Optimization of Sludge Removal System Operated Under Tube Settlers

WQTC 2016, Indianapolis, IN
November 15th, 2016

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BJWSA
BEAUFORT - JASPER WATER & SEWER AUTHORITY

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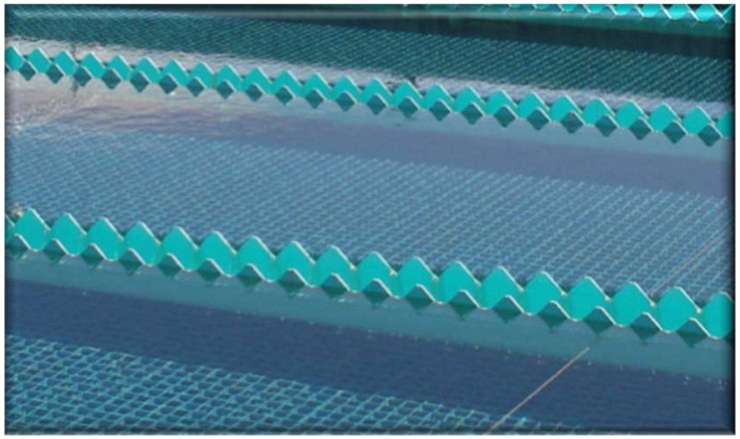
INTRODUCTION

- Lamella Settler Systems Widely Used in Drinking Water Treatment
  - Capacity increase
  - Footprint reduction
  - Effluent water quality improvement
  - Economical considerations



- Effective Removal of Settled Solids Underneath Lamella Settlers is a Challenge
  - Maximizing sludge/solids removal
  - Removing less useable water
  - Avoiding clogging

INTRODUCTION

- Traditional Sludge Removal System:
  - Orifice Pipe Header Vacuum System with Belt

- Innovative Sludge Removal System:
  - Cable-drive Triangular Header System

BJWSA Introduction

Beaufort-Jasper Water and Sewer Authority

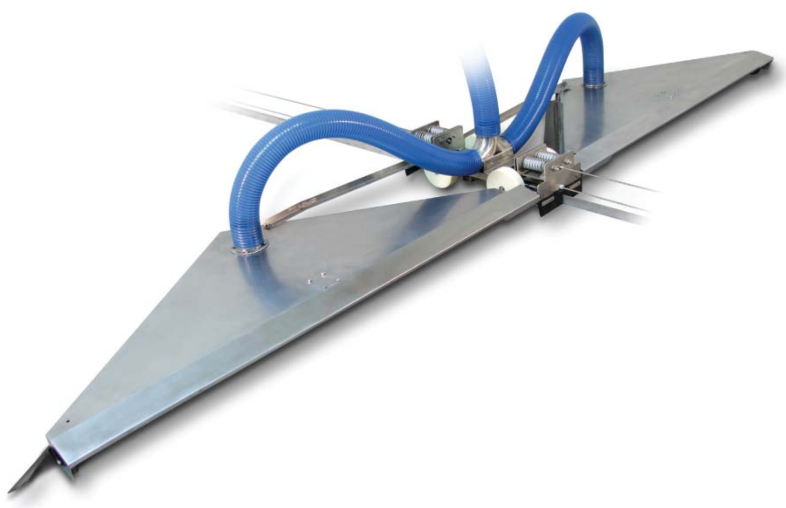
- A Public Service District Located on Coast of South Carolina
- Treat and Deliver Average of 20 MG of Drinking Water Daily
- Serves Population of 170,000 People Through 53,000 Retail and 10 Wholesale Accounts.
- Collect, Treat, and Recycle More Than 9 MG of Wastewater Daily

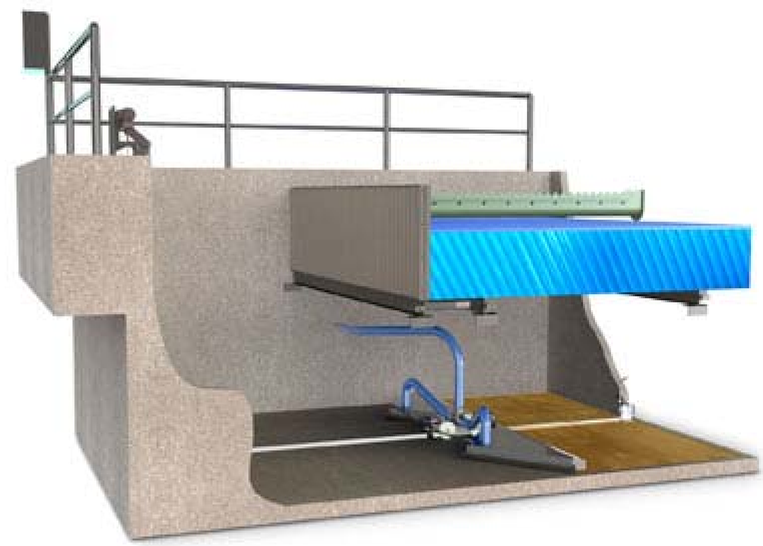
CHELSEA WATER TREATMENT PLANT

- Source Water: Savannah River
- Conventional Filtration Plant
- Plant Capacity = 24 MGD
- Average Raw Water Turbidity = 35 NTU (2011-2013 data)
- Peak Raw Water Turbidity = 110 NTU
- Partnership for Safe Water Phase III
- Tube Settlers Installed in Sedimentation Basins in 1999. Replacement CIP in 2014.

SedVac™ Sludge Removal System

- Cable Driven
- Vacuum or Pump Configuration
- Triangular Header
- Flexible in Operation
- Better Suit for Confined Space
  - Underneath Lamella Settlers





Objective

- To demonstrate the performance of SedVac™ underneath tube settlers
- To compare SedVac™ and a traditional orifice pipe header sludge removal system, side by side

Site Configurations

- Two sedimentation basins, each with two sections:
  - 90 ft x 90 ft square open sedimentation area with circular rakes
  - 90 ft x 21 ft rectangular area with tube settlers

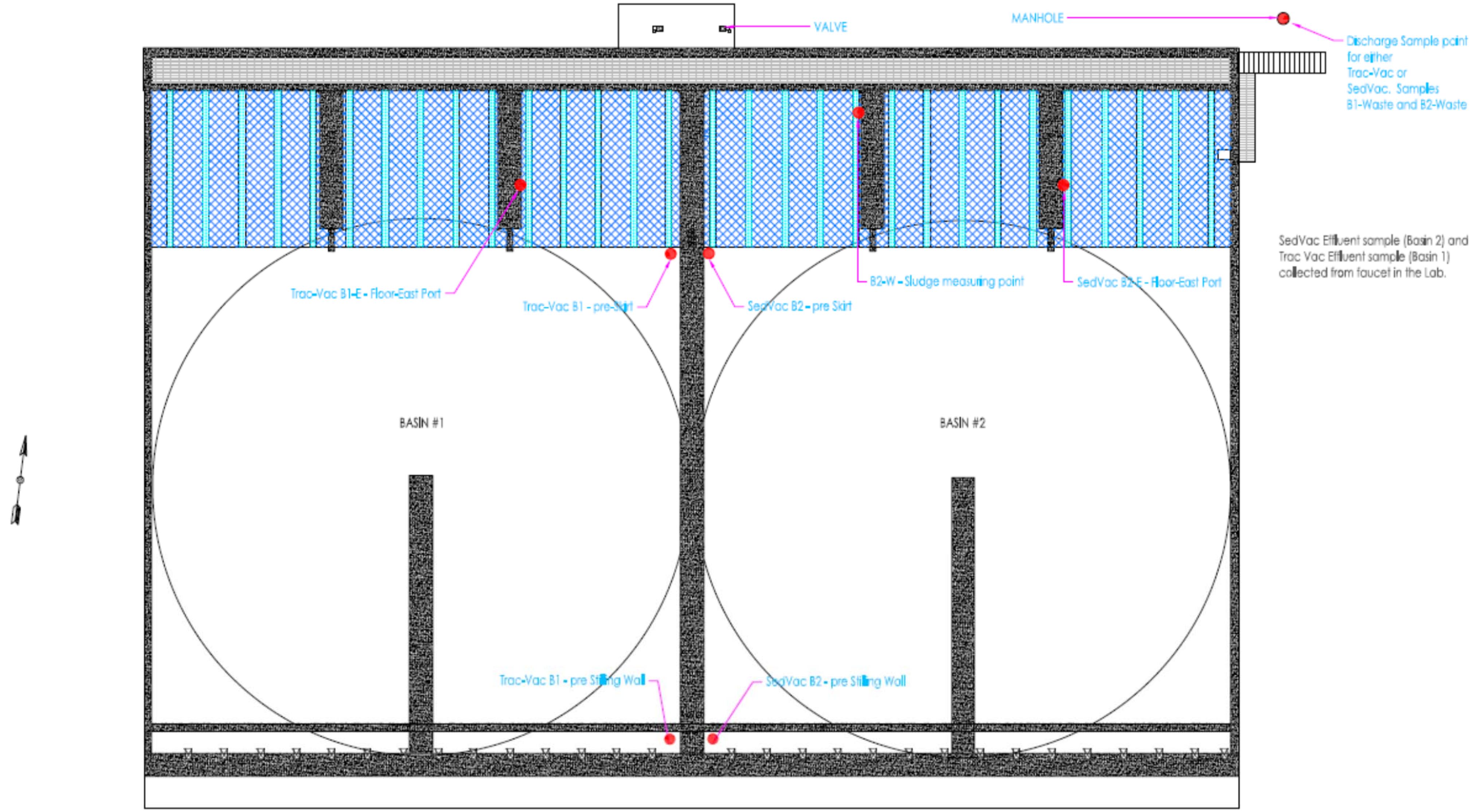
SITE CONFIGURATIONS

- Tube Settlers
  - Basin #1 with a traditional orifice pipe header sludge removal system
  - Basin #2 with SedVac sludge removal system

- Collected sludge discharged to a sludge lagoon at head of plant and supernatant fed back to the head of the plant.

PILOT TESTING – SITE CONFIGURATION

PILOT TESTING – LAYOUT



Pilot Testing – Layout

Under Normal Operating Conditions

- Samples Collected at Various Locations Along Basin length
  - Influent
  - Effluent
  - Wasted Sludge

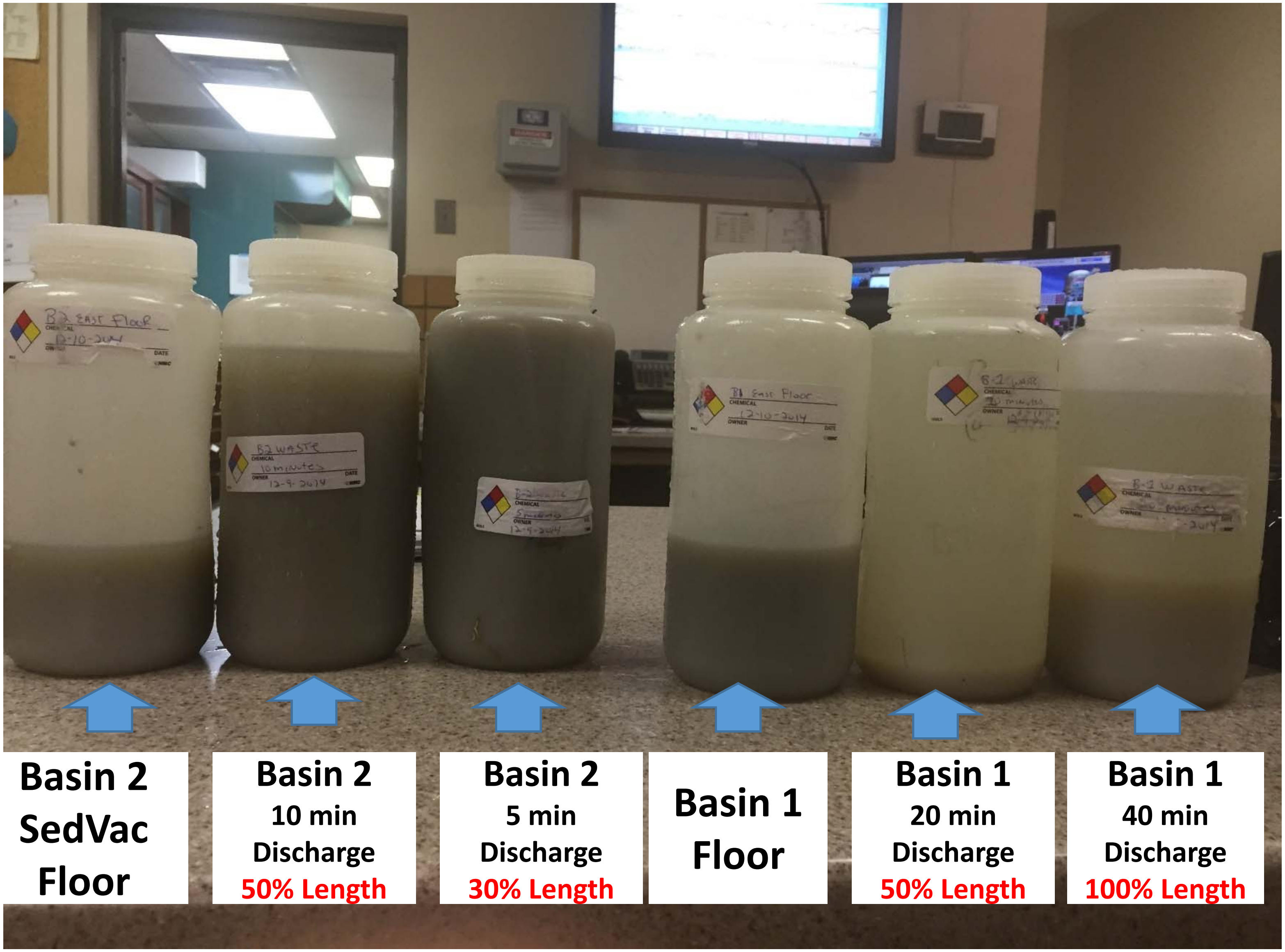
- Sample Analyzed/Measured for
  - TSS (Laboratory or Cerlic Sludge Blanket Tracker)
  - Sludge Blanket Depth (Cerlic Sludge Blanket Tracker)
  - Sludge Discharge Flow Rate (Global Water Flow Probe)

- Testing Conducted during One Year Period

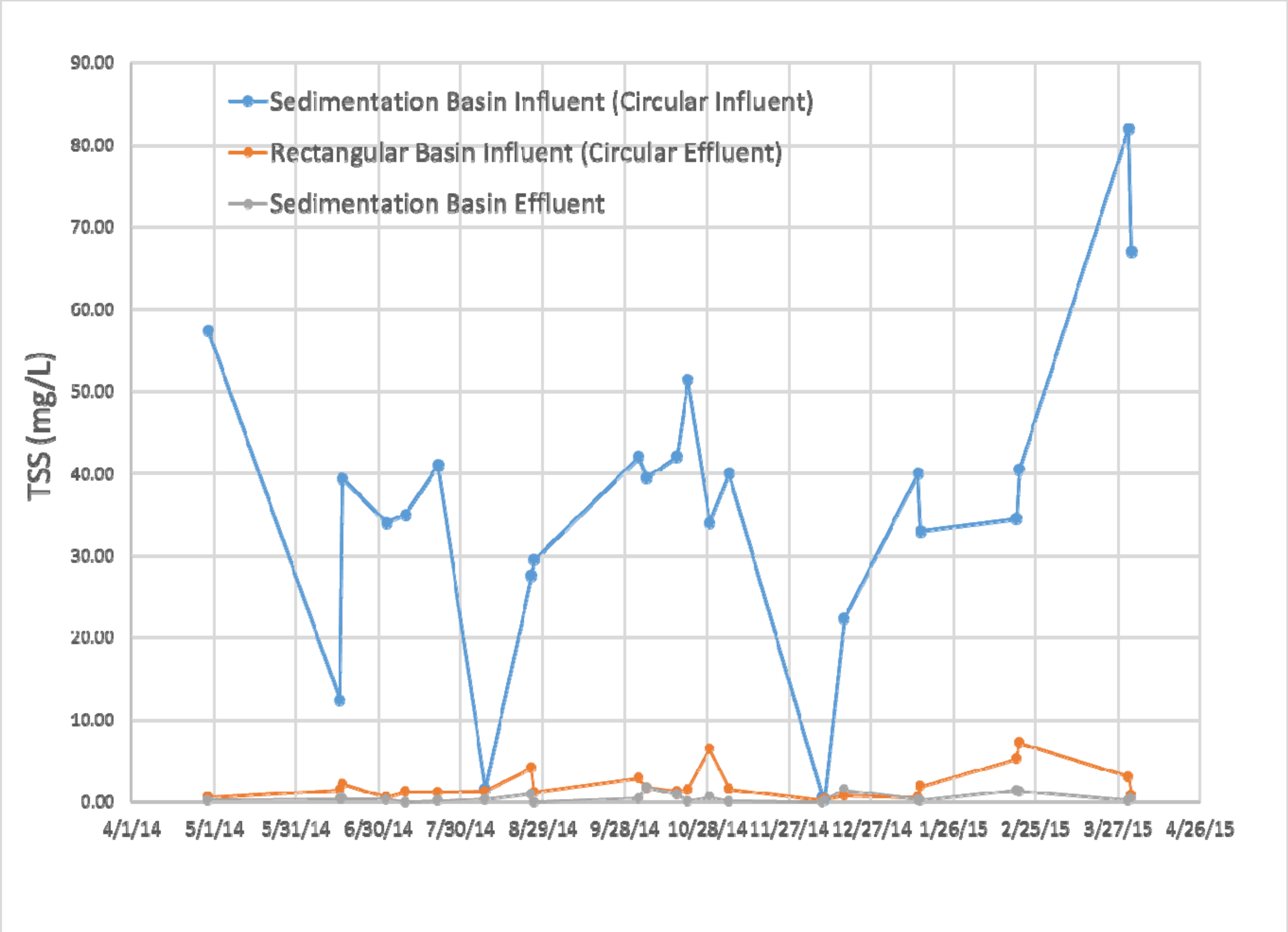
Results – Operating Parameters

	Basin #2 SedVac™	Basin #1 Orifice Pipe System
Basin Flow Rate	6 MGD	6 MGD
Cleaning Frequency	2 Run cycle/day	2 Run cycle/day
Total Run Time per Cycle	28 mins	70 mins
Residual Discharge Time per Cycle	18 mins	70 mins
Residual Discharge Flow Rate	430 gpm	290 gpm
Wasted Solids Concentration	5,900 mg/L	1,600 mg/L
Total Water Wasted per Day	15,480 gallon	40,600 gallon
Total Solids Removed per Day	761 lbs	541 lbs

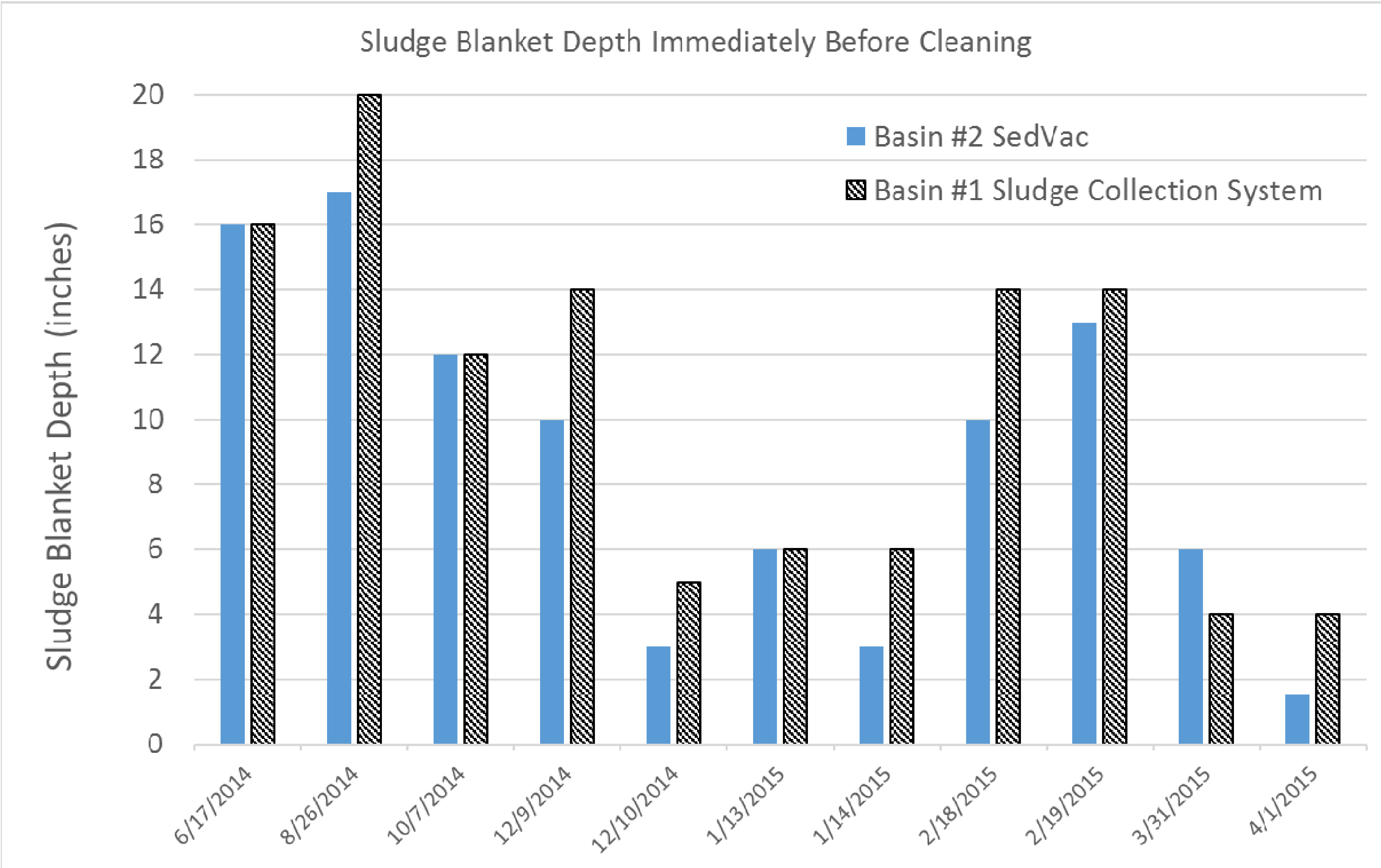
Results – Solids Removal



RESULTS – EFFLUENT QUALITY



RESULTS – SLUDGE BLANKET DEPTH



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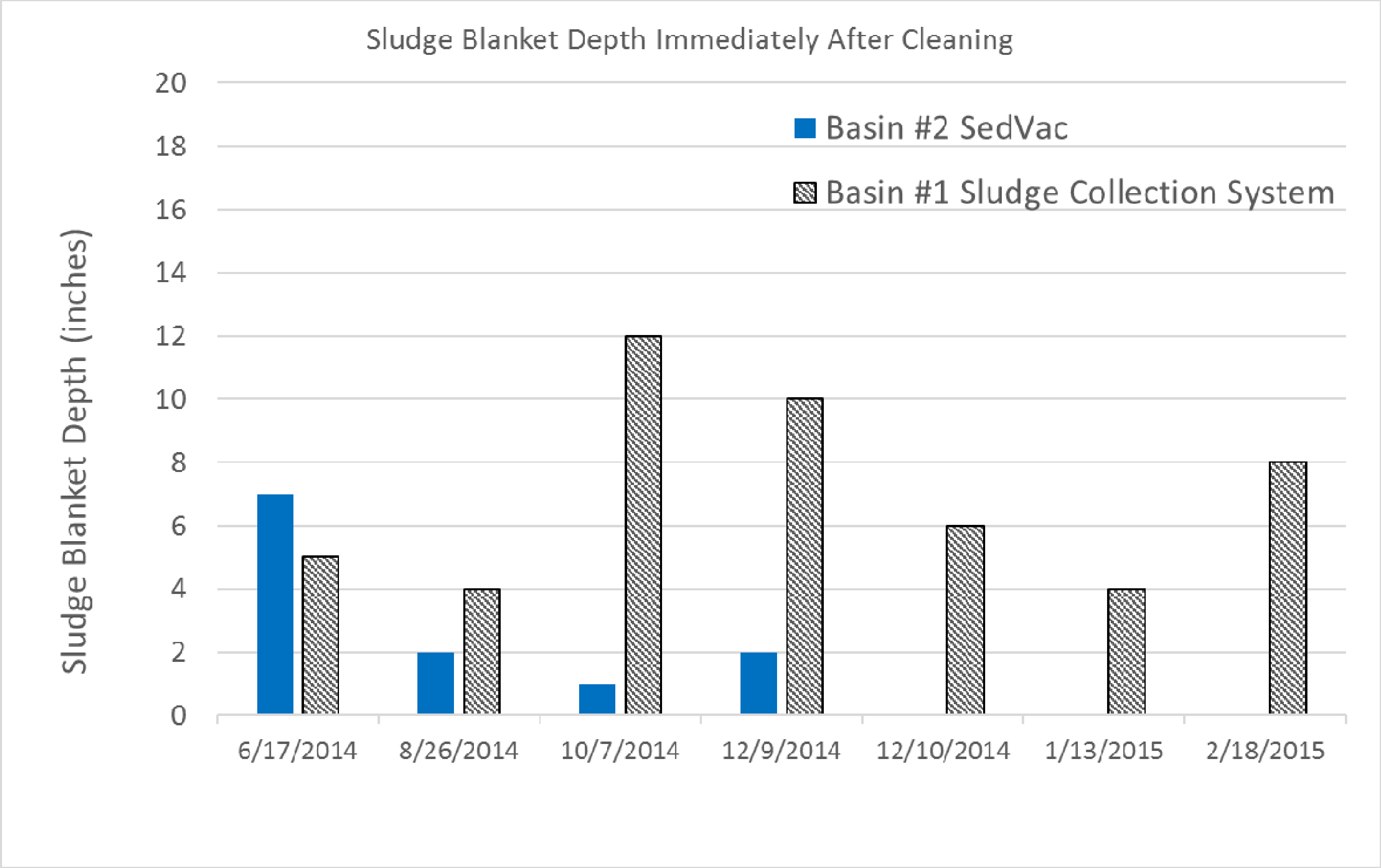
RESULTS – SLUDGE BLANKET DEPTH



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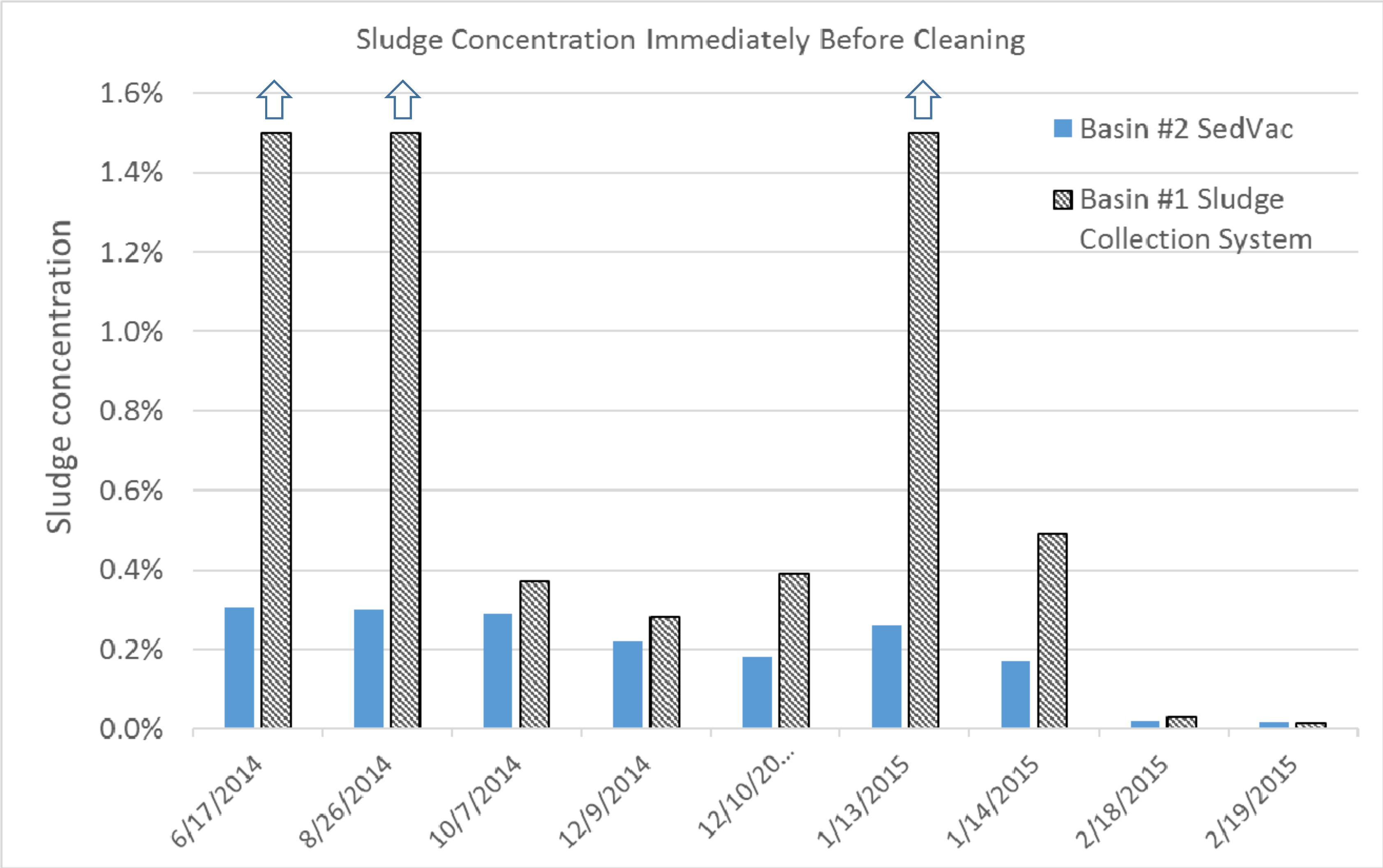
RESULTS – SETTLED SOLIDS CONCENTRATION



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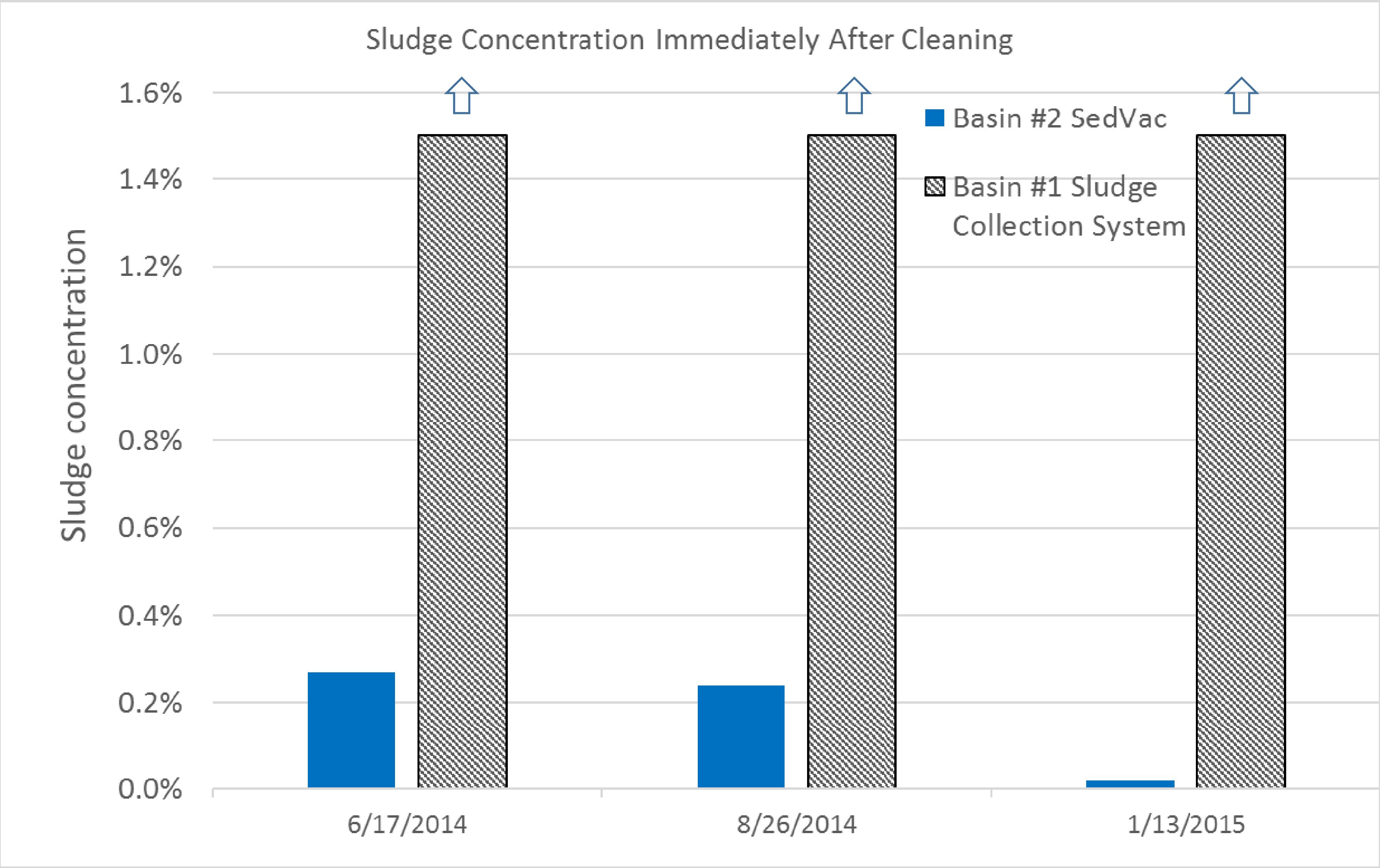
Results – Settled Solids Concentration



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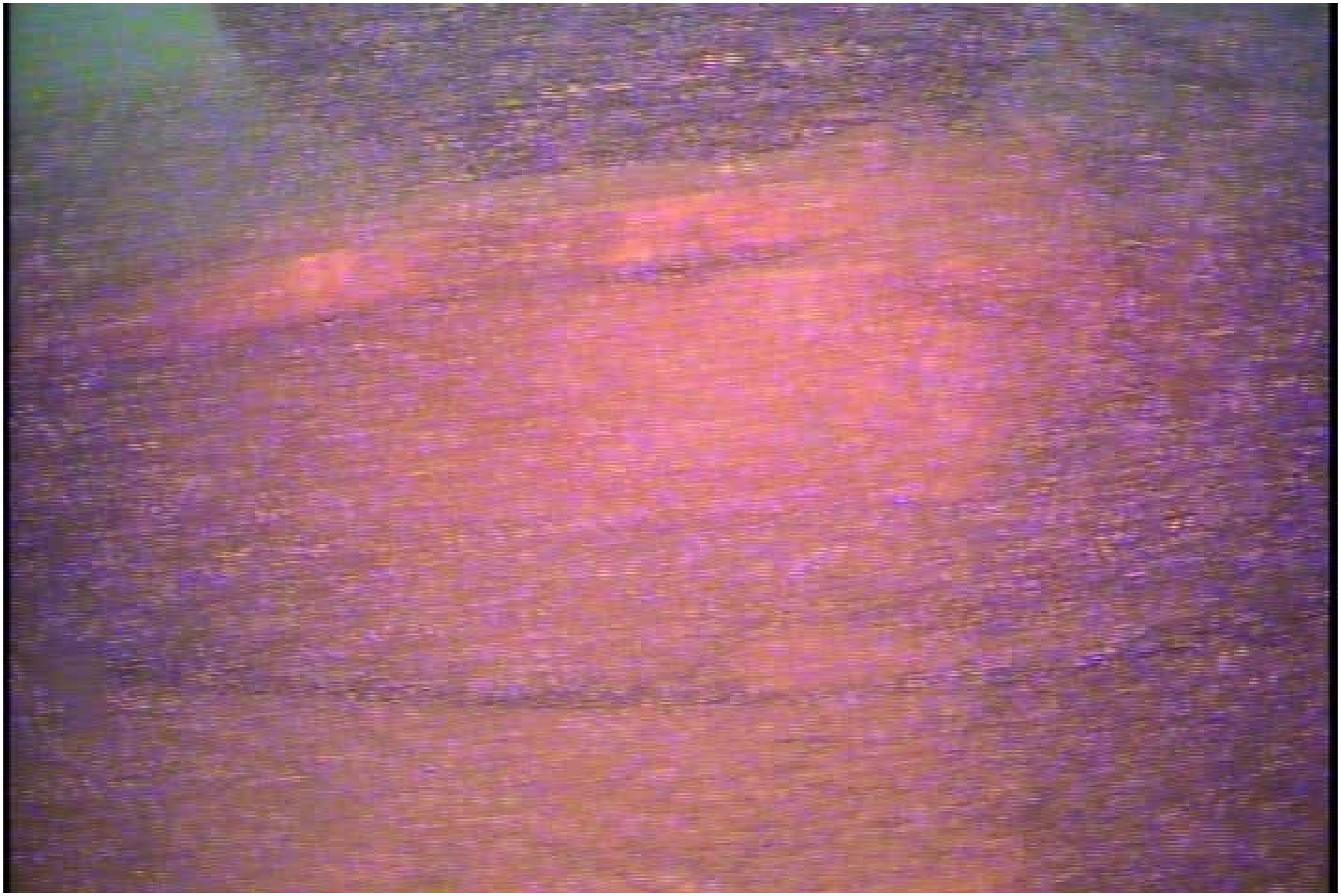
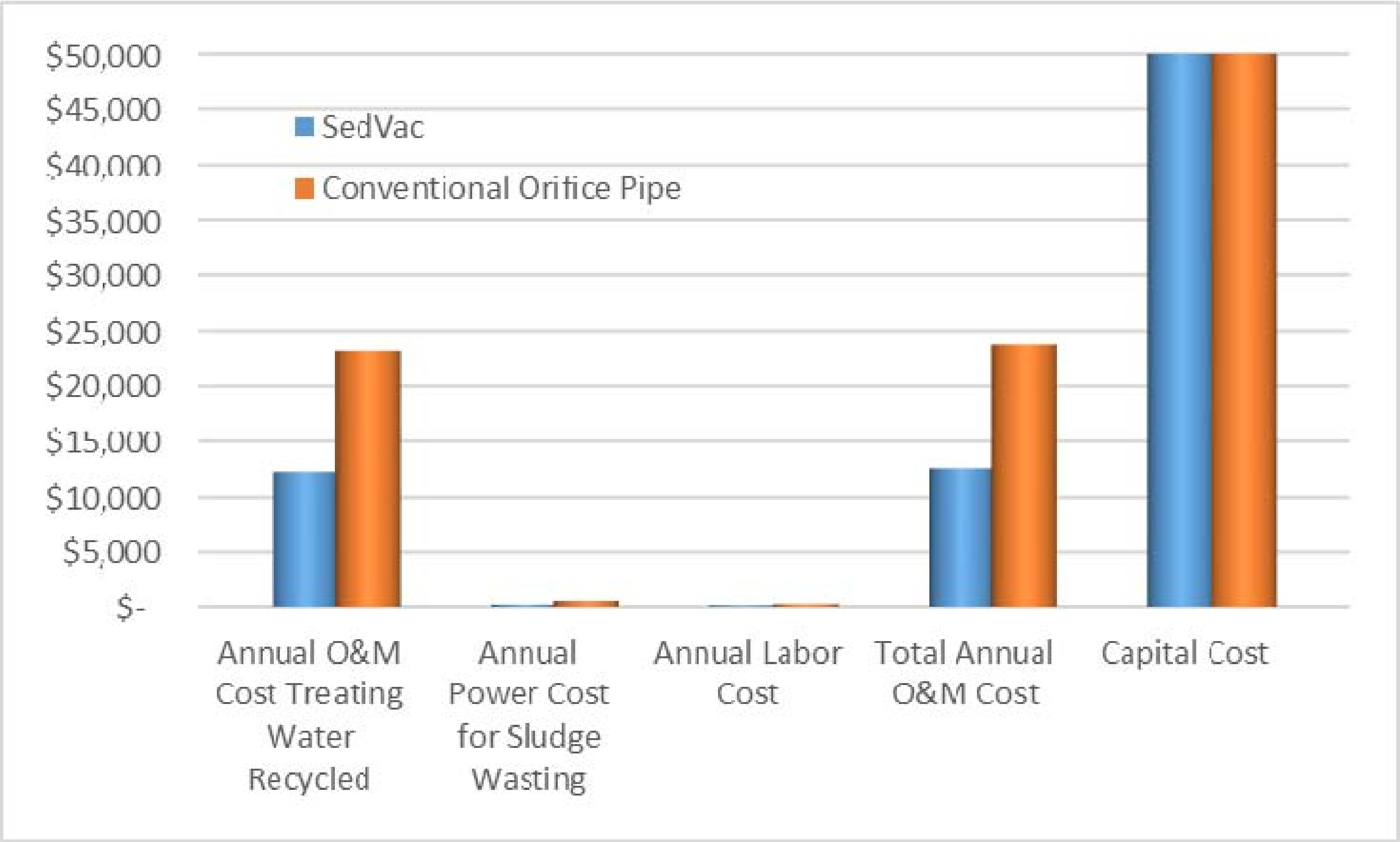
SedVac in Action

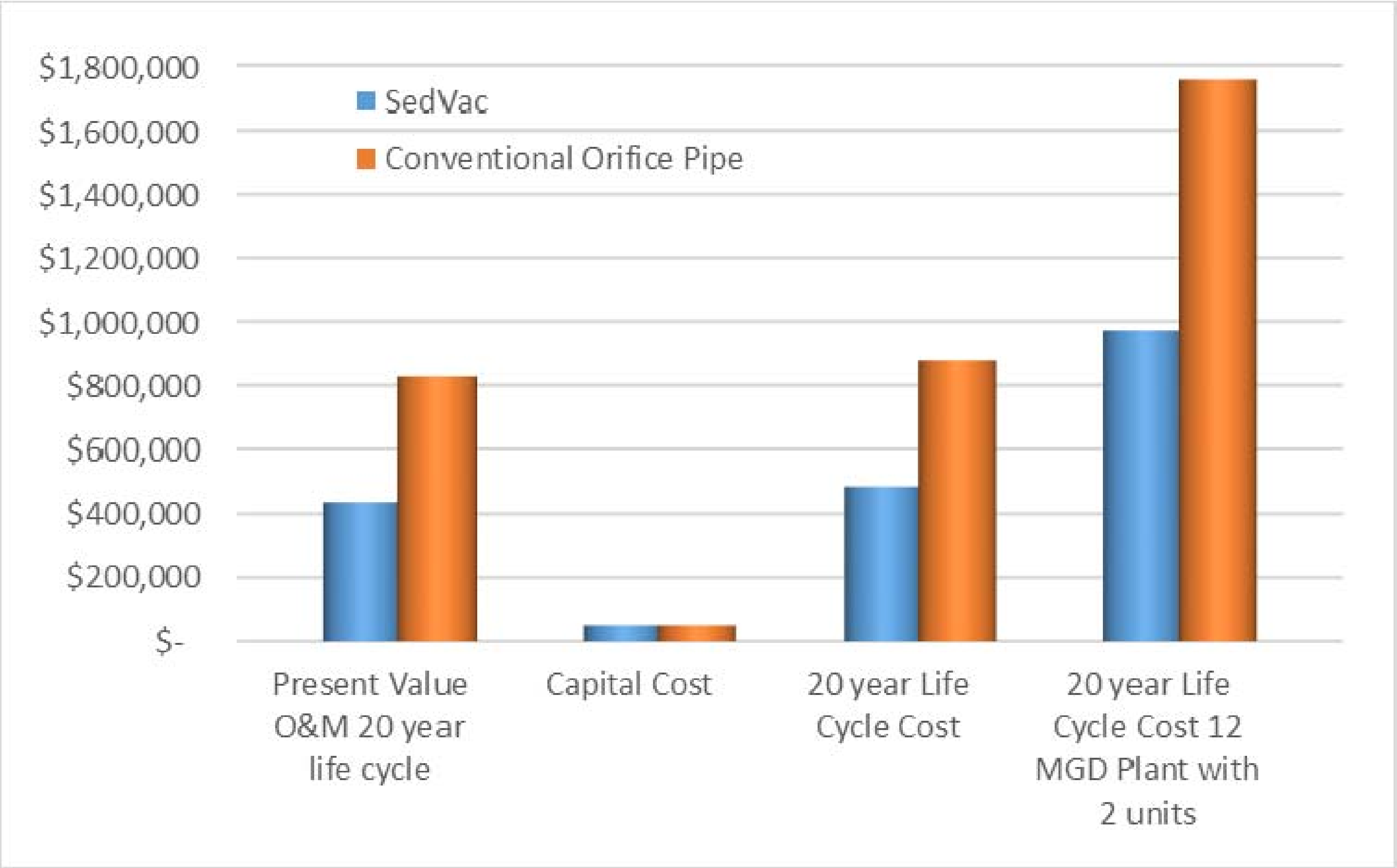


COST ANALYSIS - ANNUALLY



Assuming identical capital cost

Cost Analysis – 20 year Life Cycle Cost



Assuming identical capital cost and 5% annual appreciation

CONCLUSIONS

- Tube Settler and SedVac™ combination successfully removes influent Turbidity at greater than 95% removal efficiency on average
- Average filter effluent Turbidity levels below 0.1 NTU.
- Successfully removes 8 inches of sludge blanket per cleaning run
- Averaged settled solids concentration of 0.2% Post Cleaning
- Compared to orifice pipe type sludge removal system
  - Removes solids more efficiently
  - Higher wasted solids concentration (x 3.7)
  - Less water wasted (62% reduction)
  - Cost reduction

QUESTIONS?

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