



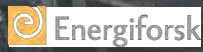
OUTLINE

- 1. Concept
- 2. Systems
- 3. Simulation
- 4. Mattagami
- 5. Path forward

Mattagami River system

Inputs

- Water inflows
- Air temperatures
- Debris accumulation
- Water temperatures
- Operating rules
- Power demand





Mattagami River system

Little Long



OUTLINE

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Mattagami River system

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Smokey Falls





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Mattagami River system

Harmon Station



Mattagami River system

Kipling Station



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Internal incidents (e.g.)

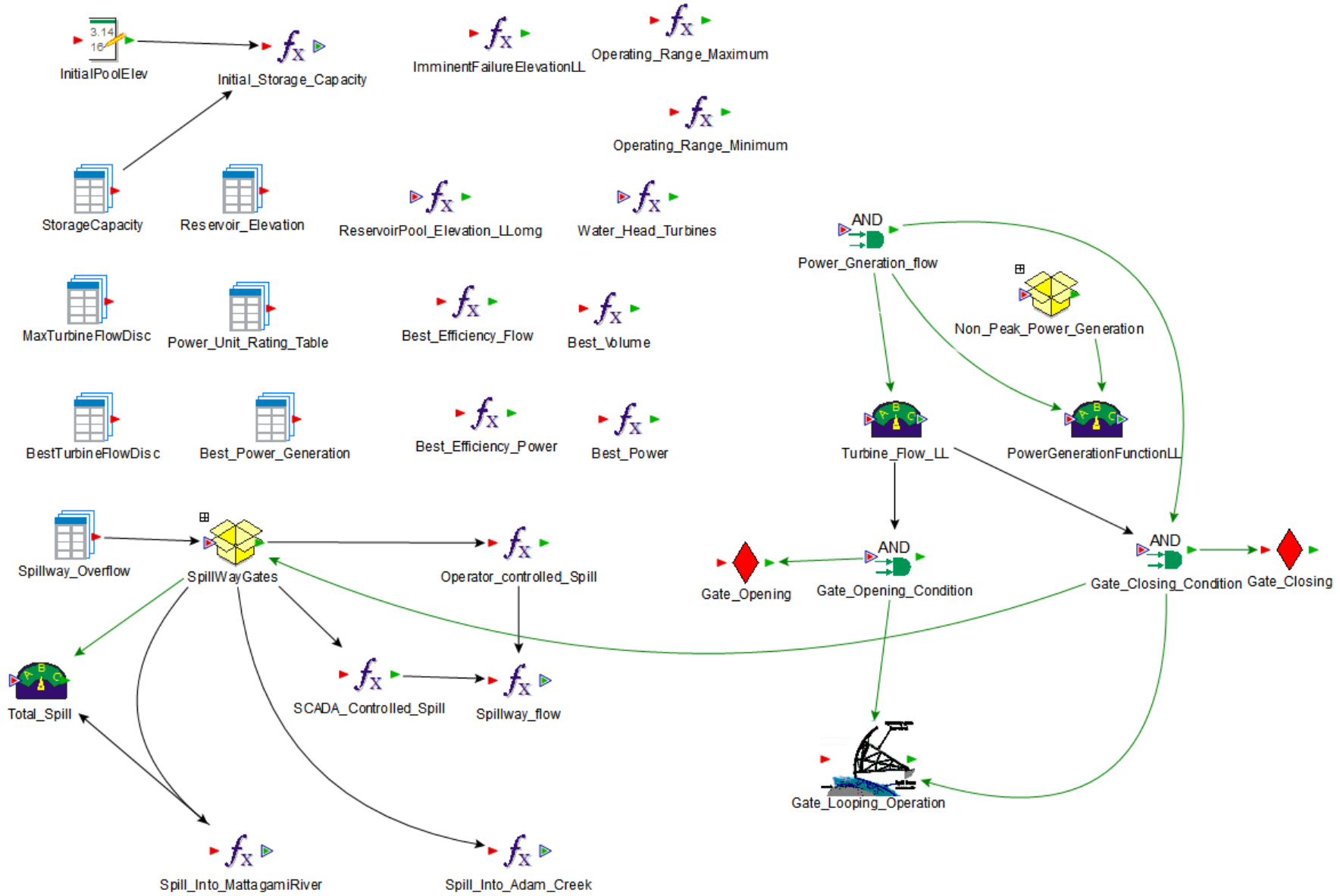
- Overtopping
- Environmental flows
- Non-compliance with WMP
- Unexpected releases
- Power production failures

External disturbances (e.g.)

- Electrical system disturbance
- Environmental changes (weather)
- Grid operation changes
- Ice (gates)
- Debris accumulation
- Public mishaps



Parameters and calculations for LittleLong operations



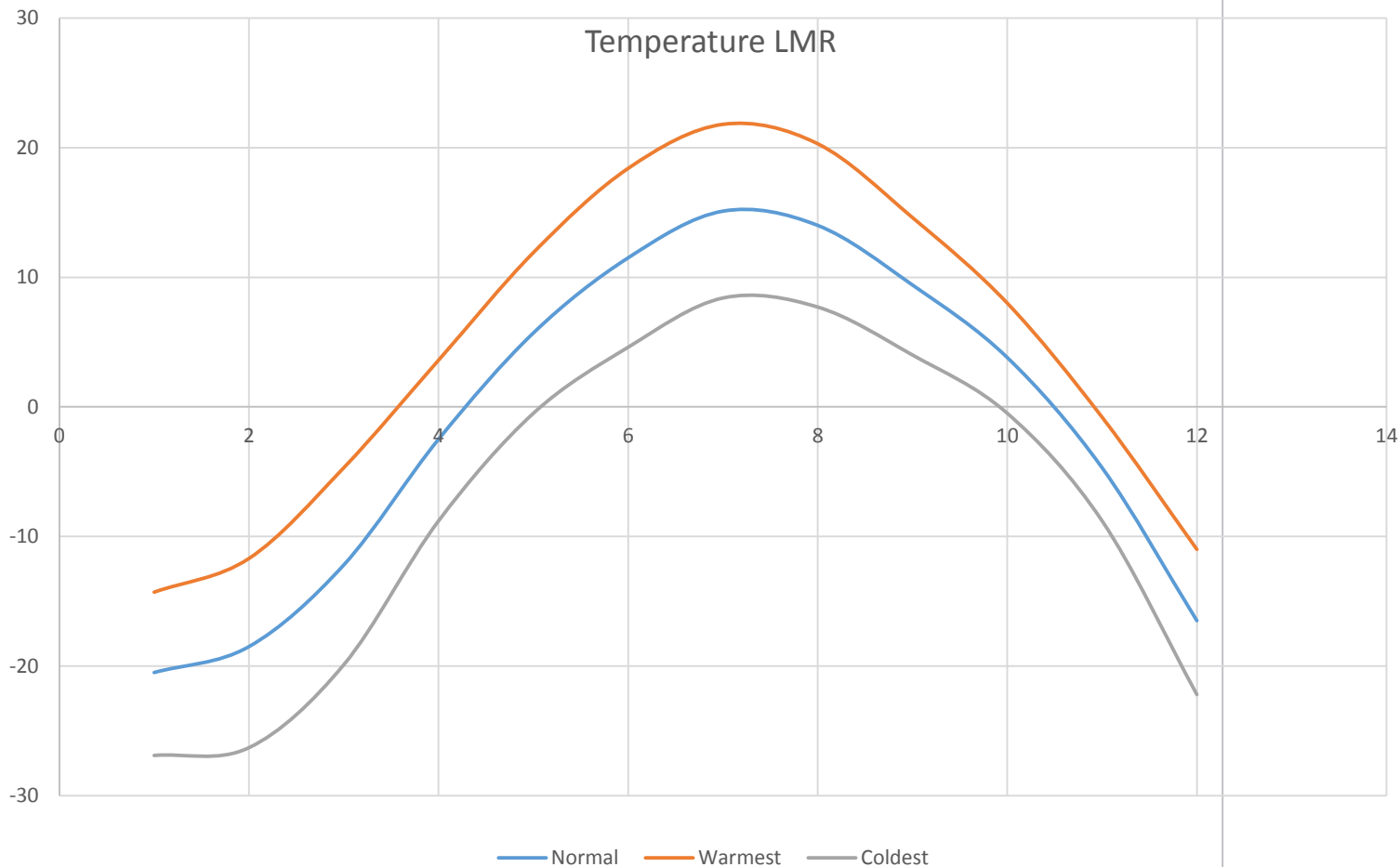


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Mattagami River system

Ambient air temperature (°C)



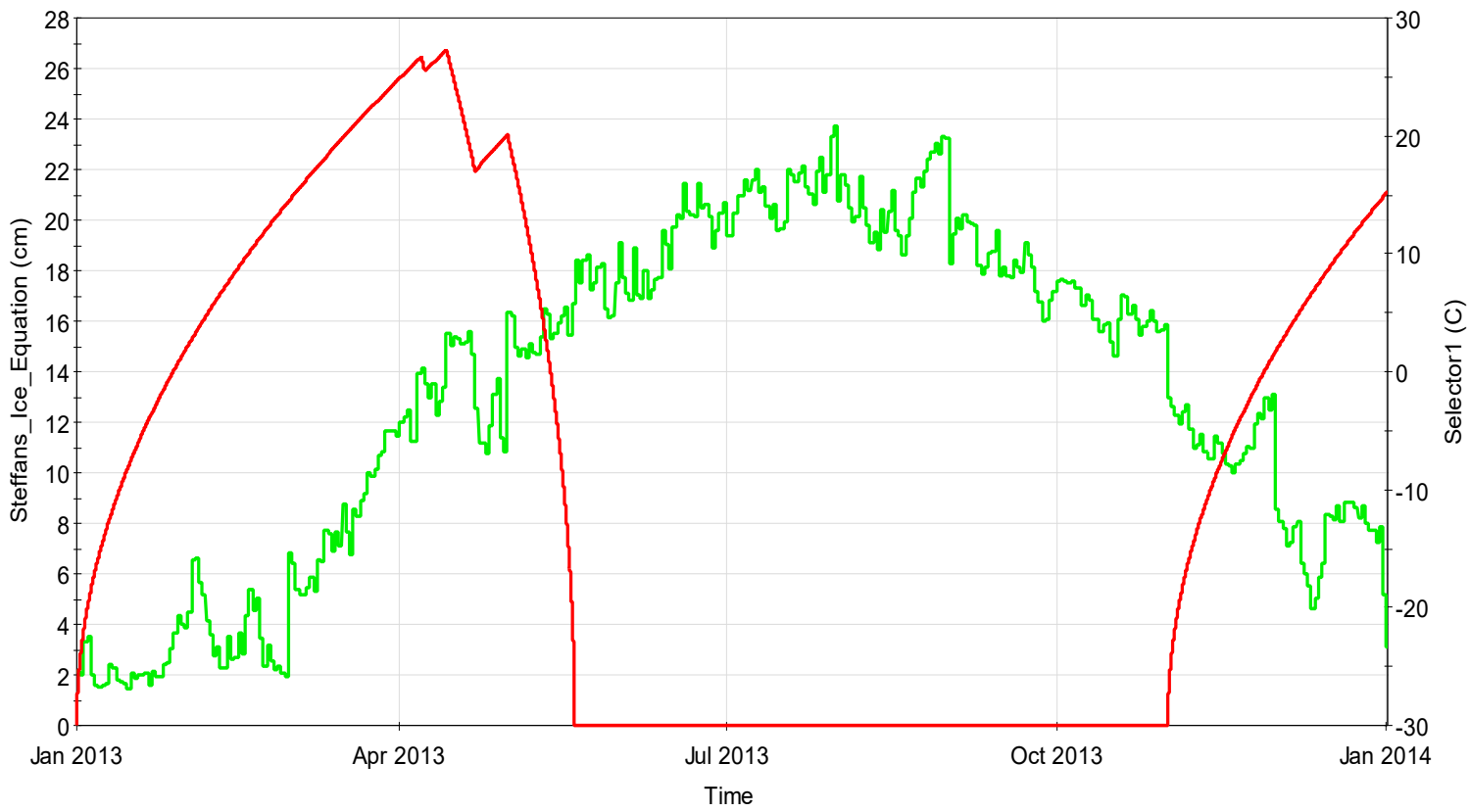


Mattagami River system

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Result2



Realization #14
Steffans_Ice_Equation Selector1



Mattagami River system

OUTLINE

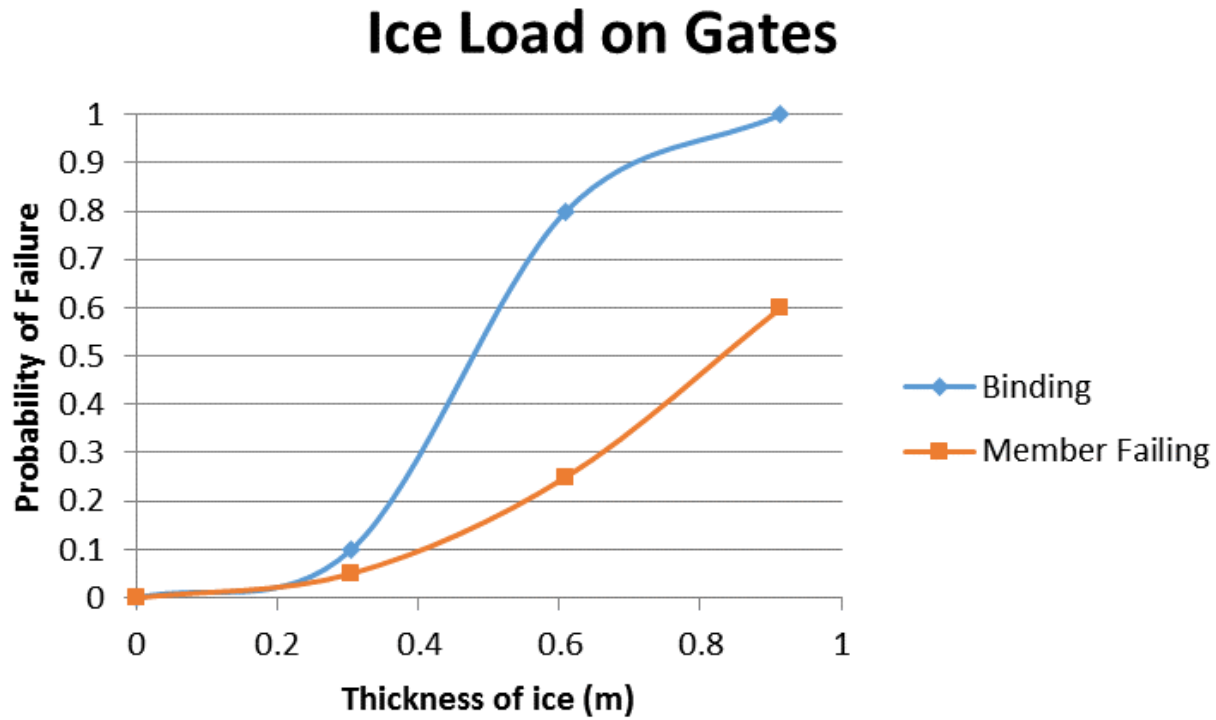
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Mattagami River system

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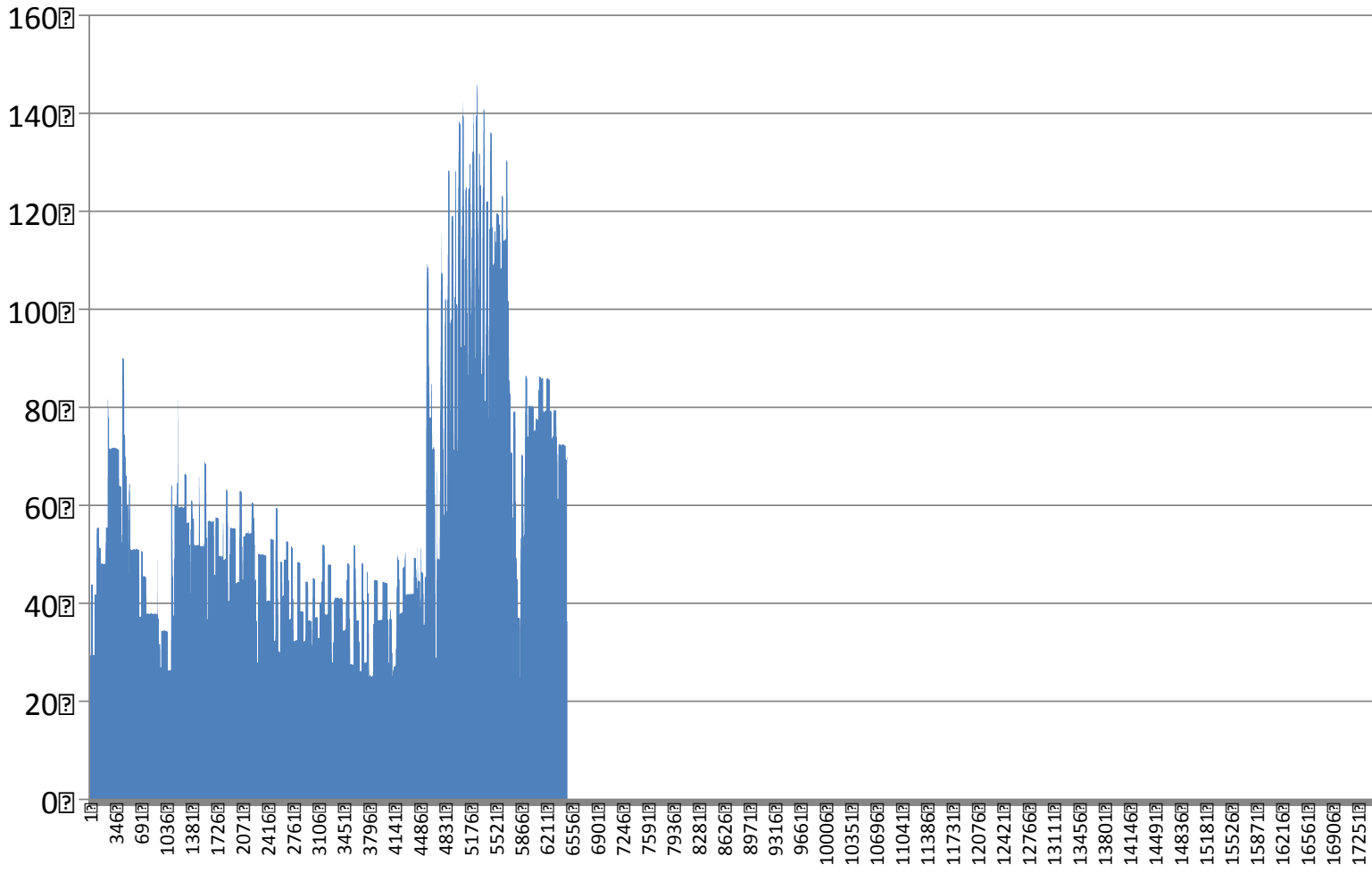


Mattagami River system

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Grid Demand (MW) 30-minute intervals



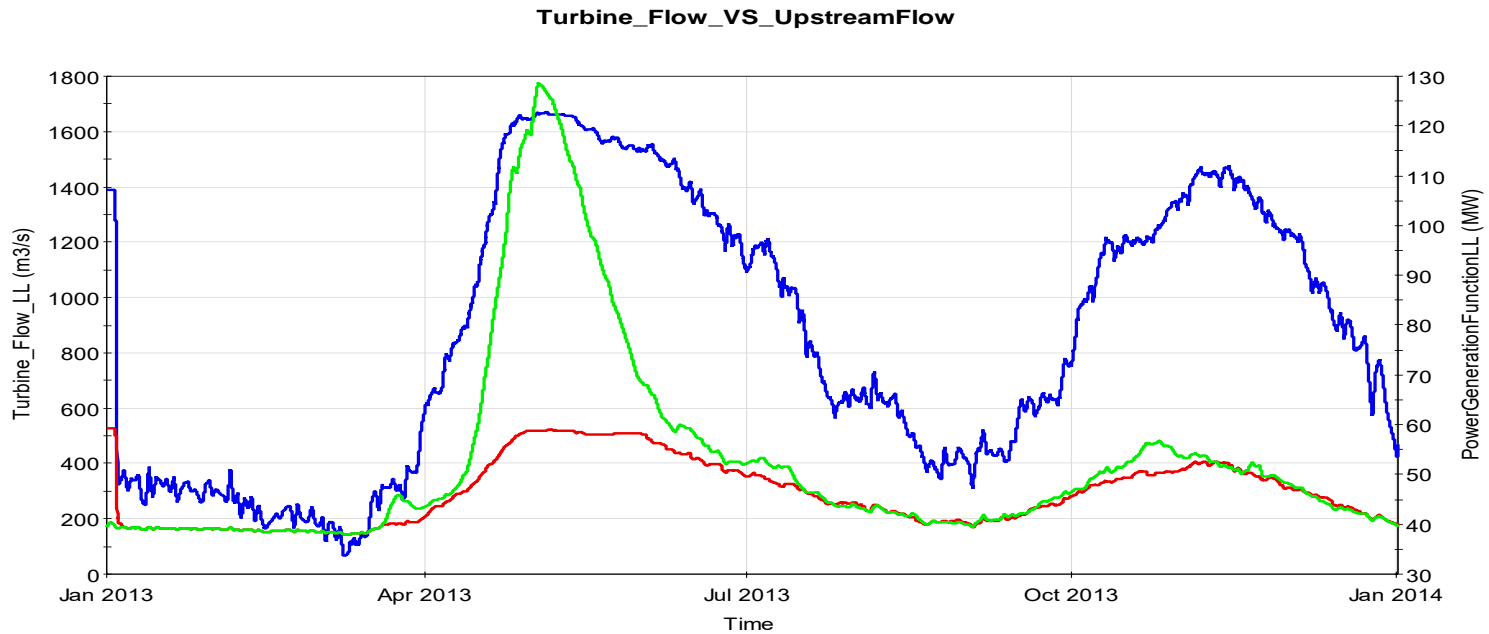


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Spillway and turbine flows



Mean
— Turbine_Flow_LL — UpstreamDailyFlow — PowerGenerationFunctionLL

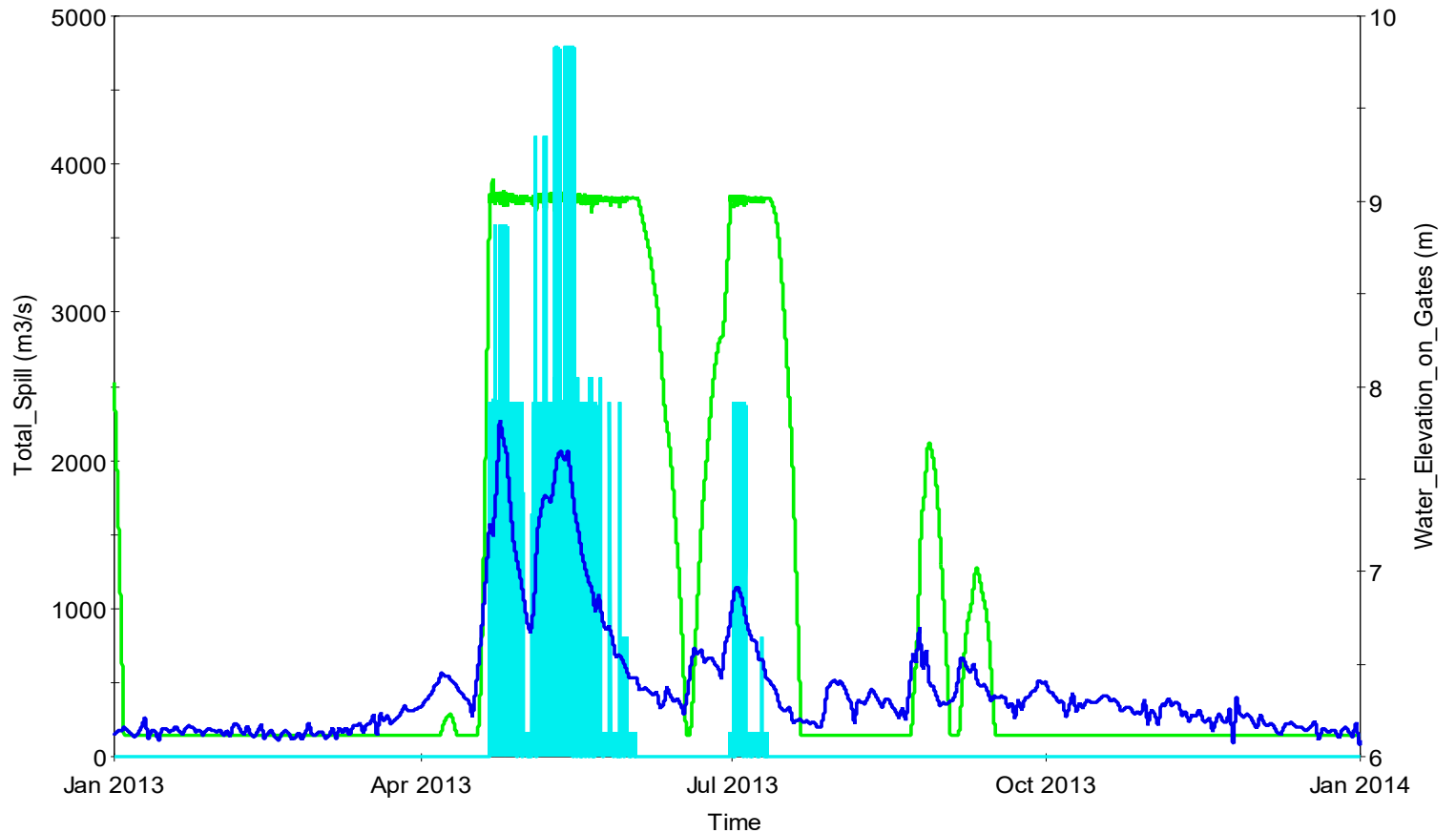


Mattagami River system

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Water_Elevation On Gates

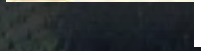


Realization #49

Total_Spill

UpstreamDailyFlow

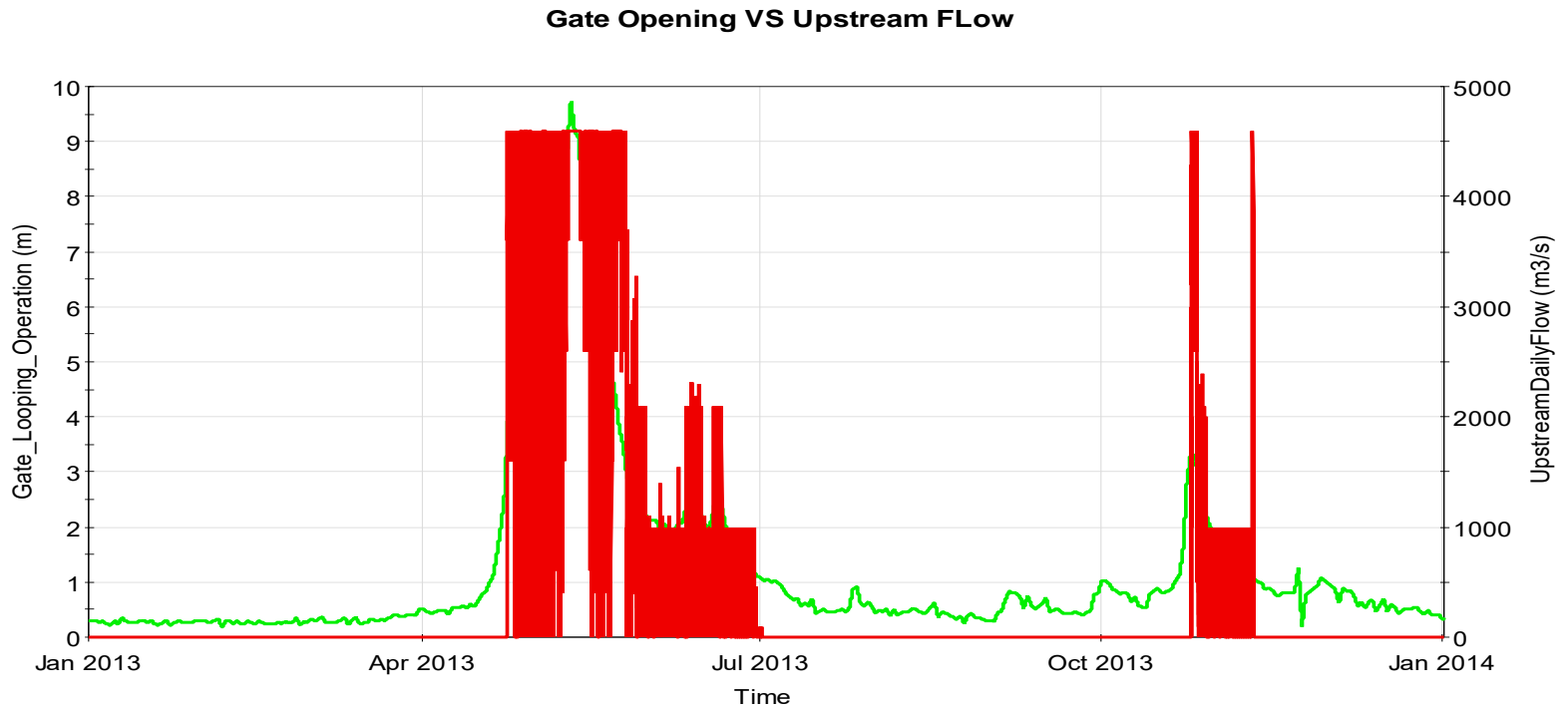
Water_Elevation_on_Gates



Mattagami River system

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Realization #47
Gate_Looping_Operation UpstreamDailyFlow

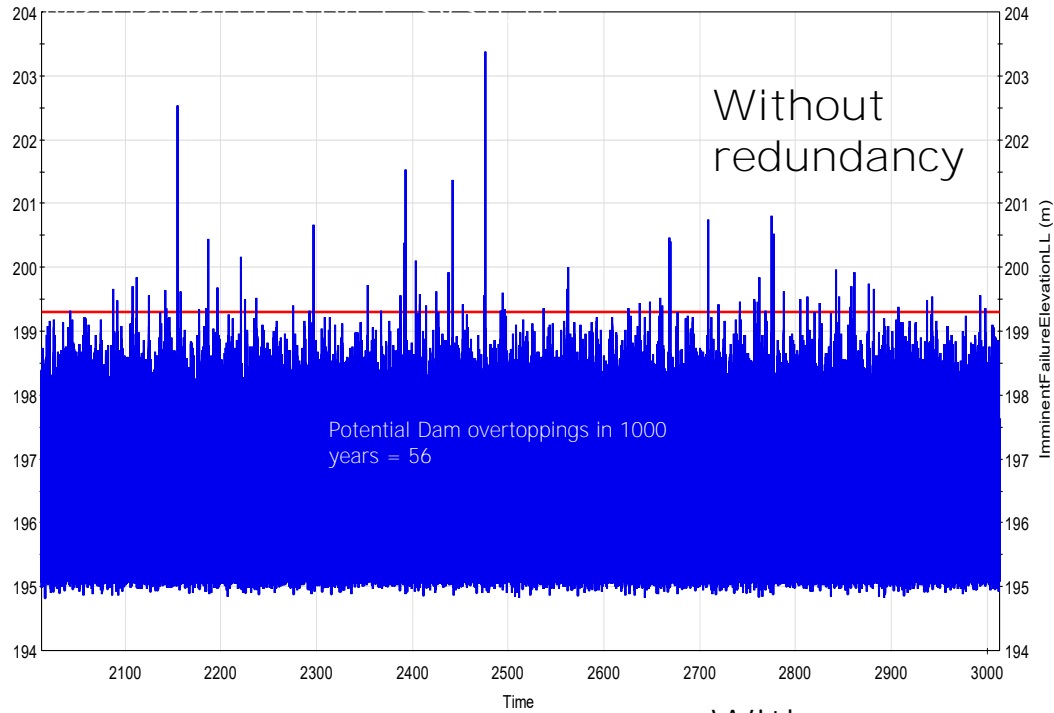


OUTLINE

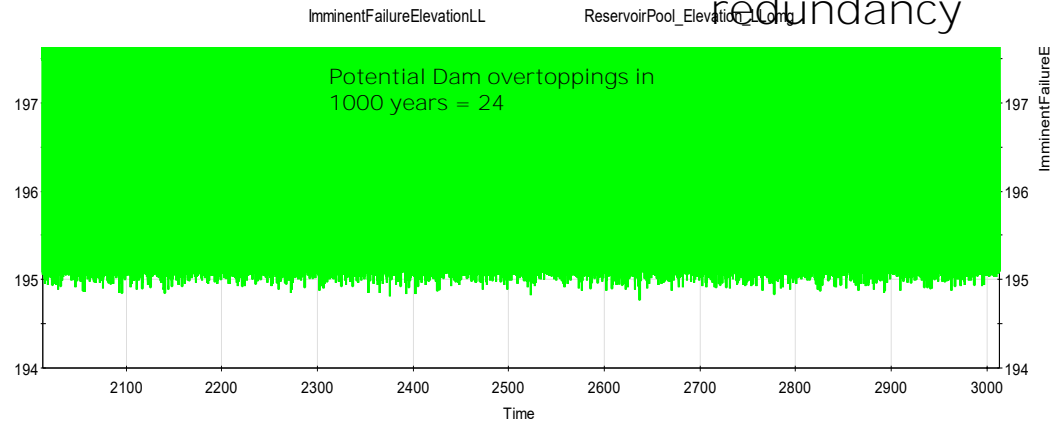
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Result18



With redundancy





Where to from here?

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Where to from here?

Some assembly required ...

- Systems thinking about dam safety is becoming viable
- Parallel developments in many industries
- Sheds new light on operation and its effect on safety
- Need to apply systems thinking to case histories

Where to from here?

Case examples

What was the system configuration (station, dam, transmission or distribution network)

- What went wrong?
- What could have compounded the situation (i.e. did not happen, but if it did)?
- What were the consequences, actual and potential?
- What corrective actions were instituted?



Thank you.

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Operational Safety of Dams and Reservoirs

Understanding the Reliability of Flow-control Systems



Desmond ND Hartford, Gregory B Baecher, P Andy Zielinski,
Robert C Patev, Romanas Ascila, Karl Rytters

