WOODARD & CURRAN

Reusing Stormwater at a University CoGen Facility

Jay Sheehan, PE

New England Water Environment Association (NEWEA)
2016 Annual Conference | January 26, 2016 | Boston, Massachusetts

When Does Water Reuse Make Sense?

When water is scarce

- Limited water sources
- Frequent droughts & weather variability
- Regulatory constraints limiting water withdrawal
- Sustainability goals

But also…

When economic conditions are right

- Pre-treatment is required
- Sewer discharge to POTW
- Water purchased from public utility
- Proximate water reuse opportunities
- Permitting limitations for discharge

WOODARD &CURRAN

How Should We Evaluate Reuse?

Feasibility study

- Resources
- Constructability/Implementation
- Permitting
- *Economics*

Economics are a key consideration

- Must include analysis of the “levelized cost”
  - CapEx + OpEx = total levelized cost
  - Cost / 100 cf is a good metric
  - Compare payback periods
- O&M costs are critical considerations

About the University

Confidential

- University policy for confidentiality
- Permitting concerns (premature disclosure to regulators)

Typical urban New England campus

Central utility plant

- Cooling needs
  - Low Winter / high Summer demands (170,000 GPD vs 965,000 GPD)
  - Large seasonal variability
  - Inconsistent / unpredictable needs

The University's Challenge – Project Drivers

Water scarcity (modest concern)

- Regulatory constraints limiting water withdrawal (river protection)
- Sustainability goals (self-imposed)

Economics (significant concern)

- Sewer discharge currently necessary (very costly)
- Water purchased from public utility (rising costs)
- Proximate local reuse opportunities (stormwater, non-contact cooling water, filter backwash, wastewater, RO reject, etc.)
- Permitting limitations (treatment requirements for discharge)

WOODARD & CURRAN

More About the Regulatory Drivers

Prohibition on the discharge of non-contact cooling water to sewer

- Permit required for >100,000 GPD
  - Regulatory policy intended to encourage reuse

Nutrient removal

- Requirement for P removal from stormwater generated by new projects
  - Regulatory policy concept – address nutrient issues in receiving waters

River water can be used up to 100,000 GPD without a permit

WOODARD &CURRAN

Feasibility Study

Assessed the feasibility of reuse on four factors:

1. Resources
2. Constructability/implementation
3. Permitting
4. Economics

WOODARD &CURRAN

Resources

Identified Water Source Opportunities

- Multiple existing & future non-contact cooling water/HVAC condensate
- Stormwater (drainage system)
- Future reverse osmosis (RO) reject from CoGen
- Cooling tower blowdown
- Neutralized industrial wastewater with boiler blowdown
- Future treatment reject & filter backwash from this project (if implemented)
- River water
- City water (current source)

Reviewed multiple combinations of sources

WOODARD & CURRAN

Projected Stormwater Flows

Analyzed three capture conditions based upon 63 years of rainfall data at nearest NOAA station:

- Less than 0.25 inches – no captured volume
- <0.25 and <1.2 inches – captured volume without overflow
- >1.2 inches – captured volume with potential overflow

Impervious capture – roof & yard drains (normally flow to river)

- 0.595 acre feet (194,000 gallons)

WOODARD & CURRAN

- Water balance performed for average winter & summer conditions for each option
- Assess ability of sources to meet full or partial volume demand
  - Addresses seasonal demand variability
- Water Quality Assumed for 15 parameters based on prior analytical data and flow and mass balances for various water source combinations.

Reviewing Options

Base Case	Use <100,000 of River Water	Use >100,000 of River Water
0: Add P removal system to treat SW (do nothing else)	1A: SW & River (Cl & Filtration)	1B: 90,000 municipal water
	2A: Add cooling tower blowdown (ultrafiltration & RO)	2B: 0 gals of municipal water
	3A: Zero discharge (Evaporator)	3B: 0 gals of municipal water

Cascading levels of complexity

WOODARD & CURRAN

Constructability/Implementation

Infrastructure Assessment

Existing river intake/discharge pipe

- Assessed structural condition using NASSCO sewer system manual
- Confirmed stormwater collection system discharge into river water intake & discharge piping

Equipment upgrades & modifications

- Existing non-related tanks & pipelines for potential repurposing
- New collection & treatment equipment for each option

WOODARD & CURRAN

Greenhouse Gas Assessment

Cursory comparison based on metric tons of CO_2 equivalent per year

Additional emissions from equipment required to implement the options

vs.

Reduced emissions for the power consumed by the municipality for treatment & transmission of water and wastewater

Permitting

Applicable Permits

Water

- Water Management Act (WMA)
- State Waterways Permit Environment
- 401 Water Quality Certificate
- Local Sewer Authority Sewer User Discharge Permit

Environmental

- Environmental Policy Act (EPA)
- State Wetlands Protection Act
- U.S. Army Corps of Engineers

Air

- State Air Permit (determined not applicable under all options)

WOODARD & CURRAN

Economics

Cost Evaluation

Capital

- Baseline condition includes need to do something for cooling water discharge & stormwater treatment (nutrients)
  - ~$1M treatment system
- Utilizing cost/100 CF allows direct comparison to utility rates
- Capital cost recovery period – 15 years

O&M

- Included power consumption at current electrical cost (with escalation)
- Utilized existing water & sewer rates (with escalation)
- Current staff cannot handle additional operations

WOODARD & CURRAN

Conclusions & Recommendations

Reuse Alternatives Are Feasible

- Use of alternative sources provide sufficient water to eliminate purchase of public water
- Average summertime demand could be met under multiple options without purchasing city water
- Stormwater reuse presents a valuable savings
- Permitting is a significant consideration in some options, but only a one-time cost
  - Permitting timeframe estimated at 18 to 24 months

Additional Conclusions

- No options had a lower capital cost than baseline
- All 6 options resulted in lower O&M cost than baseline condition (less water purchase & less sewer discharge)
  - Annual operating savings: $30K/year to $700K/year (up to 15%)
- Four options have a lower total cost (capital and O&M) than the baseline condition
  - Reflect a 9% to 15% reduction from the baseline condition
- Simple payback timeframe ranges from 8 years to >200 years
- New projects could reduce reuse project payback further!

WOODARD & CURRAN

Questions & Answers