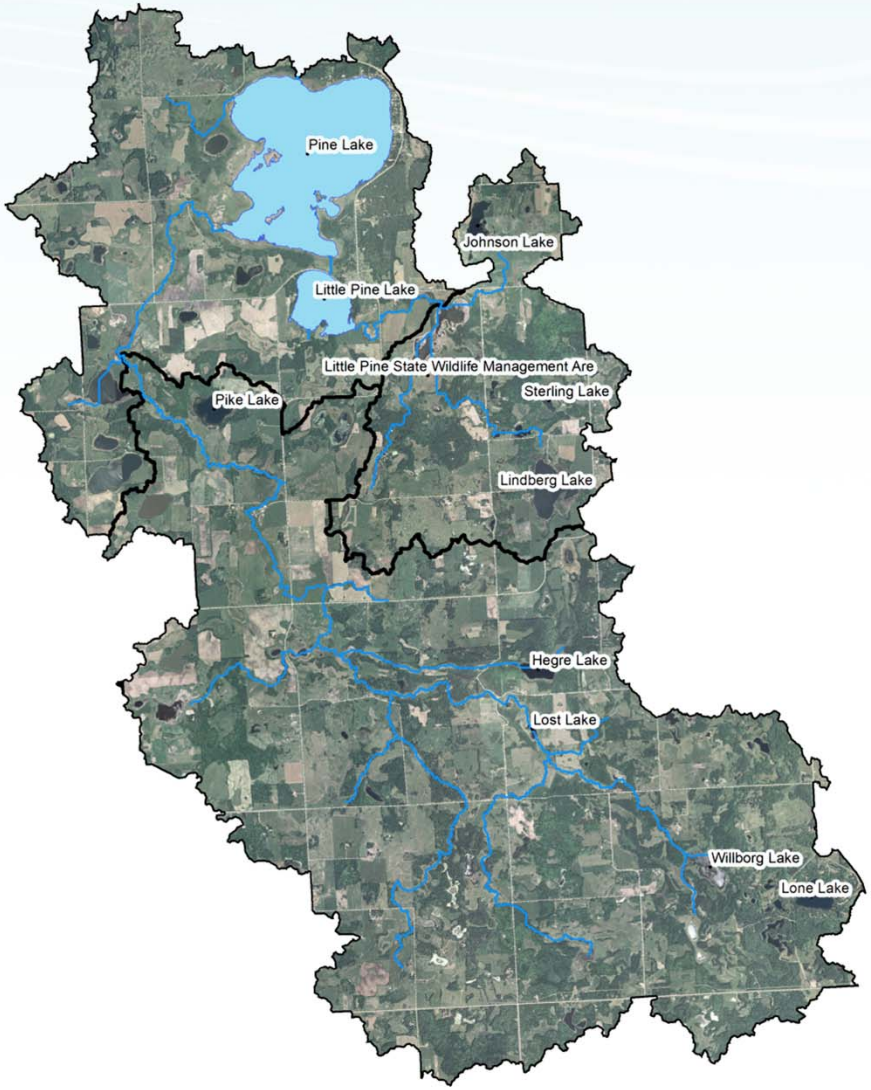
Pine Lake

Red Lake Watershed District

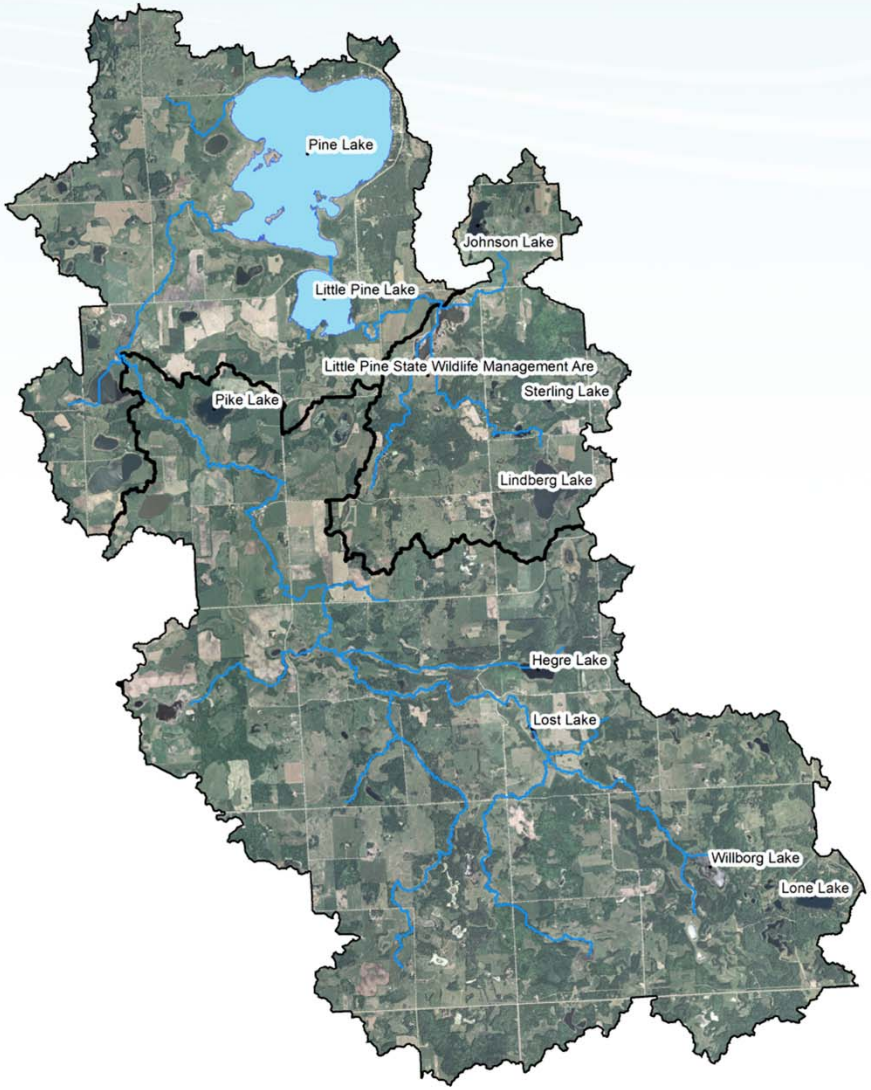
Project History

- In 1980, the Clearwater County Board of Commissioners petitioned the Red Lake Watershed District for an improvement of the Pine Lake outlet that would provide the public with flood control measures and wildlife benefits. The project, completed in 1981, consisted of a sheet pile dam with two adjustable stop log bays. The Gonvick Lions Club also operates a nearby aeration system to improve fish habitat in the lake.

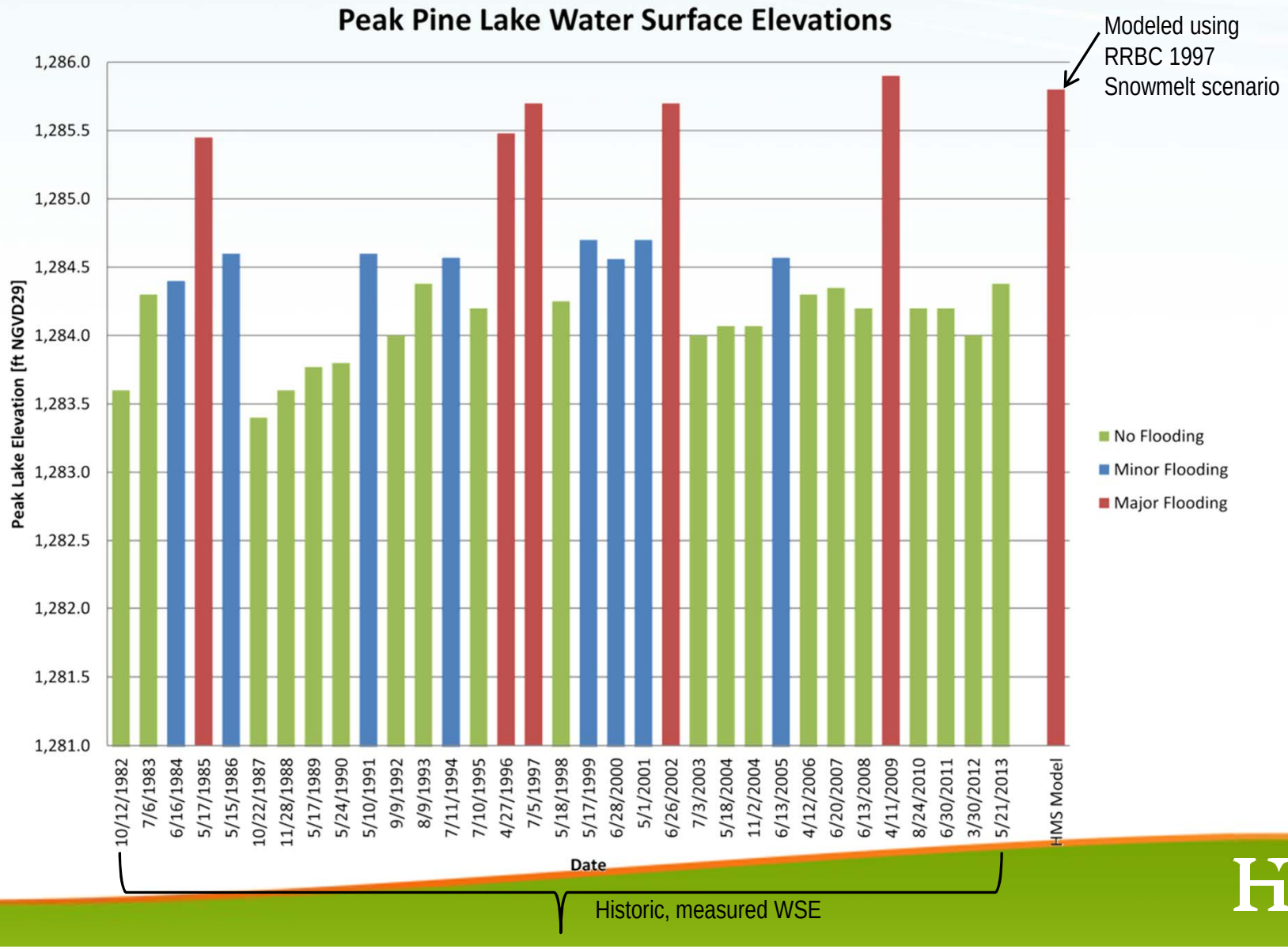


Project History

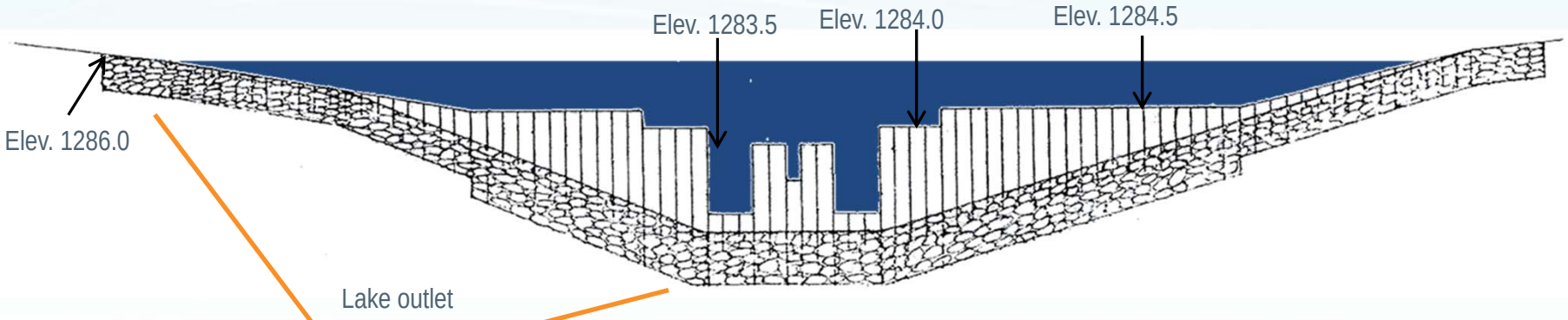
- Runoff from 45 mi^2 drainage area causes rapid increases in lake elevation
- Flooding concerns in 13 of last 33 years
- Lower lake levels in late summer, fall, and winter result in water quality issues
- POOPLA letter received regarding high and low lake level issues
- RLWD 20% Flow Reduction Initiative ID'd – Pine Lake FDR opportunity

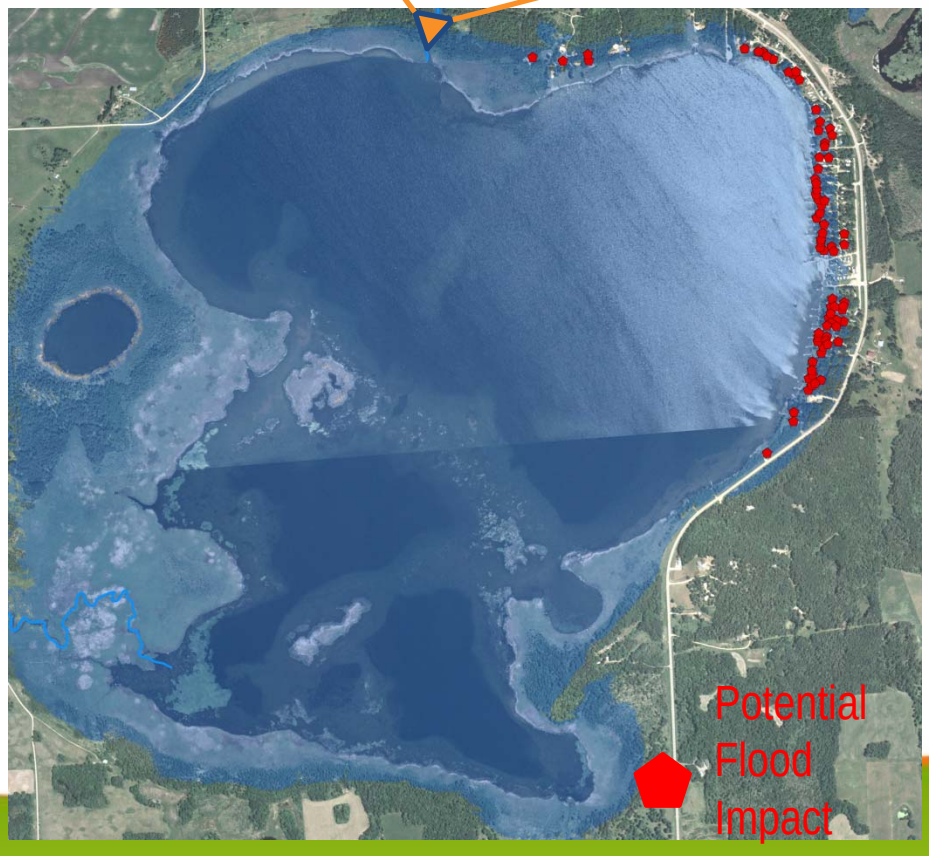


Historic and Modeled Peak Lake WSE



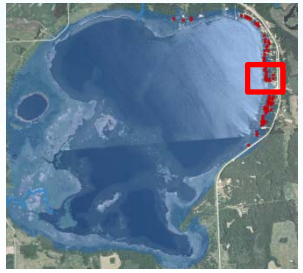
Highest Peak - 2009

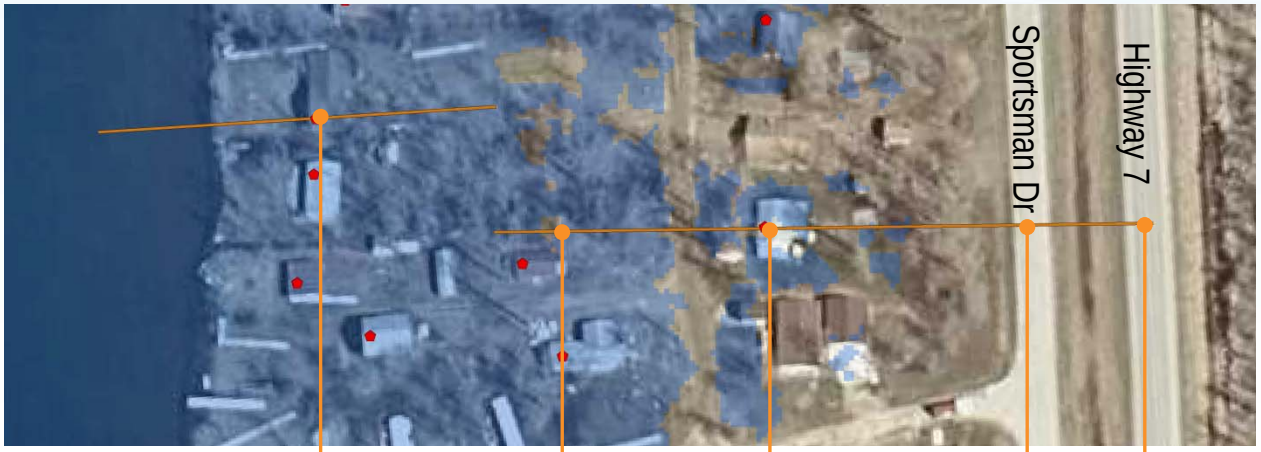


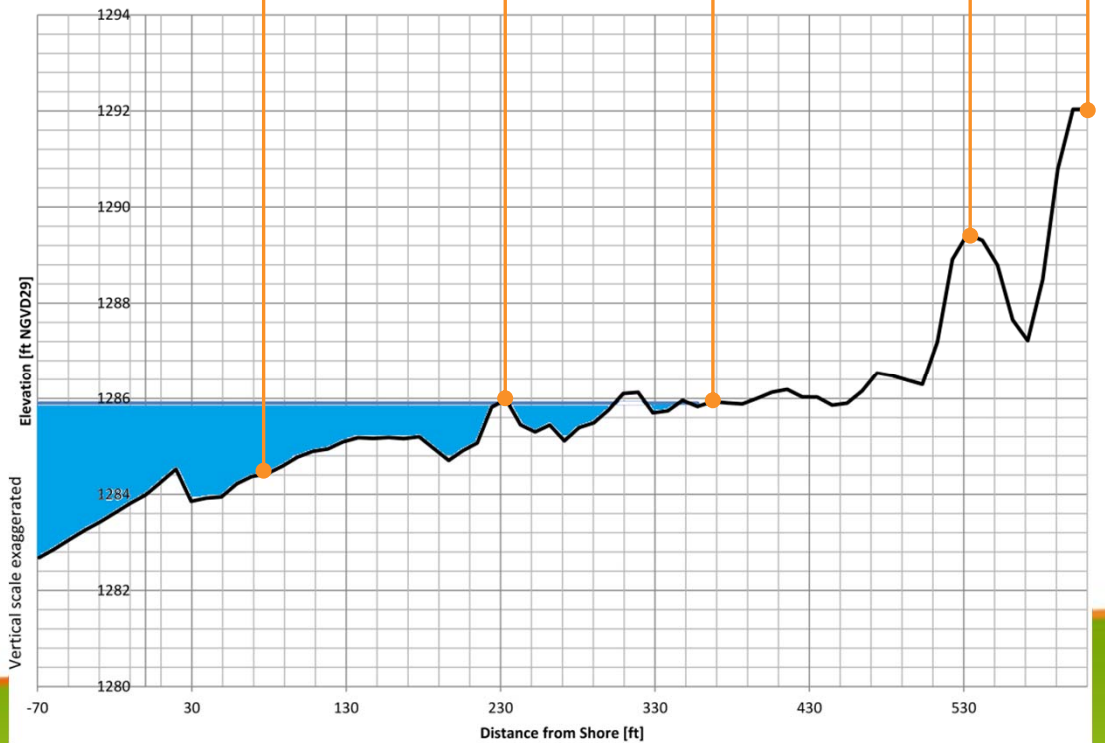


- Highest recorded lake level of 1285.9 feet on April 11, 2009
- Lake exceeded or at the natural ground elevation of 52 cabins
- Lake exceeded or at the first floor elevations of 22 cabins

Representative Cross Section
2009 Conditions





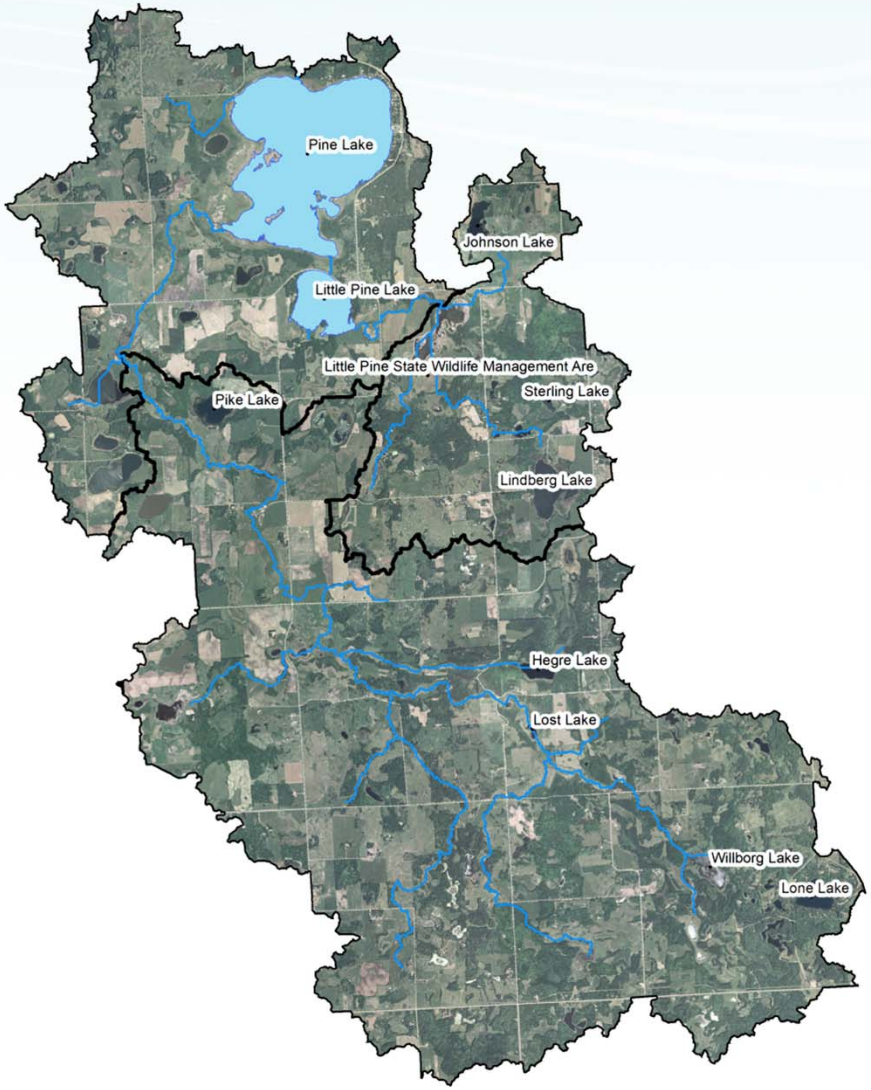


Project BACKGROUND

- Goals (Local and Regional)
  - Flood Damage Reduction
  - Water Quality Enhancement
  - Slightly Higher / Stable Summer Lake Levels
  - Reduce or Eliminate Fish Kills
  - Improve Habitat for Fish & Wildlife

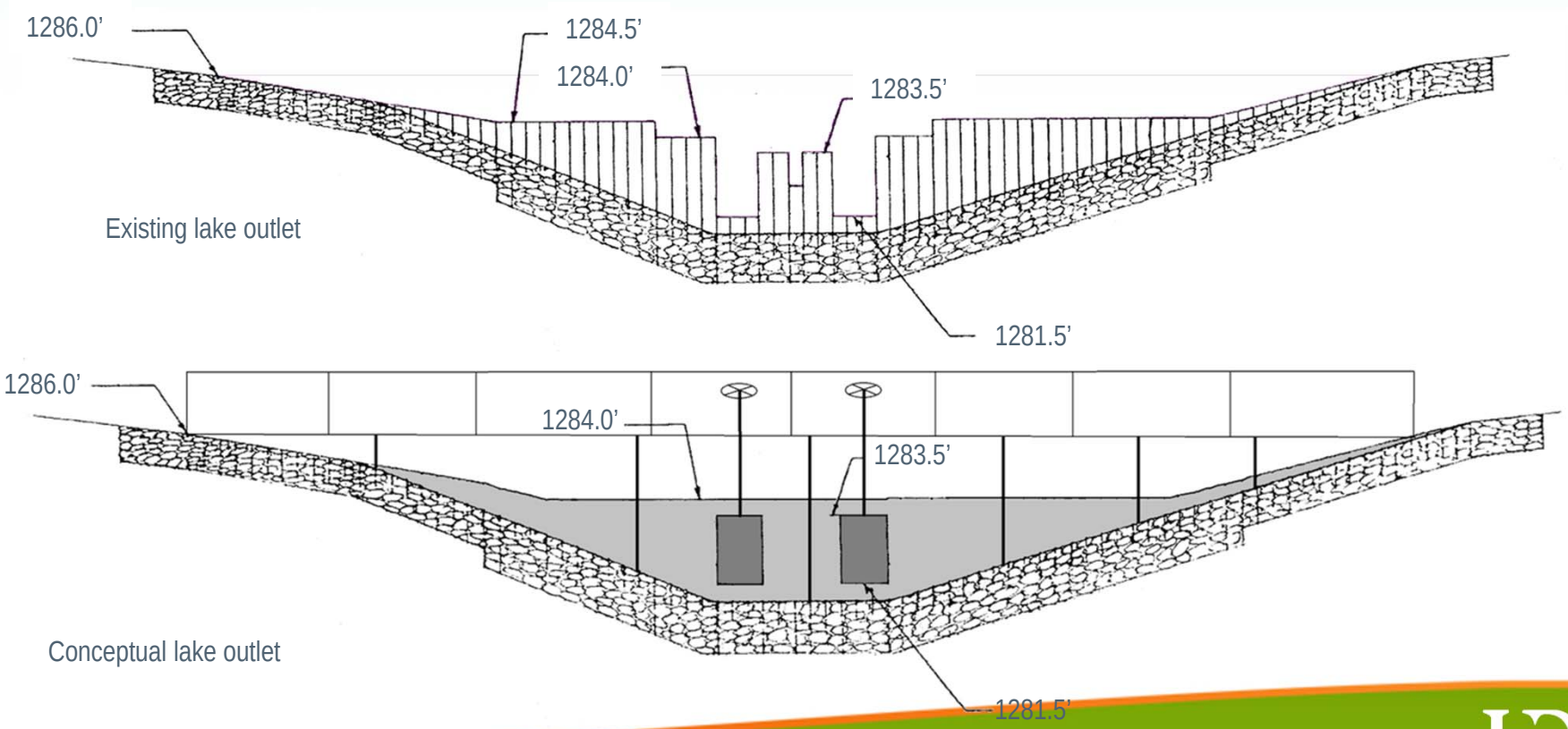
Project Goals and Focus

- Goals – Local Benefits
  - Modify outlet to assist with preferred summer and winter lake levels, manage agreeable lake levels, and improve water quality
  - Provide upstream storage to reduce persistent flooding conditions, manage lake levels, and improve water quality in the lake and downstream

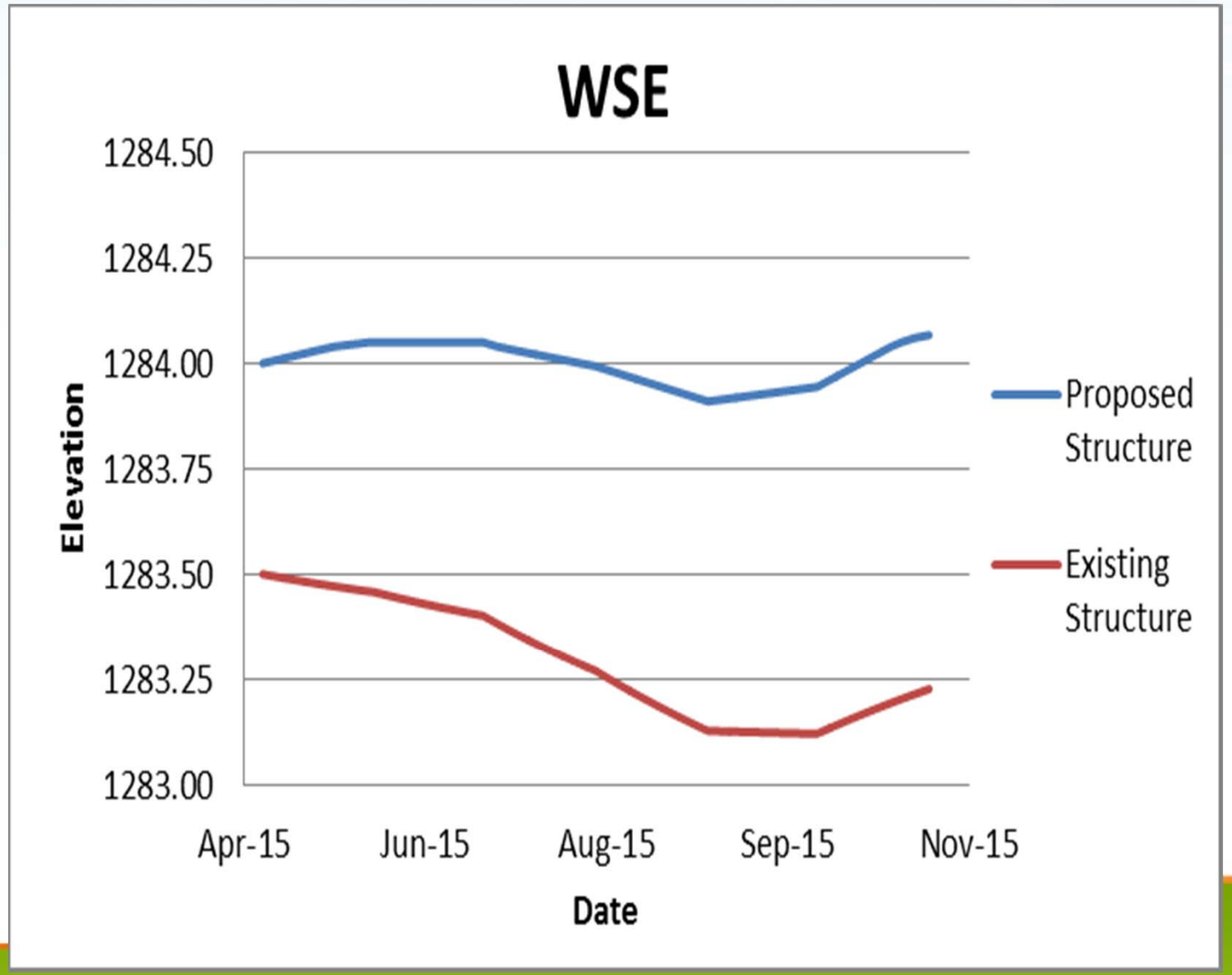


Conceptual Lake Outlet

- Top of weir at 1284.0 feet, the approximate Ordinary High Water Level elevation, by removing the 1284.5 feet weir portion and raising the 1283.5 feet weir portions
- Provide gates to lower lake for spring runoff and provide Lost Creek low flows



WATER BUDGET: TYPICAL SUMMER (WEIR CREST AT 1284.00)



Hydraulic model: preliminary results

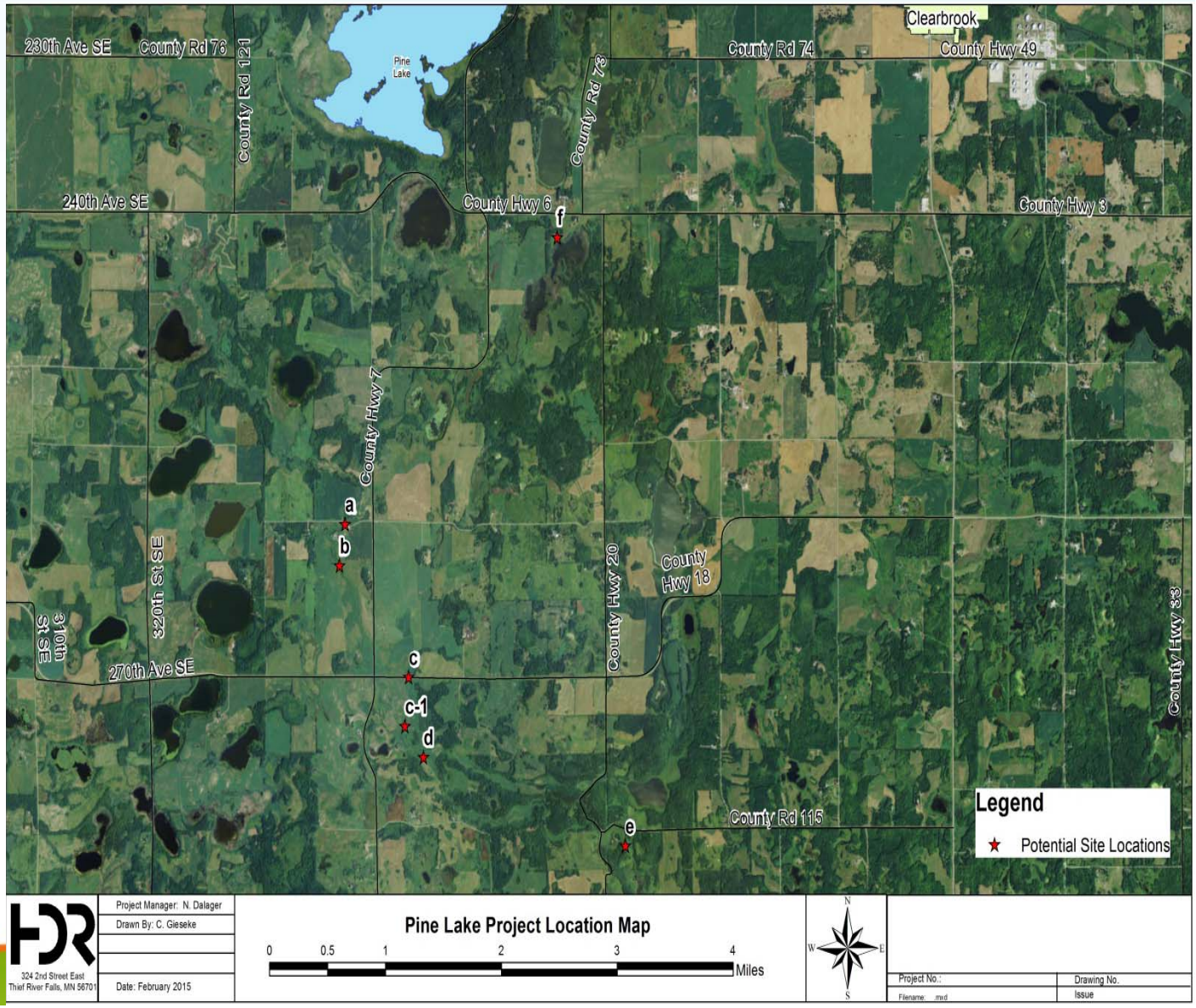
- Outlet structure has minimal effect on peak WSEs & discharges for 100-YR runoff events. It is actually the downstream Lost River channel that has the greatest effect on high Pine Lake outflows.

Benefits of New Outlet

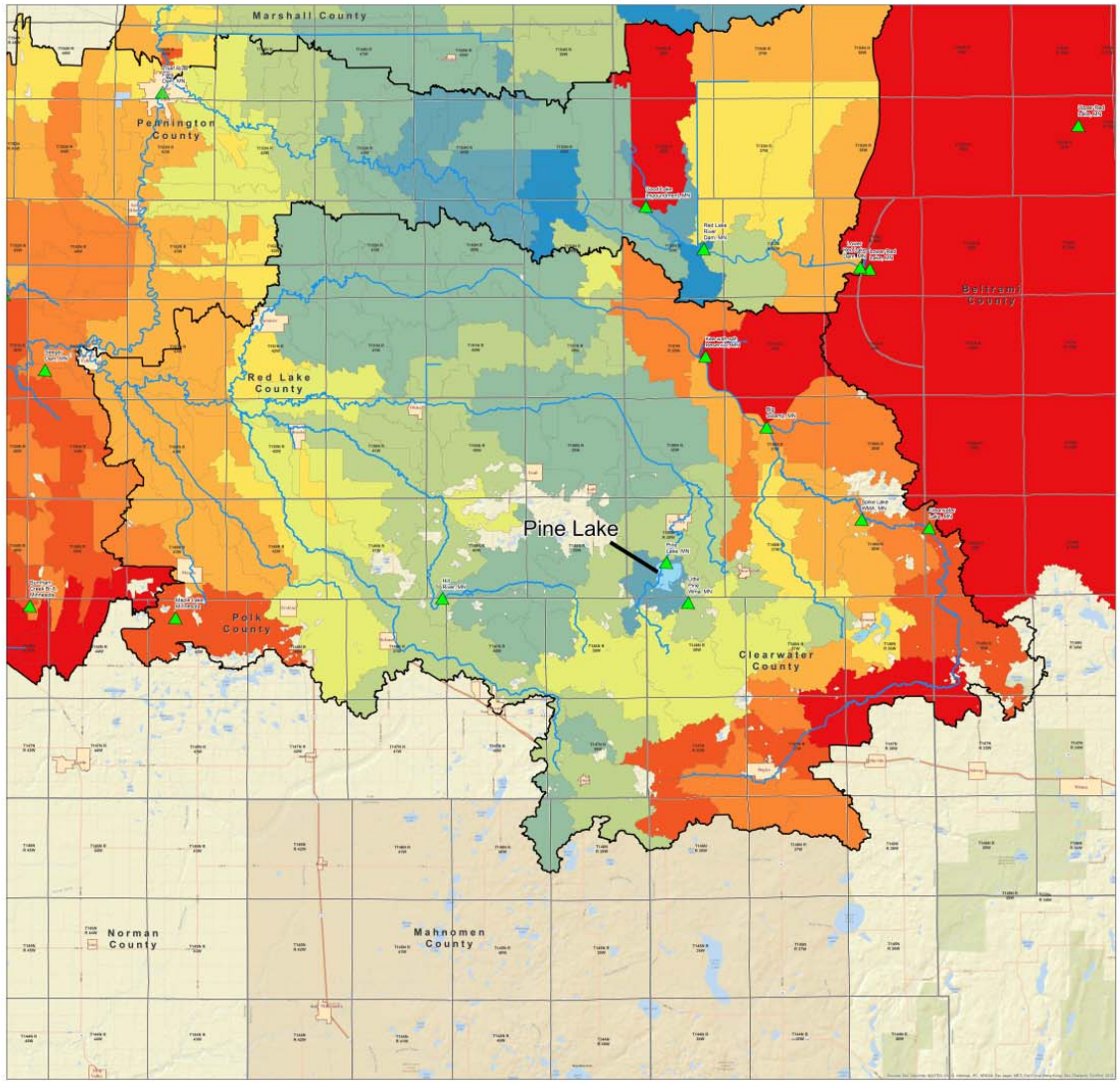
- Operational Flexibility / Access / Response Time
- Higher Summer/Fall Lake Level
- Discharges lower DO water through gate

PHOTOS COURTESY OF RED LAKE WATERSHED DISTRICT

RETENTION SITES EVALUATION



Impacts at Crookston



0 1.5 3 6 9 12 Miles

Kilometers 0 1.5 3 6 9 12

Hydrologic Impacts

Impact to Crookston Gage

- -0.12 to -0.09%
- -0.09 to -0.06%
- -0.06 to -0.05%
- -0.05 to -0.04%
- -0.04 to -0.03%
- -0.03 to -0.02%
- -0.02 to -0.017%
- -0.017 to -0.01%
- -0.01 to 0%
- 0%
- Drainage Line
- Crookston Gage
- Existing Impoundment

Values represent the expected change (reduction) in peak flow at the Crookston Gage for each square mile detained in a subbasin. Blue colors are subbasins that highly influence Crookston peak flows. Red colors indicate subbasins that have limited influence on Crookston peak flows.

Project Location

Figure 8
Hydrologic Impact Zones
Clearwater River, MN

Notes: The HEC-HMS model from the Red River HMS Phase 2 project and snow melt progression was modeled under existing conditions. Each subbasin in the watershed was removed from the analysis to detemine the sensitivity of storage in the subbasin to watershed outlet peak flow.

October 31, 2013

HDR

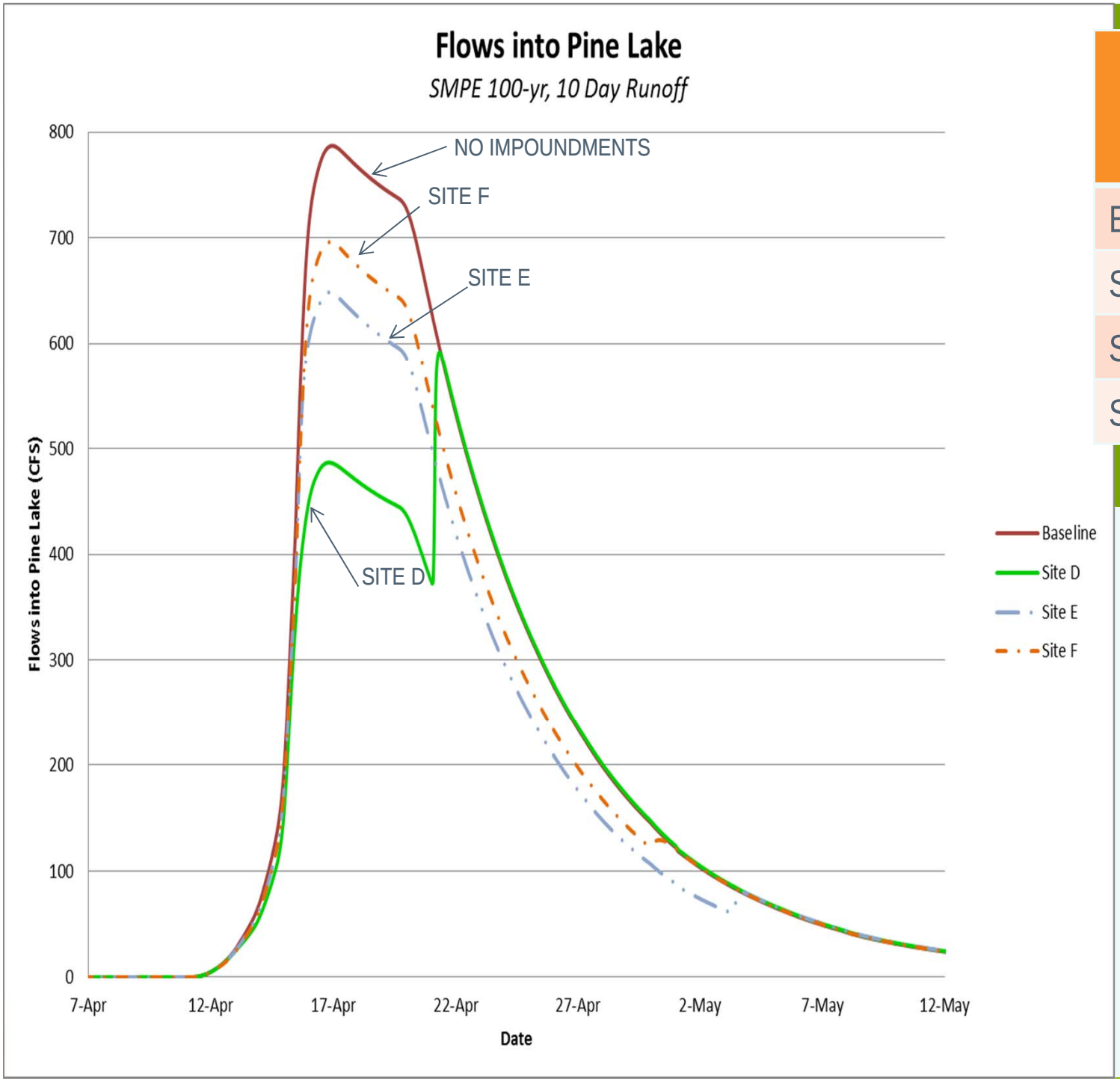
Retention sites were evaluated using ten criteria

- Miles of Stream Impacted
- Miles of Road Impacted
- Volume of Embankment Required
- Maximum Embankment Height
- Acres of Wetland Impacted
- Acre-Feet of Storage
- Inches of Runoff Captured
- Homes or Structures Impacted
- Number of Landowners Impacted
- Flooded Footprint Acres

RETENTION SITE RANKING MATIRX

Rating Multiplier		x 1		x 1		x 1.5		x 1		x 1.5		x 1.5		x 1		x 1		x 1		x 1			
Site	Drainage Area Sq. Miles	Miles of Stream	RANK	Miles of Roads	RANK	Volume of Embankment (CY)	RANK	Maximum Embankment Height (ft)	RANK	Acres of Wetlands Impacted	RANK	AC-FT Storage	RANK	Inches of Runoff Captured	RANK	Homes / Barns	RANK	Number of Landowners affected	RANK	Flooded Footprint acres	RANK	SUM	RANK
A	24.1	5.4	5	2.0	7	235400	4	17.0	2	194	3	4075	4	3.2	7	6	7	13	6	482	4	50.0	7
B	23.8	5.2	4	1.5	6	343500	5	21.8	3	209	5	4900	3	3.9	5	0	1	11	4	500	5	43.0	4
C	21.4	6.5	6	1.5	5	674700	7	32.5	5	206	4	7000	2	6.1	2	2	5	11	4	530	6	47.5	5
C-1	21.2	7.6	7	0.6	4	570800	6	35.1	7	326	6	7001	1	6.2	1	0	1	16	7	594	7	48.0	6
D	18.5	5.0	3	0.1	3	212700	3	32.1	4	93	2	3220	5	3.3	6	0	1	8	1	265	2	31.5	2
E	9.6	3.1	2	0.0	1	54600	2	34.6	6	74	1	3032	6	5.9	4	2	5	8	1	204	1	30.0	1
F	6.0	1.6	1	0.0	1	2600	1	9.5	1	359	7	1901	7	5.9	3	0	1	8	1	447	3	32.5	3

- 7 sites were broken up and ranked 1-7 based on 10 different criteria. A ranking of 1 is more favorable and a ranking of 7 is less favorable with respect to a particular criterion.
- The criteria that were deemed to be more influential with respect to site feasibility have a multiplier applied to that criterion.
- The ranking values are summed for each of the sites with the lowest score representing a more feasible site based upon this relative scale approach.



	Peak Discharge (CFS)
Existing	787
Site D	591
Site E	649
Site F	696

Local Benefits

- Modify Outlet
  - More desirable (higher) levels in Summer and Fall
  - WQ benefits
  - Longer duration base flows downstream

- Upstream Storage
  - Significant downstream FDR
  - More desirable (higher) levels in Summer and Fall
  - WQ benefits
  - Longer duration base flows downstream

Project Team Status - Retention Screening

- It was the consensus that Site C should be removed for future discussion. Myron stated that Site A should be removed as it has too many barriers with various homes and paved roads. Mark Larson stated that Sites A and B are the same and he has a big stake in them. No structure impacts on Site B. It was the consensus of the group that Sites A and B be removed for future discussion.
- It was the consensus of the group to remove Site C1 from large pool, but leave Site C1 in the small category
- Severts stated use 1-8 rankings for all three classes in small medium large. The sites would be worthy of all. But Site D is a 9. It was the consensus that we use rankings 1-9. Rave stated that Site F on the large area should be removed also. Jesme stated to keep Site F on the radar. Both Rave and Thul stated to remove Site F-Large. Site F-Small could remain. Thul stated that Site F-Small would also depend on timing, duration, etc.
- .

Landowner Meeting Discussion

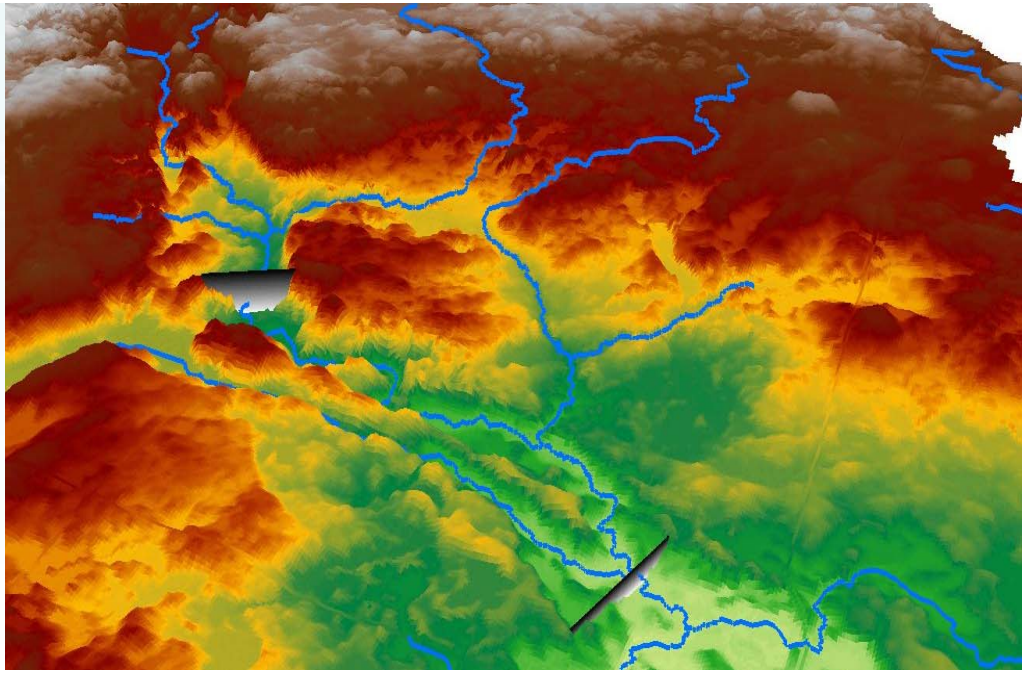
- Dalager asked the groups thought's on when are we going to hand out maps. Should we distribute maps? Next step is a landowner meeting with the maps.
- Discussion was held on holding landowner meeting at the Gonvick Community Center. Meeting was held August 17.

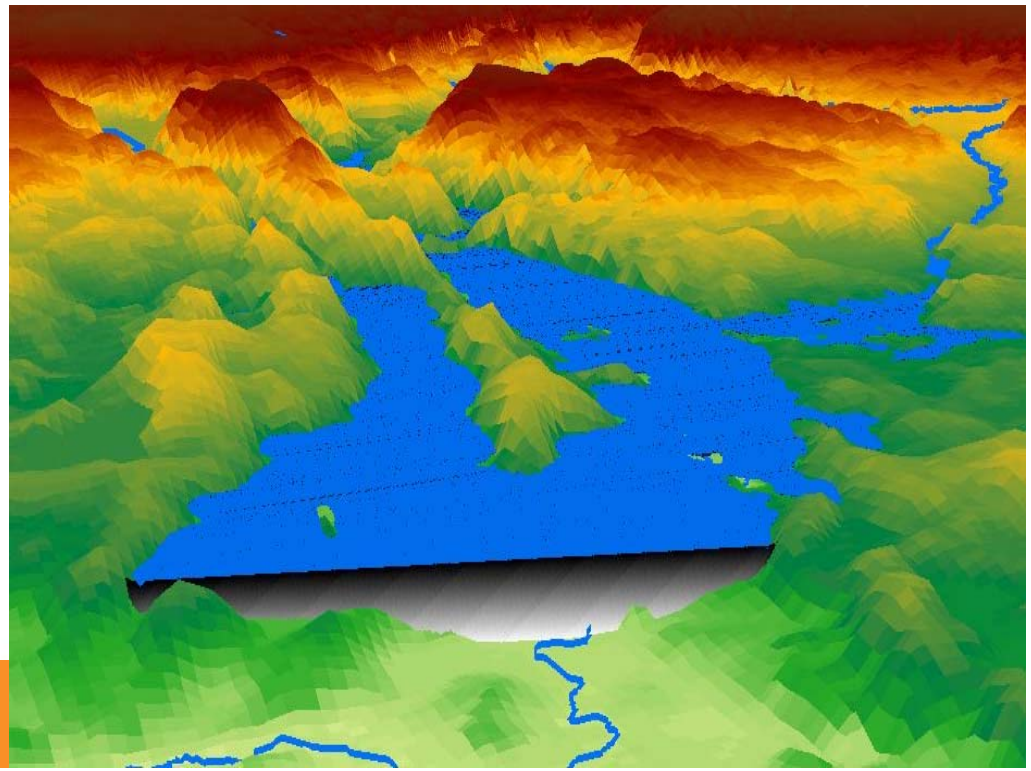
- NRCS PL-566 Funding was pursued after this meeting.

- Review July 17, 2015 minutes

LET'S TAKE A LOOK AT SOME OF THE SITES

- "Aerial Views"





Further Discussion

- Further Goals Discussion?

- Water Quality Discussion?

Project BACKGROUND

- Goals (Local and Regional)
  - Flood Damage Reduction
  - Water Quality Enhancement
  - Slightly Higher / Stable Summer Lake Levels
  - Reduce or Eliminate Fish Kills
  - Improve Habitat for Fish & Wildlife

PINE LAKE WATER QUALITY DISCUSSION

WATER QUALITY enhancement considerations

- Upstream Best Management Practices
  - Restoring wetlands
  - Conservation easements
  - Buffer strips
- Education about protecting native aquatic plant beds

See Pine Lake Water Quality Analysis by RMB Environmental Laboratories, 2011

PHOTO COURTESY OF RED LAKE WATERSHED DISTRICT

Pine lake

- MPCA Lake Classification – 2B & 2C (Aquatic Life & Recreation)
- Category – Shallow Lake or Reservoir
- Ecoregion – North Central Hardwood Forests, Red River Valley
- Impairment – Mercury
- *Notice differences from upstream to downstream sample results (following slides)

CONVENTIONAL POLLUTANTS

- Dissolved Oxygen: 5 mg/L
- Turbidity: 25 NTU

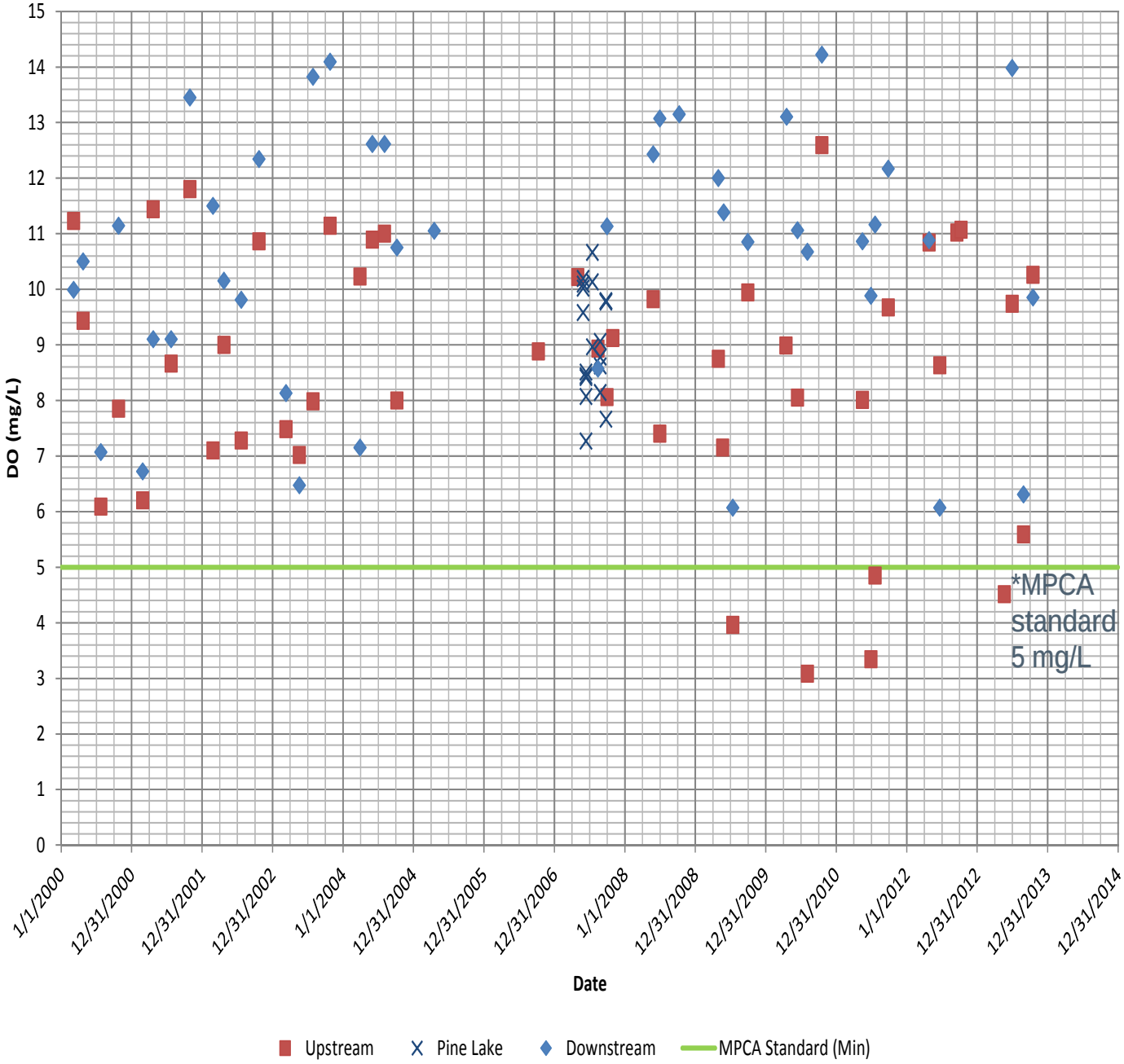
EUTROPHICATION STANDARDS

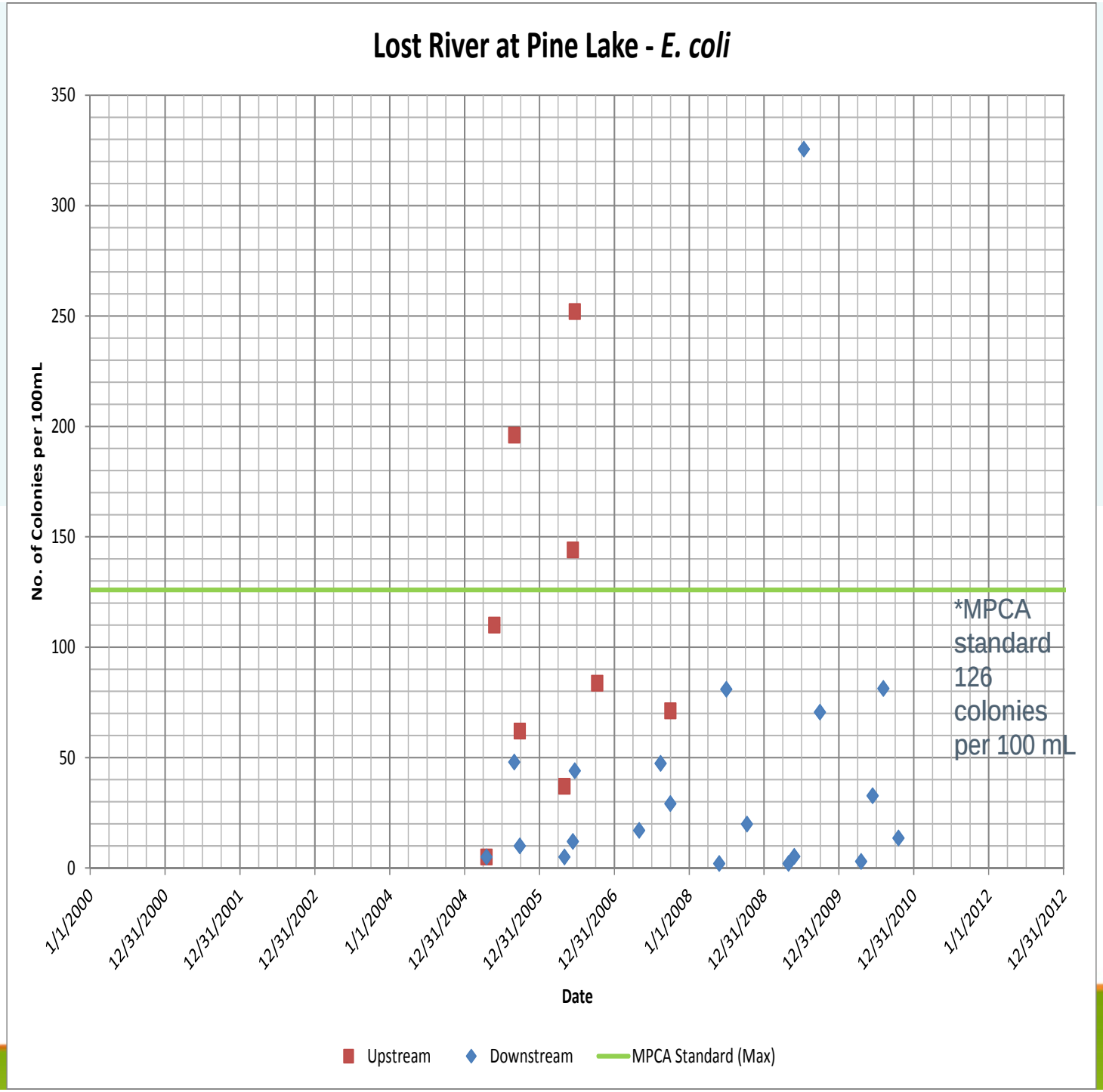
- Total Phosphorus: 0.06 mg/L
- Chlorophyll A: 0.02 mg/L

E. COIL STANDARDS

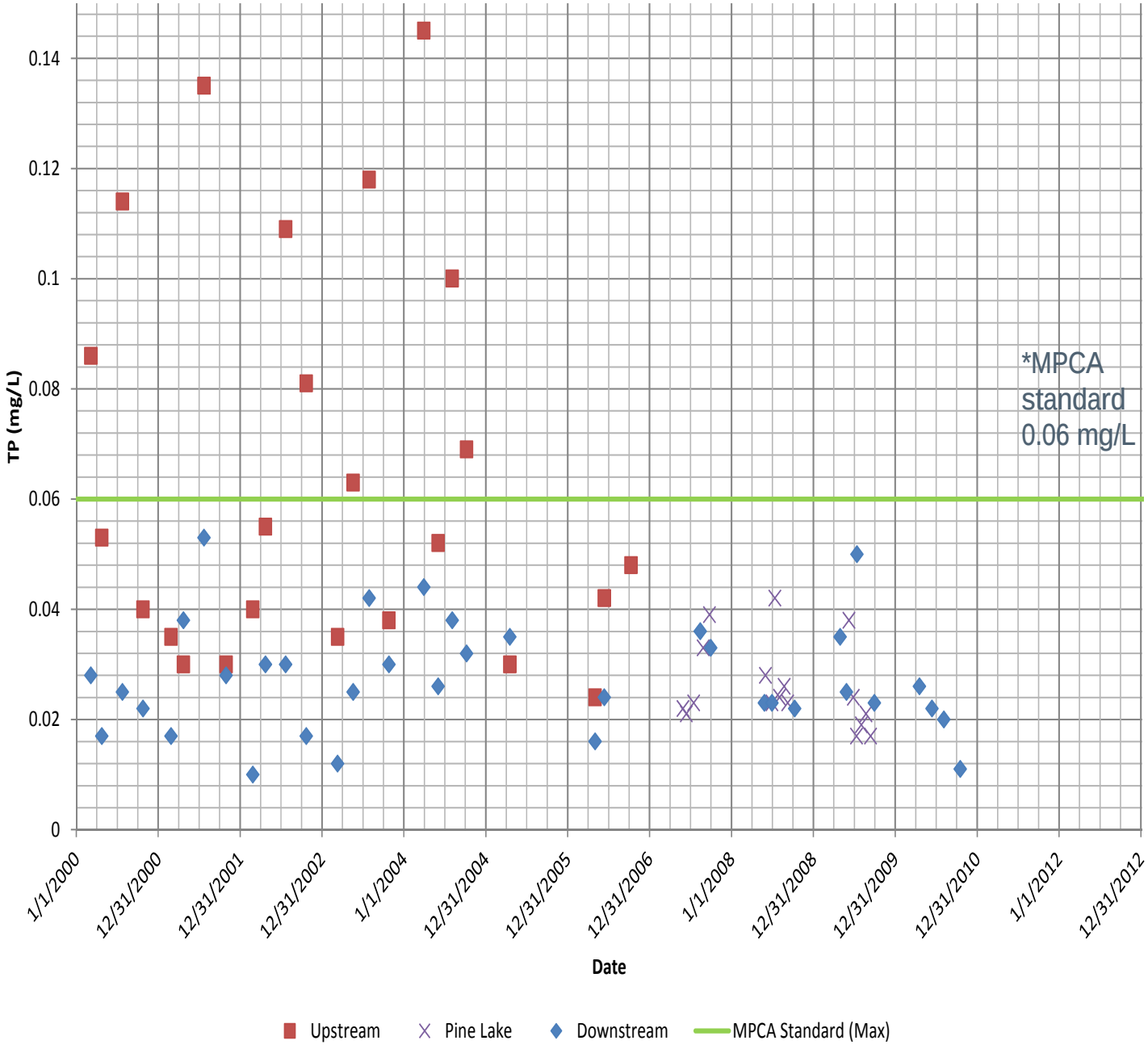
- Monthly Geometric Mean – 126 Organisms per 100 mL

Lost River and Pine Lake - Dissolved Oxygen

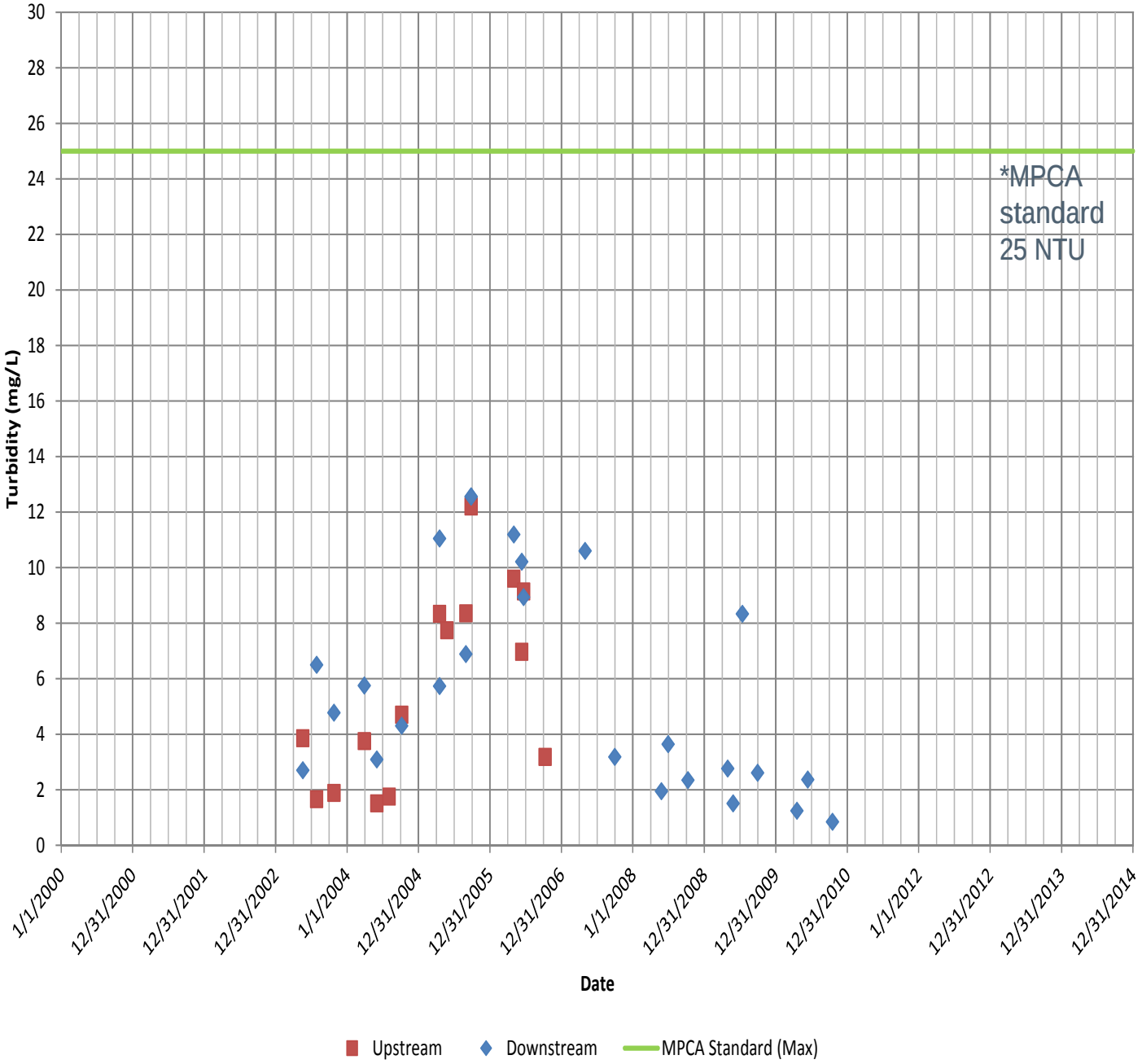



Lost River at Pine Lake - E. coli
No. of Colonies per 100mL
350
300
250
200
150
100
50
0
1/1/2000
12/31/2000
12/31/2001
12/31/2002
1/1/2004
12/31/2004
12/31/2005
12/31/2006
1/1/2008
12/31/2008
12/31/2009
12/31/2010
1/1/2012
12/31/2012
Date
*MPCA standard 126 colonies per 100 mL
Upstream
Downstream
MPCA Standard (Max)

Lost River and Pine Lake - Total Phosphorus



Lost River at Pine Lake - Turbidity



Winterkill:

- Raising lake outlet strictly for summer months would not impact winterkill.

Water Clarity:

- There is a strong relationship between water clarity and phytoplankton levels. Levels of algae are quite low for this particular lake.

E. coli:

- Raising the WSE 0.5 feet during summer would not alter any potential E. coli sources.

Low Pipe Intake:

- Proposed gate would draw water from the bottom of the water column to the extent possible. Inlet channel may need to be cleaned.

Winterkill

Raising the Pine Lake outlet elevation by 6 inches only in summer will have no impact on winterkill. Winterkill is a function of the volume of water and DO levels present at ice-up, oxygen-demanding sources under the ice (e.g. fish), oxygen-producing sources under the ice (e.g. phytoplankton), and light penetration through the ice to drive phytoplankton oxygen production.

Pine Lake

Questions, Discussion, and Next Steps

top 3 sites based on matrix (lowest scores)

SITE D

- 3220 AC-FT of Storage
- 3.3 Inches of Runoff Captured
- 265 Acres of Footprint
- 212,700 CY of Embankment Required
- 5.0 Miles of Streams Impacted
- 3031 AC-FT of Storage
- 5.9 Inches of Runoff Captured

SITE E

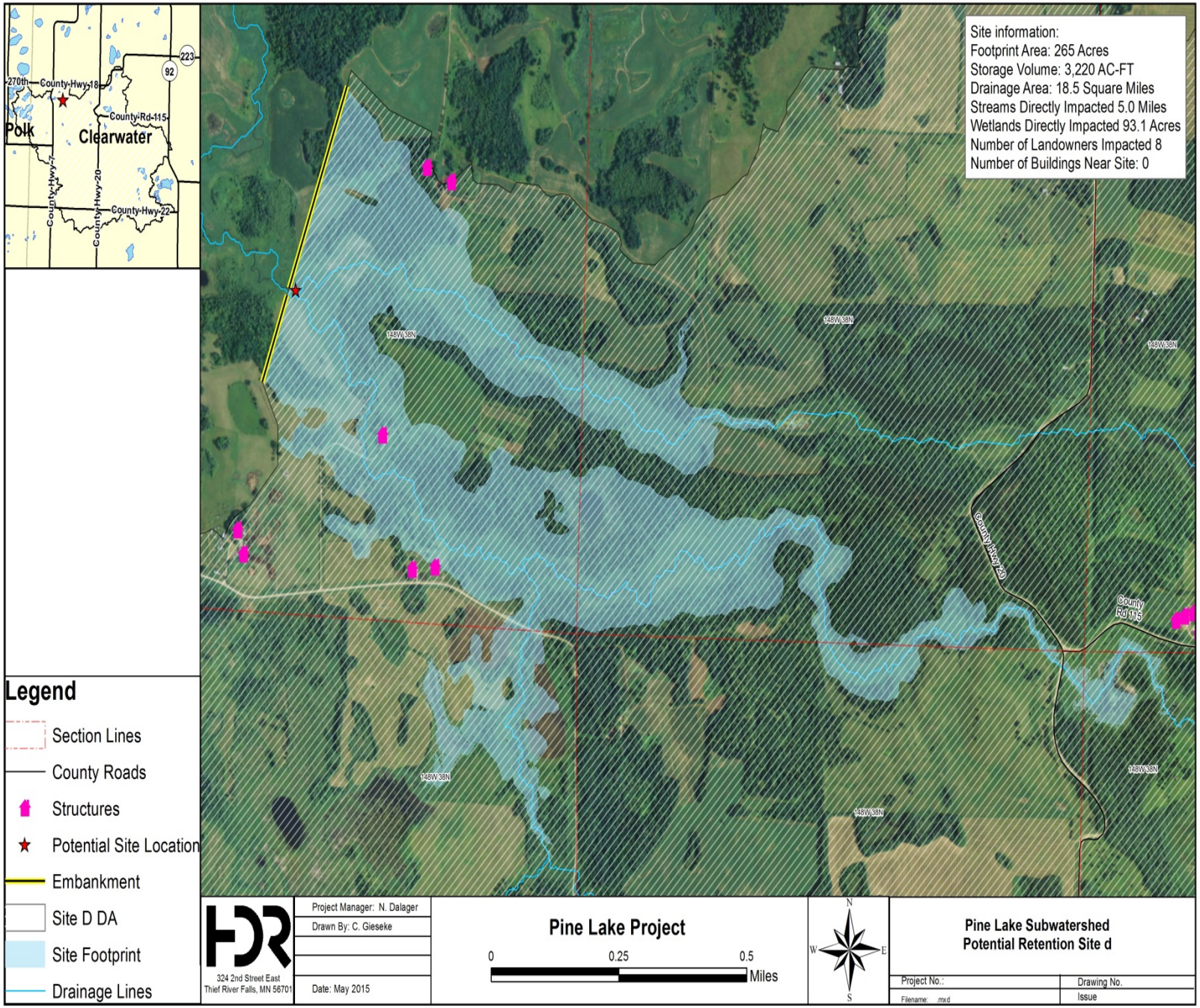
- 204 Acres of Footprint
- 54,600 CY of Embankment Required
- 3.1 Miles of Streams Impacted
- 1901 AC-FT of Storage
- 5.9 Inches of Runoff Captured
- 447 Acres of Footprint
- 2,600 CY of Embankment Required

SITE F

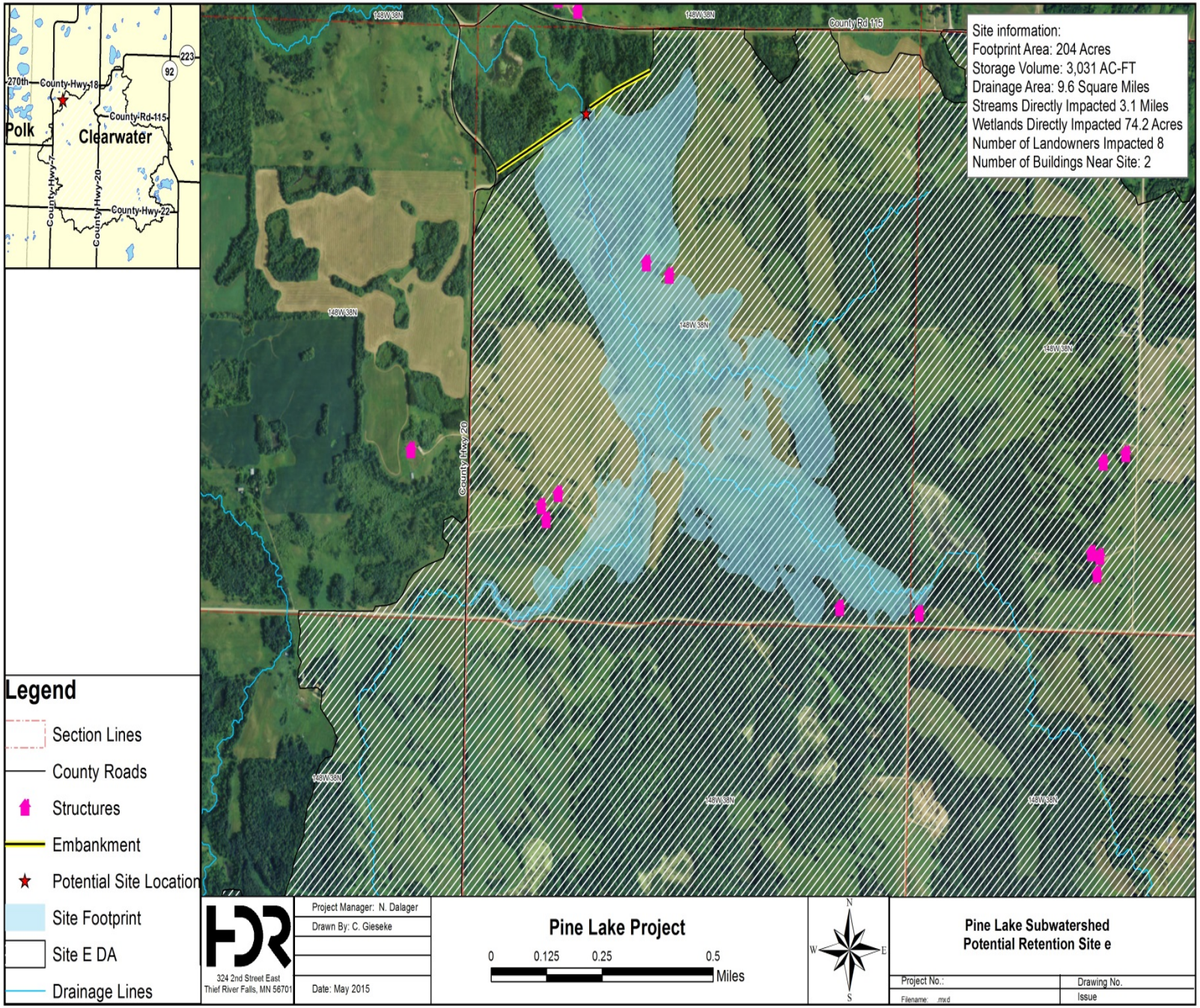
- 1.6 Miles of Streams Impacted


a
b
c
c-1
d
e
f

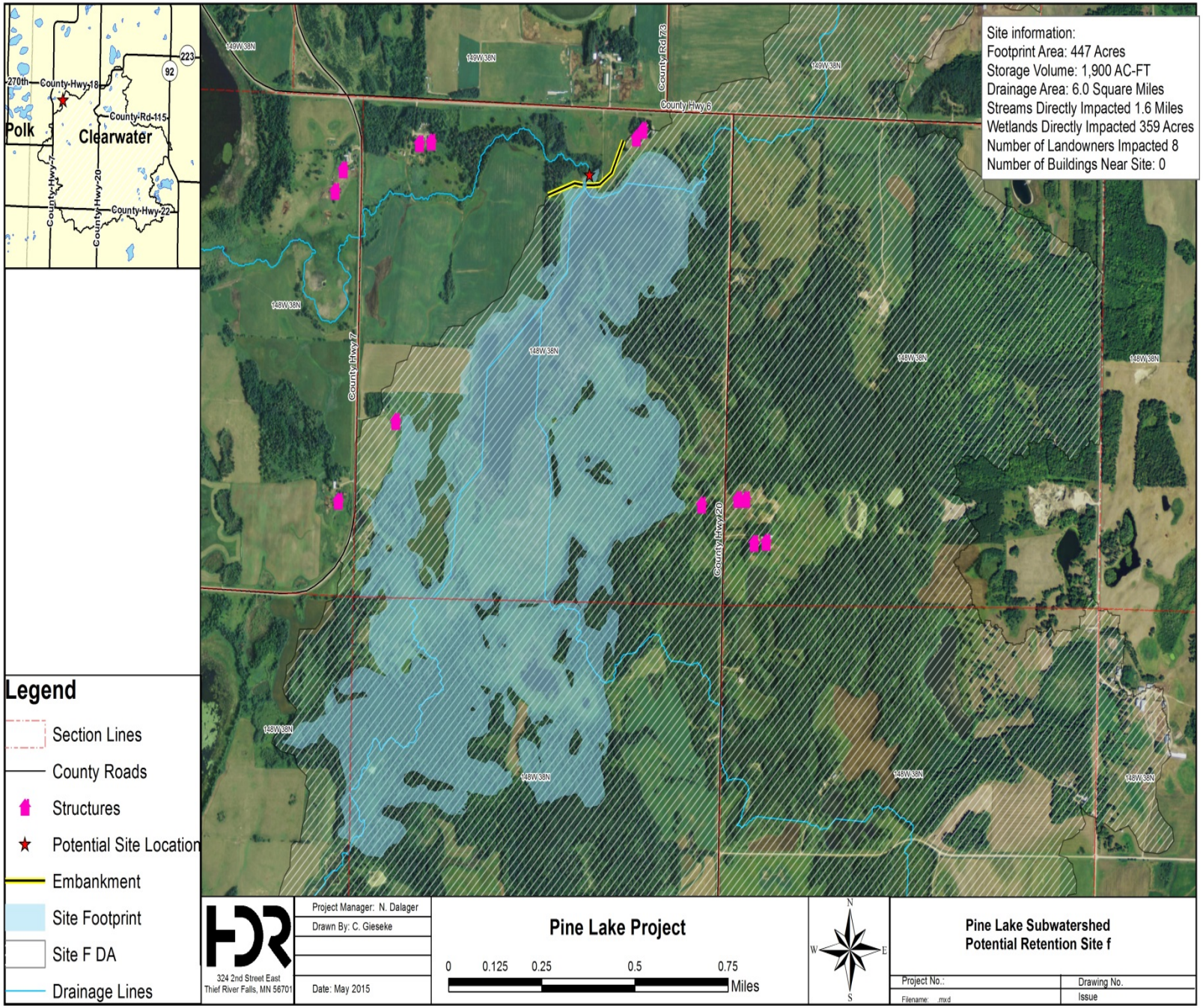
Site D


Site information:
Footprint Area: 265 Acres
Storage Volume: 3,220 AC-FT
Drainage Area: 18.5 Square Miles
Streams Directly Impacted 5.0 Miles
Wetlands Directly Impacted 93.1 Acres
Number of Landowners Impacted 8
Number of Buildings Near Site: 0
270th
County-Hwy-18
223
92
County-Rd-115
Polk
Clearwater
County-Hwy-7
County-Hwy-20
County-Hwy-22
148W 38N
County Hwy 20
County Rd 115
Legend
Section Lines
County Roads
Structures
Potential Site Location
Embankment
Site D DA
Site Footprint
Drainage Lines
324 2nd Street East
Thief River Falls, MN 56701
Project Manager: N. Dalager
Drawn By: C. Gieseke
Date: May 2015
Pine Lake Project
0
0.25
0.5
Miles
N
W
E
S
Pine Lake Subwatershed
Potential Retention Site d
Project No.:
Drawing No.
Filename: .mxd
Issue

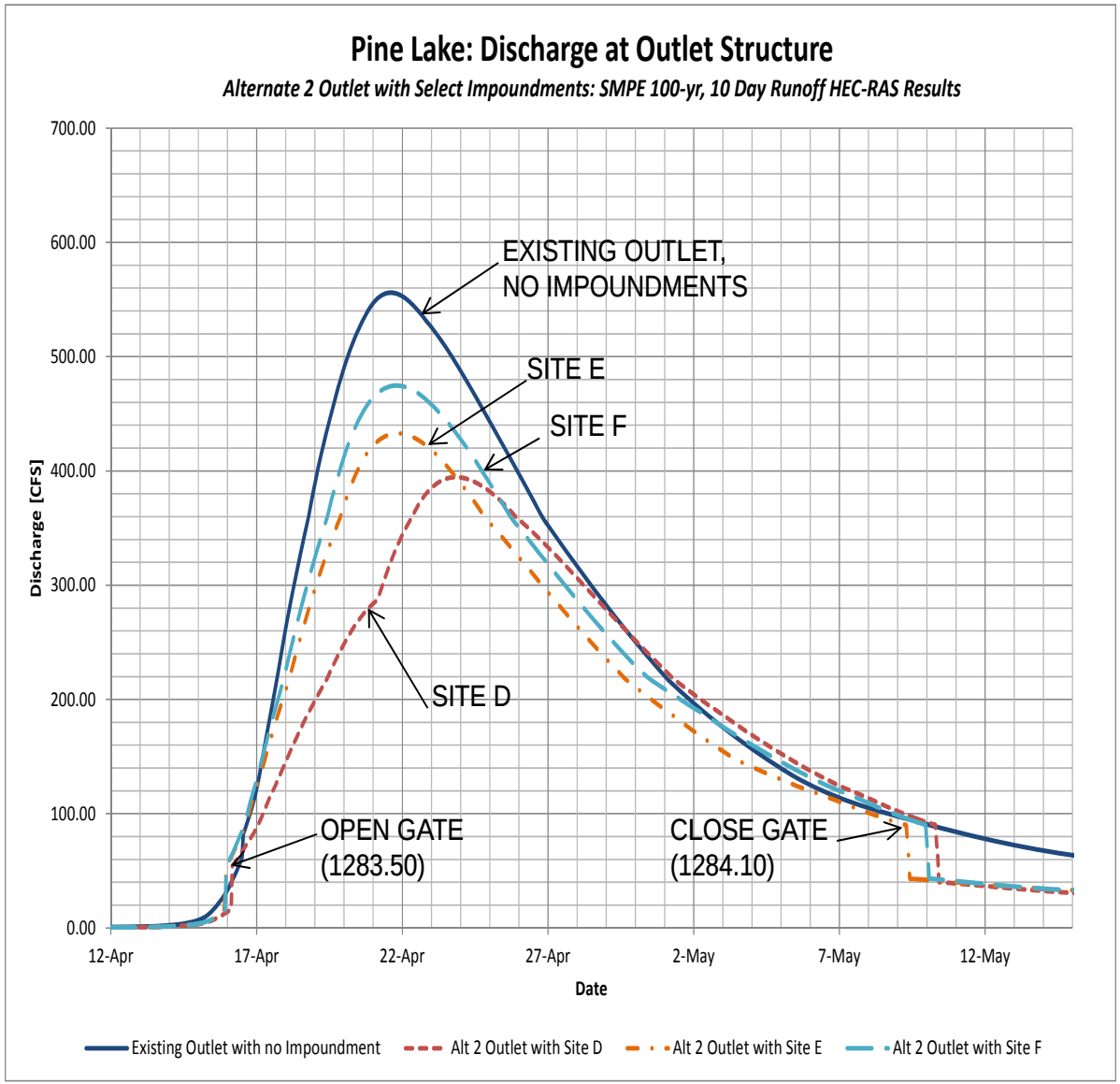
Site E


Polk
Clearwater
270th
County-Hwy-18
County-Rd-115
County-Hwy-7
County-Hwy-20
County-Hwy-22
223
92
148W 38N
County Rd 115
County Hwy 20
Site information:
Footprint Area: 204 Acres
Storage Volume: 3,031 AC-FT
Drainage Area: 9.6 Square Miles
Streams Directly Impacted 3.1 Miles
Wetlands Directly Impacted 74.2 Acres
Number of Landowners Impacted 8
Number of Buildings Near Site: 2
Legend
Section Lines
County Roads
Structures
Embankment
Potential Site Location
Site Footprint
Site E DA
Drainage Lines
Project Manager: N. Dalager
Drawn By: C. Gieseke
Date: May 2015
324 2nd Street East
Thief River Falls, MN 56701
Pine Lake Project
0 0.125 0.25 0.5
Miles
N
W
E
S
Pine Lake Subwatershed
Potential Retention Site e
Project No.:
Drawing No.
Filename: .mxd
Issue

Site F

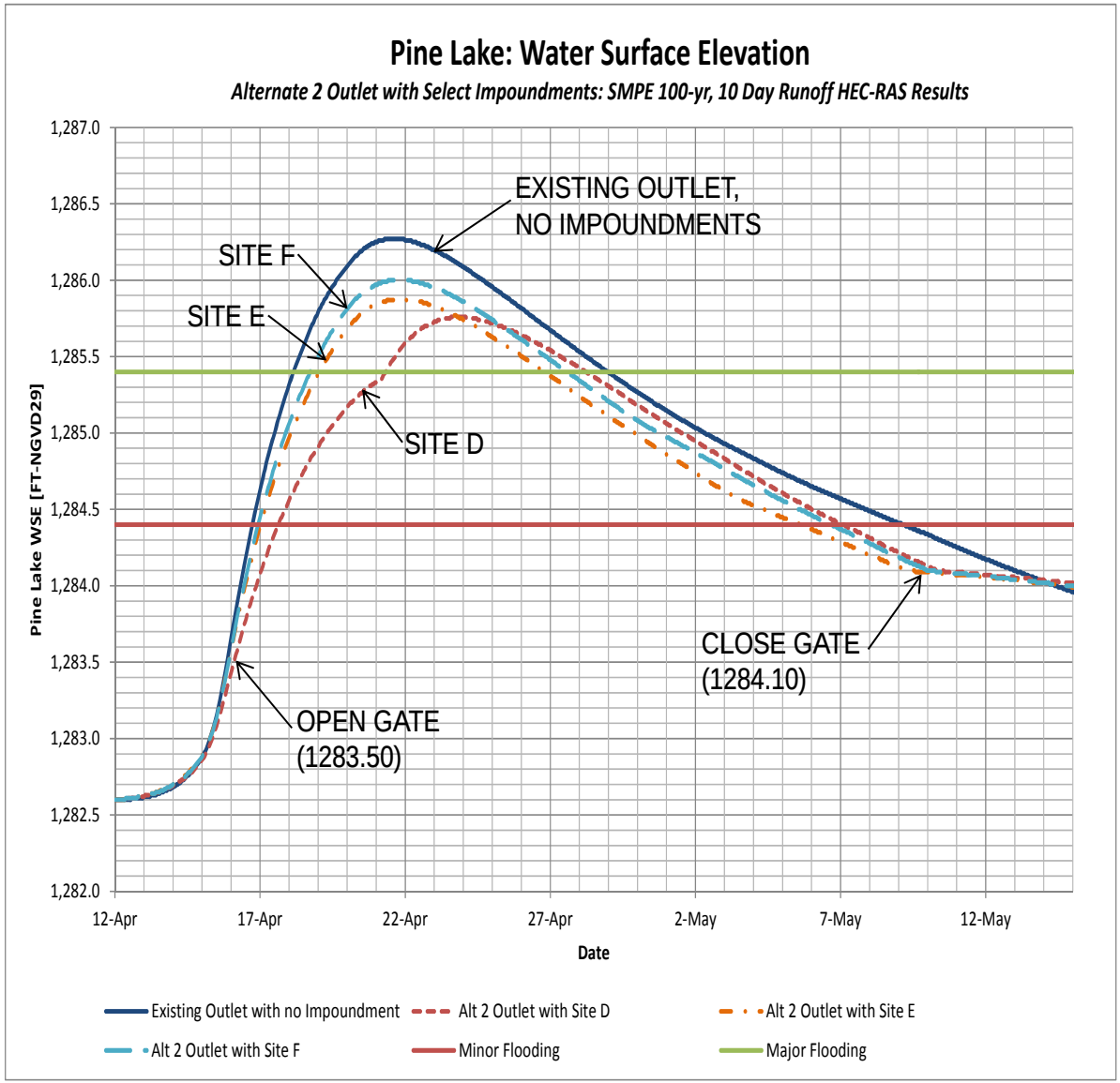

Site information:
Footprint Area: 447 Acres
Storage Volume: 1,900 AC-FT
Drainage Area: 6.0 Square Miles
Streams Directly Impacted 1.6 Miles
Wetlands Directly Impacted 359 Acres
Number of Landowners Impacted 8
Number of Buildings Near Site: 0
Polk
Clearwater
County Hwy 18
County Rd 115
County Hwy 7
County Hwy 20
County Hwy 22
County Rd 73
County Hwy 6
148W 38N
Legend
Section Lines
County Roads
Structures
Potential Site Location
Embankment
Site Footprint
Site F DA
Drainage Lines
324 2nd Street East
Thief River Falls, MN 56701
Project Manager: N. Dalager
Drawn By: C. Gieseke
Date: May 2015
Pine Lake Project
0 0.125 0.25 0.5 0.75
Miles
N
W
E
S
Pine Lake Subwatershed
Potential Retention Site f
Project No.:
Drawing No.
Filename: mxd
Issue

100 YEAR 10 DAY SNOWMELT ANALYSIS: DISCHARGE



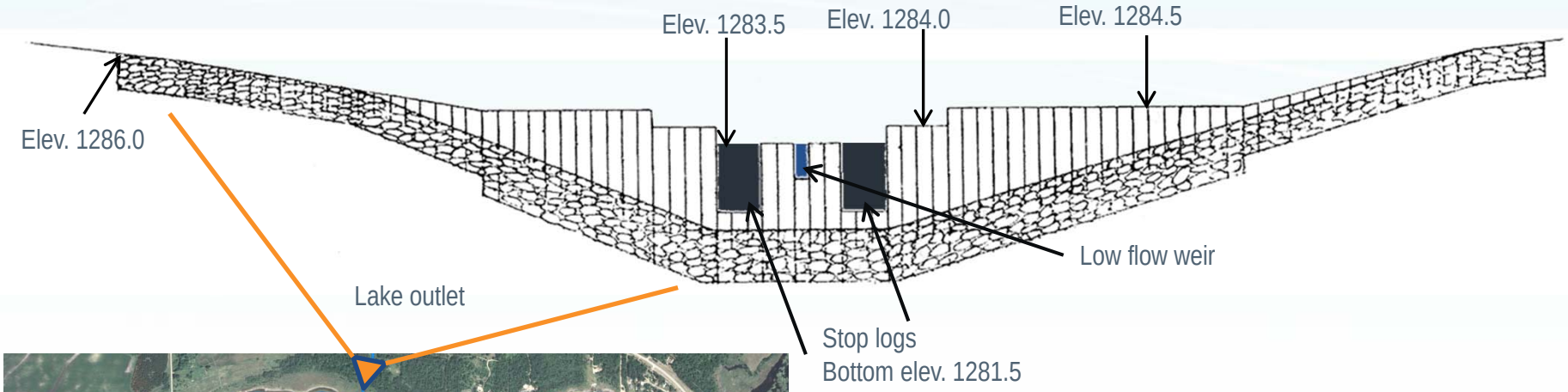
	Peak Discharge (CFS)	Approx. FDR Value (AC-FT)
Existing	556	N/A
Site D	395	2,839

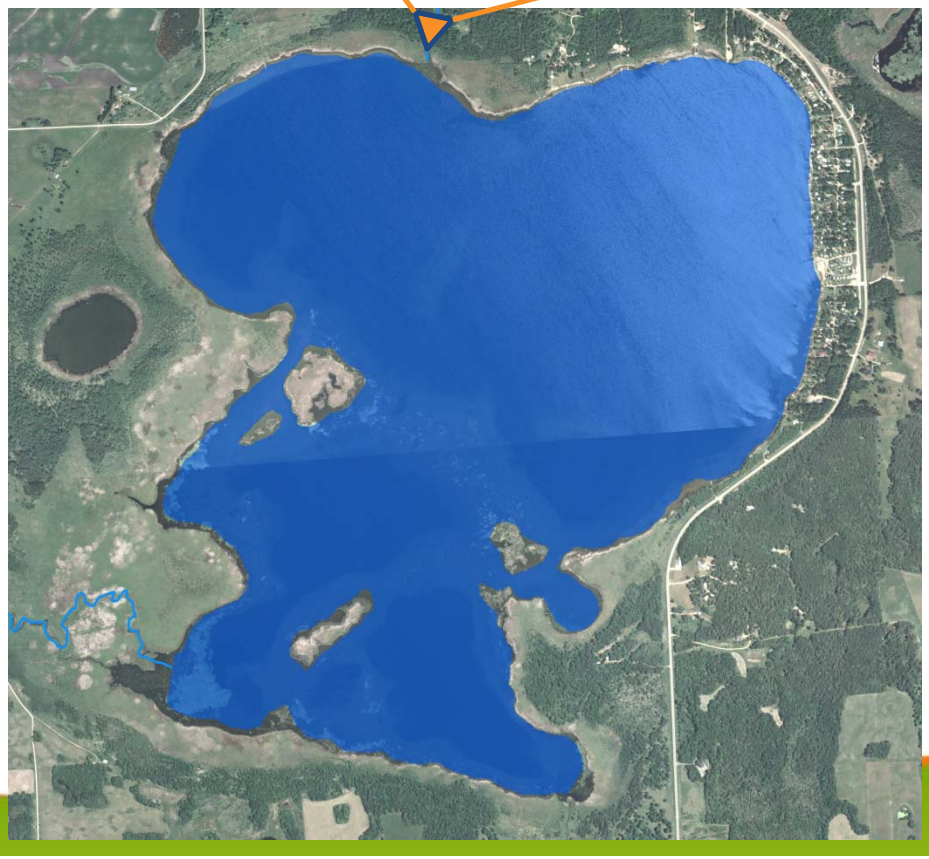
100 YEAR 10 DAY SNOWMELT ANALYSIS: PEAK WSE



	Peak WSE (FT)	Difference (FT)
Existing	1286.27	N/A
Site D	1285.76	-0.51

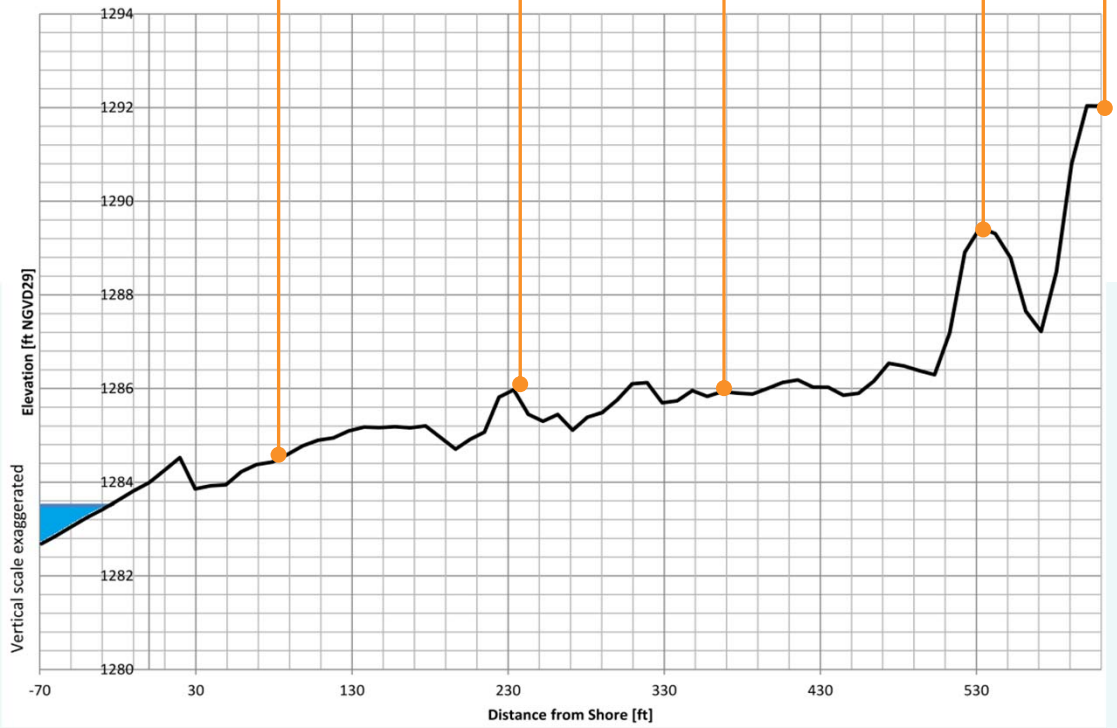
Current Summer Conditions



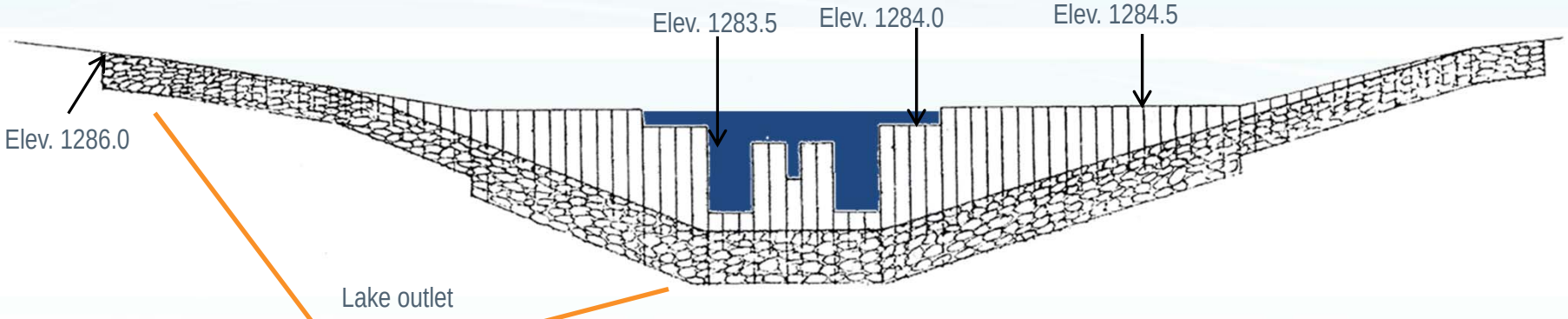


- Stop logs are in place
- Typical summer lake elevation of 1283.5 feet at the top of the stop logs
- Maintenance flows to Lost Creek with the low flow outlet – 1282.6 in 2013

Representative Cross Section
Typical Summer Conditions

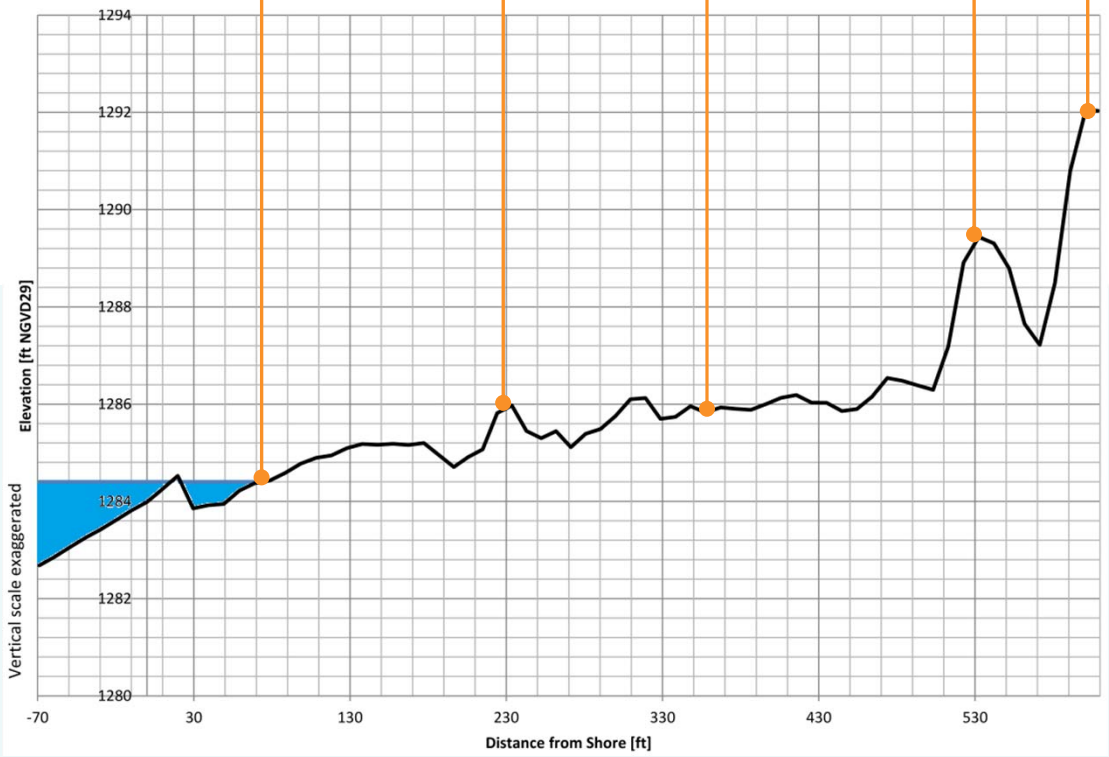


Current Minor Flooding Conditions

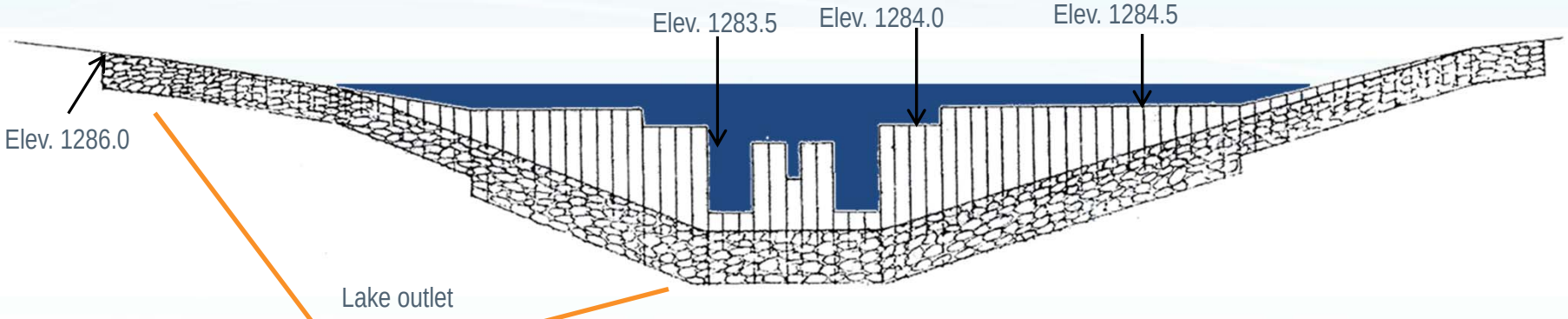


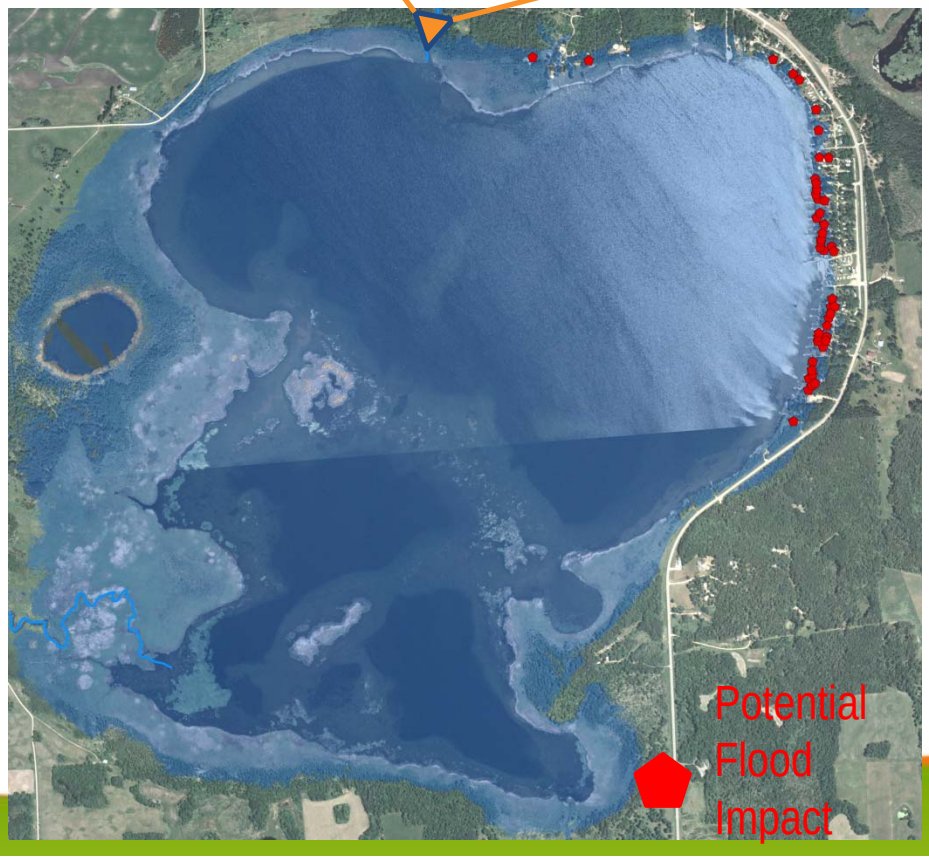
- Minor flooding concerns reported at lake elevation of 1284.4 feet.
- Stop logs have been removed when lake exceeds 1284.0 feet
- Water is at the 2nd stage of the outlet

Representative Cross Section
Minor Flooding Conditions



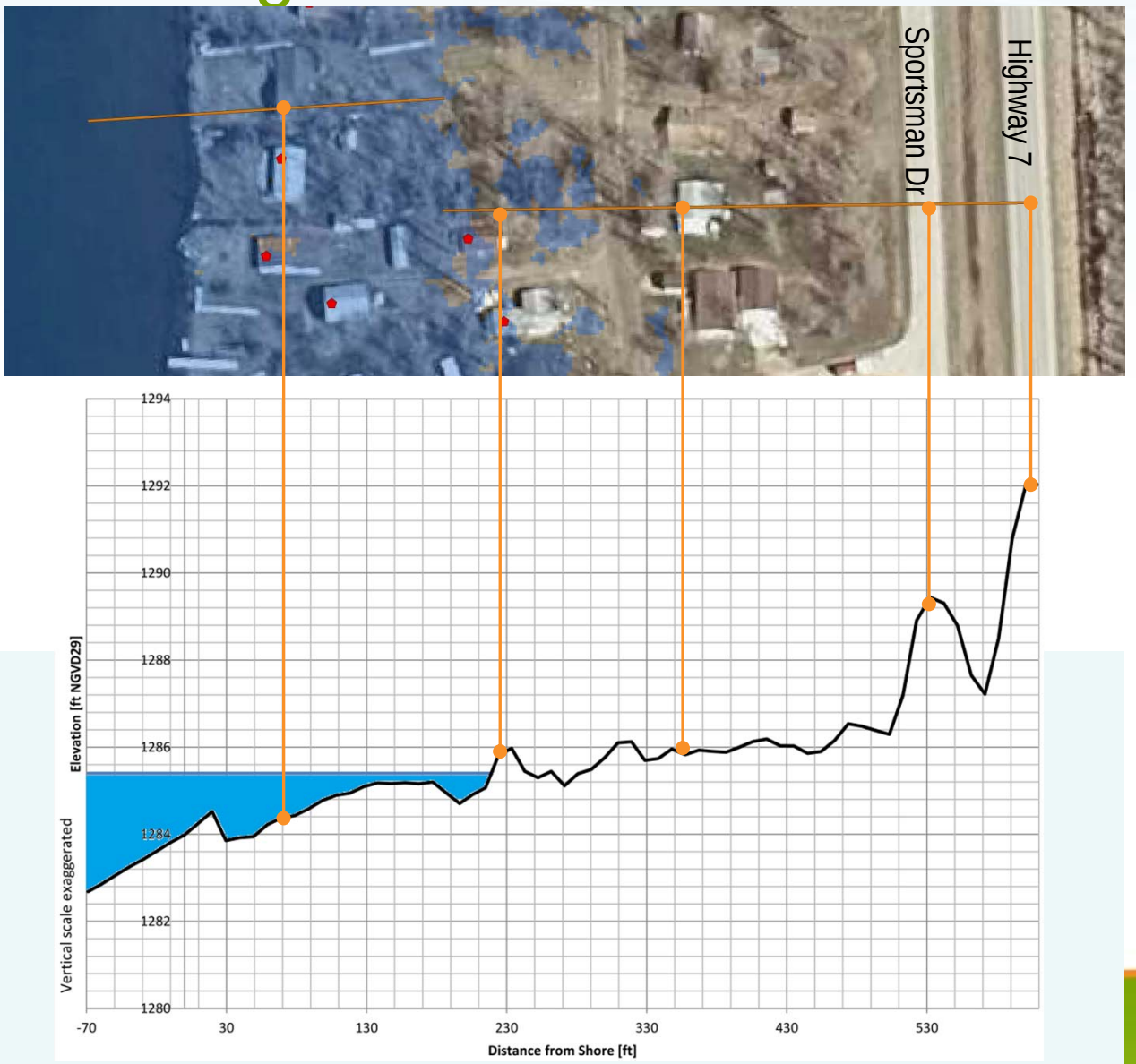
Current Major Flooding Conditions



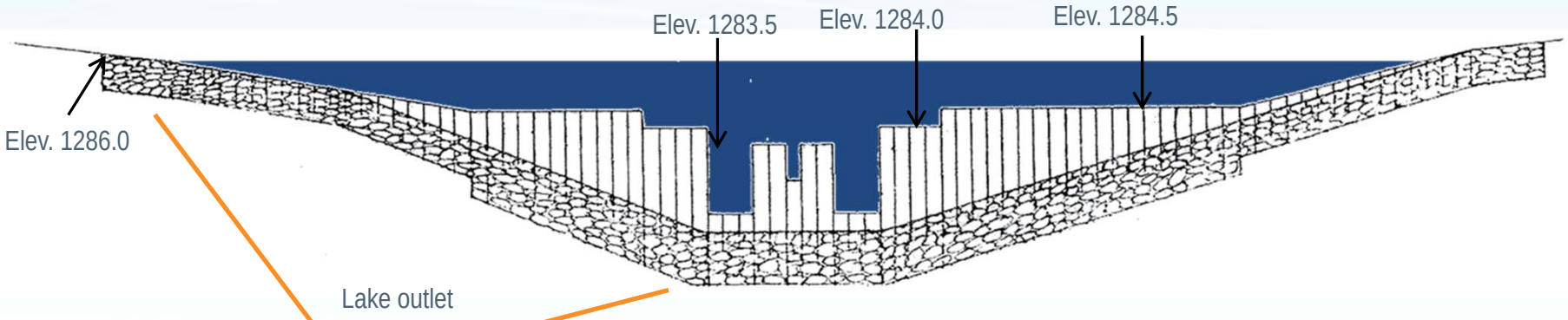


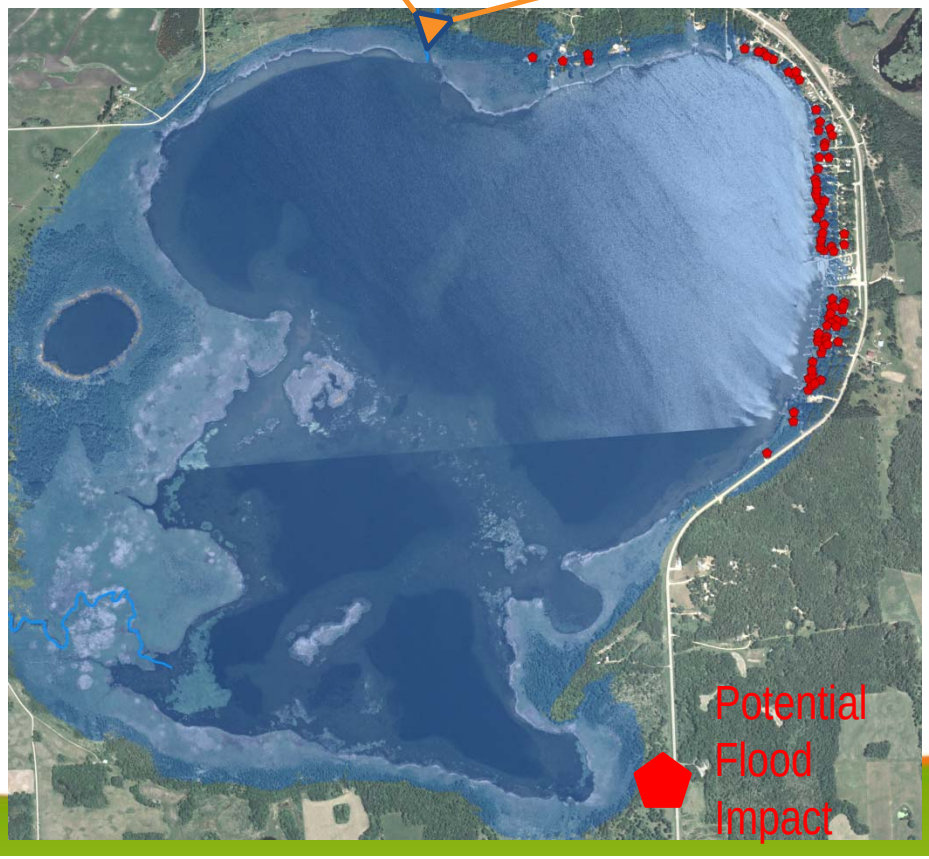
- Major flooding concerns reported at lake elevation of 1285.4 feet.
- Cabins, half of the campground, and public access to lake is flooded
- Stop logs have been removed
- Outlet is submerged

Representative Cross Section
Major Flooding Conditions



Highest Peak - 2009





- Highest recorded lake level of 1285.9 feet on April 11, 2009
- Lake exceeded or at the natural ground elevation of 52 cabins
- Lake exceeded or at the first floor elevations of 22 cabins

Representative Cross Section
2009 Conditions