Dam Safety and Civil Structural Projects Past and Present

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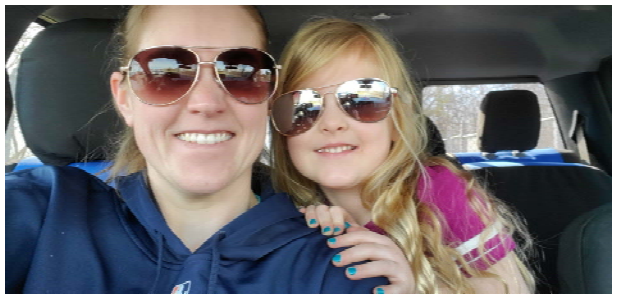
May 6, 2021

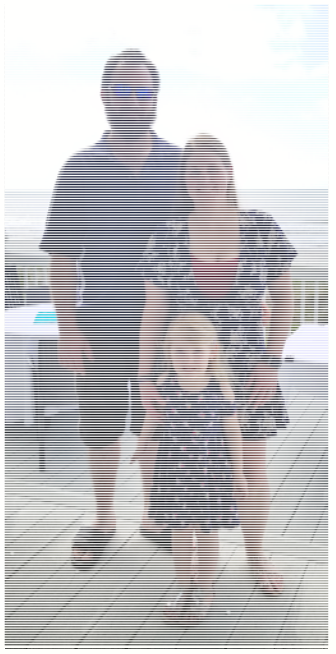
Consumers Energy
Count on Us®

Who Is Your Presenter?

Marianne Walter

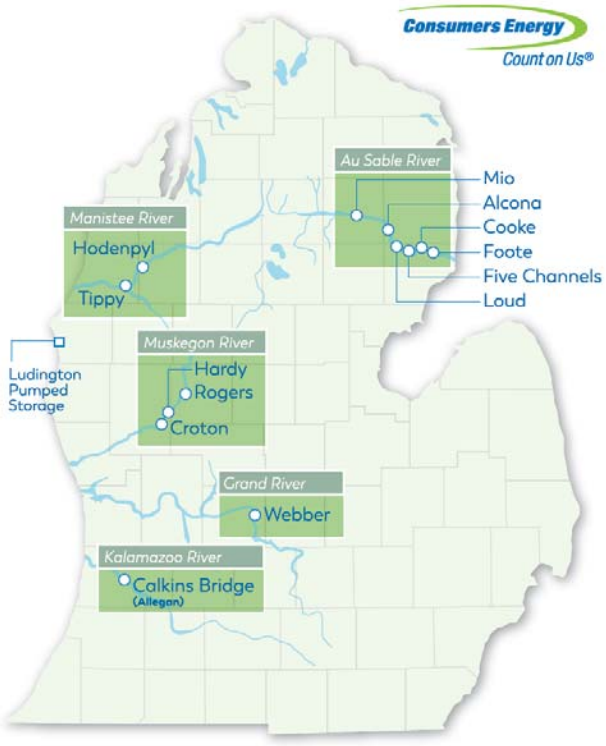
- Intern at CE summer 2008
- BSE - Western Michigan University 2009
- Started at CE in 2009
  - Engineering Services Department
  - Generation Engineering
  - Generation Planning 2017-2020
- MSE – Norwich University 2013





Hydro Site Locations

Dam	Capacity (Mw's)	Plant Commissioned	FERC License Expiration Date
Rogers	6.72	1906	6/30/2034
Hardy	31.3	1931	6/30/2034
Croton	9	1907	6/30/2034
Hodenpyl	18	1925	6/30/2034
Tippy	21	1918	6/30/2034
Calkins Bridge	2.63	1935	3/31/2040
Webber	3.3	1907	5/31/2044
Mio	5	1916	6/30/2034
Alcona	8	1924	6/30/2034
Loud	4	1913	6/30/2034
Five Channels	6	1912	6/30/2034
Cooke	9	1911	6/30/2034
Foote	9	1918	6/30/2034
Ludington Pumped Storage	2310	1973	6/30/2069



Hydroelectric facilities

Rigorous Safety Program Ensures Public Safety

Elements of Consumers Energy's Dam Safety Program

- Owners Dam Safety Philosophy Statement
  - Dam safety is of the highest priority
- Rigorous regulatory compliance
- Owner/Regulator cooperation
- Strong leadership support
- Effective operations & maintenance
- Detailed instrumentation and monitoring
- Frequent Inspection and reporting
- Emergency Action Plans
- Continuous improvement

Hardy Dam

All Consumers Energy hydro generation employees have a responsibility to maintain and operate Consumers Energy's hydro generation plants in a safe, compliant, efficient, and dependable manner.

Detailed Monitoring for Dam Safety

Minimum Dam Safety Inspection Frequency

- Operator – monthly (daily dam safety observations completed by Operators)
- Supervisor – quarterly
- Dam Safety Engineering Staff – yearly
- FERC – yearly
- Independent Consultant (Code of Federal Regulations Part 12D) – every 5 years
  - Provided to Michigan Department of Environment, Great Lakes, and Energy
- External Owners Dam Safety Program External Audit- every 5 years
  - 2019/2020 Audit – "All levels of CEC have a commitment to high standards for dam safety and place public safety, personnel safety and environmental compliance above all other performance goals."

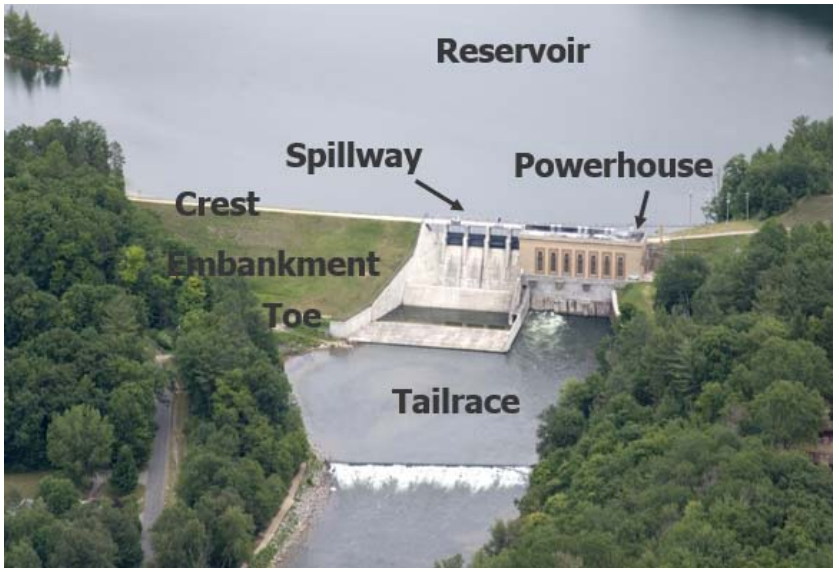
Inspector Qualifications

- Consumers Energy personnel complete annual dam safety training.
- The Independent Consultants are FERC approved.

Diligent Dam Safety Inspections

Inspections and Monitoring Observe for

- Seepage (new or significant changes)
- Piping (sand boils)
- Depressions (sinkholes)
- Erosion
- Brush growth
- Concrete condition
- Spillway condition
- Unusual instrumentation readings
- Public safety devices
- Any other signs of instability of any project works



Tippy Dam

Ensuring the Reliability of Hydropower

Asset Health Inspection Frequency

- Semi-annual civil inspection
  - Specific condition assessments as necessary
- Bi-Annual mechanical inspections
- 6 Year electrical inspection

System Health

- Asset Health Database
  - Updated through out the year
  - Reviewed annually
- Threats to Generation
  - Updated through out the year
  - Reviewed in weekly in daily operating review

Tippy Dam

Present Projects

Hardy Dam (Engineering)

- Auxiliary Spillway Replacement
- Hydraulic Barrier (Splash wall)
- Crest Compaction

2020 Webber Dam

- Training Wall Replacement

2021 Ludington Pumped Storage

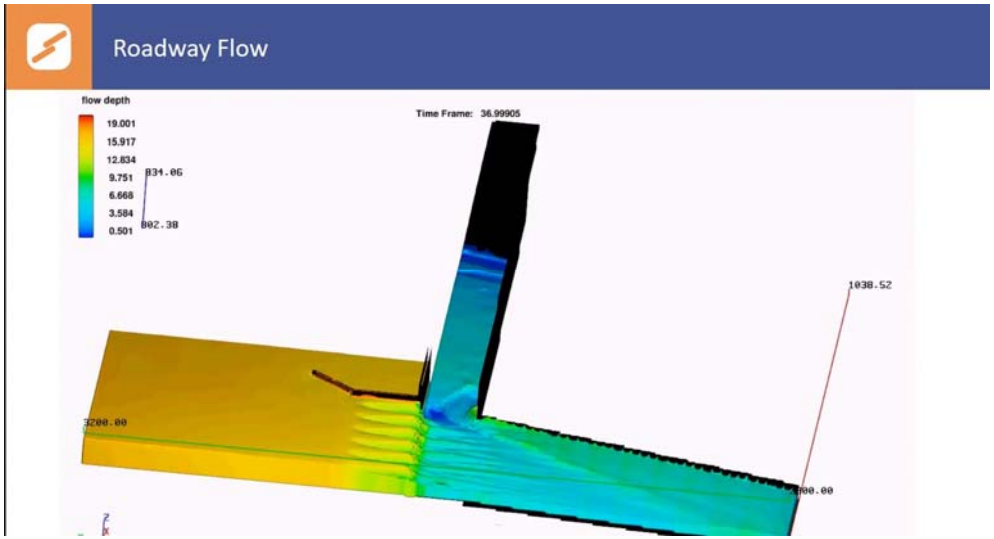
- Upper Reservoir Liner Mastic Coating
- Trench Features (Maintenance)

Hardy Dam

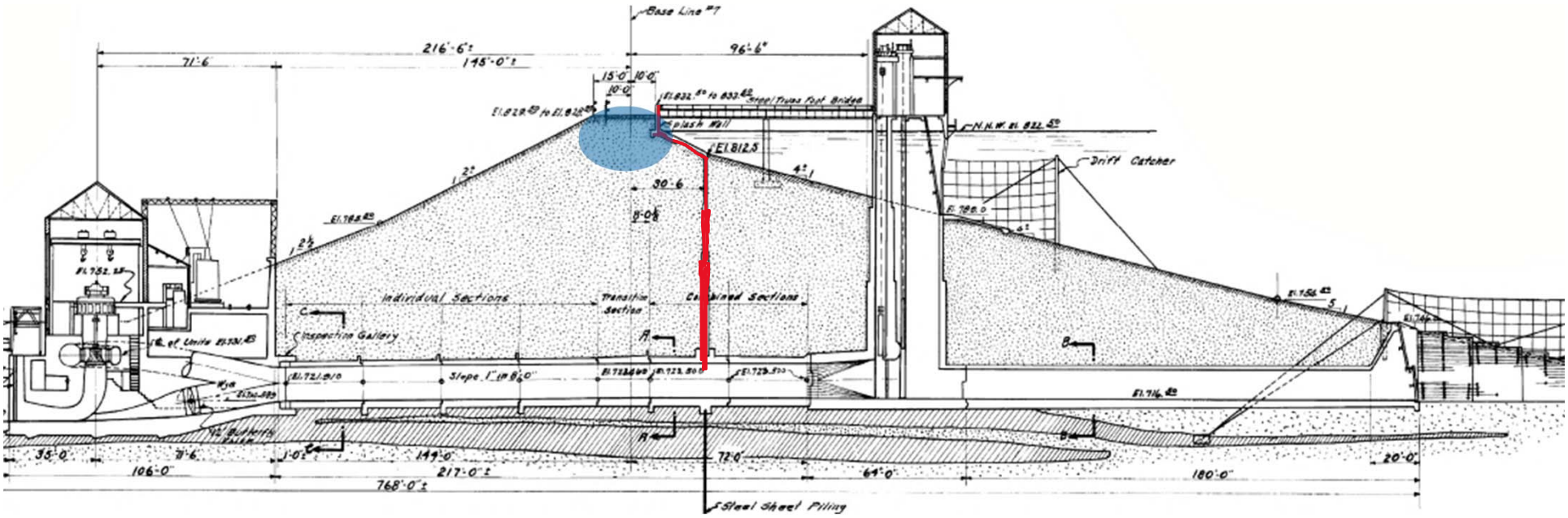

Auxiliary Spillway
Intake Tower
Powerhouse/Service Spillway
Tailrace

Hardy Auxiliary Spillway Remediation

- Engineering for Replacement
- Design Considerations
  - PMF (Increase Capacity)
  - Roadway
  - Passive Control Structure
  - Board of Consultants
- Construction
  - Target 2022/2023 Start

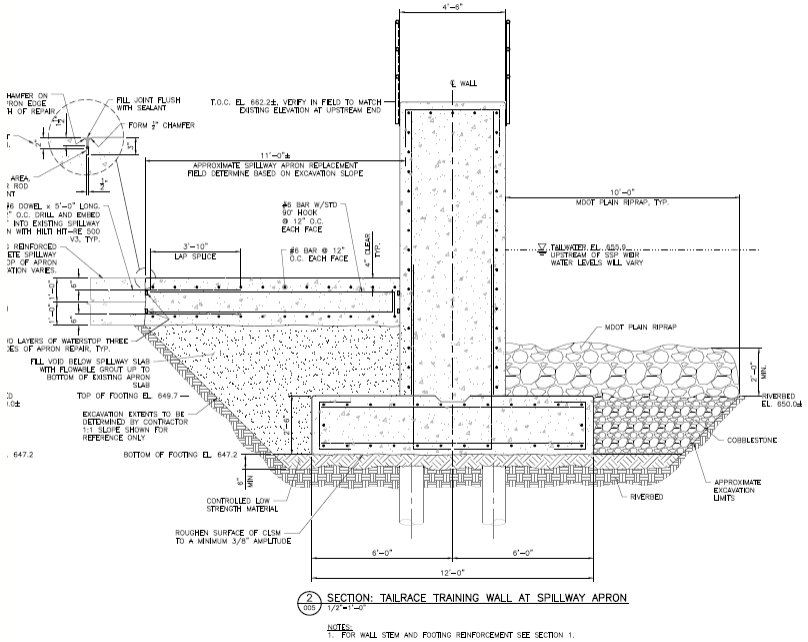


Hydraulic Barrier & Crest Compaction



Webber Dam

Webber Training Wall



2 SECTION: TAILRACE TRAINING WALL AT SPILLWAY APRON
1/2" = 1'-0"

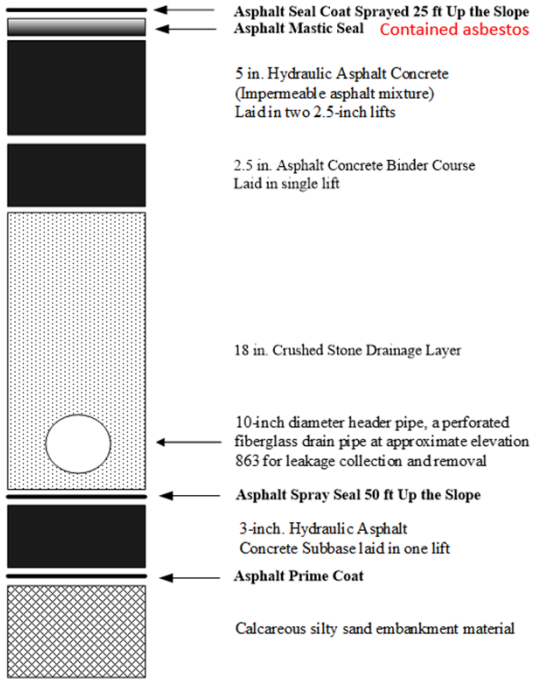
NOTES:
1. FOR WALL STEM AND FOOTING REINFORCEMENT SEE SECTION 1.

Webber Training Wall

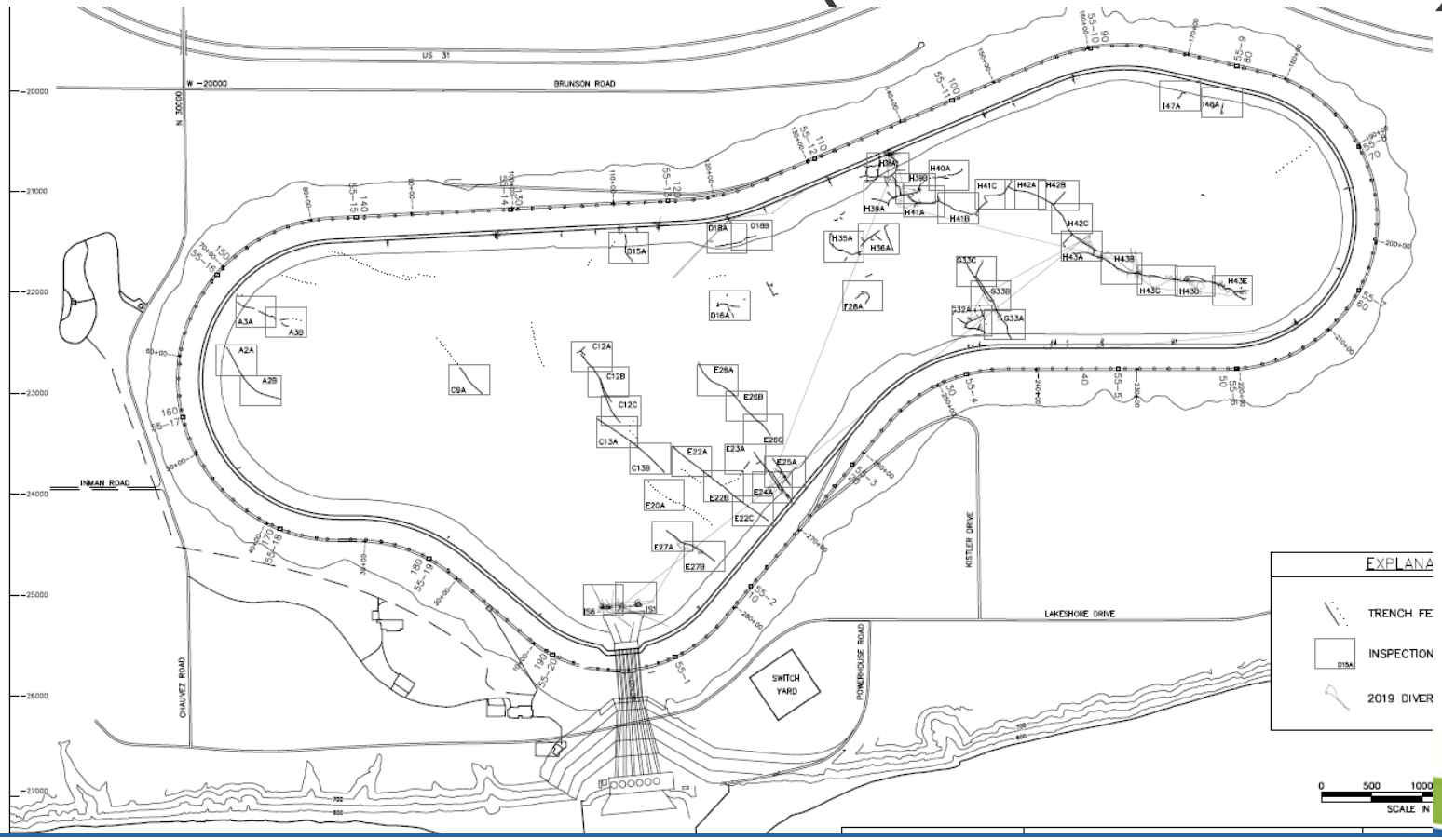
Webber Training Wall

Ludington Pumped Storage (LPS)

LPS Upper Reservoir Mastic Liner



LPS Trench Features (Maintenance)



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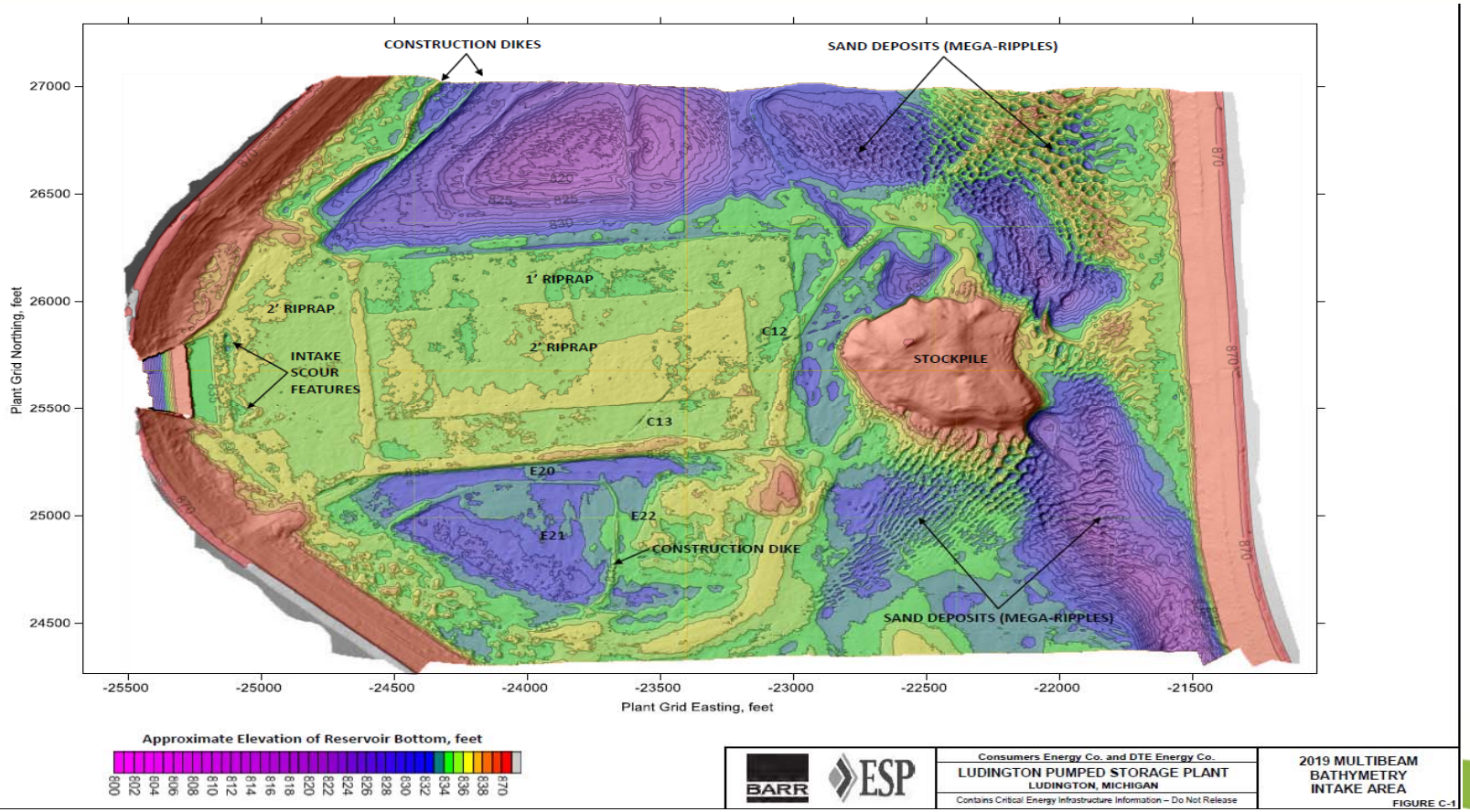


Past Projects

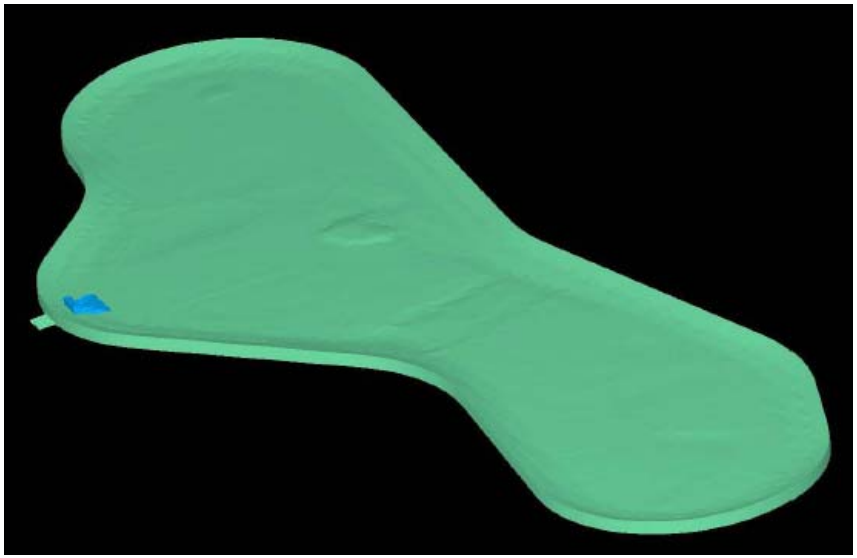
- Croton Right Spillway Wall Replacement (2019)
- LPS Interior Ramp Remediation (2014)
- LPS Numerical and Physical Modeling (2011/2012)

Croton Right Spillway Wall Replacement

Croton Right Spillway Wall Replacement

LPS Interior Ramp Replacement

LPS Numerical and Physical Modeling



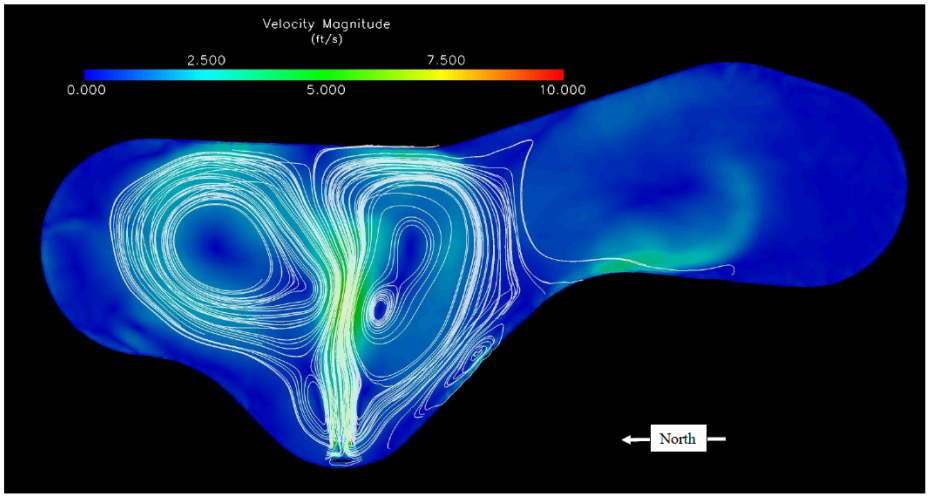


Figure D-14: Streamlines; Existing flowrate, pumping, 908.5'

LPS Numerical and Physical Modeling

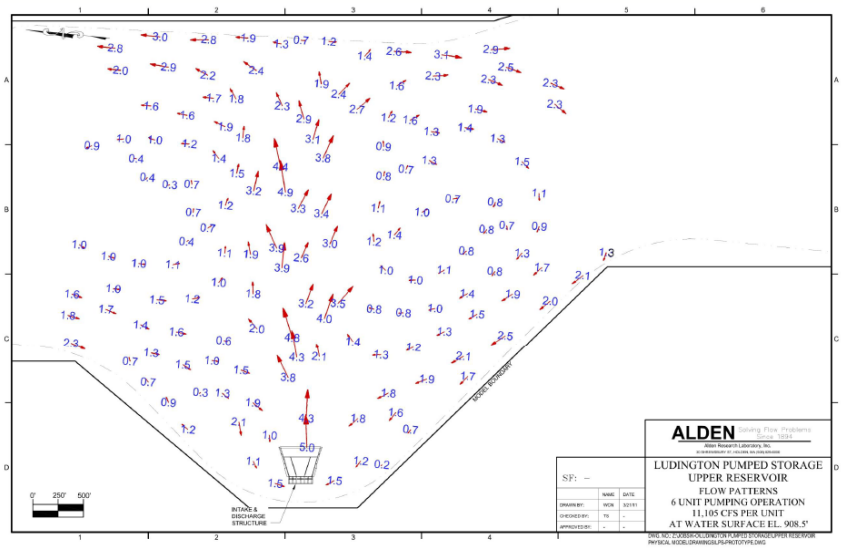
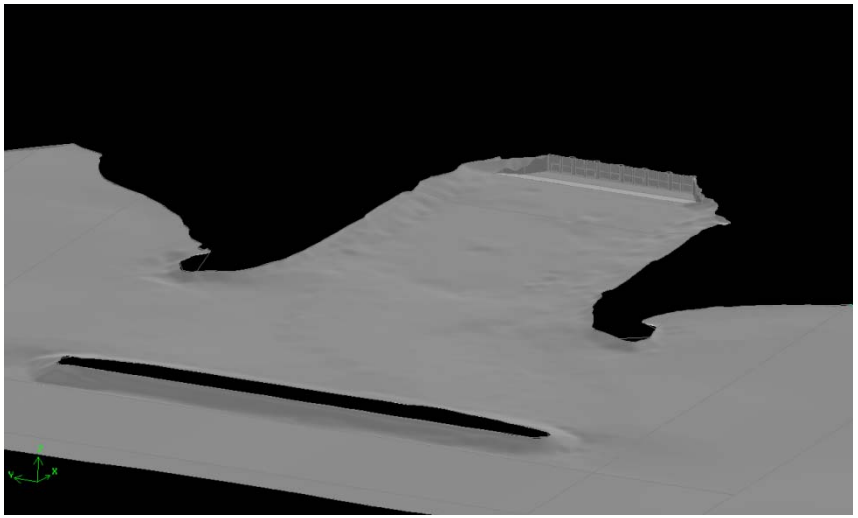
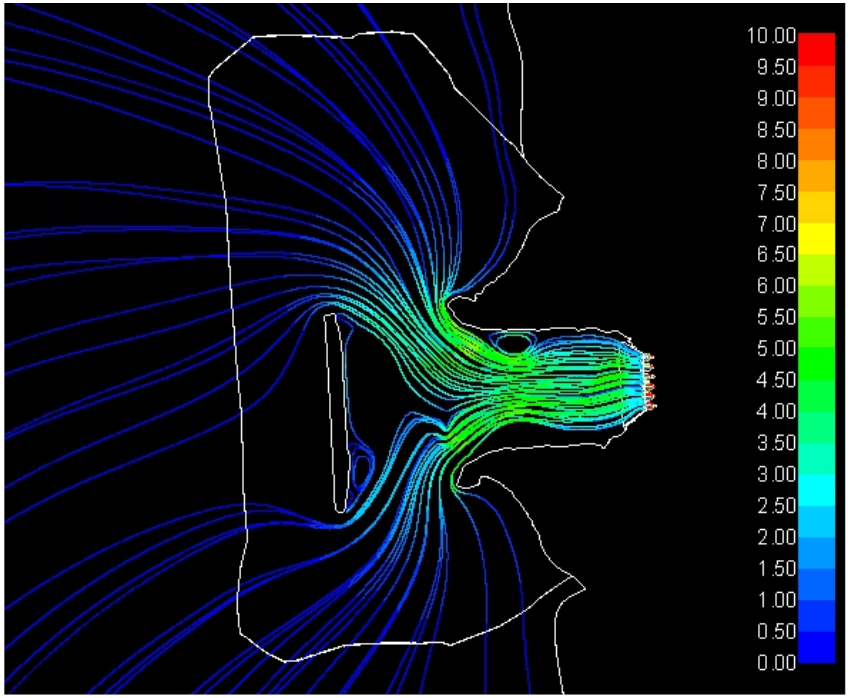


Figure 28: Upper Reservoir Pumping Flow Patterns; WSEL 908.5; 11,105 cfs per Unit

LPS Numerical and Physical Modeling





LPS Numerical and Physical Modeling

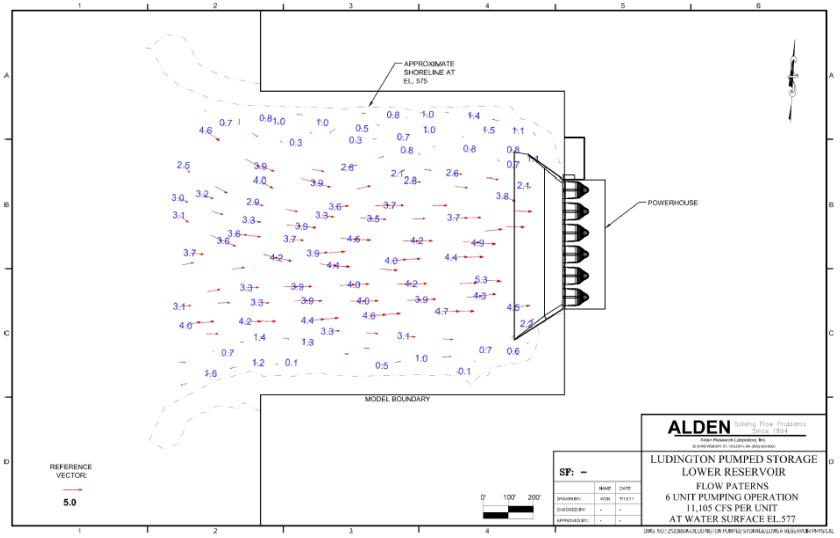


Figure 29: Pumping Flow Patterns; Q =11,105 cfs per unit ; WSEL = 577'

Questions?