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The First Class A-1 Effluent Permit in Montana

Moonlight Basin, Big Sky Montana

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Topics

- Effluent Reuse
- Treatment Selection
- Design & Permitting
- Construction
- Project Challenges

Regulation

Montana DEQ
Circular DEQ-2, Appendix B

Class A-1 Standard

CLASS	TREATMENT STANDARDS
A-1	Class A-1 reclaimed wastewater must, at all times, be oxidized, coagulated, filtered and disinfected, as described below or defined in this Appendix B. Class A-1 reclaimed wastewater that is treated to the standards below is exempt from ground water permit requirements pursuant to ARM 17.30.1022. Following treatment, Class A-1 reclaimed wastewater effluent quality should have approximately 10 mg/L or less of BOD and TSS. To achieve the turbidity requirements for Class A-1 reclaimed wastewaters, a treatment process that incorporates coagulation, flocculation, sedimentation and filtration is typically required. See Section 111 (Clarification Processes) for the required design standards. Class A-1 reclaimed wastewater must be disinfected such that the median number of total coliform organisms, in the wastewater after disinfection, does not exceed 2.2 colony forming units (CFU) per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed and such that the number of total coliform organisms does not exceed 23 CFU per 100 milliliters in any sample. Class A-1 reclaimed wastewater has the quality of effluent such that all constituents meet Montana nondegradation requirements prior to application, allowing it to be applied to land at rates that exceed the agronomic uptake rate. Specifically, total nitrogen must not exceed 5.0 mg/L at any time. Per MCA 75-5-410, reclaimed wastewater proposed for aquifer recharge or injection purposes must meet, at a minimum, secondary treatment, as defined in 40 CFR Part 133, and Level II treatment for the removal of nitrogen. For aquifer recharge proposals, the effluent quality must meet either primary drinking water standards or non-degradation requirements at the point of discharge. For aquifer injection proposals, the effluent quality must meet the more stringent of either the primary drinking water standards or the nondegradation requirements at the point of discharge. Soil aquifer treatment (infiltration/percolation basins) may not be considered in meeting these requirements. The minimum monitoring level required during periods of use (including prior to seasonal startup, if applicable) must include: continuous turbidity analysis with recorder, weekly total coliform analysis, and bi-weekly total nitrogen analysis. Weekly disinfectant residual analysis if chemical disinfection is being utilized.*

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Allowable Uses of Reclaimed Wastewater	Class of Reclaimed Wastewater Required for Identified Use					
	A-1	A	B-1	B	C	D
Spray Irrigation of Nonfood Crops *(greater than agronomic uptake rate)**						
Trees and Fodder, Fiber, and Seed Crops	YES	NO	YES	NO	NO	NO
Sod, Ornamental Plants for Commercial Use, and Pasture to Which Milking Cows or Goats Have Access	YES	NO	YES	NO	NO	NO
Drip or Subsurface Irrigation of Nonfood Crops *(greater than agronomic uptake rate)**						
Trees	YES	NO	YES	NO	NO	NO
Spray Irrigation of Food Crops *(greater than agronomic uptake rate)**						
Food Crops Which Undergo Physical or Chemical Processing Sufficient to Destroy All Pathogenic Agents	YES	NO	YES	NO	NO	NO
Drip or Subsurface Irrigation of Food Crops *(greater than agronomic uptake rate)**						
Food Crops Where There is No Reclaimed wastewater Contact With Edible Portion of Crop (e.g. orchards, vineyards)	YES	NO	YES	NO	NO	NO
Root Crops	YES	NO	NO	NO	NO	NO
Landscape Irrigation *(greater than agronomic uptake rate)**						
Restricted Access Areas (e.g., Cemeteries and Freeway Landscapes)	YES	NO	YES	NO	NO	NO
Unrestricted Access Areas (e.g., Golf Courses, Parks, Playgrounds, School Yards and Residential Landscapes)	YES	NO	NO	NO	NO	NO
Impoundments						
Landscape Impoundments	YES	NO	NO	NO	NO	NO
Restricted Recreational Impoundments	YES	NO	YES	NO	NO	NO
Unrestricted Recreational Impoundments	YES	NO	NO	NO	NO	NO
Animal & Fish Operations						
Fish Hatchery Basins (with discharge permit)	YES	YES	YES	NO	NO	NO
Zoo Operations and Animal Shelter Wash Down Water *(discharge to sewer)*	YES	YES	YES	YES	NO	NO
Decorative Fountains *(discharge to sewer)*	YES	YES	NO	NO	NO	NO
(discharge to groundwater)	YES	NO	NO	NO	NO	NO
Jetting and Flushing of Sanitary Sewers	YES	YES	YES	YES	YES	NO
Street Cleaning and Washing Operations						
Street Sweeping, Brush Dampening	YES	YES	YES	YES	YES	NO
Sidewalks and Parking Lot Washing, Spray	YES	NO	YES	NO	NO	NO
Dust Control and Soil Compaction/Consolidation						
Unpaved road dust control, road construction compaction, backfill consolidation around pipelines (Not Drinking Water lines)	YES	YES	YES	YES	YES	NO
Fire Fighting and Fire Protection Systems						
Dumping from Aircraft	YES	YES	YES	YES	YES	NO
Hydrants or Sprinkler Systems in Buildings	YES	YES	NO	NO	NO	NO
Toilet and Urinal Flushing	YES	YES	NO	NO	NO	NO
Washing Aggregate and Concrete Batching Operations *(no discharge)*	YES	YES	YES	YES	YES	NO
Industrial Uses						
Aerosols not created (e.g. heat pumps, boilers) (non-discharging recirculation type)	YES	YES	YES	YES	YES	NO
Aerosols or other mist created (e.g., cooling towers, forced air evaporation, or spraying)	YES	YES	NO	NO	NO	NO
Aquifer Recharge						
Controlled Surface or Subsurface Addition to Replenish the Aquifer **	YES	NO	NO	NO	NO	NO
Aquifer Injection						
Direct Injection into Aquifer for Purpose of Enhancing a Water Right or Allocation **	YES	NO	NO	NO	NO	NO
Indirect Potable Reuse						
Intentional Return of Reclaimed Wastewater to Augment Raw Water Supplies***	YES	YES	NO	NO	NO	NO
Stream flow Augmentation						
Fisheries Support, or Recreational Enhancement with Unrestricted Access ***	YES	YES	YES	YES	NO	NO
Snow Making						
Restricted Access – designed for discharge to groundwater	YES	NO	YES	NO	NO	NO
Unrestricted Access – such as ski slopes***	YES	NO	NO	NO	NO	NO

Treatment Selection

Moonlight Basin Resort:

- Original Plant was a trickling filter system treating septic tank effluent. Disposal to drainfield.
- An oxidation ditch treatment plant replaced the original plant. Storage ponds and disposal to forest irrigation.

Treatment Selection

Preliminary Engineering Report

- Make Recommendations For Wastewater Treatment and Disposal

Moonlight Basin
Wastewater Treatment
Plant Improvements

Preliminary Engineering Report

October 2015

Prepared for:

MB MT Acquisition, LLC
P.O. Box 160040
Big Sky, MT 59716

Prepared by:

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MMI #: 3958.012

Wastewater Treatment Alternatives

- Single MBR
- Existing Oxidation Ditch, 2 New Oxidation Ditches
- Existing Oxidation Ditch, 2 New SBRs
- Existing Oxidation Ditch, 2 New MBRs

New Plant Effluent Disposal Options

- Golf Irrigation
- Surface Water Discharge
- Groundwater Discharge

- Class A-1 Compatible with Each Option

Wastewater Treatment Selection

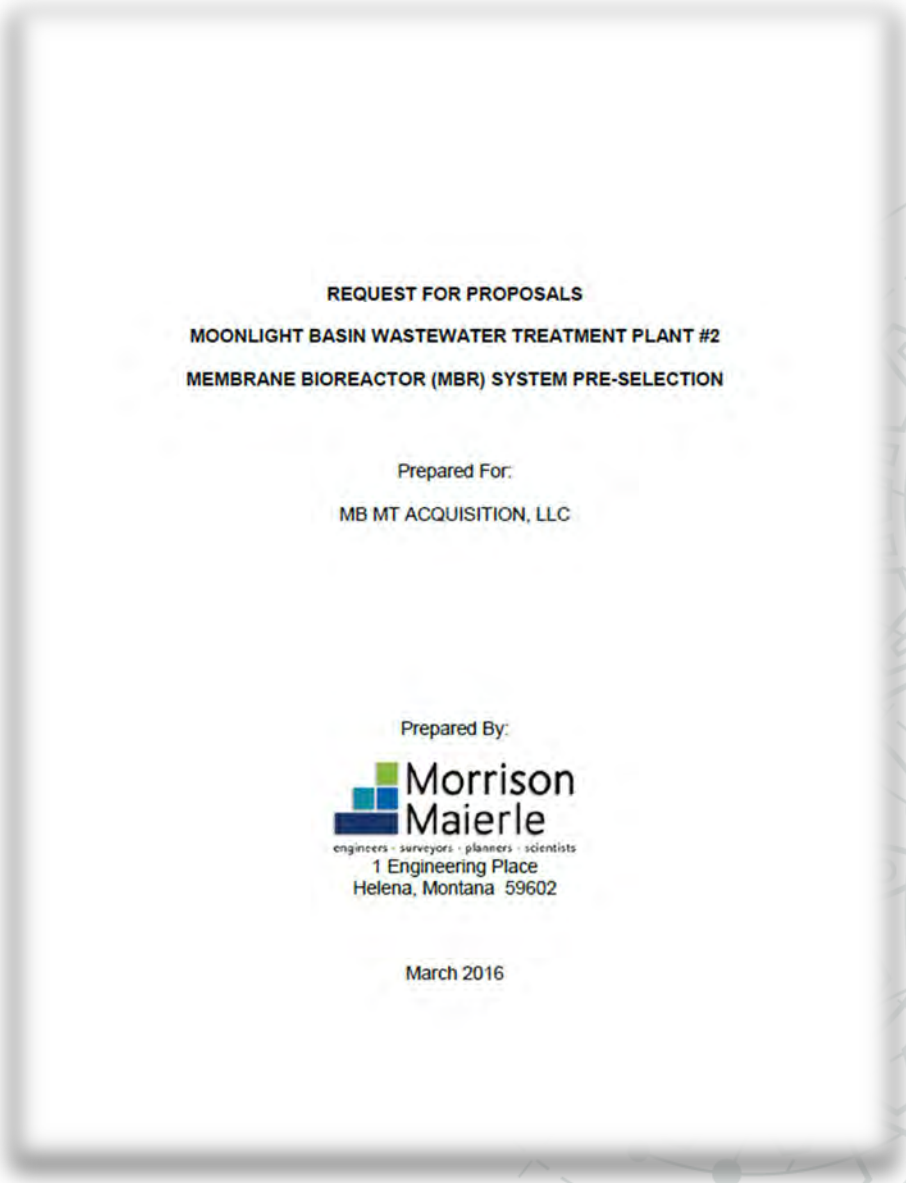
- Existing Oxidation Ditch, 2 New MBRs Selected

TABLE 3
CONCEPT TREATMENT ALTERNATIVE RANKING

Comparison Parameter	Parameter Weight	Single MBR	Exist OD + 2 New OD	Exist OD + 2 New SBR	Exist OD + 2 New MBR
COST EFFECTIVENESS	5	2	3	3	4
TREATMENT RELIABILITY	4	4	3	3	4
OPERATIONAL EASE	3	2	4	3	2
FACILITY FLEXIBILITY	3	5	3	3	5
ENERGY/RESOURCE USE	2	3	4	3	3
WEIGHTED RANK TOTAL		**53**	**56**	**56**	**58**

Design Pre-Selection

- Request for Proposals
- Solicitation from 3 Manufacturers
- Conducted Interviews
- Three Engineers Reviewed and Scored Proposals



REQUEST FOR PROPOSALS

MOONLIGHT BASIN WASTEWATER TREATMENT PLANT #2

MEMBRANE BIOREACTOR (MBR) SYSTEM PRE-SELECTION

Prepared For:

MB MT ACQUISITION, LLC

Prepared By:

Morrison Maierle

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1 Engineering Place

Helena, Montana 59602

March 2016

Design Pre-Selection

- Treatment Requirements

INFLUENT FLOW CHARACTERISTICS

Design Parameter	2018 [1]	2020 [2]	2030 [3]	2035 [4]
Annual Ave Day Flow, gpd	5,500	21,000	99,900	104,700
Maximum Month Flow, gpd	7,400	27,900	132,800	139,300
Maximum Day Flow, gpd	12,800	48,600	231,200	242,500
Peak Hour Flow, gpd	20,700	78,600	373,900	392,000

[1]5% of Annual Average Flow
[2]20% of Annual Average Flow
[3]95% of Annual Average Flow
[4]100% of Annual Average Flow

ANNUAL AVERAGE INFLUENT LOAD CRITERIA

Design Parameter	2018 [1]	2020 [2]	2030 [3]	2035 [4]
BOD_5, lb/day	12	45	214	224
TSS, lb/day	5	18	87	92
Total Phosphorus, lb/day	0.3	1.2	5.8	6.1
TKN, lb/day	2	9	43	45
NH3-N, lb/day	2	8	37	39

[1]5% of Annual Average Flow
[2]20% of Annual Average Flow
[3]95% of Annual Average Flow
[4]100% of Annual Average Flow

EFFLUENT DESIGN CRITERIA

Design Parameter	Monthly Avg. Concentration	Maximum Concentration
NH3-N	1 mg/L	1.5 mg/L
BOD_5[1]	5 mg/L	10 mg/L
TSS[1]	5 mg/L	10 mg/L
Total Nitrogen[1]	5 mg/L	5 mg/L
Total Phosphorus	1 mg/L	2 mg/L
Turbidity	0.2 NTU	0.5 NTU
Total Coliform[2]	<2.2 CFU/100 mL	<23 CFU/100 mL

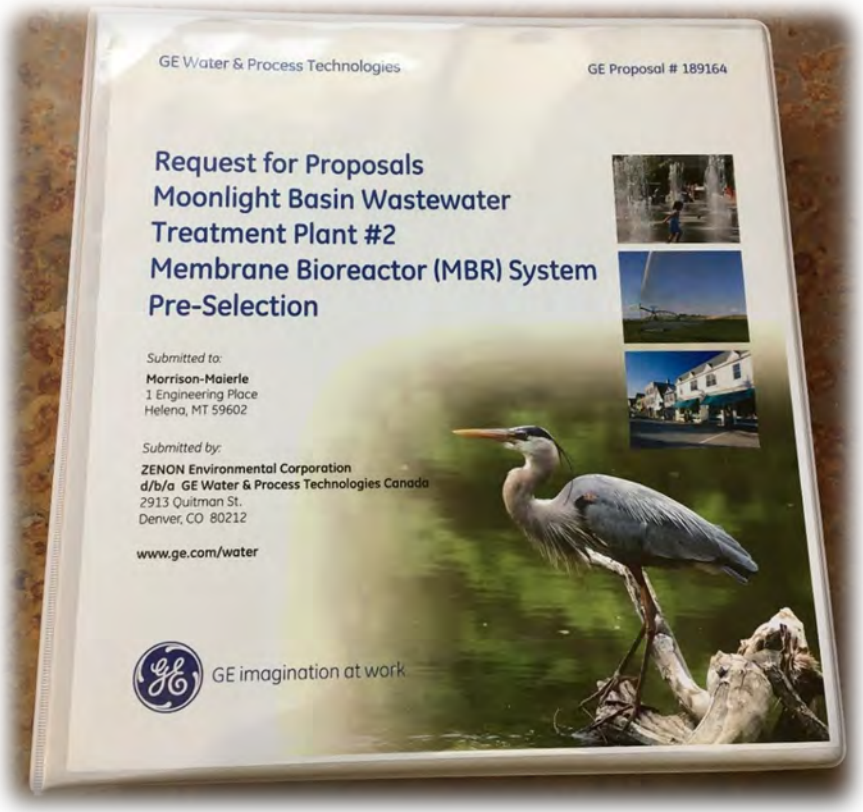
[1]Based on MDEQ Circular DEQ-2 Class A-1 Reuse.
[2]UV disinfection follows MBR

Design Pre-Selection

- MBR Requirements

Design Parameter	Requirement	
Influent Characteristics		
Temperature Range	8-18	°C
Alkalinity	236	mg/L as $CaCO_3$
Membranes		
Number of Membrane Trains (N+1)	3	Minimum
Membrane Type	Ultrafiltration	
Nominal Membrane Pore Size	0.01 – 0.1	µm
Net Flux Rate (Max Day @ 8^0C)	10	gfd
Net Flux Rate (Peak Hour @ 8^0C)	20	gfd
Design Mixed Liquor Suspended Solids	6,000-12,000	mg/L
System Parameters		
Number of Biological Process Trains (N+1)	3	Minimum
RAS/Mixed Liquor Recycle Rate	3-5 Q	x max month
Internal Mixed Liquor Recycle Rate	2-4 Q	x max month
Number of Process Pumps, Blowers, or Other Equipment (N+1)	3	Minimum
Standard Oxygen Transfer Efficiency (SOTE)	2	%/ft
Alpha Factor (α)	0.5	max
Beta Factor (β)	0.95	max

Wastewater Equipment/Process Pre-Selection

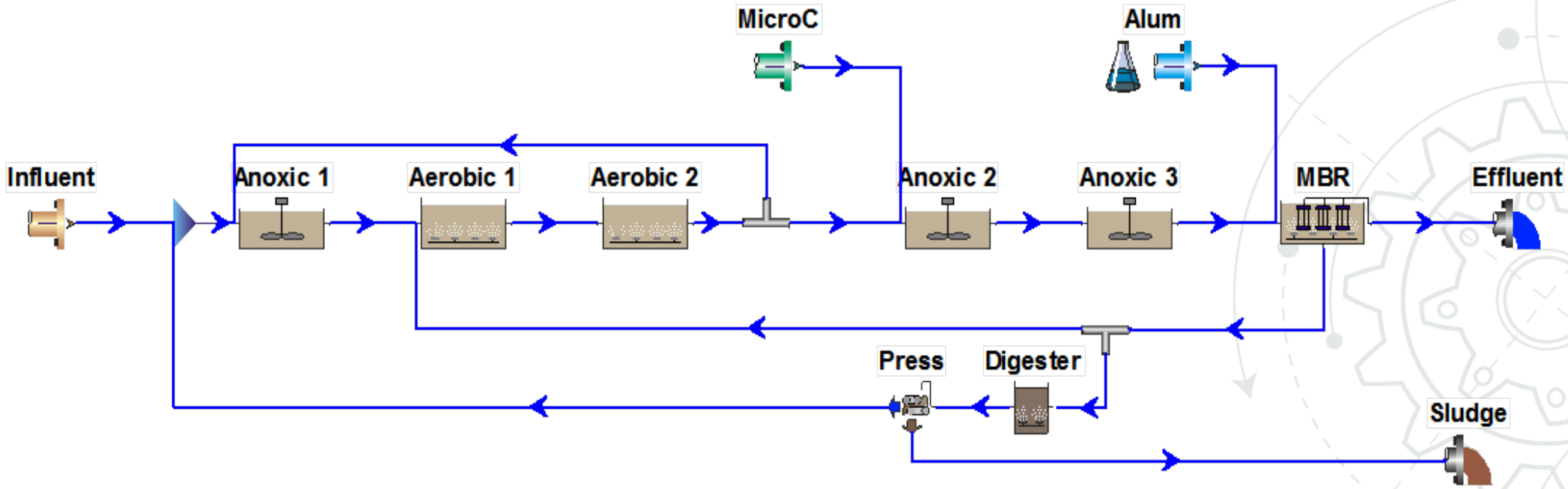


- Selected Suez (formerly GE)

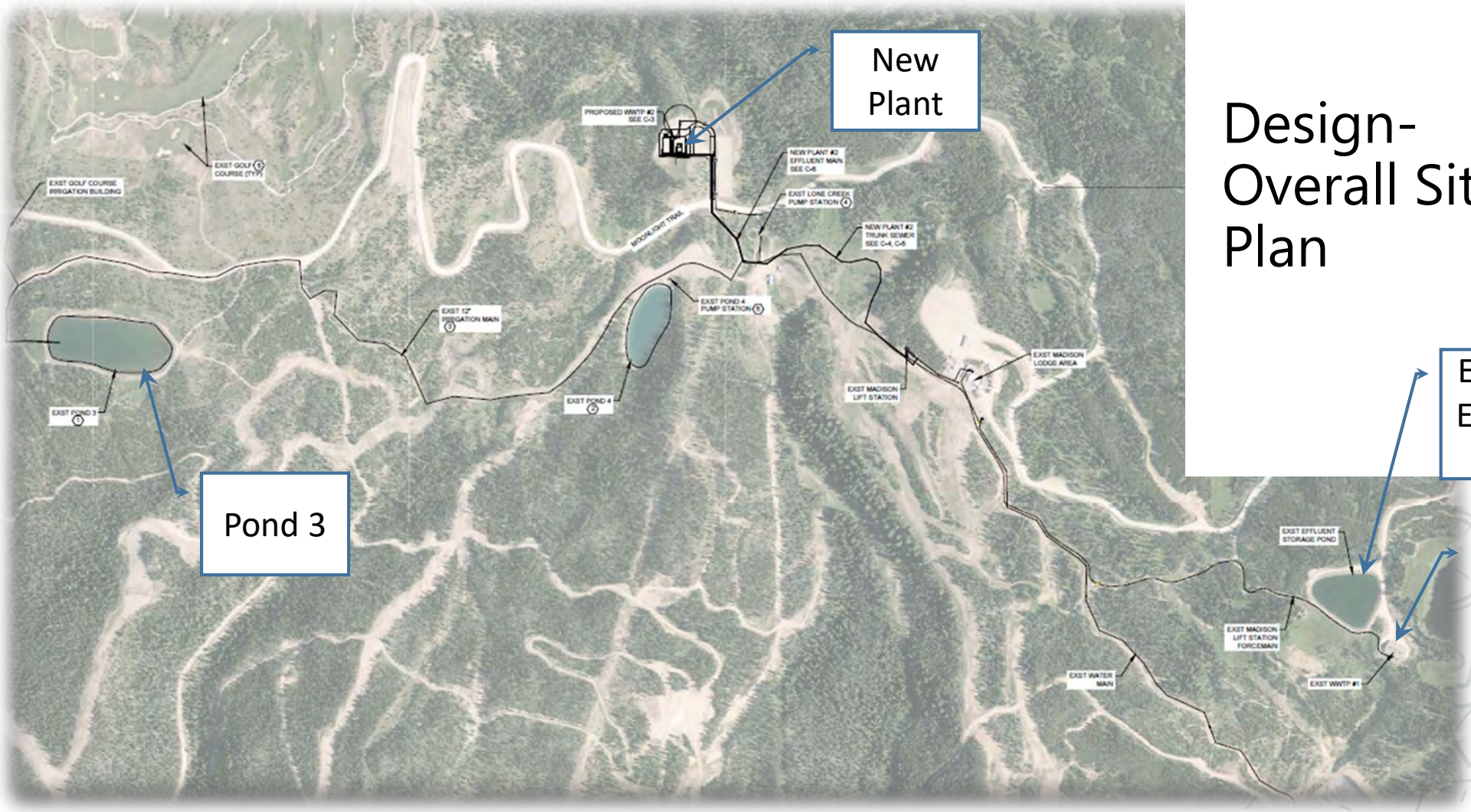
Wastewater Equipment/Process Pre-Selection

- 3 Train Bioreactors and Membrane Basins for Operational Flexibility
- 4 Stage Process- Pre Anoxic, Aerobic, Post Anoxic, Membrane Basin (Aerobic)
- Process Chemical Systems- Sodium Hydroxide, MicroC, and Alum
- Membrane Chemical Systems- Sodium Hypochlorite and Citric Acid
- ZW-500 Reinforced Hollow Fiber PVDF Membranes

Wastewater Equipment/Process Pre-Selection



Design- Overall Site Plan



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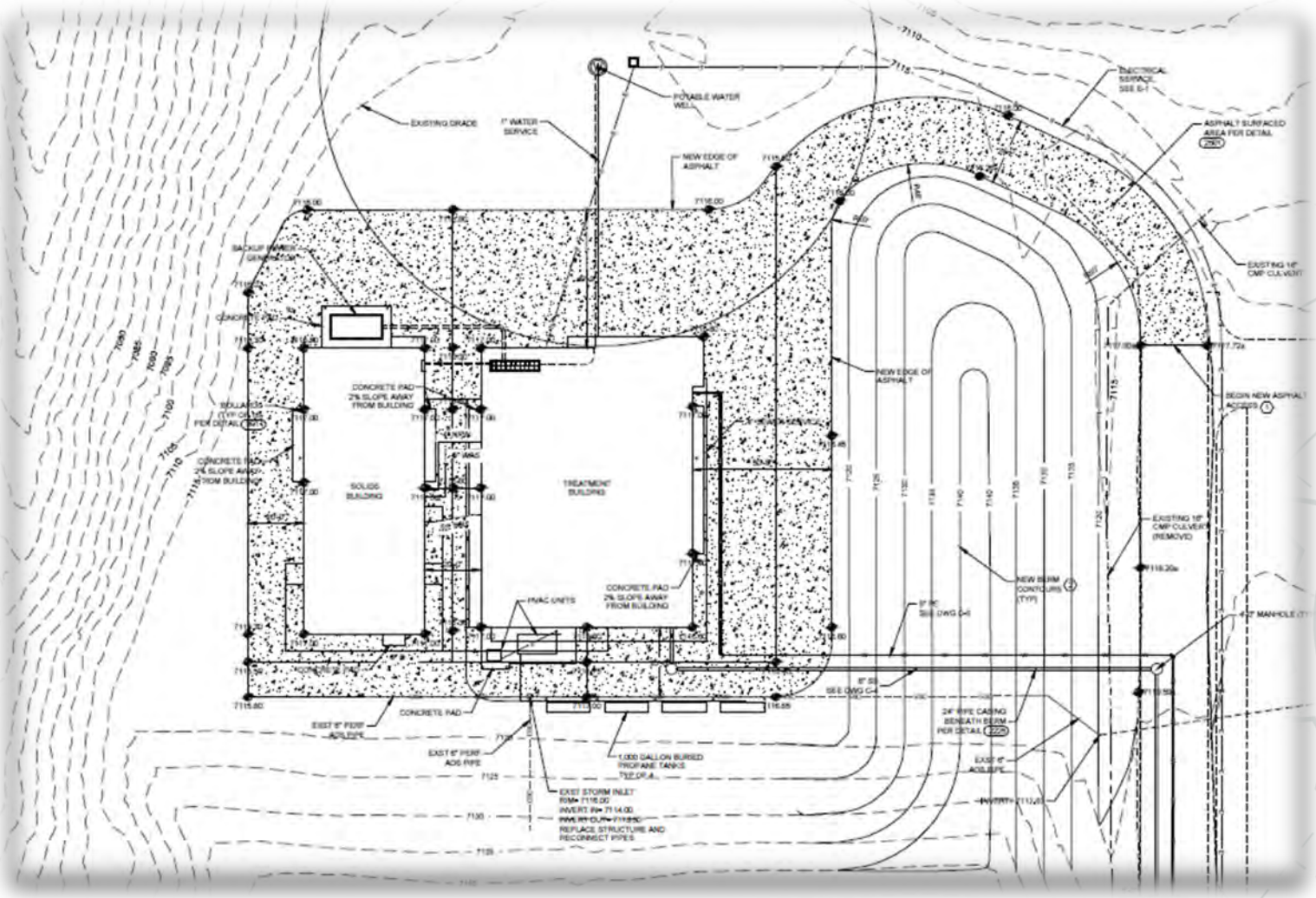
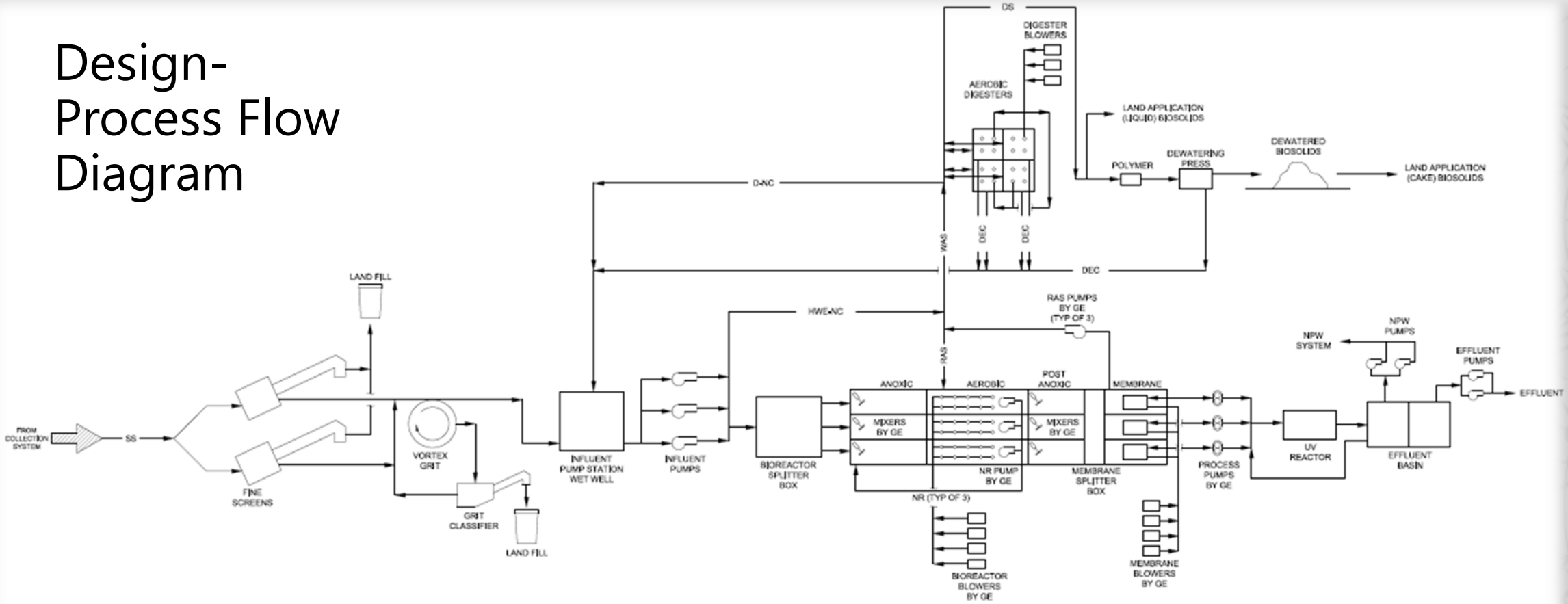
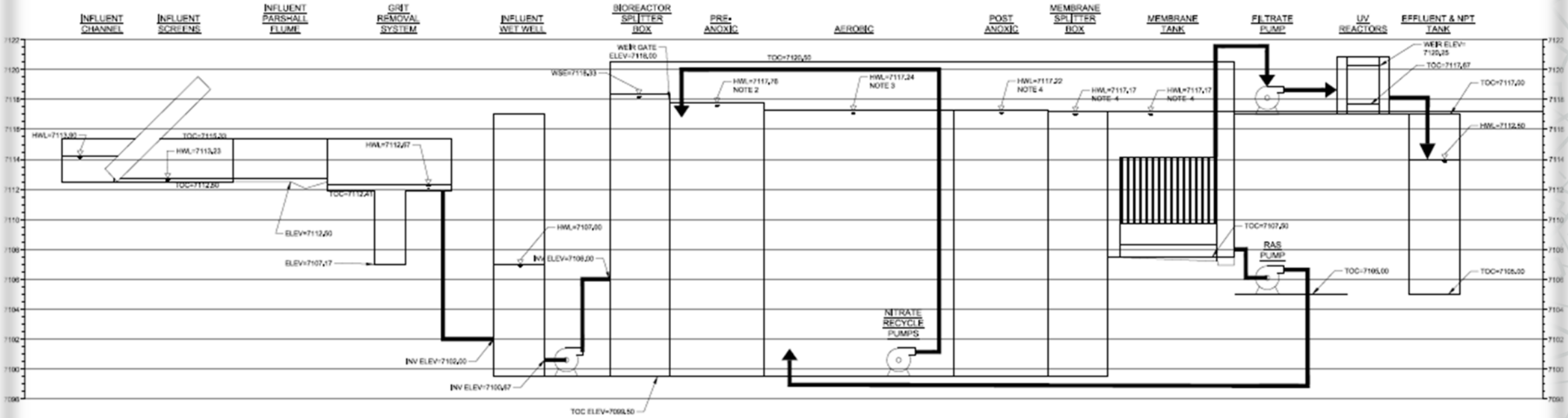
Design- Plant Site Plan



Design- Process Flow Diagram



Design- Hydraulic Profile



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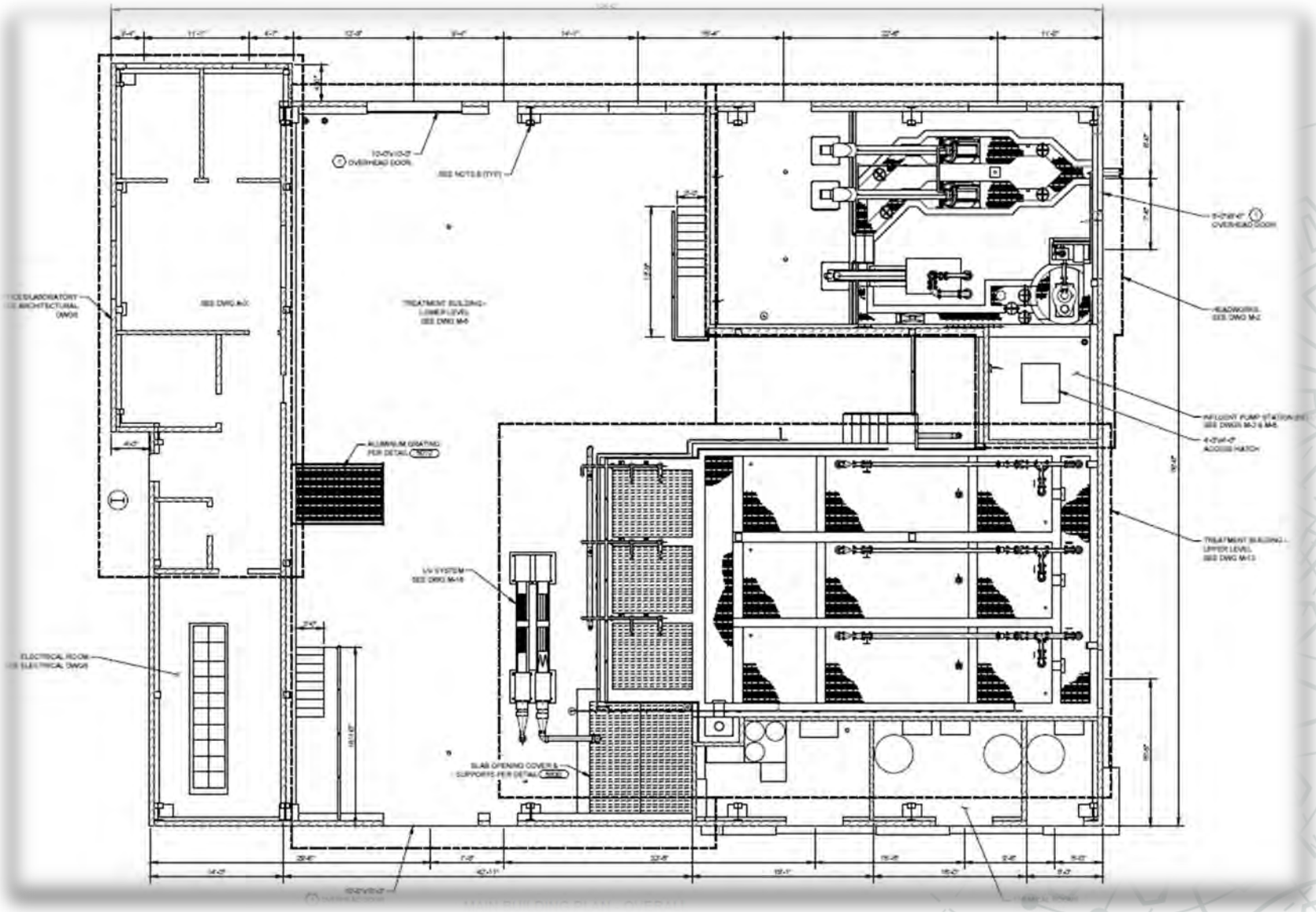
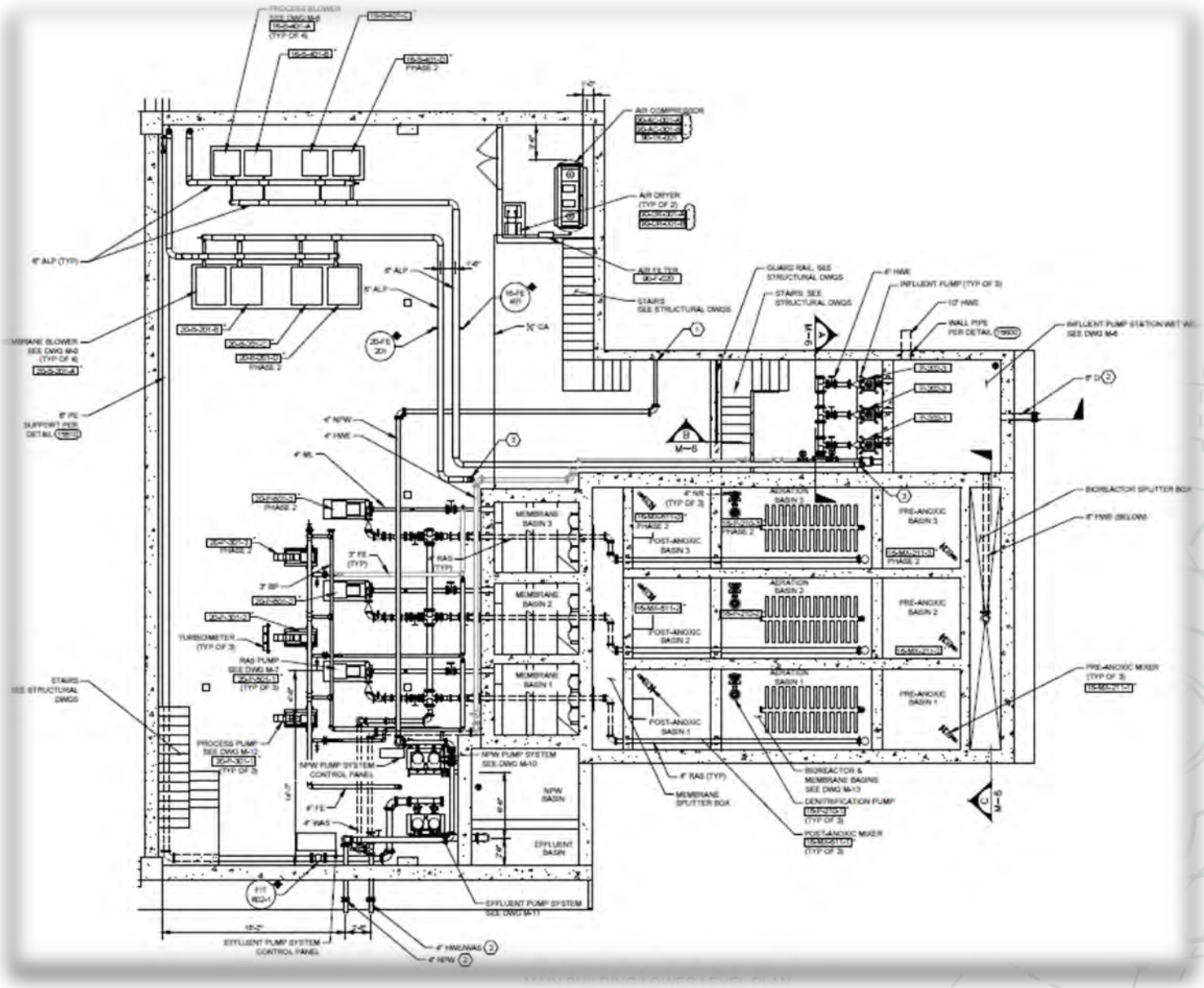
Design- Main Building

Processes Housed Indoors, Separate Headworks, Separate Chemical Rooms, Operator Lab and Offices



Design-Lower Level Area

Access to Equipment, Flooded Suction for Influent Pump Station, MBR Pumping Systems, NPW and Effluent Pumping Systems



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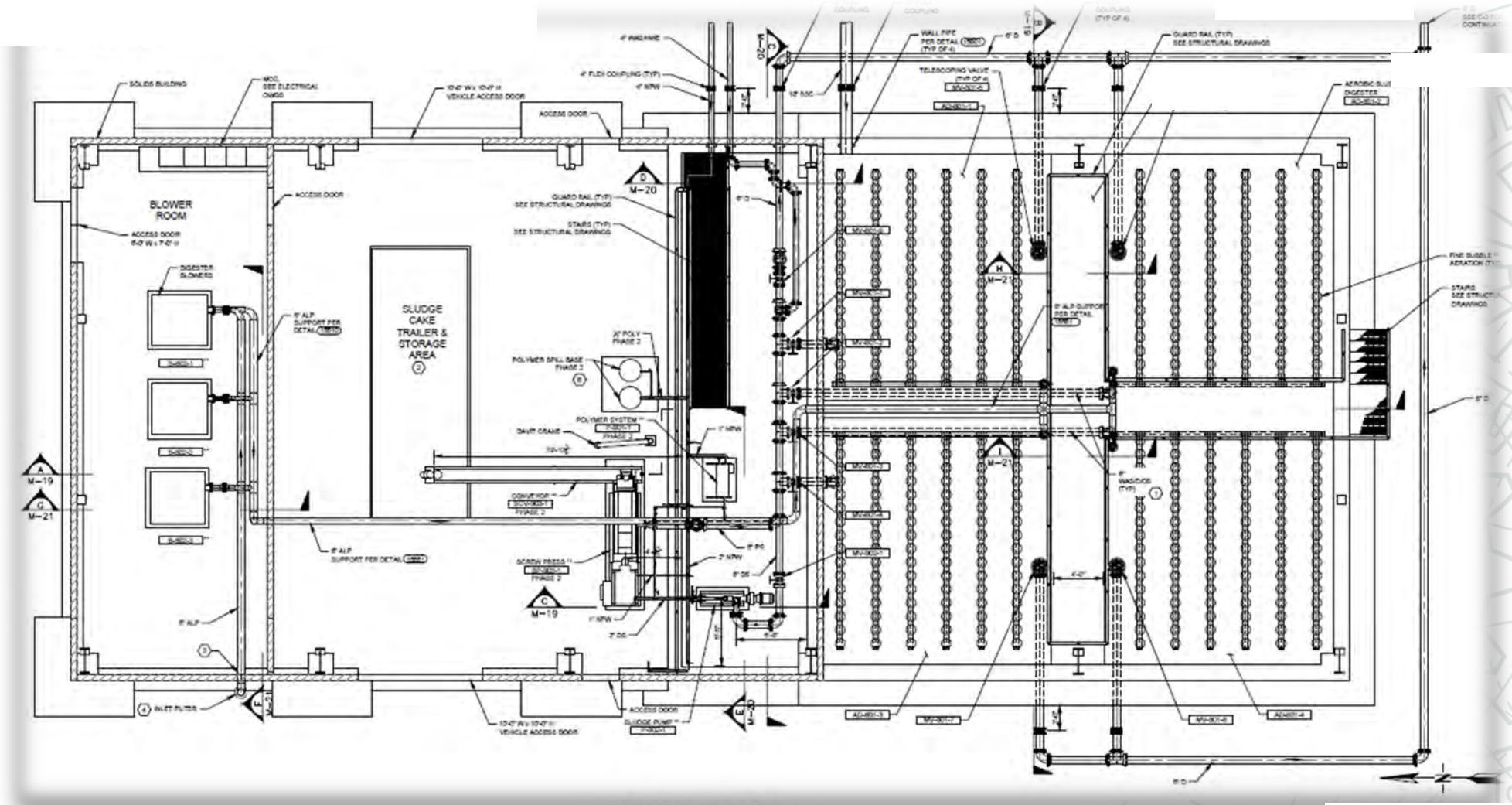
Design-Solids Handling

Aerobic Digesters Equalization

Screw Press Dewatering



Permitting

- Plans and Specifications Review Submittal to DEQ, August 31, 2016
- Provided Additional Information About Storage Pond and Golf Irrigation.
- Approved by DEQ: January 23, 2017

Permitting

- Monitoring Requirements

Year	Total Coliform	Total Nitrogen	BOD_5	TSS
1	Weekly	Bi-weekly	Monthly	Monthly
2	Monthly	Monthly	Quarterly	Quarterly
3	Monthly	Quarterly	Quarterly	Quarterly
4 and beyond	Quarterly	Quarterly	Semi-annually	Semi-annually

Construction

- Bids Due: January 2018
- Contractor- Dick Anderson Construction
- Original Contract Amount: $8.36 M
- Work began May 2018
- Completed November 2019
- Final Amount: $8.63 M

May 3, 2018

Construction

July 3, 2018

August 3, 2018

Construction

September 14, 2018

October 30, 2018

Construction

- Challenge- Dry In For Work To Continue Through The Winter
- Pre-Engineered Steel Buildings

November 30, 2018

Construction

January 7, 2019

Construction

August 27, 2019

Construction

- Start-Up and Seeding
- ~32,000 Gallons From Big Sky County Water & Sewer District

September 30, 2019

Construction-Final Completion

Construction-Final Completion

Fine Screens

Influent Pumps

Construction-Final Completion

Bioreactors and UV

Bioreactors

Construction-Final Completion

Process and Membrane Blowers

MBR Pumps

Construction-Final Completion

Aerobic Digesters

Challenges and Approaches

- Choosing Treatment and Disposal: Compile a PER to Study and Recommend a Solution
- 1st of a Kind Permitting: Research and Communicate with Regulators
- Existing Infrastructure: Permitting to Allow a New Use Includes Inspections, Testing, and Reports
- Construction: Managing Season and Suppliers
- Start-Up: Provide Initial Operational Support

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Questions?

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