Wastewater Systems Reliability

By

City of Winnipeg, Water and Waste Department

for

Clean Environment Commission Hearings

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Wastewater Systems Reliability

Outline

- Introduction
- Collection Systems
- Treatment Facilities
- September 16, 2002 Plant Shutdown
- Risk/Criticality Assessments

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Introduction

- **Water & Waste Department Vision**
  - **“Excellence in Environmental Services”**
- **We value:**
  - **“The important contribution our services make to the good health and quality of life of the citizens of Winnipeg”**
- **We provide:**
  - **Efficient reliable collection of wastewater for the protection of health and property**
  - **Dependable highly effective treatment of wastewater for environmental protection of river water quality**

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Collection Systems

- **Statistics**
  - Approx. 2200 Km. collection sewers
  - Approx. 130 Km. interceptor sewers
  - 71 wastewater lift stations
  - Approx. 182,000 customer connections
- **Design & Operation**
  - Gravity flow in collection sewers and interceptors
  - Redundant pumping units in lift stations
  - Power interruption to lift stations
    - System storage
    - High level overflows
    - Stand-by power
  - Monitoring and alarm system

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Collection Systems - Asset Management

- Sewer condition assessment
- Sewer renewal program
  - $11.5 million per year
- Basement flood relief program
  - $7.5 million per year

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Treatment Facilities

- Three treatment plants
- Reliability, redundancy, standardization and flexibility are integral to design
- Water Environment Federation Manual of Practice No. 8 provides guidelines for reliability
- City's plants meet or exceed reliability guidelines
- Vital components designed to allow repair or replacement without interrupting treatment

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Treatment Facilities – Reliability Examples

- **Pumping**
  - multiple units, capacity can be provided with largest pump out of service
- **Process**
  - multiple trains provide redundancy so that one can be removed from service while maintaining treatment
- **Electrical**
  - two separate power feeds or stand-by power
- **Computer Control Systems**
  - duplicate process modules provided for each function plus uninterruptible power supply

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September 16, 2002 Plant Shutdown

- Why a reliability review is required

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September 16, 2002 Plant Shutdown

- Maintenance planned on one of six raw sewage pumps
- Broken guide inside 36” gate valve on pump suction
- Valve lodged open by about 13.5 inches
- Raw sewage flowed into three 57-foot deep pump wells flooding all 6 raw sewage pumps
- Sewage couldn’t be pumped through treatment process
- Overflow duration estimated at about 2 day and 9 hours
- Approx. 427 ML of untreated wastewater spilled to Red River

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September 16, 2002 Plant Shutdown

Response

- Immediately informed Manitoba Conservation, Environment Canada, Public Health officials, and downstream municipalities
- Daily media releases issued
- Intensive Daily Monitoring Initiated immediately
  - Upstream at Provencher Bridge to downstream past Selkirk
- Undertook analyses to predict downstream impacts
- Booms installed at 8 overflow locations

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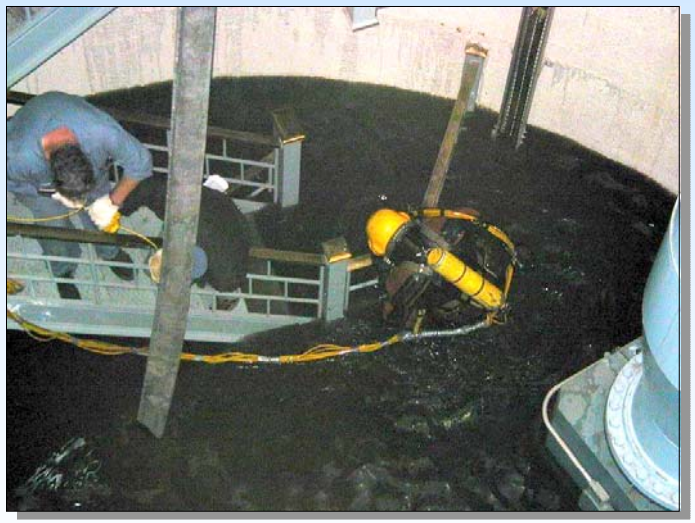
September 16, 2002 Plant Shutdown

Recovery

- Department staff worked around the clock to restore service
- Electric motors removed and cleaned, dried, serviced before re-installation
- Full treatment restored by September 19 @ 2:00 a.m.
- Retained consultant services to:
  - Investigate cause of valve failure
  - Coordinate activities to remove and replace valve
  - Design temporary bulkhead between pumpwells
  - Inspect other 5 pump suction valves



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September 16, 2002 Plant Shutdown

River Quality Impacts

- Higher river flows than normal, cool temps
- Overflow approximately 1 to 1.5% of river flow
- Reduced Dissolved Oxygen (DO)
  - Lowest DO level immediately upstream of Lockport, 5.4 mg/L
  - Downstream of Lockport 8.0 mg/L minimum
  - Above minimum level set by Province of 5 mg/L to protect aquatic life
- Elevated bacteria (fecal coliform) levels
- Odour, Floating Debris

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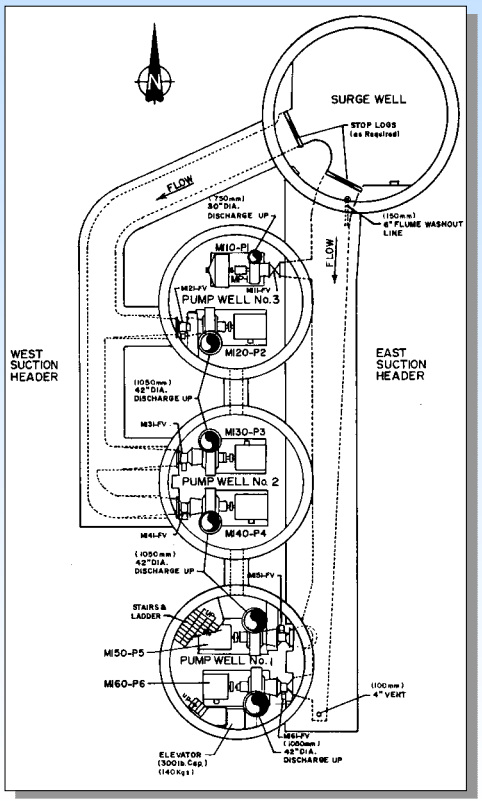

September 16, 2002 Plant Shutdown

Immediate Action:

- Isolate the 3 pump wells at NEWPCC
- Develop written procedures for critical operations
- Review training
- Evaluate gate installation on the main interceptor to NEWPCC to isolate plant
- Consider recommendations of other reviews being undertaken by:
  - Province of Manitoba
  - Environment Canada
  - City of Winnipeg (independent review by Associated Engineering)

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Risk/Criticality Assessments

- City to undertake Risk and Criticality Assessments at the three WPCCs
  - Assess reliability and backup capability of treatment systems
- Criticality assessment
  - Characterize system
  - Determine critical assets
  - Identify significant failures/adverse consequences
  - Assess likelihood of failure
  - Evaluate existing countermeasures
  - Estimate mitigation costs, and develop risk reduction plan
  - Implement mitigation measures to prevent future unplanned shutdowns
- 12-month study, to be complete in 2004