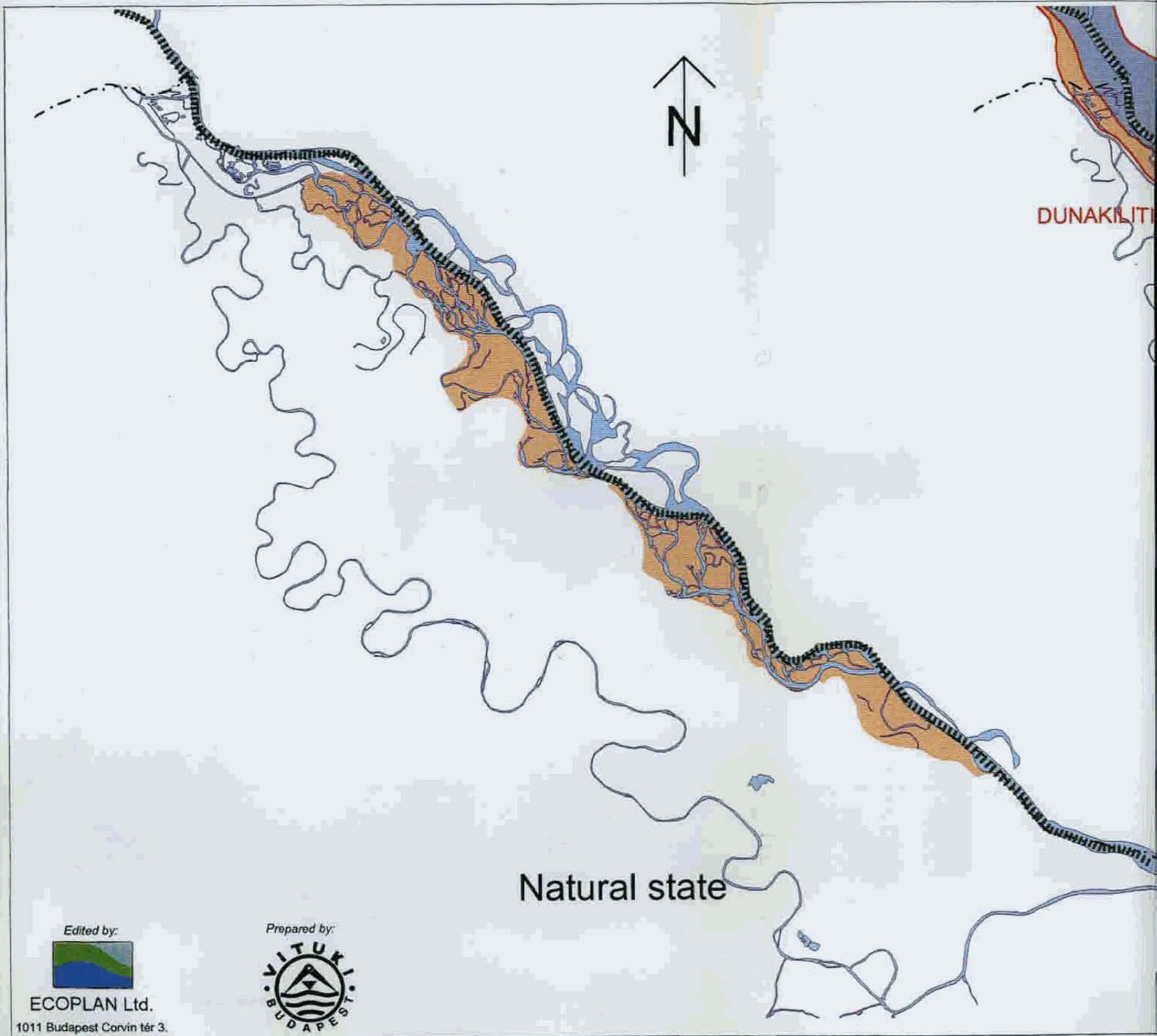

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System
Reductive and Oxidative Recharge Zones before and after Damming
Estimates of the Natural State and Original Project
WEIR
GABČÍKOVO BARRAGE
Scale: M = 1:175.000
0
10 km
Legend
Natural state:
oxidative recharge zones
reductive recharge zones (for the floodplain: extent undefined)
Estimated state after implementation of the Original Project:
oxidative recharge zones
reductive recharge zones (beneath the reservoir: extent undefined)
potential reductive recharge zones along the watercourses (extending along the recharge system)
oxidative water in observation well groups
reductive water in observation well groups
Estimated state after the Implementation of the Original Project
Plate 3.15



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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Predicted Changes in Groundwater Level due to the Implementation of the Original Project

Uncertainty due to Increased Clogging

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Scale: M = 1:175.000

0 — 10 km

Legend

Changes of groundwater level:

- *decrease between 1 and 2 m*
- *decrease less than 1 m*
- *no impact*

Plate 3.16

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Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Important Areas for Flora and Fauna

and the
Szigetköz Biological Monitoring System

Scale: M = 1:175.000

0 — 10 km

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N

Legend

- *Monitoring sites of flora and fauna*
- *Core territory*
- *Protection area I.*
- *Protection area II.*

Plate 4.1

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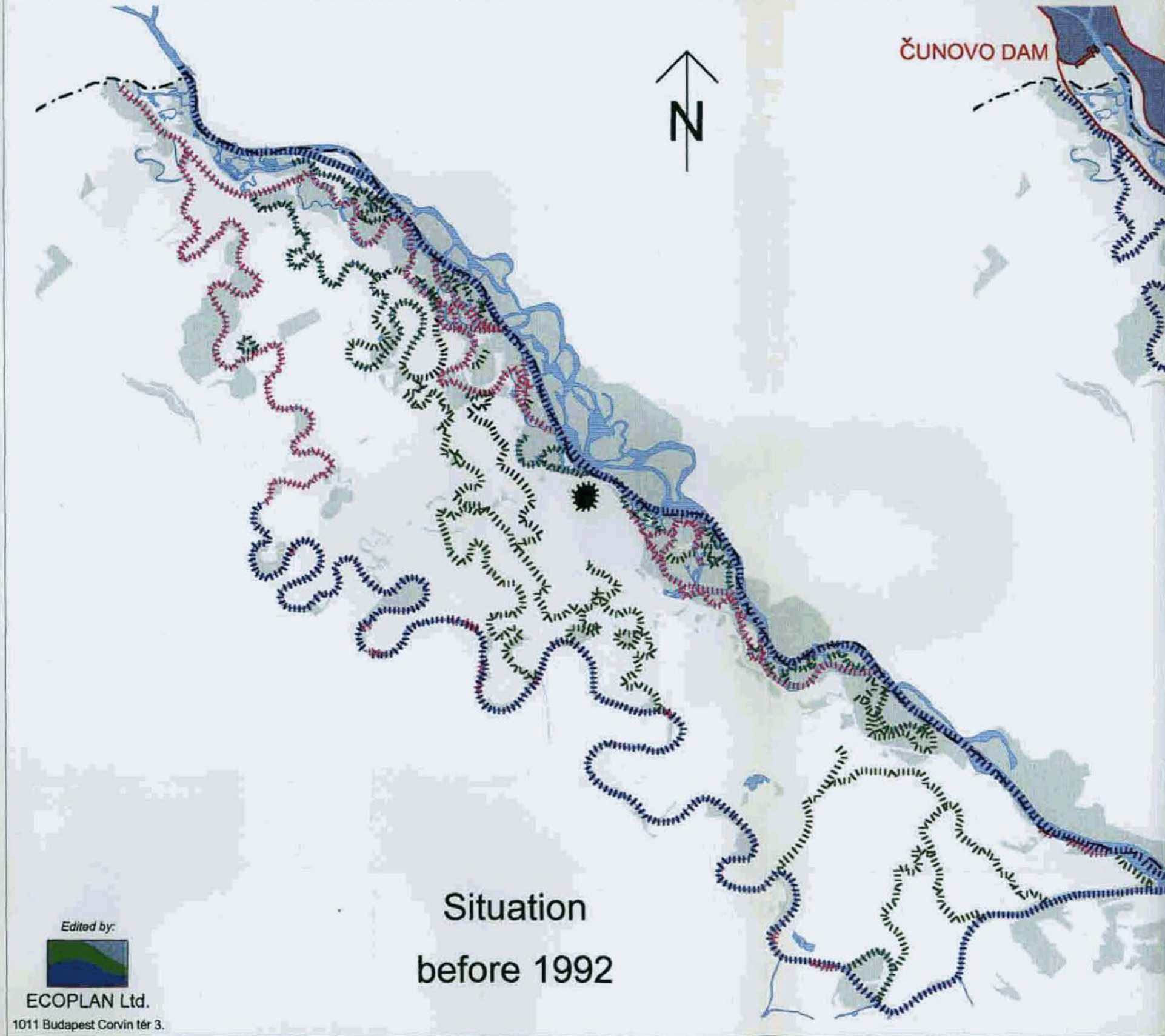
Hungarian Natural History Museum
Budapest

"Eötvös Loránd" University of Science
Budapest



Situation before 1992

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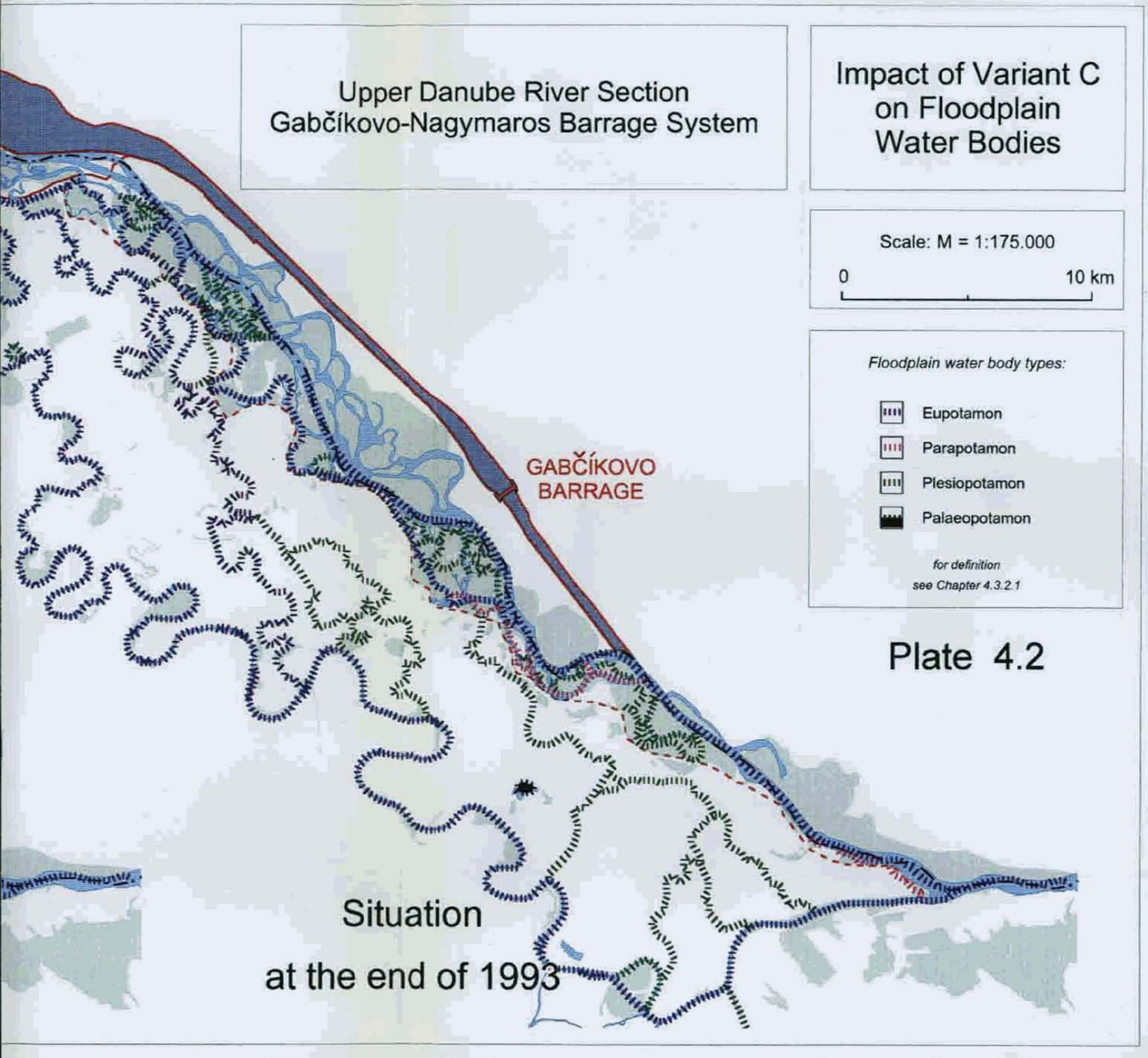
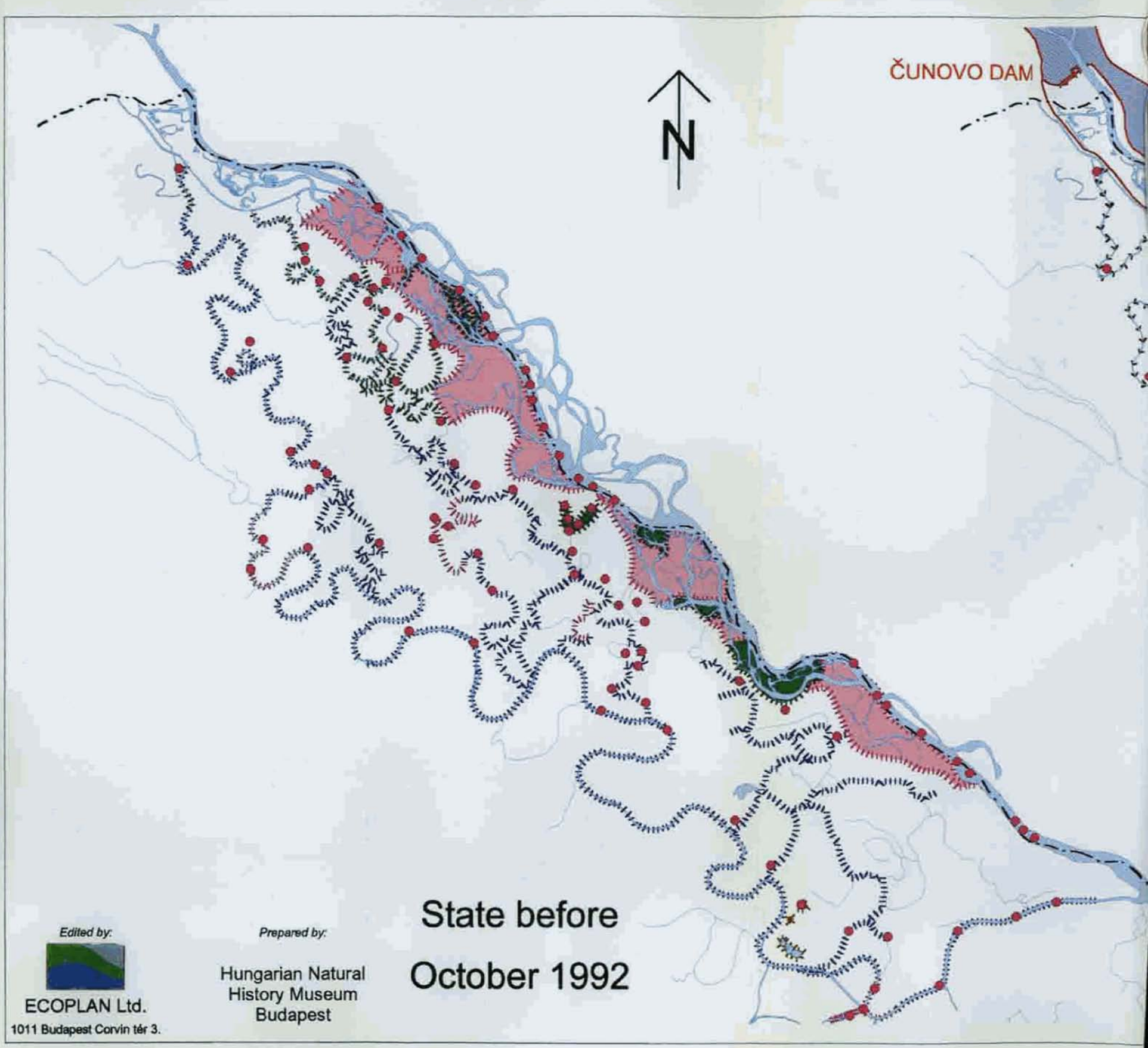

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System
Impact of Variant C
on Floodplain
Water Bodies
Scale: M = 1:175.000
0
10 km
Floodplain water body types:
Eupotamon
Parapotamon
Plesiopotamon
Palaeopotamon
for definition
see Chapter 4.3.2.1
GABČÍKOVO
BARRAGE
Plate 4.2
Situation
at the end of 1993


ČUNOVO DAM
N
State before
October 1992
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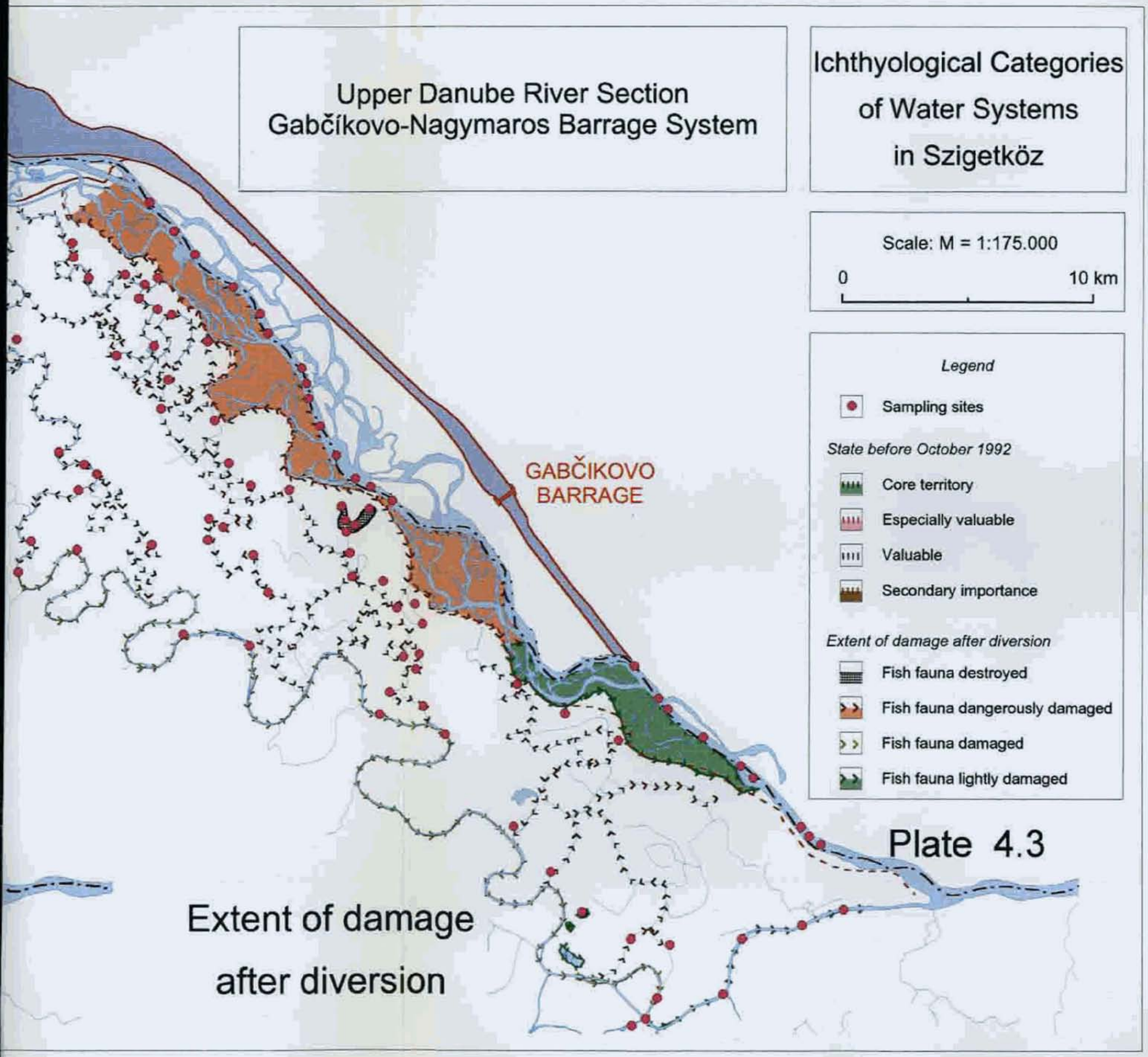
Hungarian Natural
History Museum
Budapest


Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System
Ichthyological Categories
of Water Systems
in Szigetköz
Scale: M = 1:175.000
0
10 km
Legend
Sampling sites
State before October 1992
Core territory
Especially valuable
Valuable
Secondary importance
Extent of damage after diversion
Fish fauna destroyed
Fish fauna dangerously damaged
Fish fauna damaged
Fish fauna lightly damaged
GABČIKOVO
BARRAGE
Plate 4.3
Extent of damage
after diversion

Upper Danube River Section
Gabčíkovo-Nagymaros Barrage System

Soil Classification of Szigetköz

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SLOVAKIA

HUNGARY

Scale: M = 1:175.000

0 — 10 km

N

Legend

- *Calcareous humic sand soil*
- *Noncalcareous humic sand soil*
- *Calcareous meadow chernozem soil*
- *Calcareous "terrace" chernozem soil*
- *Noncalcareous "terrace" chernozem soil*
- *Calcareous meadow soil*
- *Calcareous alluvial meadow soil*
- *Calcareous peat meadow soil*
- *Calcareous chernozem meadow soil*
- *Calcareous alluvial soil*
- *Noncalcareous alluvial soil*
- *Calcareous humic alluvial soil*
- *Noncalcareous humic alluvial soil*
- *Calcareous multilayer humic alluvial soil*
- *Resedimented alluvial soil*

Plate 5.1

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COMMERCIAL FISHERY

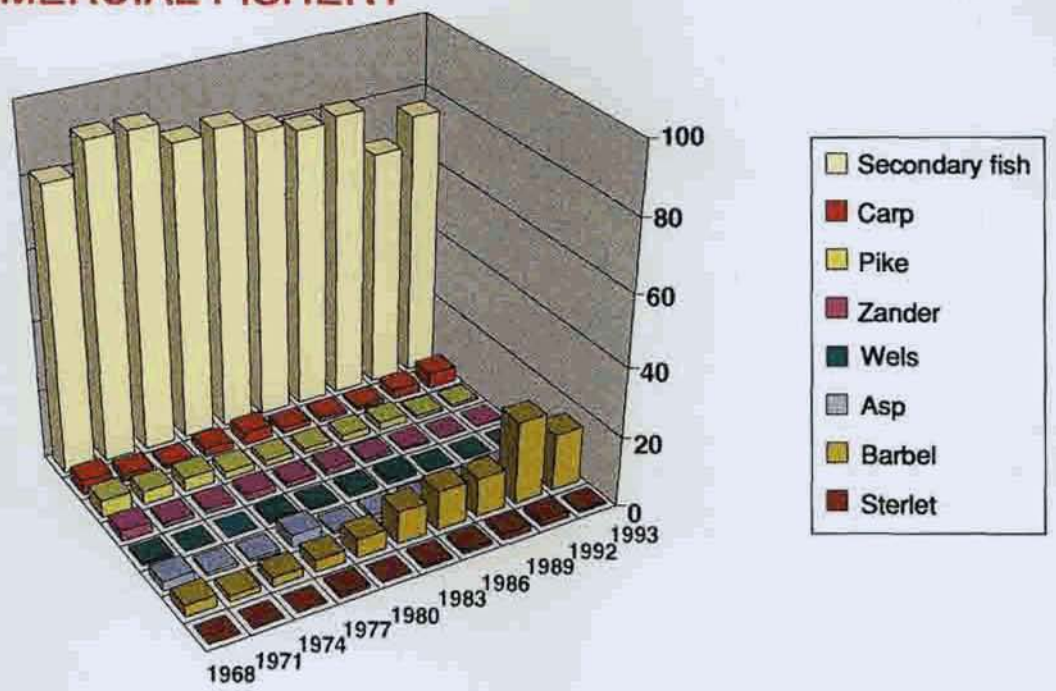

Plate 5.2a Species composition of commercial fishery on the upper stretch of the Hungarian Danube between 1968 and 1993

RECREATIONAL FISHERY

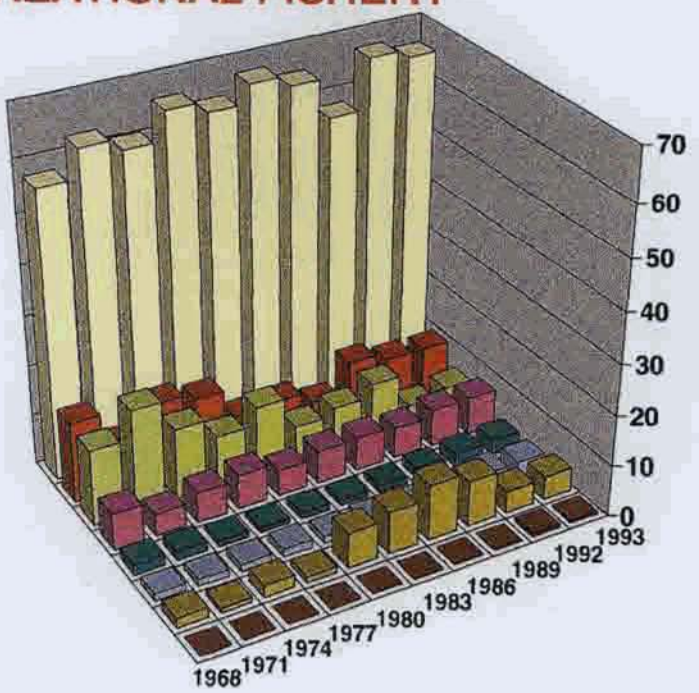

Plate 5.2b Species composition of recreational fishery on the upper stretch of the Hungarian Danube between 1968 and 1993

Plate 5.3 Proportion of Commercial and Recreational Fishery (between 1976 and 1993) and Quantitative Changes of Commercial and Recreational Catches in the Szigetköz between 1988 and 1993

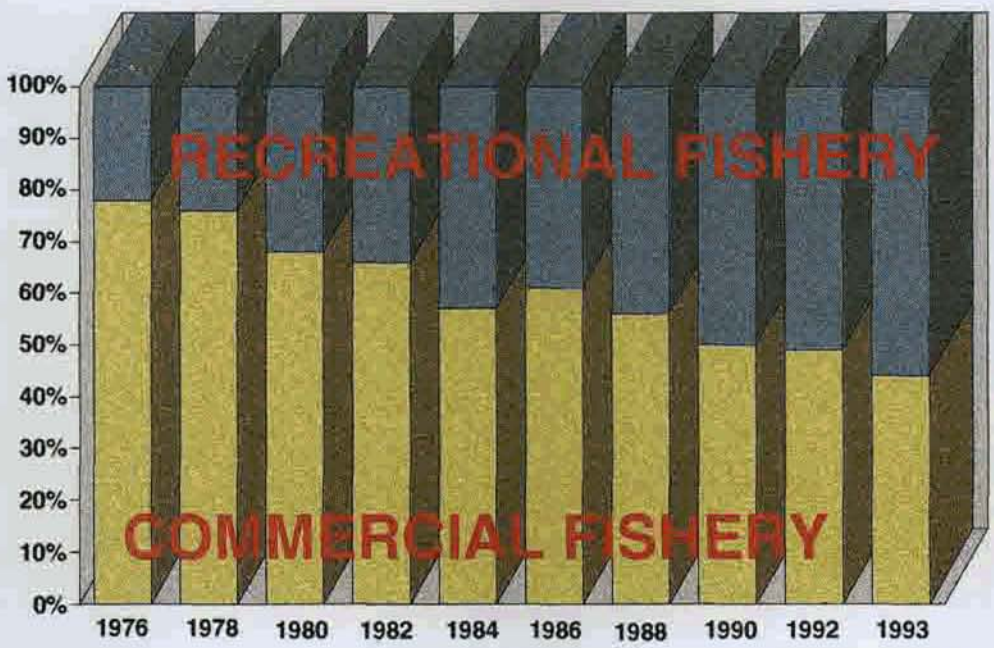

Plate 5.3a Proportion of Commercial and Recreational Fishery on the Upper stretch of the Hungarian Danube between 1976 and 1993

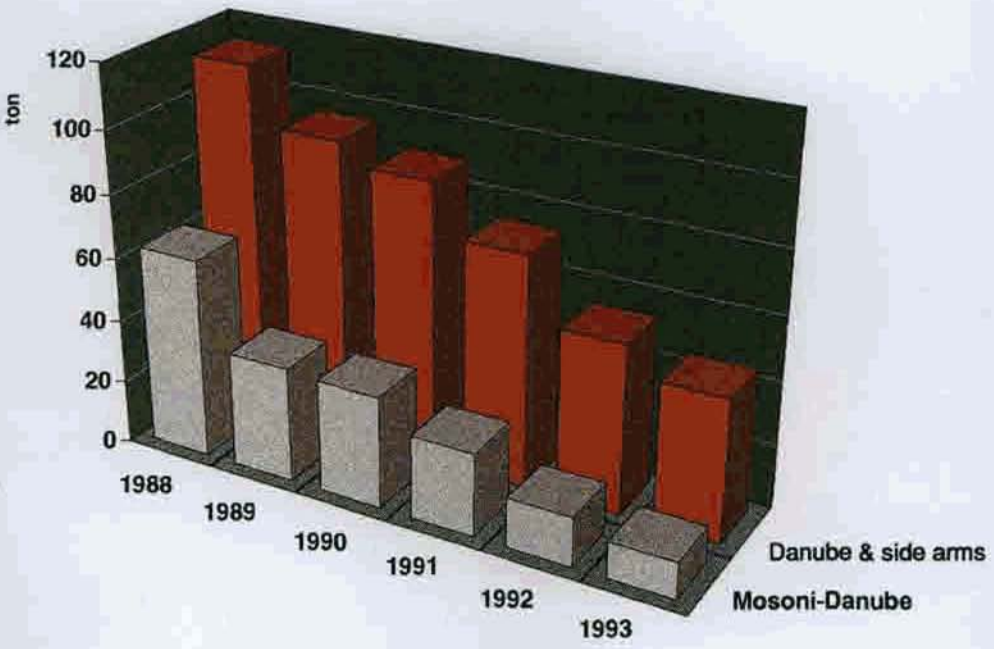

Plate 5.3b Quantitative Changes of Commercial and Recreational Catches in the Szigetköz between 1988 and 1993

Plate 5.4 Ichthyological Units of the Dunasziget Floodplain before and after the Implementation of Variant C

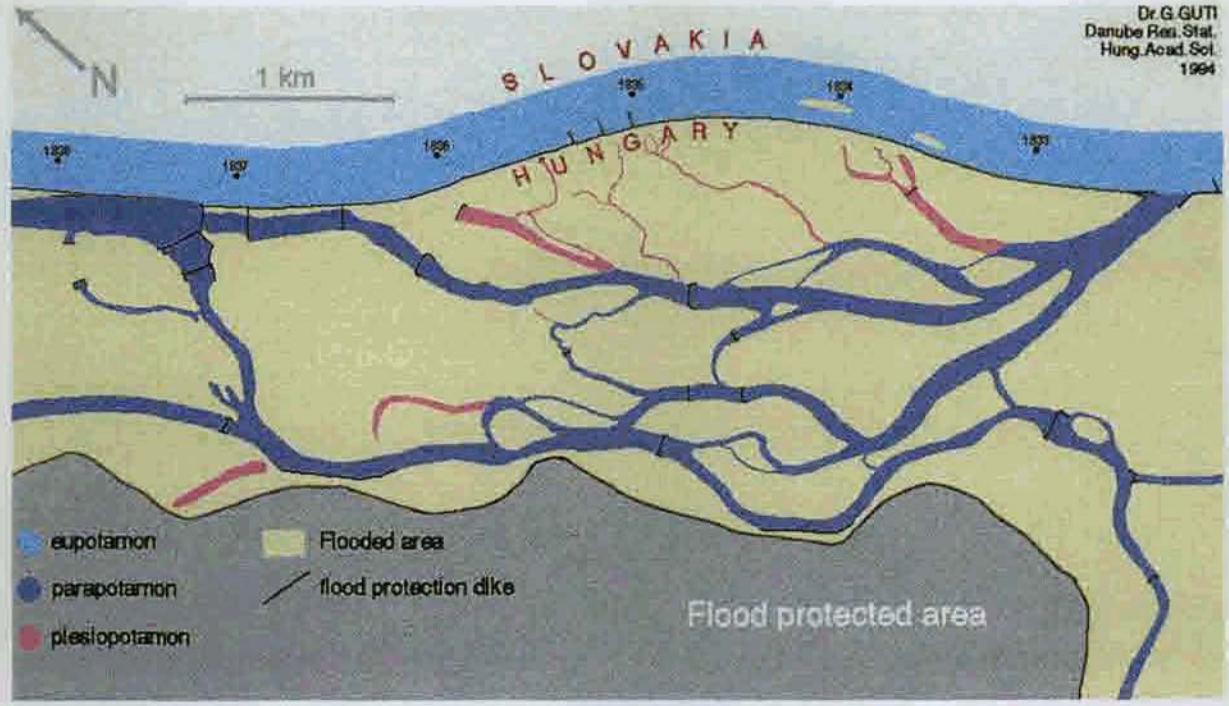

Plate 5.4a Ichthyological Functional Units of the Right Floodplain Adjacent to 1832-1838 riverkm before the Implementation of Variant C (1992)

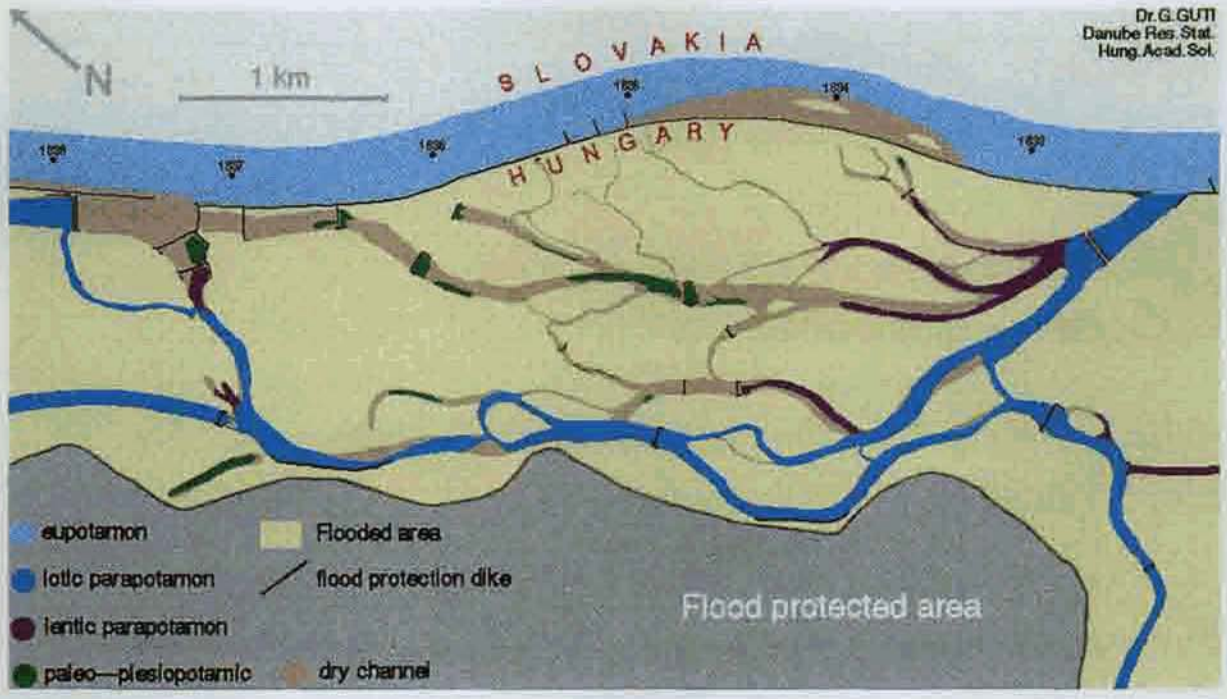

Plate 5.4b Ichthyological Functional Units of the Same Area after the Implementation of Variant C (1994)
(Cf. the aerial infrared images, Plate 11, Volume 1)

Plate 6.1 Depth of the Pre-Tertiary Basement

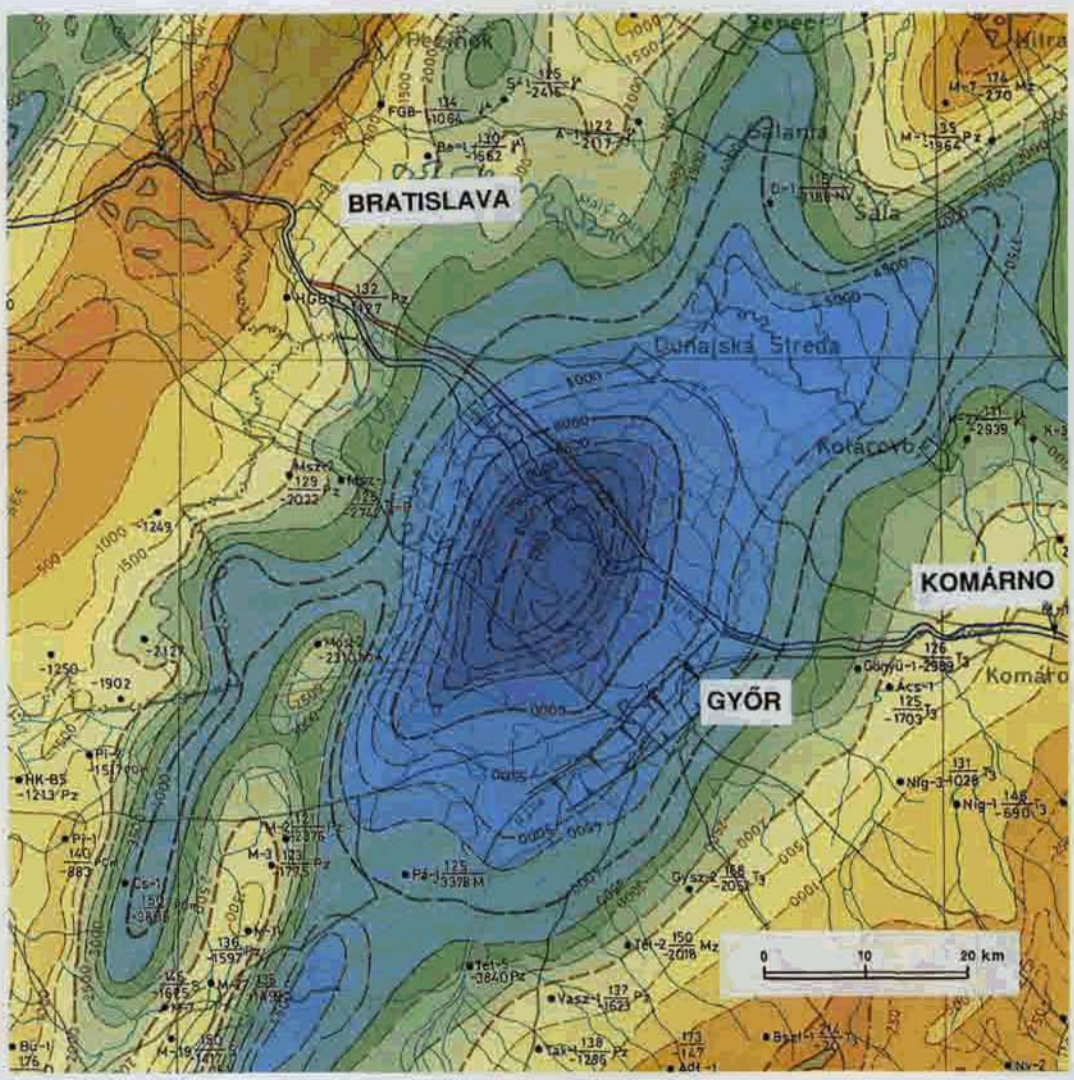

Plate 6.1 Depth of the Pre-Tertiary Basement

from the *"Pre-Tertiary Basement Contour Map of the Carpathian Basin beneath Austria, Czechoslovakia and Hungary"*. Data provided by ELGI Budapest, Geofyzika Bratislava, Geofyzika Brno, GKÜ Budapest, ÖMV Vienna, University of Leoben, and University of Vienna. Published by Geophysical Transactions, **36**, 1-2, 1991