
Metropolitan Water Reclamation District of Greater Chicago

**Study Session on Disinfection of Effluent from the
Stickney, Calumet, and North Side WRPs**

June 7, 2011

Objective of Disinfection Study - 2004

- Assemble a task force of national experts to review technologies for wastewater disinfection and prepare a recommendation for the technology(ies) most suitable for cost estimating purposes at the District's three largest water reclamation plants

Disinfection Study Approach / Participants (2004 – 2005)

- Blue Ribbon Disinfection Committee
 - Dr. Charles Haas, Drexel University
 - Dr. Benito Marinas, University of Illinois (Urbana)
 - Dr. Kellogg Schwab, Johns Hopkins Bloomberg School of Public Health

- Cost Estimate Preparation Consultants
 - CTE – North Side WRP
 - B&V / G&H – Stickney WRP
 - M&E – Calumet WRP

Long List of Technologies

- Chlorination (alone)
 - Liquid
 - Gas
- Ozone
- Ultra-Violet Light
- Chlorination-Dechlorination
 - Liquid
 - Gas
- Chlorine Dioxide
- Bromine (Br) Compounds
- Sequential Disinfection Processes
- Membrane Processes

Initial Short List of Technologies Requiring Further Consideration

- Chlorination (alone)
 - Liquid
 - Gas
- **Ozone**
- **Ultra-Violet Light**
- **Chlorination-Dechlorination**
 - **Liquid**
 - Gas
- Chlorine Dioxide
- Bromine (Br) Compounds
- Sequential Disinfection Processes
- Membrane Processes

Non-Economic Evaluation Criteria

- Safety
- Indirect Environmental and Health Impacts
- By-products Impacts
- Operational Reliability
- Operational Flexibility
- Qualitative Economic Requirements
- Modification for Future Concerns
- Public Perception Issues

Ultraviolet (UV) Irradiation Was Selected as the Most Suitable Technology

- Physical Disinfection Process where UV spectrum light is processed through the wastewater
- UV irradiation achieves disinfection by inducing photo-biochemical changes within pathogens
- Approximately 85% of the germicidal output from UV lamps have a wavelength of about 254nm
- UV light causes damage to nucleic acids in cells and thereby inactivates many pathogens

Ultraviolet (UV) Irradiation

ADVANTAGES

- No significant by-products created
- Relatively simple equipment
- Second most widely used disinfection process
- No chemical storage required: worker safety is excellent
- Low potential for neighborhood impact
- No significant increase in truck traffic
- Can inactivate *Cryptosporidium*, *Giardia*
- Inactivation efficiency unaffected by temperature

DISADVANTAGES

- High capital and power costs
- No germicidal residual – operational control can be difficult
- Does not react well to change in transmittance or flow
- Fouling is a significant issue and causes maintenance and performance problems
- Intermittent presence of UV blockers can cause permit violations
- Need reliable power sources
- Labor and cost intensive for lamp replacement and disposal
- Possible permit issues (hazardous waste)

UV DISINFECTION UNITS



Number of UV Lamps and Energy Usage

	Stickney WRP	North Side WRP	Calumet WRP	Total
Number of Lamps	4,032	1,680	1,680	7,392
UV Energy Use (kWh/yr)	84,021,600	22,195,680	20,180,160	126,397,440
Energy Increase from Current Usage	35%	37%	26%	33% AVG. INCREASE

Capital, Operating and Debt Service Costs for UV without Filtration¹

Cost ²	Stickney WRP	North Side WRP	Calumet WRP	Total
Total Design and Construction Cost	297.2	120.1	120.8	538.1
Annual O&M (\$ Million)	13.4	5.2	4.9	23.5
Annual Debt Service (\$ Million)	21.5	8.7	8.7	38.9
Total Annual Cost	34.9	13.9	13.6	62.4

¹ The need for Filtration will be assessed through water analysis and pilot testing

² June 2010 dollars

O&M Costs for UV without Filtration

	Stickney WRP ¹	North Side WRP ¹	Calumet WRP ¹	Total ¹
Energy	4.86	1.64	1.51	8.01
Personnel/Labor	3.29	2.04	1.82	7.15
Parts/Supplies	5.25	1.52	1.57	8.34
Total Cost	13.40	5.20	4.90	23.50

¹ Cost (\$ Million)

Disinfection Facilities Implementation Approach

- Investigative Phase
- Program Development and Conceptual Design
- Final Design
- Construction
- Start-up and Operation

Investigative Phase

- Review of most current equipment offered
- Evaluation of manufacturer's independent biodosimetry data for candidate equipment
- Collimated beam testing program
- Continual UV transmittance testing at each plant (up to one year)
- Site visits to large installations
- Pilot test facility

Estimated Timelines for Implementation of UV Disinfection without Filtration¹

	Stickney WRP ²	North Side WRP	Calumet WRP
Procurement of Professional Services	0.5 years	0.5 years	0.5 years
Investigative Phase	3 years	3 years	3 years
Program Development and Conceptual Design	1.5 years	1.5 years	1.5 years
Final Design	2 years	1.5 years	1.5 years
Construction	4 years	2.5 years	2.5 years
Total	11 years	9 years	9 years

¹ The need for Filtration will be assessed through water analysis and pilot testing

² The implementation schedule for SWRP is longer than NSWRP and CWRP because the SWRP facilities are both larger, and involve more extensive civil/site work related to the effluent conduits and outfall

District Financing

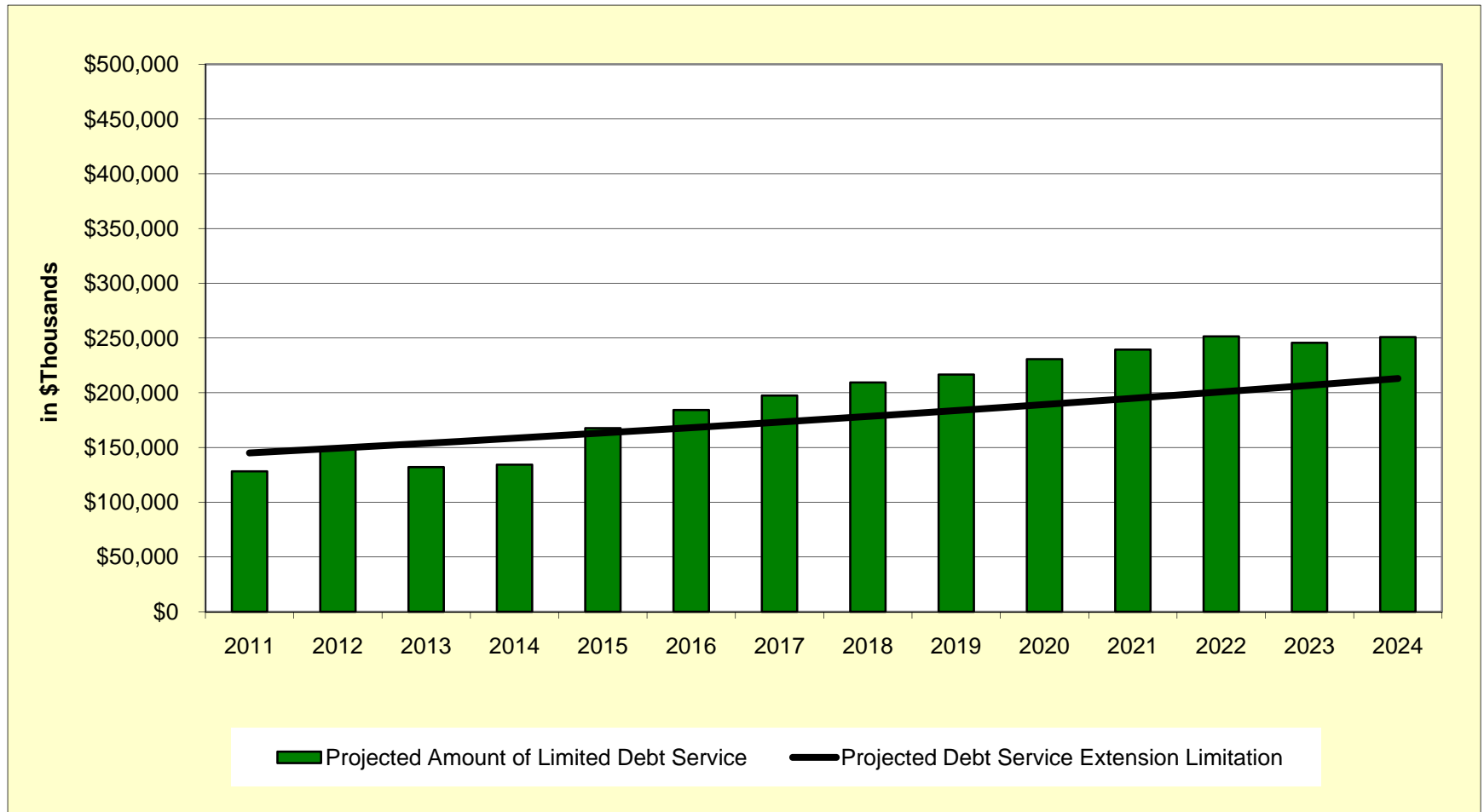
- Capital Projects
- Corporate Fund

Capital Projects

General Obligation Bonds

- Debt Limit
- Non-referendum Limit
- Non-referendum Authority

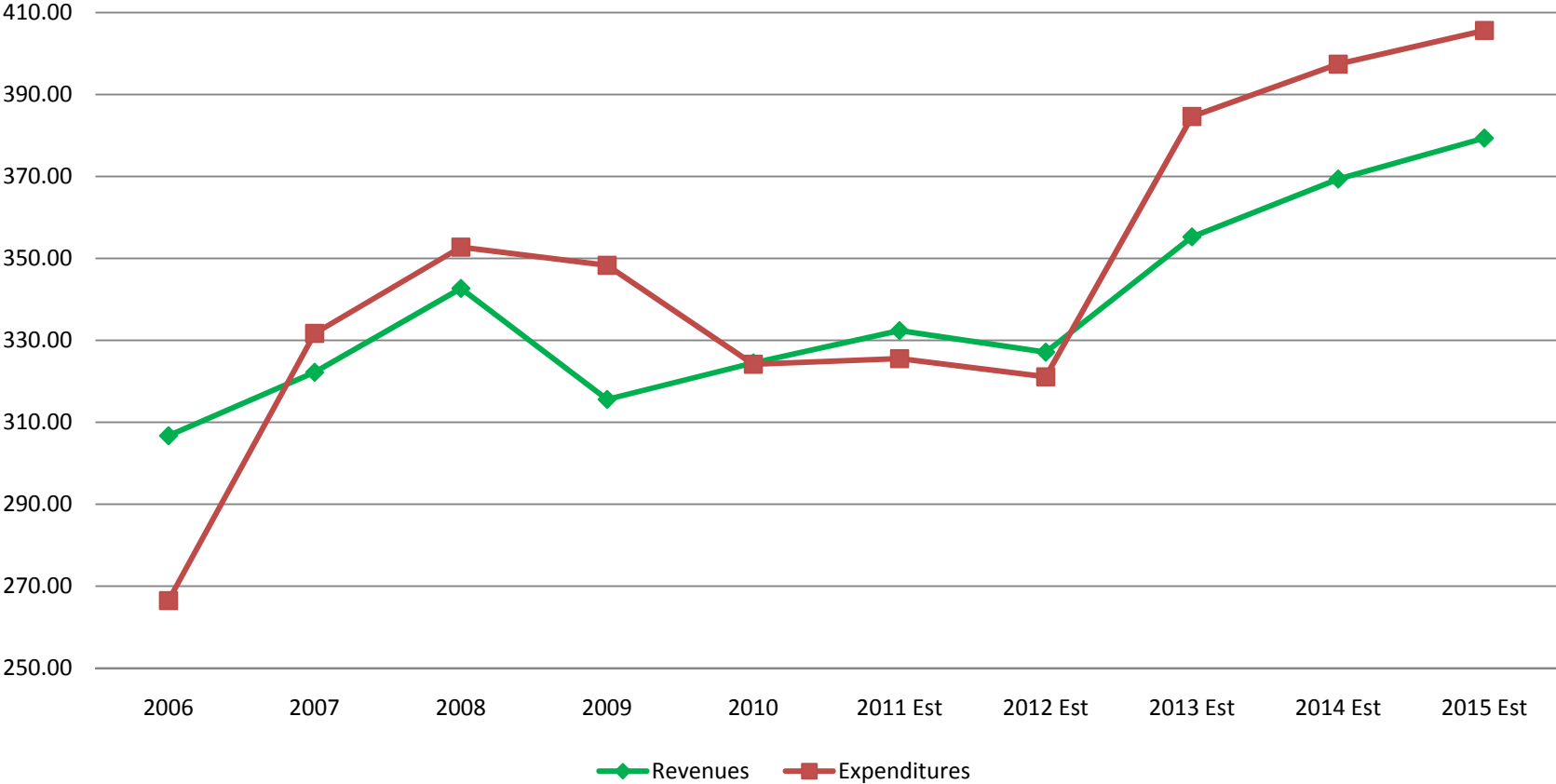
Forecasted Limited Debt Service Compared to Debt Service Extension Base



Corporate Fund

- Operating Fund
- Primary Revenue – Taxes
- Tax Rate Limit
- Tax Caps

Corporate Fund Revenues and Expenditures



Financing Alternatives

- Federal and State Grants For Capital Requirements
- Referendum
- Legislative Relief From Tax Cap
- Alternative Financing