Design of the Britannia Mine HDS Plant

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ML/ARD Workshop
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Vancouver

Steps in Design

- Process Selection
- Pilot Plant Studies
- Set Flowrates
- Design Criteria
- Plant Site Selection
- Sludge Characterization
- Sludge Disposal Options
- Discharge Water Quality
- Operating Strategy
- Feasibility Study
- Trade Off Studies/Opportunities

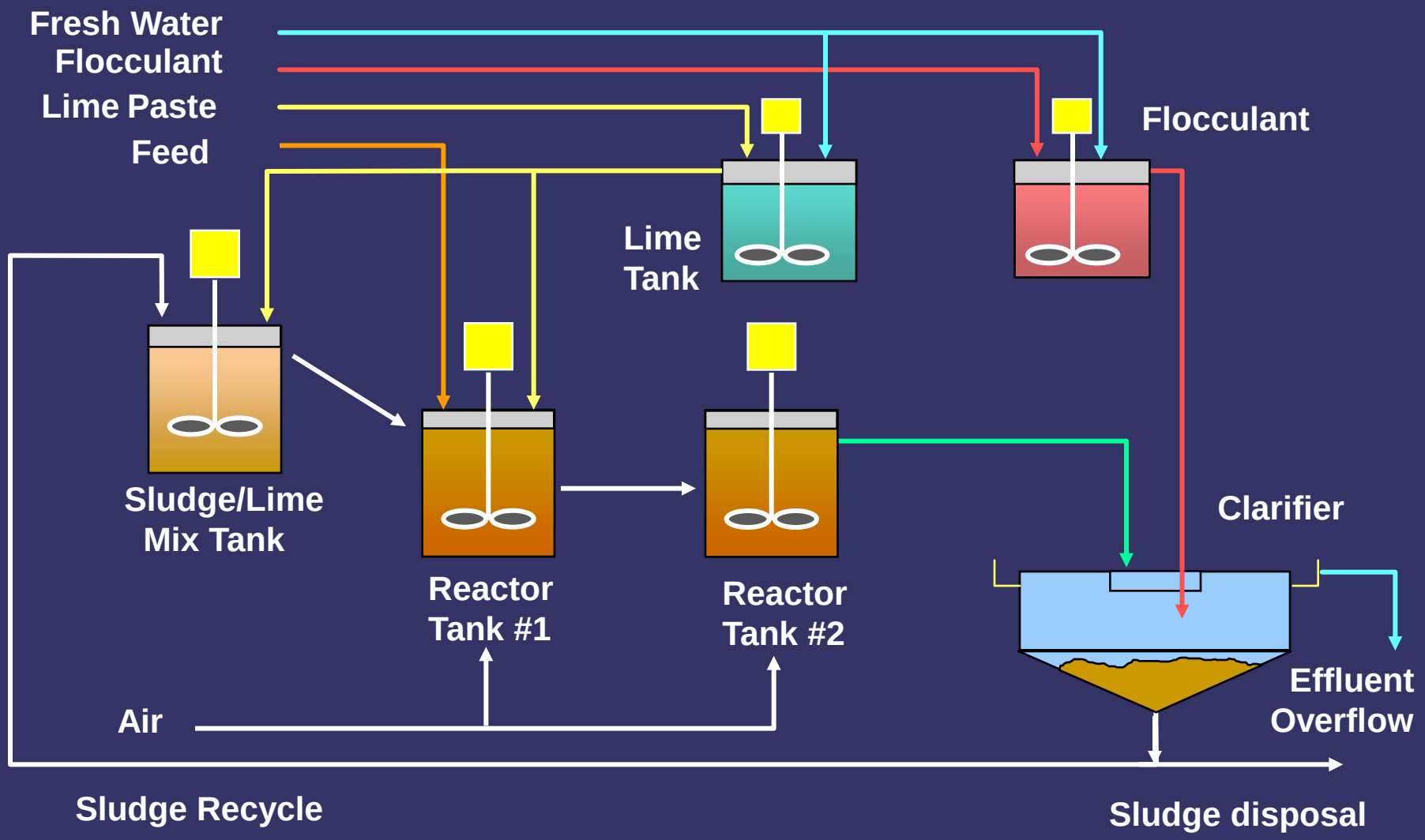
Feed Chemistry

Parameter	Unit	Design Value
Aluminum	mg/L Al	59
Cadmium	mg/L Cd	0.13
Copper	mg/L Cu	55
Iron	mg/L Fe	40
Manganese	mg/L Mn	10
Zinc	mg/L Zn	29
Sulphate (design)	mg/L SO_4	2,200
Sulphate (average)	mg/L SO_4	1,710

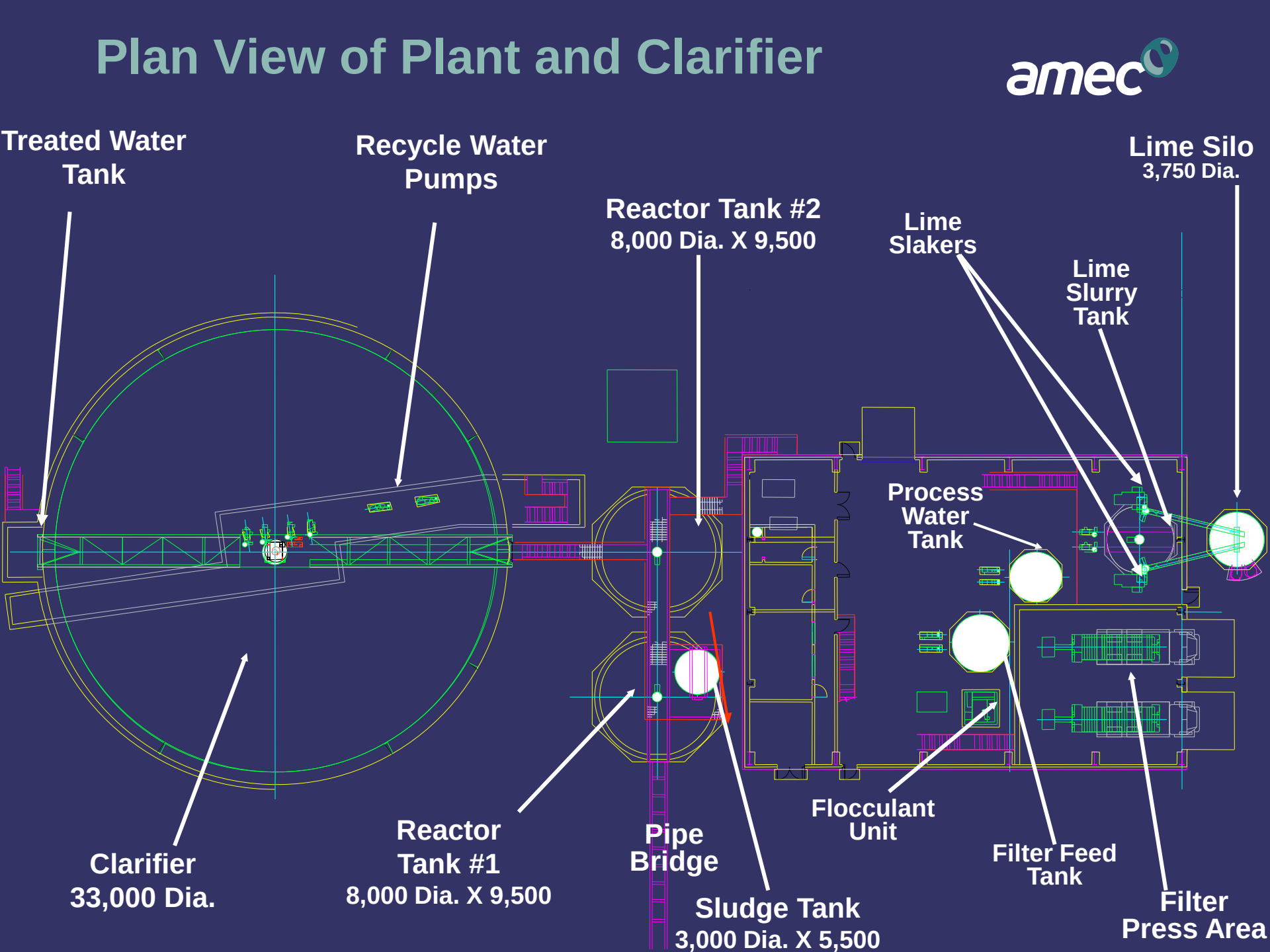
Key Design Criteria

Design capacity	1,050 m^3/h
Average flow	585 m^3/h
Maximum hydraulic capacity	1,400 m^3/h
Design lime consumption (CaO)	19.5 t/d
Operating pH	9.3-9.5
Clarifier Rise Rate	1.2 m/h
Mass Recycle Ratio	40
Design sludge production (dry)	18 t/d
Flocculant Dosage	2 mg/L
Underflow % Solid	25%
Design life	25 years
Clarifier diameter (concrete)	33 m
Reactor tank residence time (total)	45 min

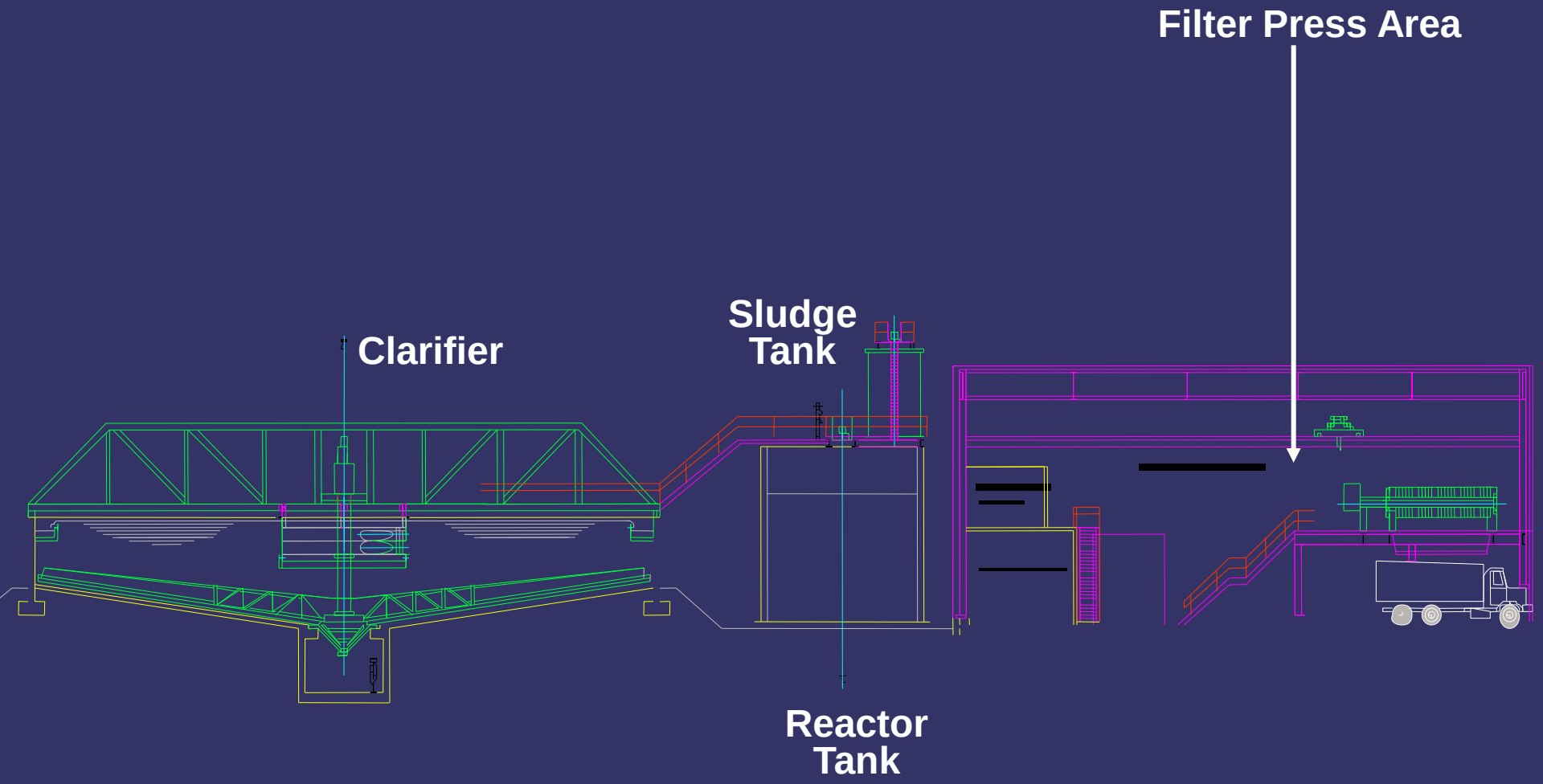
Britannia HDS - Process Flow Diagram



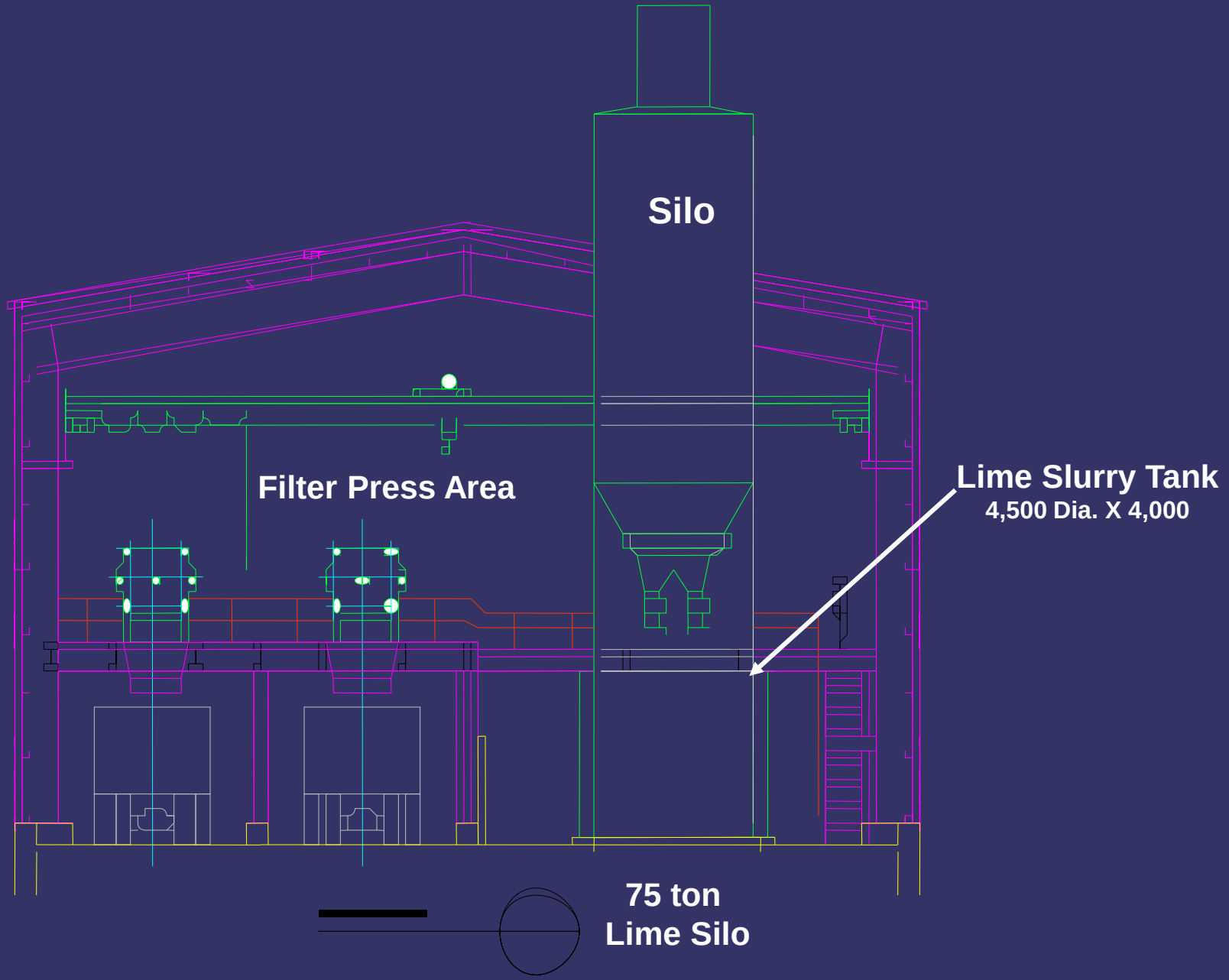
Plan View of Plant and Clarifier



Section through Clarifier, Reactors and Building



Section – Silo and Filter Press Area

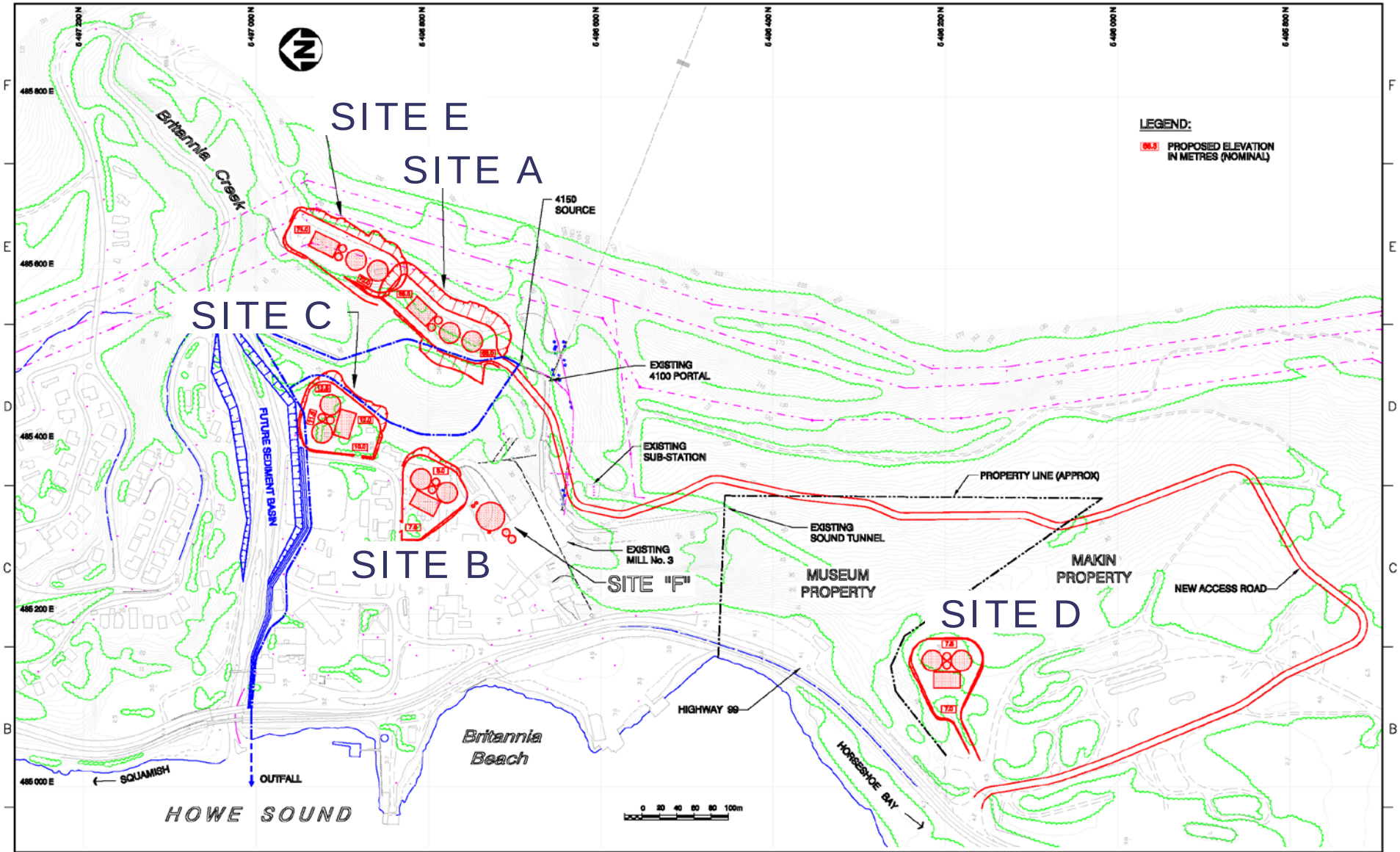


Target Discharge Water Quality

Parameter	Unit	Treated Discharge Water	
pH		9 to 9.5	
Suspended solids	mg/L	10	
Metals		**Total**	**Dissolved**
Aluminum (Al)	mg/L	1	0.5
Cadmium (Cd)	mg/L	0.002	0.001
Copper (Cu)	mg/L	0.4	0.02
Iron (Fe)	mg/L	0.3	0.01
Manganese (Mn)	mg/L	0.4	0.2
Zinc (Zn)	mg/L	0.5	0.03

Site Selection Process

- Brainstorm Session On Site – Long List
- Selected Criteria for Evaluation
- Summarized Evaluation of Long List
- Conducted Workshop with stakeholders
- Selected short list on point system with ranking of alternatives and weighting factors



APPROVED FOR CONSTRUCTION

CLIENT PROJECT MGR.	DEPARTMENT MGR.	PROJECT MGR.

PROJECT NO.		BY	D/M/Y
UB24A	DSN.		
PACKAGE CODE	DRN.	F. CHAN	16/05/02
	CHK.		
	APP.		

SCALE 1 : 2000

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AREA: PROVINCE OF BRITISH COLUMBIA
MINISTRY OF WATER, LAND & AIR PROTECTION

TITLE: BRITANNIA TREATMENT PLANT POTENTIAL SITES

CLIENT DWG. NO.

DRAWING NO. A1-UB24-400-C-0101

REV. A

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REV	D/M/Y	REVISION	DR	CHK

ISS	D/M/Y	APP	ISSUED FOR

REF	NUMBER	TITLE

REFERENCES

Alternative Sites

- Site A - expanded bench at 4150 Level
- Site B - museum property adjacent to core racks
- Site C - adjacent to copper laundersand Britannia Creek
- Site D - Makin property
- Site E - bench at 4100 Level
- Site F - museum property, partially inside concentrator building, balance of plant adjacent to core racks
- Site G - Crown land, on tailings deposit west of railway line on foreshore

Site Selection
Overall Results

Site	Description	Total Score
A	4150 Level	518
B	Adjacent to core racks	267
C	Adjacent to Britannia Creek	231
D	Makin property	516
E	4100 Level	503
F	Partially inside concentrator	304

Final Site Selection Process

- Geotechnical
- Access
- Visibility
- Land Ownership/Development Plans

- Site A Selected

Sludge Disposal Issues

- Final Disposal Location
- Chemical Characteristics
- Long term Stability
- Dewatering Methods

Sludge Production

	Units	Average	Design
Sludge generation rate	g/L	0.6	0.70
Sludge production dry wt basis	tpd	8	18
	tpy	3,075	N/A
Sludge percent solids (design)	w/w	25%	25%
Sludge production wet wt basis @ 25% solids	tpd	34	71
Sludge disposal rate	m^3/d	28	59
	m^3/y	10,249	N/A
Final dewatered sludge @ 40% solids	m^3/y	5,637	
Sludge cake volume	m^3/y	4,100	

Sludge Composition

Calcium – 11.3%	Iron – 2.5 %
Sulfate – 8.8%	Manganese – 0.6%
Aluminum - 6.3%	Phosphorus – 0.5%
Copper – 4.8%	Cadmium – <0.01%
Zinc – 4.2%	Nickel - <0.01%
Magnesium – 3.1%	Arsenic – <0.01%

Sludge Classification

Parameter (mg/L)	SWEP Results	SWEP Criteria
As	<0.05	5.0
Ba	0.005	100
B	0.083	500
Cd	<0.002	0.5
Cr	<0.005	5.0
Cu	0.09	100
Pb	<0.03	5
Hg	<0.00005	0.1
Se	<0.03	1
Ag	<0.01	5
Zn	0.074	500

Sludge Dewatering Options

- Filter Press
- Ex-filtration basin at WTP
- Slurry pumped to Mt. Sheer to Sludge Ponds

Plate and Frame Filter Press

Exfiltration Sludge Pond - Henderson

Sludge Containment Cell - Cajamarquilla

Final Disposal

- **On Site**
  - **Mt Sheer**
  - **Jane Basin**
- **Off Site**
  - **Commerical Landfill**
  - **Dedicated Landfill**
  - **Industrial Uses**

On-Site Disposal Locations

- **Jane Basin – in glory holes or landfill**
  - Seasonal access limitations
  - Requires upgraded road
  - Issues with stability

- **Mt. Sheer Town Site – in landfill**
  - Year round access
  - Requires upgraded road
  - Issues with flooding/landslide

Off Site Landfills

- Swan Hills, Alberta
- HAZCO
- Ecowaste
- Canadian Waste Services
- Squamish Lillooet Regional District

Industrial End Users

- Teck Cominco Trail Smelter
- BCR Marine, Vancouver Wharves Operations (VWL)
- LaFarge Concrete

Status of Feasibility Study

- Feasibility Draft Report completed
- Sludge disposal study underway
- Outfall options study underway
- Final Feasibility, Sludge Disposal and Outfall Options Studies to be issued in January