1.782 Environmental Engineering Masters of Engineering Project

Fall 2007 - Spring 2008

MAE LA REFUGEE CAMP WATER SUPPLY

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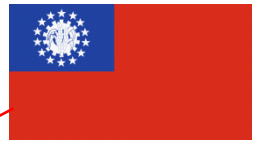
MIT - CEE

MAE LA REFUGEE CAMP WATER SYSTEM

- Background and Overview
  - Mae La Camp
  - Water Supply
- I. Distribution System Modeling
  - Intermittent supply issues
  - Program - EPANET
- II. Water Treatment
  - Turbidity
  - Stream flow & Rainfall

MAE LA LOCATION



- Karen, Karenni, and Mon refugees
- 20,000 people
- Semi-permanent camp for day laborers

Figure by MIT OpenCourseWare.

WATER SUPPLY & GEOGRAPHY

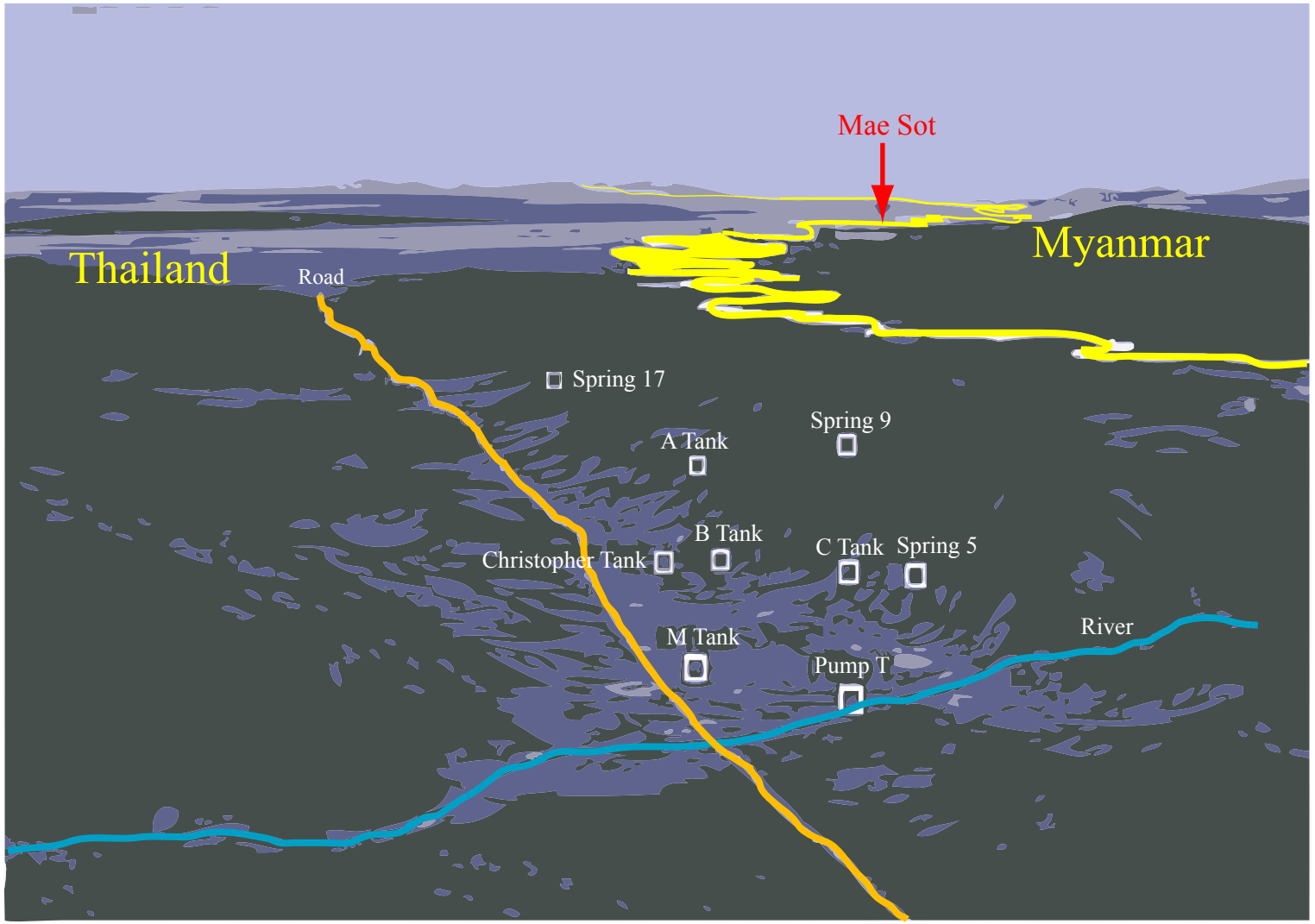
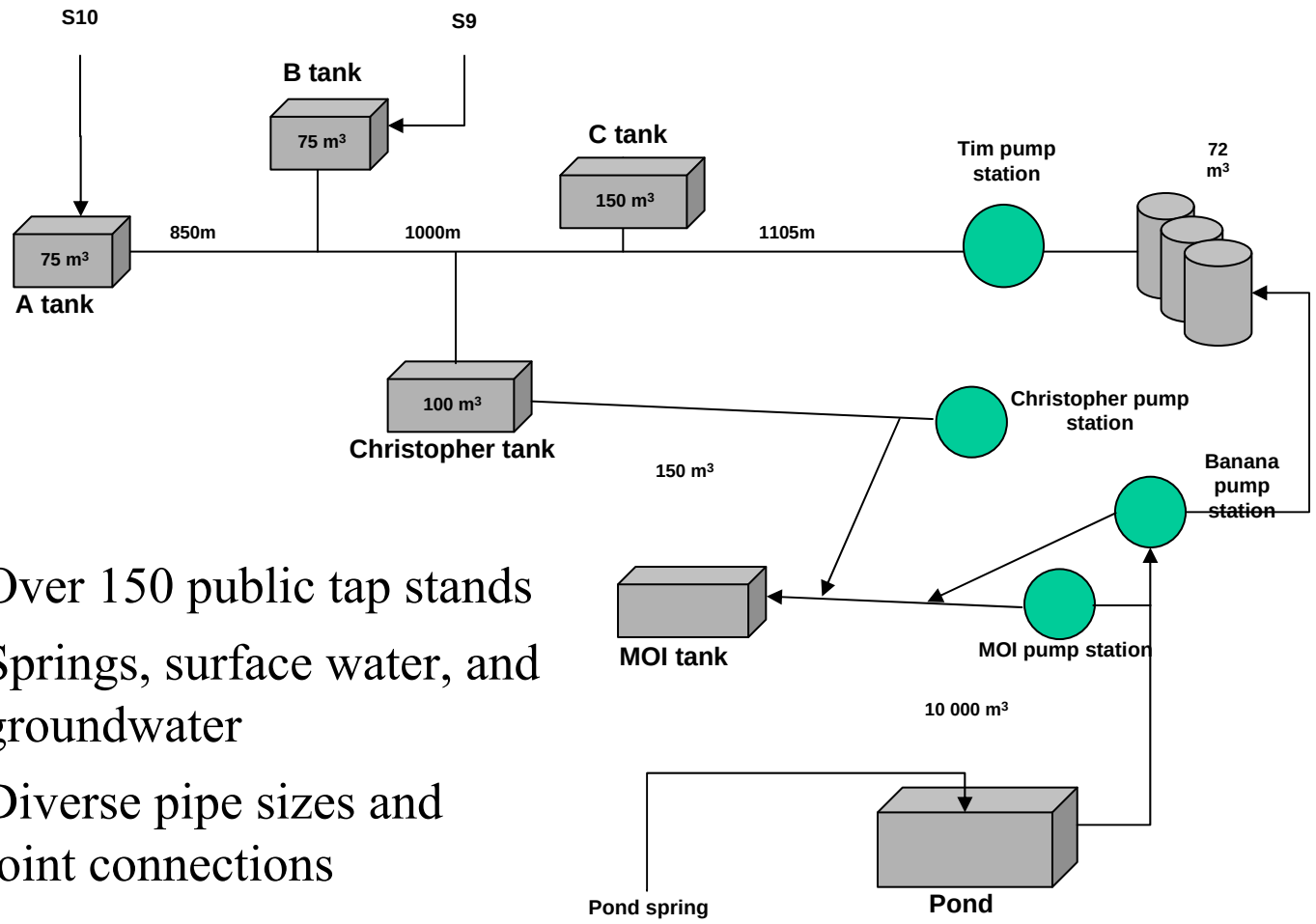


Figure by MIT OpenCourseWare.

DISTRIBUTION SYSTEM OVERVIEW



- Over 150 public tap stands
- Springs, surface water, and groundwater
- Diverse pipe sizes and joint connections

Brizou, Jean-Baptiste. “Thailand Mission: Maela Camp Nov. 2005- Aug. 2006: Final Report.”, AMI

PART I: DISTRIBUTION SYSTEM

Objectives:

1. Collect elevation & additional system data
   - Handheld GPS units to add data to GIS Map
2. Create EPANET distribution model
   - Link GIS Map and flow data to EPANET
3. Calibrate model
   - Salt or rhodamine testing
4. Suggest potential improvements
   - Pumping energy and cost, impact of new sources, contaminant tracing

INTERMITTENT FLOW

- Supply ≠ Demand
  - Pressure-driven analysis
  - Network charging; pipes not always full
- Variation of flow and roughness coefficient as expels air
- Quality concerns
  - Groundwater ingress and microbial regrowth while stagnant
  - Pressure/velocity peaks allow for biofilm detachment
- Social effects
  - Take more than necessary: “just in case” & non-metered
  - Leave collector beneath tap to get every drop

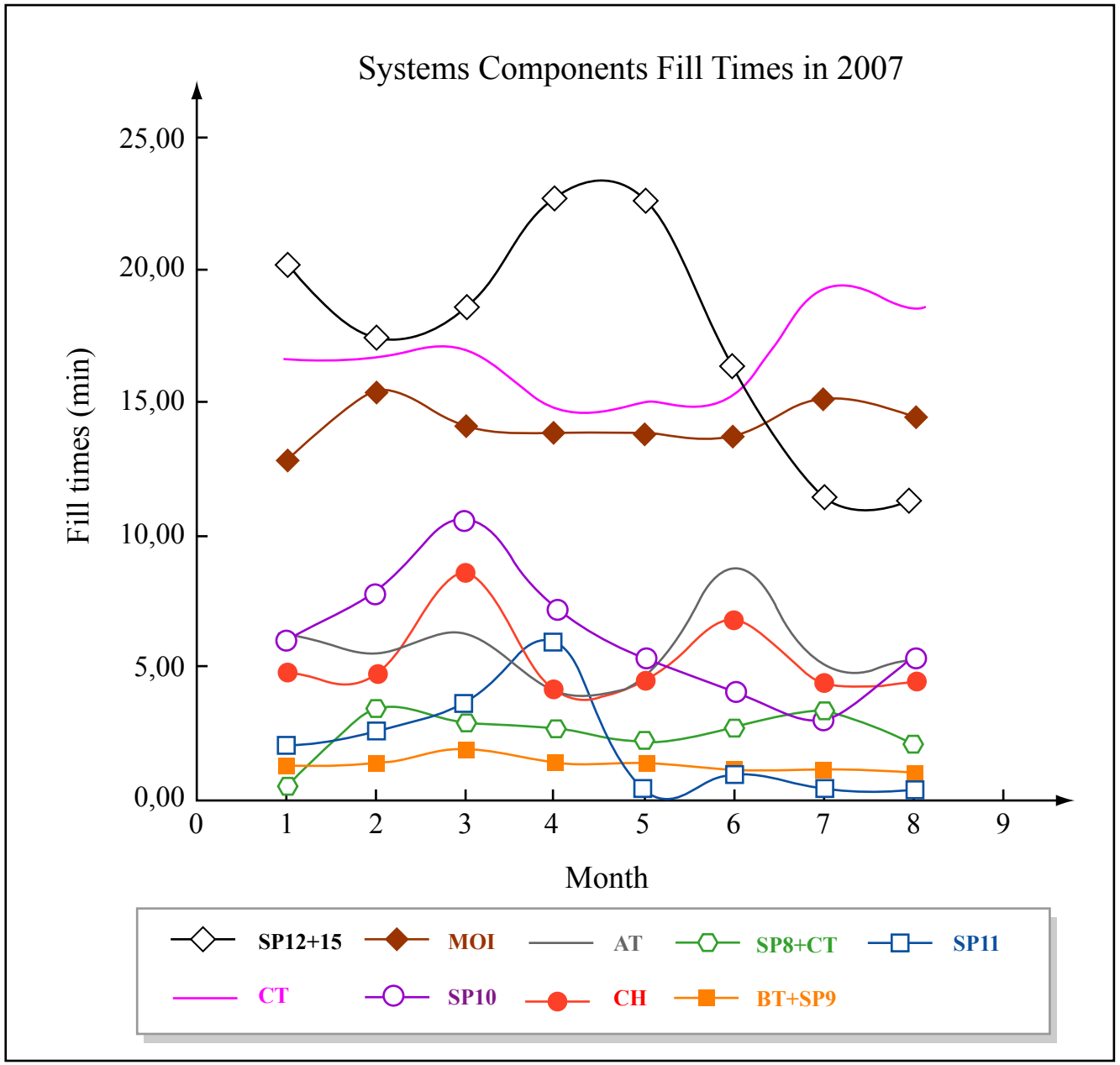
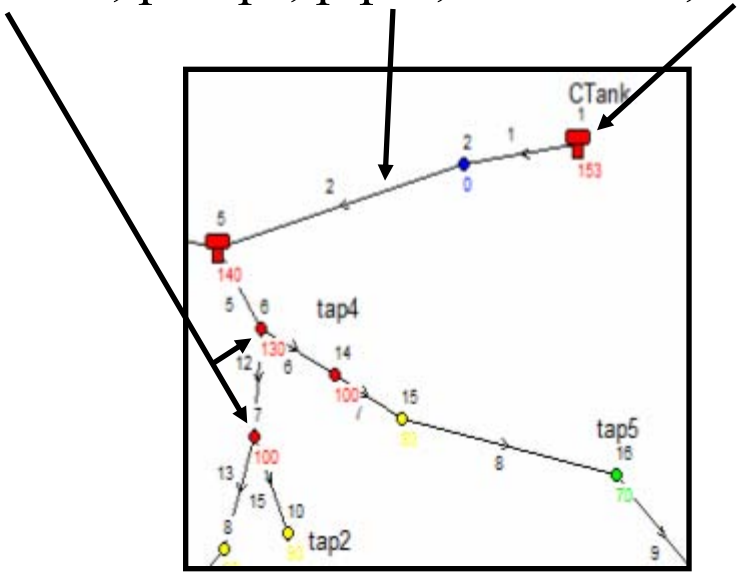


Figure by MIT OpenCourseWare.

EPANET: PRINCIPLES & COMPONENTS

- Principles
  - *Hydraulics* - Conservation of mass & energy
  - *Quality* - Continuity of flow & reaction kinetics
- Components
  - Nodes, pumps, pipes, reservoirs, tanks



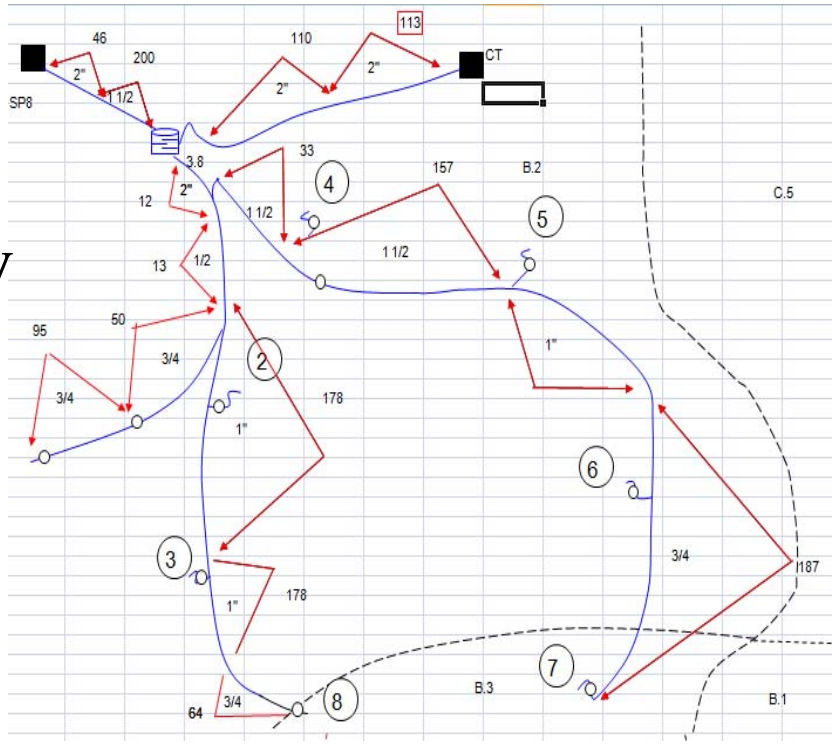
EPANET: CAPABILITIES

- No size limit
- Time-varying demand
- Pressure driven nodes
- Bulk reactions and pipe-wall reactions

  Nth order reactions, Michaelis-Menton
- Head-loss equations and mixing tank models
- Use of ArcGIS data

EXISTING DATA

- Microsoft Excel file
- Pipe lengths & diameters
- ~10 sections broken up by feeder tanks
- No obvious joint information
- Some missing or confusing data



PART II: WATER QUALITY

- Goal: provide higher quality spring-water using appropriate treatment processes

- Existing situation
  - Known elevated turbidities
  - Various disconnected storage tanks and distribution systems
  - Chlorination

LOCATIONS OF STORAGE TANKS

TURBIDITY AT STORAGE TANKS

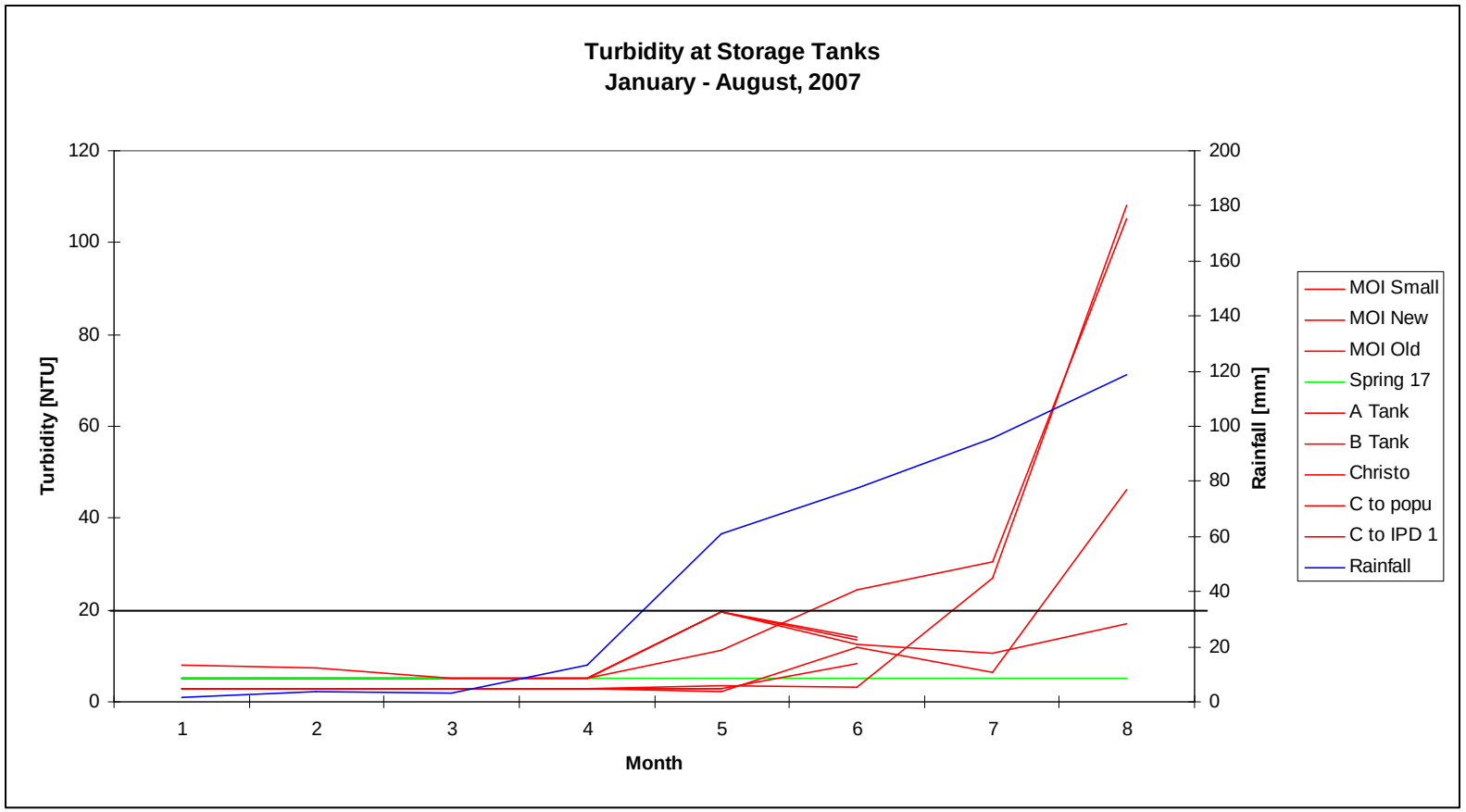
Data from D. Lantagne, August, 2007.

> 20 NTU

5 – 20 NTU

TURBIDITY AT STORAGE TANKS

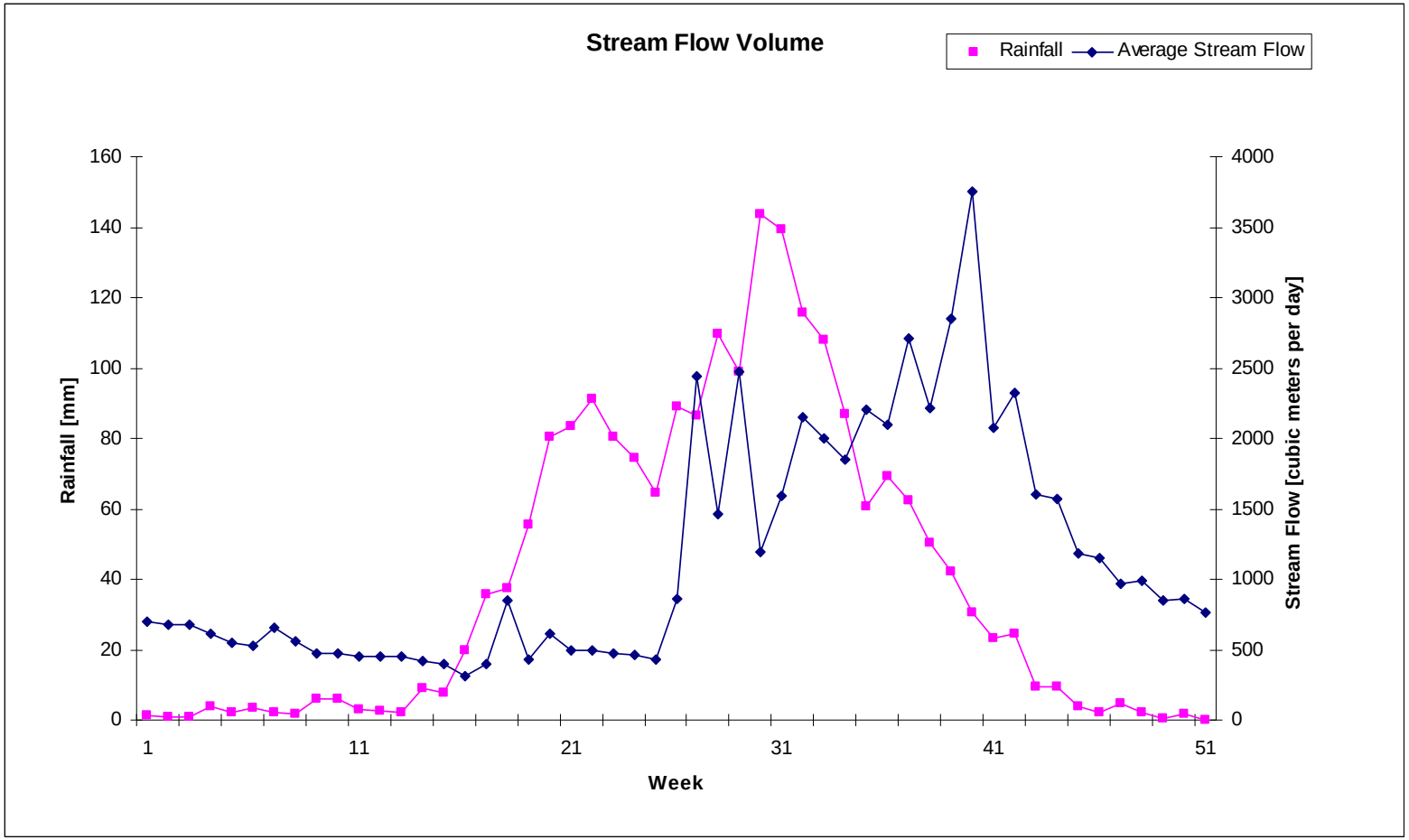
Data from AMI, 2006-2007.



Rainfall Surface/Combined Source Spring Source

STREAM FLOW AND RAINFALL CORRELATION

Data from AMI, 2005-2007 and GOSIC, 1951-2007.



DESIGN PARAMETERS

- Water Quality Measurements
  - Turbidity
  - Total coliform
- Capacity
  - Confirm flow data
  - Determine flow composition
- Location
  - Size of units
  - Potential sites

ANALYSIS

- Determine necessary treatment processes
  - Pre-treatment (rough filtration, sedimentation)
  - Slow sand filtration
- Design locations
- Integration of potential pipe system changes with treatment facilities
  - Fewer-more centralized locations?

POTENTIAL DIVISION BY FLOW VOLUMES