LEC 2014-15 MANAGEMENT PLAN REPORT

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- **Neil Trombly, GIS Specialist, GO Environmental Services**

This report was presented at the 2015 August LECD Annual Meeting. The version shown here is updated to show some new results as of August 31st 2015 and discussion from the Jan 2015 LECD Public MP meeting.

If you have questions, comments, recommendations or would like to participate in the planning process please go to LECD Website and fill out and send the general contact form at http://lakeeauclaire.org/contact-us

2014-15 LEC MANAGEMENT PLAN STATUS REPORT

- The following report is a summation of an open LECD public meeting presentation in Jan 2015 and presentations given at the LECD Annual meeting in August 2015. The report is broken down into the following four topics in order.

1) **Aeration System Started June 3, 2015**
2) **Fish Habitat Installations and Evaluations**
3) **Sedimentation and Erosion**
4) **River Flood Plain Reconnectivity Projects**

LECMP SECTION: AERATION SYSTEM THROUGH AUGUST 31, 2015

LECMP 2015-16: WATER QUALITY THROUGH DESTRATIFICATION

- Monitoring and Adjustment of Destratification During Summer 2015 and Through 2016 Began Operation June 3rd 2015
- Tom Hartell Compressor Operations Manager
- Bury Pipeline and Protect From Ice Damage
- System Start Up After Ice Off in Spring
- Operates to Fall Turn Over
- Maintenance Schedule for Fall Shut down and compressor Oil Changes
- Other Maintenance: Pipelines and Aerator Disk Cleaning in Spring Each Year, Building, Raceway, Dock,

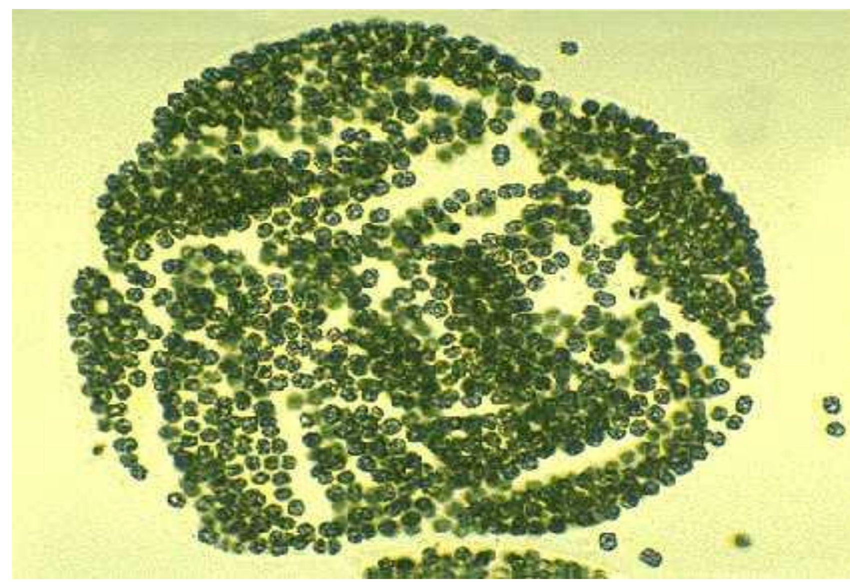
  Etc.

Because of extensive aerobic organism growth and iron precipitation on aerator diffusion disks during months of operation the aeration disks will need to be cleaned and recalibrated each spring. The description of the cleaning and calibration process will appear in new 2016 MP.

The cyanobacteria of concern are generally freshwater or brackish water species and are commonly found as 'blooms' in slow-flowing, nutrient-rich waters, usually in the warmer months of the year (when both temperature and sunlight are optimal). Blooms are often found in farm dams or ponds where very little mixing occurs, allowing warm water layers to form near the surface. As a result, highly toxic 'scum' material often forms on the water surface, creating a potential danger for livestock and, indeed, humans.

LEC CYANOBACTERIA BLOOM

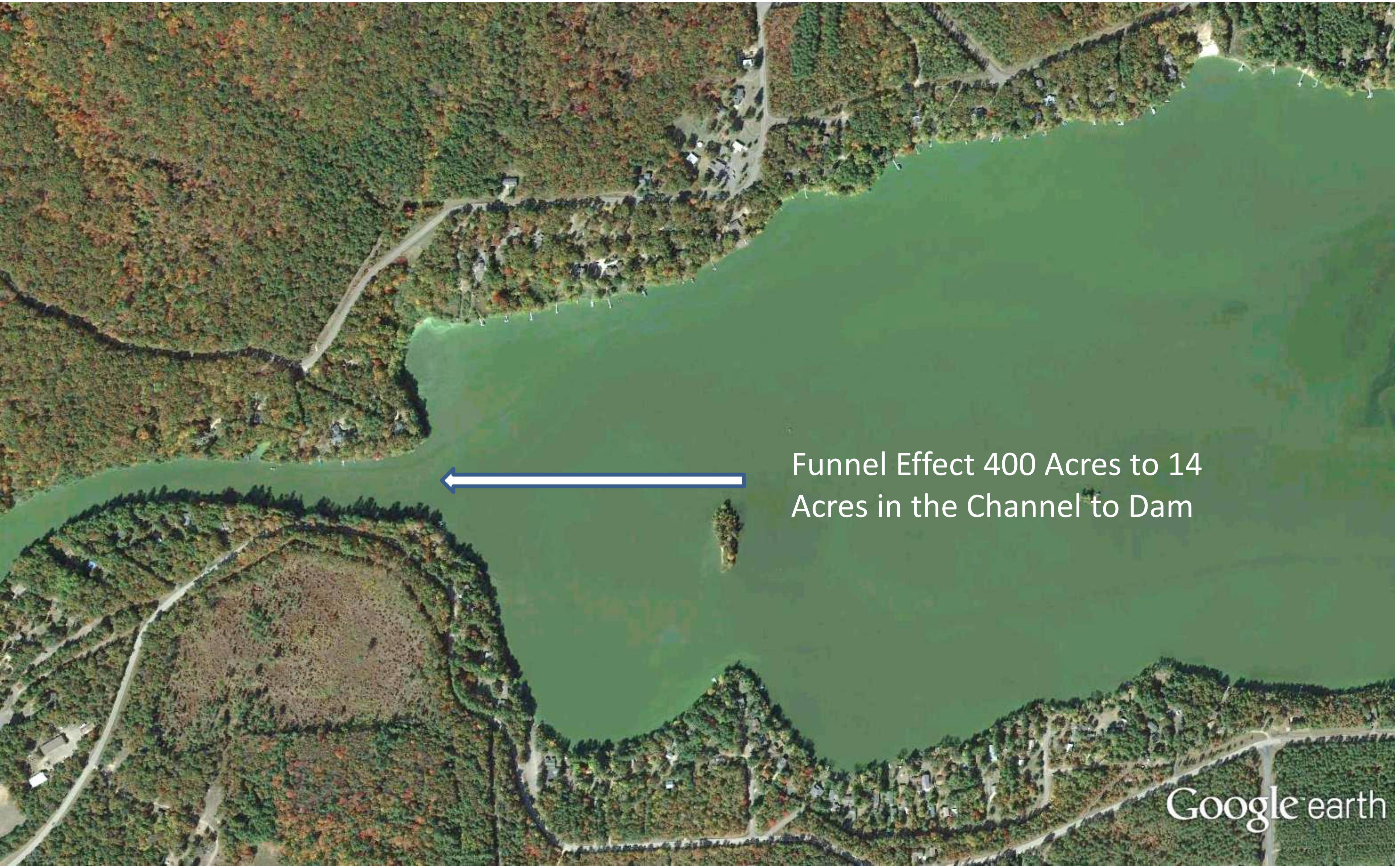
MICROCYSTIS



SEQUENCE OF FOLLOWING 5 PHOTOGRAPHS SHOWS DOWNSTREAM IMPACT OF LEC BLOOMS

1. **The first of a sequence of photographs that show the downstream impacts of LEC eutrophication on the river below LEC and on Lake Altoona itself. No such extensive bloom events were observed during the first summer of aerator operation**
2. **The picture above is color enhanced to clearly define the algal bloom from Lake Eau Claire traveling over the dam and on its way to Lake Altoona. This is a common event with Lake Eau Claire blooms and is visible by eye at the dam. This capture of this bloom event in an aerial image was fortuitous.**
3. **Note this is not 2012 because no aerial images were available in river below Hwy 27 bridge at this point in time. Also sharp front of algal bloom does not appear to be a splice because it is not vertical and no obvious splice exists.**
4. **The frontal boundary of the fresh incoming river water is defined by the green algal growth line across the delta. It is tempting to relate this to river enriched nutrient supply, but this sharp gradient line does not fit the growth kinetics curve for the algal bloom forming or the physics of the situation. More than likely the algal cells are dispersed in the shallow water on the delta and the cold water subduction along the delta edge in the lake is creating a quiescent floatation zone for the buoyant blue green algae. The increased chlorophyll concentration along the front then becomes distinguishable to the satellite coloration imagery software.**

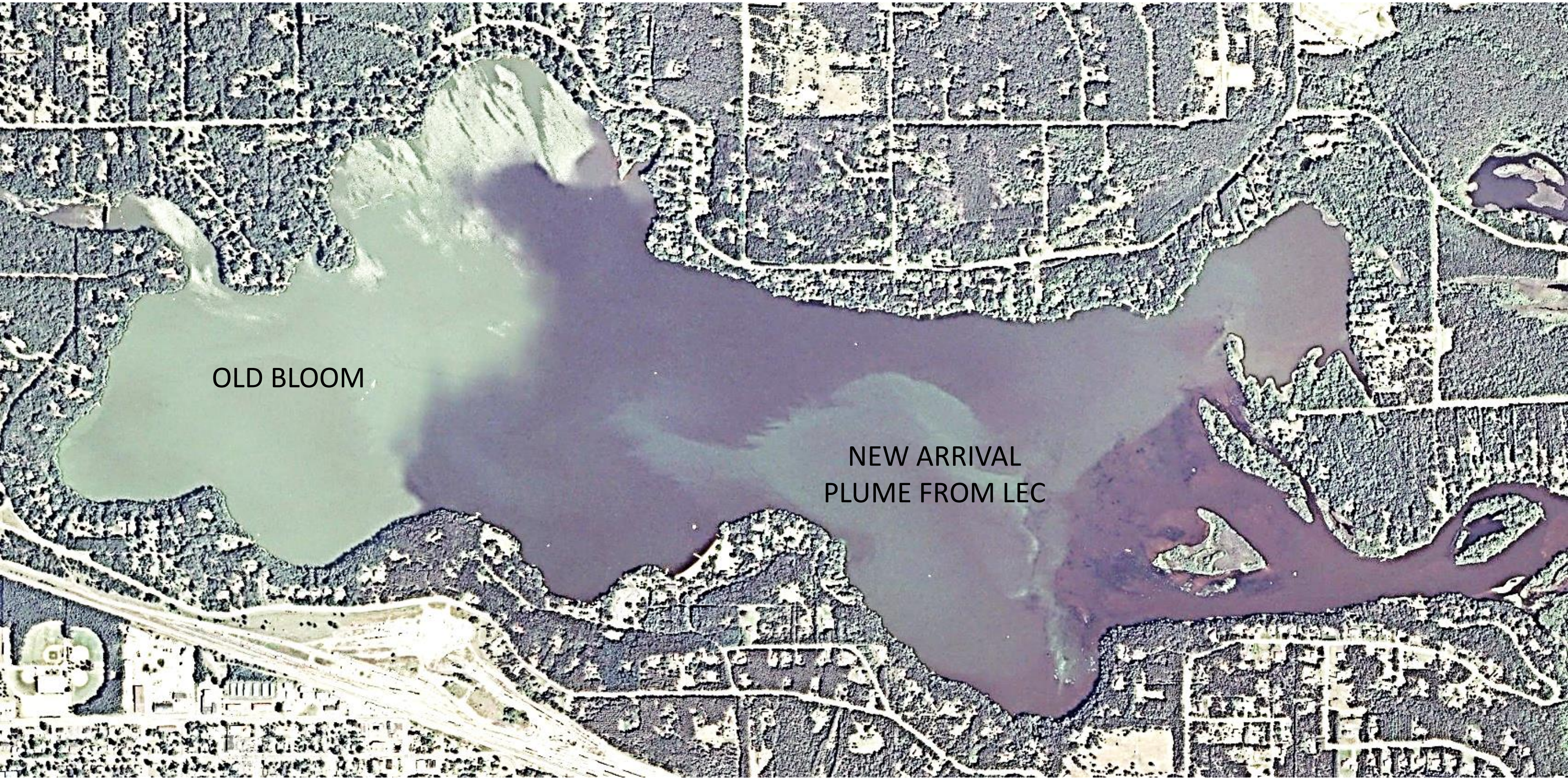
WEST END LEC SEPTEMBER 29, 2012



LEC DAM SEPTEMBER 29, 2012

TERMINAL END OF ALGAL PLUME HEADED FOR LAKE ALTOONA
JUNE 22, 2008

LAKE ALTOONA BLOOMS JUNE 22, 2008



PHOSPORUS (P) SOURCES AND CHEMISTRY

- Primary Sources
  - Agricultural
  - Riparian Runoff (fertilizers and septic systems)
  - Lake Sediment Recycling (in LEC approx. 50%)
- Destratification Prevents Bound P Recyling
  - P + Al, Ca and Fe + O2 ----> Insoluble Solid
  - P + Fe + No O2 ----> Dissolved P + Fe

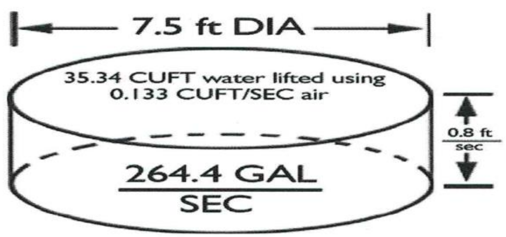
Lake Eau Claire has since its formation in the 1937 been accumulating bound and dissolved phosphorus from the three sources shown above. Today the agricultural source is by far the largest external source of P_{total} however studies have shown that internal lake sediment recycling of P may be an equivalent source. When the lake bottom is well mixed with oxygen most of the P is bound in the sediments as insoluble iron (Fe III) complexes. However when oxygen disappears, as in summer, Fe III is converted to Fe II and P is released and becomes available as a dissolved nutrient to drive algal blooms. Another important aspect of the P release is that it must get from the bottom into the lake surface waters. For this to happen the lake deep and surface water must mix. This is called process is called destratification and it is initiated by cold air, high winds (particularly storm fronts), lake flooding, and even excessive boating activity.

The Air Diffusion System that was installed in LEC in 2015 is designed to provide a large continuous supply of buoyant bottom water that rapidly rises to the surface and displaces the oxygen rich surface water. The created overturn breaks down the destratification process and stops the conversion of iron III to iron II and hence the release of dissolved P.

Air Diffusion Systems
NEW LTC DISK MODULE

Estimated Pumping Rate: Each LTC Disk located in 15 ft (4.6m) WD or deeper will pump a column of water equal to 7.5 ft DIA (2.3m) with rise rate of 0.8 foot per second (0.25m/s). That is over 20 Million Gallons per Day ($75{,}700 m^3/d$).

NOTE: 8 CFM of oil-less air is delivered to each disk. That is equal to 0.133 cubic fps

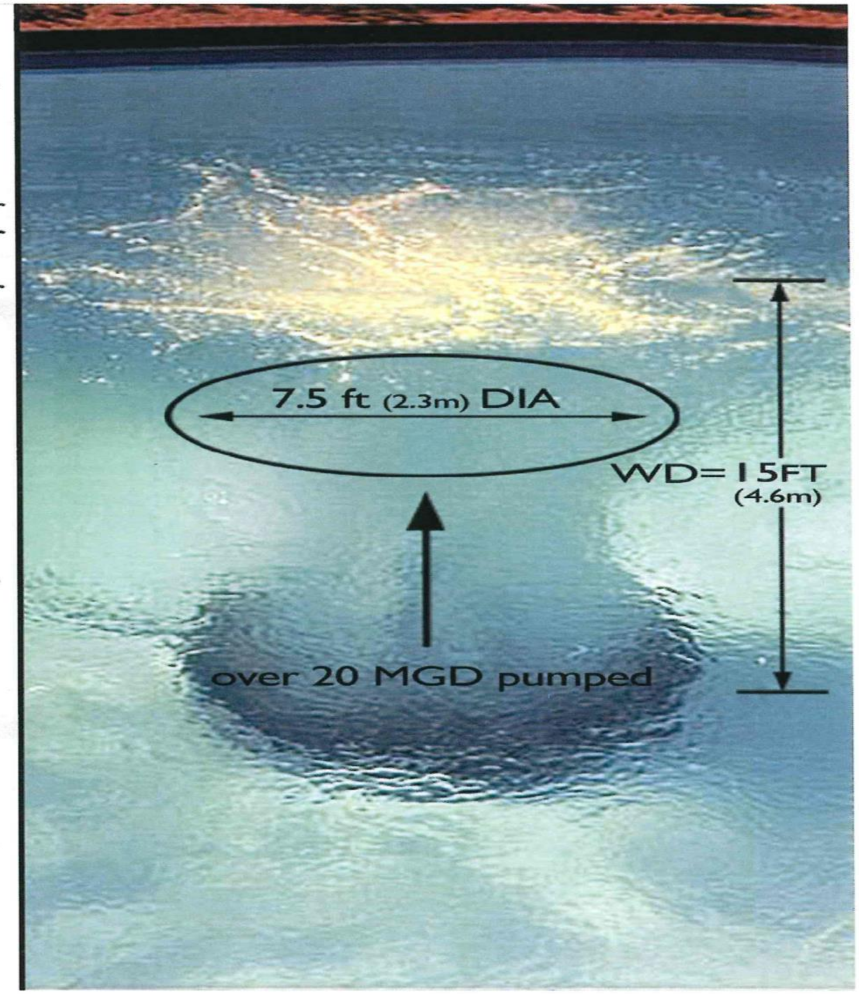


VOLUME = $\pi r^2 h$

$\pi(3.75')^2(0.8') = 35.34$ CUFT/SEC
× 86,400 SEC/DAY
3,053,628 CUFT/DAY

3,053,628 CUFT/DAY
× 7.48 GALS/CUFT
22,841,137 MGD

over 20 MGD
($75{,}700 m^3/d$)

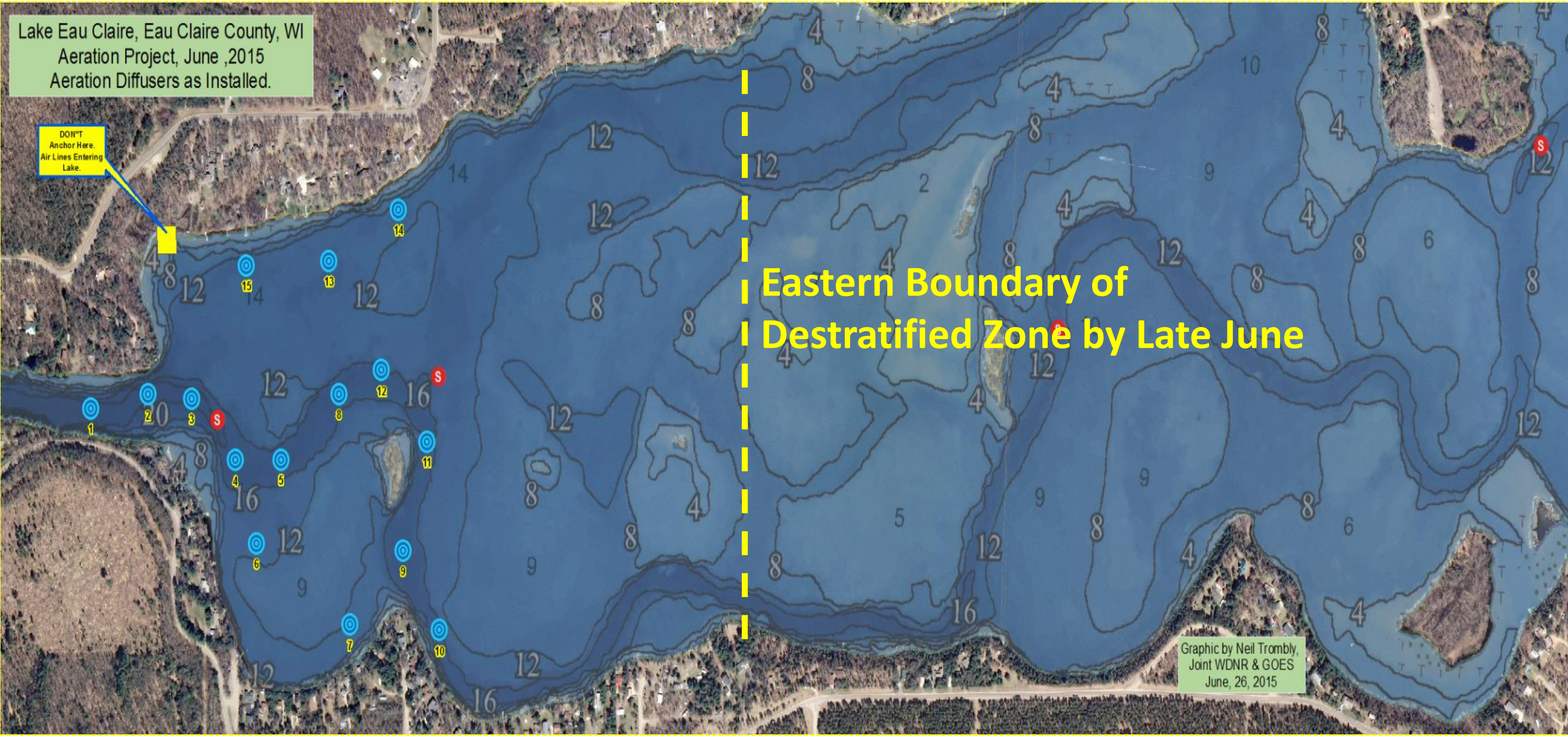


3964 Grove Ave Gurnee, IL 60031
Office: 847-782-0044   Fax: 847-782-0055
www.airdiffusion.com

THE PROGRESS ON THE MANAGEMENT PLAN AERATION PROJECT

1) **Aeration Installation Completed Summer 2015**
2) **Aeration System Started June 3, 2015**
3) **Water Quality Monitoring Began May 2015 and Scheduled for next Two Years**
   - **Temperature Profiles (Continuous Thermistor and By Boat Sampling)**
   - **Oxygen Profiles**
   - **Iron and Phosphate Grab Samples**
   - **Fish Population and Redistribution Studies**

Phosphorus, temperature, oxygen, and algal measurements were made throughout summer and into fall of 2015 by DNR, GOES and others. These measurements need to be compiled and analyzed for the new 2016 LECMP to determine how well the aeration system worked and decide what changes if any need to be made going forward.



The complete 15 aerator system was installed and became operational the first week in June 2015. GOES regularly evaluated the system performance with profiles of oxygen and temperature. After 2-3 weeks of continuous operation the destratification zone progressed eastward to approximately the dotted yellow line shown in the figure above. In other words significant differences between the surface and bottom oxygen and temperature measurements were observed starting at this line and progressing eastward.

By all accounts the summer of 2015 produced significantly better water quality than in pervious years. Minor short-term algal blooms were observed, but based on prevailing summer temperatures, solar insolation, storms and rainfall there should have been a greater incidence of blue-green blooms. Nevertheless water data collected throughout the later summer and fall showed characteristics which are hard to explain at this point and will further study.

This is a picture of early summer showing end of aeration pipeline. Not shown: During the summer the boardwalk was completed, the pipeline was buried deeper and covered with irregular rip-rap to ice damage to pipeline and boardwalk. GOES developed plans and permits and worked with volunteers to complete the work. Also designed and prepared a dock for installation in spring of 2015.

Volunteer crew and GOES installed pipelines in May 2015.

Volunteer crew, DNR, ADS and GOES installing bottom of the lake pipeline and aerators in early June 2015.

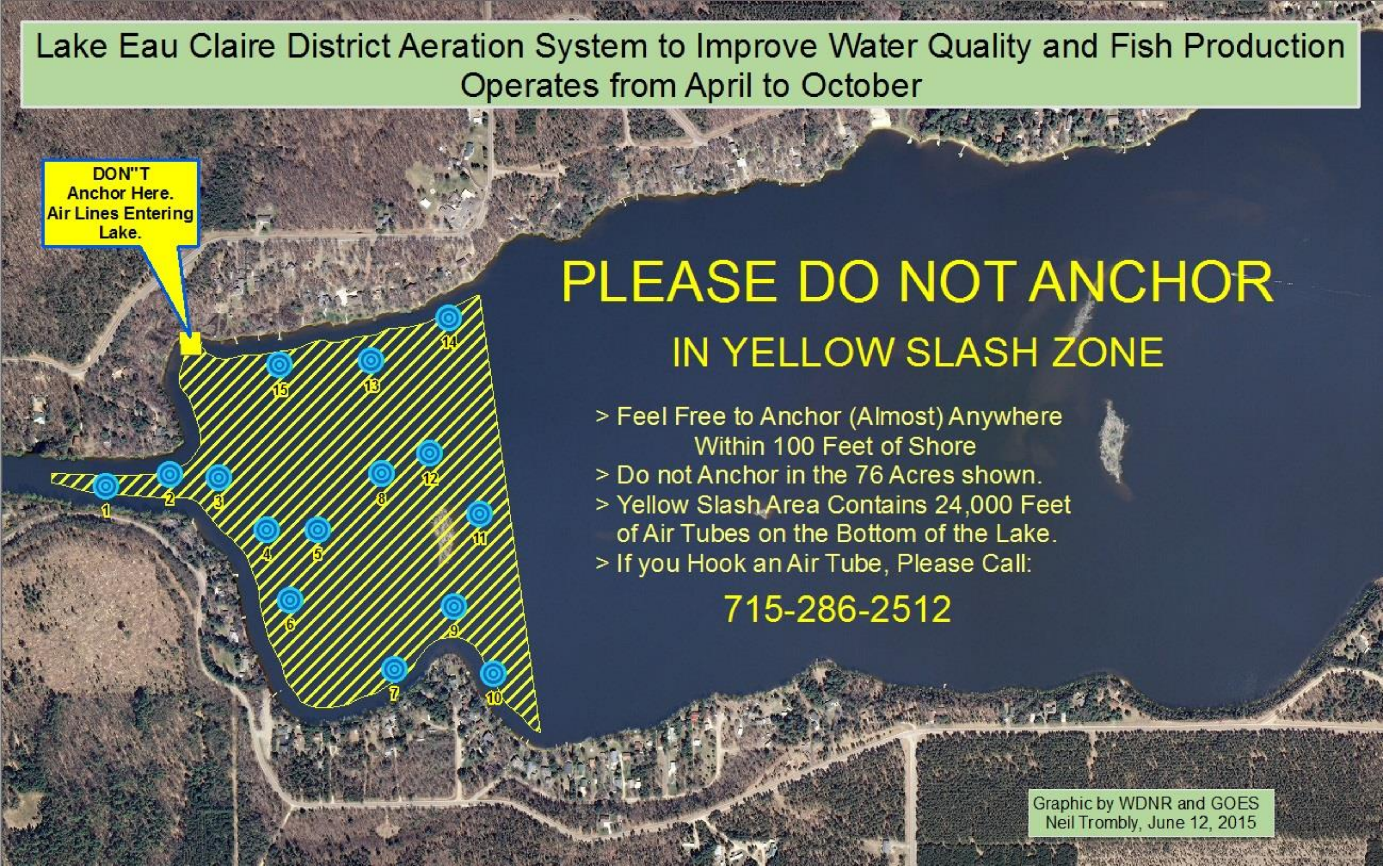
Elevated pipeline raceway as viewed from the lake towards the aeration control building.

Completed aeration system taken in October 2015. Pipeline was dug down to maximum expected bottom ice level and the 3 x 8” protection conduit were weighed and then covered with rip-rap to protect the pipelines and the raceway from ice and high water damage.

Front view of the aeration control building from the access road.

View of the interior of the compressor control room. To the right is the 30hp Kaiser rotary screw compressor. Center is the compressed air ballast tank and air particle and condensation filter. To the left are the 15 air flow calibrated control gages for the lines leading to the individual submerged aeration disks.

ADS, GOES and volunteers assembled aeration components in building and ran pipelines, adjusted operation parameters and did first measurements of total system performance in early to mid June. 2015 was an evaluation and testing year for the system as installed. Results of the first year or two of operation will help determine if improvement to aerator flow requirements are necessary and define the frequencies of cleaning, servicing, and adjusting to reach highest operational performance efficiency. From the first month of operation it was apparent that that this would required an scheduled ongoing clearing an adjustment phase.



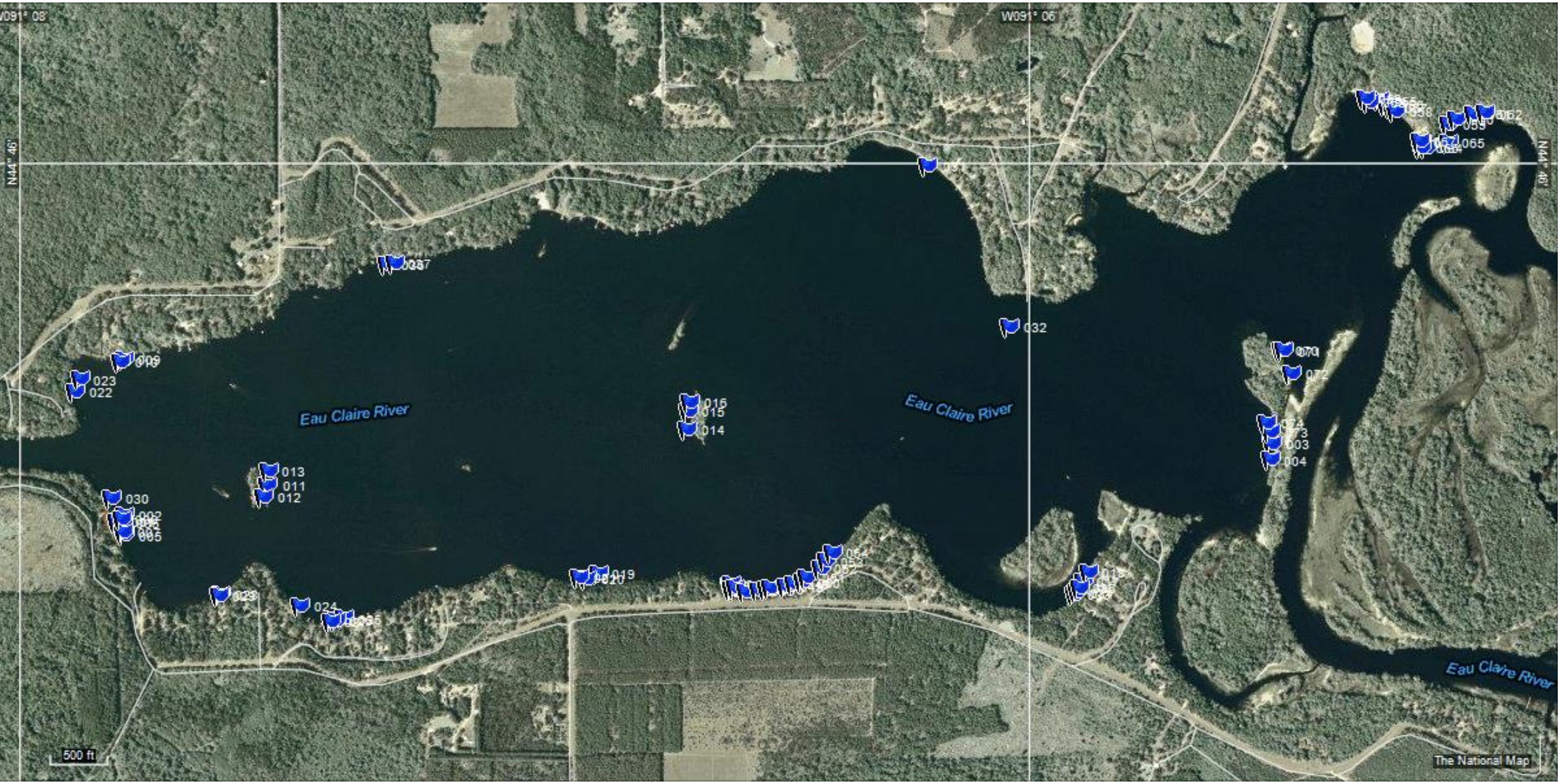
GOES did final surveying of aerator locations and performance and oxygen and temperature conditions. They also produced these information maps of the aeration area from the survey results.

LECMP SECTION: FISH HABITAT INSTALLATIONS AND EVALUATION TO OCTOBER 2015

This work from Schindler et al. 2000 as well as many others clearly defines the value to a lake's fishery of having higher levels of coarse woody habitat to the log growth rate of fish in the lake. Lake Eau Claire fits into the category of low to high development The undeveloped regions such as the rookery, the meander floodplains, Hay and Muskrat Creeks, some of the islands all offer potentially productive an high growth rate areas.

A fall launch of shallow water fish cribs destine
for location around the lake. These cribs are low
profile structures that a located in no more than
5 feet so the that they grow sunlight induced
food communities within the crib structures.

HALF-LOG INSTALLATIONS UP TO 12/31/2012



This graphic only shows early fish crib installations many more have been added since then. Since these represent the earliest installations they need to be evaluated for location stability and how well they are surviving after several seasons in the water. A preliminary evaluation by summer student interns showed that after an up to year duration they were doing well, but that the accuracy of the original GPS coordinates were not good enough to easily locate them The complete record files for all cribs and tree drops should be brought up to current status and maintained.

Tree falls and new fish cribs were added to the lake during 2015. The map above shows where the tree falls were located. Complete file records should be established and maintained.

Trees marked for 2015 Woody Habitat project (tree drops

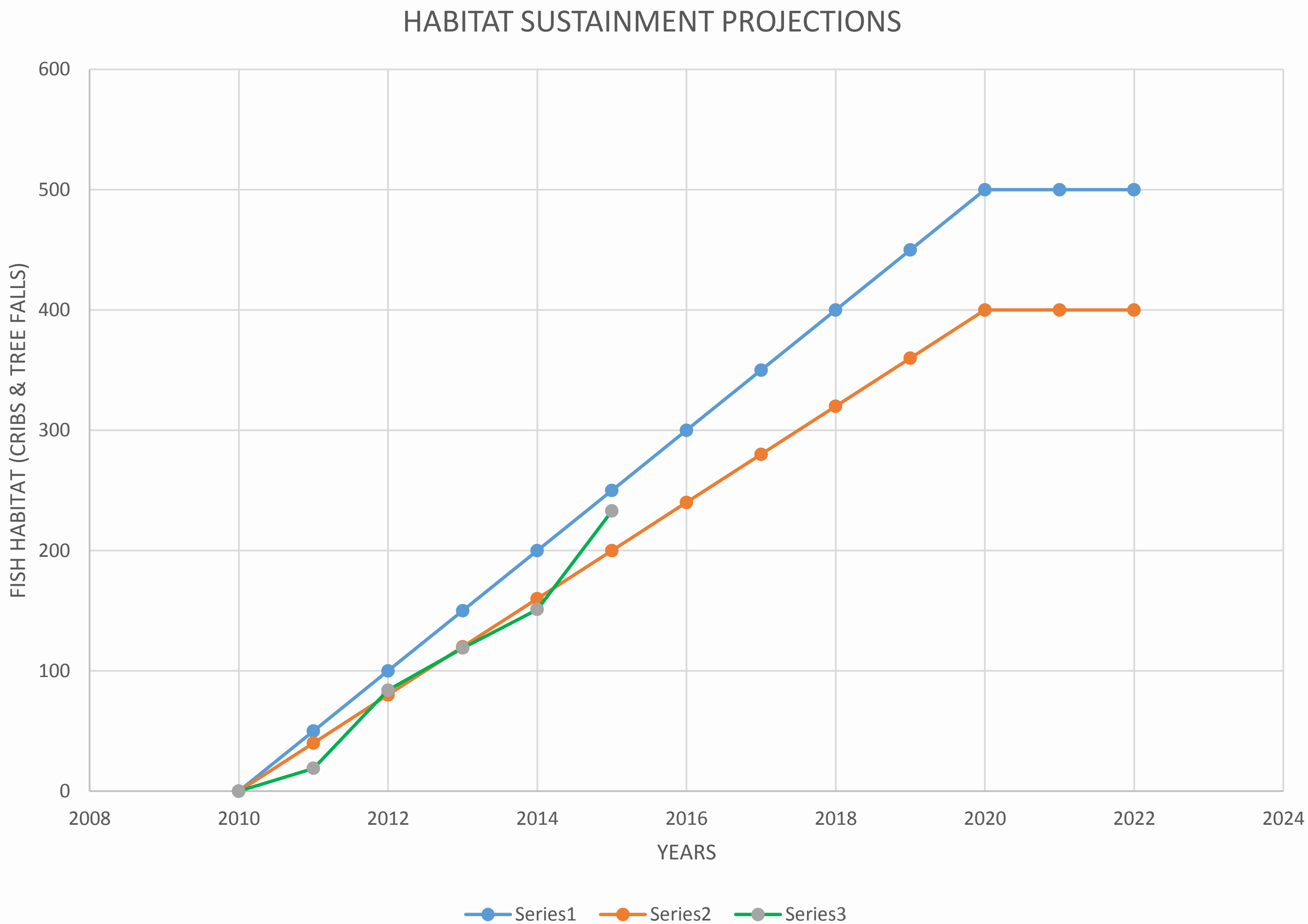
Lake Eau Claire

Eau Claire County

Land Conservation Div.

227 - 1st Street West

0 500 1,000 2,000 Feet



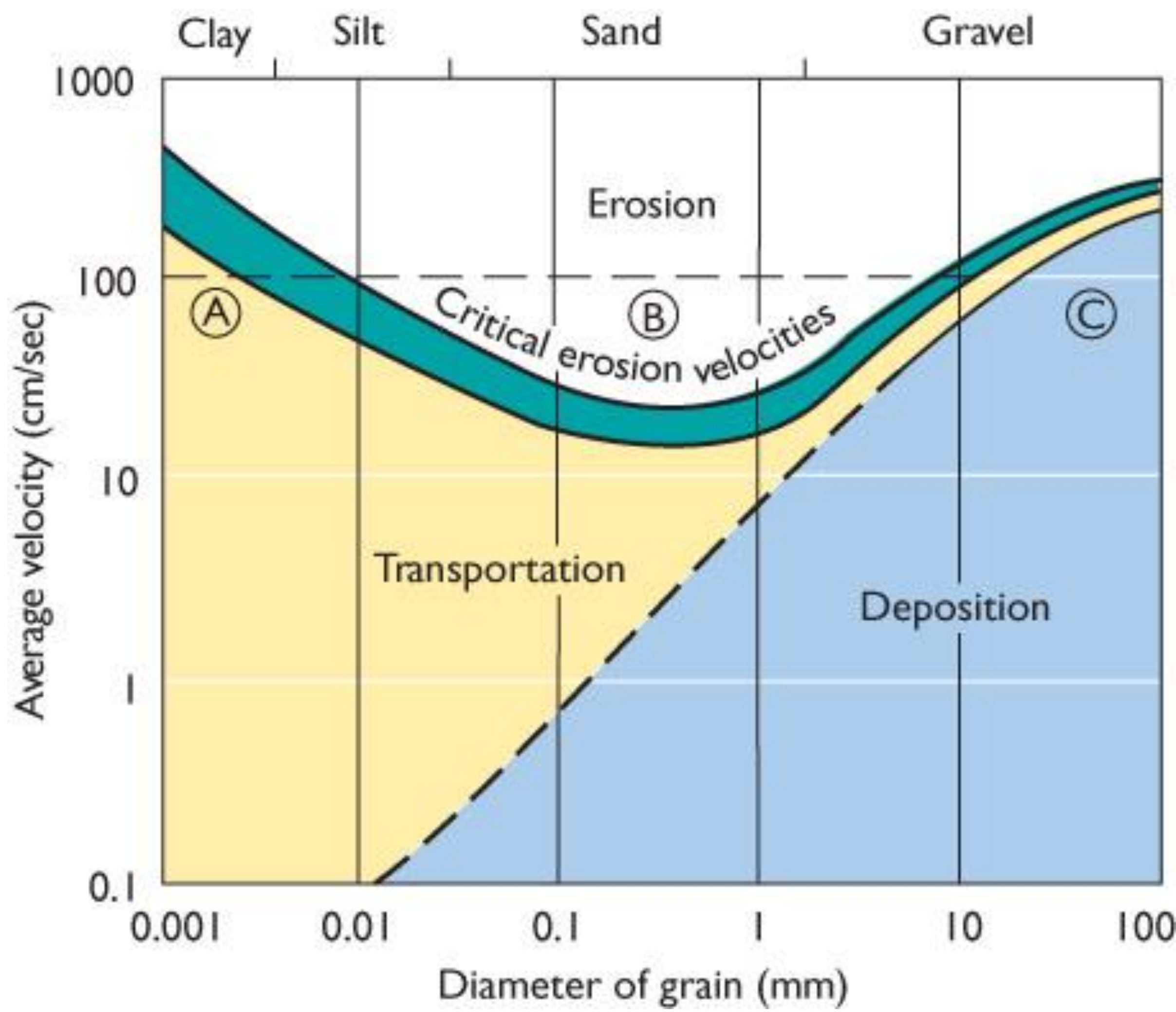
The above plot shows the projected habitat installation curve where series 1 (blue) are proposed total installations/year from 2010 LECMP. A peak of 500 was planned for initially and at 50 installations/year the total quota of 500 would be reached by 2020. Series 2 (orange) shows the decay and loss curve of the installations – this is an assumed value and needs to be evaluated regularly to see if it adjustment. Series 3 (green) is the actual installation rate and this is close the projected rate as of fall 2015. The difference between the orange and the blue lines in 2020 is actual replacement number/year to sustain the habitat improvement program. At this time this is an estimated number and is yet to be determined.

LECMP 2015-2016: FISHERIES AND HABITAT

- As of Today 249 Structures Have Been Installed In the Lake.
- Roughly 32 Installations/Year are Planned for 2015-2016 Plus 50 Tree Falls/Year
- Fishing Reports from 2013-14 are Excellent with Large Numbers of Bluegills and Black Bass Reported – Bait fish Like Shiners also being Observed
- Considerable Improvements to the Fisheries are Expected
    1) As Result of River Restoration Changes
    2) As a Result of Aeration System Going on Line

LECMP SECTION: SEDIMENTATION AND EROSION

- Hjulström’s Diagram graphs the relationship between particle size and energy for
  - erosion
  - transportation
  - deposition



EC RIVER SEDIMENT SIZE DISTRIBUTION

- **Humics, Clay, Silt, Sand, Gravel, Cobble, and Boulders**
- **~~Moves as the Wash, Suspended, and Bed Load~~**
- **Bulk and Unbulked Sediment**
  - **Unbulked = 165 lbs/cubic foot**
  - **Bulked = 90 lbs/cubic foot (for LA porosity = 0.46 volume of voids/volume of solids + volume of voids**

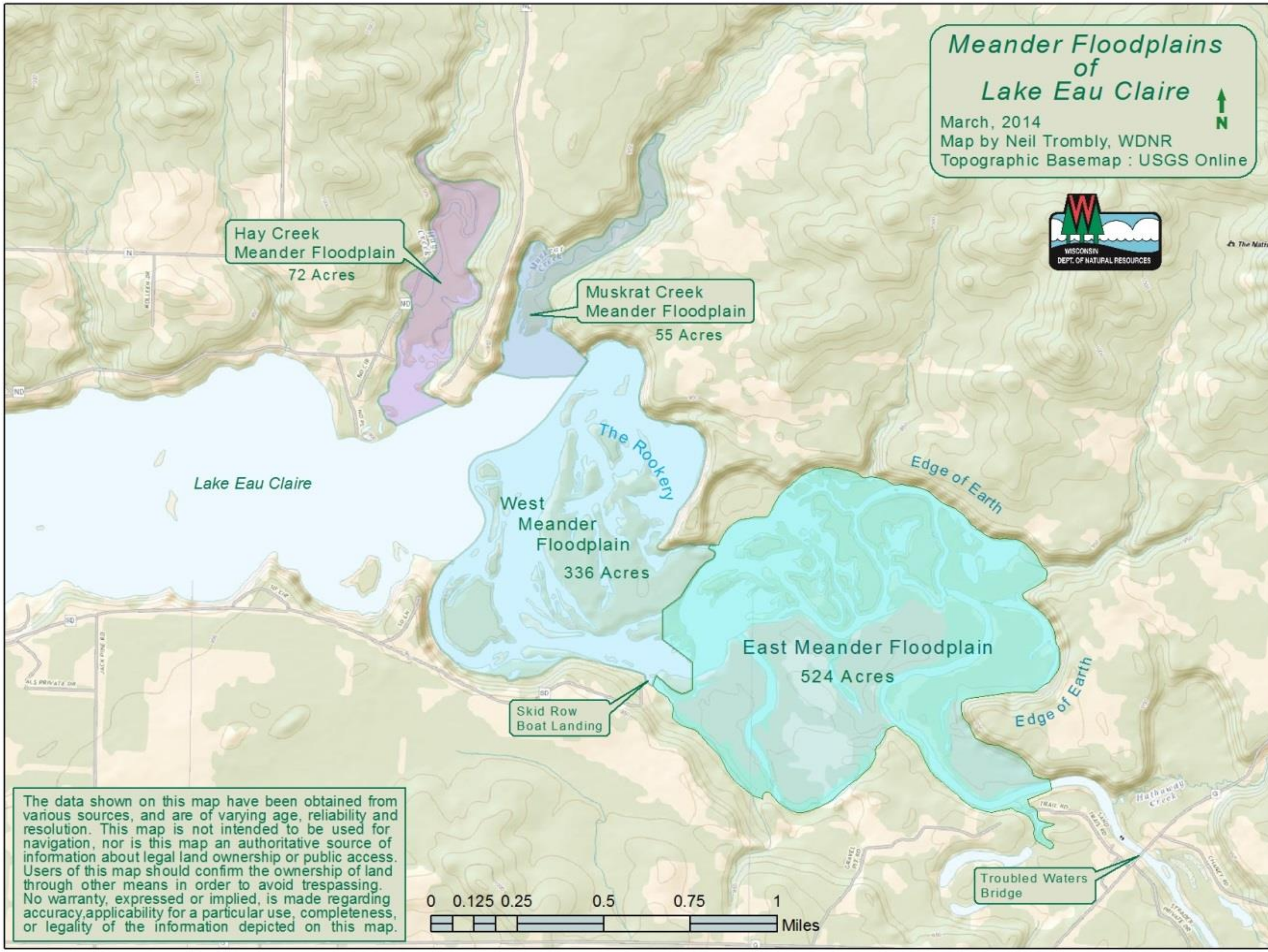
It is important to understand that what Hjulstrom's diagram above predicts is that what the EC River and other LEC sediment traps collect during high water flow is sand, gravel and some cobble. Suspended materials like clay, silt, and fine sand only are deposited when the water flow slows way down as it does when the streams enter the lake. These sediments will deposit throughout the lake and this deposition rate has never been accurately measured for LEC.

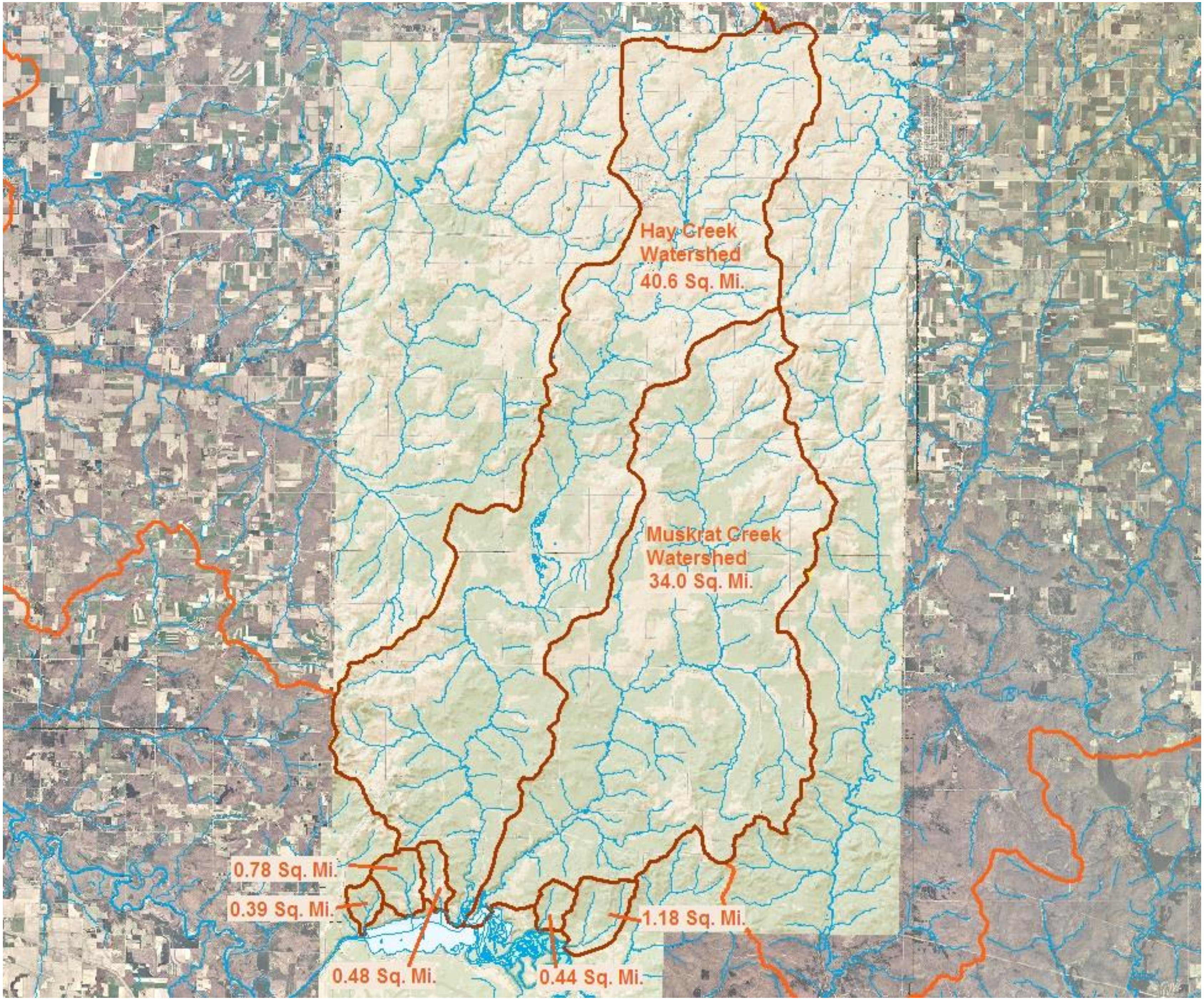
Also it is important to realize that a yd3 of sediment in the water (bulked) has a much lower total amount of sand than a yd3 of sand that is piled in a spoils site.

EASTERN LAKE EAU CLAIRE SEDIMENT SOURCE AND DEPOSITION AREAS

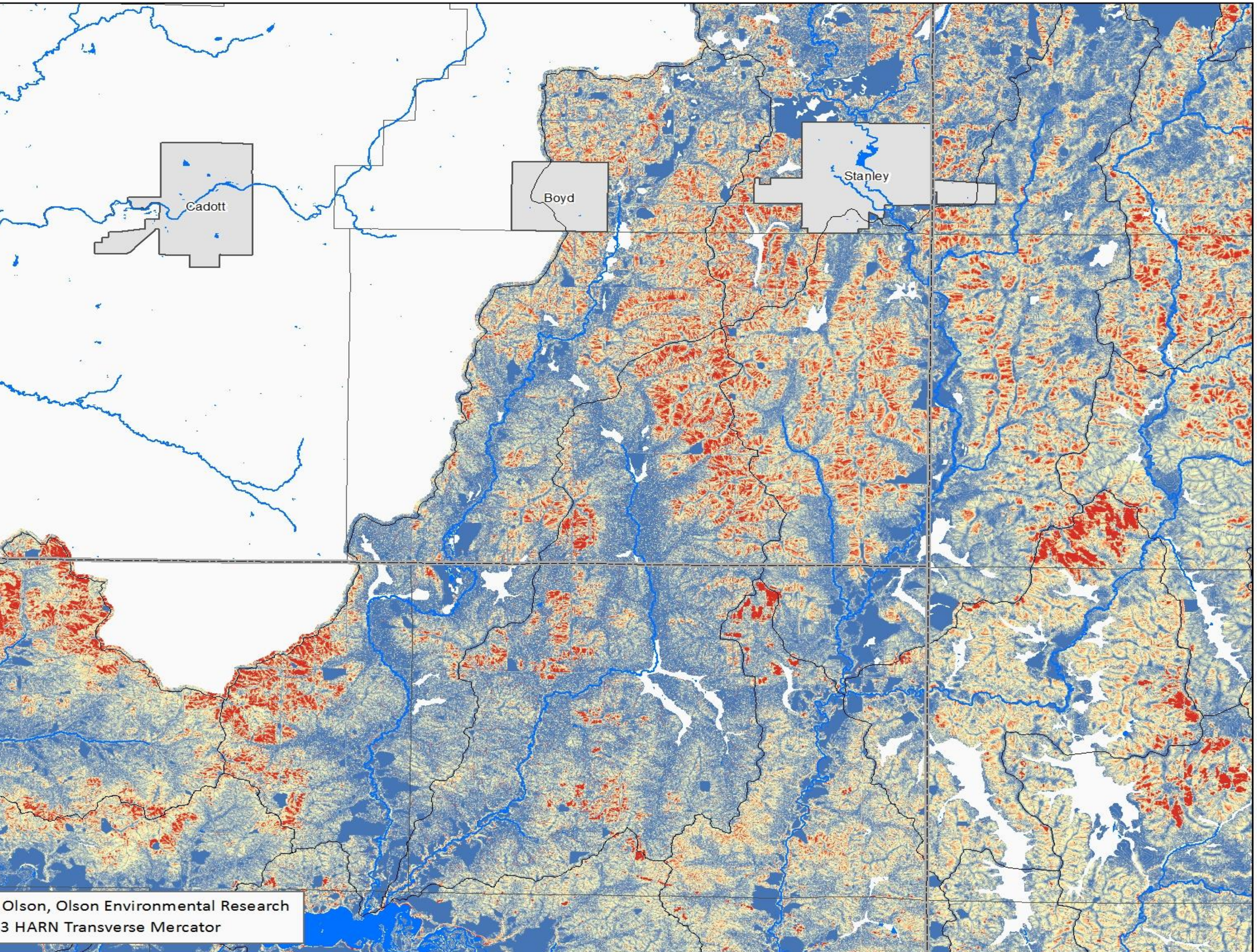
Comments for next three figures:

1. We designated four different major meander flood plains for LEC. They are shown as different colored regions in the figure below. These flood plains have different features and sources, but all are united in the gradual sediment infilling and control of nutrient (particularly phosphorus) levels in LEC. Much of the 524 acre East Meander Floodplain sediment storage has been exhausted and as a result the West Meander Floodplain is now heavily impacted by sediment infilling.
2. This figure shows the multiple sediment and nutrient source drainage areas for LEC north shore streams. Obviously Muskrat and Hay Creeks represent the major drainage areas.
3. The erosion vulnerability figure below for Hay and Muskrat Creek drainage areas show that both are high potential source threats to LEC of both agricultural erosion soils and nutrients. These streams may present a larger problem than originally estimated for these materials and should be addressed as part of the ECR Watershed Coalition Planning.


Meander Floodplains of Lake Eau Claire
March, 2014
Map by Neil Trombly, WDNR
Topographic Basemap : USGS Online
N
WISCONSIN DEPT. OF NATURAL RESOURCES
Hay Creek Meander Floodplain
72 Acres
Muskrat Creek Meander Floodplain
55 Acres
Lake Eau Claire
The Rookery
West Meander Floodplain
336 Acres
Edge of Earth
East Meander Floodplain
524 Acres
Edge of Earth
Skid Row Boat Landing
Troubled Waters Bridge
The data shown on this map have been obtained from various sources, and are of varying age, reliability and resolution. This map is not intended to be used for navigation, nor is this map an authoritative source of information about legal land ownership or public access. Users of this map should confirm the ownership of land through other means in order to avoid trespassing. No warranty, expressed or implied, is made regarding accuracy,applicability for a particular use, completeness, or legality of the information depicted on this map.
0 0.125 0.25 0.5 0.75 1
Miles


Hay Creek
Watershed
40.6 Sq. Mi.
Muskrat Creek
Watershed
34.0 Sq. Mi.
0.78 Sq. Mi.
0.39 Sq. Mi.
1.18 Sq. Mi.
0.48 Sq. Mi.
0.44 Sq. Mi.

ion Vulnerability in the Hay and Muskrat Creek Watersheds, Eau Claire Rive



Key

Cou
Sub
Rive
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Tow

Erosion Vul

High
Sto

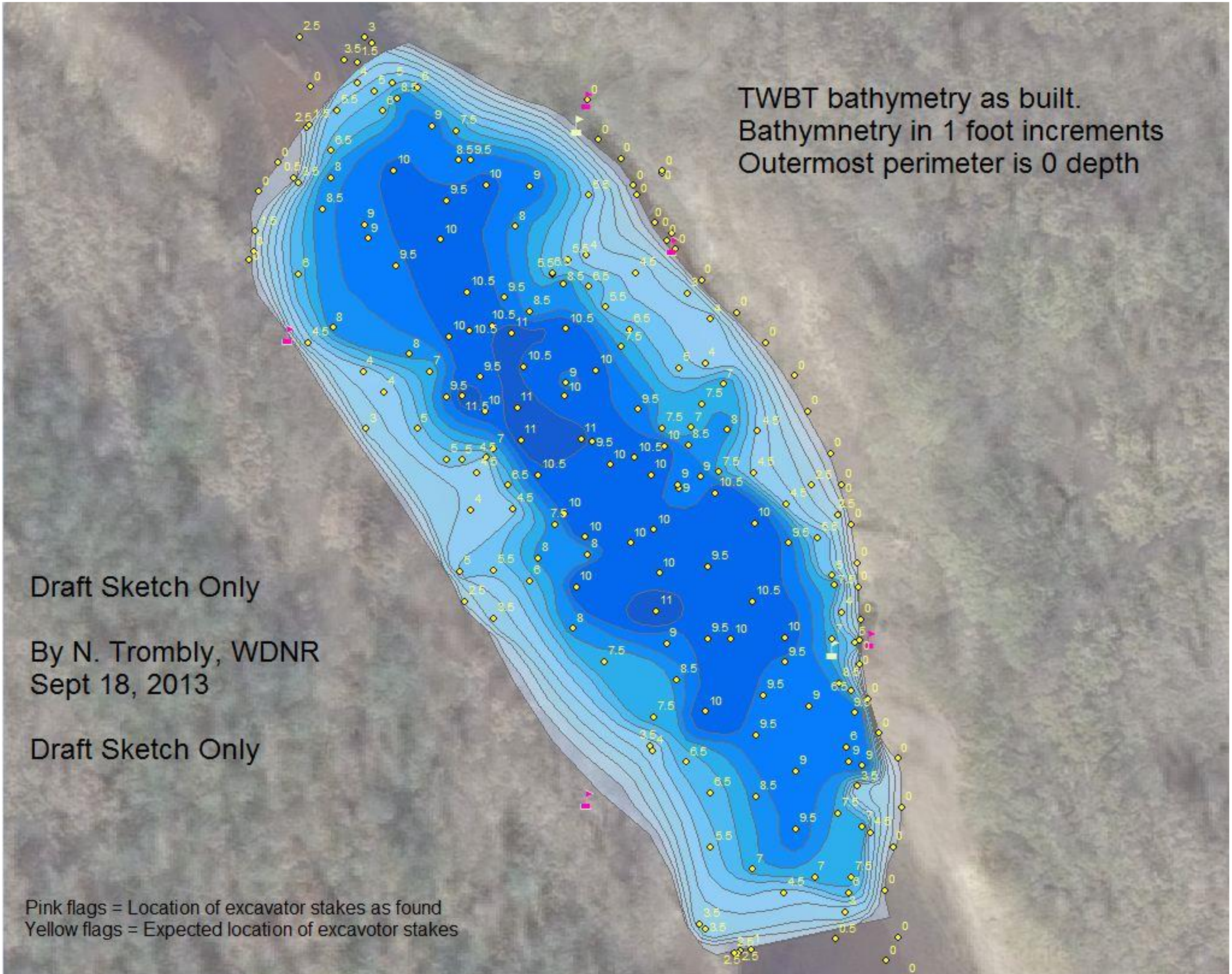
0 0.75 1.5
1

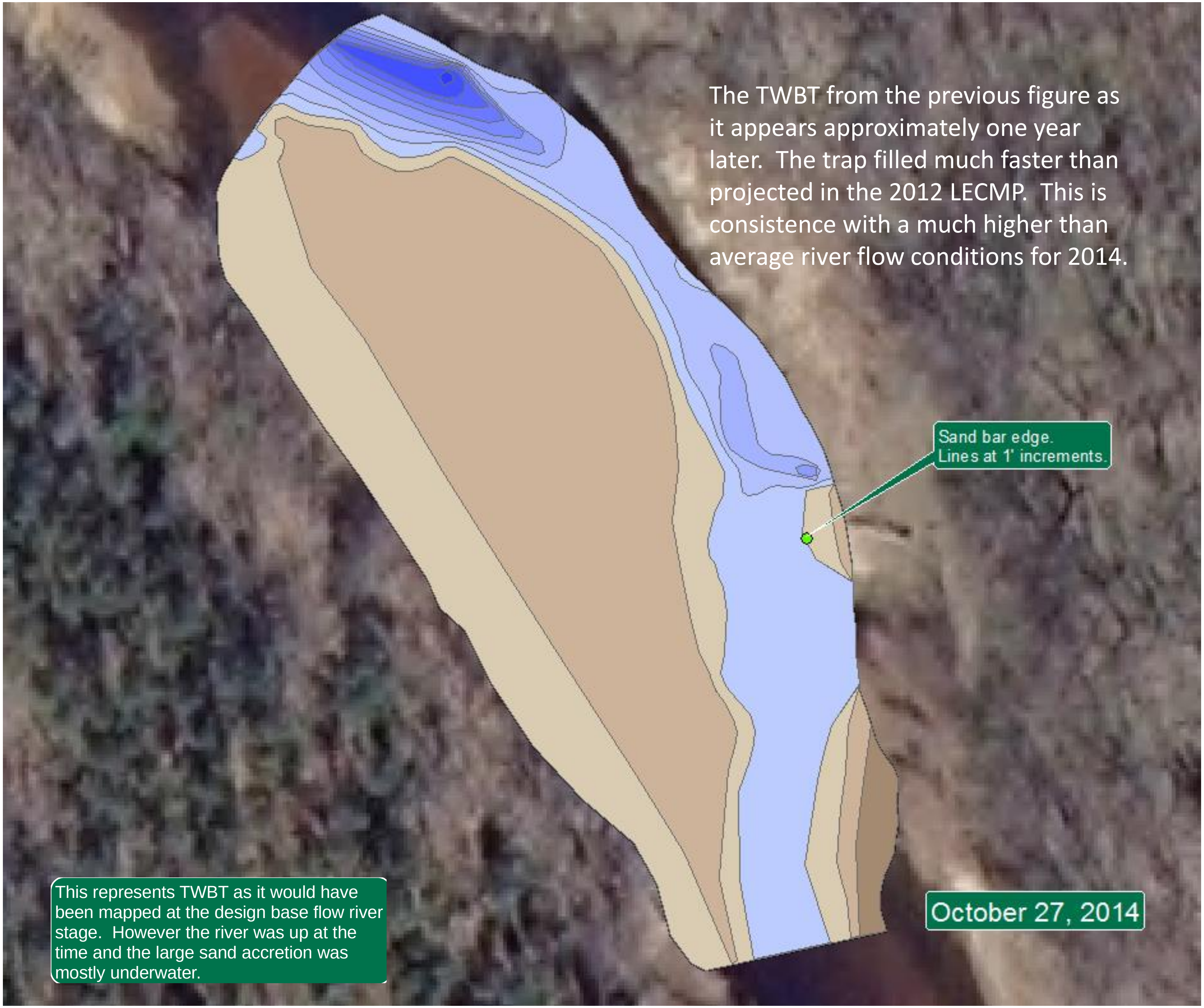
Map developed
Natural Resour
Agricultural Land
datasets were s
Chippewa Count
National Weather

CHARACTERISTICS OF RIVER SEDIMENT TRAPS

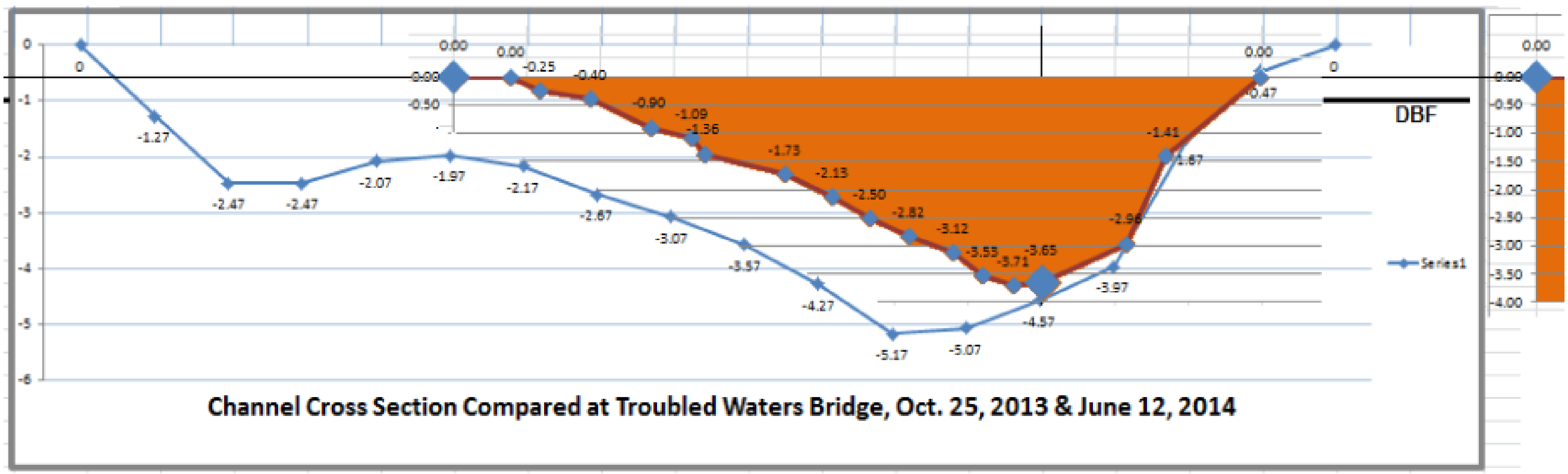
TOTAL TRAP CAPACITY AS DUG IN 2013

• TWBT	14,129 yd^3
• GPT	9,848 yd^3
• Upper SRT	5179 yd^3
• Middle (Channel)	3007 yd^3
• Lower SRT	5381 yd^3
TOTAL YARDS DUG 2013	37,644 yd^3


TWBT bathymetry as built.
Bathymnetry in 1 foot increments
Outermost perimeter is 0 depth
Draft Sketch Only
By N. Trombly, WDNR
Sept 18, 2013
Draft Sketch Only
Pink flags = Location of excavator stakes as found
Yellow flags = Expected location of excavotor stakes


The TWBT from the previous figure as it appears approximately one year later. The trap filled much faster than projected in the 2012 LECMP. This is consistence with a much higher than average river flow conditions for 2014.
Sand bar edge.
Lines at 1' increments.
This represents TWBT as it would have been mapped at the design base flow river stage. However the river was up at the time and the large sand accretion was mostly underwater.
October 27, 2014

BATHIMETRY OF TWB RIVER CROSS-SECTION

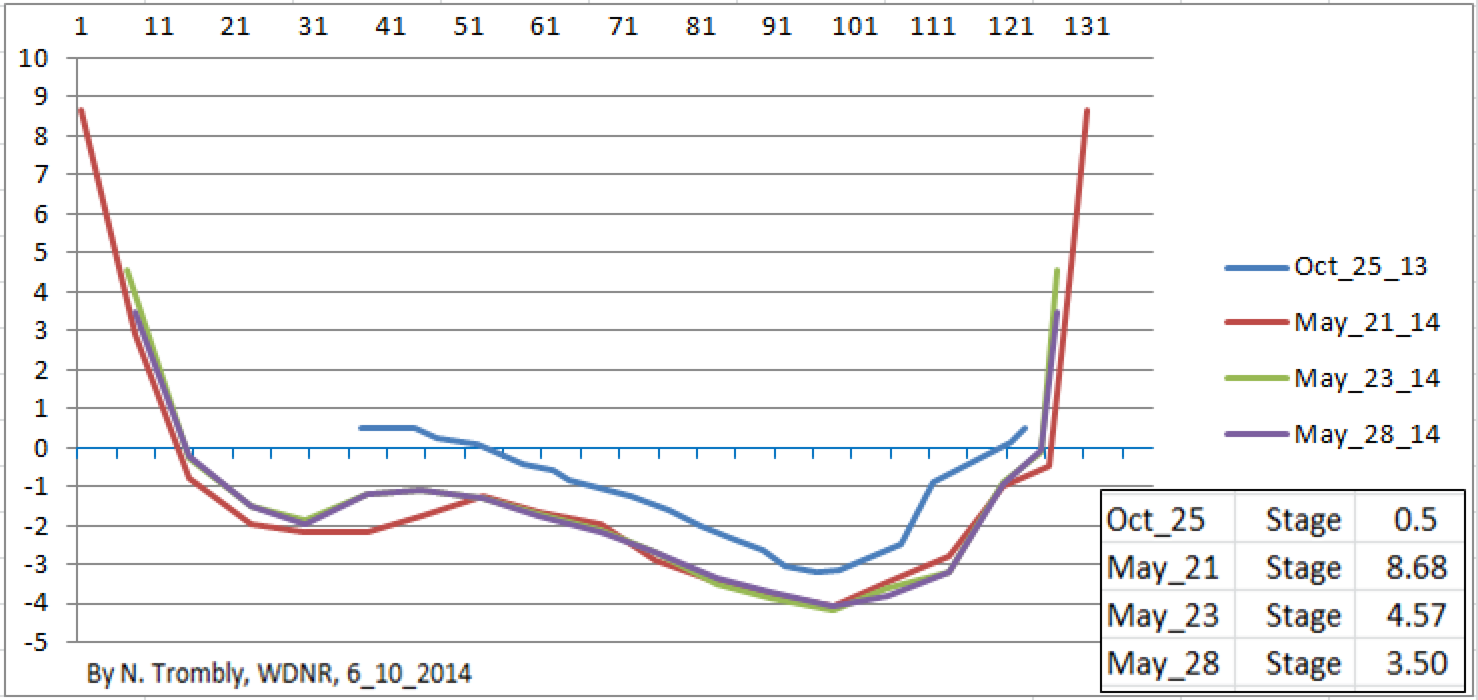


The desired consequence of the large amount of sediment removal by the TWBT and GPT can be seen along the course of the river. For example the figure above shows how much sediment was removed from the river bed from the time the sediment trap was created in 2013 to the period after the 2014 spring flooding. This deepening of the river bottom was observed downstream to the GPT and beyond and is nicely illustrated in the following two pictures taken before the TWBT was completed in 2013 and in the summer of 2014 after the spring floods. The pictures were taken from the same point and at low flow.

Graph of River Channel Morphometry at the TWB (Troubled Waters Bridge)

By Neil Trombly, WDNR

The graph below shows river stage as well as flowing water channel width, depth and shape.
The stage/flow surveys of October 25, 2013 and the first three post-flood surveys are graphed.
This graph's zero line is the Design Base Stage (August, 2013) from which trap volume is calculated.
The elevated blue line is the width, shape and depth of flowing water channel in October, 2013.
The major spring flood event of 2014 (red line) heavily scoured the channel at the TWB.
Subsequent surveys (purple and green lines) show little change although some sand may have reappeared between the 31 and 51 feet tick marks, between the purple and red lines.
The TWBT (TWB Trap) was highly successful at starving the river for bedload causing the channel to deepen by a mean 19.75 inches ***over the width of the blue line*** -- deepening was up to 30 inches to the left of the blue line but that deepening has not been quantified.



Oct_25	Stage	0.5
May_21	Stage	8.68
May_23	Stage	4.57
May_28	Stage	3.50

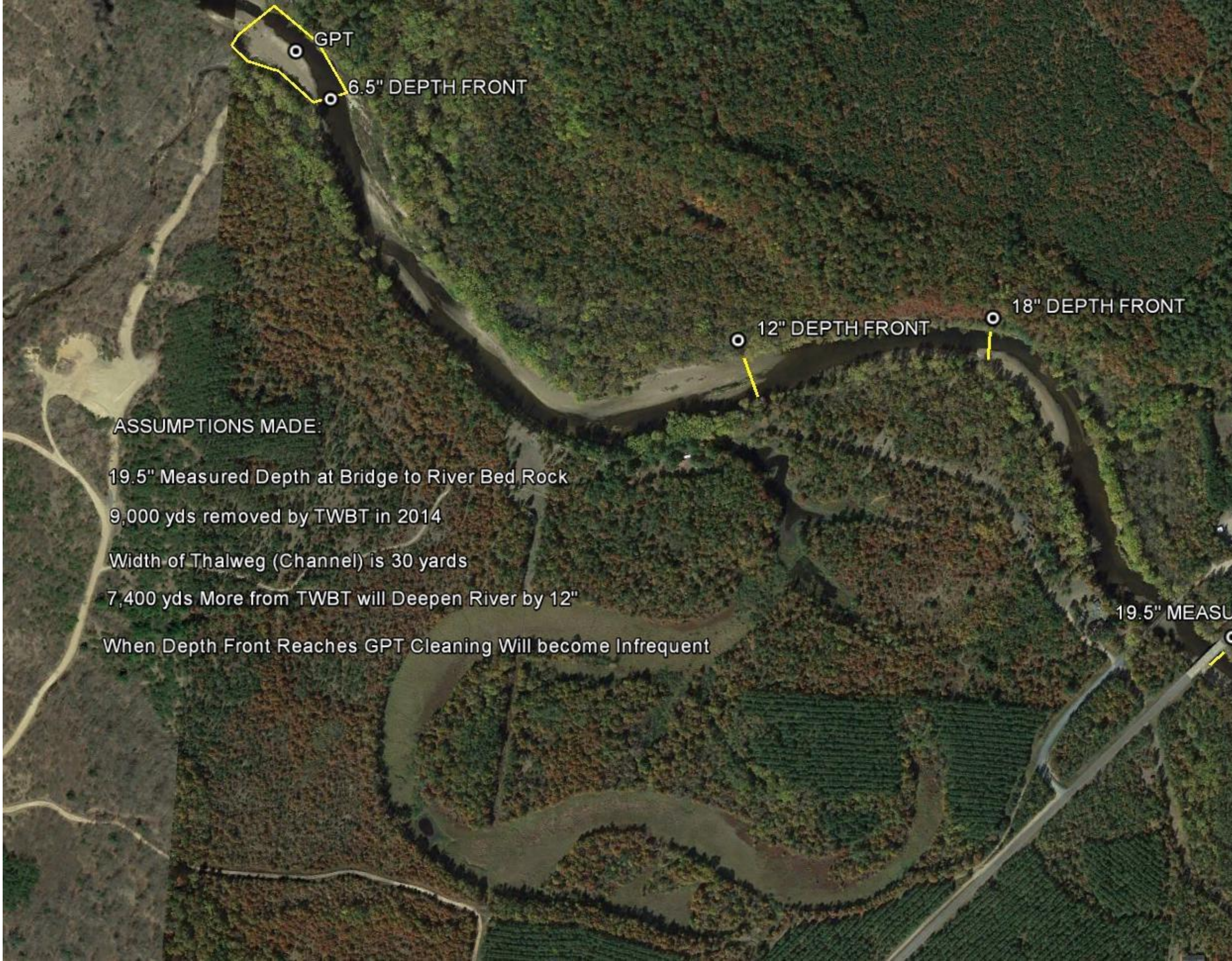
Troubled Water Bridge Stage -Flow Graph. Units are in feet.

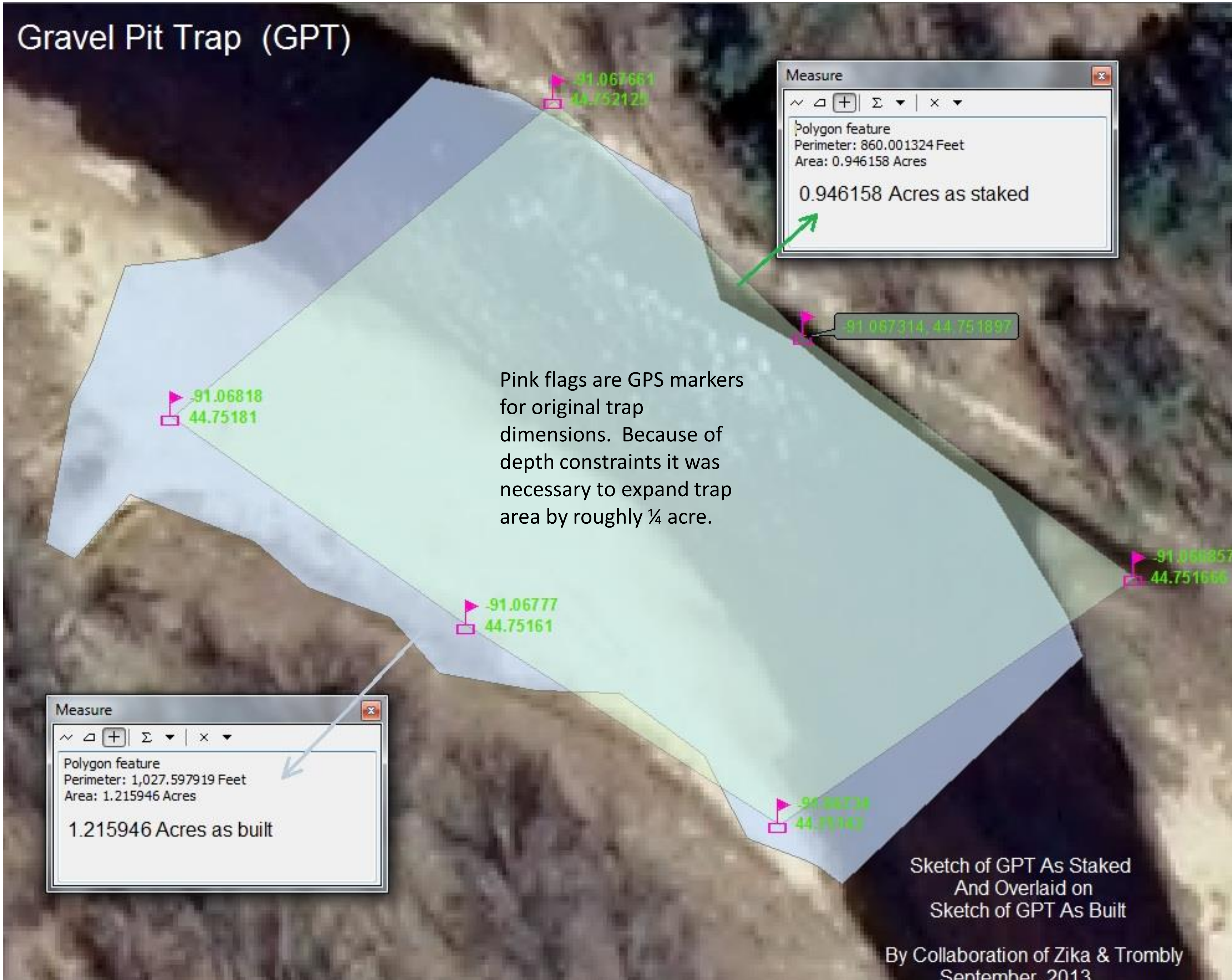
EVIDENCE FOR RIVER SEDIMENT SCOURING BELOW TWBT

NOTES PERTAIN TO FOLLOWING 3 FIGURES

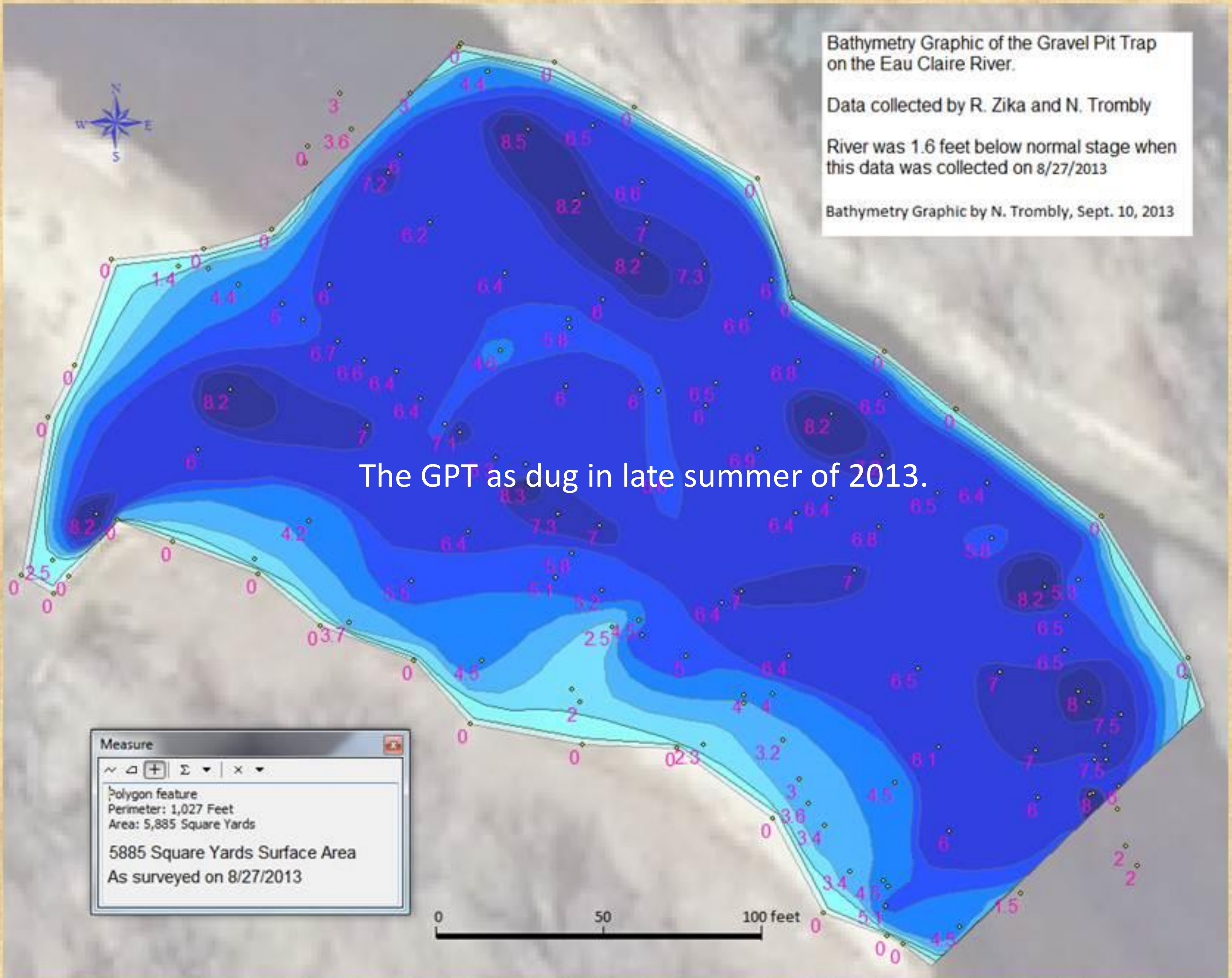
1. Picture looking upstream from old TW bridge taken during 2013 summer low water period before dredging started. Note the shallow water and emergent sand bars. Compare this to the following 2014 photo graph from same position.
2. Picture from TW bridge taken in mid-August of 2014 at low water. The spring to early summer months of 2014 were a period of multiple sustained flood events with well above average sediment transport potential as show from the continuous river stage measurements at TWB. Note that unlike the proceeding picture the emergent sand bars are gone and the river bottom is no longer visible, although sky lighting conditions makes this more difficult to discern from the photo. The status of partially submerged rocks along the shorelines indicate that the river water surface level is lower than in the preceding 2013 photo, yet the discharge volume (although not measured at the time of the photograph) appears to clearly be greater. This can only mean that the cross-sectional area of river volume has increased and that river bottom elevation has decreased.
3. The river is doing as expected with the addition of the TWBT; the sediment transport is substantially decreasing the river bed bottom elevation. The river has deepened to the point where the second phase or reconnection of the flood plain channels should begin asap to reduce flow velocities in the main channel. The river should be evaluated for detailed bottom elevation changes, widening, and new developing erosive features.


08/15/2014

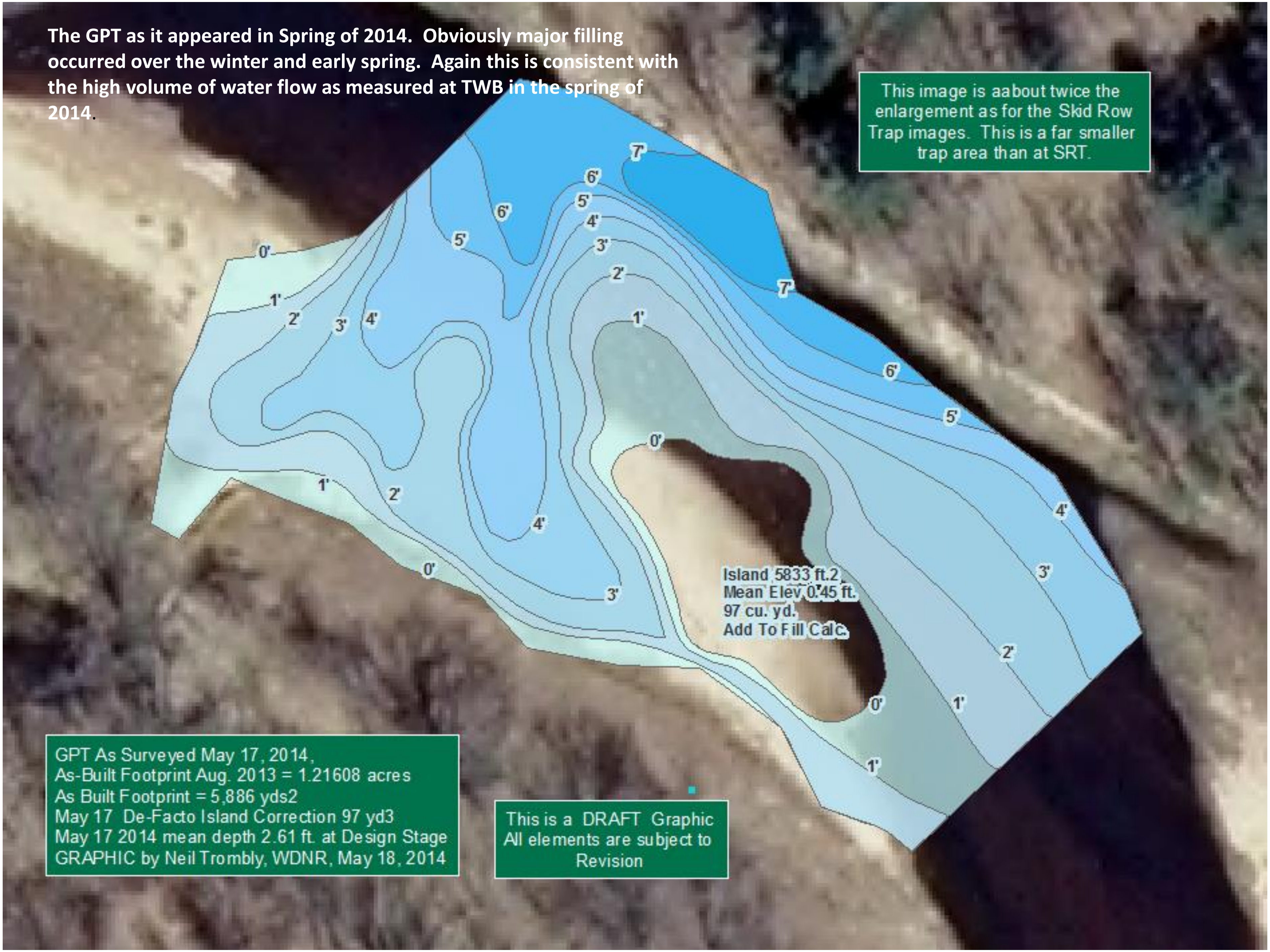

GPT
6.5" DEPTH FRONT
12" DEPTH FRONT
18" DEPTH FRONT
19.5" MEASU
ASSUMPTIONS MADE:
19.5" Measured Depth at Bridge to River Bed Rock
9,000 yds removed by TWBT in 2014
Width of Thalweg (Channel) is 30 yards
7,400 yds More from TWBT will Deepen River by 12"
When Depth Front Reaches GPT Cleaning Will become Infrequent

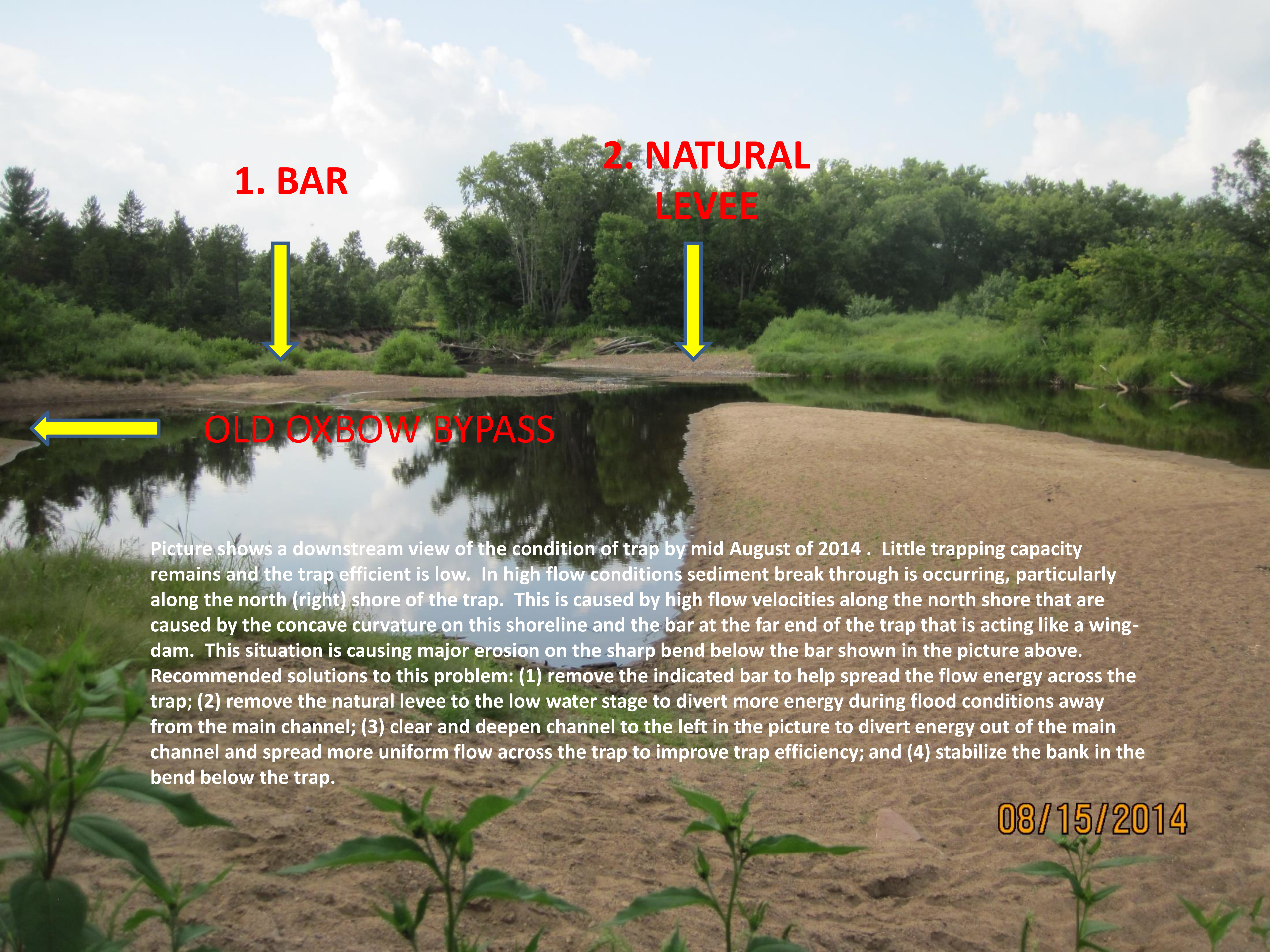


Gravel Pit Trap (GPT)
-91.067661
44.752125
Measure
Polygon feature
Perimeter: 860.001324 Feet
Area: 0.946158 Acres
0.946158 Acres as staked
-91.067314, 44.751897
-91.06818
44.75181
Pink flags are GPS markers for original trap dimensions. Because of depth constraints it was necessary to expand trap area by roughly ¼ acre.
-91.066857
44.751666
-91.06777
44.75161
Measure
Polygon feature
Perimeter: 1,027.597919 Feet
Area: 1.215946 Acres
1.215946 Acres as built
Sketch of GPT As Staked
And Overlaid on
Sketch of GPT As Built
By Collaboration of Zika & Trombly
September, 2013



The GPT as dug in late summer of 2013.

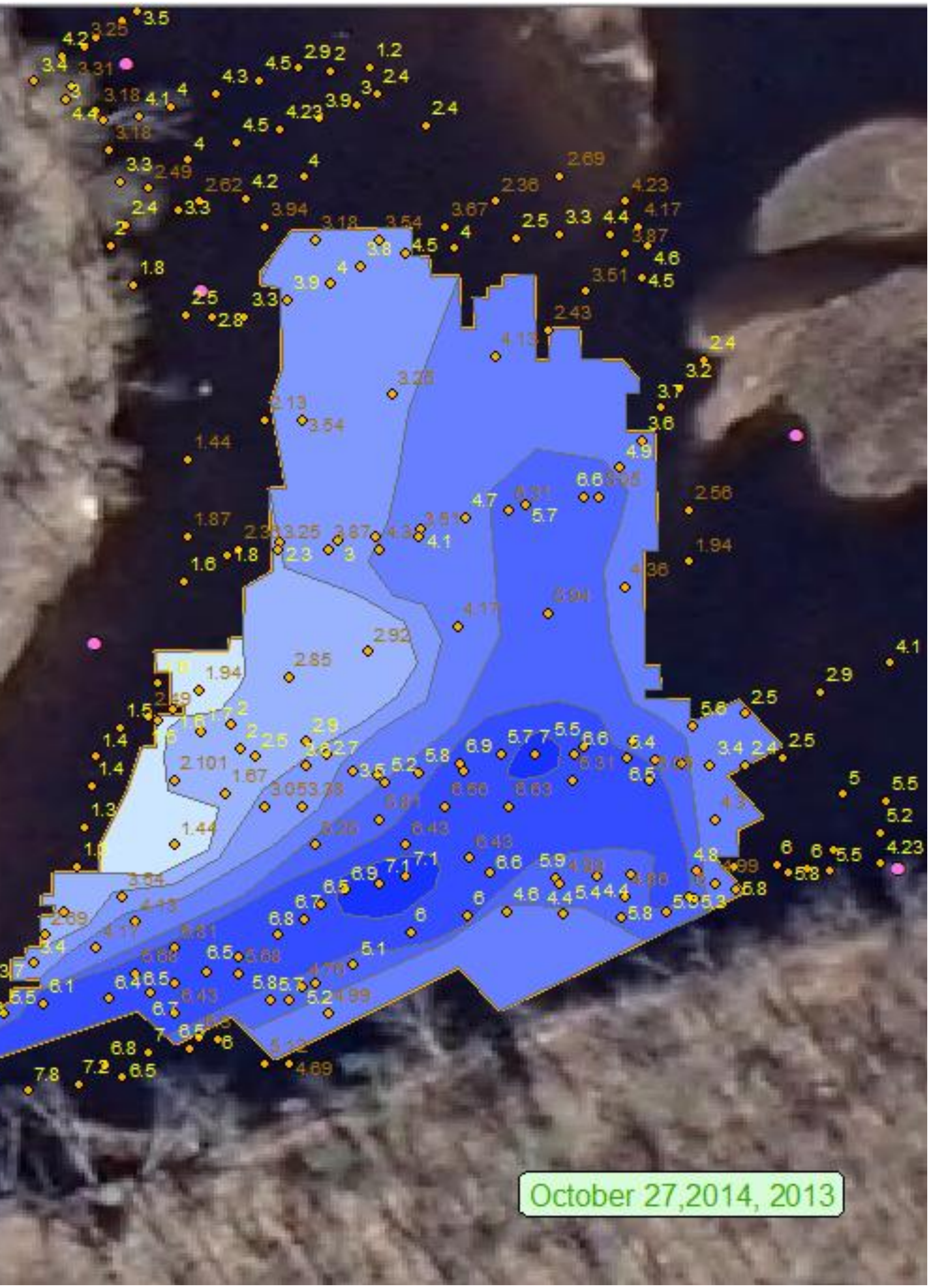

The GPT as it appeared in Spring of 2014. Obviously major filling occurred over the winter and early spring. Again this is consistent with the high volume of water flow as measured at TWB in the spring of 2014.
This image is aabout twice the enlargement as for the Skid Row Trap images. This is a far smaller trap area than at SRT.
Island 5833 ft.2
Mean Elev 0.45 ft.
97 cu. yd.
Add To Fill Calc.
GPT As Surveyed May 17, 2014,
As-Built Footprint Aug. 2013 = 1.21608 acres
As Built Footprint = 5,886 yds2
May 17 De-Facto Island Correction 97 yd3
May 17 2014 mean depth 2.61 ft. at Design Stage
GRAPHIC by Neil Trombly, WDNR, May 18, 2014
This is a DRAFT Graphic
All elements are subject to Revision


1. BAR
2. NATURAL LEVEE
OLD OXBOW BYPASS
Picture shows a downstream view of the condition of trap by mid August of 2014 . Little trapping capacity remains and the trap efficient is low. In high flow conditions sediment break through is occurring, particularly along the north (right) shore of the trap. This is caused by high flow velocities along the north shore that are caused by the concave curvature on this shoreline and the bar at the far end of the trap that is acting like a wing-dam. This situation is causing major erosion on the sharp bend below the bar shown in the picture above. Recommended solutions to this problem: (1) remove the indicated bar to help spread the flow energy across the trap; (2) remove the natural levee to the low water stage to divert more energy during flood conditions away from the main channel; (3) clear and deepen channel to the left in the picture to divert energy out of the main channel and spread more uniform flow across the trap to improve trap efficiency; and (4) stabilize the bank in the bend below the trap.
08/15/2014


Upper SRT as dug in fall 2013. As a result of high river flow conditions during spring of 2014 most of the capacity of this portion of the SRT was gone. The entire trap as designed consisted of the upper, middle and lower sections which together would have a combined capacity of 40,000 yd3 when completed, because of financial constraints only 20,000 yd3 was to be removed in the first round of dredging in 2013. For a variety of reasons the actual amount excavated was 13,566 yd3 of in situ volume sediment.
October 10 & 23, 2013

Lower SRT was designed to protect Skid Row area from further excessive sediment buildup from the boat landing westward towards the lake. It appears to have accomplished this because the deposit island that existed in front of the properties adjacent to the boat landing has been diminishing with each flood since the SRT was dug. This is occurring because of sediment transport reduction for the up stream traps at SRT, however the island will return quickly once the traps sediment capacity is gone. This reversal in the island development and rapid infilling of the Skid Row channel will likely happen soon, since the capacity of the entire SRT is nearly gone. The infilling rate of the Skid Row channel is for now being moderated by increasing sediment transport into the western meander floodplain by the development of rapidly expanding cuts along the west shoreline of much of the entire SRT. A serious consequence of this is the loss of prime aquatic habitat in the western meander floodplain and the Rookery. To minimize the sediment impacts on Skid Row, the western meander floodplain, and sections of the eastern meander flood plain a more efficient sediment trap placed further upstream at a good sediment choke point is suggested.

Another concern about the Skid Row area is the continued development of meander channels into the western meander floodplain. These channels have been developing over the last 15 years and represent a major threat to the west meander floodplain wetlands and productive fisheries habitat. A rethinking of the protective measures at Skid Row is required and soon.

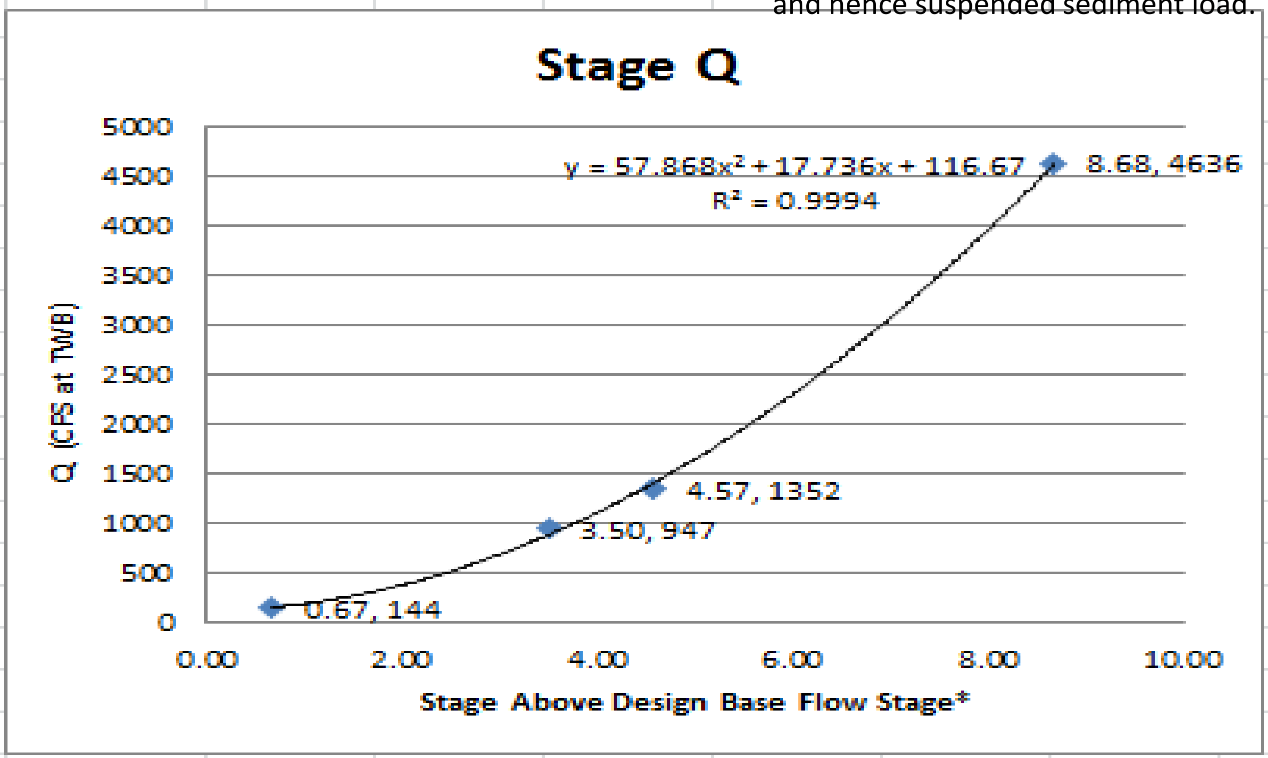


EC RIVER FLOW MEASUREMENT AT TROUBLED WATERS BRIDGE AND REGIONAL PRECIPITATION TRENDS

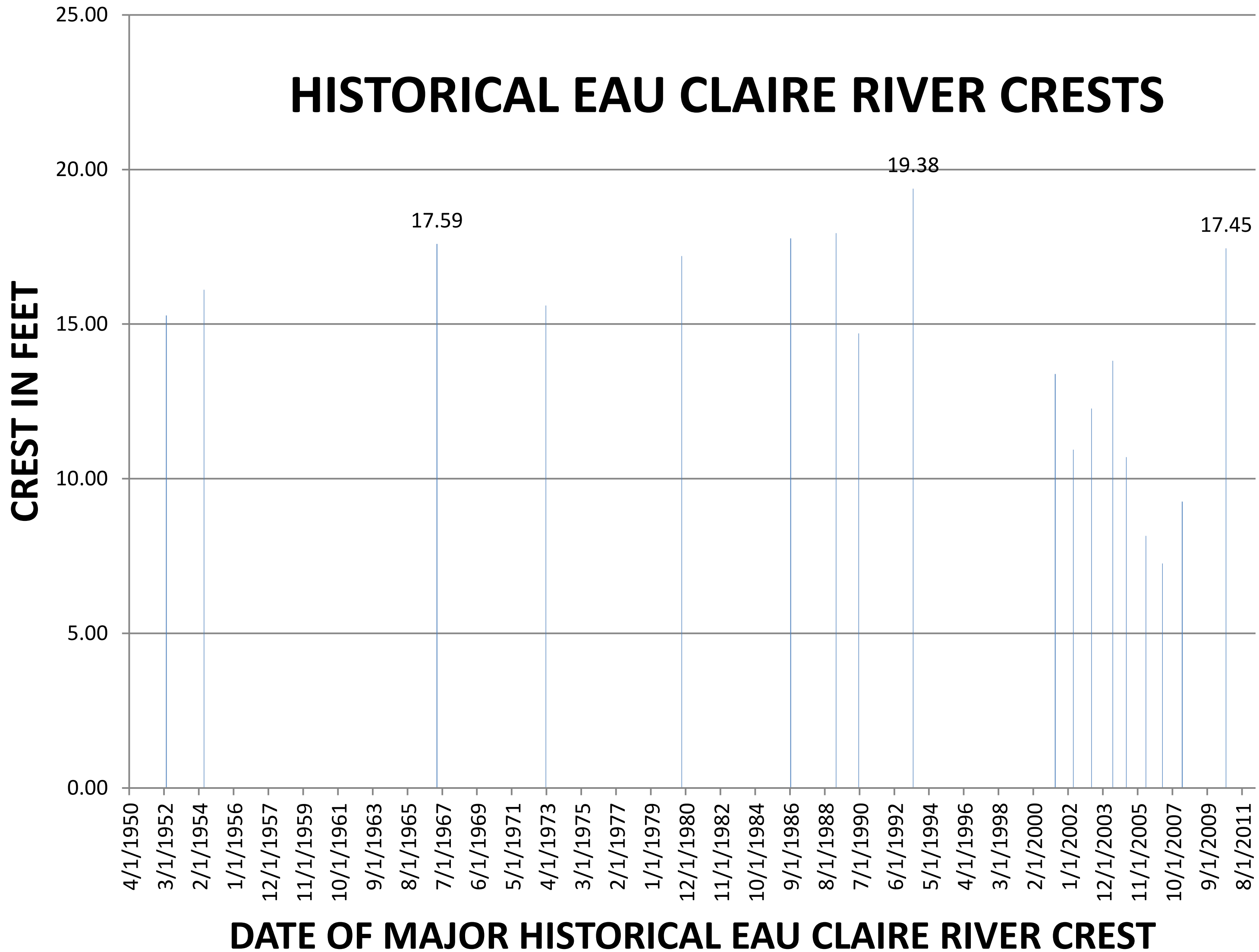
First Four 2014

n=4		TWB Stage	TWB Q
	May_21	8.68	4636
	May_23	4.57	1352
	May_28	3.50	947
	June_12	0.67	144

Data collected from identical locations using bridge railing post locations.



Since the last LECMP a stage gauge has been installed and is being monitored by GOES. The stage gauge readings were calibrated to produce a measure of flow vs stage height that is shown in the above figure. It is important that this station continue to be maintained and monitored and further calibrated with sediment transport. This establishes the relationship between precipitation levels and sediment transport towards LEC. Also because these flow meter calibrations were completed before complete bottom scouring occurred the calibration should be repeated soon. Recommendation calls for the replacement of current pressure sensor with an atmospheric vented pressure sensor that reports telemetry data daily. A sensor package is available that can also simultaneously measure turbidity and hence suspended sediment load.



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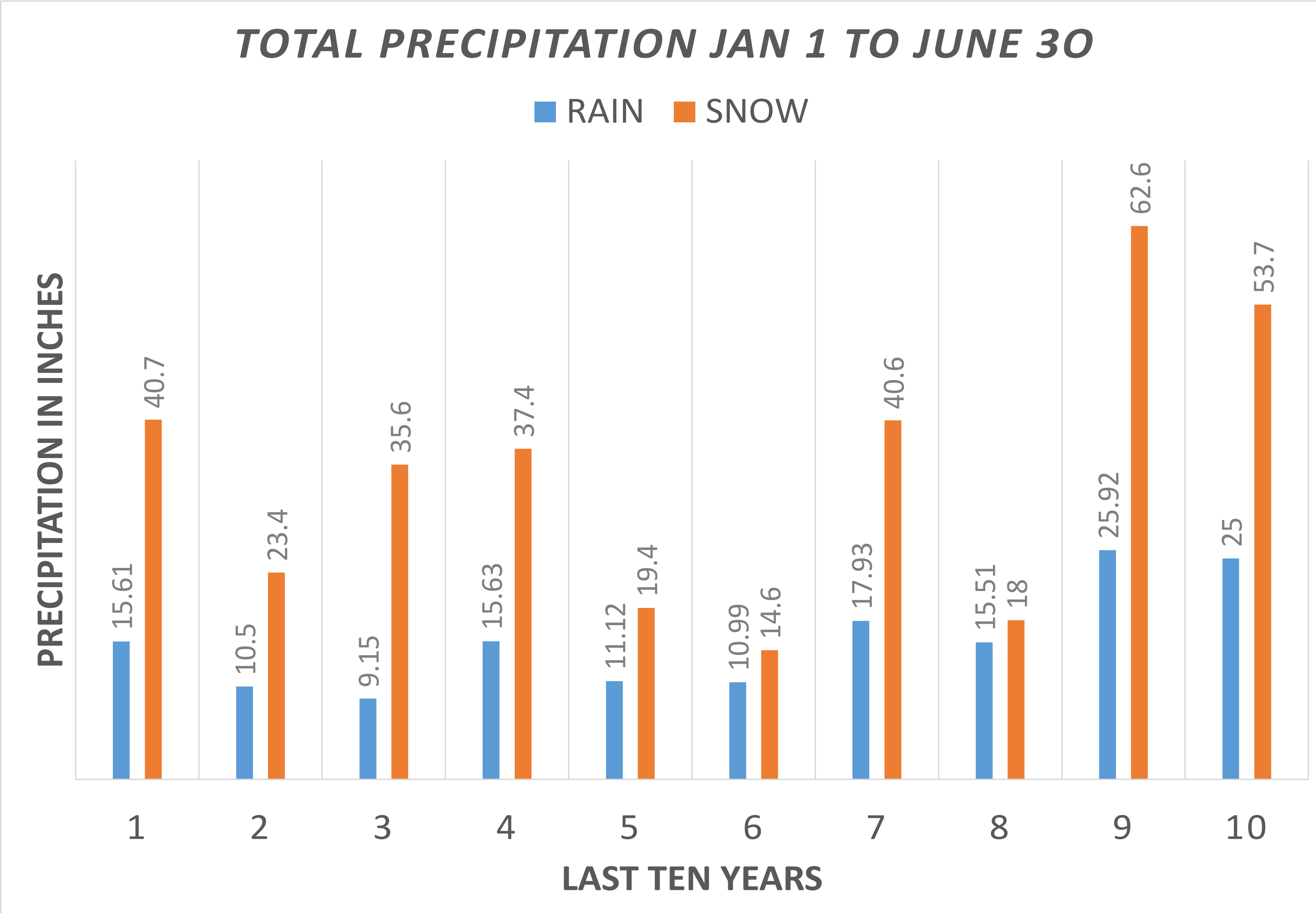
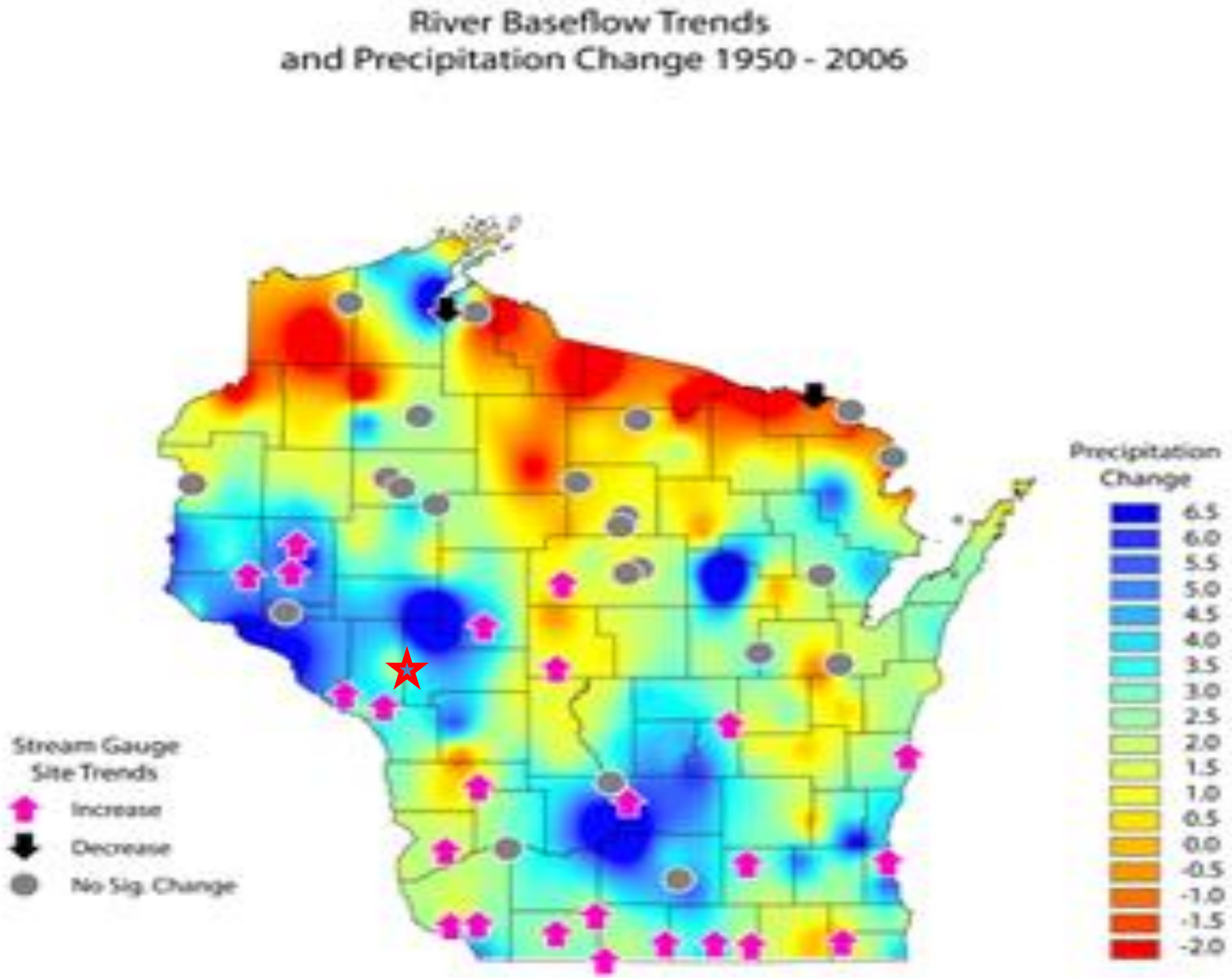


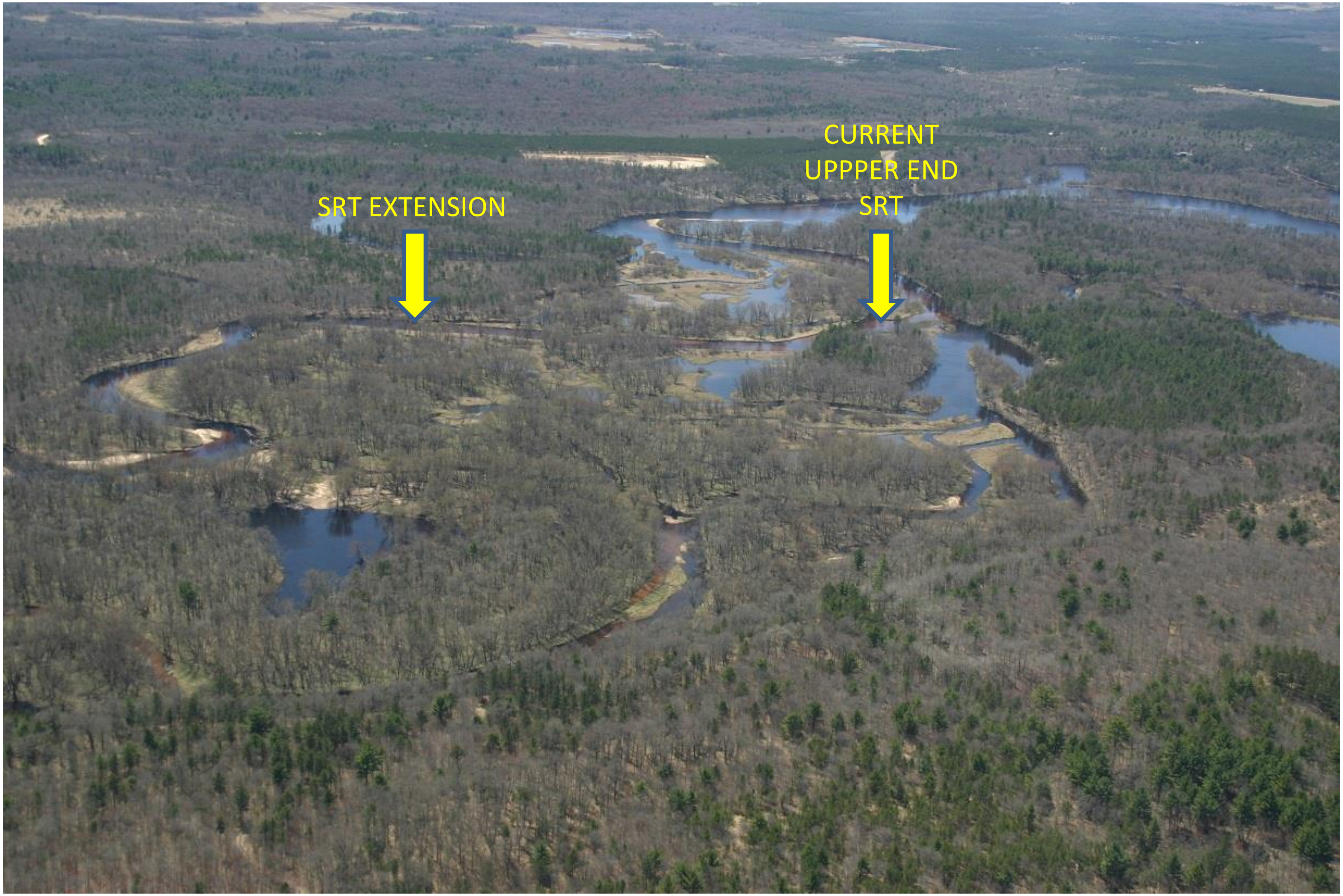
In the last 10 years up to 2014 there is an apparent increase in total precipitation. Although it is not shown this is probably true for 2015.

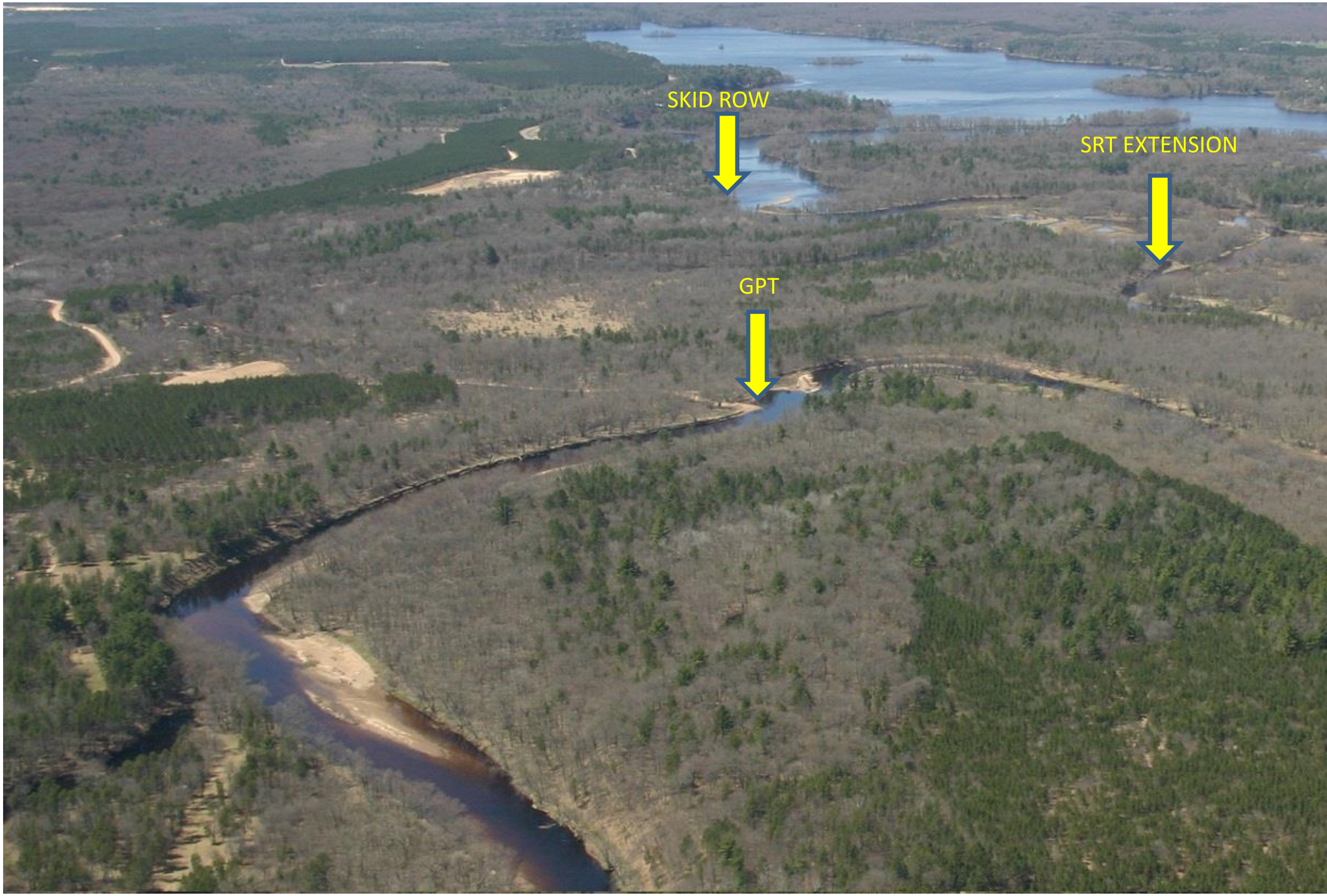


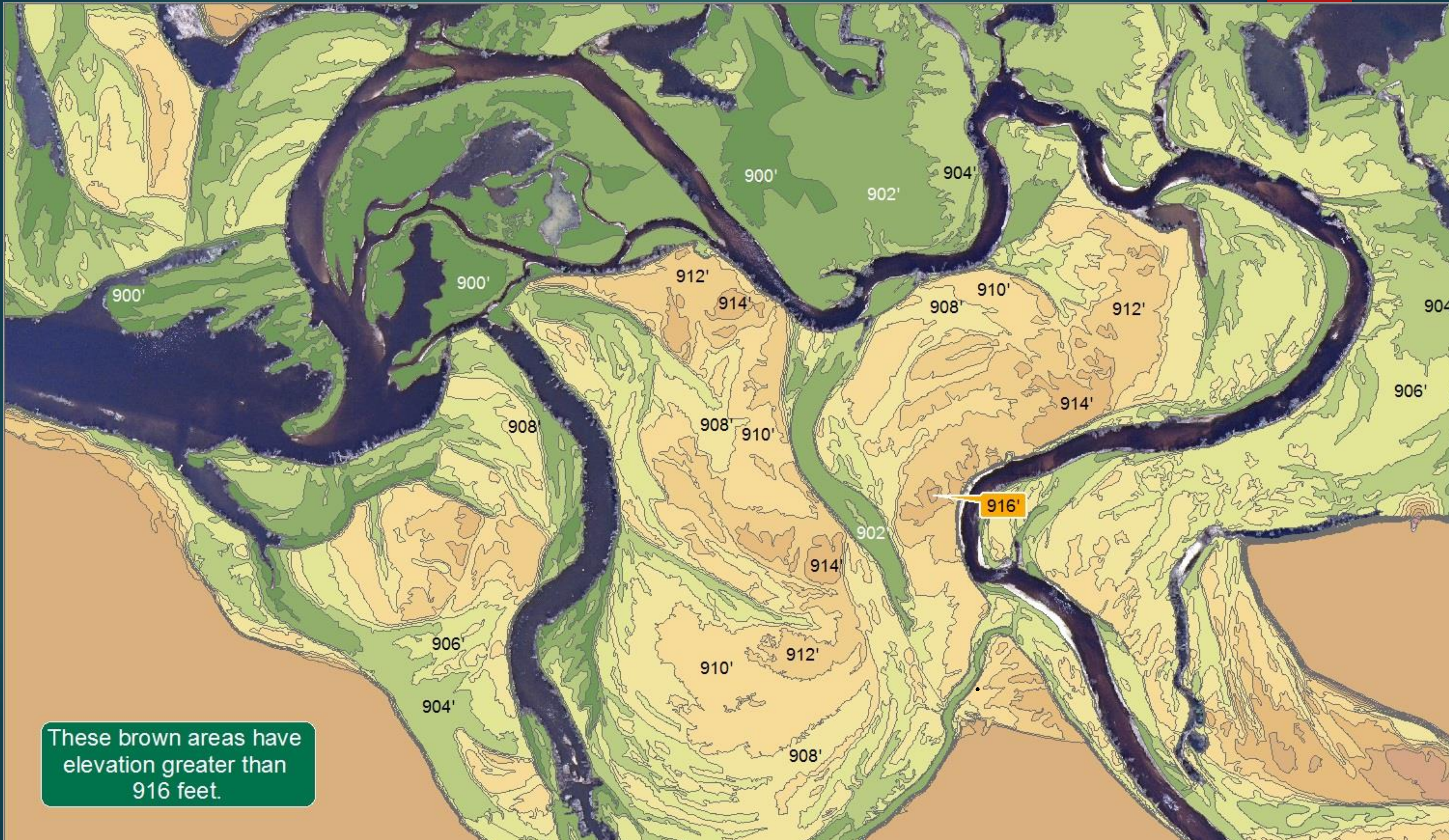
The open red star in the figure above is LEC. Most of the LEC watershed region is under an increasing climate trend in river base flow and precipitation since 1950 which is way above the regional average. This might be due to increasing nucleation out flow from the Twin Cities region.

PRELIMINARY DESIGN PLAN FOR SKID ROW EXTENSION TRAP AND NEW SEDIMENT SPOILS AREA

A new extension of the existing Upper SRT is proposed and is referred to as the SRT Extension. Its location is shown in the following figures as is a newly proposed spoils area that would serve to retain dredge spoils from local sediment traps


SRT EXTENSION
CURRENT
UPPPER END
SRT


SKID ROW
SRT EXTENSION
GPT



Lidar image from 2013 showing elevations of the GPT and SRT flood plain regions.

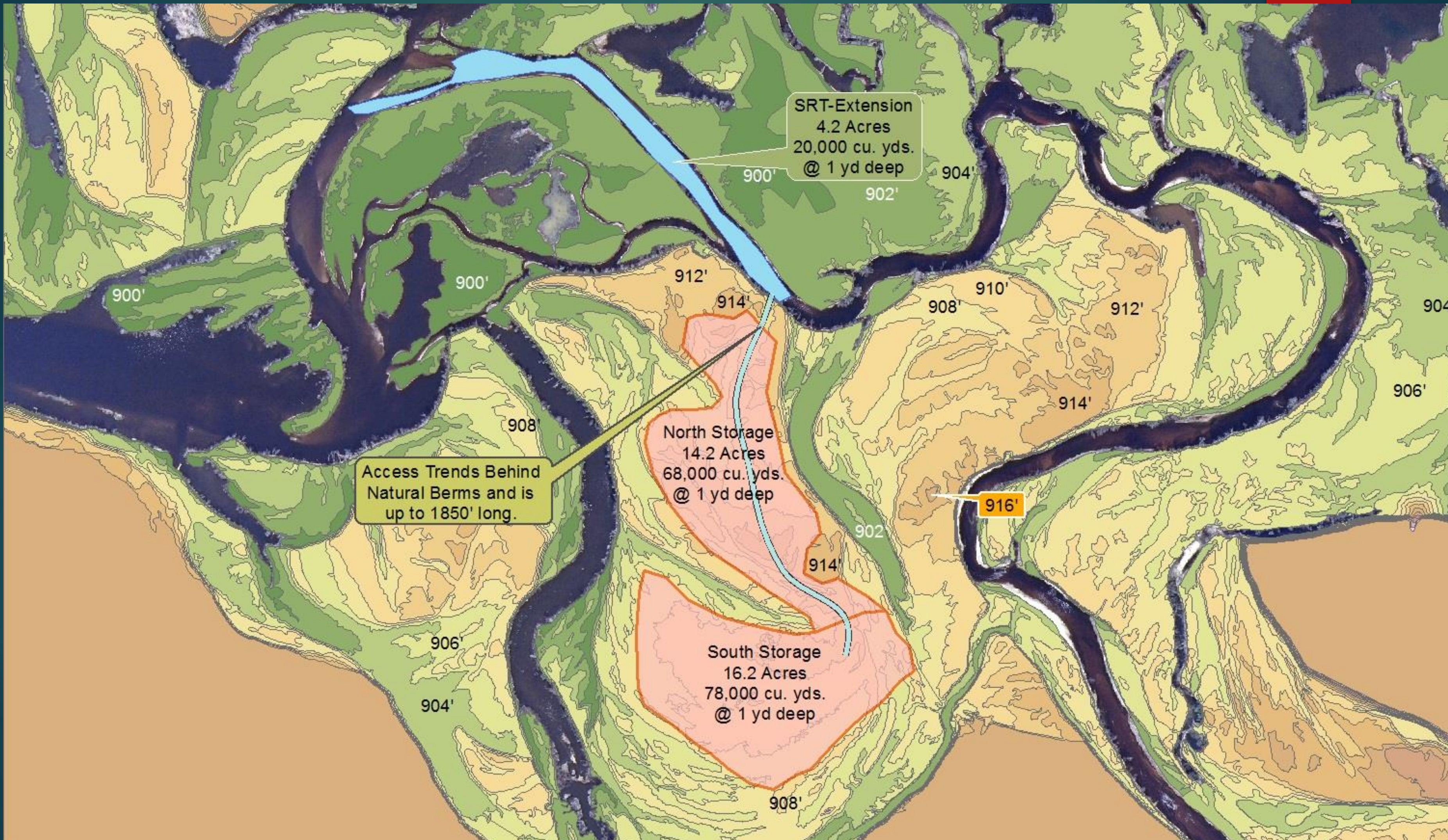
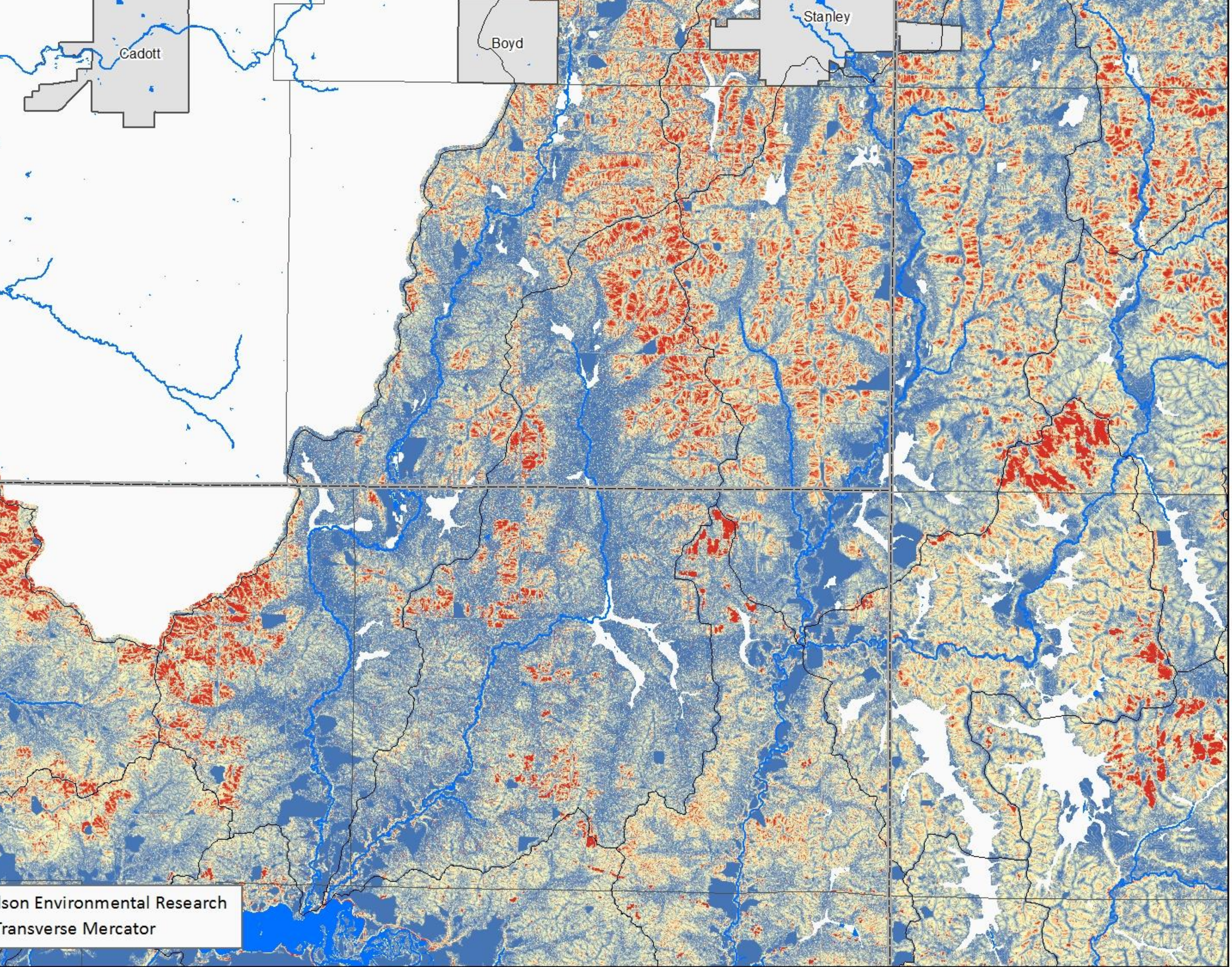


Figure shows the superimposed image of proposed new spoils site in pink, access road to SRT Extension in blue, and SRT Extension Trap in blue.

MUSKRAT AND HAY CREEKS PRELIMINARY EVALUATION

Muskrat and Hay Creek lake deposit areas were dredged around 2003-2005, however no adequate sediment traps were added to protect the newly dredged areas. Hence they are quickly returning to original condition prior to 2003. Also there is evidence from past bathymetry maps of infilling of areas adjacent to the Muskrat and Hay Creek deltas that there is a substantial deposition zone developing in the NW area of the lake. It is suspected that much of this might be suspended load from agricultural lands further north in the two stream watersheds (see Erosion Vulnerability Map above).
This suspected situation needs to be further evaluated by regular high quality bathymetric mapping, stream sediment load characterization and lake sediment coring.


Cadott
Boyd
Stanley
lson Environmental Research
Transverse Mercator

M
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N

The 2012 LECMP defines a sediment trap for coarse sediment load reduction in Muskrat Creek. Although this plan exists and could be carried out, providing funds are available, it would be wise to revisit this plan after an updated data analysis using LIDAR data that was not available during the preparation of the 2012 LECMP.

LECMP 2015-16: SEDIMENTATION AND EROSION

- Permits for North Shore Sediment Traps Have Been Renewed to 2023
- Ten Year Renewal of Spoils Site Lease with County Revised and Renewed: Includes GP Spoils Area
- Excavation of TWBT and GPT in Winter of 2015
- Planning Underway for SRT and Muskrat and Hay Creek
- Studies on River-Bed Elevations, Discharge Rates, Ground Penetrating Radar Images, Sediment Coring, and Sediment Transport Need to Continue or be Started
- Reconnectivity Plan Should Commence in 2015-16
- Alternative Bank Erosion Measures Need to Be Explored

LECMP SECTION: RIVER FLOOD PLANE RECONNECTIVITY PROJECTS

Some example projects appear in the following photos:

Most of this section is already available but needs updates before being included in future LECMP. The original report is, I believe, still available in the LECA website library. The report was as far as I know never finalized or approved by DNR. It is important to understand that the full sediment mitigation strategy as designed for the sedimentation variance included implementation of the reconnectivity projects.

THE END OF REPORT

The LECD has plans to compose a follow on this document which will be the 2016-17 LECD Management Plan

If you have questions, comments, recommendations or would like to participate in the planning process please go to LECD Website and fill out and send the general contact form at

http://lakeeauclaire.org/contact-us