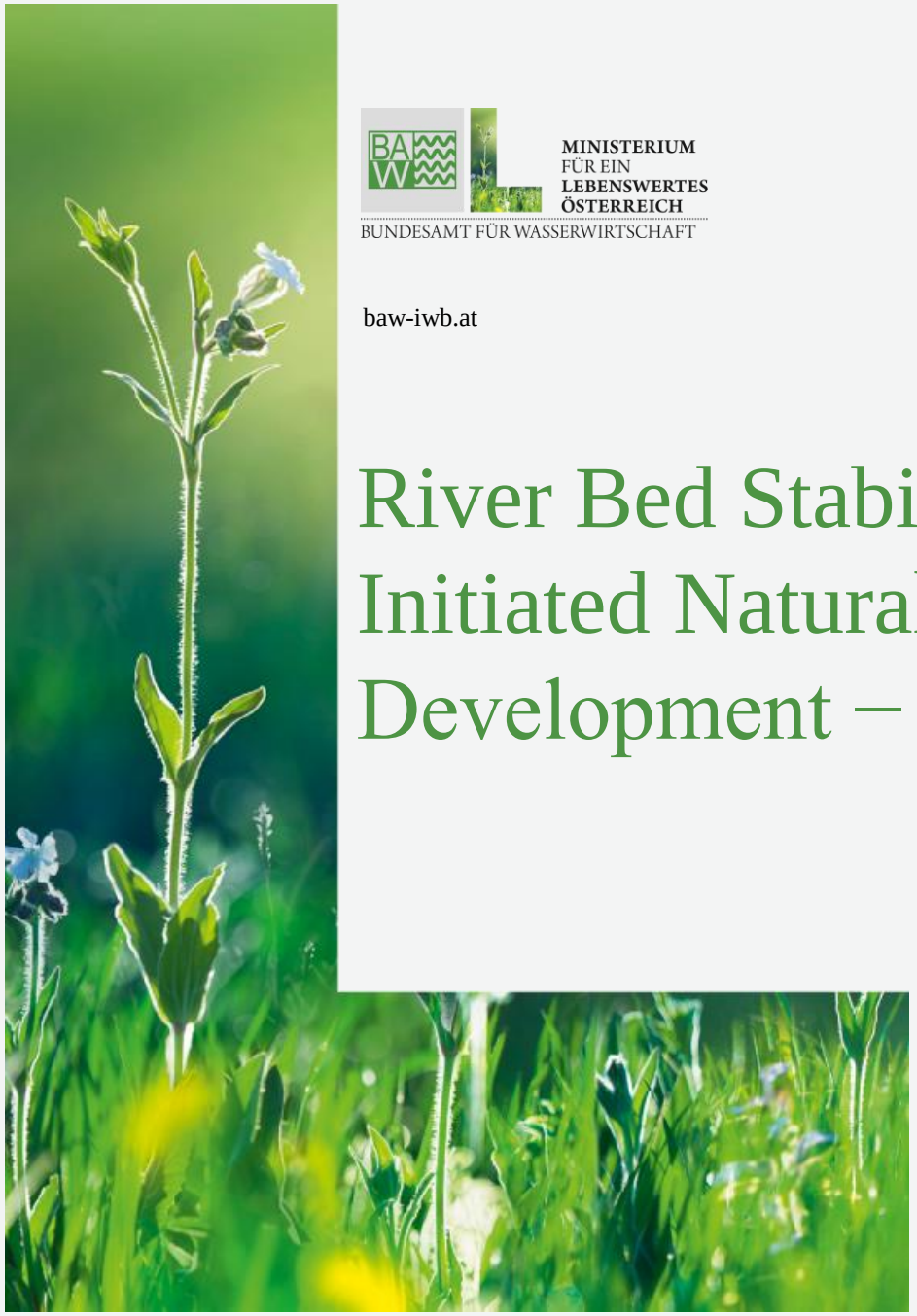

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River Bed Stabilization by Initiated Natural Morphological Development – Prediction and Reality

CONTENT

1. Where, Why, What, When?
2. Forecasting of natural river development (physical and numerical models)

3. What has happened since initiation of the natural process?

4. Comparison: Prediction – Reality

5. Conclusions

WHERE?

Lower Salzach, 15 km downstream of the city of Salzburg

Catchment area = 6 112 km² (gauging station Laufen)

Mean flow = 250 m³/s

HQ100 = 3 100 m³/s

WHY? (THE PROBLEM)

Erosion of the river bed (up to 5 meters in a 50 km long river stretch, in more than 100 years)

Implications are:

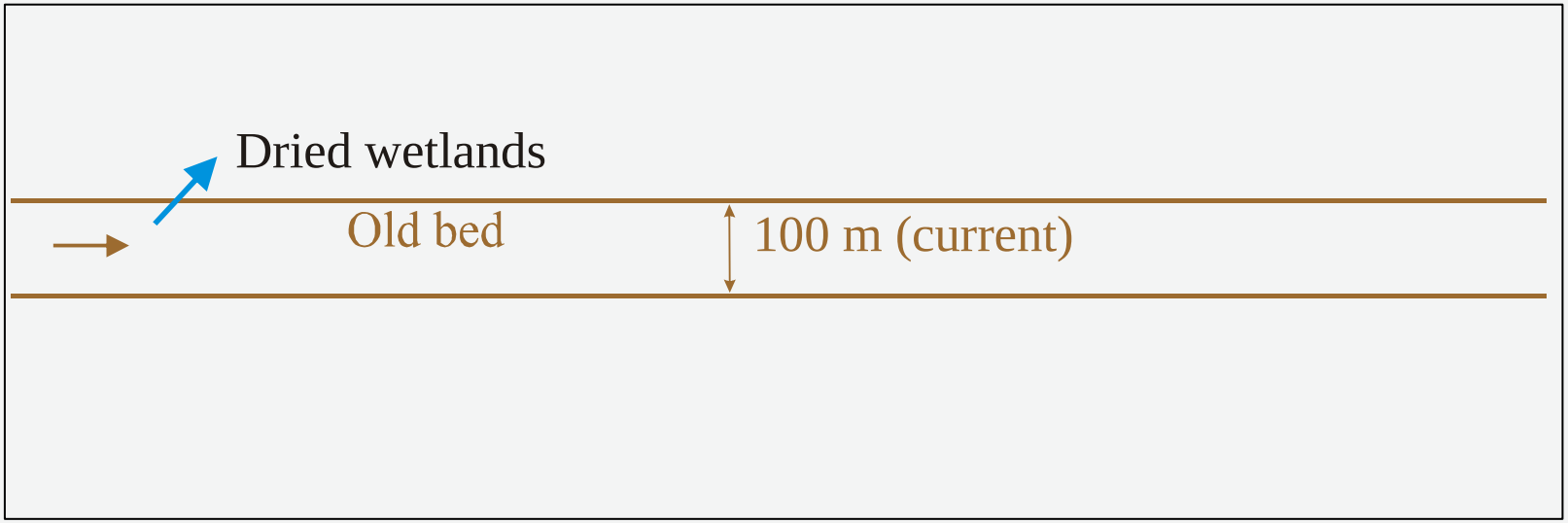
- Cut off of surrounding wetlands (Nature 2000 areas)
- Hostile river banks
- Falling groundwater table
- Risk of accelerated erosion in fine sediments below of the gravel river bed, especially during floods
- **Risk of flood damages**

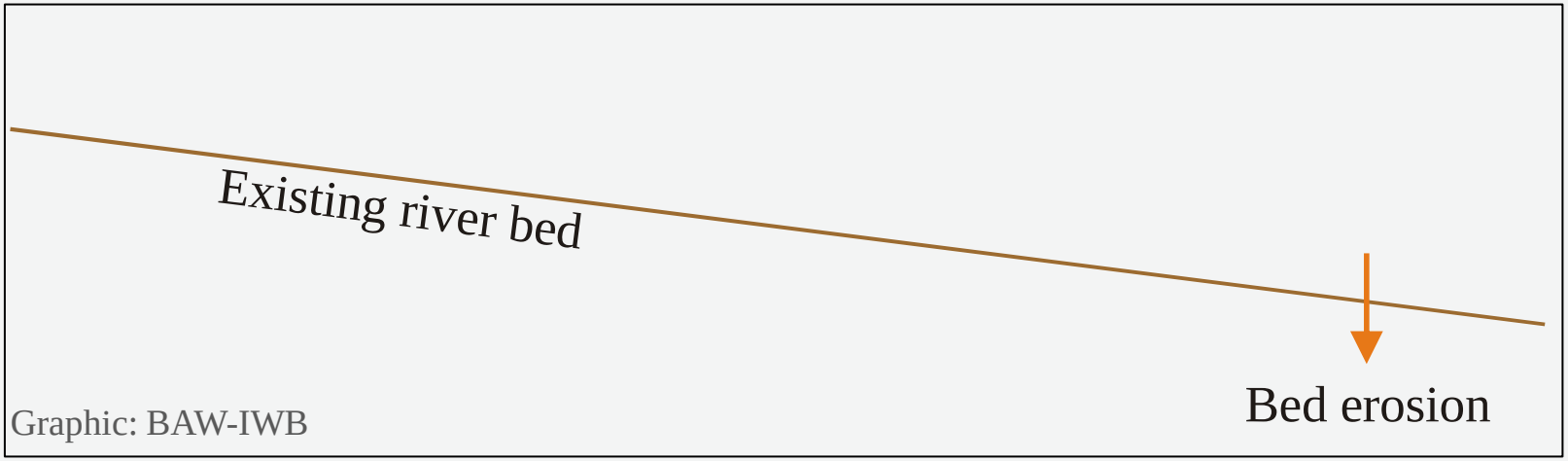
WHY? (AIMS OF THE PROJECT)

1. Turn the erosion process in a stabilization and if possible in a controlled sedimentation process
2. Flood protection
3. Ecological improvement of river and wetlands (aquatic and terrestrial with cross-links)

Photo: P. Stockhammer, 2004

WHAT? (THE CONCEPT FOR 30 RIVER-KM)





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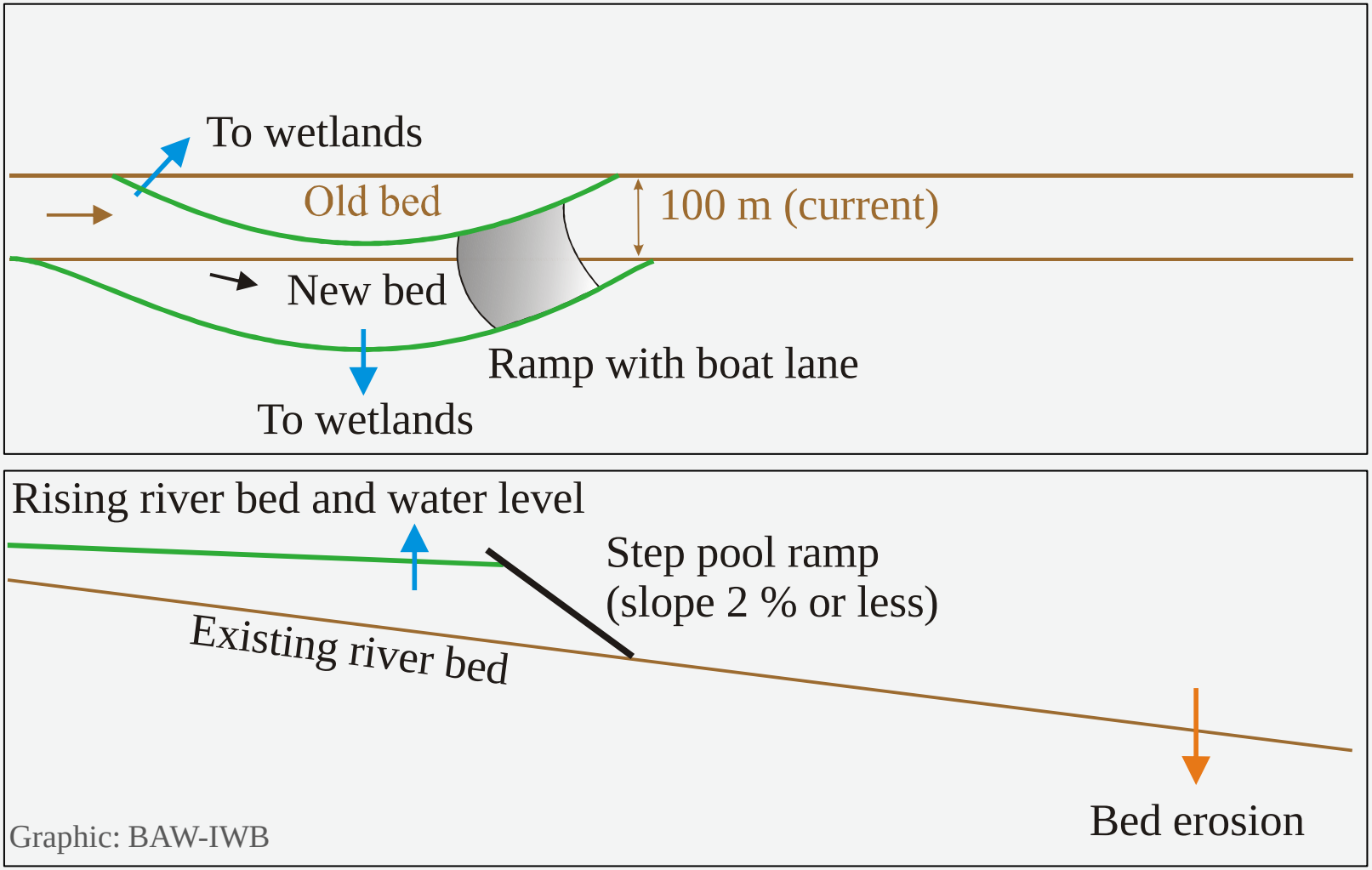

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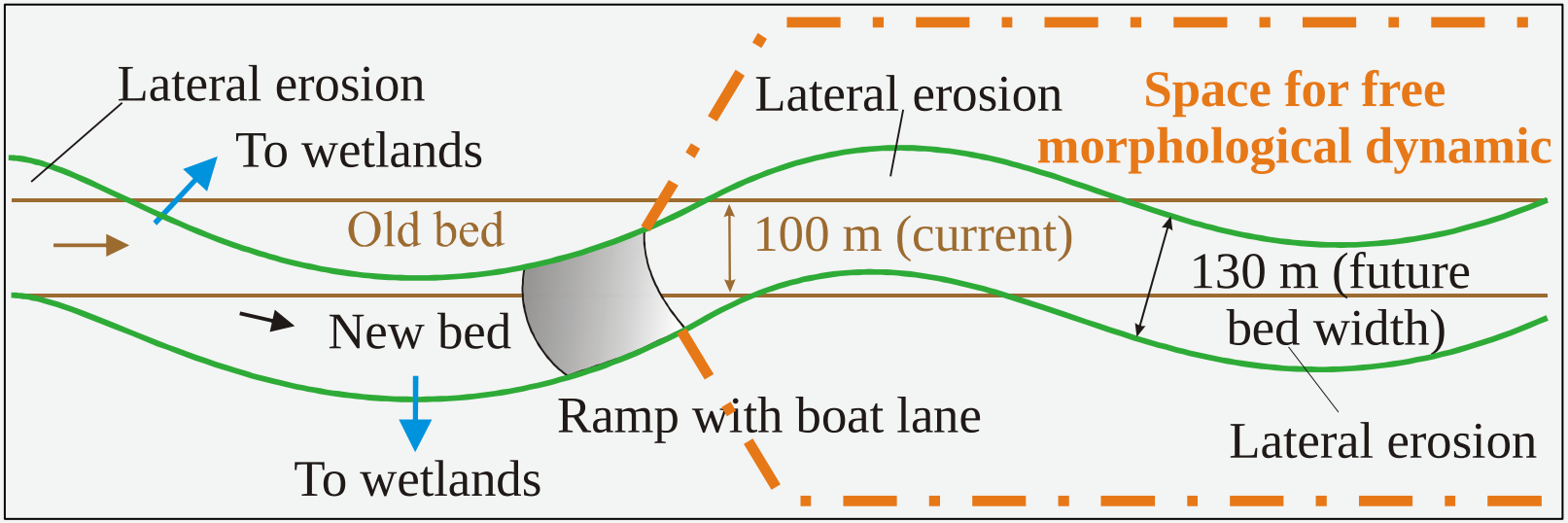

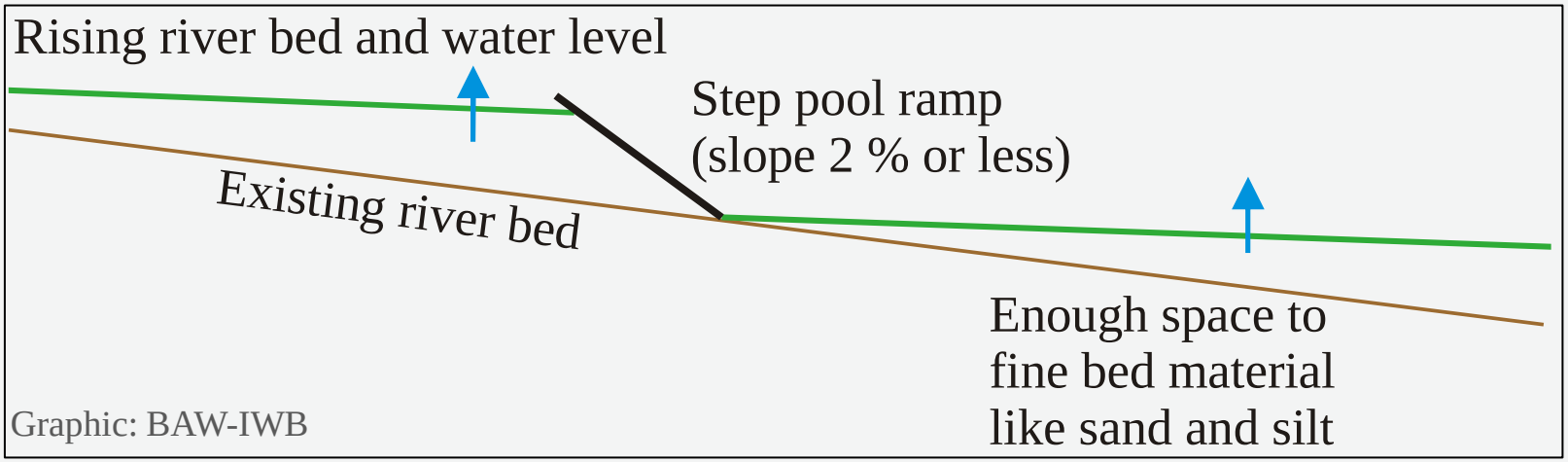

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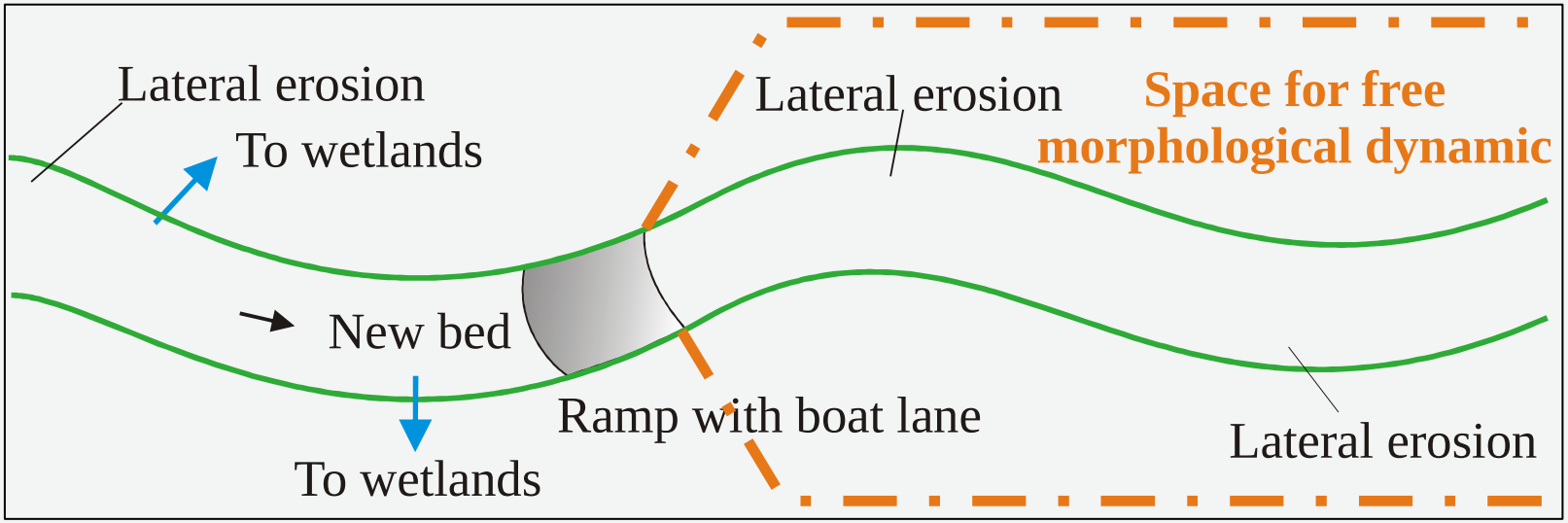
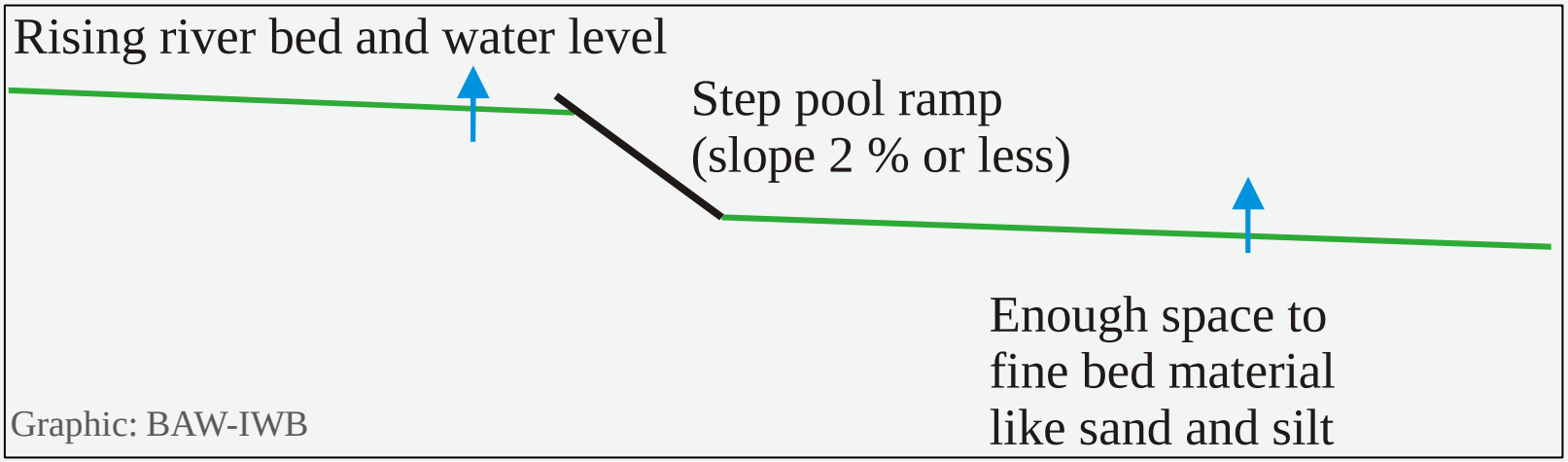




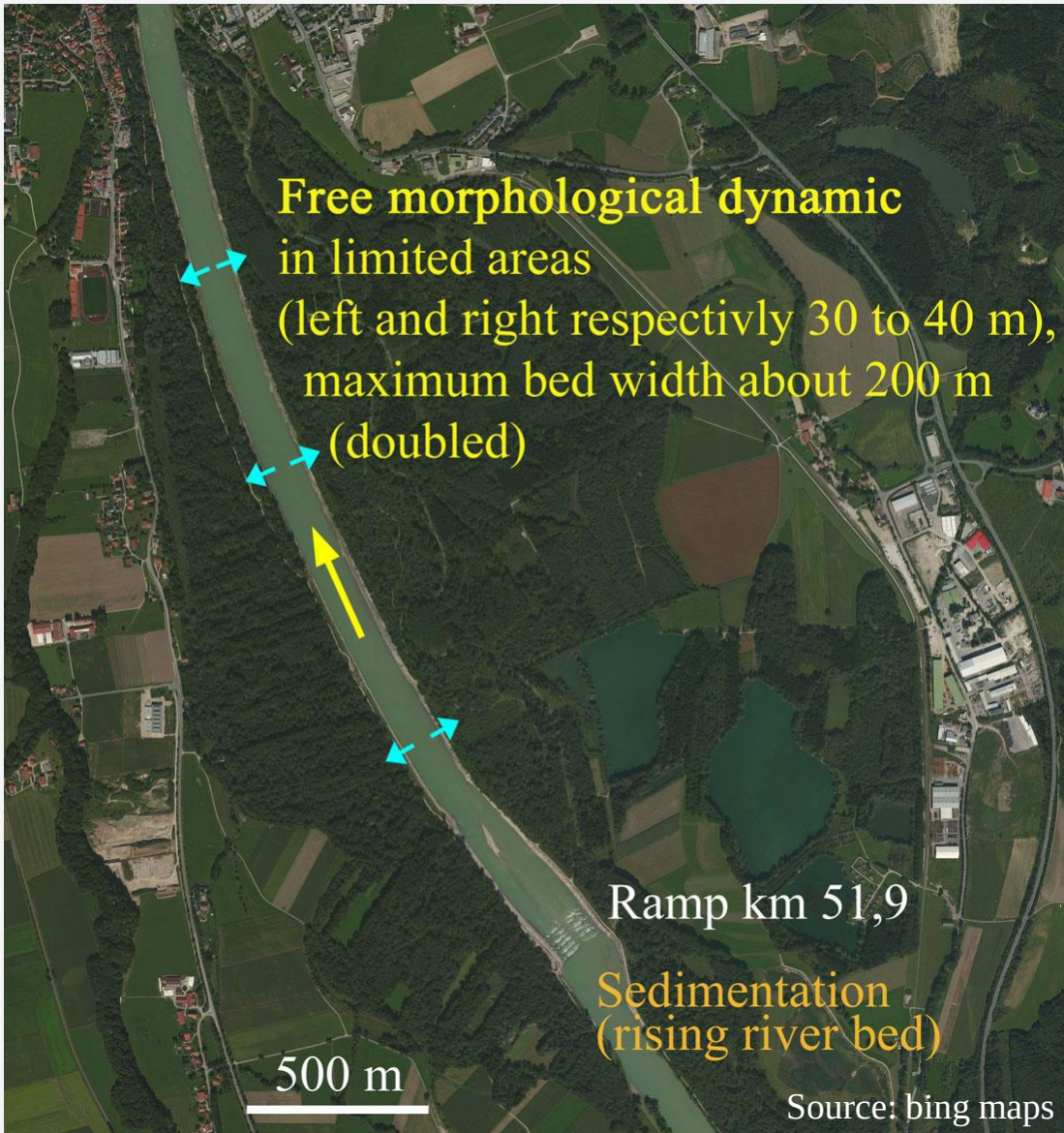
Please note: the project presented here is only one step of this concept

WHAT? (IMPLEMENTATION OF THE CONCEPT)

Build a Ramp + remove the bank protection downstream, for about 3 km, on both sides.

WHEN?

2009 – 2010, completed in spring 2010.



Source: bing maps

SALZACH WITH RAMP

FREE NATURAL BANK EROSION – PREDICTION

1. **Physical Model Tests**
   (Austrian Federal Water Management Agency + TU Wien)

2. **Numerical Modelling**
   Model “Uferlos“ (“Boundless”), developed by Tobias Hafner at TU München;
   Background for the calculations: Physical Model Test Salzach + additional bank erosion experiments.

PHYSICAL MODEL TESTS

- Model-Scale 1:50,
- Model-Area 53 x 10 m,
- 18 morphological years were simulated (floods with different peaks),
- **Homogeneous bed load** (1 grain size distribution for the whole model)

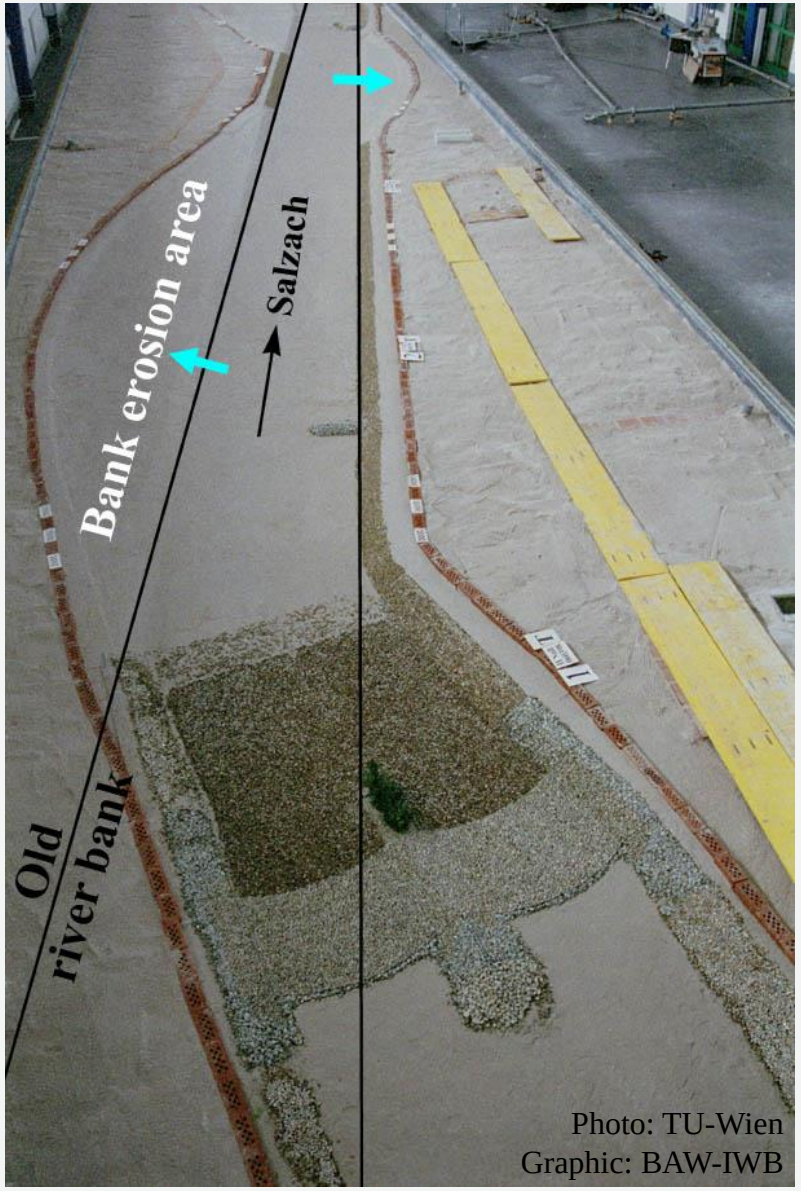
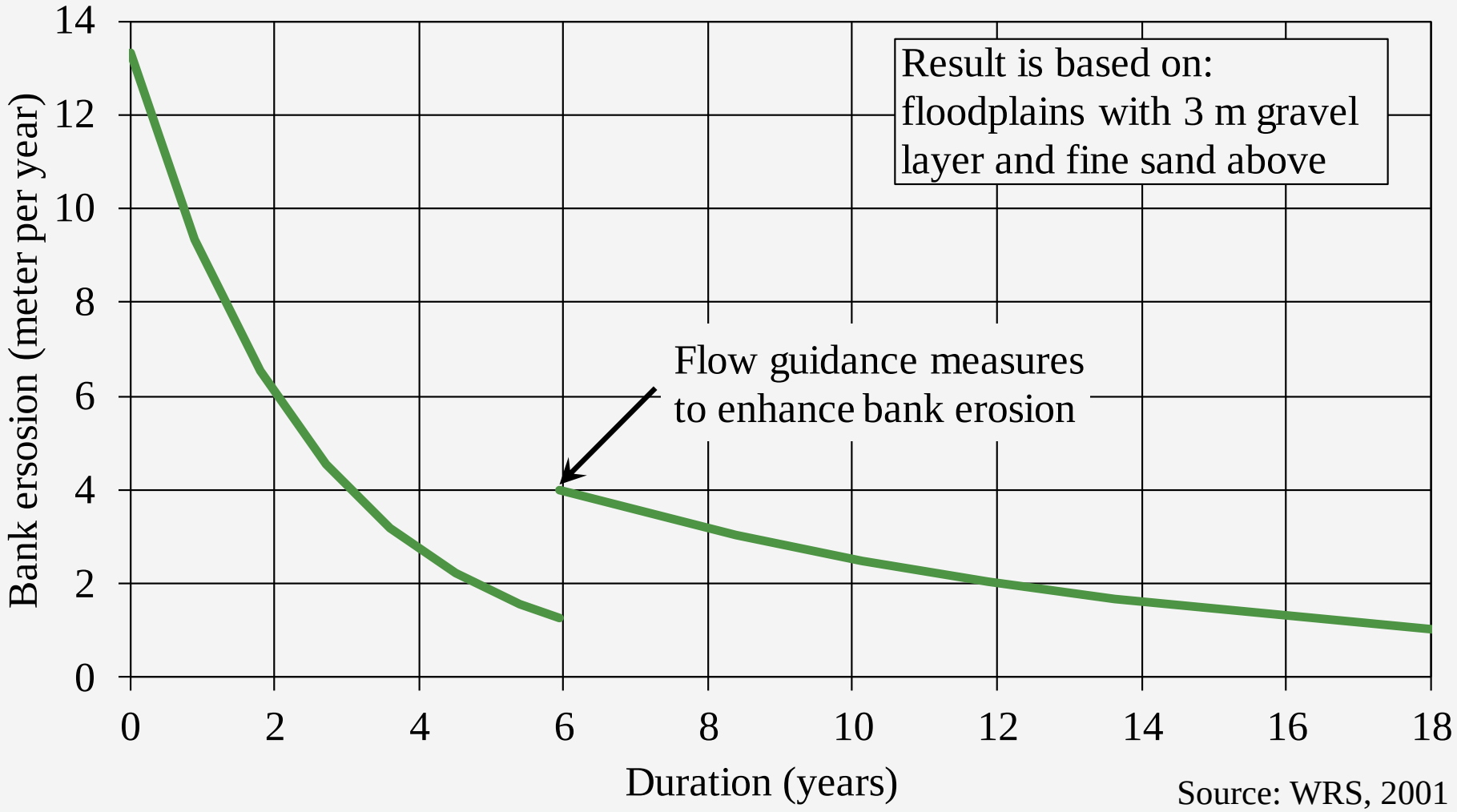


Photo: TU-Wien
Graphic: BAW-IWB

FINE SAND ON TOP OF THE GRAVEL

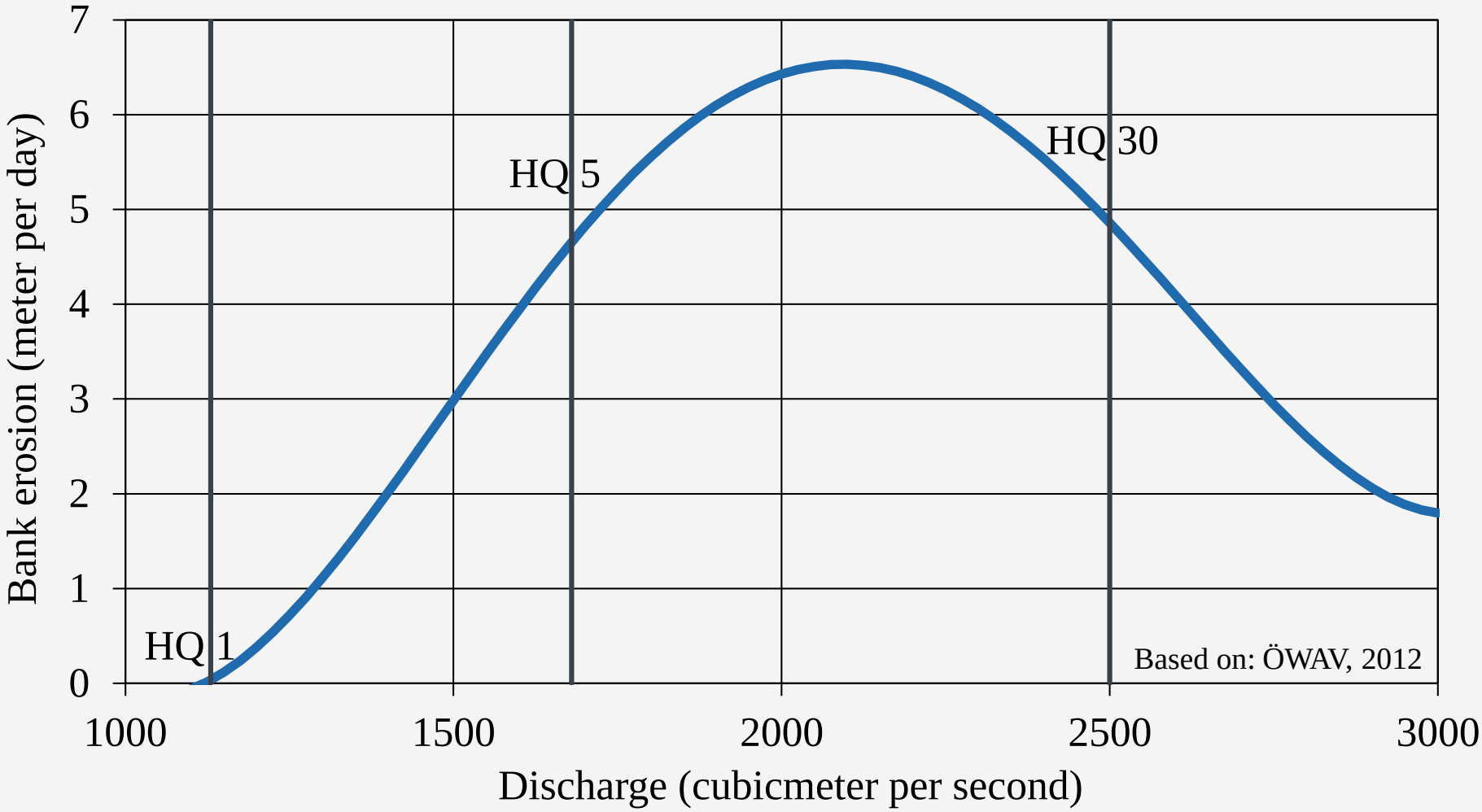
Photo: M. Hengl

BANK EROSION – PREDICTION from MODEL TESTS



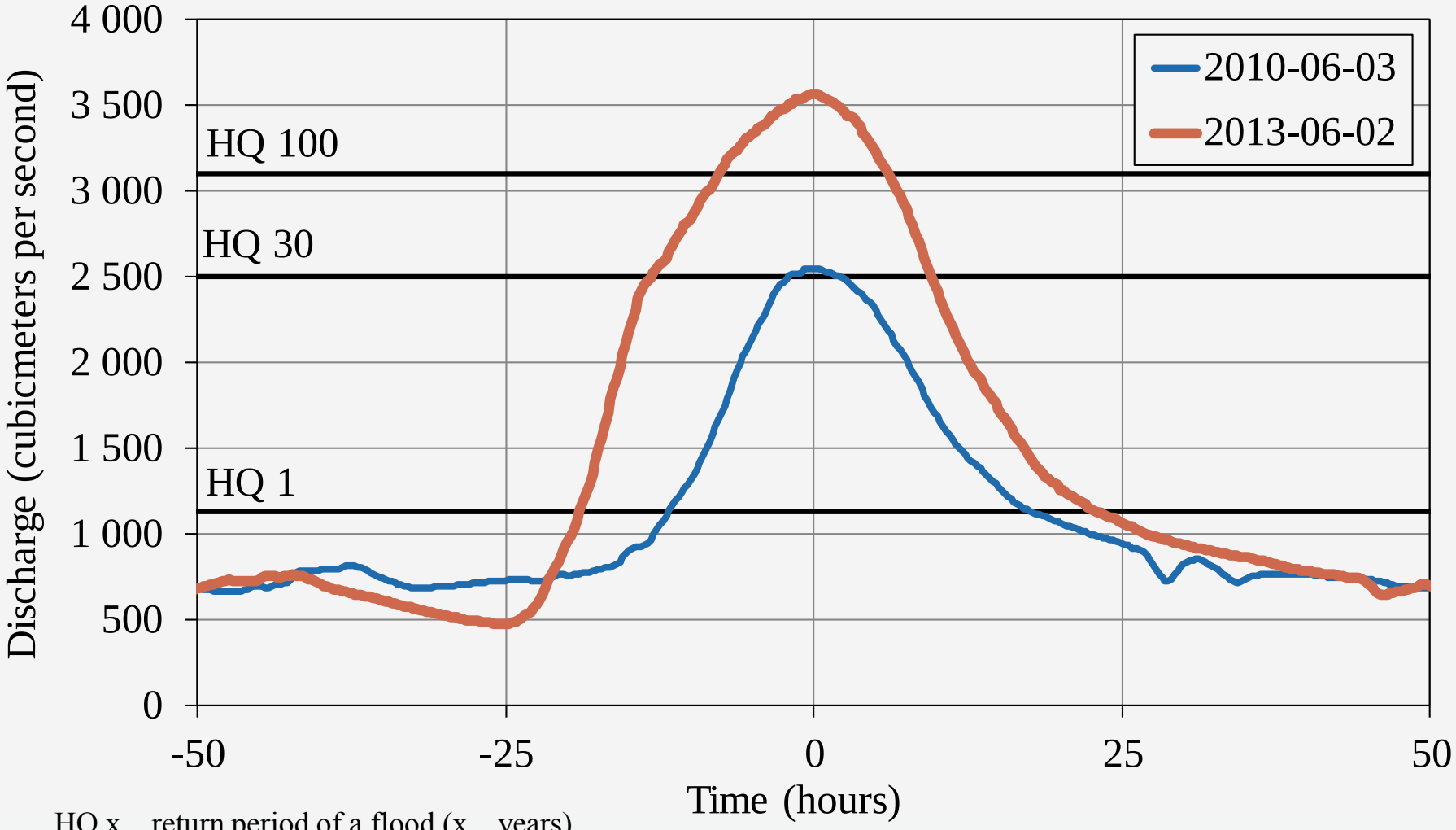
Source: WRS, 2001

PREDICTION – NUMERICAL MODEL



HQ x…return period of a flood (x…years)

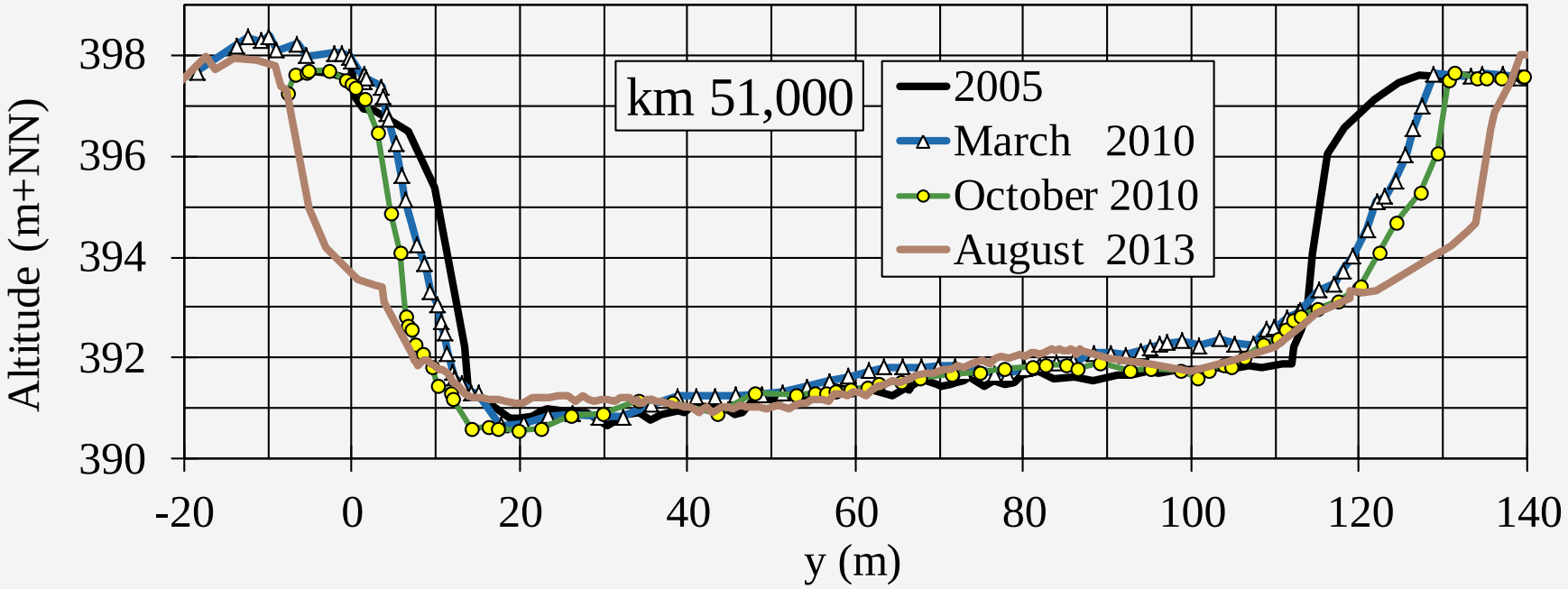
OBSERVATIONS – GAUGE at LAUFEN



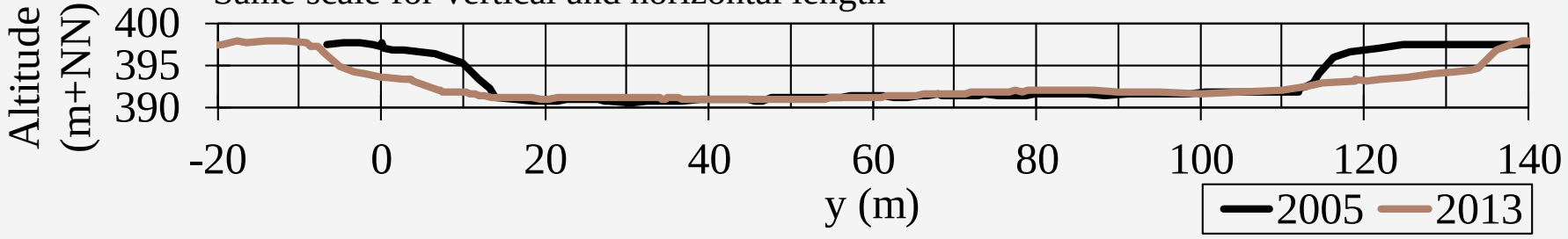
HQ x…return period of a flood (x…years)

OBSERVATIONS – CROSS-SECTIONS (1)

Note: Vertical length 6 times higher than horizontal



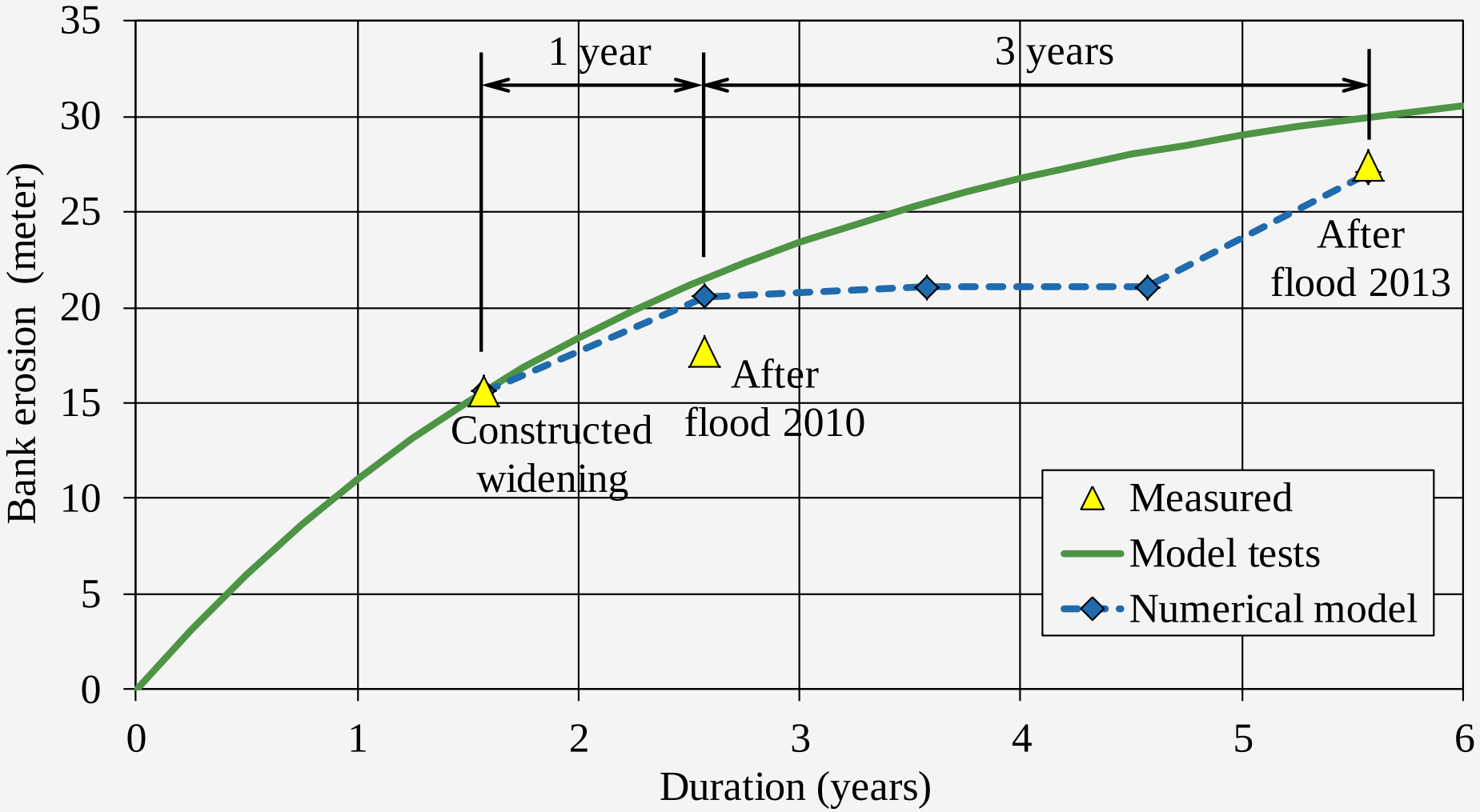
Same scale for vertical and horizontal length



OBSERVATIONS – CROSS-SECTIONS (2)

Photo: M. Hengl (June 2012)

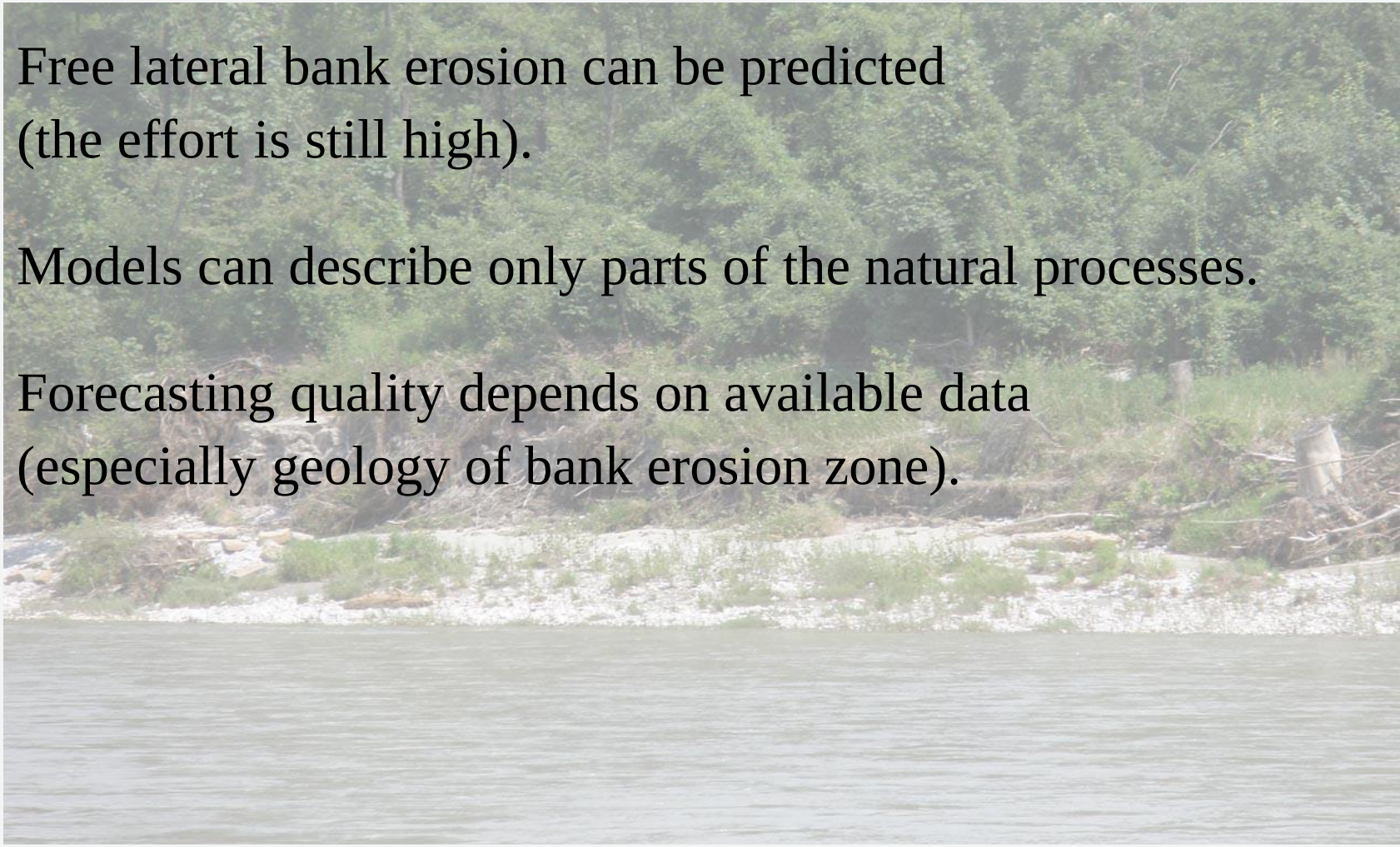
COMPARISON OBSERVATION – PREDICTION



INFLUENCE ON RESULTS – PRESENT

INFLUENCE ON RESULTS – IN THE FUTURE

CONCLUSIONS (1 of 2)



1. Free lateral bank erosion can be predicted (the effort is still high).
2. Models can describe only parts of the natural processes.
3. Forecasting quality depends on available data (especially geology of bank erosion zone).

CONCLUSIONS (2 of 2)

4. Currently uncertainties can be covered only by expert knowledge.

5. Natural morphological development depends on the hydrology – no flood, no development!

Natural River Development = Benefit for

- **Flood Protection AND**
- **Ecology AND**
- **Recreation AND …**

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Wasserwirtschaftsamt Traunstein

LAND SALZBURG