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Gastroenteritis: A waterborne outbreak affected 430 triathletes in an ironman competition - Could this be avoided?

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Gastroenteritis: A waterborne outbreak affected 430 people in Copenhagen harbour during ironman competition – Could this be avoided?

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Introduction

During night of the 14th of August 2010 an extreme rain event overloaded the sewer system in Copenhagen, Denmark

Consequently untreated rain- and wastewater was discharge d at the coast through a combined sewer overflow

Also the waste water treatment plant Lynetten was overloaded, which caused bypass of mechanical treated rain- and wastewater from the combined sewer system

The following day a triathlon competition with ironman distance was held in the Laguna of Amager Strandpark were 1582 triathletes competed

Many of the competitors got gastroenteritis

Aim

To investigate if the risk of disease can be predicted by the use of models of indicator bacteria. To show that models is a strong tool for early warnings

Results

The overflow event

• 45.6 mm of rain within 24 hours
• 26.000 m^3 overflow from the combined sewer system to Oresund
• 190.000 m^3 mechanical treated bypass water from Lynetten to Oresund

• **Increased concentrations of indicators**
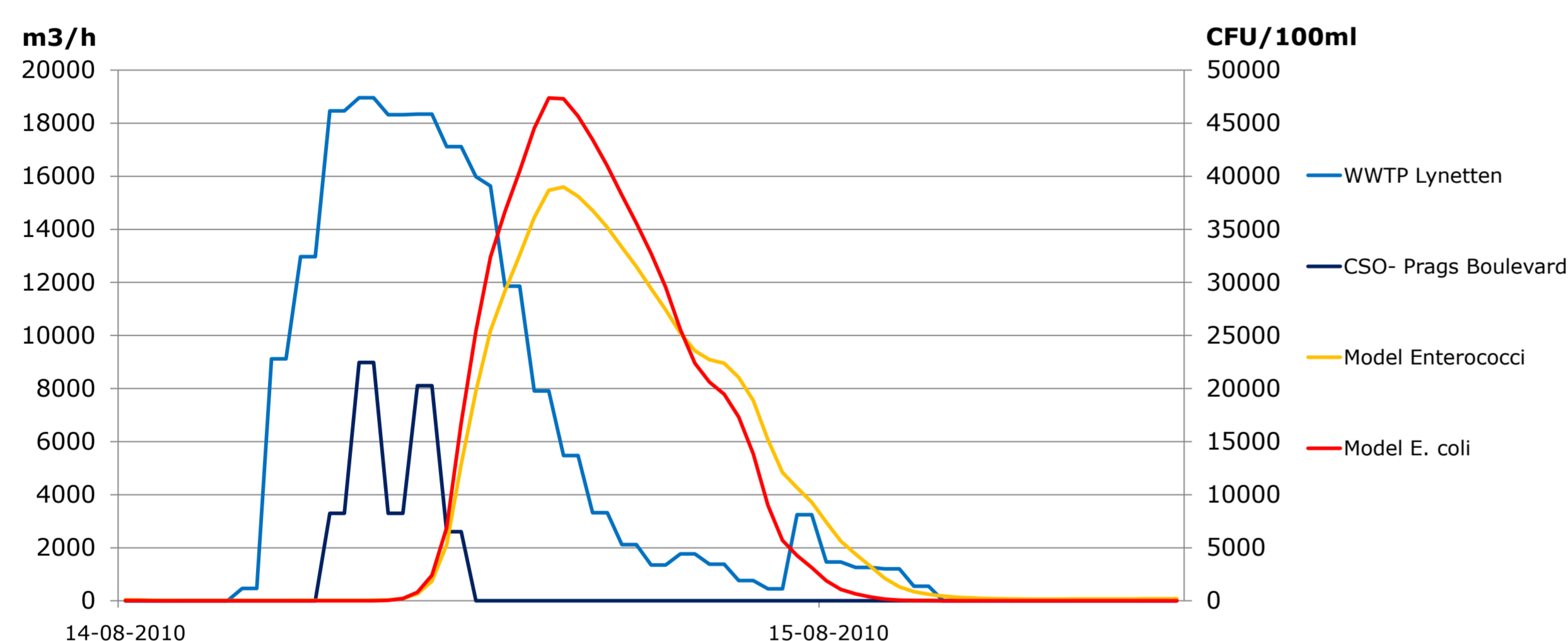
Figure 2. Bypass water from the waste water treatment plant (WWTP) "Lynetten" and combined sewer overflow (CSO) at Prags Boulevard. Model forecast of *E. coli* and *Enterococci* in the Laguna of Amager Strand, August 2010.

What were the consequences

• Several pathogenic agents caused disease:
  ➢ Campylobacter spp.
  ➢ *E. coli* (ETEC)
  ➢ Intimin producing *E. coli* (A/EEC)
  ➢ Giardia lamblia

• Virus and toxins were not examined

• **778 (59%) answered the survey; 428 (55%) had gastroenteritis**

Figure 5. Disease in triathlon competitors, August 2010. (Modified from EPI-NYT week 42/43, 2010, DK)
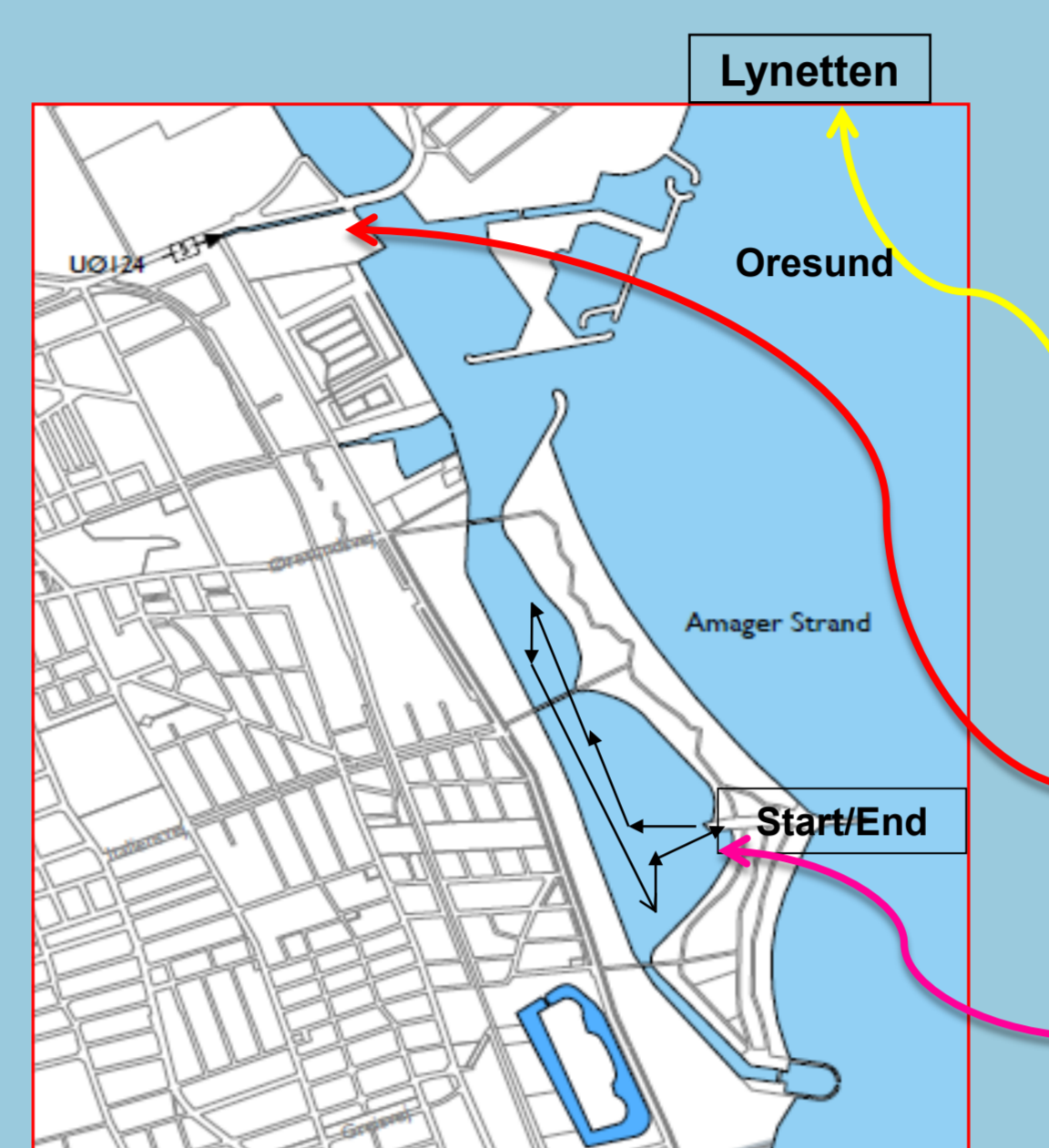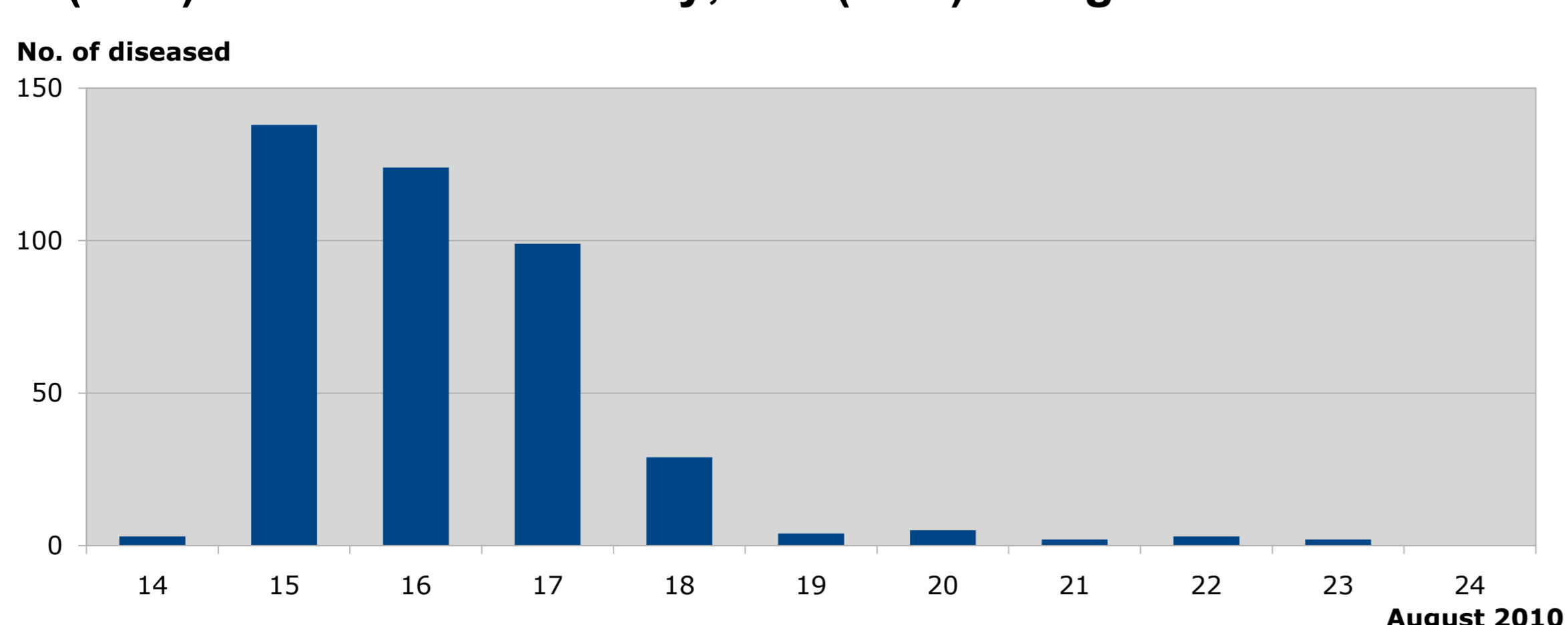
Catchment description

Figure 1. Amager Strandpark, Copenhagen, DK.

The ironman competition was executed in the Laguna of Amager Strand.

Outlet from Lynetten is located north to the Laguna

The location of the combined sewer overflow (CSO) at Prags Boulevard

The swimming route of the competition, start (7 am.) and end of route

What caused the contamination

• The 3D water quality model (MIKE 3 FM by DHI) forecasted, in real-time, high levels of the two indicator bacteria *E. coli* and *Enterococci* at Amager Strandpark

• **The combined sewer overflow caused the bacterial pollution of the Laguna**

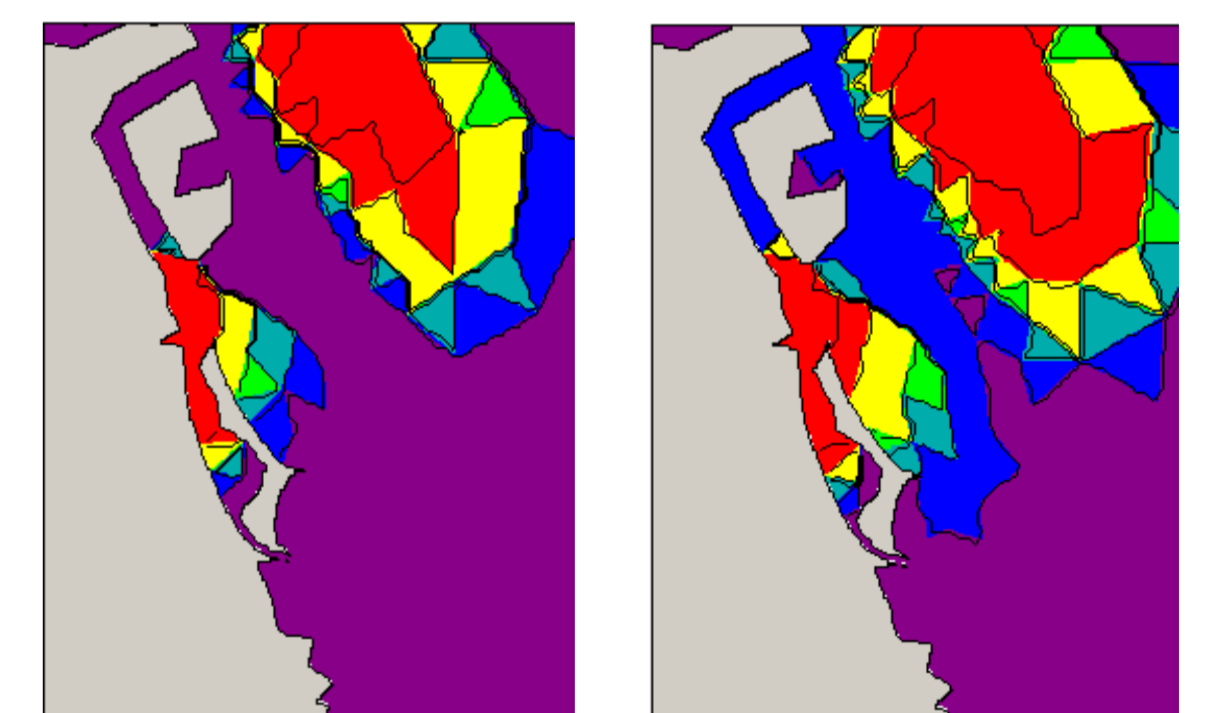• Minor contribution from the bypass water from WWTP Lynetten

Figure 3. Model forecast of *E. coli* and *Enterococci* CFU/100 ml, August 14th at 22 pm.

How serious was the contamination

• The model forecasted high levels of indicators in the Laguna at 7 am.

• 25.554 CFU/100 ml *E. coli*
• 25.217 CFU/100 ml *Enterococci*

• **The high indicators levels indicates a potential risk of disease**
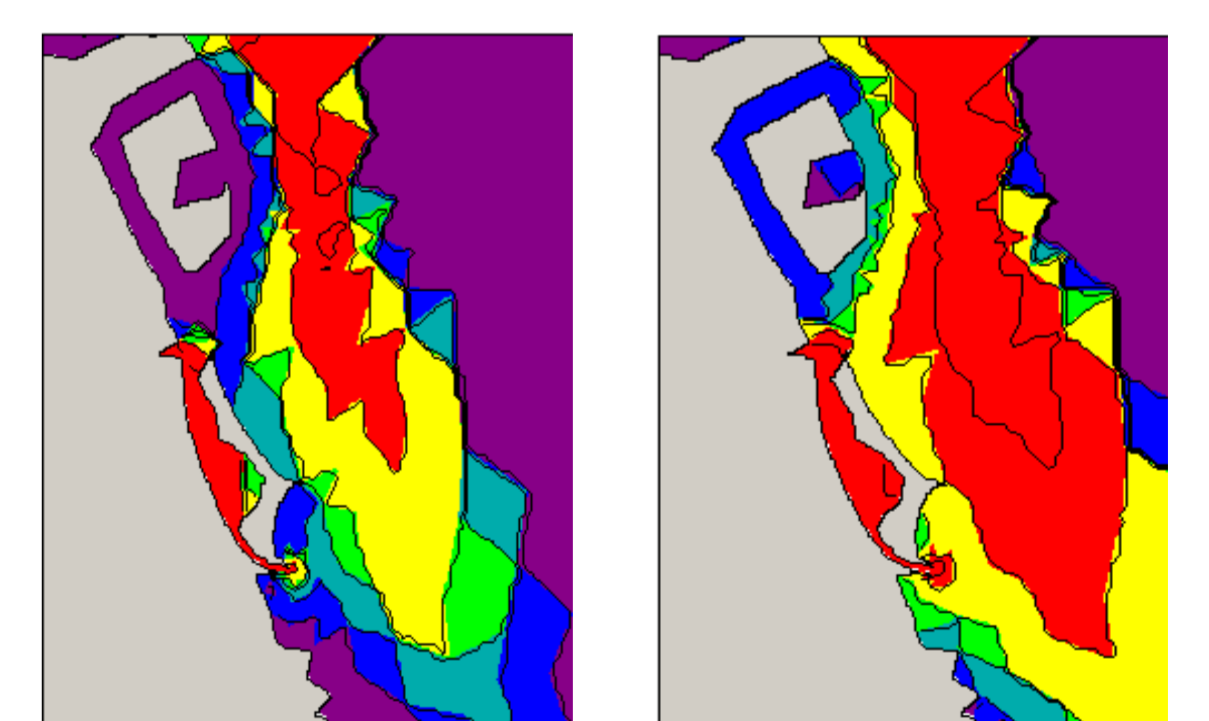
• No measurements were done on the day of the triathlon

Figure 4. Model forecast of *E. coli* and Enterococci CFU/100 ml, August 15th at 7 am.

Predicting disease

Acute situations; Measurements are time demanding and not always available, models gives real-time information at all times

The model predicted a likely risk of disease if swimming in the Laguna

The prediction was true, the triathletes became diseased

The model is shown to be a strong tool for warnings but requires that warnings are taken seriously

Conclusions

• **A combined sewer overflow caused the contamination**

• **Disease when ingesting contaminated seawater when swimming**

• **Models are fast and strong tools for analysis of water quality**