

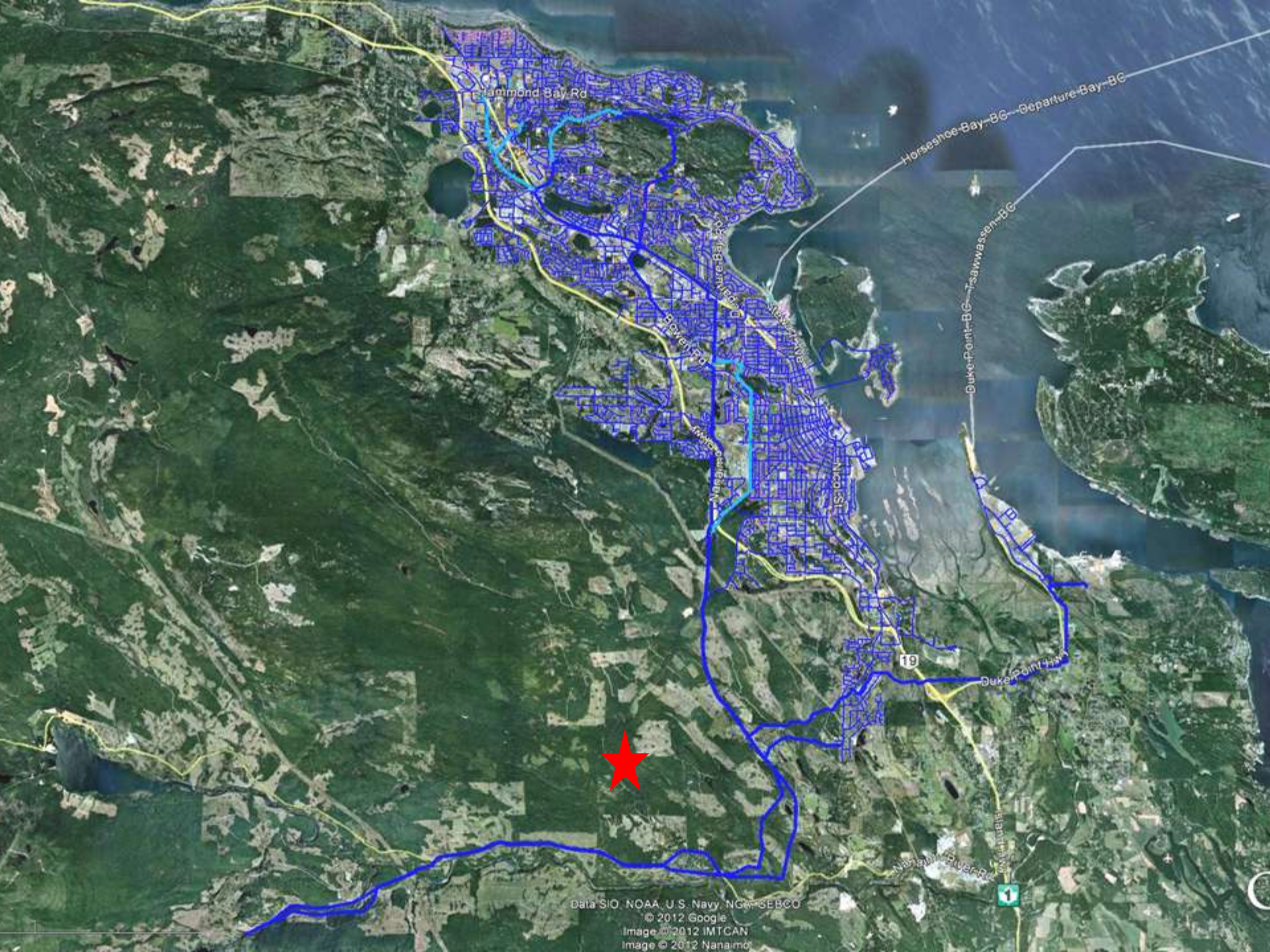
# Applying Value Analysis for the South Fork Water Treatment Plant

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Manager, Water Resources  
City of Nanaimo

CSVA Symposium 2014  
Toronto 18 November 2014

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Hammond Bay Rd

Cowiway Rd

Wave Street

NANAIMO

19

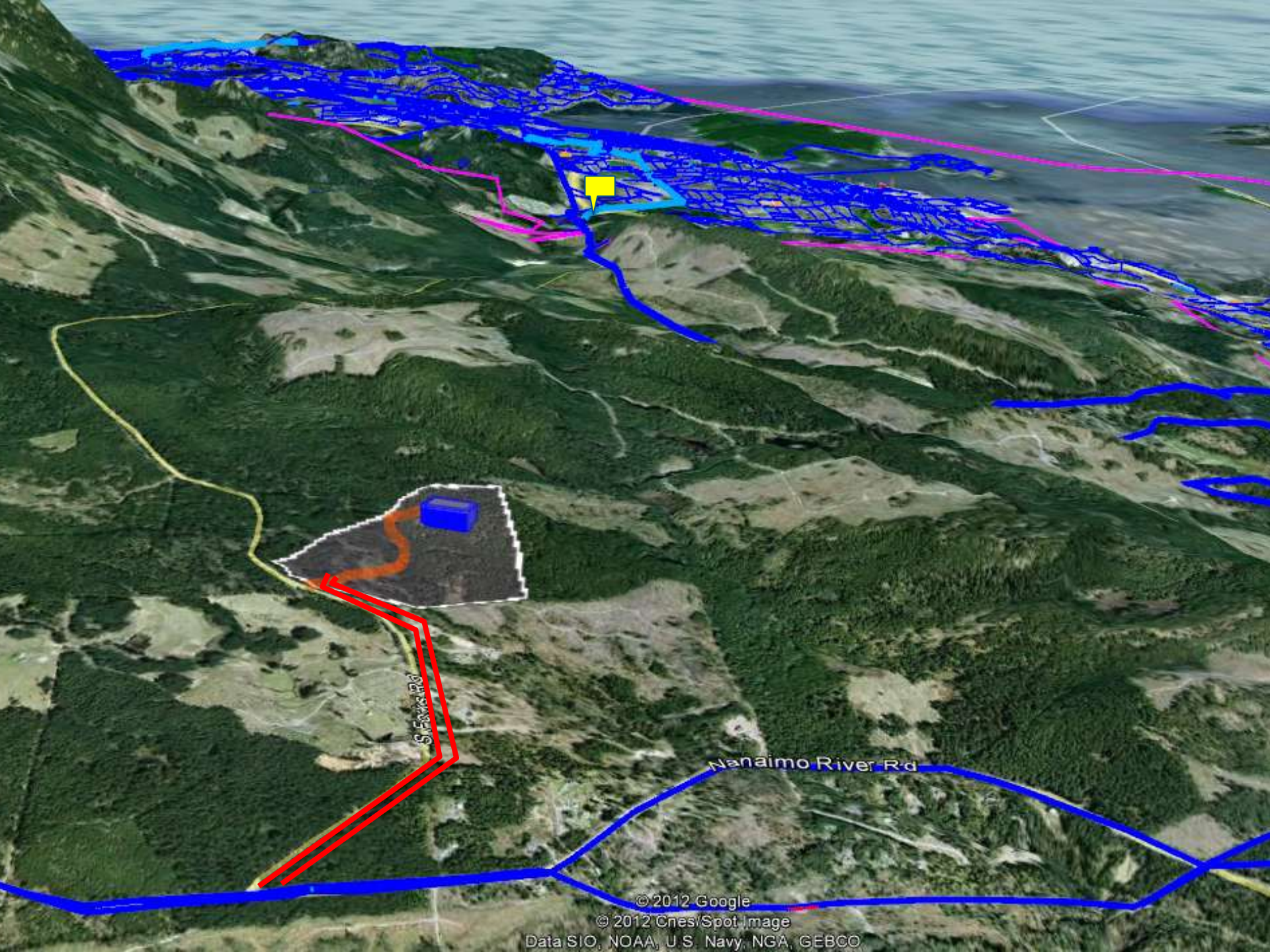
Duke Point

Nanaimo River Rd

Horseshoe Bay - BC - Departure Bay - BC

Duke Point - BC - Tsawwassen - BC

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# Water Source & Treatment

- Surface water storage in a closed watershed
- City's current treatment: gaseous chlorine
- Water Supply Strategic Plan (2007)
- Change to Operating Permit (Health Authority)
- New green field plant

# Drivers

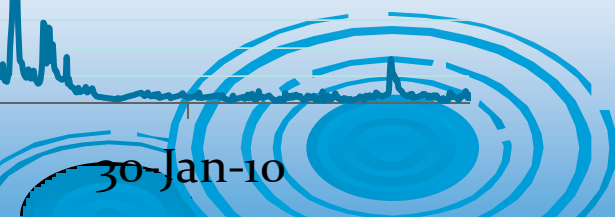
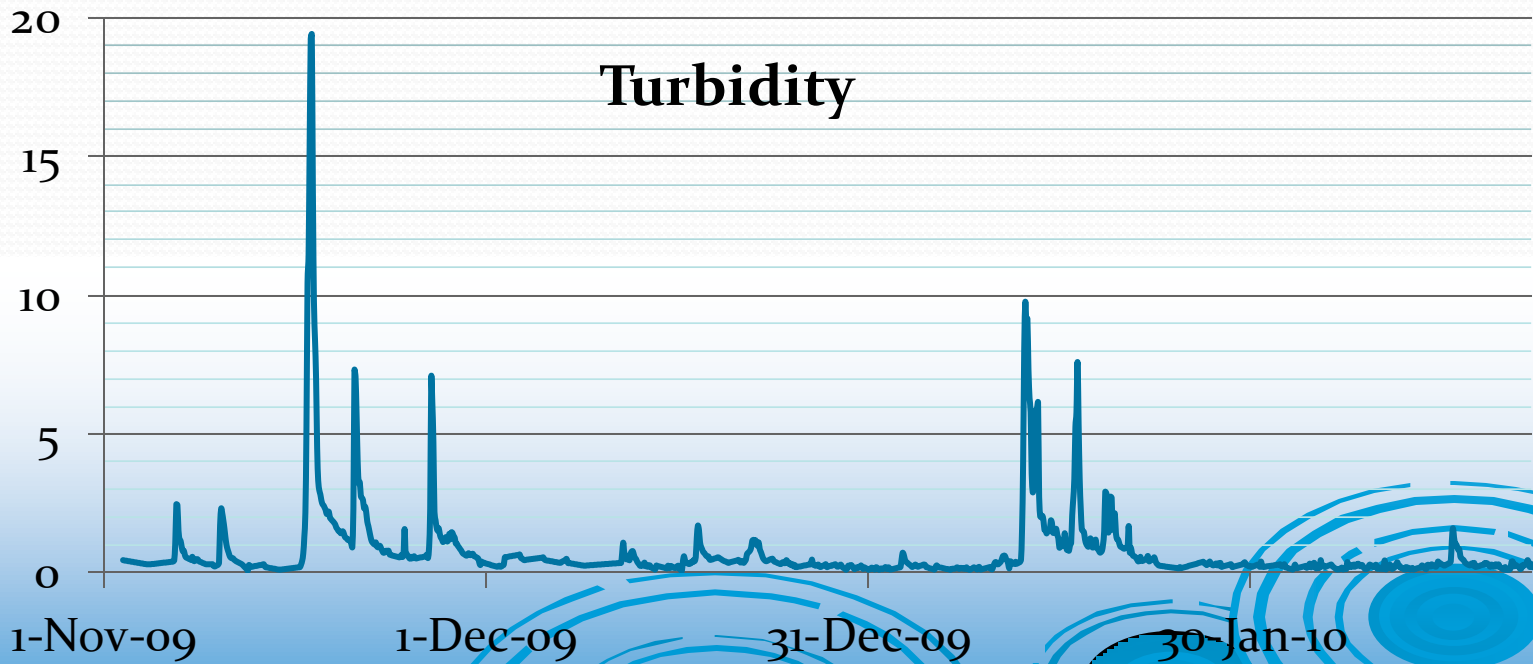
- In July, 2009, VIHA changed the City's Operating Permit to require filtration
  - deadline of **March 21, 2015** for plant start-up
- “4-3-2-1” Surface Water Treatment Policy
  - 4-log removal/inactivation of viruses
  - 3-log removal/inactivation of Giardia and Crypto
  - 2 treatment processes, usually filtration + disinfection
  - 1 NTU (max) in finished water

# City's Goals for the Project

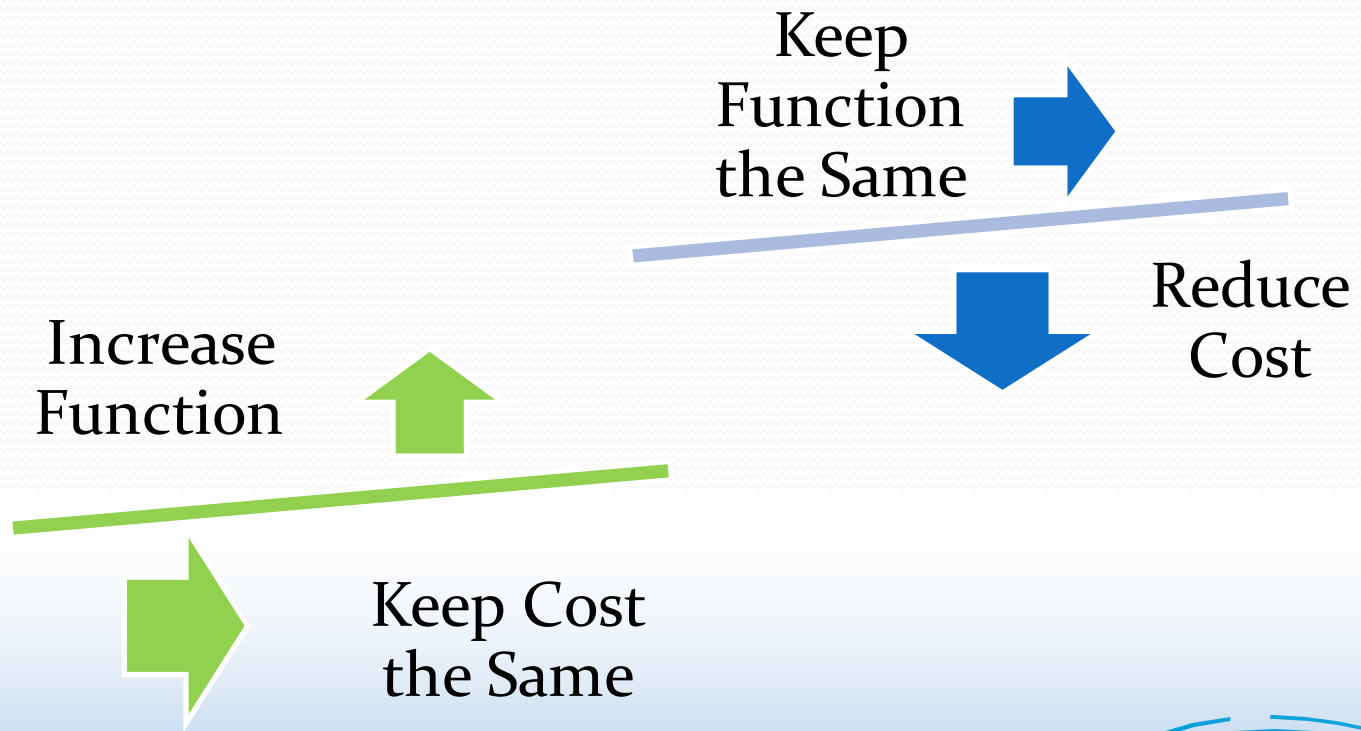
- Meet 20 year max day demand (116 ML/d – 30 mgd)
- Meet/exceed CDWQG and VIHA Surface Water Treatment Policy (4-3-2-1)
- Sustainable, long life-cycle design
- Minimum carbon footprint
- Potential for training in partnership with post-secondary trainers

# Design

- Pilot testing: direct filtration, DAF, membranes
- Decision to go with **siphon-driven** submerged membranes
- Secondary membranes to maximize recovery to 99%+
- Provision for flocculation and coagulation, pH adjustment, disinfection



# Why?



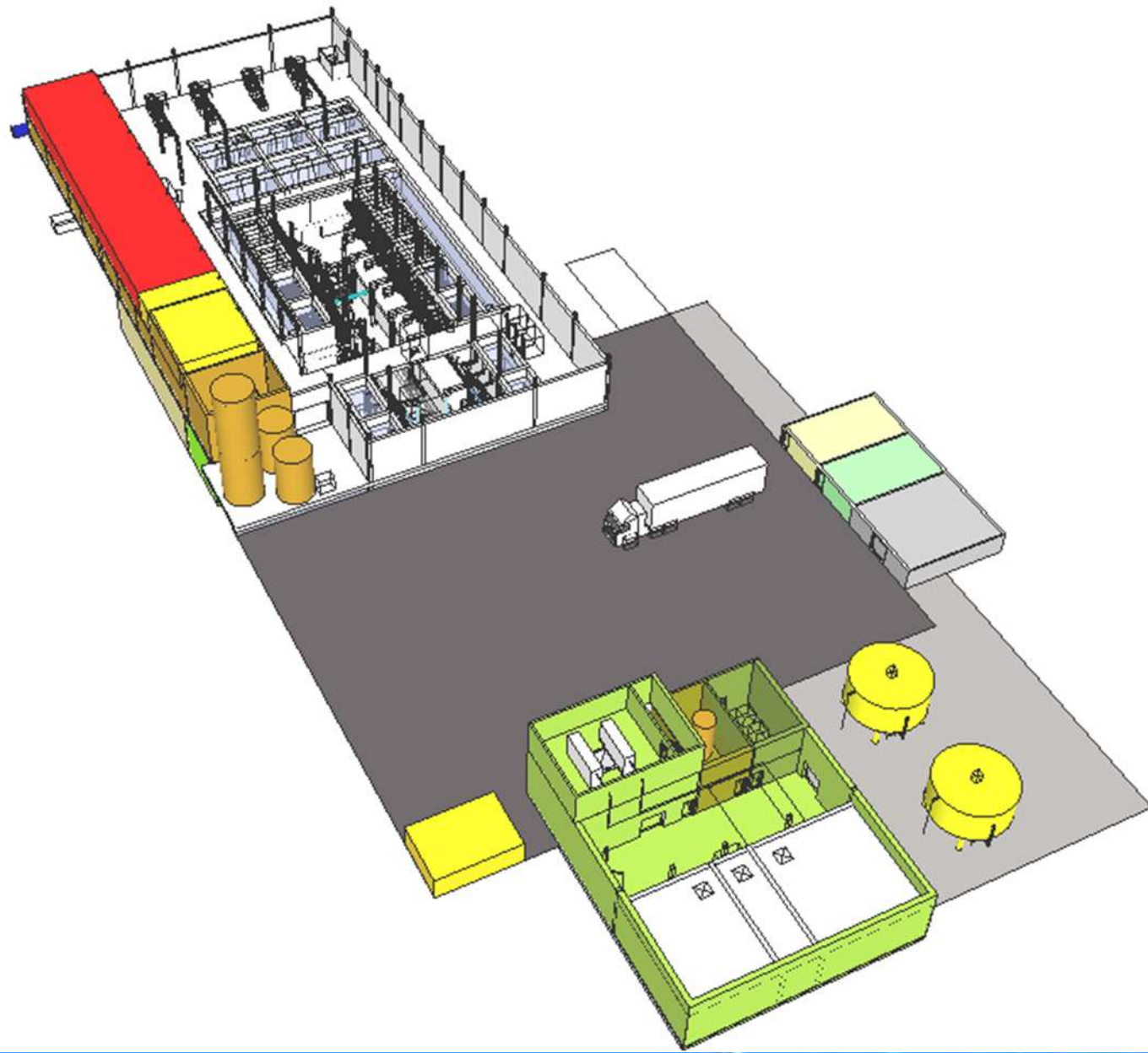
# City's Goals & Objectives for the VE Study

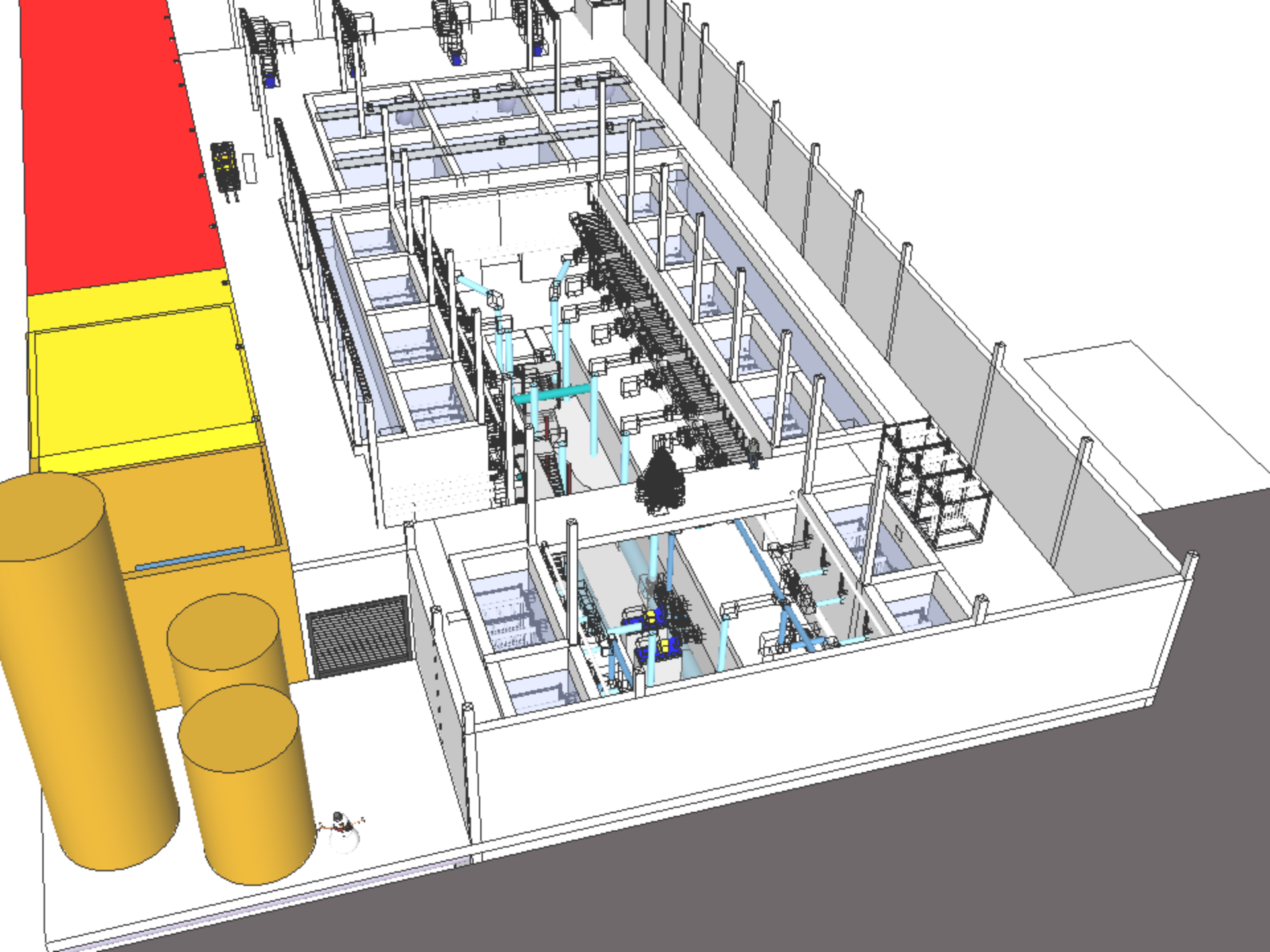
- We were new to VE
- Good idea on such a high-value project
- Requirement of Grant funding
- Nail down the budget in advance of borrowing
- Capital / life cycle cost control (\$65M budget)
- Membrane procurement (how much to buy when)
- Public communications / City confidence
- Staffing

# VE Study Constraints

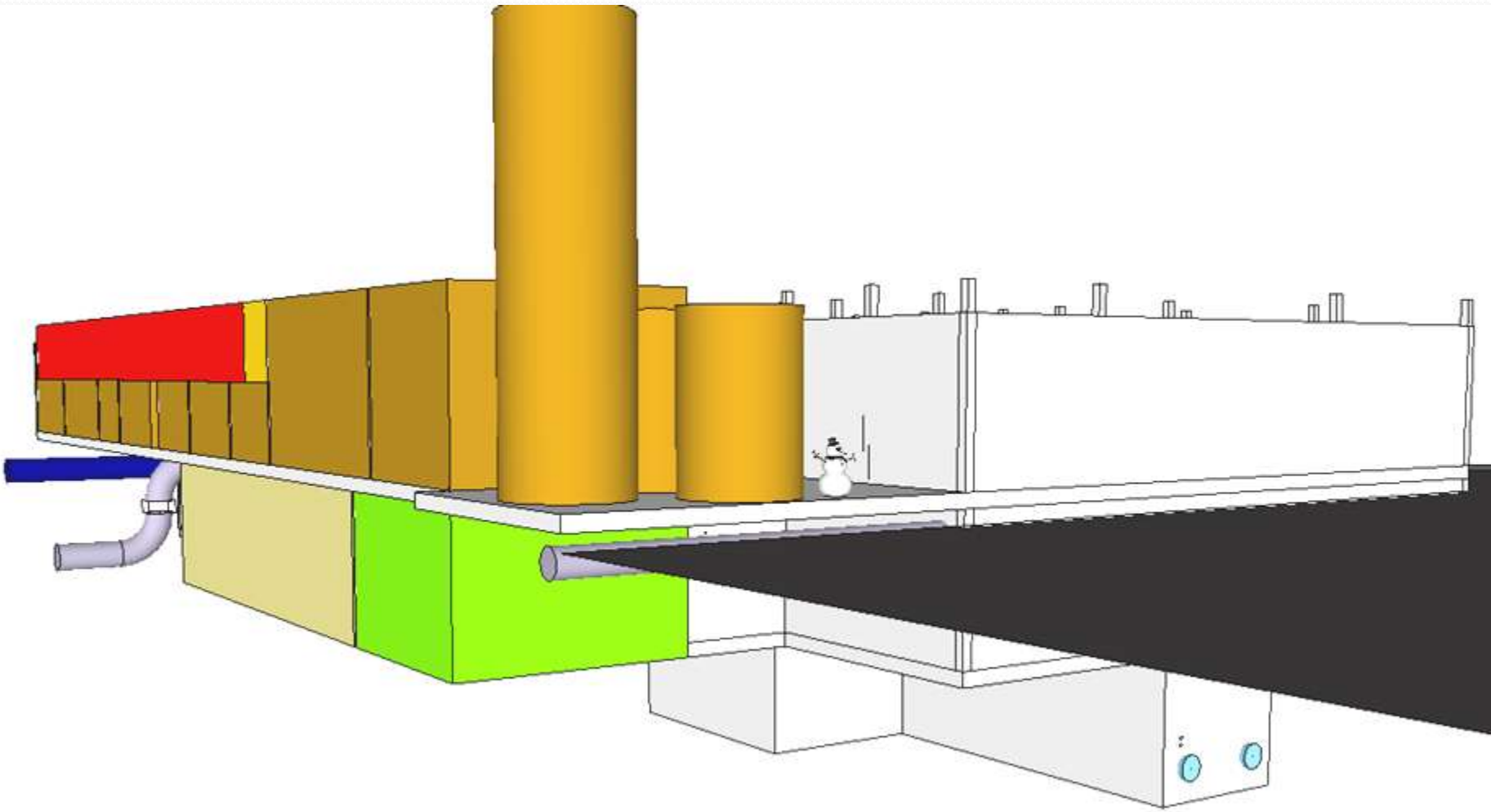
- Committed to submerged membranes
- Plant location: We are 'this close' to acquiring the property – too much invested to change
- Project delivery method: anticipated to be design-bid-build. Design-build is out
  - Would like to consider construction management

# Prelimi

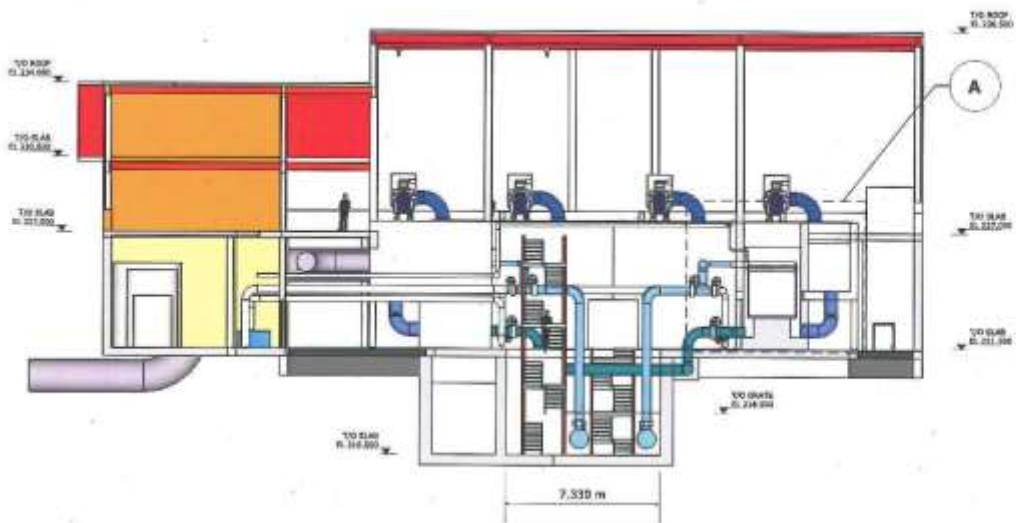
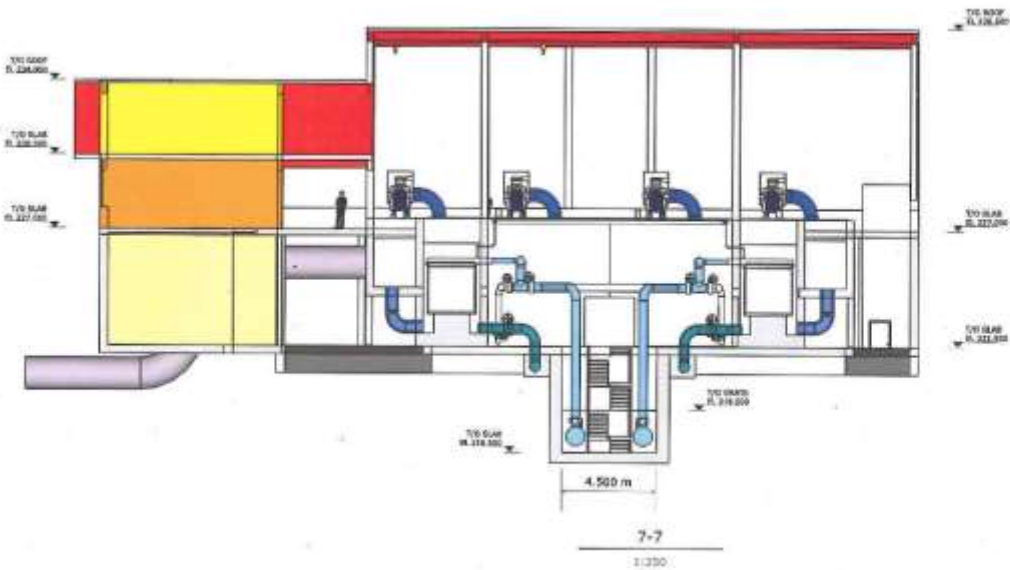




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# T H E H A R B O U R C I T Y



# Hiring a VE Consultant

- Advertised across North America
- Qualifications-Based Selection
- Submissions from VE firms, engineering consultants
- Selected RSRI, negotiated fees

# VE Exercise #1

- Held at draft preliminary design completion
- Four day, February 2010
- Industry experts from across North America – independent!
- Apprehensive of change – we'd built this from the ground up
- City PM, Senior Operator & Engineer PM part of the VE Team



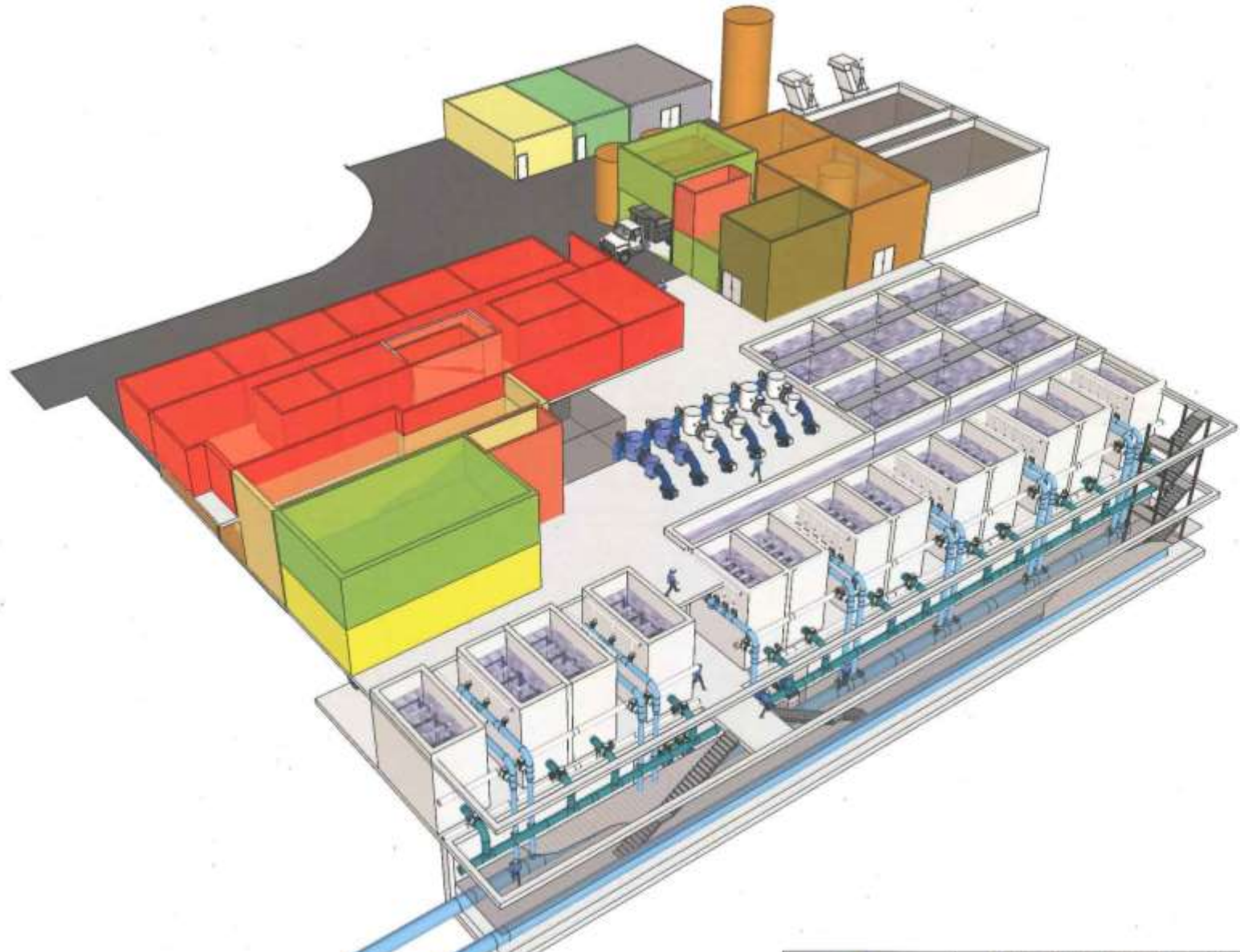
# Major Findings of VE #1

- Build a single building for all operations
- Optimize building layout and operational efficiency (\$7.5 M)
- Use chlorine gas instead of on-site hypo generation (\$1.3 M)
- Install membrane cassettes for 10-year life (instead of full capacity) \$940k
- Use reject from secondary membranes to augment stream flow in summer (\$1.5M)
- Total cost savings: ~\$12 M

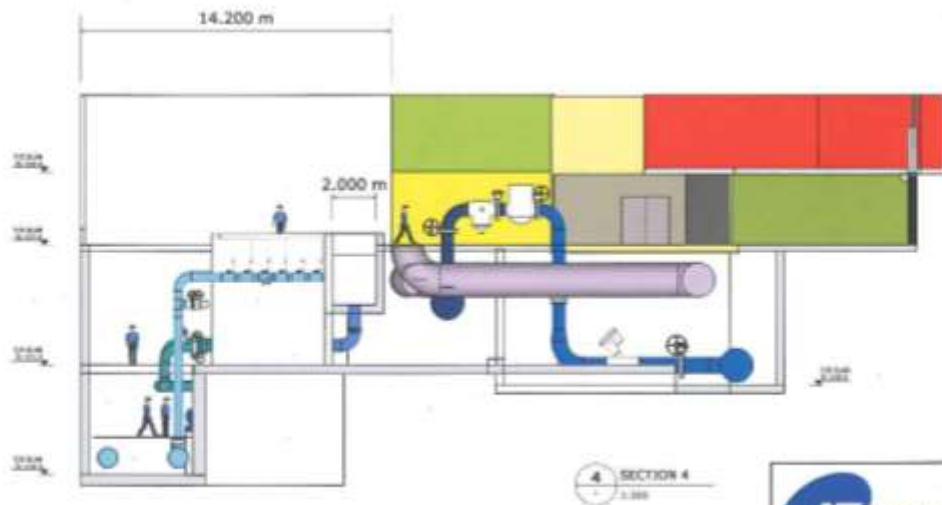
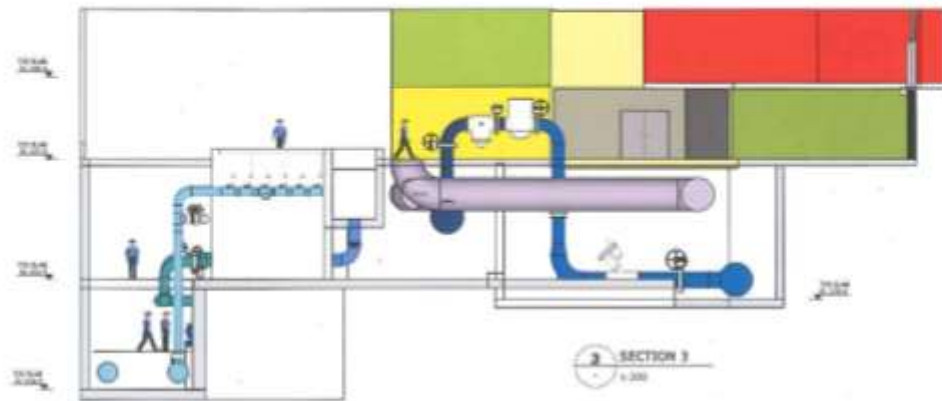
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After



# Design Cost Estimate

Offsite Pipelines	\$7 million
Civil Site-works	\$5 million
Membrane Equipment Pre-purchase	\$9 million
Water Treatment Facility	\$26 million
Inflation and Contingency Allowance	\$10 million
Engineering & Indirect Project Costs	\$8 million
<b>Total Capital Cost</b>	<b>\$65 million</b>

# VE Exercise #2

- Held at 50% detailed design
- City PM and Operator & consultant PM on VE Team again
- Industry experts: some old, some new, all borrowed, none blue (or green for that matter)
- Conducted by the same facilitators – brings continuity and comfortable relationship
- 4 days

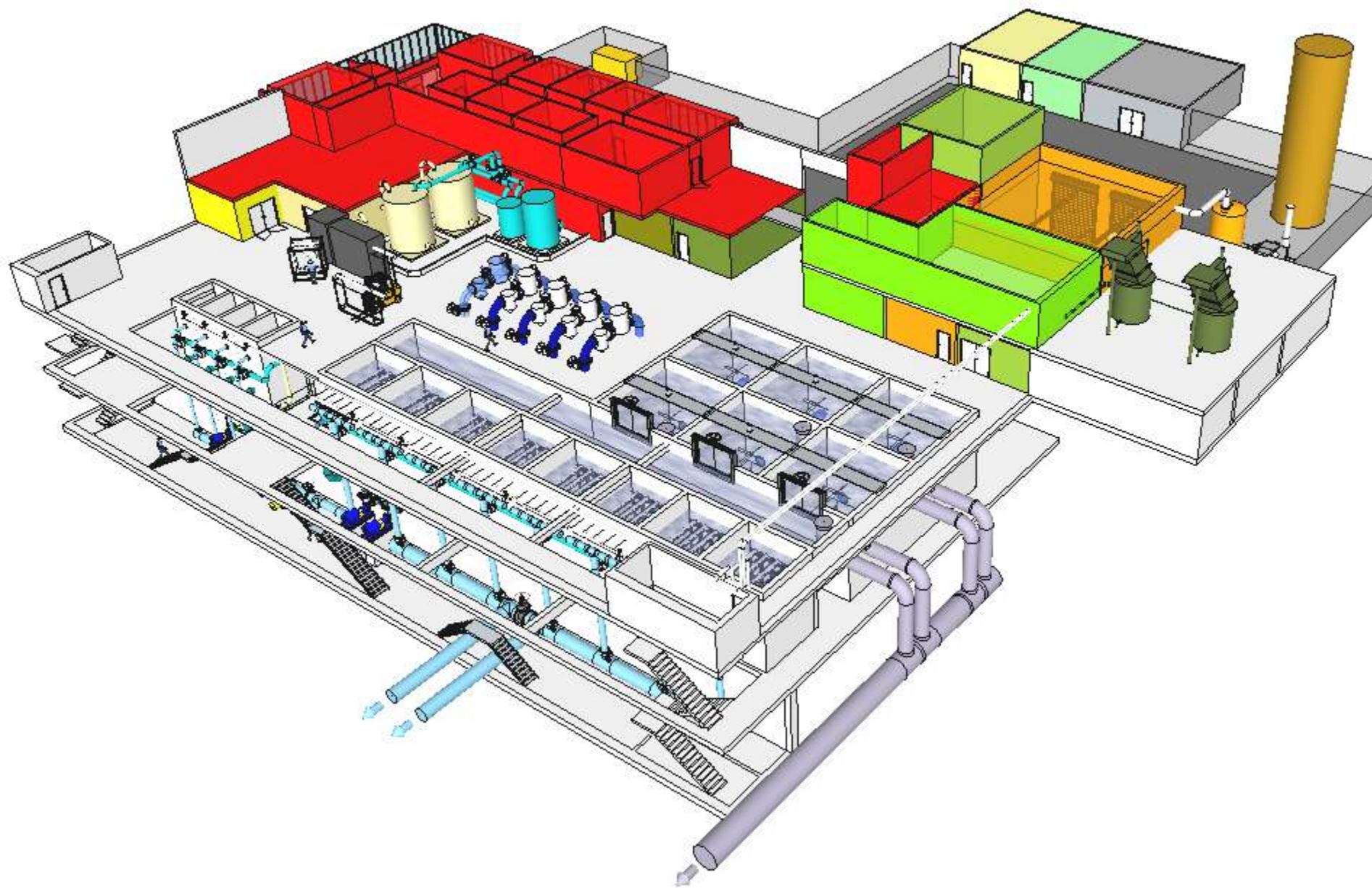
# Major Findings of VE #2

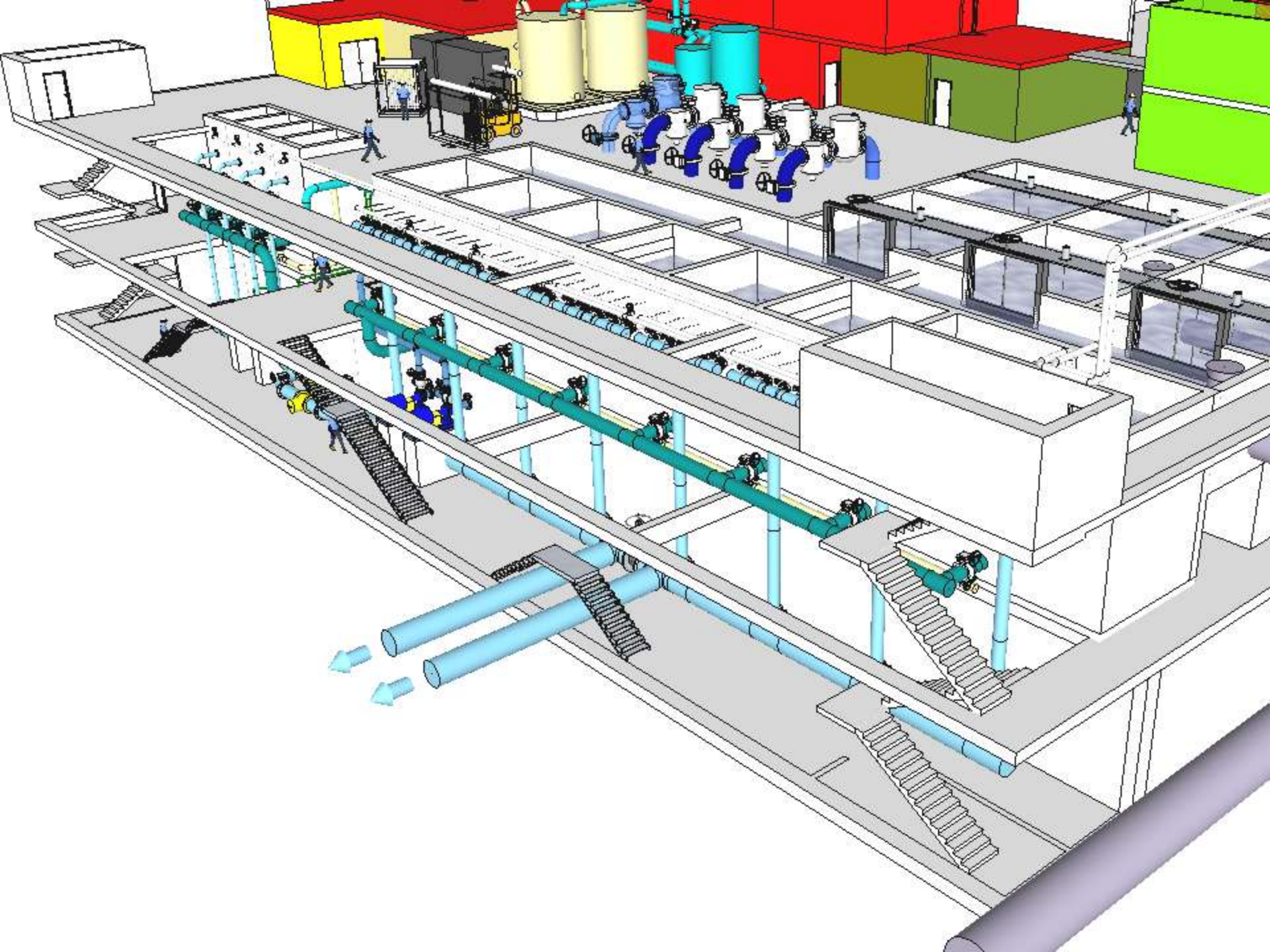
- Reduce piping complexity (\$1.1M)
- Revisit plant staffing (\$8.5 M – 20 year life)
- Resize gen-set (\$250k)
- A number of electrical efficiency improvements (\$1.7)
- A number of design suggestions that will improve operations (truly what it's all about)
- Validated cost estimate (relief!)



# Final Design



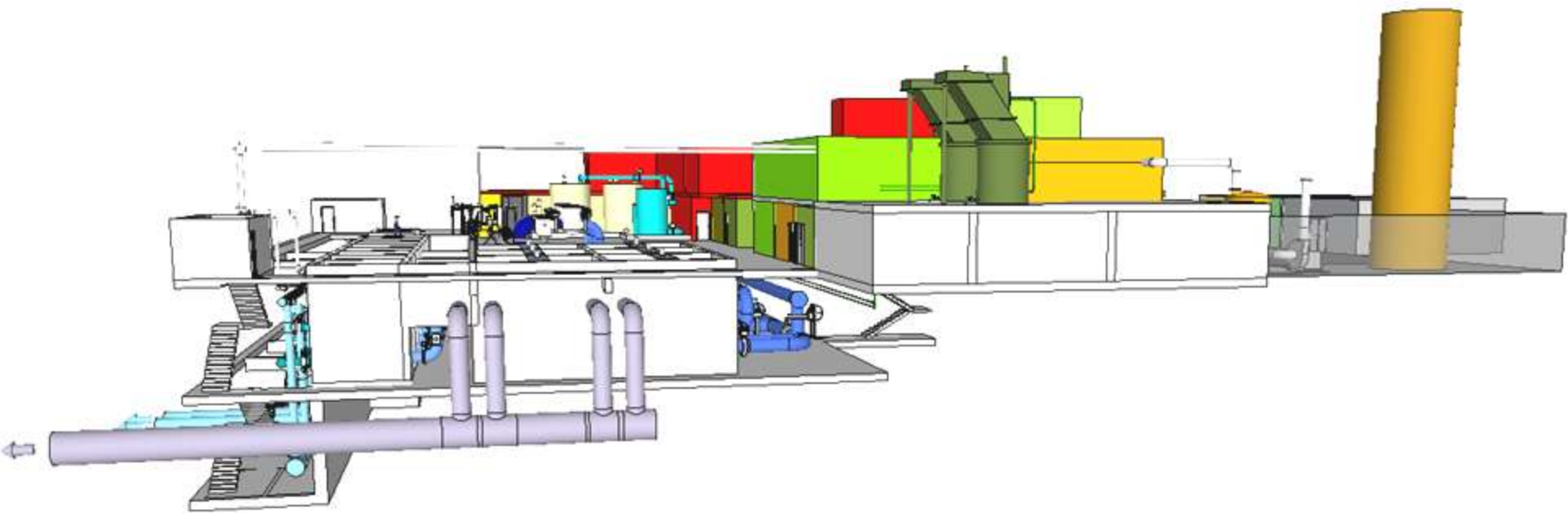




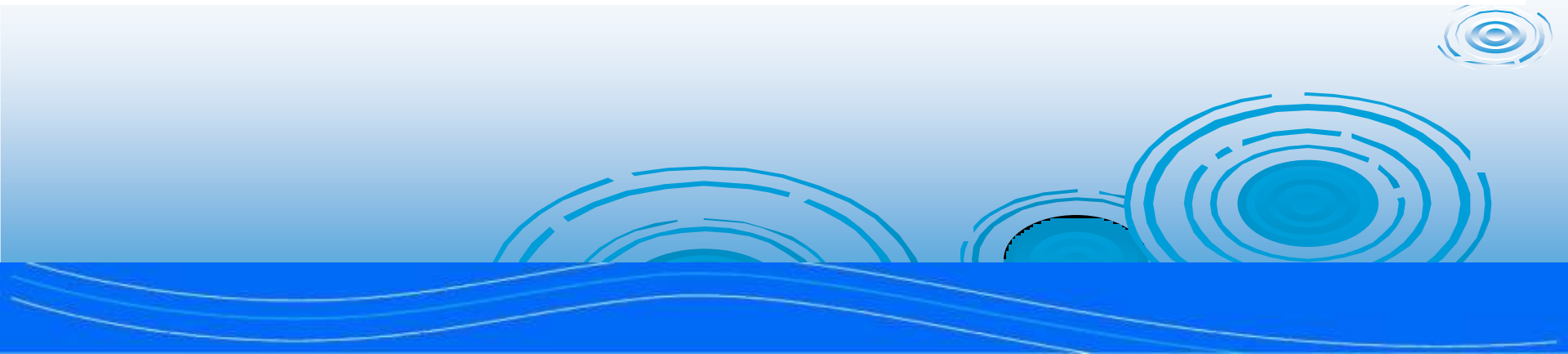
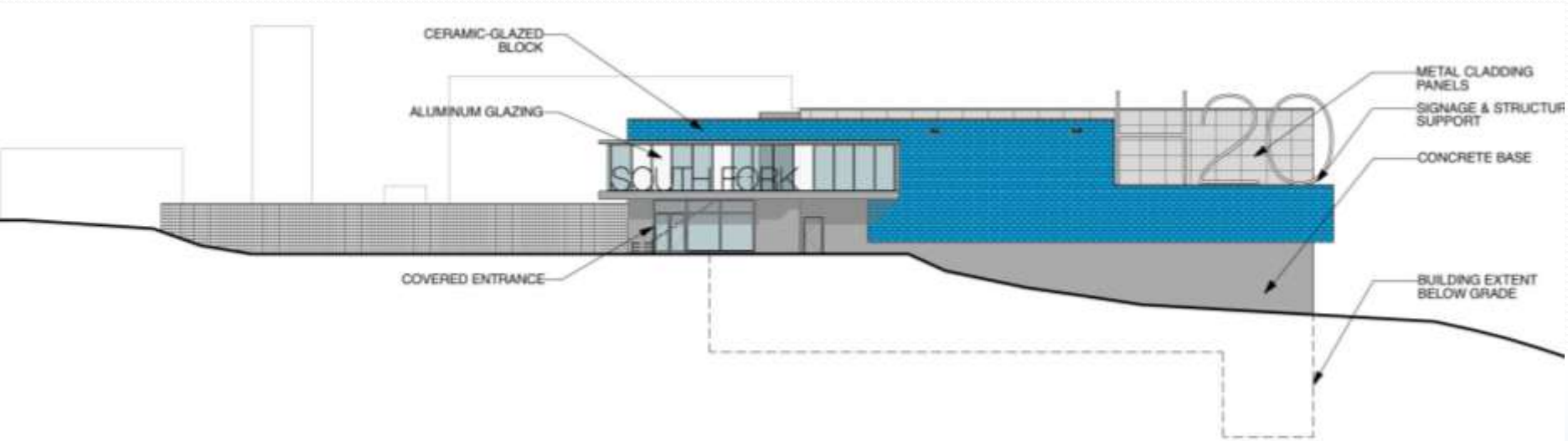
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# T H E H A R B O U R C I T Y



# Lessons Learned

- VE Study costs: \$110k + 110k
- Capital savings when everything integrated: \$7.5M + 3M
- Facilitation by a pro very important (CVS)
- Team needs to be un-attached (i.e. no consultants that didn't win the job!)
- In our case, PM and Operator involvement was beneficial – could quickly explain culture of City, design rationale

- VE early in process = greater benefit (i.e. draft predesign, or at concept stage). Once in the detailed design stage, hard to find major change; greater impact to schedule
- 3D Model greatly aided the VE Team
- Brings a high level of confidence to the project
- Worthwhile for projects \$10M +

# Lessons (cont'd)

- Lots of up-front focus (trying to get it right)
- Always a push at the end of design
- What happens when bids come in 15% high?
- Preconstruction estimate: 42.5 M
- Tenders: 47.5 (2<sup>nd</sup> was 47.7)
- Contractor proposed a 'VE Exercise'

# Contractor's VE

- Essentially a scope/cost reduction
- Again, 3D model was beneficial
- Managed to shave \$1.72 M
  - Delete maintenance bldg, change finishes, downsize equipment
- Final award amount: \$45.8
- City adjusted budget to \$70M (additional borrowing)



# OK, let's get on with it

- We thought we were out of the woods, budget wise, but the voters of BC had other plans.... regressed to a PST/GST model.
- Province came out with rules *after* award
- Needed to include an allowance of \$2M
- (Infrastructure projects more costly, but at least there's no PST on meals anymore!)

# On time and on budget! (right?)

- Original target: Dec 31, 2014
- Current aspiration: Sept 30, 2015
- Implications for Waterworks Operating Permit
- Change Orders (excl PST) are less than 2% < +ve!
- Working on structural steel superstructure, with target of January to have a closed building (have you been on the Wet Coast in winter?)

# Further lesson

- How did VE help here?
- The scope was solid; defensible
- We set the project up for success, but sometimes there's things out of our control....
- The project team was focussed in getting the project right
- Lesson (or maybe a fact of life):
  - When the design is done, the project team isn't as available to problem solve, and it relies on the construction team
  - Very little opportunity for cost reduction/improvement

# What may have helped

- Speculative hindsight.... Do projects always have to cost more and take longer?
- Realistic expectations:
  - Constructability review
  - Schedule validation (was 24 months enough?)
- Contractor involved in 50% design VE?





07/11/2014

