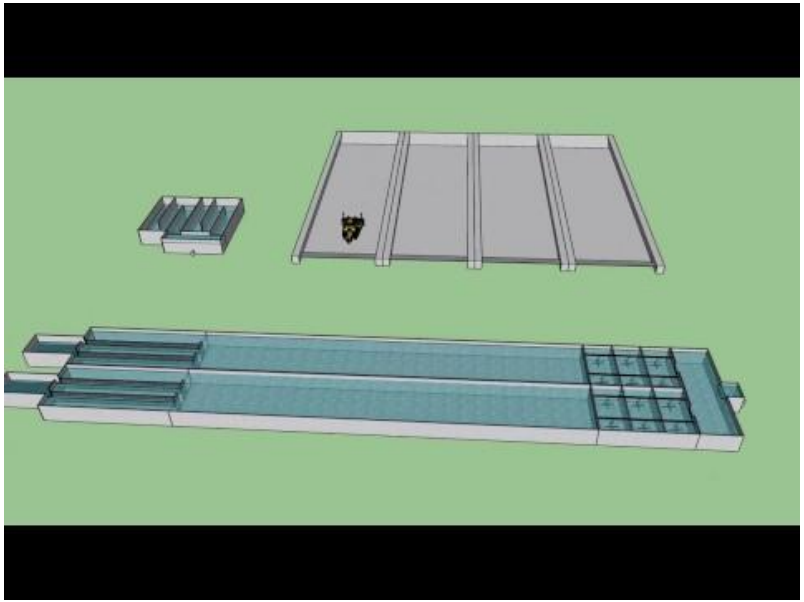


If video doesn't work, use link
https://youtu.be/E55lst_D0uk

Website: civicusengineering.github.io

Civicus Engineering

J. Lannister Water Treatment & Dinklage Memorial Intake

Prepared By:
Group 1

First Client Meeting: 5-23-18

Patrick Cheng, ENV SP
Transportation Engineer

Alex Tran, STP CA, ENV SP
Structural Engineer

Chris Estevan, STP CA
Transportation Engineer

Andrew Koscal
General Civil Engineer

Abraham Mercado
General Civil Engineer

Dang Nguyen, STP CA, ENV SP
Transportation Engineer

Our Company

Established this morning

Architectural/Engineering/Construction Services (AEC)

Sustainability

Project Description

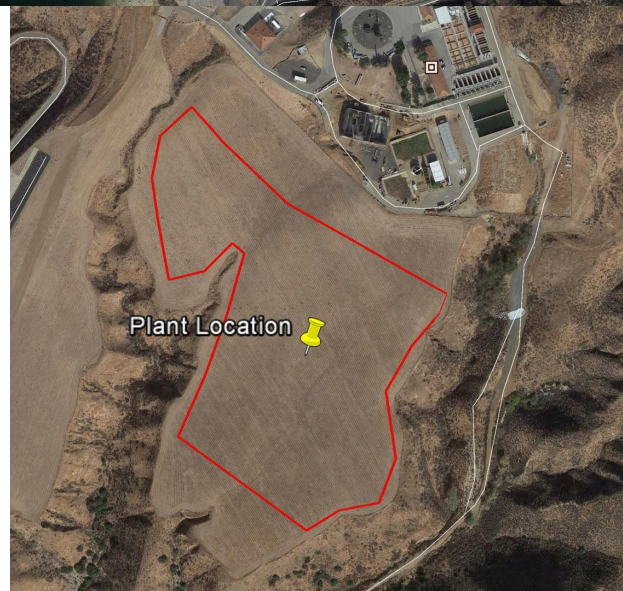
Project located near Castaic Lake, Castaic.

Client: Castaic Lake Water Agency (CLWA)

Project: Replace existing water treatment plant (Earl Schmidt Filtration Plant)

Proposed Intake will be sited near the shoreline

Proposed Water Treatment Plant will be sited near existing treatment plant



Site Background

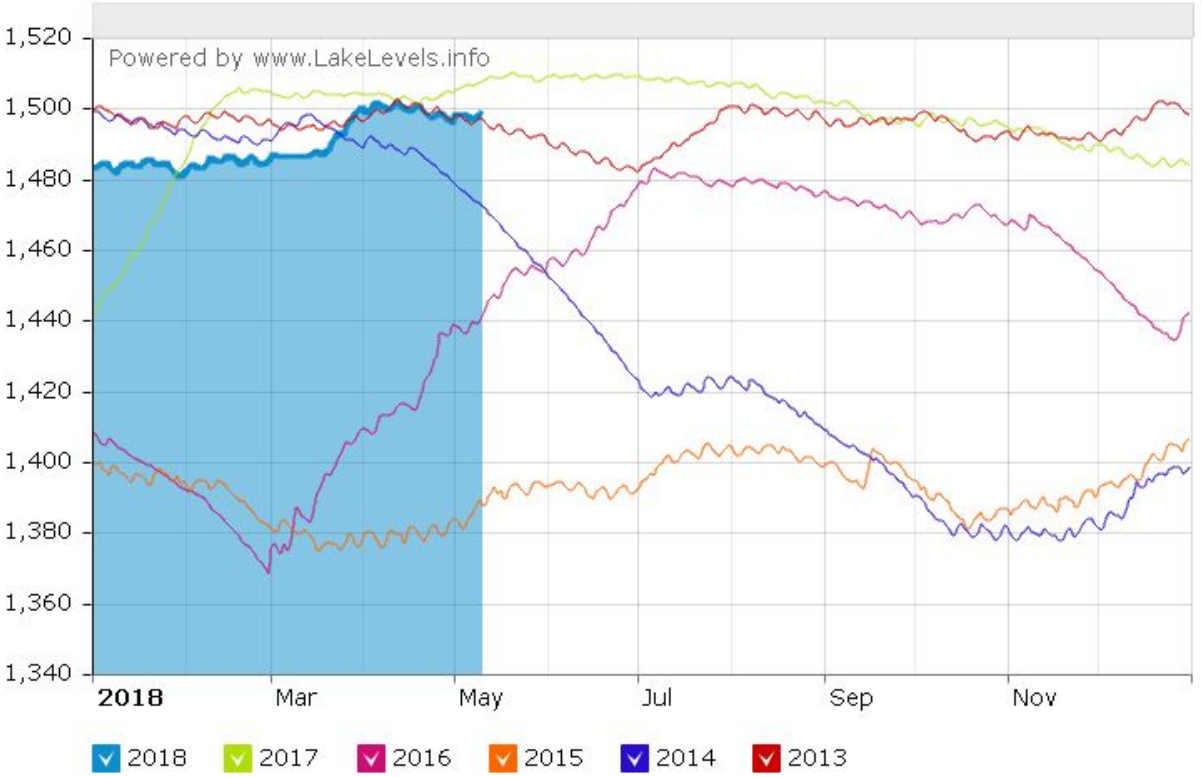
Lowest Lake Level: 1370’ above sea level (ASL)

Highest Lake Level: 1510’ above sea level (ASL)

Max Water Level: 1515’ ASL due to Castaic Dam Spillway

No earthquake faults on site

Loam Soil at site



Sustainability Considerations

Utilize Envision (rating system for green infrastructure)

Use recycled content for building materials

Permeable pavements

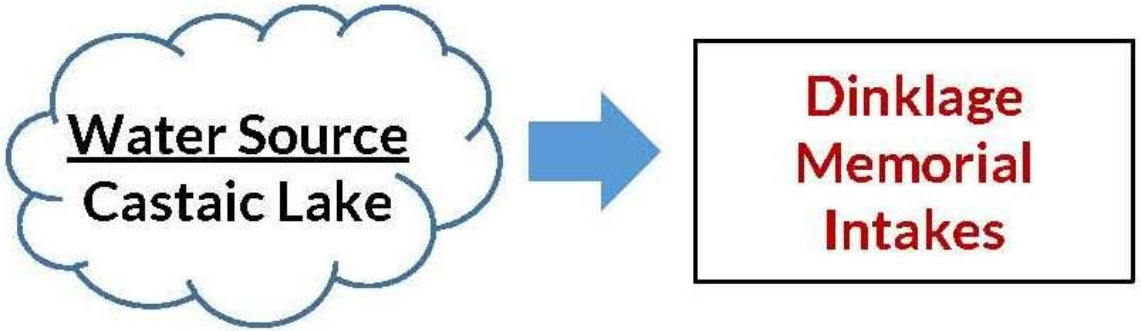
Use native plants & eliminate invasive plants

Implement swales to capture and reuse rainwater

Use Tesla’s solar panels and battery packs for renewable source of energy

ENVISION™

Intake Design



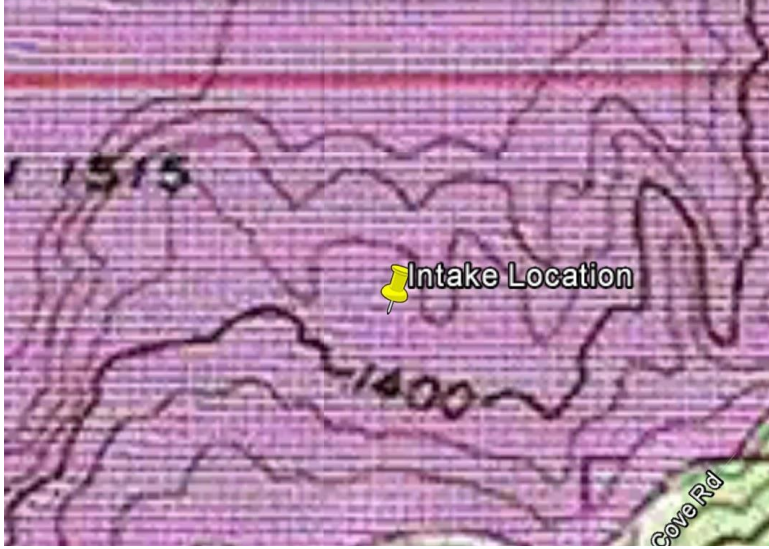
Proposed Intake Site

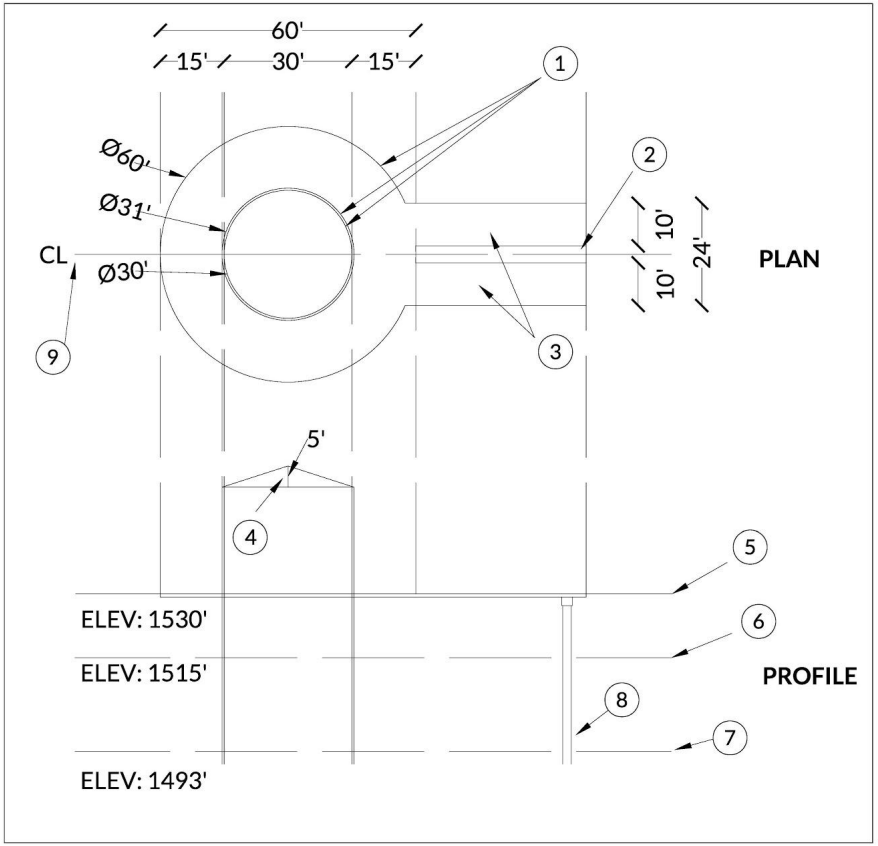
Lowest Water Level: 1360’ ASL

Highest Water Level: 1510’ ASL

Intake Tower from 1365’ to 1530’ ASL

- 165’ tall
- Access bridge required
- Reinforced concrete





CIVICUS
ENGINEERING

9400 Flair Dr
El Monte, CA 91731

CLIENT: Castaic Lake Water Agency

CLIENT REPRESENTATIVE:
Professor David Whipple

DRAFT NO.: 1

DRAWN BY: Alex Tran 5-18-18

CHECKED BY: Chris Estevan 5-19-18

REGISTERED CE STUDENT
ALEXANDER TRAN
Exp. 06/2018
No. 102016
CIVIL
STATE OF CALIFORNIA

PLAN TYPE: PLAN/PROFILE

PROJECT ADDRESS

Lat: 34.523347°
Long: -118.599049°

INTAKE TOWER STRUCTURAL PLAN

PROJECT NO.: 52318

SHEET 2 OF #

Pump Selection

Five identical pumps

- Three pumps operate at minimum flow rate
- Two extra pumps accommodate maximum flow rate

Pump Characteristics

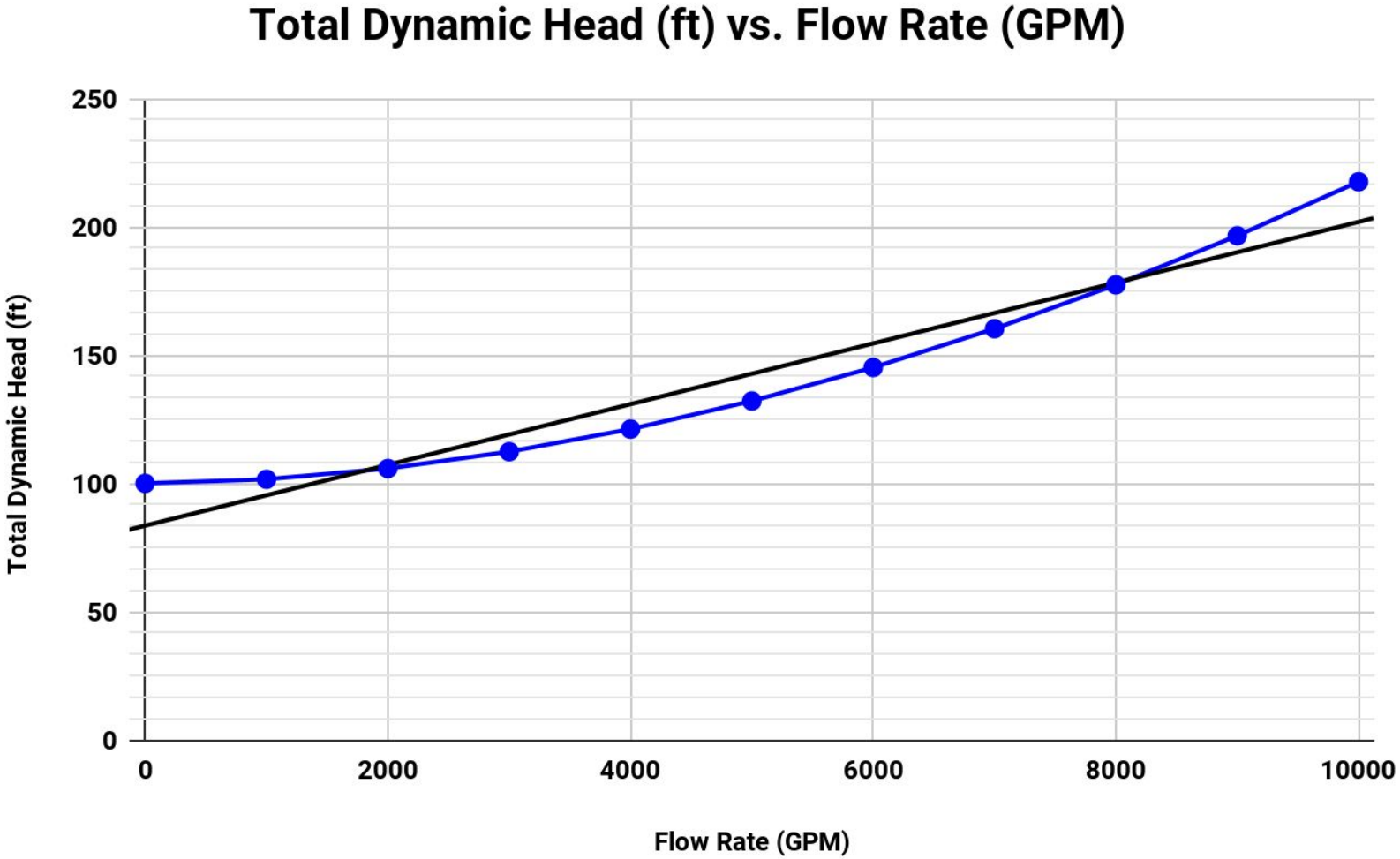
- Pipe Diameter = 2 ft
- Total Pipe Length = 11,000 ft
- Flow Rate (Q) = 12.0 MGD = 18.6 cfs
- C Coefficient = 100

$$Q = V(A) = V(\frac{\pi}{4}D^2) => D = \sqrt{\frac{4Q}{\pi V}}$$

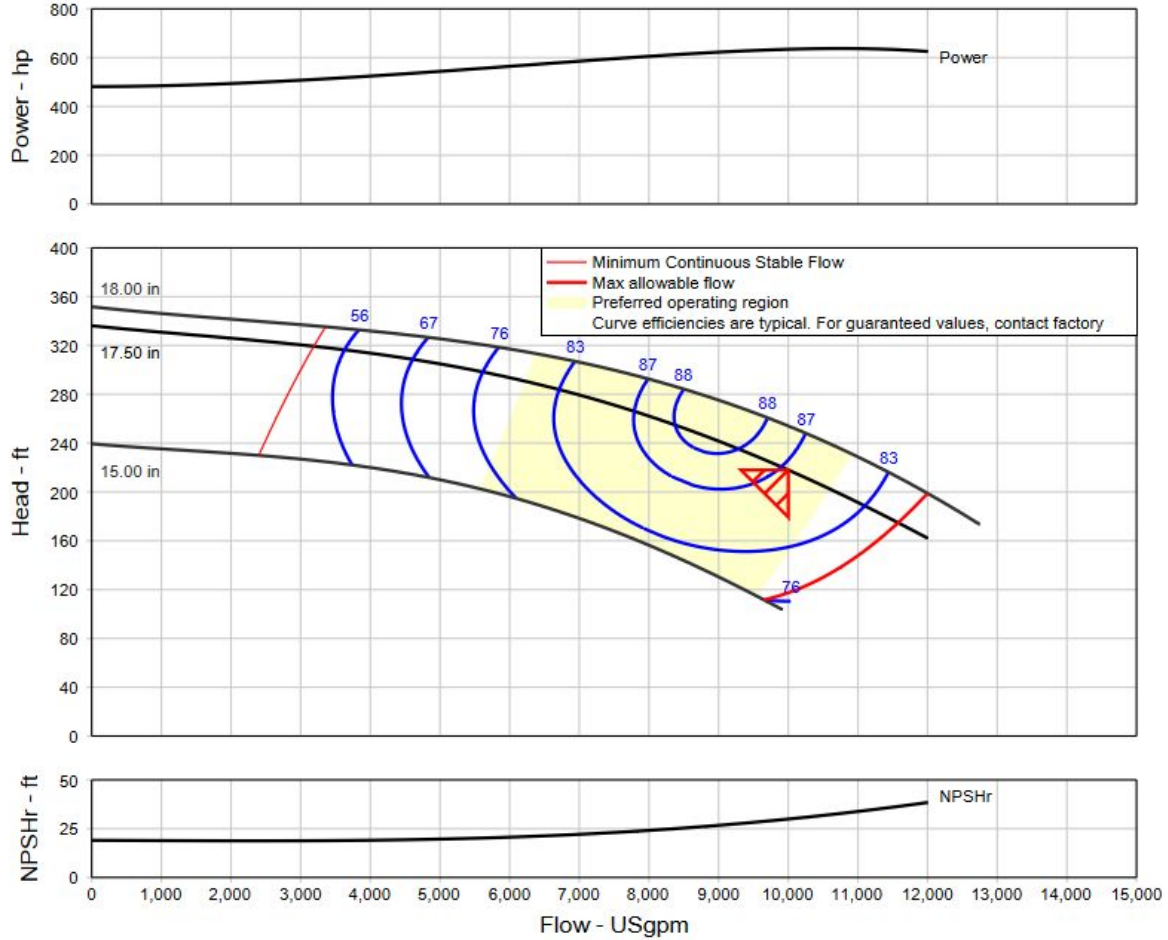
$$H_{Major} = \frac{4.73(L)(Q^{1.85})}{(D^{4.87})(C^{1.85})}$$

$$Total\ Dynamic\ Head = H_{Static} + H_{Minor} + H_{Major}$$

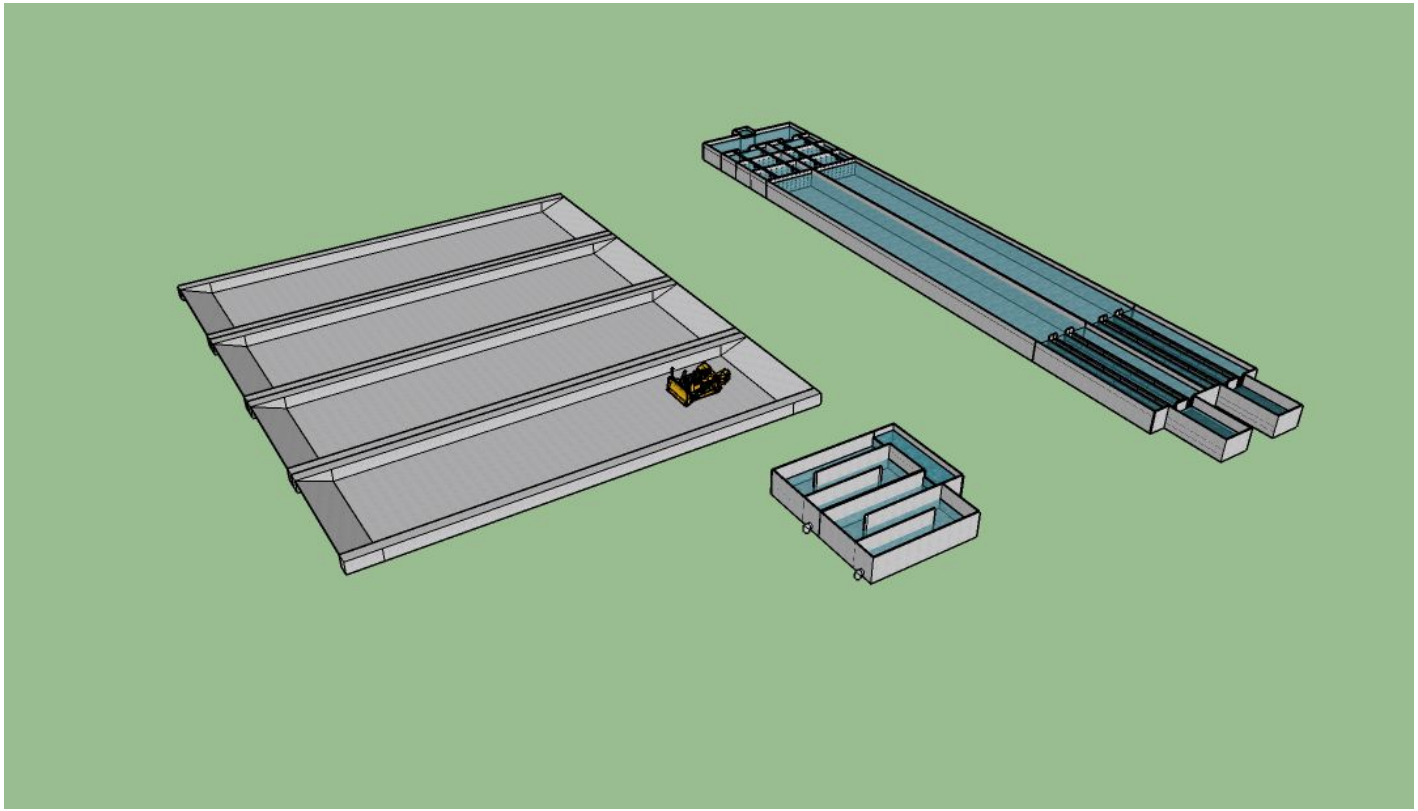
System Demand					
Q (gpm)	Q (cubic feet per second)	Major Losses (ft)	Minor Losses (ft)	Static Head (ft)	Total Dynamic Head (ft)
0	0.00	0.00	0.00	100.00	100
1000	2.23	0.70	0.09	100.80	102
2000	4.46	2.52	0.36	102.91	106
3000	6.68	5.34	0.80	106.21	112
4000	8.91	9.09	1.42	110.64	121
5000	11.14	13.73	2.23	116.15	132
6000	13.37	19.24	3.21	122.73	145
7000	15.60	25.59	4.36	130.34	160
8000	17.83	32.76	5.70	138.96	177
9000	20.05	40.74	7.21	148.58	197
10000	22.28	49.50	8.90	159.19	218


Total Dynamic Head (ft) vs. Flow Rate (GPM)
250
200
150
100
50
0
Total Dynamic Head (ft)
0
2000
4000
6000
8000
10000
Flow Rate (GPM)

Pentair - Aurora Split Case Pump 410 Series



Plant Design



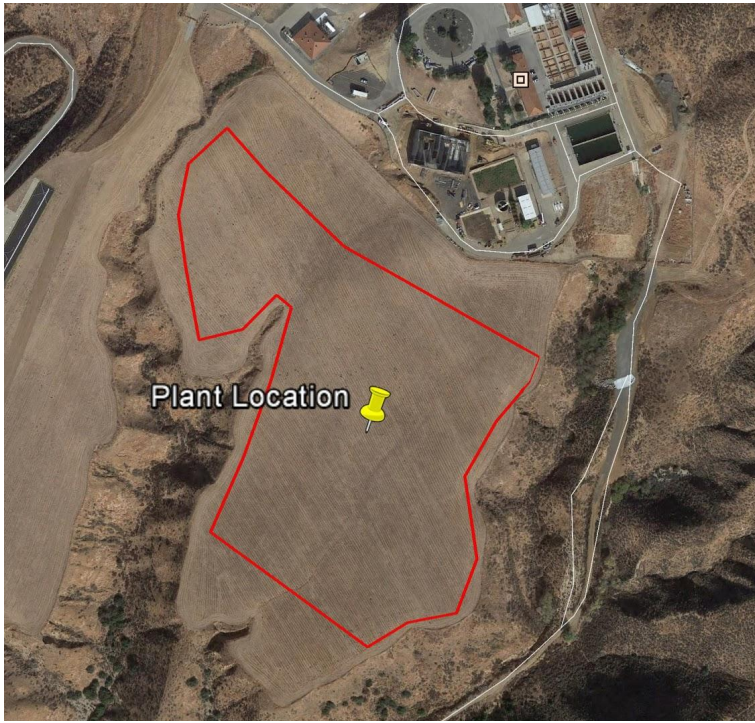
Plant Sizing

Qmax = 12 MGD

Area greater than or equal to $(Qmax)^{0.7}$

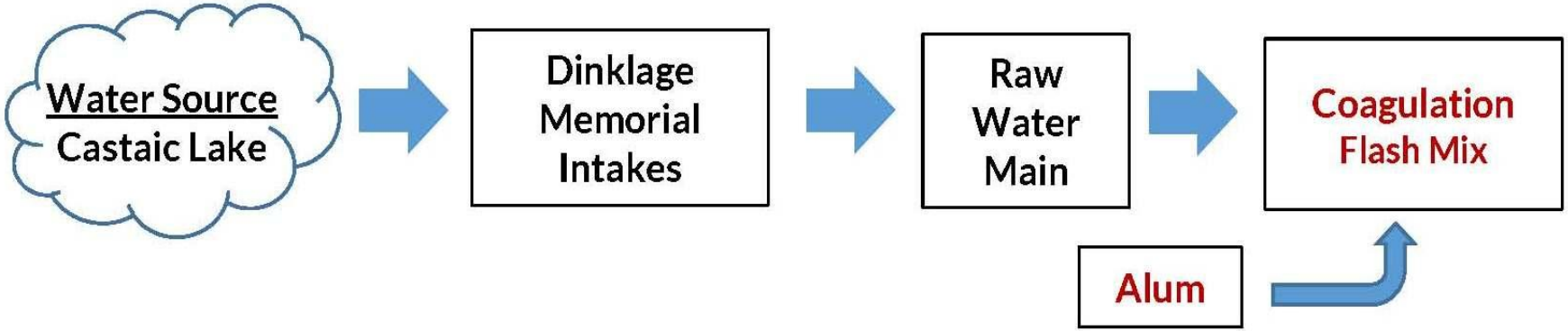
A = 5.7 acres

Proposed Plant Site: 17.2 Acres



Plant Design

Coagulation



Flow Meter & Coagulation

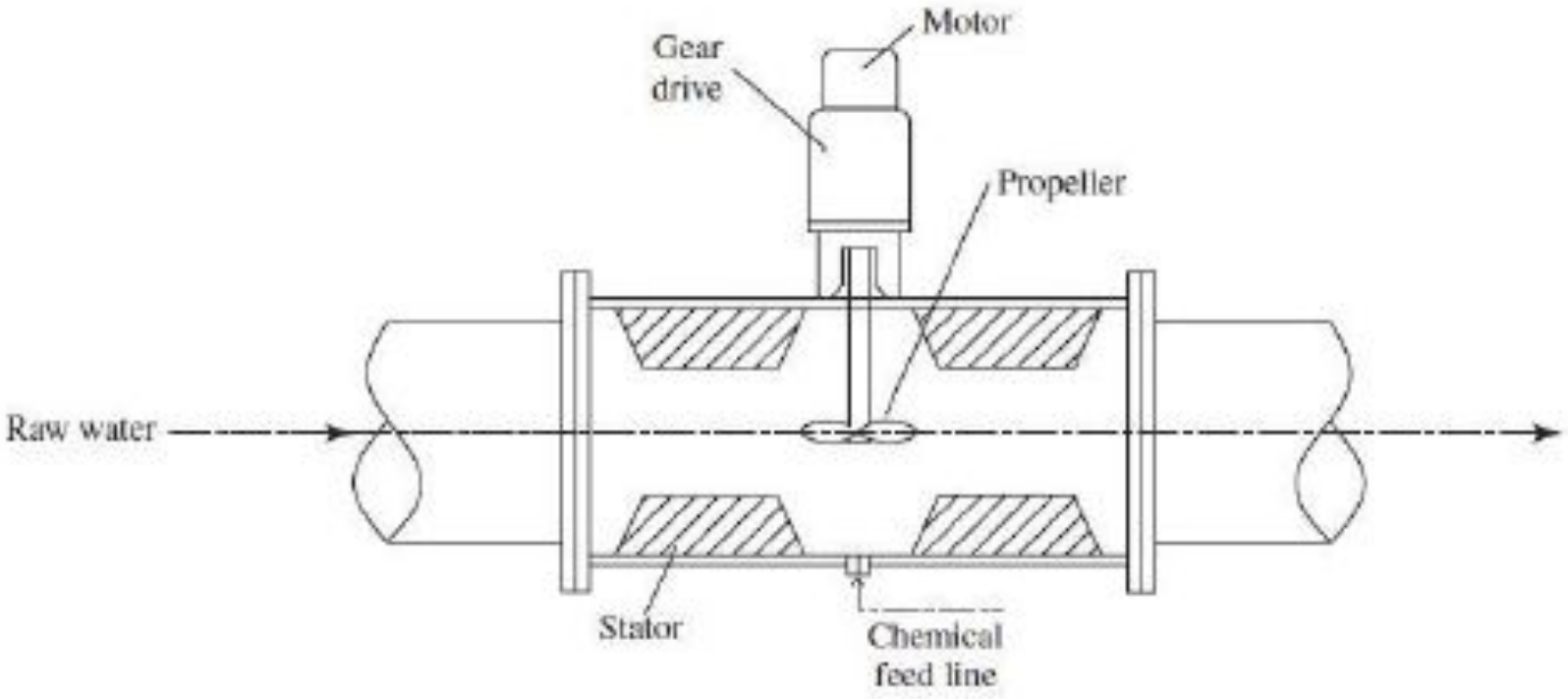
- Coagulant → Alum
- Flow Meter → Venturi Design
  - ➔ Average Inlet Velocity (V) = **8 ft/s**
  - ➔ Q_{avg} = **12.4 cfs**
  - ➔ Diameter (D) = A $4Q/\pi V$ = A(4*12.4 cfs)/(π8 ft/sec) = 1.40 ft ≈ **18”**
  - ➔ Length (L) = **15 ft**

In-Line Blender

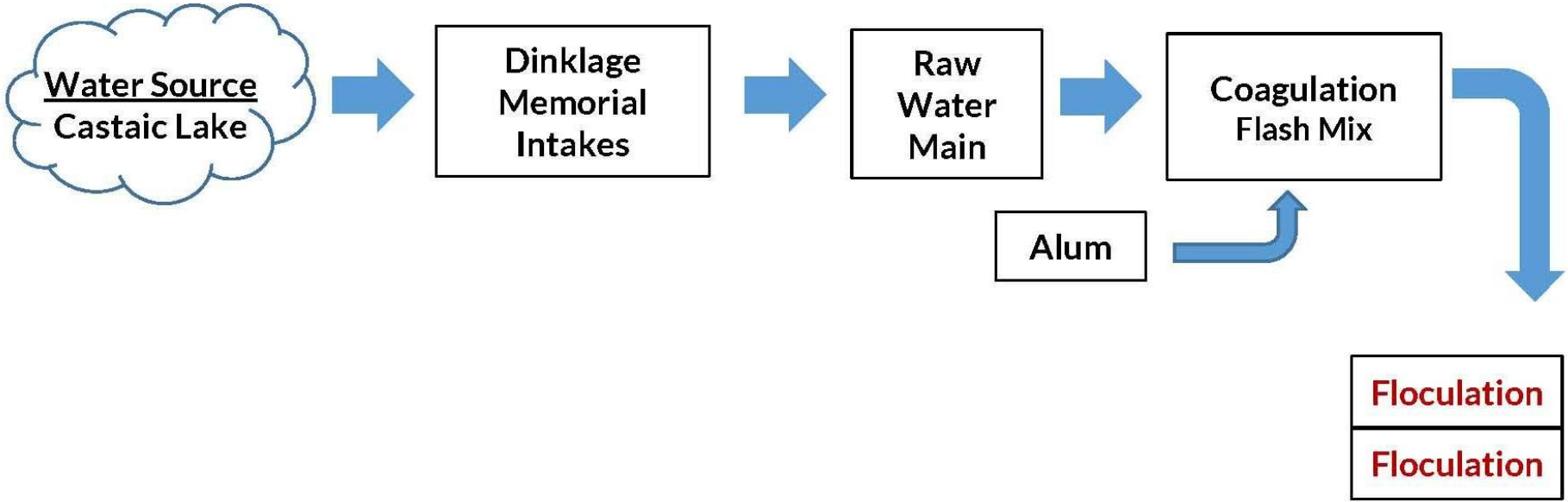
- Mixing time (t) = 1 sec
- Alum Dose = 5-50 mg/L
- Spec
  - ➔ Length of mixing zone = **6 ft**
  - ➔ Diameter of mixing zone = **2 ft**
  - ➔ Volume of mixing zone = **18.8ft^3**

- Q_{pd} = 0.05 Q_{max} = 0.93 cfs
- Velocity (V) = 23.8 ft/sec
- D = A(4Q/V π) = 3″
- TDH = 23.5 ft
- BHp = $Q\gamma DH$ / 550ε = 3.10Hp
- $Motor\ H$P = BHp/ ε = 3.10 / 0.8 = **4 Hp Motor**

Pump Diffusion System



Flocculation



Flocculation Design Summary

- 2 Total Flocculation Tanks each→ L x W x D = 48 ft x 32 ft x 11 ft
- 3 Stages with 2 Flocculators per Stage
- Flocculator Blade Diameter→ 6 ft

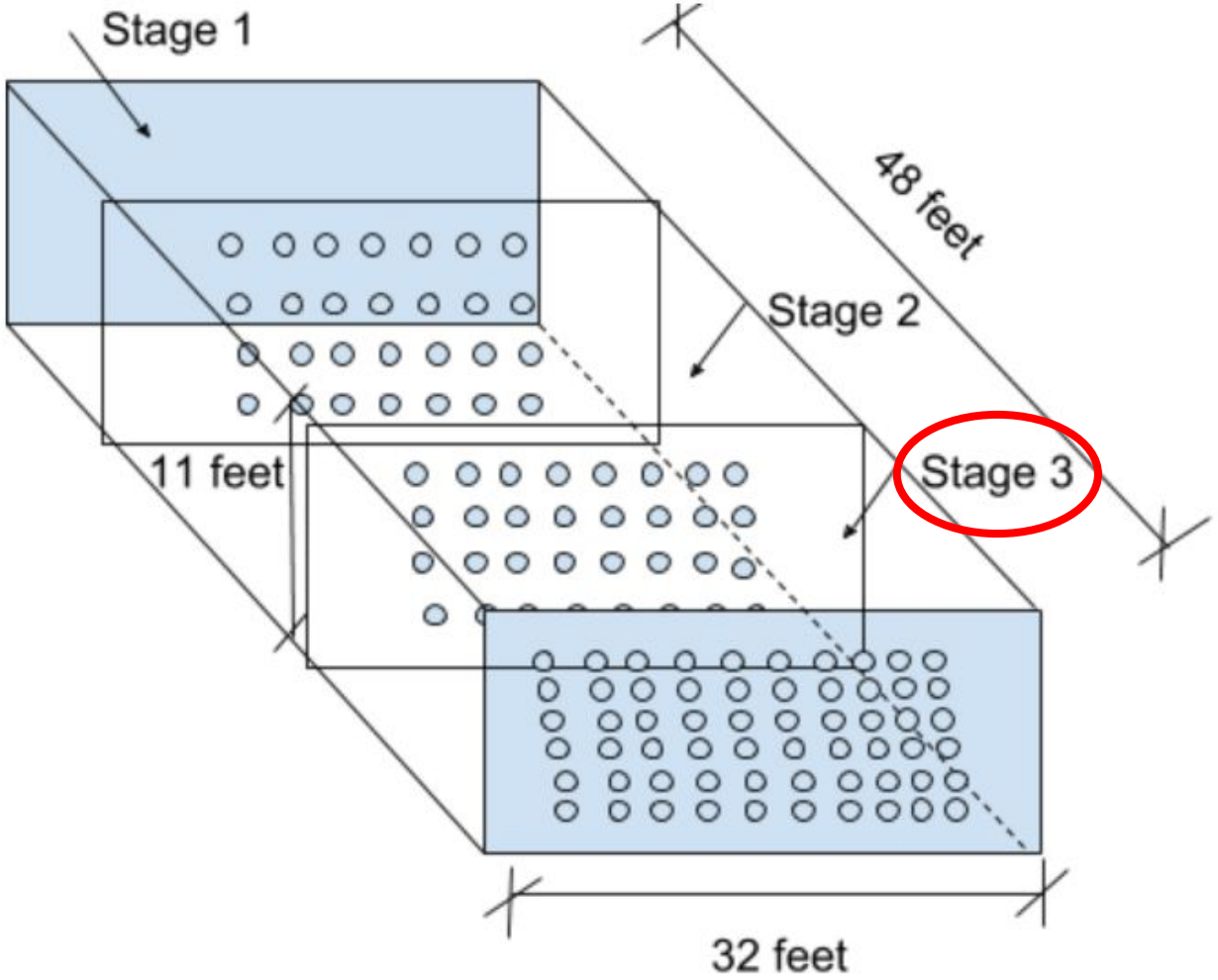
Flocculator Motor Summary

Stage	RPM	HP
Stage 1	22.3	2
Stage 2	15.9	1
Stage 3	3.2	0.25

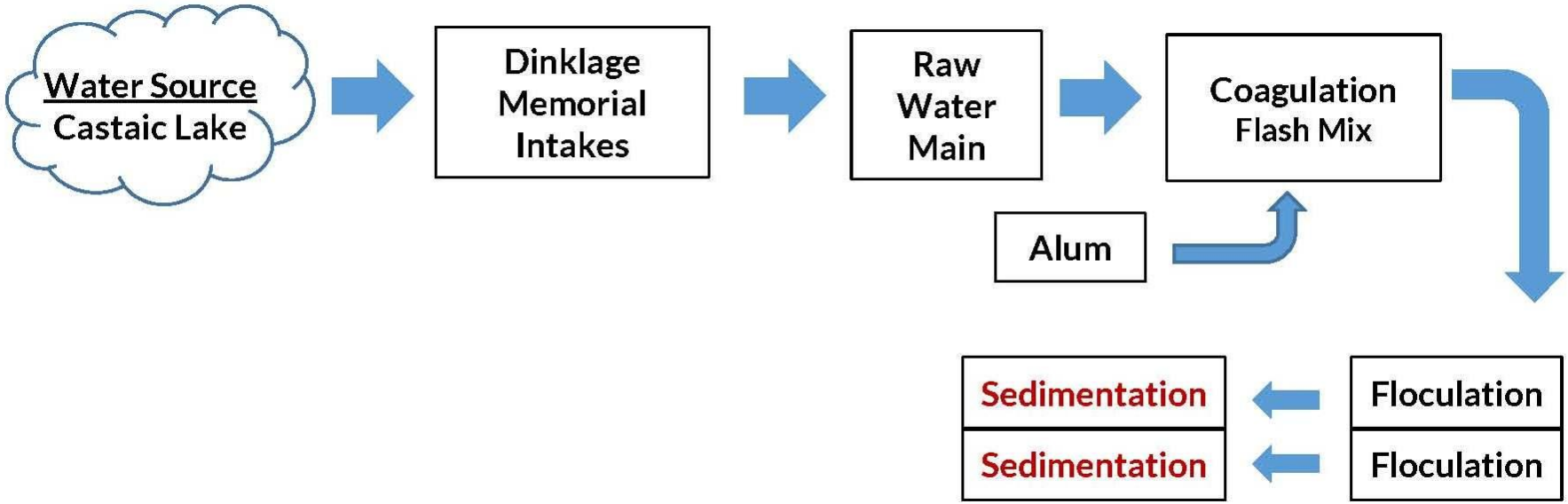
Baffled Wall Design Summary

Stage	Velocity Through Baffle Wall, ft/sec	Number of Circular Ports	Port Layout
Stage 1	1.8	28	7 columns (3.5 ft wide) and 4 rows (2 ft deep)
Stage 2	1.5	32	8 columns (4 ft wide) and 4 rows (2 ft deep)
Stage 3	0.8	60	10 columns (6 ft wide) and 6 rows (3 ft deep)

Flocculation Tank

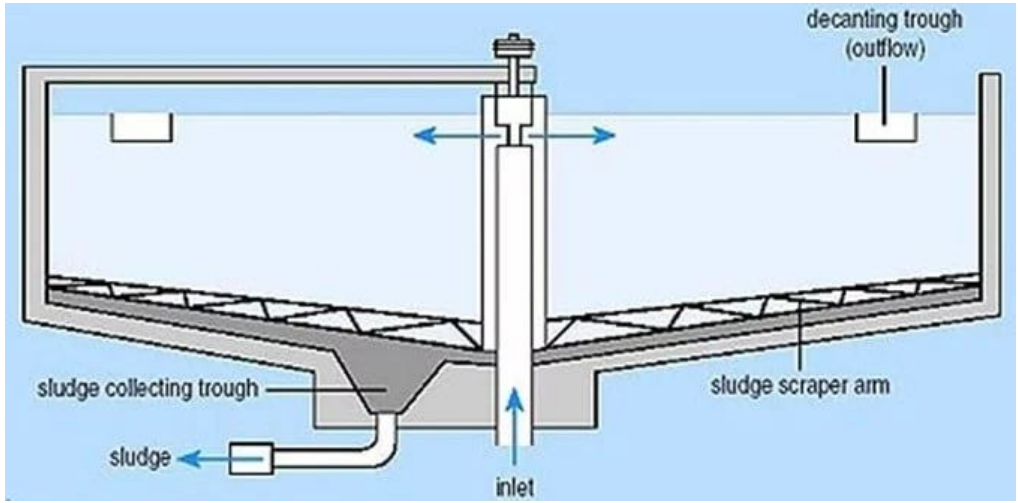


Sedimentation



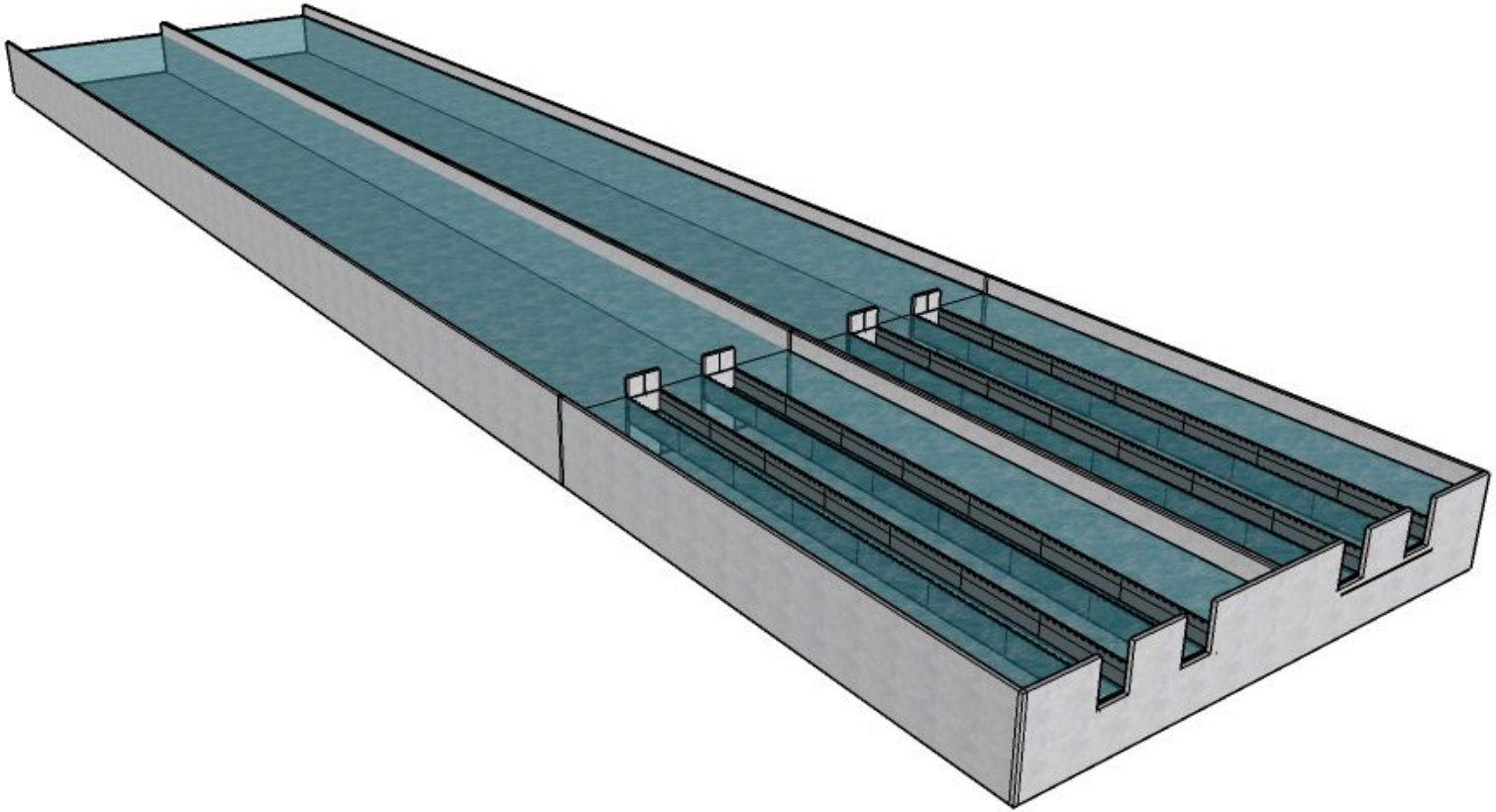
Sedimentation

- Water moves slowly through tank and suspended floc settles to bottom.
- Clearer water moves out through launders, while settled floc creates sludge at bottom of tank.
- A scraper periodically pushes sludge into a hopper where it is pumped out.

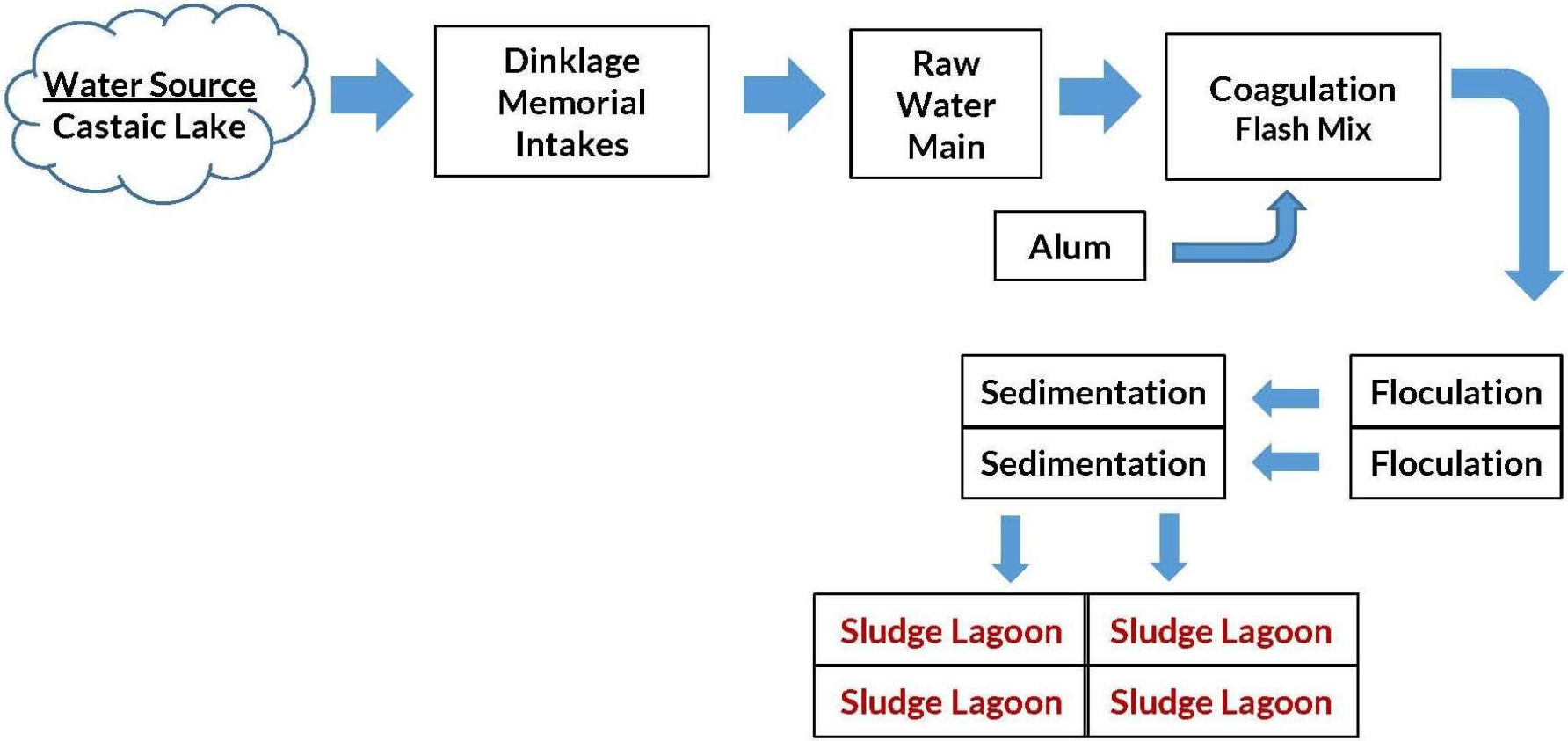


Sedimentation Design Summary

- 2 Total Sedimentation Tanks each→ L x W x D = 220 ft x 32 ft x 11 ft
- Horizontal Velocity → 1.6 ft/min
- Average Detention Time → 2.2 hours
- Sludge Pump Capacity → 320 GPM
- 2 Launders in each tank that draw on both sides → 70 ft each



Sludge Lagoon

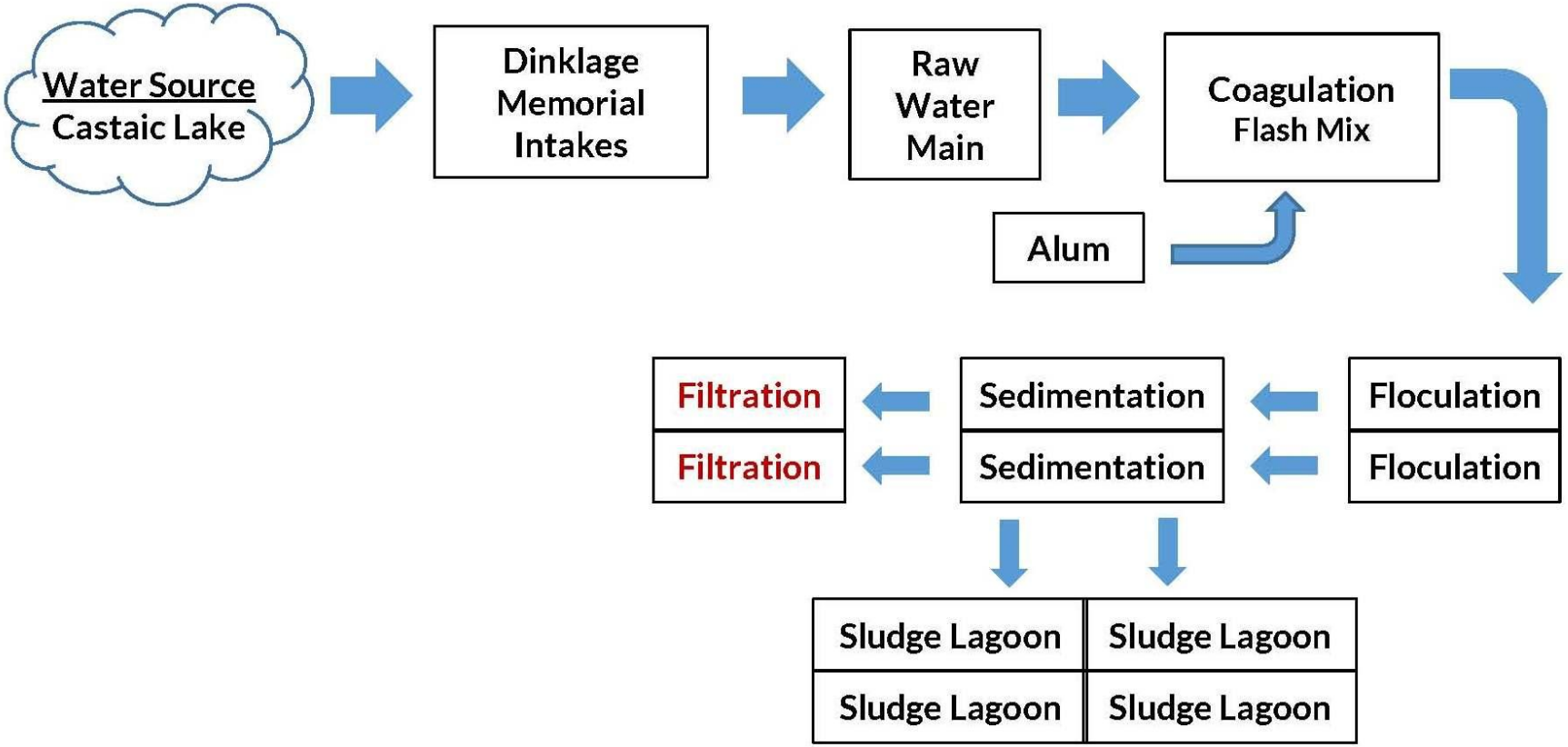


Sludge Lagoon

- 4 identical sludge lagoons
- Holds sludge for 90 days
  - 187,200 lbs of sludge
    - 20 mg/L alum dosage
    - 20 NTU raw water turbidity
- Lagoon size
  - ≈12,000 ft^2
  - 6 feet deep
  - 4W:1L
  - Width = 55 ft
  - Length = 220 ft

Picture taken from Agua de Lejos Field Trip

Filtration


Water Source
Castaic Lake
Dinklage Memorial Intakes
Raw Water Main
Coagulation Flash Mix
Alum
Filtration
Filtration
Sedimentation
Sedimentation
Floculation
Floculation
Sludge Lagoon
Sludge Lagoon
Sludge Lagoon
Sludge Lagoon

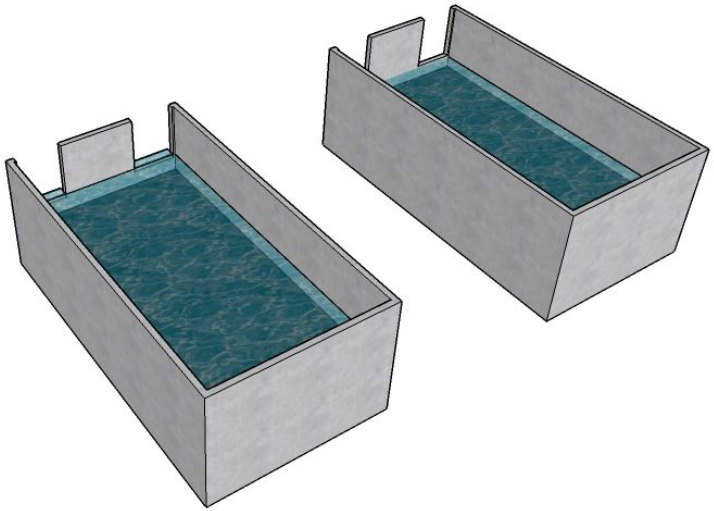
Filtration

- 4 Total Filters each→ L x W = 28 ft x 14 ft

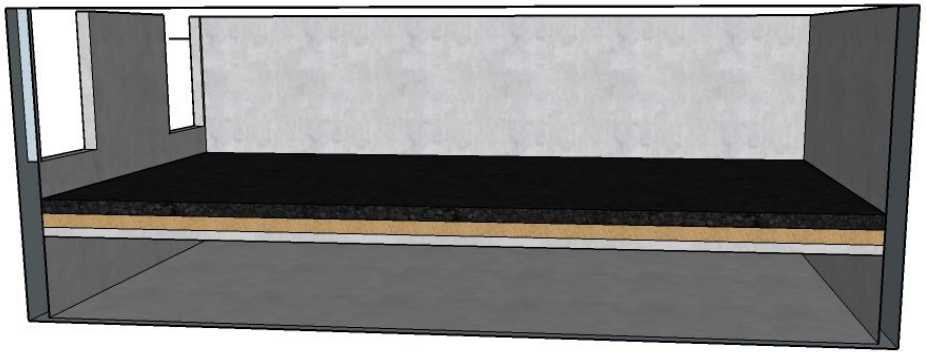
- Uses standard dual media filter with anthracite coal as top layer and sand as bottom.
- To clean the filter, the system uses a self backwash with fixed nozzle surface wash system.

Filtration Gravel Support Layers

Layer #	Passing Sieve Size	Retaining Sieve Size	Depth of Layer
1	¾”	½”	3”
2	½”	¼”	3”
3	¼”	NO 6 Sieve	3”
4	NO 6 Sieve	NO 12 Sieve	3”

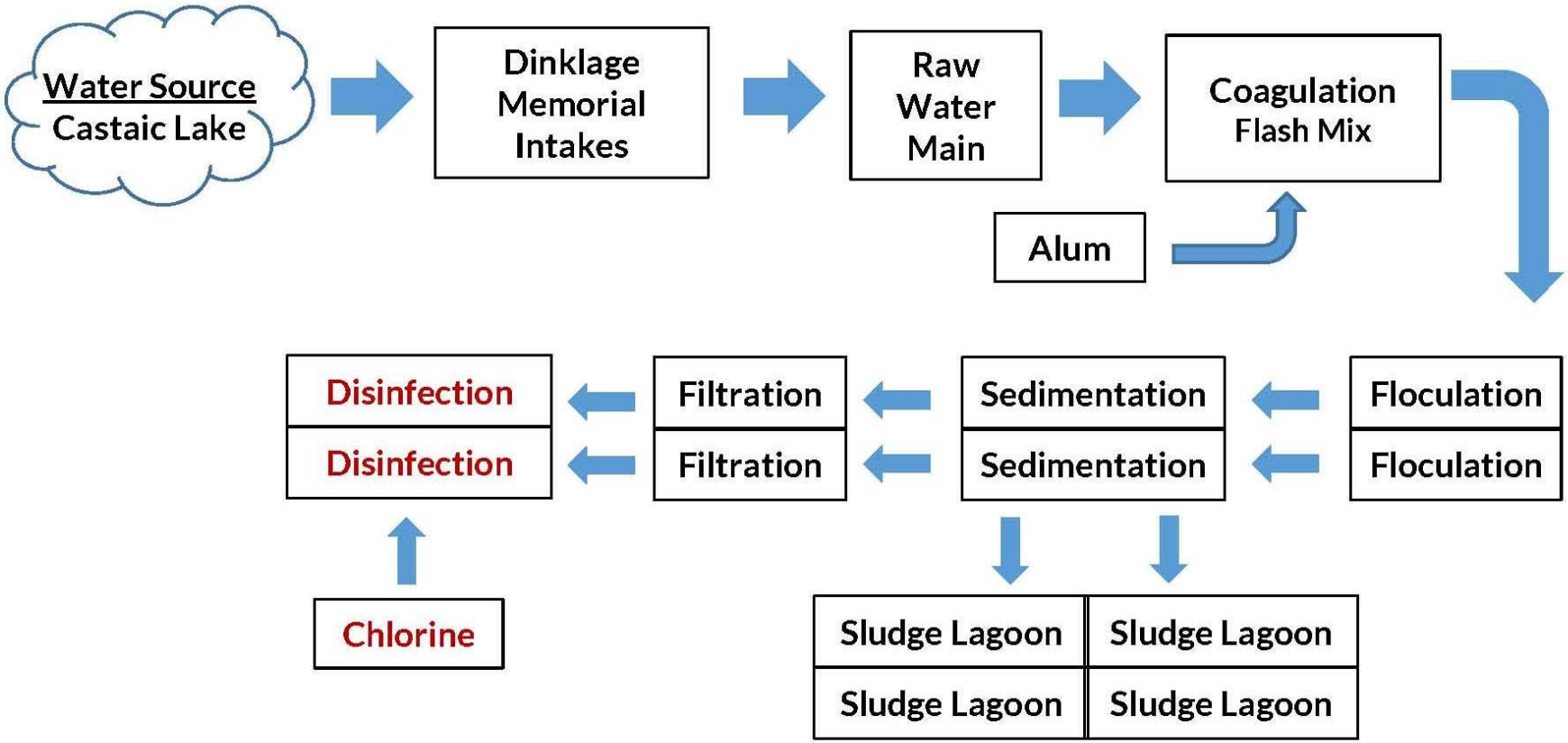


Isometric View of FIltration Tanks



Cross Section of FIltration Tanks

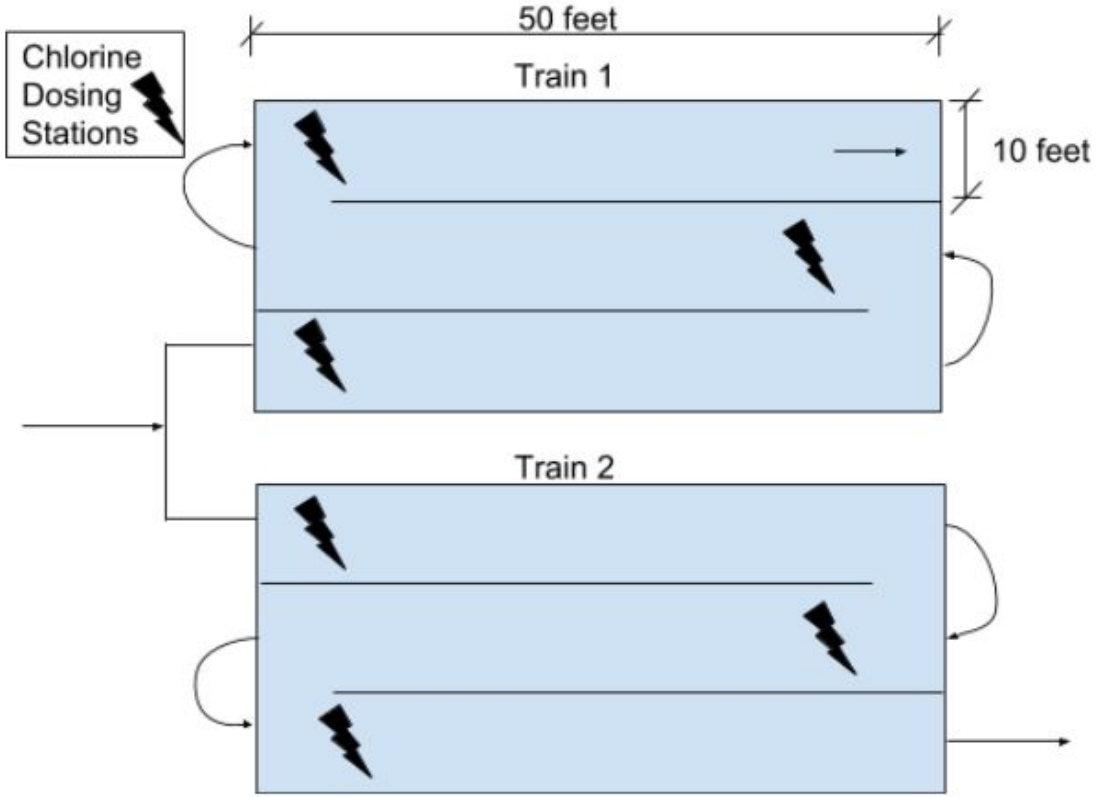
Disinfection



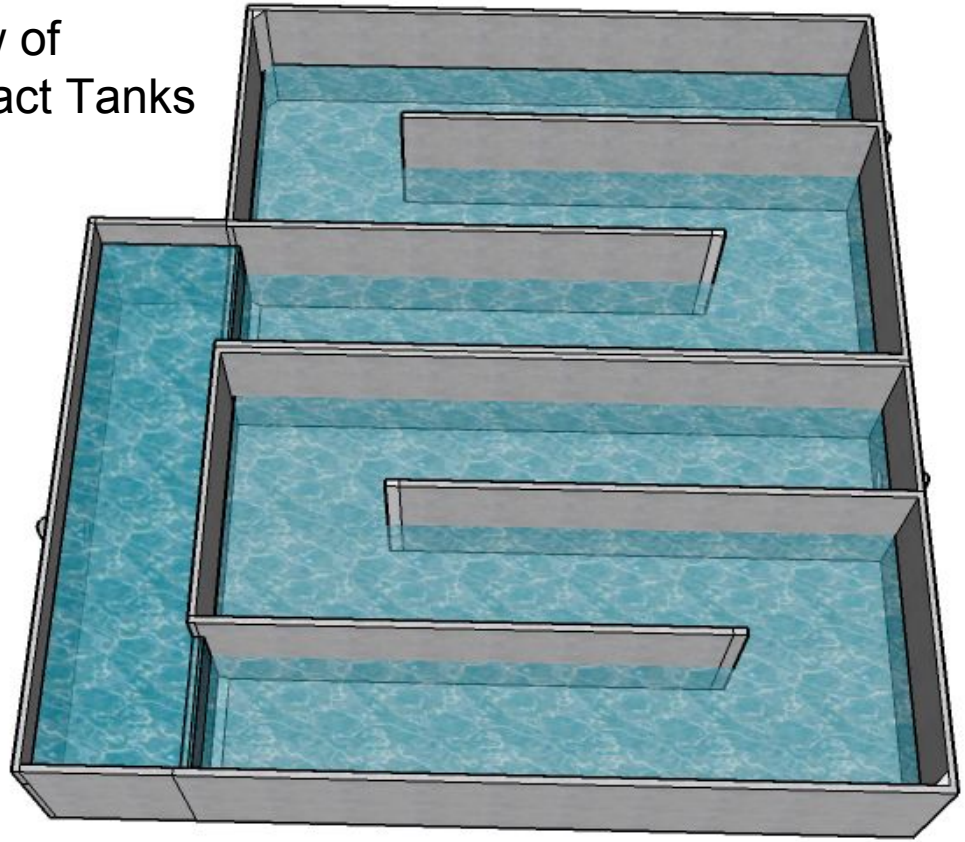
Disinfection Design Summary

- Total Volume of Two Parallel Trains→ 36,000ft^3
- Train Volume → 16, 760 ft^3
- Each Train has 3 Tanks Parallel to each other
- Tank Volume → 5580 ft^3
- Tank Dimensions → L x W x D → 50 ft x 10 ft x 12 ft
- Total Chlorine Residual→ 32.3 mg-min/L
- Chlorine Contact Time→ 32.3 min

Disinfection



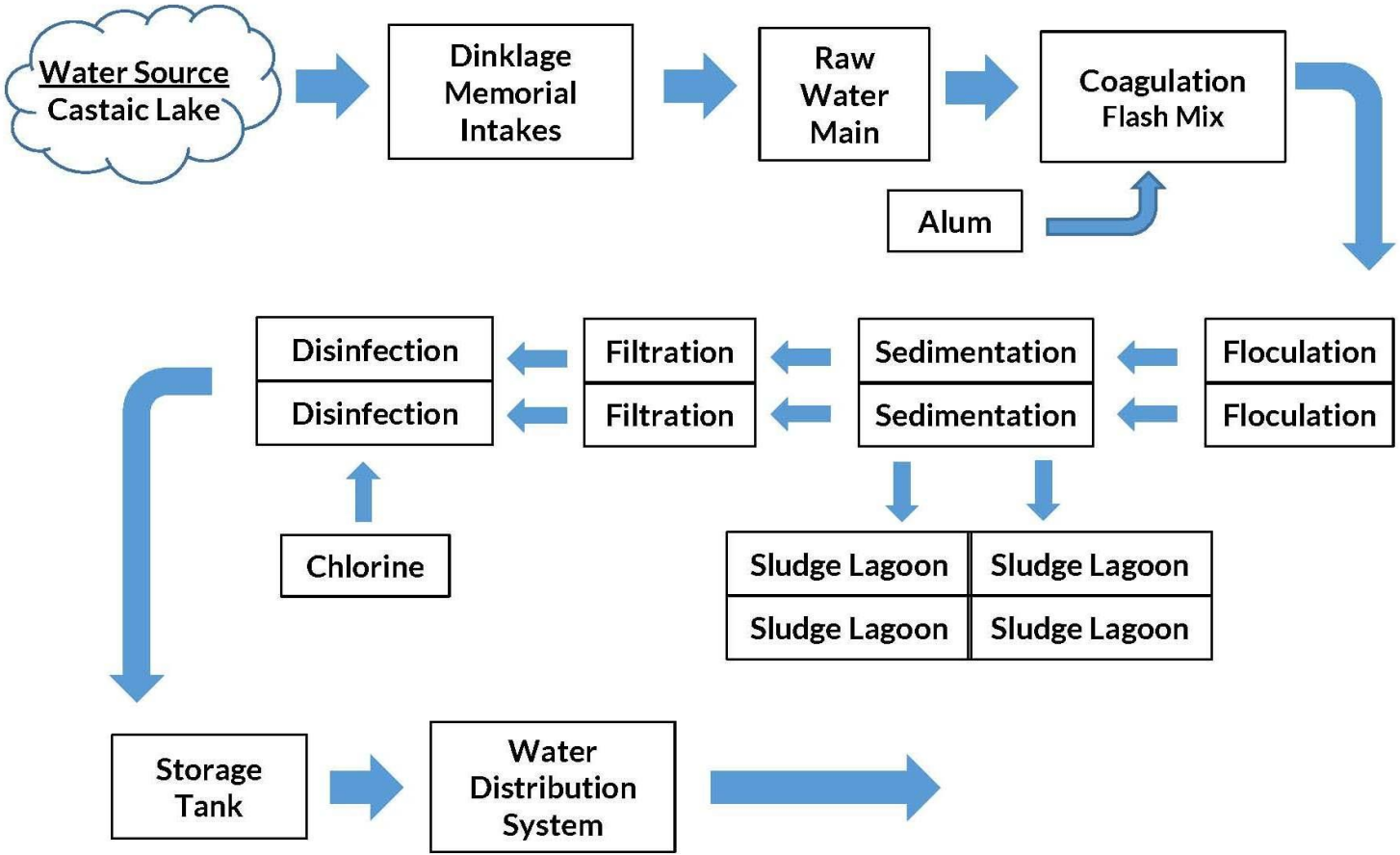
Isometric View of
Chlorine Contact Tanks



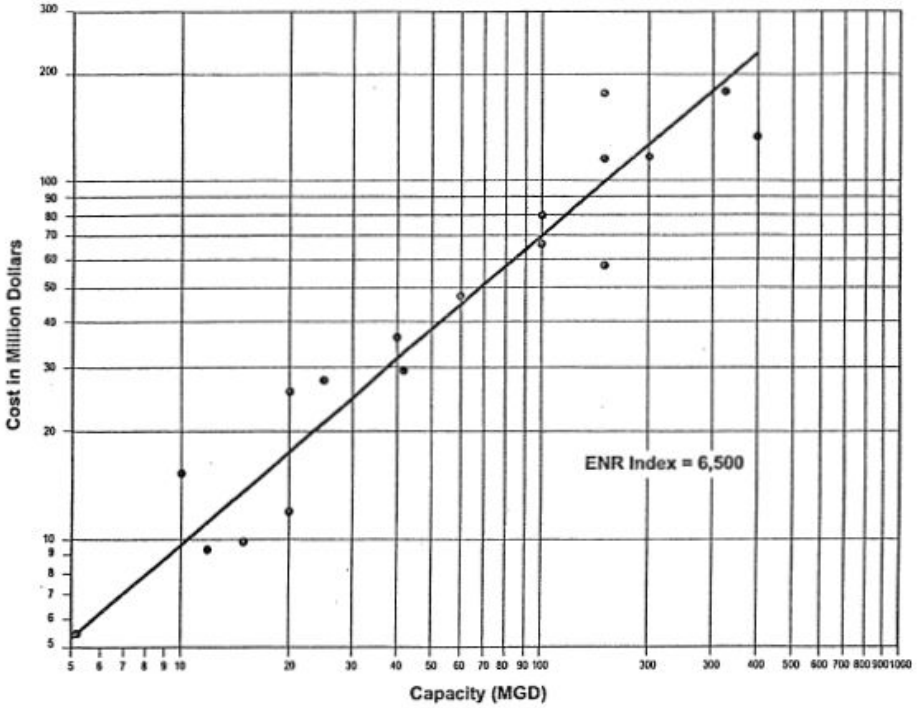
LOADING PROCESS DIAGRAM…..

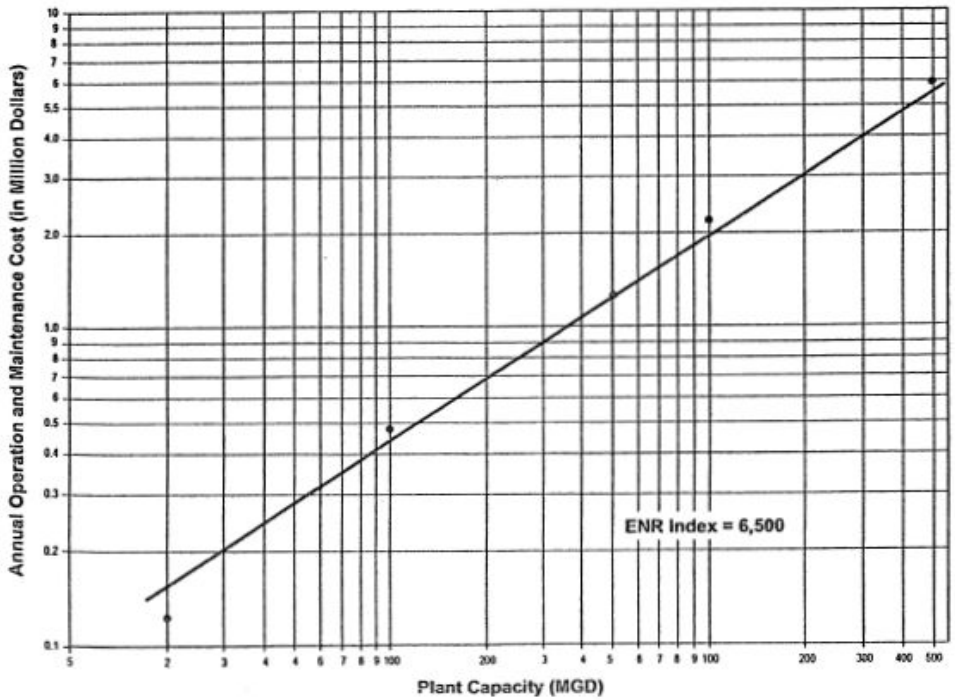
Cleaning the water...

Water Treatment Plant Process Diagram



Cost Estimate





Kawamura (2000)

Cost Estimate

Construction Cost:

Adjusted Cost = (Current Index/Chart Index) x (Cost value from chart) x (1.3)

= (10315.44 / 6,500) x (15,000,000) x (1.3) =

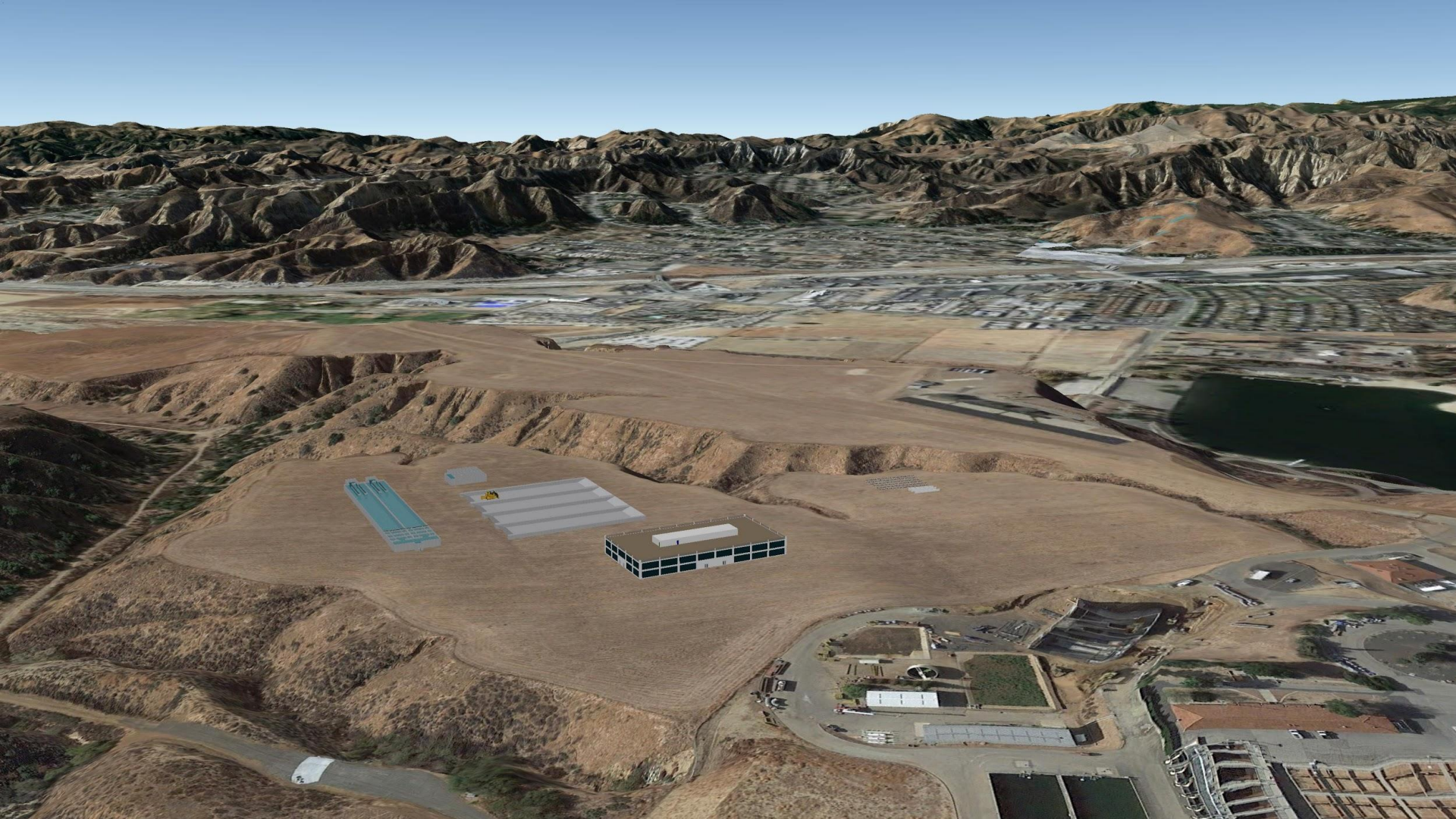
$31,000,000.00

Operation and Maintenance Cost:

Adjusted Cost = (Current Index/Chart Index) x (Cost value from chart) x (1.3)

= (10315.44 / 6,500) x (420,000) x (1.3) =

$890,000.00



Social Media

“Company” Instagram Page

@alexthecivil

Company Website

civicusengineering.github.io