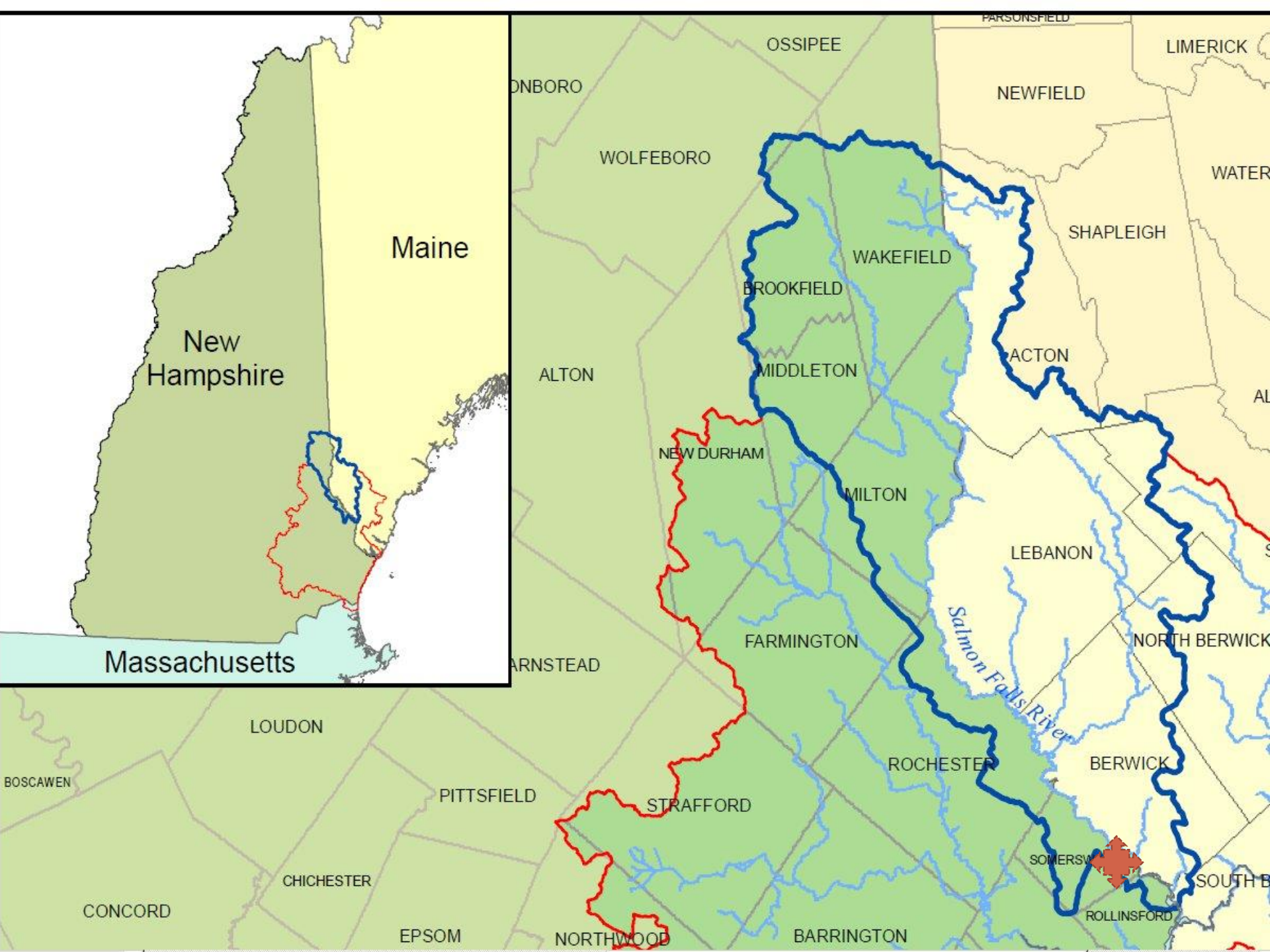
Residuals Management Somersworth Drinking Water Treatment Facility

A HISTORICAL OVERVIEW OF SURFACE WATER TREATMENT RESIDUALS HANDLING

Ian Rohrbacher, Treatment Operator IV

Background

- We are a Grade III surface water treatment plant
- Located in Somersworth, NH next to our source, the Salmon Falls River (which forms the lower border between New Hampshire and Maine)
- The Salmon Falls watershed begins at Great East Lake and Milton Three Ponds in NH
- Drains an area of ~232.5 square miles (148,801 acres) and includes portions of towns in Maine and New Hampshire
- In addition to over 12,000 residents, we serve many commercial and industrial users including Velcro USA, General Electric, General Linen, and several medical centers


Maine
New Hampshire
Massachusetts
PARSONSFIELD
OSSIPEE
LIMERICK
NEWFIELD
ONBORO
WOLFEBORO
WATER
SHAPLEIGH
WAKEFIELD
BROOKFIELD
ACTON
MIDDLETON
ALTON
NEW DURHAM
MILTON
LEBANON
FARMINGTON
NORTH BERWICK
Salmon Falls River
ARNSTEAD
LOUDON
ROCHESTER
BERWICK
BOSCAWEN
PITTSFIELD
STRAFFORD
SOMERSW
SOUTH B
CHICHESTER
CONCORD
ROLLINSFORD
EPSOM
NORTHWOOD
BARRINGTON

Quality and Capacity

- With such a large watershed, the river quality fluctuates seasonally and daily, with swings in turbidity and color from 1.5 to over 20NTU and 40 to 400ptcu; TOC from 3-14mg/l
- This makes our source one of the most challenging to treat, and also why it was selected by both PALL Corporation to pilot nanofiltration membranes, and by the US military for testing tactical treatment units.
- Finished water production can peak at 2.5 million gallons per day with a 9MGD max capacity and typically enters the distribution system at less than 0.070NTU, 0ptcu, <2.7mg/l TOC, 7.3 pH, 1.10 mg/l free chlorine, and a hardness of 7-15 mg/l (very soft)

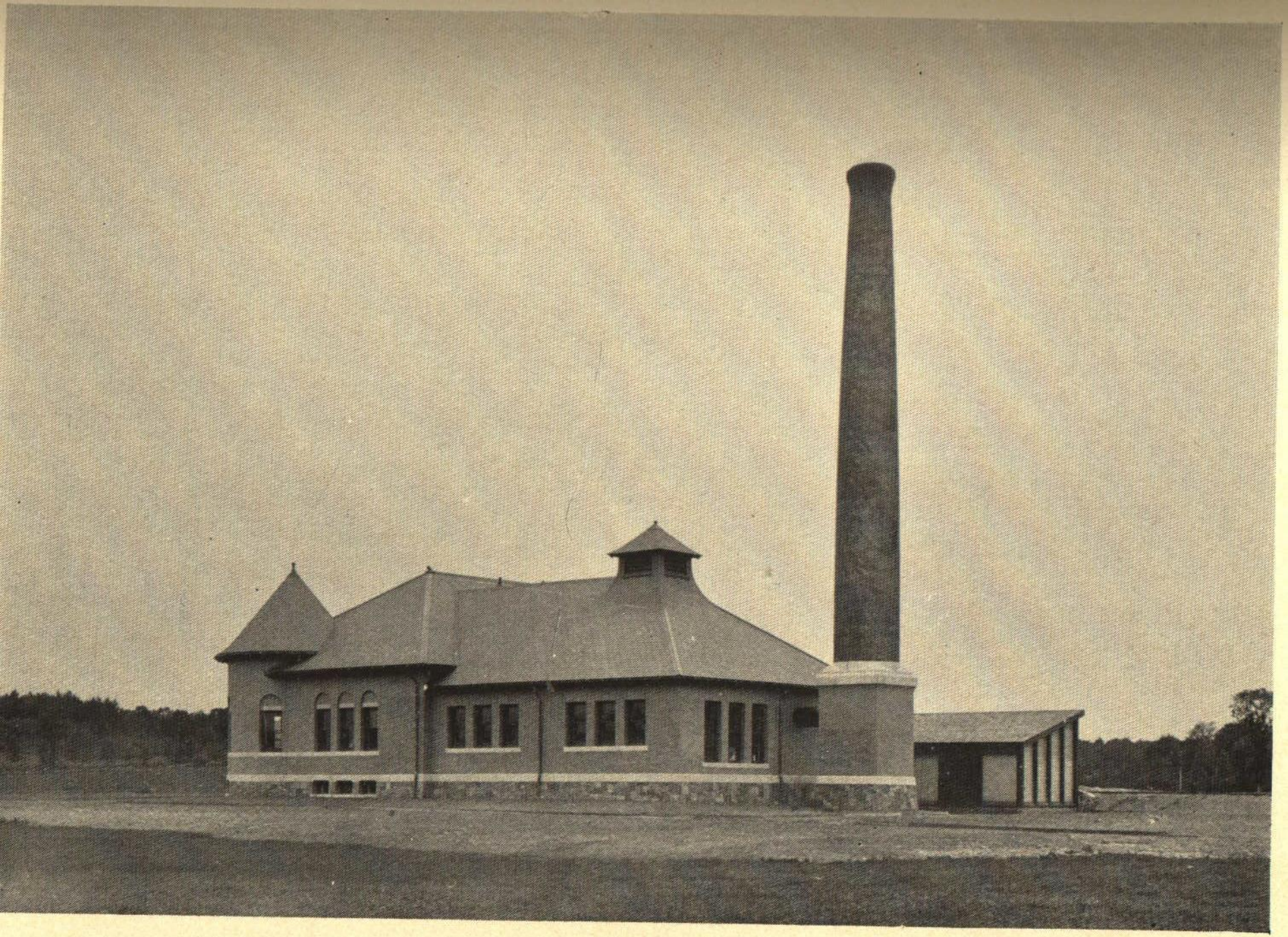
1895 – Slow Sand Filter Bed & Pump Station

•In 1895 the Great Falls Manufacturing Company owned and operated the waterworks. When the City decided to build a larger system, they negotiated with Great Falls to buy the rights.

•This system used a slow sand filter and coal-fired steam engines to deliver chlorinated water to the Hamilton Street Standpipe.

•Few records available

•Unknown residuals management
- •Sludge bed removed and disposed of in "contemporary" manner?
- •Low volume, no drinking water standards



PUMPING STATION BUILDING FROM SOUTH EAST

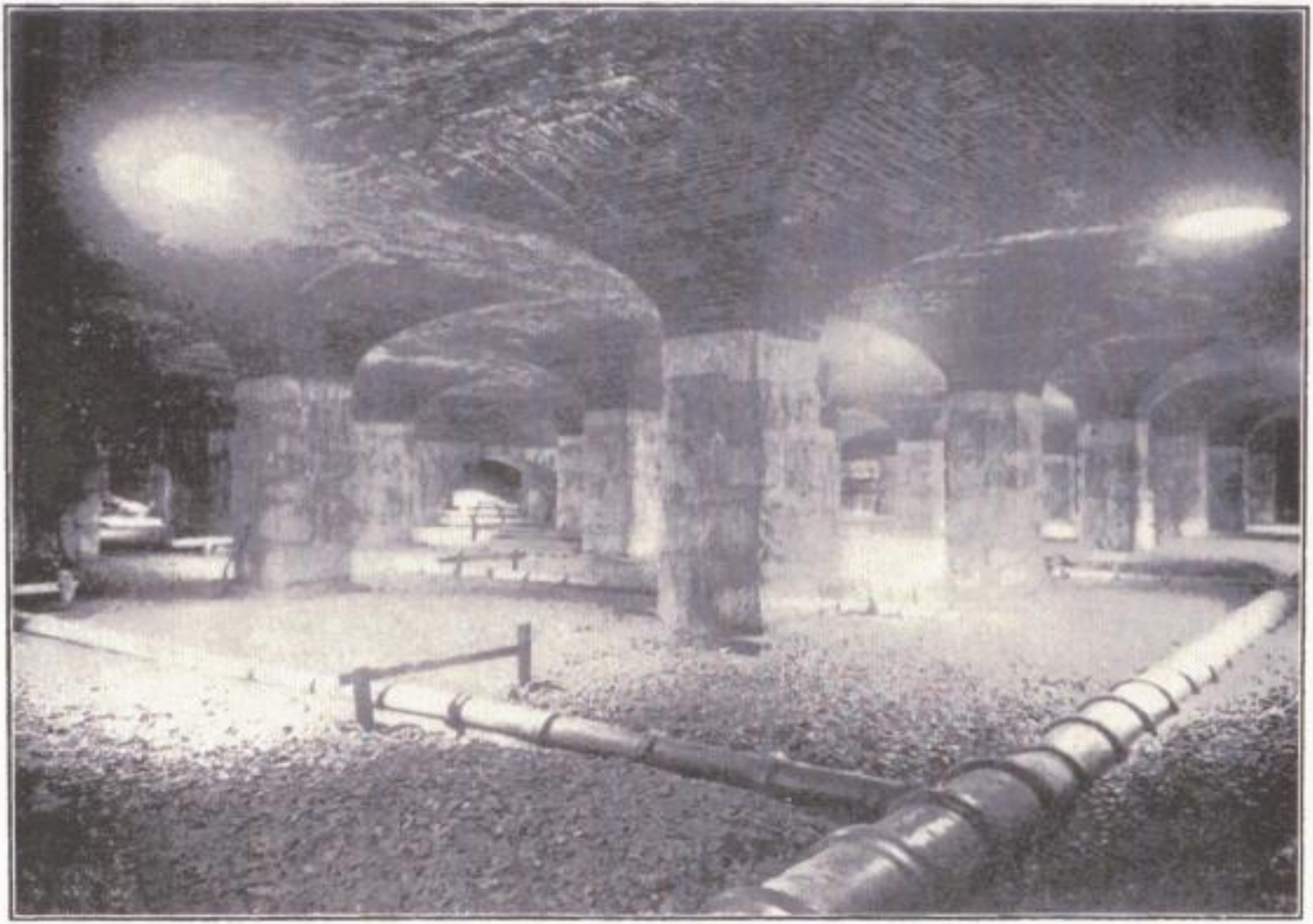


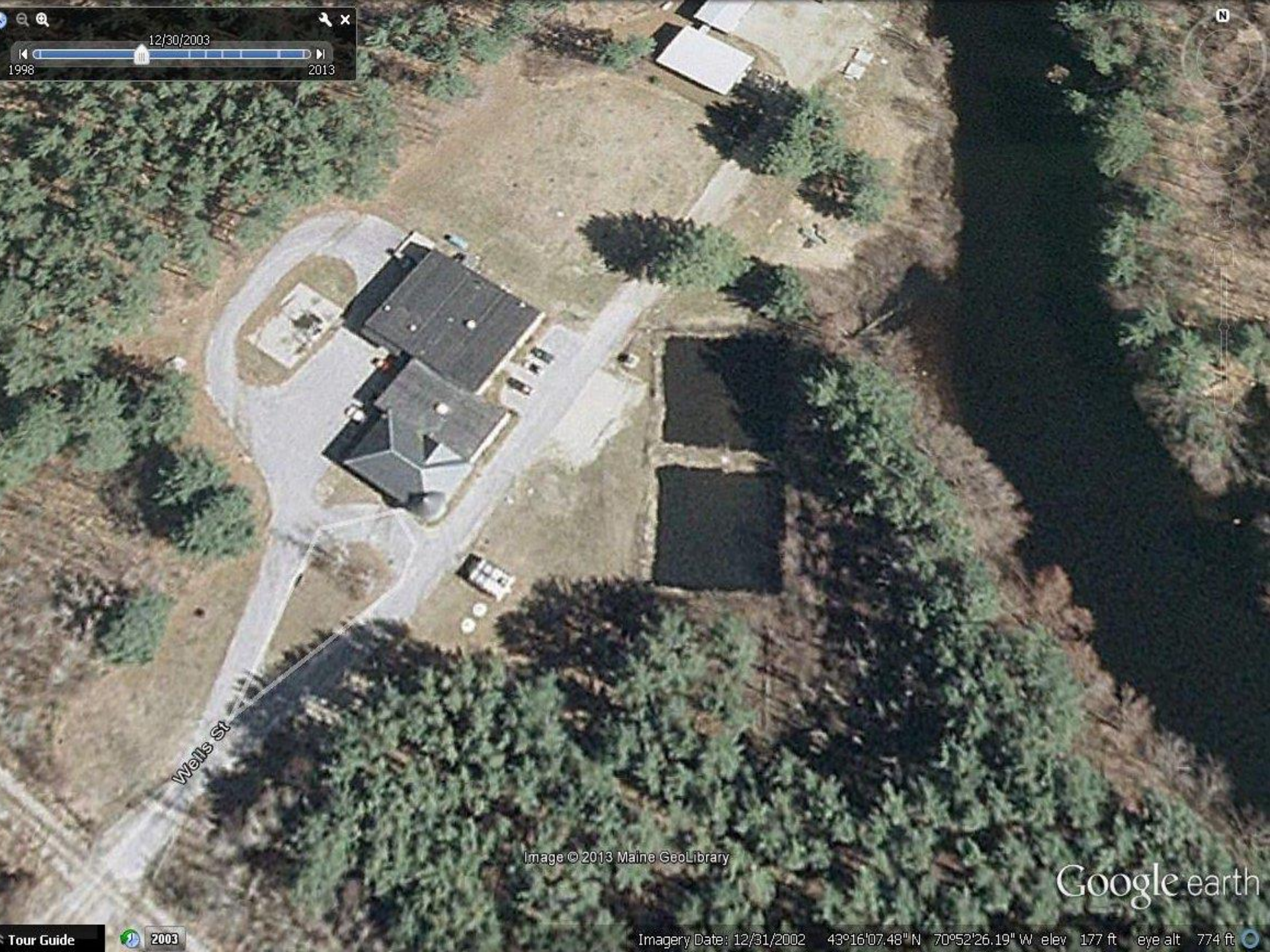
PLATE VIII.—INTERIOR VIEW OF SOMERSWORTH, N. H., COVERED FILTERS. UNDERDRAINS AND GRAVEL BEING PLACED IN POSITION

1970 & 1991 Modernization

- Two substantial upgrades
- In 1970 the existing pump station and boiler room were renovated for 1MGD Trident conventional treatment system
- Pair of simple lagoons built to handle residuals
- In 1991, a 3MGD Microfloc Upflow Clarifier with two multimedia filter beds was installed
- Included a sludge settling tank, recycle capability
- Most solids pre-settled in sludge tank
  - Required cleaning (confined space)
  - Did not recycle often due to process disruption
- Could now discharge directly to sanitary sewer
  - Problems: sampling and operational challenges regarding wastewater plant
  - Reverse flow into neighborhood homes
  - Cost
- In both plants, residuals cleaned about every two years
- Disposed of at municipal leaf/compost pit
- Volume remained stable even with increased demand - organic coagulant produced less floc compared to alum/caustic

Original Lagoons

- In service 1970-2008
- Utilized by both Conventional and Upflow systems
- Two unlined, dug & bermed beds
- Rudimentary flow control via weir plates
- Liquid fraction percolated into ground or decanted to surrounding land


12/30/2003
1998
2013
Wells St
Image © 2013 Maine GeoLibrary
Google earth
Tour Guide
2003
Imagery Date: 12/31/2002 43°16'07.48" N 70°52'26.19" W elev 177 ft eye alt 774 ft

2006-2008 Major Plant Overhaul

- 2 Kruger Actiflo Ballasted Microsand Clarifiers
- 4 multimedia filter beds
- Full SCADA
- New clearwell/chlorine contact tank
- Pipework for a raw water equalization tank
- 3 new lagoons & control structures

Actiflo Process

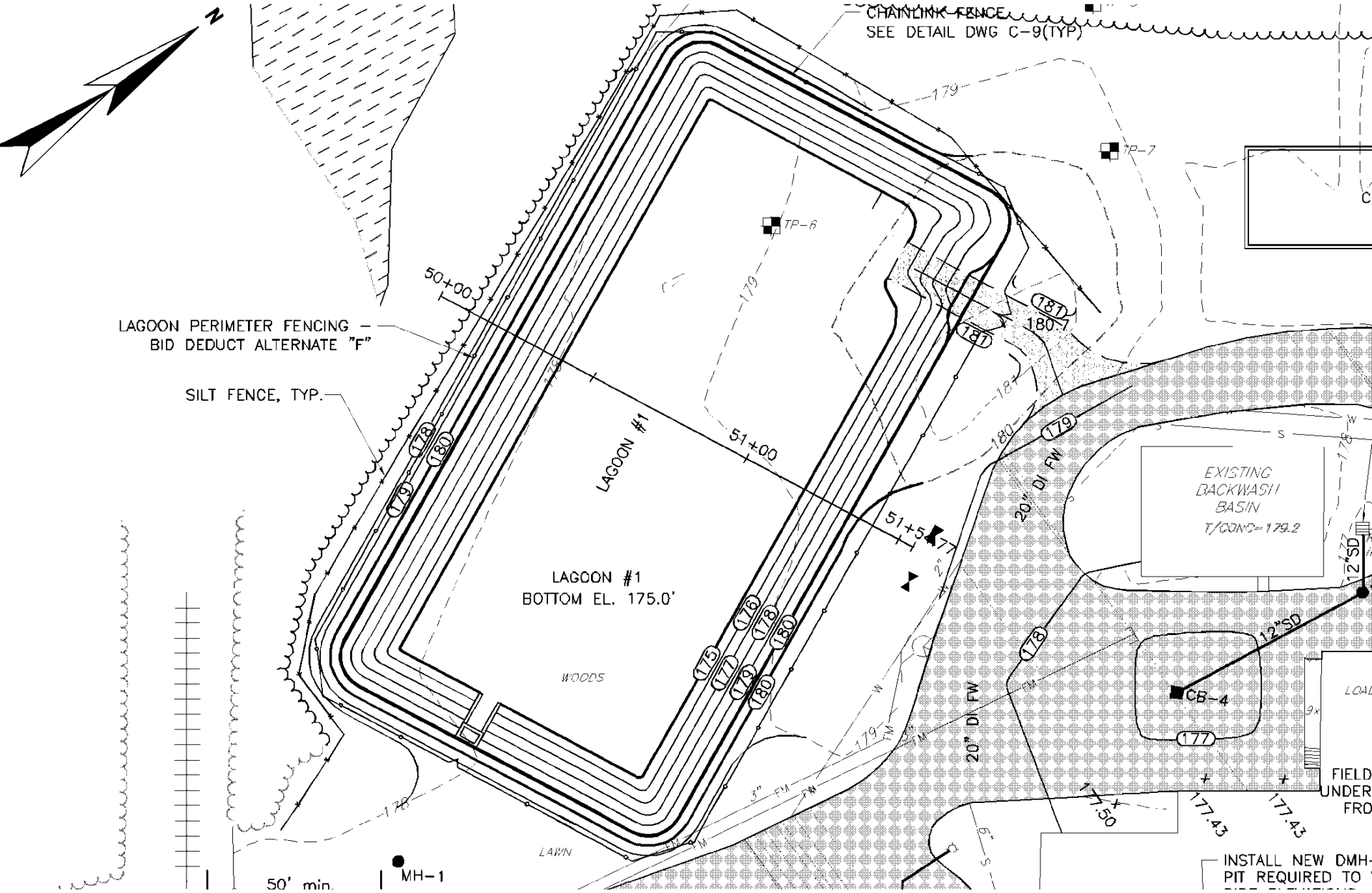
- Significantly different from the other plants
- Rapid flocculation & sedimentation
- Hydraulic retention time 30-60mins
- River water is blended with lagoon effluent, filter waste, and pretreatment discharge into a 1.2 million gallon equalization basin.
- Potassium permanganate is applied for pre-oxidation of NOM, iron/managnese
- Conditioned water is then clarified by two parallel trains to less than 1NTU and ~0/1ptcu.
- Using aluminum sulfate, sodium hydroxide, powdered activated carbon, anionic polyelectrolyte aid, and microsand.

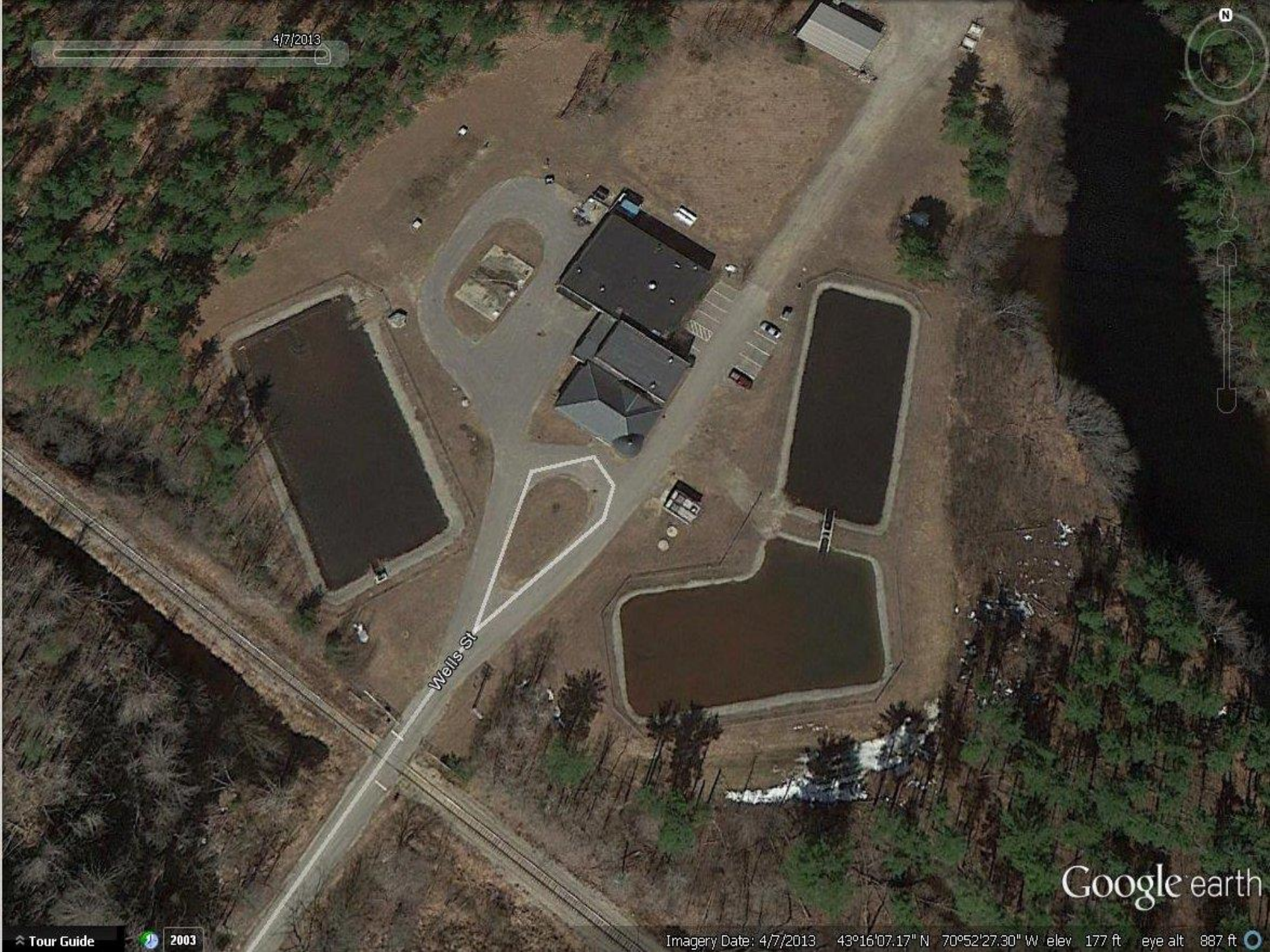
Actiflo Process

- 4 Multimedia filter beds polish water to typically <0.040NTU
- TOC removal exceeds 65%.
- Filter runtime averages 48 hours per backwash during peak flow and source quality extremes.

- Expectation of greater sludge production
  - Alum coagulation instead of organic polymer
  - Increased removal capability results in increased solids
- Required the larger, more manageable lagoons

Lagoon Construction


N
CHAINLINK FENCE
SEE DETAIL DWG C-9(TYP)
LAGOON PERIMETER FENCING –
BID DEDUCT ALTERNATE "F"
SILT FENCE, TYP.
LAGOON #1
BOTTOM EL. 175.0'
LAGOON #1
50+00
51+00
51+55
TP-6
TP-7
WOODS
LAWN
EXISTING
BACKWASH
BASIN
T/CONC=179.2
20" DI FW
12"SD
CB-4
MH-1
50' min.
INSTALL NEW DMH-
PIT REQUIRED TO


4/7/2013
N
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2003
Imagery Date: 4/7/2013 43°16'07.17" N 70°52'27.30" W elev 177 ft eye alt 887 ft

New Lagoons

- Lagoon & recycle system integral part of our entire treatment process
- Dilutes raw water
- Collect hydrocyclone waste from the clarifier
- Backwash waste from filters
- Daily: 79,000 gals waste from clarifier, 54,000 gallons per 2 backwashes
- #1 ~22,000 ft^2, #2&3 ~15,000 ft^2 each. 4 feet deep.
- Each lagoon contains a groundwater super-under drain

New Lagoons

- Stone and sand dewatering layers


09/11/2006

New Lagoons

- HDPE liner & nonwoven geotextile fabric layer
- Washed sand “filter bed”
- Influent pipe and cement outfall pad

Lagoon Management

- Weir trough & valved collection system
- Excellent flow control
- Control filtrate and supernatant flow rates
- Quickly season beds with thick Schmutzdecke
- Make adjustments depending on rain and discharge volume from the plant.

Lagoon Management

- We alternate & reuse the lagoons to maximize drying and layering
- Sand/membrane beds facilitate rapid dewatering
- Each lagoon filled to ~4ft of hydrated material
- Stop flow. Dries to ~18 inches of alligatored clumps with tops as dry as anthracite and a thick jelly at bottom.
- We could repeat this process 2-3 times
- Drying time measured in months
- Had three lagoons to fill. Why worry? What's the rush?

Buildup of residuals

- Everything working great, until the warm weather and sunshine
- Started to notice an elevation in our finish manganese
- Traced it to an increase in the raw water – not from the river, but the beds
- Manganese reuptake was occurring – beds became anoxic & biologically active
- Created demand on permanganate, affected TOC removal
- 0.080 mg/L Mn being elevated by a lagoon stream of 0.300 to 14 mg/L of Mn!
- Underscores need for immediate, effective cleaning
- Forced us to take action, and develop a long term strategy

Residuals Management

What to do with a byproduct that is non-reactive, topically inert slurry/sludge containing chemically neutralized and precipitated natural organic material, sediment and debris removed from surface water?

- We had all these “nice” biosolids
- Never worried about it before (limited recycling, less waste)
- It’s “just” alum, swamp water, dead leaves and bugs.
- As we began to plan for removal, we quickly learned that there was a considerable amount we did NOT know about residuals management
- We were newcomers to NPDES, SQCs, etc. TCLP? RCR8?
- Whatever we did, had to be done correctly
- For both regulatory and process reasons

Proposals

- Evident that we needed to team with an experienced and knowledgeable partner
- Full service, who could coordinate and streamline permitting.
- Provide cost effective, environmentally responsible disposal
- Could quickly and gently remove material
- Restore storage capacity and filtration efficiency
- Without damage to the system's under drain or membrane
- Fulfill this goal efficiently and neatly, without interfering with the facility operation or grounds.
- Bidding came back:
- Significant cost differences between landfill disposal and beneficial reuse across the board

Partnership with RMI

- Good stewardship of creation is important from both operator and citizen viewpoints
- Beneficial reuse appealed to staff, city, and sustainability committee
- Idea of rebuilding farmland (or similar) felt more appropriate an alternative than landfill disposal for our material
- Somersworth contracted with RMI
- Provided best/lowest cost
- Met goals and requirements

Partnership with RMI

- RMI Mobilized
- On-site process completed in just a few days
- Included removal, grading, sand addition, site restoration
- Autonomous, timely
- No disruption to process or staff
- 2010 - Lagoon 1
  - 337 wet tons (381 yd^3)
- 2011 – Lagoons 2&3
  - 586 wet tons (685 yd^3)
- 2012 – Lagoon 1
- 2013 – Lagoon 2&3 upcoming

Partnership with RMI



On November 16, 2010, RMI loaded the first of what would ultimately be 13 loads into trucks for removal. The hydrosolids were taken to an RMI end-user for use in manufactured topsoil blending. Twelve loads were removed on November 16. After the edges of the lagoon were cleared, the last load was removed on November 17, 2010. RMI removed its equipment on November 19, 2010 and will return to drag and seed the disturbed area outside the fence the week of November 29 or when site conditions have sufficiently dried up.



Conclusion

- Excellent communication. Quick turnaround.
- Understand importance of proper lagoon & biosolids management – at both ends.
- Consistent team and plan was **essential**

"We walked around and within the lagoon earlier today - everything meets or exceeds our expectations. We appreciate your work."

Ian Rohrbacher, SWTF 11/18/10

Any Questions?