Cost-Effective Industrial Water Reuse Yields Significant Reduction In Wastewater Discharge

NEWEA Water Reuse & Industrial Wastewater Conference

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Challenges of an Older Facility

- Must Stay Competitive with Other Facilities in the World
- Must Obtain Capital Funding in Competition with other Sister Corporate Facilities
- ROI Requires < 3 –Year Payback, Preferably < 2 Year
- Facility Started Operation in 1817 as Upton Glue
- Many Buildings Pre-Date WW II

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Facility History

- 1908 – Started Making Photographic Grade Gelatin
- 1930 – Eastman Kodak Purchased Facility in Full
- 2011 – Eastman Kodak Sells Facility to Rousselot
- 2014 – Rousselot Acquired by new Owner along with an Additional 100 facilities in the World
- Due to advent of Digital Photography plant has Diversified into Pharmaceutical and Food Grade Gelatin

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Gelatin Process

- Pig Hides, Bones and Cattle Hides and Bones and Fish Bones are Used.
- This Plant Uses Cattle Bone to Make the Highest Quality Gelatin used in Photography
- Gelatin Production is a Batch Process, with each Batch Tracked to Bone Source
- It takes 2 – 3 Months to Produce Depending Upon Ambient Temperature

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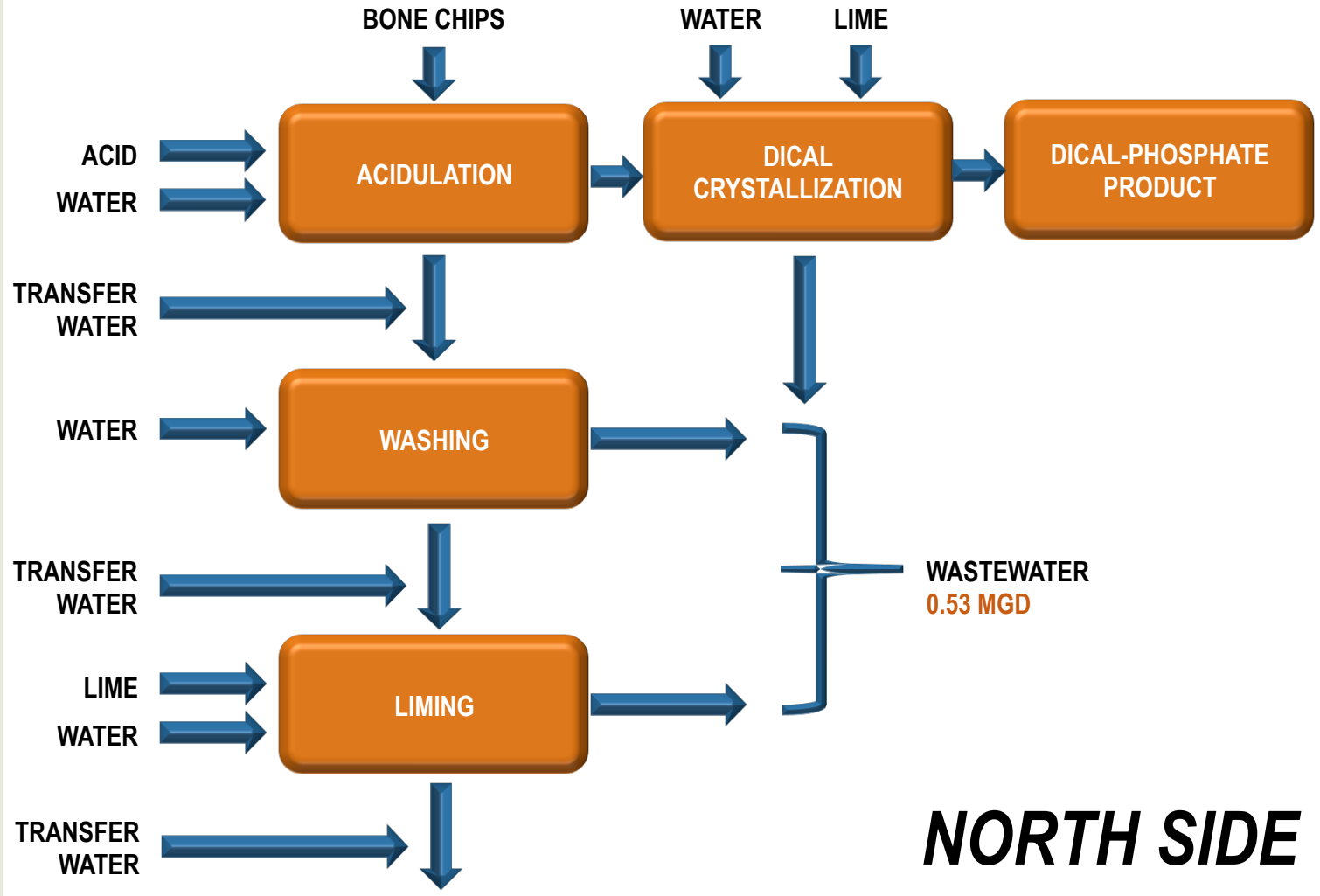
Gelatin Process Flow Chart



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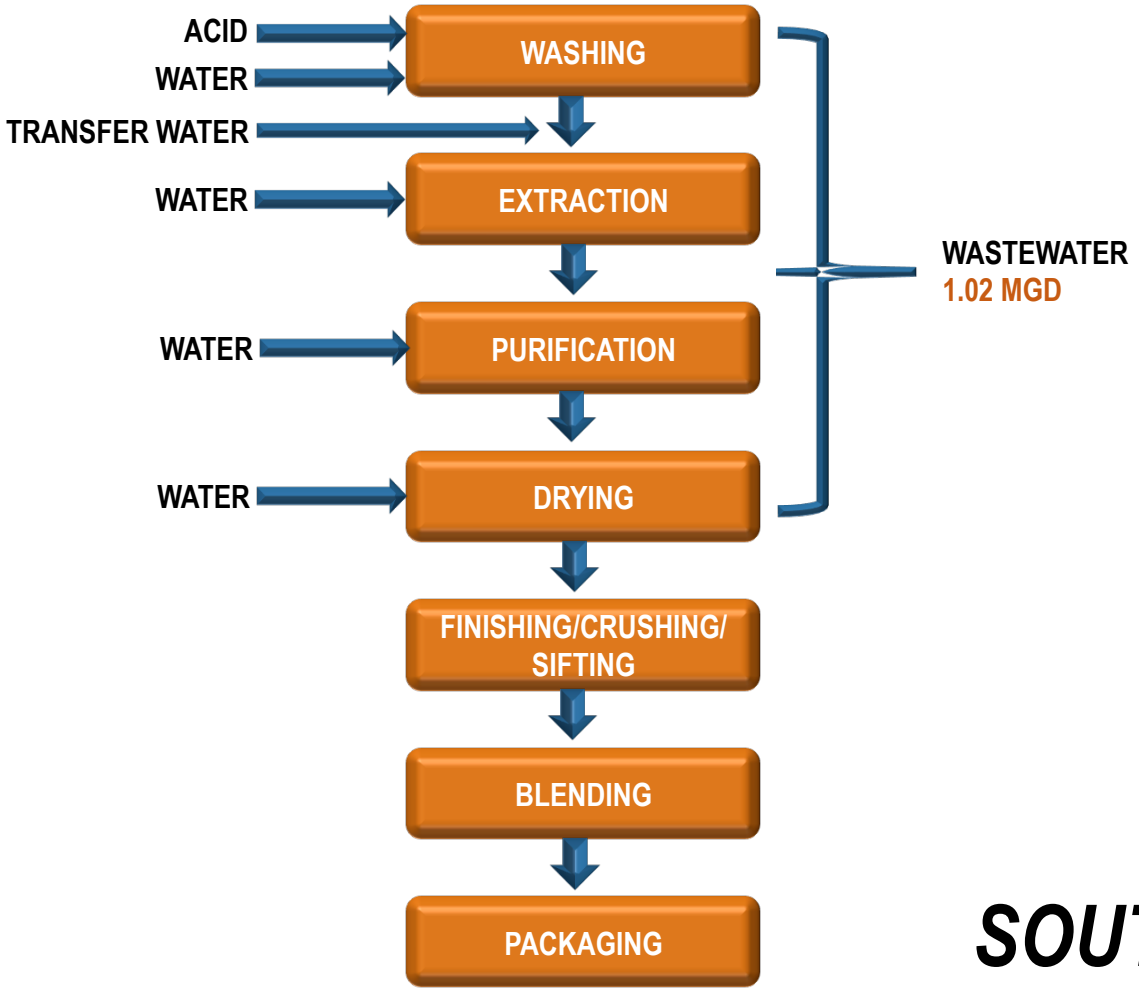
Gelatin Process Flow Chart



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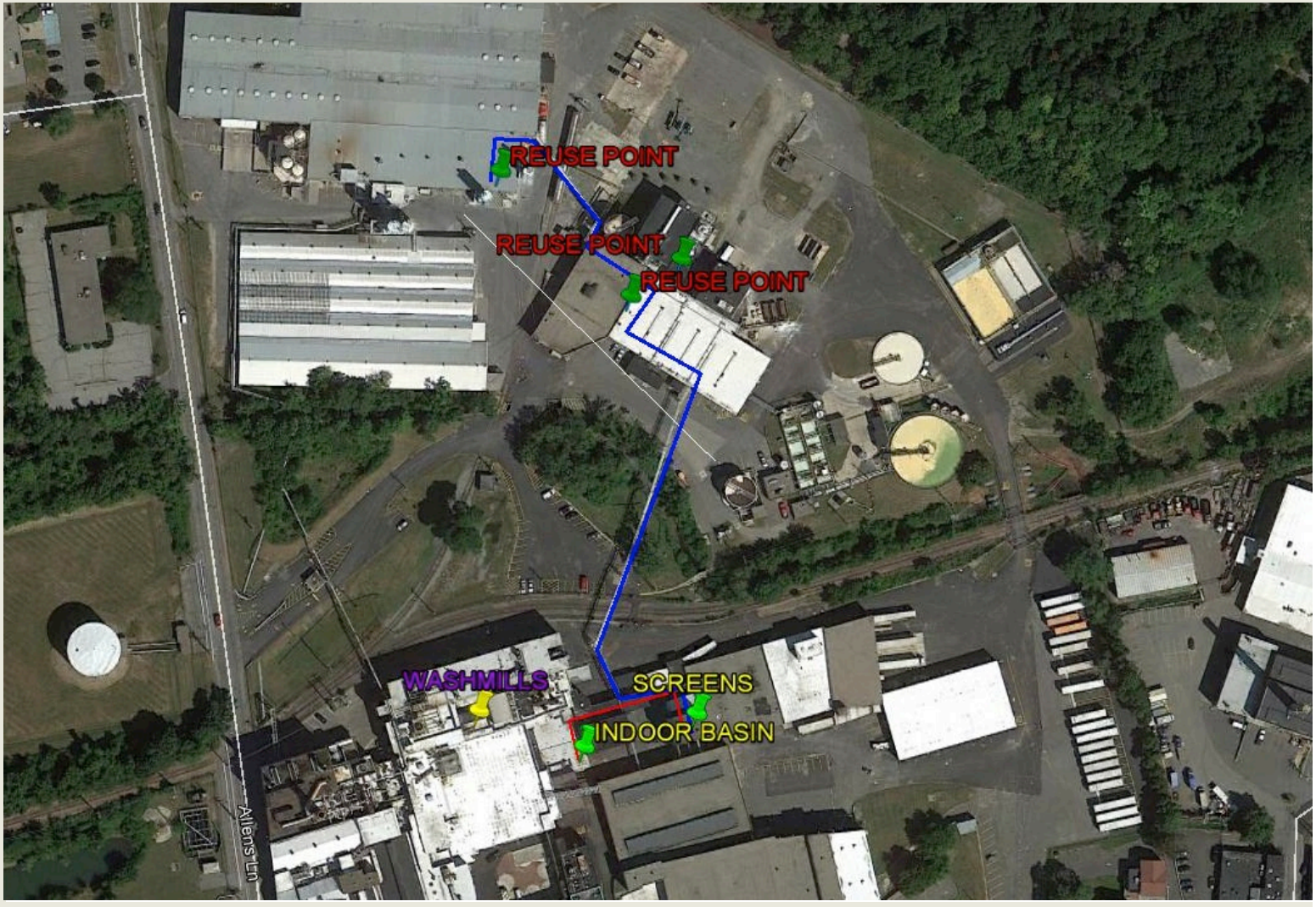
SOUTH SIDE

Facility Layout



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Washmill Discharge Water

- Flow Average 275,000 gpd (190 gpm)
- Varies From 57,000 to 470,000 gpd
- Flow Rate 0 gpm to 580 gpm
- pH 5 to 12
- Total Solids 3,200 mg/l at the beginning of a wash to 600 mg/l at end of a 36-hour wash cycle.
- Depending Upon Gelatin type Washwater Solids Concentration Averages 1,100 to 1,500 mg/l
- 72% of solids are Bone Fiber, Rest are Lime Inerts
- Bone Fiber in Washmill Water Effluent 2,200 lb/day = 360 lbs of Organic Nitrogen

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Washmill Water Treatment Process

- Segregate Washmill Water in Indoor Basin
- Pump All Washwater to Treatment Process
- Want to Process all the water since half of its value is from the Recovered Solids
- 60,000 gallons of Dirty Water Equalization
- Gravity Flow, Flow Control Valve with Splitter Box Distribution to Screens
- Four- 60” ⌀ Sweco Screens 400-Mesh (37-micron)
- Total Design Capacity 250 gpm Max 300 gpm

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Washmill Water Treatment Process

- Captures 60% of Solids ~ 1,300 lb/day Bone Fiber that Contains ~ 215 lb/day Organic Nitrogen
- Captured Solids Returned to Gel Extraction Process
- Captured Solids the Texture and Consistency of Cream of Wheat
- Screened (Reuse) Water is Pumped two 30,000 – Gallons of Equalization Storage Tanks
- Excess Reuse Water Overflows to Plant Sewer, but Solids Have Been Captured for Product

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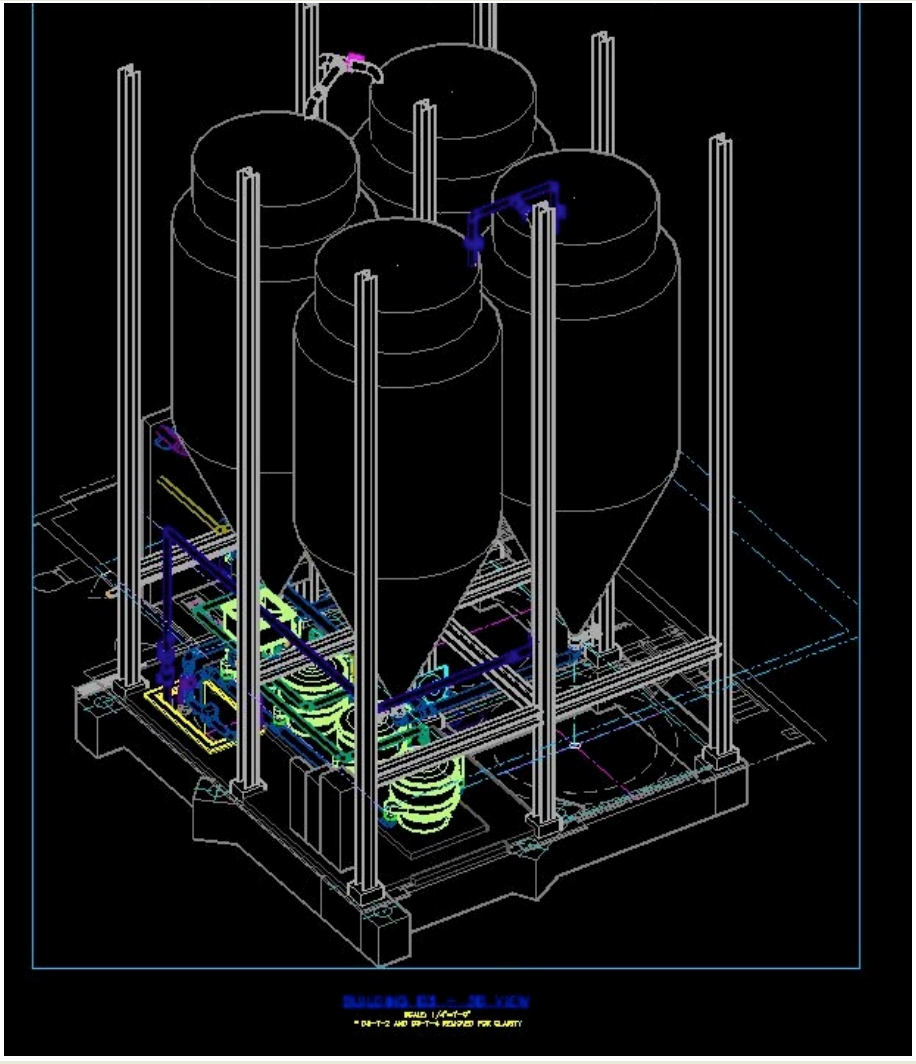
3D Modeling of Tanks



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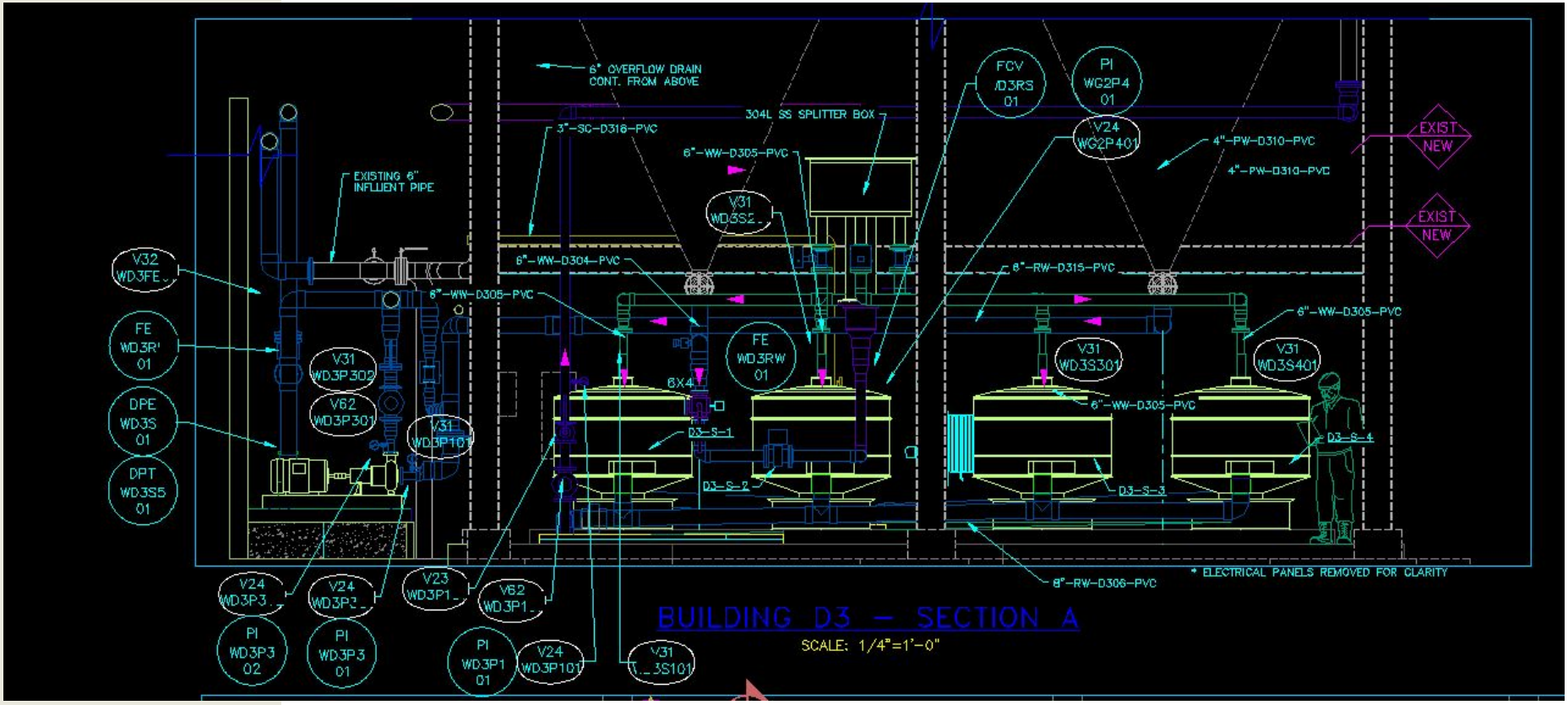
3D Modeling of Screens



Old Small Washmill

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Indoor Basin

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Indoor Basin w/ New Pump Suction

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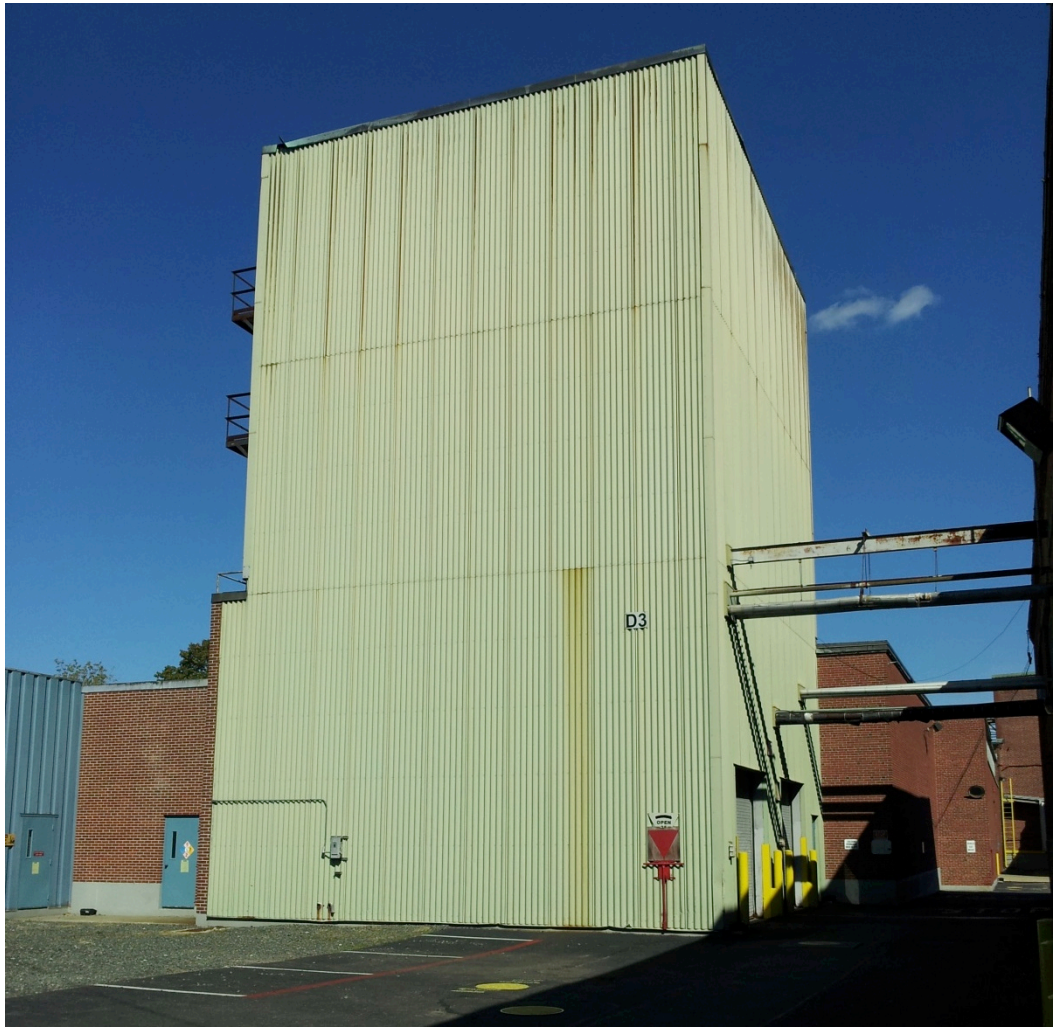
Reused 40-Year Old Building



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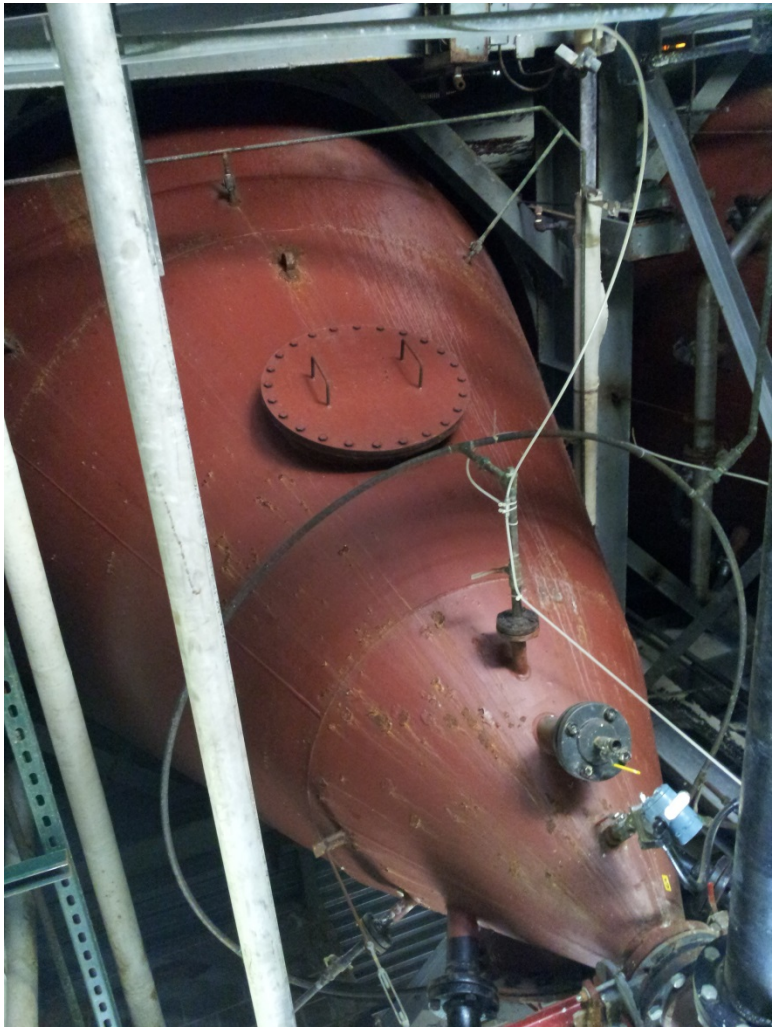
Reused 30,000 Gallon Tanks (Typ 4)



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Reused Tanks - Inside (Typ 4)

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Screens Recover Bone Fiber

Recovered Bone Fiber

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Reuse Pumps Old and New

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Reuse Water Distribution

- Reuse Water Demand Varies between 7 gpm and 555 gpm with 160 gpm Average (230,000 gpd)
- New Pony Pump Delivers 95 to 400 gpm
- Repurposed Existing Pump Delivers 600 gpm
- 1,200 Feet of Distribution Pipe to North Side of Plant
- Distribution System Connects to Existing Well Water System with Existing Large Pump for Extreme High Demands or Lack of Reuse Water and a New Pony Pump for 18 to 120 GPM Connected to a Hydro-Pneumatic Tank

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Reuse Water Distribution

- Reuse Water Demands – System Design

Water Demand	GPD
Transport Water	35,000
Washing Water	20,000
Lime Slaking and Dilution	165,000
Misc and Pump Seals	10,000
Total Reuse Water Demand	**230,000**

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Reuse Water Distribution

- Washmill Effluent Flow Highly Variable Day to Day Combined with 7 to 555 gpm Reuse Demand Required Supply & Demand Modeling
- Utilizing Two of 30,000 Gallon Tanks For Dirty Water Storage and a Screening Capacity of 250 gpm Provides for 99% of the Washmill Water to be Screened to Capture Product.
- Utilizing the Other Two 30,000 Gallon Tanks for Screened Effluent Provides for 83% of Washmill Water to be Reused.
- Excess 45,000 gpd Overflows to Plant Sewer

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Reused Infrastructure

- 40-Year Old Building with Remains of Liming Pilot Plant were Reused.
  - 31’ x 31’ x 54’ Tall Building
  - 4 – 30,000 gallon conical tanks 14.5’ ∅x 39’ Tall
  - 600 gpm – 80 psig pump
  - Control Valves and some Existing Piping
- 300 ft of Piping and Concrete Collection Basin from a Previous Failed Water Reuse Project
- 100 ft of Abandoned Process Piping Reused in Distribution System

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Timely Construction of Other Projects

- Recovered Water on South side of Plant
- Reuse Demands on the North Side
- All Existing Piping spanning Railroad and Stream was Underground - No spare Pipe for Reuse Water
- Separate Project Constructed a 425 ft Overhead Pipe Trestle. 6” Line Installed on Trestle
- Inadequate Power to Reuse Water Treatment Area
- A Separate Gelatin Sifting Project was Constructed on the Other Side of Reuse Treatment Building Wall.

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Timely Construction of Other Projects

- Gelatin Sifting Project Carried the Cost of Jointly Utilized Electrical and Controls Upgrades
  - Installation of 550 ft 4” Conduit
  - 800 amp MCC
  - New PLC for Sifting Project Shared with Water Reuse Project

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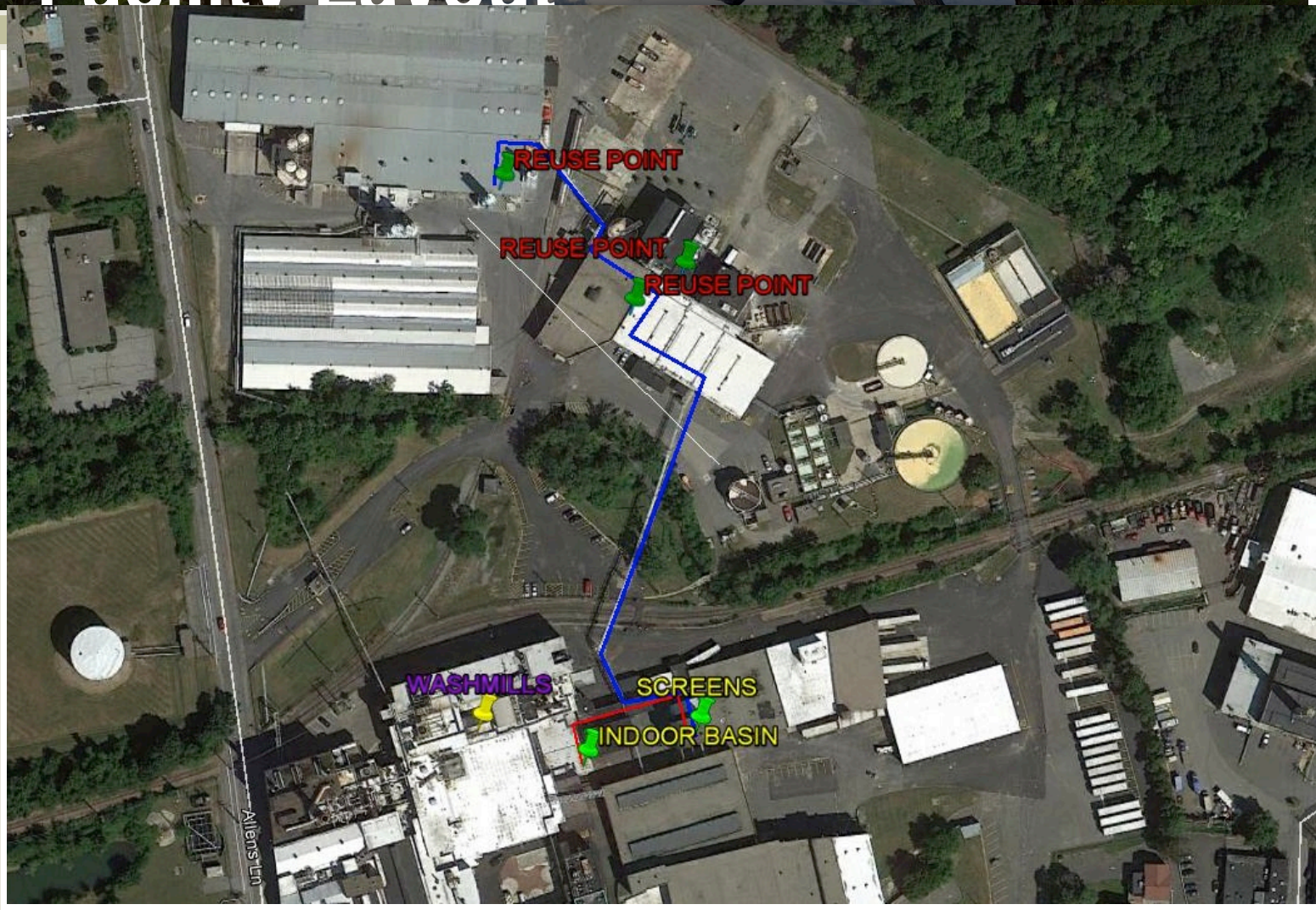
Facility Layout



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Project Costs

- Estimated Construction Cost Budget For Funding- $1.1 Million
- Actual Construction Cost $1.2 Million
  - Mechanical $219K
  - Civil $99K
  - Electrical & Controls $350K
  - 4 - 30,000 gallon Tank Cleaning and Repair $80K
  - Screens $150K
  - Pumps, Valves, Instruments $150K
  - Engineering Concept and Design $103K
  - Bidding and Construction Services $33K

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Project Savings

- System Designed to Reuse 230,000 gpd
- Actual Reuse 250,000 gpd (365 day/yr)
- Water Reuse to Date 110 million gallons
- Annual Sewer Savings $500,000
- 475,000 lb/year of Recovered Washed Bone for Gelatin Extraction
- 1,800 lb/day BOD Load Reduction To Treatment Plant
- $80,000 Per Year Reduction in Sludge Dewatering and Disposal
- $25,000 per Year in Aeration Power Savings

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Keys to Project Success

1. Dedicated and Vested Plant Employee
2. Plant Conducted Pilot Testing for Proof of Process
3. Solids Recovered in the Water are Lost Product about as Valuable as the Water Savings
4. Sewer Discharge Fee $5.54/1000 gallons
5. Production Process Progresses from Bone to Clean Sterilized Product Allowing Counter flow of Reuse Water
6. Simple Treatment Process – Used Elsewhere at the Plant – Sweco Screens
7. **Project Payback 1.1 years**

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Future Opportunities

- 25-Years Ago Plant Used 4.5 MGD Water
- All Water is Extracted From On-Site Groundwater
- Today with Water Reduction and Reuse Plant Uses 1.3 MGD
- 3.0 MGD of Water Could Be Sold to the City
- City of Peabody Water Withdrawal Permit Allows 2.1 MGD From Groundwater and 3.89 MGD from the Ipswich River
- Ipswich River Has Minimum Flow > 141 CFS in Summer to Allow Extraction

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Future Opportunities

- City Authorized to Obtain 1.0 MGD from MWRA
- Goal was to Average 0.5 MGD
- Ipswich River Basin is Water Stressed
- Mandatory Non-Essential Municipal Water Use Restrictions Implemented in July 2014 for Following Communities in Ipswich River Basin
  - Danvers
  - Middleton
  - Lynnfield
  - Reading
  - Wenham
  - Topsfield
  - Wilmington

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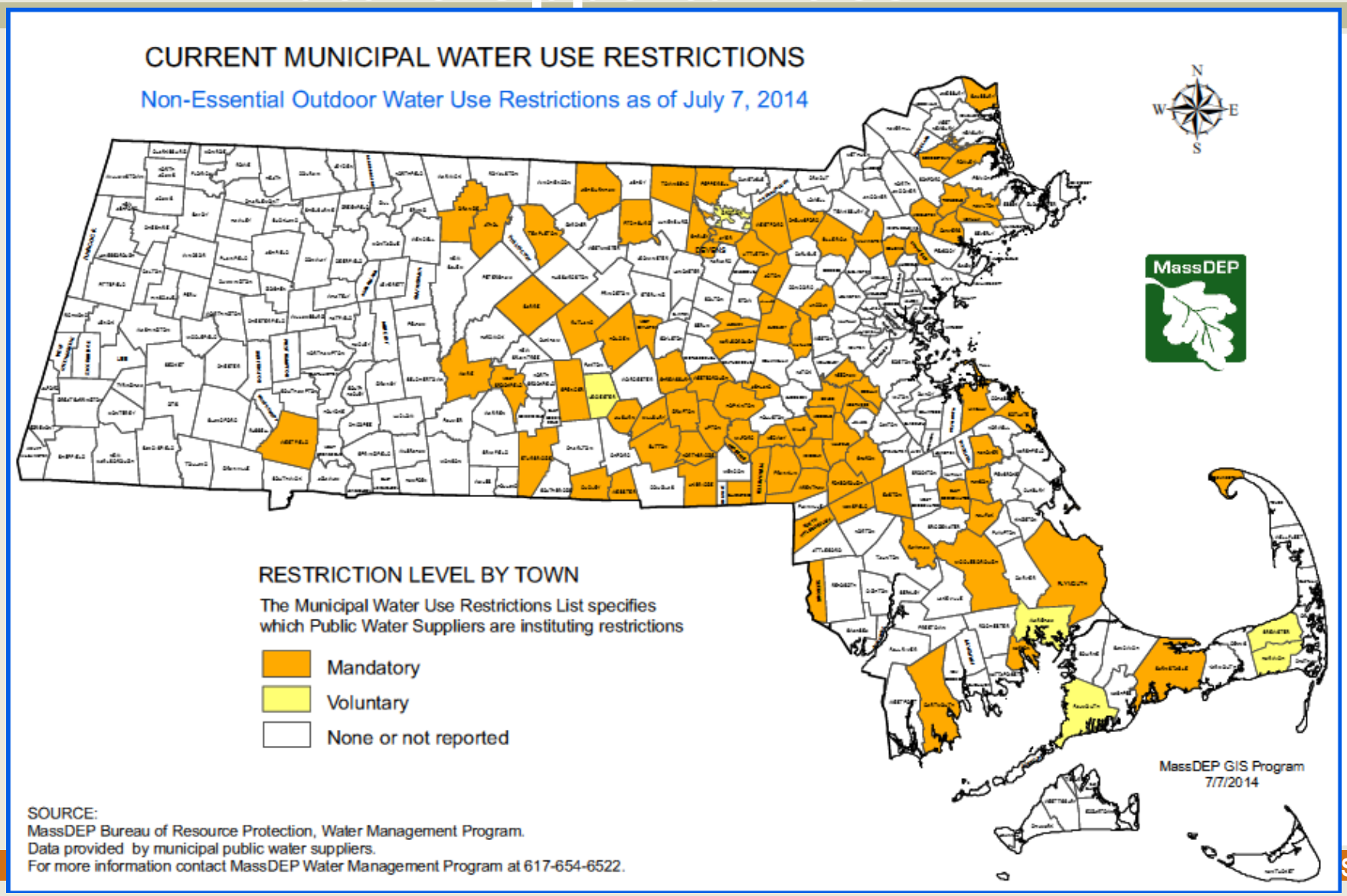
Future Opportunities



Plant Future Opportunities

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Plant Future Opportunities

- The Plant Currently Provides Groundwater to the City of Peabody Golf Course – 20 Million Gallons Per Year.
- City has not provided the agreed property tax rebate which is about $100,000/year.
- Replace the Use of Groundwater with Plant's Treated Effluent – Reduce Sewer Fees by $110,000 per Year
- Use the Groundwater To Replace City Extracted Ipswich River Water Used for Drinking Water

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THANK YOU!

QUESTIONS?

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