2016

Clearwater River
WATERSHED DISTRICT
Promote. Protect. Preserve.

2016 PROJECT INSPECTION REPORT

The mission of the Clearwater River Watershed District is to promote, preserve, and protect water resources within the boundaries of the district in order to maintain property values and quality of life as authorized by MS 103D.

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Overview

This 2016 Project Inspection Report serves to summarize the results of project inspections conducted April-June of 2016. These on-site, visual inspections were performed to provide status updates and recommendations on maintenance and modification needs for the majority of District projects on the landscape. Staff that conducted the inspections are not licensed professional engineers; consideration should be given to the need for professional engineering input and oversight.

Tables 1 & 2 below summarize the estimated costs for recommended and optional maintenance and modification activities based on respective funds. Costs are estimated based on past work and are subject to change. Please note that several of the recommend activities do not have estimated costs due to the need for further information; as such, this table does not account for those activities.

Table 3 on page 4 summarizes inspection results and recommendations of maintenance activities with estimated costs. The detail descriptions section provides more information on each inspection. The included appendices provide further information on several maintenance and modification activities.

Table 1: Cost estimate summary for maintenance/ modification activities

Project Name	Fund	Prioritization	Estimated Cost
Clearwater Chain of Lakes (1980): Annandale Wetland Treatment System	210	Primary	$25,000-50,000
		Secondary	Unknown
		Optional	Unknown
Clearwater Chain of Lakes (1980): Kingston Wetland Treatment System	210	Primary	$15,000-40,000 + unknown
		Secondary	Unknown
		Optional	N/A
Clearwater Chain of Lakes (1980): Upper Watkins Wetland Isolation Project (North)	210	Primary	$25,000-50,000 + $1,500
		Secondary	$3,000
		Optional	Unknown
Clearwater Chain of Lakes (1980): Watkins Wetland Treatment System	210	Primary	$25,000-50,000 + $1,500 + unknown
		Secondary	Unknown +$1,500
		Optional	Unknown
Clearwater Chain of Lakes (1980): Lake Augusta Erosion Control	210	Primary	N/A
		Secondary	$1,000
		Optional	Unknown
Pleasant Lake Outlet Control	203	Primary	$500
		Secondary	N/A
		Optional	N/A
School Section Lake Outlet Control	206	Primary	$100
		Secondary	N/A
		Optional	Unknown
Kimball Stormwater Projects	210	Primary	$1,350
		Secondary	$500
		Optional	Unknown
Project #06-1: Fish Barriers	215	Primary	Unknown
		Secondary	Unknown

Project Name	Fund	Prioritization	Estimated Cost
		Optional	$5,000
Project #06-1: Segner Pond	215	Primary	Unknown
		Secondary	N/A
		Optional	N/A
Wastewater Treatment Systems	620	Primary	$500
		Secondary	N/A
		Optional	N/A
TOTALS (of known estimates)			$106,450- $206,450

Table 2: Cost estimate summary by priority and fund

Project Name	Fund	Estimated Cost
Primary	203	$500
	206	$100
	210	$25,000-$50,000 +$10,000-40,000+ $25,000-50,000+ $1,500+$25,000-50,000+ $1,500+ $1,350+ Unknown
	215	Unknown
	620	$500
Secondary	203	N/A
	206	N/A
	210	$3,000+ $1,500+ $1,000+ $500+ Unknown
	215	Unknown
	620	N/A
Optional	203	N/A
	206	Unknown
	210	Unknown
	215	$5,000
	620	N/A
TOTALS (of known estimates)		$106,450- $206,450

The CRWD Board of Managers should indicate to staff which activities to undertake, and should provide staff with the option to prioritize implementation. This prioritization should be based on: timeframes, other District matters, cost-saving and cash flow analysis.

Table 3: 2016-17 Proposed Maintenance/ Modification Activities

Project: Modification/ Maintenance Activities	Prioritization			Estimated Cost
	Primary	Secondary	Optional	
Annandale Wetland Treatment System [Fund 210]				
1. Repair break in the berm	✓			Contractor: ~$25- 50K based on past work
2. Repair ports or provide other methods for water flow	✓			
3. Evaluate accumulated sediment and determine cleanout necessity		✓		UNKNOWN
5. Schedule GPS survey in 2017 if berm and/or channel work is performed		✓		UNKNOWN
6. Decide on repair/ replacing fencing along west channel			✓	UNKNOWN
7. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Kingston Wetland Treatment System [Fund 210]				
1. Remove beaver dam and trap for future beavers	✓			UNKNOWN: 1) Beaver trapping performed by drainage authority 2) Beaver dam removal may also be performed by drainage authority
2. Develop agreement with adjacent property owners for sediment disposal site	✓			UNKNOWN: Development – attorney and staff time to work with property owners and develop document
3. Remove sediment from basin at same time banks are repaired, repair washed out banks w/ riprap	✓			Contractor: ~$15-40K based on past work
4. Schedule GPS survey in 2017 of project components		✓		UNKNOWN
Upper Watkins Wetland Isolation Project (North) [Fund 210]				
1. Cleanout sediment in northern channel	✓			Contractor: ~$25-50K based on past work
2. Repair breach in northern berm	✓			
3. Address sedimentation from adjacent agricultural fields	✓			UNKNOWN: needs design
4. Repair and reset culvert	✓			Contractor as part of items 1-2

Project: Modification/ Maintenance Activities	Prioritization			Estimated Cost
	Primary	Secondary	Optional	
crossing in northern channel				above
5. Clear remaining woody brush from berm and treat		✓		Staff or CCM crew: $1,500
6. Clear woody vegetation from around wooden weirs		✓		Staff or CCM crew: $1,500
7. Treat noxious weeds (as needed)	✓			Maintenance: $1,500
8. Decide on repair/ replacing fencing along west channel			✓	UNKNOWN
9. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Watkins Wetland Treatment System (South) [Fund 210]				
1. Cleanout of channel section where sedimentation has occurred	✓			Contractor: ~$25-50K based on past work
2. Repair man-made breach in berm	✓			
3. Evaluate repairing low spots or convert to overflows		✓		UNKNOWN
4. Clear remaining woody brush from berm and treat		✓		Staff or CCM crew: $1,500
5. Treat noxious weeds (as needed)	✓			Maintenance: $1,500
6. Decide on repair/ replacing fencing along west channel			✓	UNKNOWN
7. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Nistler-Geislinger Basin [Fund 210]				
1. Basin in good condition				NO ACTION NEEDED
Aerator Buildings [Fund 210]				
1. Consider whether buildings should continue to be maintained or abandoned	✓			UNKNOWN
2. Lake Augusta-Repair to soffits and eaves	✓			UNKNOWN
3. Lake Augusta- Remove excess fill pushed against building		✓		UNKNOWN
4. Lake Augusta: Hire contractor to examine foundation to determine stability and soundness		✓		UNKNOWN

Project: Modification/ Maintenance Activities	Prioritization			Estimated Cost
	Primary	Secondary	Optional	
5. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Lake Augusta Erosion Control Project [Fund 210]				
1. Clear woody vegetation from fence in multiple locations		✓		Staff: $1,000
2. Remove trees from outlet pipe portion of easement			✓	UNKNOWN
3. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Ostmark Basin [Fund 100]				
1. Basin in good condition			✓	NO ACTION NEEDED
Pleasant Lake Outlet Project [Fund 203]				
1. Repairs to rebar on front of structure; replace broken hinge and lock; tighten loose board; grease guillotine valve	✓			Staff: $500
School Section Lake Outlet Project [Fund 206]				
1. Grease guillotine valve	✓			Staff: $100
2. Conduct legal survey to determine exact easement location and place signage			✓	UNKNOWN
Kimball Stormwater Infrastructure [Fund 210]				
1. Rain Garden: place additional riprap		✓		Staff: $500
2. Rain garden: Grease agri-drain baffle slides	✓			Staff: $100
3.Rain garden: speak with city staff on sand removal and upstream sump cleaning	✓			Staff: minimal
4. Reuse Basin: place additional riprap	✓			Staff: $500
5. Hwy. 55 Basin: place additional riprap	✓			Staff: $750
6.Hwy. 55 Basin: speak with city staff and yard owner on options to address snow melt erosion		✓		Staff: minimal
7. Place signage to mark easement areas			✓	UNKNOWN
Old Highway 55 Treatment Area				
1. Project in good				NO ACTION NEEDED

Project: Modification/ Maintenance Activities	Prioritization			Estimated Cost
	Primary	Secondary	Optional	
operational order				
Cedar Lake Subwatershed Fish Barriers [215]				
1. [Henshaw] Finish initial evaluation of velocity tube option	✓			Staff- minimal
2. [Swartout Outlet] Partner with Wright County when CO RD 6 is replaced to integrate fish barrier into culvert		✓		UNKNOWN: Requires further discussion with Wright County
4. Illsley Ave.: damaged by fallen tree, steel panels deteriorating	✓			UNKNOWN: Fallen tree removed; repairs are being evaluated
5. [Segner Pond] Consider modification to barrier to lessen buildup of debris			✓	Staff: $5,000
Segner Pond [Fund 215]				
1. Determine if slightly higher runout elevation of diversion structure should be addressed	✓			UNKNOWN
Highway 55 Fish Trap [Fund 210]				
1. Recently repaired, Board seeking seining from lakes				NO ACTION NEEDED
Norton Ave Sediment Basin[Fund 100]				
1. Basin in good condition				NO ACTION NEEDED
Eddie Schultz Buffer[Fund 100]				
1. Buffer in good condition				NO ACTION NEEDED
Clear Lake North Notch Weir [Fund 210]				
1. Notch weir outlet structure in good condition				NO ACTION NEEDED
Clear Lake South Notch Weir & Sand-Iron Filter [Fund 100]				
1. Modification scheduled				NO ACTION NEEDED
Wastewater Treatment Systems [Funds 610-630]				
1. Signage and Fencing in good condition				NO ACTION NEEDED
2. Woody vegetation and noxious weeds under control				NO ACTION NEEDED
3. Treat western sediment basin at RAW for algae	✓			Contract Vendor: Estimated $500

Detailed Descriptions of Project Inspections

Annandale Wetland Treatment System

Table 4: Annandale Wetland Treatment System - Components Inspected

Inspection Year	Components							
	West Channel & Berm	*West Diversion Berm*	*West Channel Ports*	*East Channel & Berm*	*East Diversion Berm*	*East Channel Ports*	*Center Diversion Structure*	*Fencing*
2014	I	I	I	I	I	I	I	I
2015	NI	NI	NI	NLI	NLI	NLI	I	NI
2016	I	I	I	NI	NI	NI	I	NI
I = inspected, NI = not inspected, NLI = no longer inspected								

Table 5: Annandale Wetland Treatment System – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
West Channel & Berm	Breach in berm, sedimentation in channel	Visual- A, GPS survey- 2017, 2018, 2020, 2023
West Diversion Berm	Needs woody veg. clearing	Visual- A, GPS survey- 2017, 2018, 2020, 2023
West Channel Ports	Multiple ports no longer function	Visual- A, GPS survey- 2017, 2018, 2020, 2023
East Channel Berm	NLI per engineer recommendations	None
East Diversion Berm	NLI per engineer recommendations	None
East Channel Ports	NLI per engineer recommendations	None
Center Diversion Structure	IWO	Visual- A
Fencing	NI	ND
A = annually, IWO = in working order, ND = not decided, NI = not inspected, NLI = no longer inspected		

Site inspection was conducted May 27, 2016. Inspection was conducted as part of task order #16-0001 with Wenck Associates, Inc. Wes Boll of Wenck Associates and Dennis Loewen, Assistant Administrator, completed the inspection. Full detail can be found in appendix A.

The CRWD Board of Managers has already authorized work be completed to repair the breach in the western channel and berm. However, this inspection has noted that a large amount of sedimentation has occurred in the channel, as well as several ports that are no longer functioning.

Recommendation: The effect of accumulated sediment on project effectiveness should be evaluated in order to determine if and where sediment cleanout is necessary.

Recommendation: A plan to repair the break in the berm should be developed to restrict water from flowing directly into the wetland. This plan could include the evaluation of potential options for project modification that would result in similar treatment as the original project.

Recommendation: If the break in the berm is fixed, a plan to repair the ports or provide other ways for water to flow back into the wetland should be developed in order to reduce the risk of future berm failures.

Recommendation: Another GPS survey of project elements should be planned in 2017 if berm and channel repairs are made.

Finally, the CRWD should decide what to do with the fencing in place, as multiple sections are bent and broken.

Recommendation: One potential solution would be to remove the fencing and replace with signage instead; similar to what is done for state land (ex. WMAs, state parks, etc.). This is a lower priority than the noted berm and channel work.

An optional item would be to conduct a legal survey to clearly delineate the easements for each of these projects on a drawing and in current geospatial terms.

Prior to any work, the District may wish to contact easement holders to inform them of work to be undertaken in order to avoid any potential confusion.

Kingston Wetland Treatment System

Table 6: Kingston Wetland Treatment System - Components Inspected

Inspection Year	Components						
	Low flow channel	*Limestone filter berm*	*Rock riffle structure & plunge pool*	*Sediment basin w/ forebay*	*High flow channel & berm*	*High flow overflow structures*	*Fencing*
2014	I	I	I	I	NI	NI	I
2015	I	NI	NI	I	NI	NI	I
2016	I	I	I	I	NLI	NLI	NI
I = inspected, NI = not inspected, NLI = no longer inspected							

Table 7: Kingston Wetland Treatment System – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Low flow channel	Beaver dam present at diversion; needs to be removed	Visual- A, GPS survey- 2017, 2020, 2023
Limestone filter berm	IWO	Visual- A, GPS survey- 2017, 2020, 2023
Rock riffle structure	IWO	Visual- A, GPS survey- 2017, 2020, 2023
Sediment basin w/ forebay	Need decision on sedimentation	Visual- A, GPS survey- 2017, 2020, 2023
High flow channel & berm	NLI per engineer recommendations	NLI per engineer recommendations
High flow overflow structures	NLI per engineer recommendations	NLI per engineer recommendations
Pool at State Hwy 55	NI (underwater)	NI
Fencing	I	ND
A = annually, IWO = in working order, ND = not decided, NI = not inspected, NLI = no longer inspected		

Site inspection was conducted May 19, 2016. Inspection was conducted as part of task order #16-0001 with Wenck Associates, Inc. Wes Boll of Wenck Associates and Cole Loewen, Administrator, completed the inspection. Full detail can be found in appendix A.

The pool at the end of the river channel near State Hwy. 55 was not examined due to being underwater.

Inspection indicated the re-meandered low-flow channel was in good condition; its shape seems to be very stable, and vegetation is established. Two large beaver dams were discovered at the diversion of the river between the high and low-flow channels. Erosion around the dam has allowed flow into the low-flow channel; evidence indicates that a large amount of ponding had recently occurred (dead and dormant grasses above the dam). It is unclear whether beaver remain in the area.

Recommendation: The CRWD should contact both the MN DNR and Meeker County (ditch authority for this stretch of the river) to coordinate removal of the beaver dam (it is too large to be hand-removed) as well as to set up traps in the area to control beaver activity in the future. In addition, riprap (preferably granite) should be brought in to shore up the banks along the diversion area due to erosion that has occurred.

Recommendation: Another GPS survey of the constructed channel in 2017 should be planned.

The sediment basin has had significant deposit within the area that was cleaned out in early 2015. This seems to confirm suspicions that a large amount of sediment would deposit in this basin during periods of high flow. There remains enough room in the basin that cleanout is not needed this year; however, since riprap needs to be brought in to this same area in order to shore up the banks along the diversion area due to erosion that has occurred, it may be cost effect to remove accumulated sediment.

Recommendation: Another GPS survey of the basin in 2017 should be planned.

Recommendation: The CRWD should develop an agreement with the adjacent property owners to provide a disposal site for future sediment removal from this basin.

Recommendation: Since riprap needs to be brought it to shore up the banks due to erosion cause by the noted beaver dams, the Board may wish to remove sediment during this inspection period rather than waiting to future years.

The limestone filter berm and rock riffle structure and corresponding plunge pool were surveyed. Results indicate:

1. The limestone filter has settled by ~0.3 feet
2. The rock riffle structure is functioning well
3. Sediment accumulation in the plunge pool is ~3.5 feet, which is nearly full

Recommendation: Survey the filter in 2017 to continue to determine rate of settling.

Recommendation: No action needed for the rock riffle structure.

Recommendation: Determine whether removing sediment from the plunge pool is necessary for the project to maintain operational effectiveness.

Prior to any work, the District may wish to contact easement holders to inform them of work to be undertaken in order to avoid any potential confusion.

Upper Watkins Wetland Isolation Project (North)

Table 8: Upper Watkins Wetland Isolation Project (North) - Components Inspected

Inspection Year	Components				
	Isolation Berm	*Diversion Channel*	*Wooden Weir Structures*	*Upper Culvert Crossing*	*Fencing*
2014	I	I	I	I	I
2015	I	I	I	I	I
2016	I	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected					

Table 9: Upper Watkins Wetland Isolation Project (North) – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Isolation Berm	One breach; need clearing of woody vegetation in several sections	Visual- A, GPS survey- 2017, 2020, 2023
Diversion Channel	Large deposit of sediment in section of channel	Visual- A, GPS survey- 2017, 2020, 2023
Wooden Weir Structures	IWO, needs clearing of woody vegetation	Visual- A, GPS survey- 2017, 2020, 2023
Upper Culvert Crossing	IWO	Visual- A, GPS survey- 2017, 2020, 2023
Fencing	Several spots where broken, missing, or overgrown	Visual- A
A = annually, IWO = in working order, ND = not decided, NI = not inspected, NLI = no longer inspected		

Site inspection was conducted May 16, 2016. Inspection was conducted as part of task order #16-0001 with Wenck Associates, Inc. Wes Boll of Wenck Associates and Cole Loewen, Administrator, completed the inspection. Full detail can be found in appendix A.

The CRWD has already authorized the cleaning of the southern diversion channel to as-built conditions; this was put on hold pending approval from permitting authorities. During inspection, staff noted several small areas of deposition as well as one area of large deposition near the previously-noted breach in the berm in the northern portion of the diversion channel. Most of this deposition seems to be coming from adjacent farm fields.

Recommendation: Accumulated sediment in the northern diversion channel is severely impeding flow in the channel downstream of the breach in the berm. A plan for removing the sediment should be developed in conjunction with the repair of the breach in the berm. Large sections of the channel will likely need to be cleaned to return the channel to as-built conditions.

Recommendation: The breach in the berm is allowing nearly all of the flow from the diversion channel upstream of the noted accumulated sediment above to flow directly into the wetland. The breach should be repaired.

Recommendation: Sediment accumulation in the channel seems to be driven in several locations from runoff form adjacent agricultural fields. Options to address these areas to prevent future sedimentation should be evaluated and implemented where possible.

The inspection also discovered the culvert crossing on the eastern end of the northern diversion channel to be washed out.

Recommendation: Repair and reset the culvert crossing.

Much of the berm has been cleared of woody vegetation. There remain several segments in need of woody vegetation clearing, but most of those segments will be covered by previously-authorized work for the southern diversion channel. Noxious weeds need to be treated as needed.

Recommendation: Clear remaining woody brush from isolation berm; treat noxious weeds as needed on the berm.

The wooden weir diversion structures are in good condition; however, woody vegetation around the western weir should be cleared. Fencing around the Isolation Project is in good condition in most area; in some areas the fencing is broken, missing, or overgrown.

Recommendation: Remove woody vegetation from around the wooden weirs. Consider repairing portions of broken fencing, or remove broken portions and replace with signage. The fencing work is a lower priority than other noted work items.

An optional item would be to conduct a legal survey to clearly delineate the easements for each of these projects on a drawing and in current geospatial terms.

Prior to any work, the District may wish to contact easement holders to inform them of work to be undertaken in order to avoid any potential confusion.

Watkins Wetland Treatment System (South)

Table 10: Upper Watkins Wetland Treatment System (South) - Components Inspected

Inspection Year	Components				
	Diversion Berm	*Diversion Channel*	*Diversion Ports*	*Diversion Overflow Structures*	*Fencing*
2014	I	I	I	I	I
2015	I	I	I	I	I
2016	I	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected					

Table 11: Watkins Wetland Treatment System (South) – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Diversion Berm	Breach in berm	Visual- A, GPS survey- 2017, 2020, 2023
Diversion Channel	IWO	Visual- A, GPS survey- 2017, 2020, 2023
Diversion Ports	Several ports need cleaning	Visual- A, GPS survey- 2017, 2020, 2023
Diversion Overflow Structures	IWO	Visual- A, GPS survey- 2017, 2020, 2023
Fencing	Broken or missing in large sections	Visual- A
A = annually, IWO = in working order, ND = not decided, NI = not inspected, NLI = no longer inspected		

Site inspection was conducted May 16, 2016. Inspection was conducted as part of task order #16-0001 with Wenck Associates, Inc. Wes Boll of Wenck Associates and Cole Loewen, Administrator, completed the inspection. Full detail can be found in appendix A.

Channel A and corresponding diversion berm are in good condition, with few channel sections where sedimentation has occurred. Channel B has several sections where sedimentation has occurred. Flow seems to not be significantly restricted; however, capacity of the ditch is affected by this sedimentation.

Recommendation: Cleanout of channel sections where sedimentation has occurred is likely needed to return channel to design capacity and mitigation potential drainage concerns of upstream properties.

Most of the diversion ports are in good working order, but there are a couple that need to be cleaned to return to operational effectiveness. However, the CRWD undertook action a number of years ago to install overflow structures that may negate the need to keep the ports clean. The overflows seem to be in good condition.

Recommendation: No action needed for overflow structures.

Several low spots were noted in the diversion berm, principally along channel B.

Recommendation: Evaluate need to repair low spots or convert into new overflow structures.

There is a significant breach located on the far eastern end of the northern diversion channel. This beach looks to be caused by some type of machinery. The result of the breach is flow circumventing the wetland treatment system.

> **Recommendation:** Breach should be repaired. Signage should be placed to inform local residents that no alteration to the system may occur without permission of the CRWD.

Beaver activity was noted on banks of channel B. At this time it does not seem beaver activity is causing an issue, but this should be monitored going forward.

Treating noxious weeds that may grow on the berm should continue as needed. There are several sections along the berm where woody vegetation should be cleared. Large sections of fencing are either missing, damaged, or overgrown.

> **Recommendation:** Remove woody vegetation from the diversion berm. Treat noxious weeds that grow on the berm. Consider repairing portions of broken fencing, or remove broken portions and replace with signage. The fencing work is a lower priority than other noted work items.

An optional item would be to conduct a legal survey to clearly delineate the easements for each of these projects on a drawing and in current geospatial terms.

Prior to any work, the District may wish to contact easement holders to inform them of work to be undertaken in order to avoid any potential confusion.

Nistler-Geislinger Basin

Table 12: Nistler-Geislinger Basin - Components Inspected

Inspection Year	Components	
	Sediment Basin South Cell	*Sediment Basin North Cell*
2014	I	I
2015	I	I
2016	I	I
I = inspected, NI = not inspected, NLI = no longer inspected		

Table 13: Nistler-Geislinger Basin – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Sediment Basin South Cell	IWO	Visual- A; Depth Survey- 2017, 2022, 2027
Sediment Basin North Cell	IWO	Visual- A; Depth Survey- 2017, 2022, 2027
A = annually, IWO = in working order		

Site inspection was conducted April 22, 2016. No depth survey was taken of the basin this year. Last depth survey was conducted in 2012, and indicated a slight buildup of sediment in the northern cell of the basin.

Overall, basin seemed to be in good condition.

Recommendation: No further action warranted at this time.

Other items to note: 1) the placement of the notch weir above the inlet to the basin should lead to less sediment entering the basin, increasing the basin's useful life, 2) the source of the delta that formed on the southwestern end of the southern cell has been rectified due to the District's cooperative effort with Forest Prairie Township in improving the road ditching and drainage above that location.

Aerator Buildings

Table 14: Aerator Buildings - Components Inspected

Inspection Year	Components	
	Lake Augusta Aerator Building	*Lake Marie Aerator Building*
2014	I	I
2015	I	I
2016	I	I
		I = inspected, NI = not inspected, NLI = no longer inspected

Table 15: Aerator Buildings - 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Lake Marie Aerator Building	IWO	Visual- A, Compressor oil & turn over- A
Lake Augusta Aerator Building	Damage to soffits, eves, and perhaps foundation; new coat of paint; remove excess dirt and debris from building	Visual- A, Compressor oil & turn over- A
		A = annually, IWO = in working order

Site inspection was conducted April 12, 2016. Staff only viewed the outside of the building. Maintenance personnel Kevin Wittrock goes inside the buildings each year to oil and turn over the compressor cylinder.

The Lake Marie aerator building is in good condition. The Lake Augusta aerator building is in need of a new coat of paint, as well as some work to its soffits, eves, and potentially its foundation. In addition, recent work on the lake access road located adjacent to the building has resulted in a large amount of dirt and debris pushed against the lake Augusta aerator building.

Recommendation: The CRWD should consider whether this building should continue to be maintained or abandoned, considering the amount of time that has transpired since the aerators were active.

If the CRWD wishes to continue to maintain, the soffits and eves of the Lake Augusta building should be repaired. A more in-depth review of this building's foundation should be conducted in the next year or so to determine whether it needs repair work.

An optional item would be to conduct a legal survey to clearly delineate the easements for each of these projects on a drawing and in current geospatial terms.

Lake Augusta Erosion Control Project

Table 16: Lake Augusta Erosion Control - Components Inspected

Inspection Year	Components				
	Southern drop structures	*Western drop structures*	*Sediment basin and riser*	*Basin outlet*	*Fencing*
2014	I	I	I	I	I
2015	I	I	I	I	I
2016	I	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected					

Table 17: Lake Augusta Erosion Control - 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Southern drop structures	IWO	Visual- A, depth survey- 2021, 2026, 2031
Western drop structures	IWO	Visual- A, depth survey- 2021, 2026, 2031
Sediment basin	IWO	Visual- A, depth survey- 2021, 2026, 2031
Basin outlet	IWO	Visual- A, depth survey- 2021, 2026, 2031
Fencing	Minor repair needed	Visual- A
A = annually, IWO = in working order		

Site inspection was conducted April 12, 2016.

Work has recently been completed on the basin, with sediment accumulation in the basin removed and depth restored to as-built conditions. The southern drop structure inlet was cleaned and reset, and riprap that was migrating into the west channel of the lake was removed and replaced with large granite riprap. The western drop structure inlet was also cleaned. Repairs to the southern overflow were made, bringing in more robust riprap.

Portions of the fence around the basin are bent due to woody vegetation growth.

Recommendation: Clear woody vegetation from the fence in multiple locations. This is a lower priority that other noted work items.

The outlet into Lake Augusta West Channel is in good condition. However, small planted trees are located in the easement for this outlet.

Recommendation: Remove trees from easement before they become too large and cause issues with the outlet pipe, including ingress and egress.

An optional item would be to conduct a legal survey to clearly delineate the easements for this project on a drawing and in current geospatial terms.

Ostmark Basin

Table 18: Ostmark Basin - Components Inspected

Inspection Year	Components		
	Basin	*Diversion Berm*	*Tile intake / outlet*
2014	I	I	I
2015	I	I	I
2016	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected			

Table 19: Ostmark Basin – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Basin	IWO	Visual- A
Diversion Berm	IWO	Visual- A
Tile intake / outlet	IWO	Visual- A
A = annually, IWO = in working order		

Site inspection was conducted April 22, 2016. Visual inspection indicated all three components seemed to be in good working condition. Staff noted the immediate area around the basin has been mowed and cleared by some other party; the CRWD will want to watch this closely to ensure future actions near the basin do not affect the basins operation.

Recommendation: No further action seems warranted at this time.

Pleasant Lake Outlet Control Structure

Table 20: Pleasant Lake Outlet Control Structure - Components Inspected

Inspection Year	Components	
	Outlet Structure	*Guillotine Valve and Manhole*
2014	I	I
2015	I	I
2016	I	NI
		I = inspected, NI = not inspected, NLI = no longer inspected

Table 21: Pleasant Lake Outlet Control Structure - 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Outlet Structure	IWO, rebar trash guards need replacing	Visual- A
Guillotine Valve and Manhole	NI	Visual- A
Outlet Culvert	IWO	Visual- A
		A = annually, IWO = in working order, NI = not inspected

Site inspection was conducted April 12, 2016. Project components viewed included the lake outlet structure and the outlet of the culvert.

Overall, the outlet control structure is in okay condition. The rebar trash guards on the front of the structure are missing. One board on top of the structure is loose. One hinge on door access is broken, and the door is missing its lock. Last year it was noted the outlet guillotine valve does not completely close so as to make a watertight seal.

Recommendations: The rebar trash guards should be repaired, hinge and lock should be replaced, and the loose board should be tightened. In addition, the guillotine valve should be greased by maintenance personnel to promote ease of operation.

School Section Lake Outlet Control Structure

Table 22: School Section Lake Outlet Control Structure - Components Inspected

Inspection Year	Components			
	Outlet Structure	*Guillotine Valve, Weir and Manhole*	*Ice breaker*	*Multiple Conveyance Culverts*
2014	I	I	DNE	I
2015	I	I	DNE	I
2016	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected				

Table 23: School Section Lake Outlet Control Structure - 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Outlet Structure	Partially blocked by sand and debris	Visual- A
Guillotine Valve, Weir and Manhole	IWO	Visual- A
Ice breaker	IWO	Visual- A
Multiple Conveyance Culverts	IWO	Visual- A
A = annually, IWO = in working order		

Site inspection was conducted April 12, 2016.

The lake outlet pipe has sand and debris (likely muskrat activity) in it that has caused a partial blockage to occur. The CRWD has already instituted actions to rectify this problem.

Recommendations: Complete this effort.

The remainder of the outlet systems seems to be in good operational order. The stop log weir in the manhole was returned to its previous concrete configuration.

Recommendations: Once the sand and debris are removed, the guillotine valve should be greased by maintenance personnel to promote ease of operation.

An optional item would be to conduct a legal survey to clearly delineate the easements for this project on a drawing and in current geospatial terms.

Kimball Stormwater Infrastructure

Table 24: Kimball Stormwater Infrastructure - Components Inspected

Inspection Year	Components						
	Willow Creek (WC) – Rain Garden and Agri-drain	*WC – Reuse Basin and Emergency Overflow*	*Highway 55 Sediment Basin*	*Magnus Johnson Stabilization*	*Hendricks East Basin*	*Hendricks West Basin*	*Hendricks Emergency Overflow*
2014	I	I	DNE	DNE	DNE	DNE	DNE
2015	I	I	DNE	DNE	I	I	I
2016	I	I	I	I	I	I	I
I = inspected, NI = not inspected, DNE = did not exist							

Table 25: Kimball Stormwater Infrastructure - 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Willow Creek (WC) – Rain Garden and Agri-drain	Slight maintenance needs, maintenance of vegetation under contract with PRI Inc.	Visual- A
WC – Reuse Basin and Emergency Overflow	Slight maintenance needs, maintenance of vegetation under contract with PRI Inc.	Visual- A
Highway 55 Sediment Basin	Slight maintenance needs	Visual- A, GPS Survey- 2017, 2020, 2025
Magnus Johnson Stabilization	IWO	Visual- A
Hendricks East Basin	IWO	Visual- A, GPS Survey- 2017, 2020, 2025
Hendricks West Basin	IWO	Visual- A, GPS Survey- 2017, 2020, 2025
Hendricks Emergency Overflow	Significantly modified by work in Hendricks' yard, CRWD does not hold easement in this area, so nothing can be done	Visual- A, likely discontinue inspection in future years due to modification
A = annually, IWO = in working order		

Site inspection was conducted April 22, 2016.

Raingarden and Agri-drain: Water present in rain garden due to spring and one baffle board in place. Trash removed from rain garden. Light erosion within rain garden was noted. Minor sediment accumulation in rain garden was noted; likely source is from sand volleyball court/ hockey rink. Sediment in inlet to basin was noted; likely source from stormwater conveyance system upstream.

City of Kimball should be contacted to inspect upstream sump to see if vacuuming is warranted. Agri-drain's baffle slides sticky; hard to move baffle boards. Baffles need to be set to summer condition. Native plantings may need additional work; this should be determined by vegetation maintenance vendor. Upstream parking lot has been paved; this should lessen amount of sediment entering the raingarden. Riprap missing from outlet. Sand in rain garden should be removed.

Recommendation:

- Place additional riprap as needed
- Have sand in rain garden removed
- Speak with City of Kimball on checking upstream sump to see if vacuuming is needed
- Grease Agri-drain's baffle slides; set baffles to summer condition

- Work with vegetation maintenance contractor to see if additional work outside current contract is warranted

Reuse basin and emergency overflow: Basin in good condition. Lots of native plant growth. No water present when inspected. Riprap missing from inlet/ outlet. Trash removed from basin.

Recommendation:

- Place additional riprap as needed
- Work with vegetation maintenance contractor to see if additional work outside current contract is warranted

Highway 55 Sediment Basin: Basin was not surveyed with GPS equipment. Noted seeding of disturbed area from last year did not take very well. There is some erosion around the riprap on the outlet of basin, as well as erosion events occurring around basin. Some of this erosion seems to be occurring due to snow melt from neighboring property.

Recommendation:

- Place additional riprap as needed
- Work with vegetation maintenance contractor to see if additional work is warranted to improve seeded area
- Speak with City of Kimball and adjacent property owner to discuss options to address erosion caused by snow melt
- Consider having basin GPS surveyed in 2017 to ascertain sediment accumulation

Hendricks East Basin: Basin was not surveyed with GPS equipment. Basin seemed to be in good working order. Vegetation maintenance work is now under contract with Prairie Restoration, Inc.

Recommendation:

- Consider having basin GPS surveyed in 2017 to ascertain sediment accumulation
- Speak with City of Kimball to ensure underground sumps upstream are checked and vacuumed if needed

Hendricks West Basin: Basin was not surveyed with GPS equipment. Noted seemed to be in good working order. Vegetation maintenance work is now under contract with Prairie Restoration, Inc.

Recommendation:

- Consider having basin GPS surveyed in 2017 to ascertain sediment accumulation

Hendricks Emergency Overflow: Noted that due to expansion of lot at Hendricks' Sand and Gravel Inc. that a significant portion of the overflow has been altered. The alteration will have a constricting effect on flow. However, the CRWD does not hold an easement over this area, as it is in railroad right-of-way.

Recommendations: None.

Old Highway 55 Treatment Area

Table 26: Cedar Lake Subwatershed Fish Barriers - Component Inspected

Inspection Year	Components			
	Limestone Filter	*Sheet Pile Weir*	*Tile Drain*	*Channel*
2016	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected				

Table 27: Cedar Lake Subwatershed Fish Barriers – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Limestone Filter	IWO	Visual- A
Sheet Pile Weir	IWO	Visual- A
Tile Drain	Critter guard cleaned	Visual- A
Low-flow channel	IWO	Visual- A
A = annually, IWO = in working order		

This site was inspected multiple times from April-June 2016. GPS surveying was conducted this time to ensure project was built to design parameters. Per MN Department of Transportation's request, the rock that was required around the sheet pile weir by said entity was modified to better match design elevations. Signage on and around the weir to note its presence is planned. All other components are in working order.

Cedar Lake Subwatershed Fish Barriers

Table 28: Cedar Lake Subwatershed Fish Barriers - Component Inspected

Inspection Year	Components			
	Henshaw Barrier	*Swartout Inlet Barrier*	*Swartout Outlet Barrier*	*Illsley Avenue Barrier*
2014	I	I	I	I
2015	I	I	I	I
2016	I	I	DNE	I
I = inspected, NI = not inspected, NLI = no longer inspected				

Table 29: Cedar Lake Subwatershed Fish Barriers – 2016 inspection results by component

Components	Inspection results	Future inspection schedule
Henshaw Barrier	Not functioning, left partially open due to filamentous algae in Henshaw Lake	Visual- A, recommend replacement with other method
Swartout Inlet Barrier	Currently being replaced	Visual- A, to be replaced in 2016 as part of other project
Swartout Outlet Barrier	Temporary patches in place, in operation	Visual- A, may be modified as part of future road work
Illsley Avenue Barrier	Damaged by fallen tree	Visual- A
Segner Pond Barrier	IWO, optional modification to reduce maintenance	Visual- A
A = annually, IWO = in working order		

These sites were inspected multiple times during the months of April- June. All barriers require cleaning through the season to minimize blockage.

Henshaw: due to the large amount of filamentous algae being produced in Henshaw Lake, the barrier was left partially open to minimize risk of barrier failure and reduce maintenance. Staff recommends this barrier be replaced with another method, such as a velocity tube. The culvert just below the barrier is experiencing significant erosion. Staff recommends the District partner with the MN DNR to evaluate the placement of a velocity tube at this location.

Recommendation: Finish initial evaluation of velocity tube option.

Swartout Inlet: this barrier has been removed, but is slated to be replaced in 2016 as part of the Cedar Lake Watershed Protection & Improvement Project.

Recommendation: Complete replacement.

Swartout Outlet: temporary patches were put in place in May to block holes due to undercutting. The barrier is operating, but it will need significant modification in the future to remain operationally reliable. One option would be to work with the road authority to integrate a fish barrier into the road culvert. The county road is slated to be replaced in the next couple of years.

Recommendation: Partner with Wright County when County Road 6 is replaced to integrate a fish barrier into the replacement culvert.

Illsley Avenue: The barrier has been damaged by a fallen tree. The tree has been removed, and repairs are currently being evaluated. The steel panels in placed to shore up the wrings of the barrier are deteriorating; replacement with riprap is needed. Finally, evidence of beaver activity is present. Trapping may be needed in the future.

Recommendation: Institute needed repairs.

Recommendation: Replace steel panels with riprap.

Recommendation: Keep track of beaver activity; trapping may be needed in future.

Segner Pond Inlet: this barrier is in good working order. No further work is needed. An optional modification to the barrier would result in less maintenance due to buildup of debris.

Recommendations: Consider modification to barrier in future to lessen buildup of debris.

Segner Pond

Table 30: Segner Pond - Components Inspected

Inspection Year	Components			
	Diversion Berm	*Inlet Channel*	*Limestone Filter Berm*	*Sedimentation Pond and Mitigation Wetland*
2014	I	I	I	I
2015	I	I	I	I
2016	I	I	I	I
I = inspected, NI = not inspected, NLI = no longer inspected				

Table 31: Segner Pond - 2015 Inspection results by component

Components	Inspection results	Future inspection schedule
Diversion Berm	IWO	Visual- A, GPS survey 2018, 2021, 2024
Inlet Channel	IWO	Visual- A, GPS survey 2018, 2021, 2024
Limestone Filter Berm	IWO	Visual- A, GPS survey 2018, 2021, 2024
Sedimentation Pond and Mitigation Wetland	IWO	Visual- A, depth survey in 2021, 2026, 2031
A = annually, IWO = in working order		

This site was inspected on May 19, 2016. Inspection was conducted as part of task order #16-0001 with Wenck Associates, Inc. Wes Boll of Wenck Associates and Dennis Loewen, Assistant Administrator, completed the inspection. Full detail can be found in appendix A.

Project components inspected included the diversion structure, the inlet channel, the limestone filter berm, the sedimentation pond and mitigation wetland. A sonar survey of the basin confirmed the basin was excavated as designed and sedimentation has not occurred in the basin or the inlet channel. The mitigation wetland was noted to be performing well considering site conditions.

The diversion structure was determined to be functioning as designed, with a runout elevation slightly higher than the proposed design. Several areas of the limestone filter berm were observed to be lower than the design elevation.

Recommendation: Determine if slightly higher runout elevation of diversion structure should be addressed.

Recommendation: Continue to monitor areas of lower elevation on filter berm to determine if additional maintenance is needed in 2018.

Wastewater Treatment Systems

The operation of Hidden River, Clearwater Harbor, and Rest-A-While Sewer Systems is contracted out to Septic Check Inc. Wandering Pond Sewer System is contracted out to WRM Services Inc. As such, District staff did not conduct annual inspections of these systems. However, staff does ensure the contracted service providers follow the established pumping schedule of individual septic tanks, and that woody and noxious vegetation is kept under control in treatment areas. Staff also checks existing fencing and signage to make sure repairs are made as needed, and ensures algae treatment occurs in the western sediment basin of the Rest-A-While Sewer System.

Pumping schedules for these systems are now maintained by the sewer operator, and are no longer displayed here.

Other Projects

The table below summarizes other District projects that are relatively simple and do not warrant a full page to describe their status.

Table 32: Other Projects - Inspection Results and Potential Actions

Project	Date of Inspection	Inspection Results	Future inspection schedule	Potential Actions
Highway 55 Fish Barrier	04/12/2016	Recently repaired, streambed condition unknown	Visual- A	Commercial Fisherman has indicated he no longer wishes to operate the trap; board has authorized additional funds to commercial fisherman to consider seining from lakes.
Norton Avenue Sediment Basin	04/12/2016	IWO	Visual- A	None, in good condition
Eddie Schultz Buffer	04/12/2016	IWO	Visual- A	None, in good condition
Clear Lake North Notch Weir	04/22/2016	IWO	Visual- A	None, in good condition
Clear Lake South Notch Weir & Sand-Iron Filter	04/22/2016	IWO, modification to Sand-Iron Outlet on hold due to high water	Visual- A	Modification install scheduled July 2016

A = annually, IWO = in working order

APPENDIX A

WENCK File #0002-227
July 2016

Survey Report of Selected District Projects

Clearwater River
WATERSHED DISTRICT

Prepared for:

Clearwater River Watershed District

75 Elm Street East
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Annandale, MN 55302

WENCK
ASSOCIATES

Responsive partner.
Exceptional outcomes.

Prepared by:

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Table of Contents

EXHIBITS (CONT.)

1.0 Introduction

1.1 INTRODUCTION

Wenck Associates, Inc. (Wenck) was contracted by the Clearwater River Watershed District (CRWD) to complete GPS surveying and inspections of several CRWD projects in order to demonstrate current operational efficiency, needed repairs and maintenance, and general as-built/existing conditions.

This report is prepared to summarize the findings of data that was collected and observations that were made during project visits conducted by Wenck and CRWD staff in May 2016.

The projects that were inspected and surveyed include the Annandale Wetland Treatment System, Kingston Wetland Treatment System, Segner Pond, Watkins Wetland Treatment System South, and Watkins Wetland Isolation Unit. The locations of the projects are shown in Figure 1.

1.2 METHODOLOGY

Prior to conducting site inspections, Wenck reviewed available design plans for each project with CRWD staff and developed stationing points at 100 foot increments along linear project features in order to locate areas of interest for future discussion.

While on the site, Wenck surveyed the existing ditch bottom at selected points along the length of linear channels in order to develop longitudinal channel profiles. Representative cross-section information of the channels was also collected at selected locations along the channels. The bottom of the ditch channel was probed to determine the extent of accumulated sediment in the channel in some locations to verify the extent and nature of accumulated sediment.

Other notable project features such as breaks or low spots in berms adjacent to the channel were noted during the inspections. The locations of ports in the berm were also surveyed (for Watkins Wetland Isolation Unit and Annandale Wetland Treatment System).

Photos were taken of key features and are presented in the report.

Findings of the investigation are summarized for each project in Sections 2.0 through 6.0. Figures are also provided showing the design and existing conditions based on recent site observations and collected survey data. Note that not all collected survey data is presented in this report, as some data was collected to provide additional project information if maintenance work is required. A summary of conditions and recommendations for maintenance or future projects is presented in each section as well.

Note that this report is provided as a summary of general project conditions and that all survey data collected during the investigation is not presented in this report. Additional survey data was collected to be used for maintenance design and permitting of necessary maintenance projects if required.

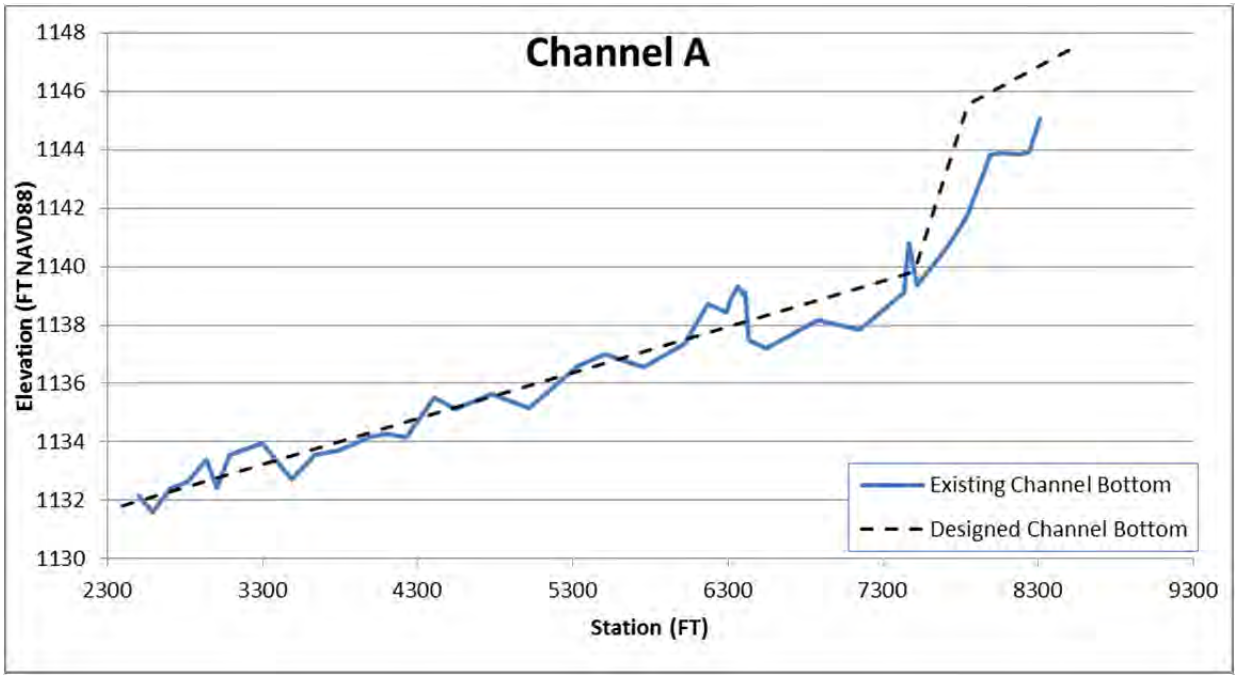
2.0 Watkins Wetland Isolation Unit

Wenck and CRWD staff investigation of the Watkins Wetland Isolation Unit focused on determining the extent of accumulated sediment in the diversion channel, the integrity of the berm isolating the channel from the wetland, and overall system functionality. Observations of each of these project components are discussed below. Figure 2 shows overall project components and areas of interest noted during the investigation.

2.1 DIVERSION CHANNEL

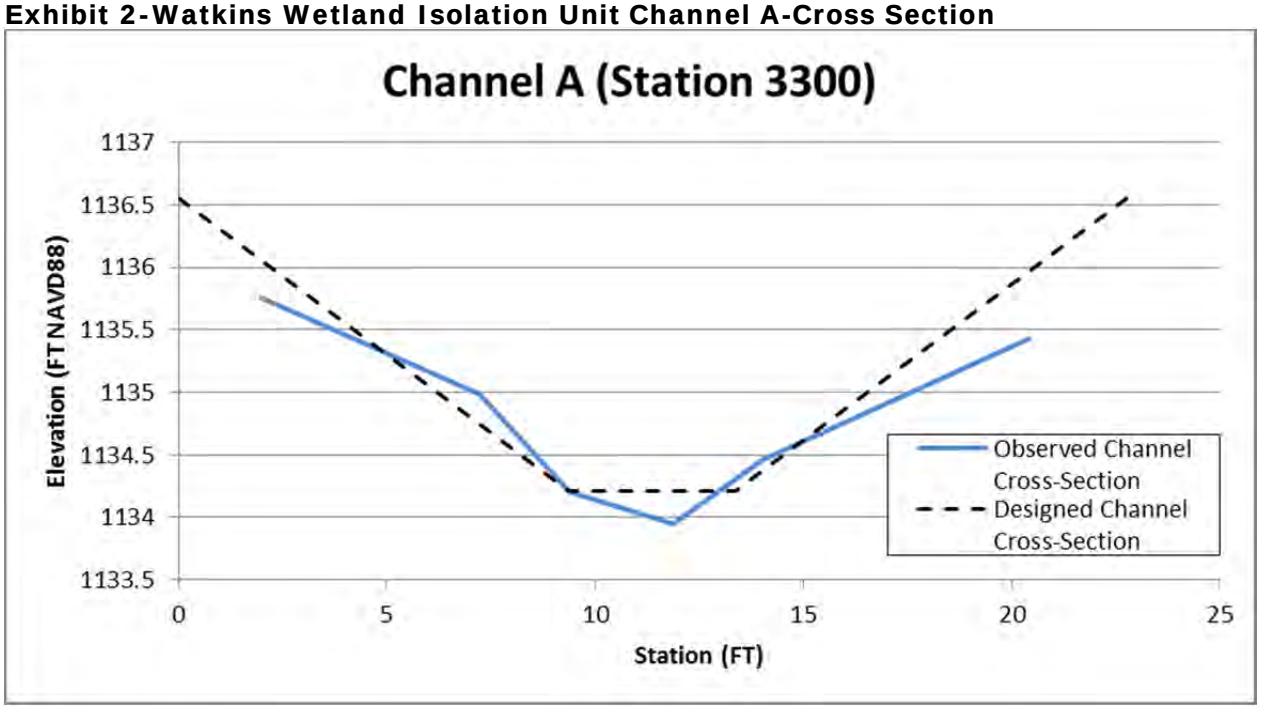
A survey of the diversion channel found that sediment has accumulated to varying degrees in the channel. The channel profile in Exhibit 1 compares the existing channel bottom to the design bottom in Channel A. Note that Channel B was investigated in January 2016 and is proposed for cleanout so that information is not included in this report.

Exhibit 1-Watkins Wetland Isolation Unit Channel A Profile



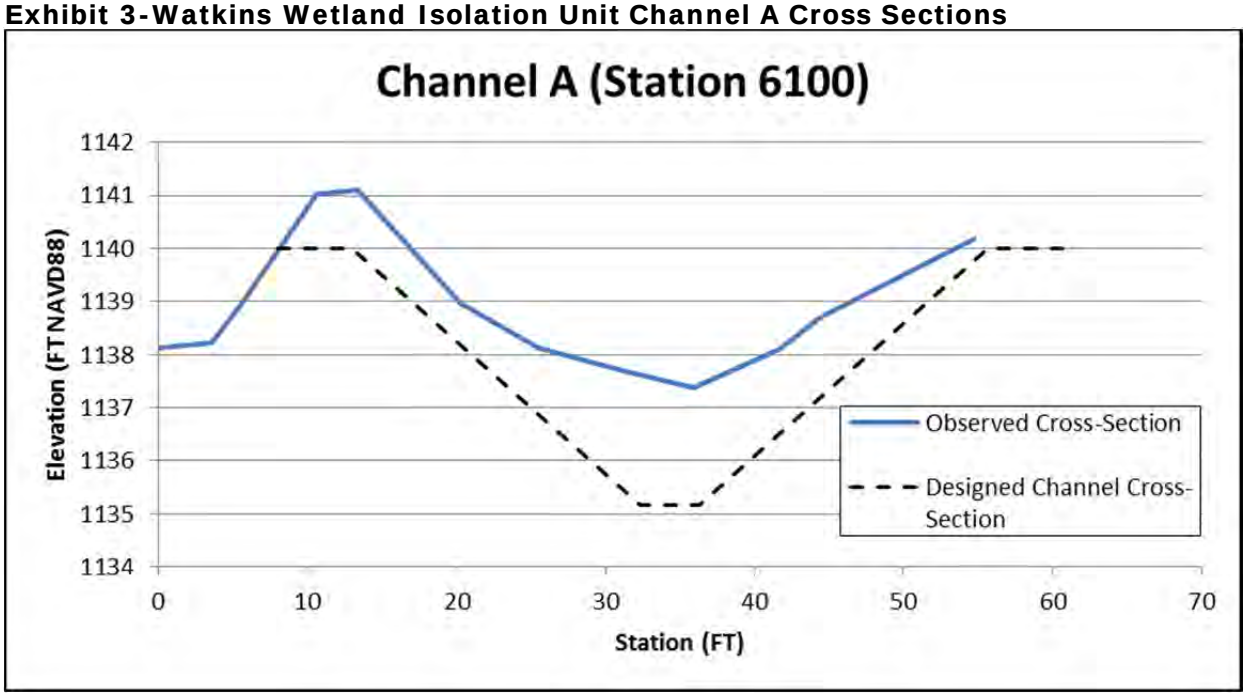
While some sediment has accumulated in the western portion of Channel A (station point 2300 to 5200), the diversion channel has maintained flow through this section and is beginning to form a natural braided channel that is slightly different in shape than the original design channel as shown in Exhibit 2. Two areas of sediment runoff from adjacent agricultural fields were observed in the western channel near station points 2900 and 3300.

Exhibit 2-Watkins Wetland Isolation Unit Channel A-Cross Section



As observed in the field and shown in the photos and profile in Exhibit 1, Channel A is nearly completely blocked in several locations upstream of station point 5200. Areas containing approximately 2.5 feet of accumulated sediment were observed throughout portions of this reach. It appears that much of the sediment that has accumulated in this channel has come from adjacent agricultural land to the east, as a washout and large sediment deposit was observed coming from the field near station point 6300 (See photo). Exhibit 3 demonstrates the change in the channel shape in this portion of Channel A.

Exhibit 3-Watkins Wetland Isolation Unit Channel A Cross Sections



In the portion of the eastern channel where previous cleanout had occurred (downstream of Station 6500) there does not appear to be any new deposit of material as the channel was observed to be at or lower than the design channel. However, the new pipe that was installed at a channel crossing at station point 7600 at that time was observed to be almost completely washed out and is non-functioning.

Significant sedimentation was not observed in the furthest upstream portion of the diversion channel, with the exception of some sediment deltas near several tile outlets observed adjacent to the channel.

2.2 BERM

The berm along Channel B and the western portion of Channel A was generally in good condition, with no areas of sloughing or degradation observed. The berm along the eastern portion of the diversion channel (upstream of station point 5200) was observed to be sloughing in several locations and was completely washed out in one location.

The washout of the berm is allowing most of the water in the diversion channel to flow into the wetland near station point 6300, contrary to the system design that was intended to prevent direct flow of water from the diversion channel into the wetland. Flow observed out of the wetland outlet pipe near station point 1100 in Channel B indicates that a significant amount of water is flowing through the wetland which demonstrates that flow is not being diverted as intended by the project.

2.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- A portion of Channel B is obstructed by sediment and vegetation and is scheduled for maintenance. (Permits approved in February 2016).
- The diversion structures constructed to divert flow from the ditch through the wetland to the diversion channels are functioning as designed with no need for repairs.
- The western portion (downstream of County Ditch junction) of Channel A is in operational condition.
- The eastern portion (upstream of station point 5200) is not operating as designed, as portions of the channel are blocked with sediment, a breach has occurred in the berm, and a pipe at a stream crossing has washed out.

Recommendations

- Sediment runoff from adjacent fields was identified in several locations and options to address these areas to prevent sedimentation in the channel should be evaluated and implemented where possible.
- The breach in the berm is allowing nearly all of the flow from the diversion channel upstream of station point 6300 to flow directly into the wetland. An evaluation should be conducted to determine potential water quality treatment impacts and the best options for repair.
- Accumulated sediment in the channel is severely impeding flow in the channel downstream of the breach in the berm. A plan for removing the sediment should be developed in conjunction with the repair of the breach in the berm.
- A plan to repair the washed out pipe at the stream crossing at station point 7600 should be developed and evaluated.

Cattails/Sediment blocking Channel B

Outflow from wetland in Channel B (Station 1100)

Diversion Structure (Station Point 2400)

Channel A (Station Point 2300)

Channel A (Station Point 3300)

Blockage in Channel A (Station Point 5300)

Diversion Structure (Station Point 5100)

Break in Berm (Station Point 6300)

Sediment in Channel (Station Point 6400)

Pipe failure at channel crossing
(Station Point 7500)

Channel A (Station Point 8000)

3.0 Kingston Wetland Treatment System

Wenck and CRWD staff investigation of the Kingston Wetland Treatment System focused specifically on the sedimentation basin at the upstream end of the restored channel reach, the remeandered channel, and the plunge pool and limestone berm at the downstream end of the channel. Each of these project components is discussed below. The location of these project components and other features of note are shown on Figure 2. Note that details of observations made near the sedimentation basin are shown in the Inset on Figure 2.

3.1 SEDIMENTATION BASIN

The sedimentation basin to the south of the beginning of the restored channel was constructed as part of the original Kingston Wetland project and was last cleaned of sediment in March 2015. The sediment forebay that was constructed offline of the remeandered channel was also cleaned in March 2015.

Observations and survey information collected during the site investigation demonstrates that a significant amount of sediment has already accumulated in the sediment forebay and sedimentation basin.

A large sediment deposit of sand and coarse grained material extending nearly completely across the channel was observed downstream of the sediment forebay. The top of accumulated sediment was found to be at an elevation of 1038.5 to 1039 feet, which translates to approximately 3 to 4 feet of accumulated sediment being present in this portion of the basin. Fine-grained sediments have also begun to deposit downstream of the main plume, but were only measured at approximately 1 to 2 feet in depth. Information was collected to determine the volume of accumulated sediment for future maintenance purposes.

Minimal sediment has also begun to accumulate in the sediment forebay, as elevations of the top of the sediment were within 0.5 foot of the design elevation of the channel.

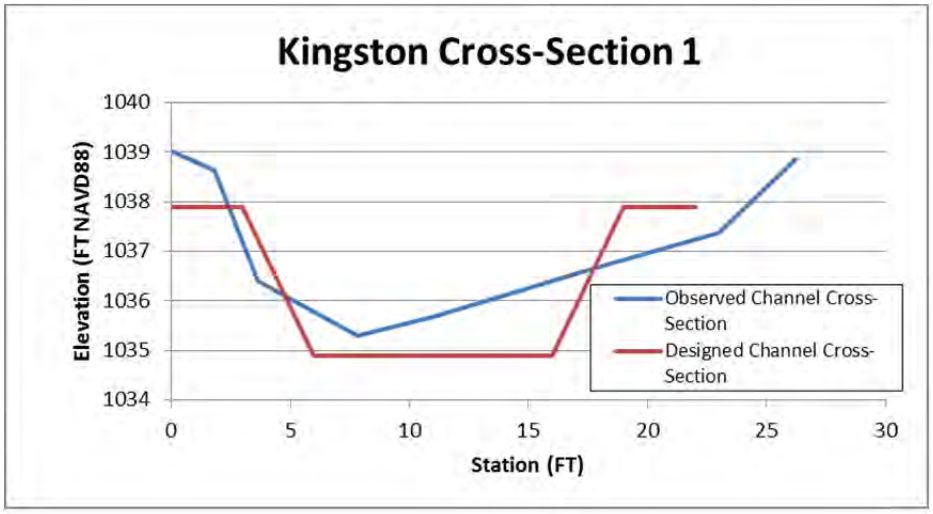
Two large beaver dams were also observed in the main channel just downstream of the sediment basin side channel. The beaver dams are currently almost completely obstructing the channel and appear to be causing damage to the south side of the channel, as erosion was observed in that area of the channel.

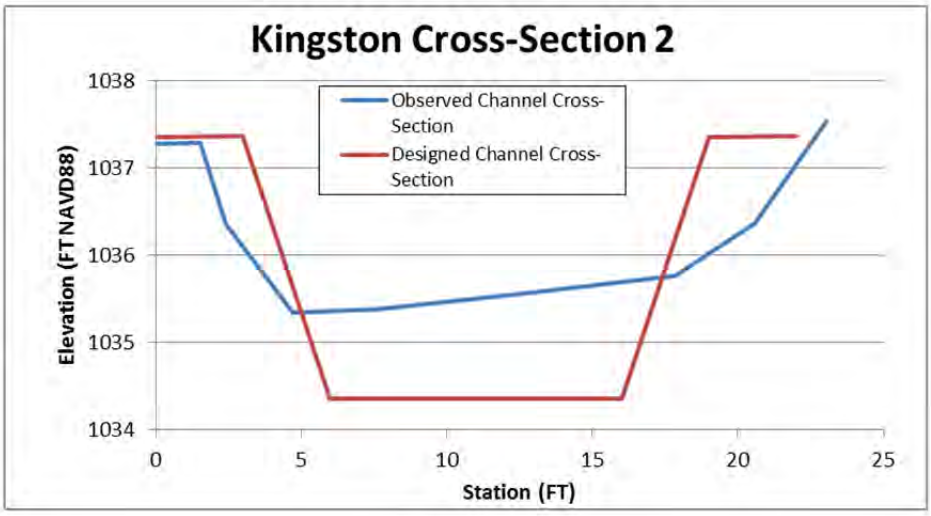
3.2 CONSTRUCTED CHANNEL

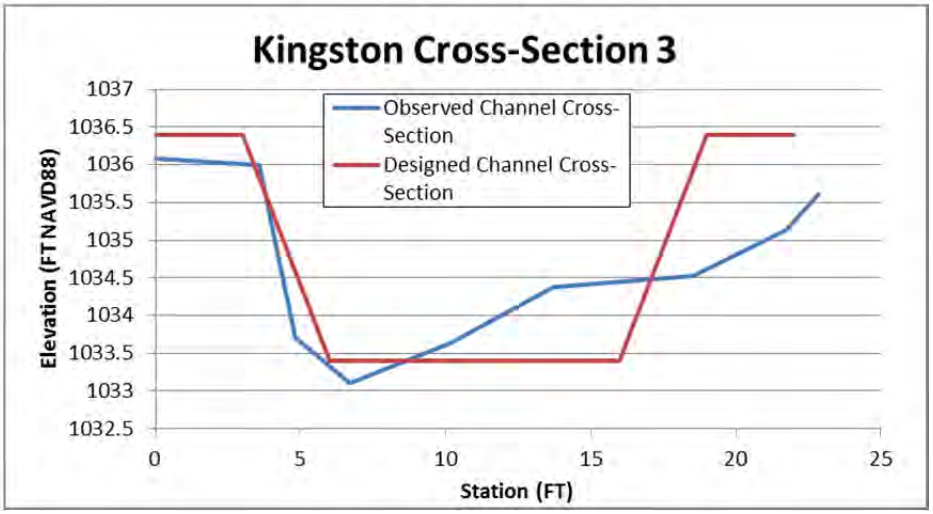
The remeandered channel constructed during the Kingston Wetland Restoration project was also surveyed to determine the condition of the channel and changes in the channel shape since the completion of project construction. Representative cross-sections were taken in multiple locations to demonstrate the existing channel shape and conditions and are shown below in Exhibit 3.

Overall, the constructed channel appears to be functioning as designed, as banks have generally stabilized with vegetation, flow is staying within the channel, and the channel is taking on characteristics of a naturally meandering stream channel, with deposits of sediment on the inside turns, and channel cutting occurring on the outside bends.

Exhibit 4-Kingston Wetland Channel Cross Sections







3.3 PLUNGE POOL AND LIMESTONE BERM

The survey of the top of the constructed limestone berm found that the top of the limestone was at an elevation of 1034.7 feet, which is slightly lower than the design elevation of 1035 feet.

Accumulated sediment was observed in the plunge pool, with the elevation of the top of the sediment observed to be 1033.5 compared to the designed bottom of basin at 1030 feet. The constructed plunge pool was determined to be nearly completely full of sediment.

3.4 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Significant sedimentation has occurred in the sediment forebay and sediment basin downstream of the forebay.
- Two beaver dams constructed on the main channel and side channel have restricted flow and is resulting in erosion of the channel banks.
- The recently constructed channel is performing as designed and is exhibiting characteristics of a natural stream channel. There are no areas requiring maintenance on the constructed channel, as the banks are well vegetated and no excess sedimentation occurring.
- The top of the limestone berm constructed across the side channel from the main wetland was found to be slightly lower than design elevation, potentially indicating that minor settling has occurred.
- The plunge pool constructed near the downstream end of the meandered channel has accumulated sediment approximately 3 feet deep.

Recommendations

- The effectiveness of removing beaver dams and/or stabilizing the channel near the beaver dams to reduce further bank erosion and potential impacts on the channel downstream should be evaluated to determine the feasibility of such work.
- The feasibility of removing accumulated sediment from the sediment forebay and sediment basin, as well as in the plunge pool, should be evaluated to determine if it is feasible and cost effective.
- Continue to monitor the constructed stream channel at established cross-sections to determine how the channel is functioning over time.

Sedimentation basin looking north towards sediment deposit

Beaver dam blocking sediment forebay channel

Beaver dam and eroded south bank of main channel

Beaver dam blocking main channel

Sediment deposit in sedimentation basin

Constructed Channel

Constructed Channel

Constructed Channel

Limestone berm

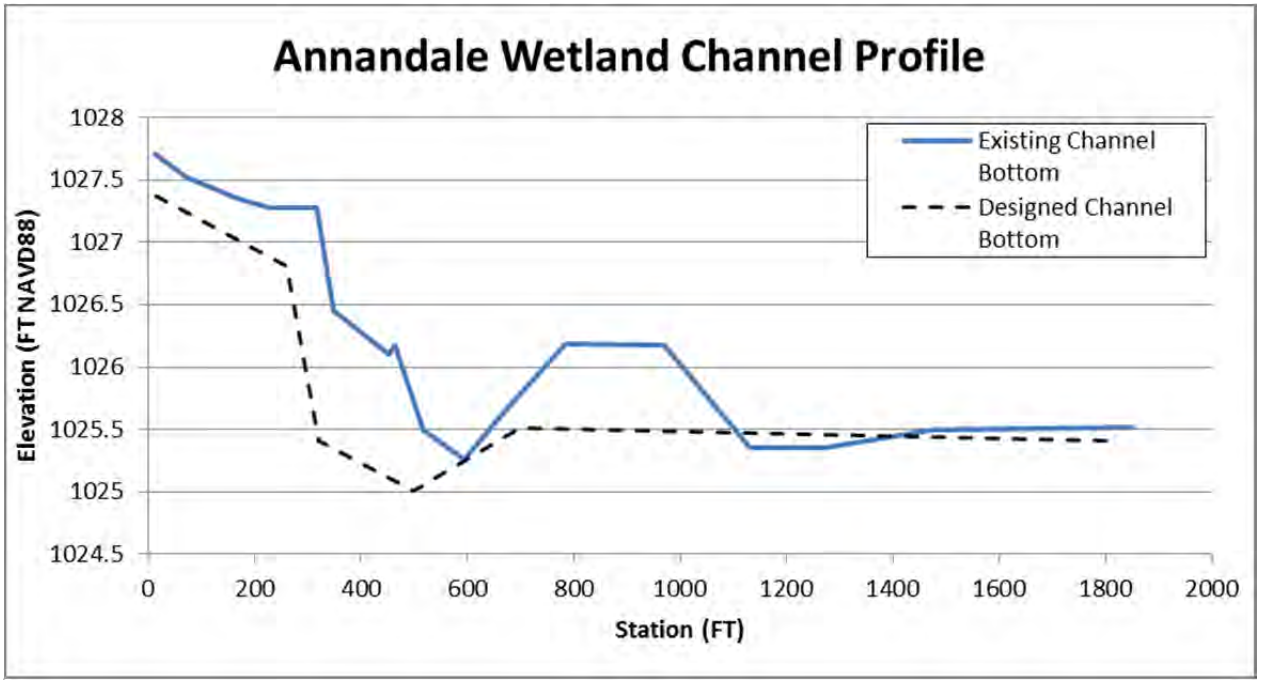
4.0 Annandale Wetland Treatment System

Wenck and CRWD staff investigation of the Annandale Wetland Treatment System focused on identifying the extent of sediment in the diversion channel, observing the condition of the berm, and documenting a known breach in the berm.

4.1 DIVERSION CHANNEL

The existing bottom of the channel was surveyed and accumulated sediment depth was measured in several locations. A profile showing the existing elevations of the bottom of the diversion channel compared to the design bottom elevation of the channel is shown in Exhibit 4.

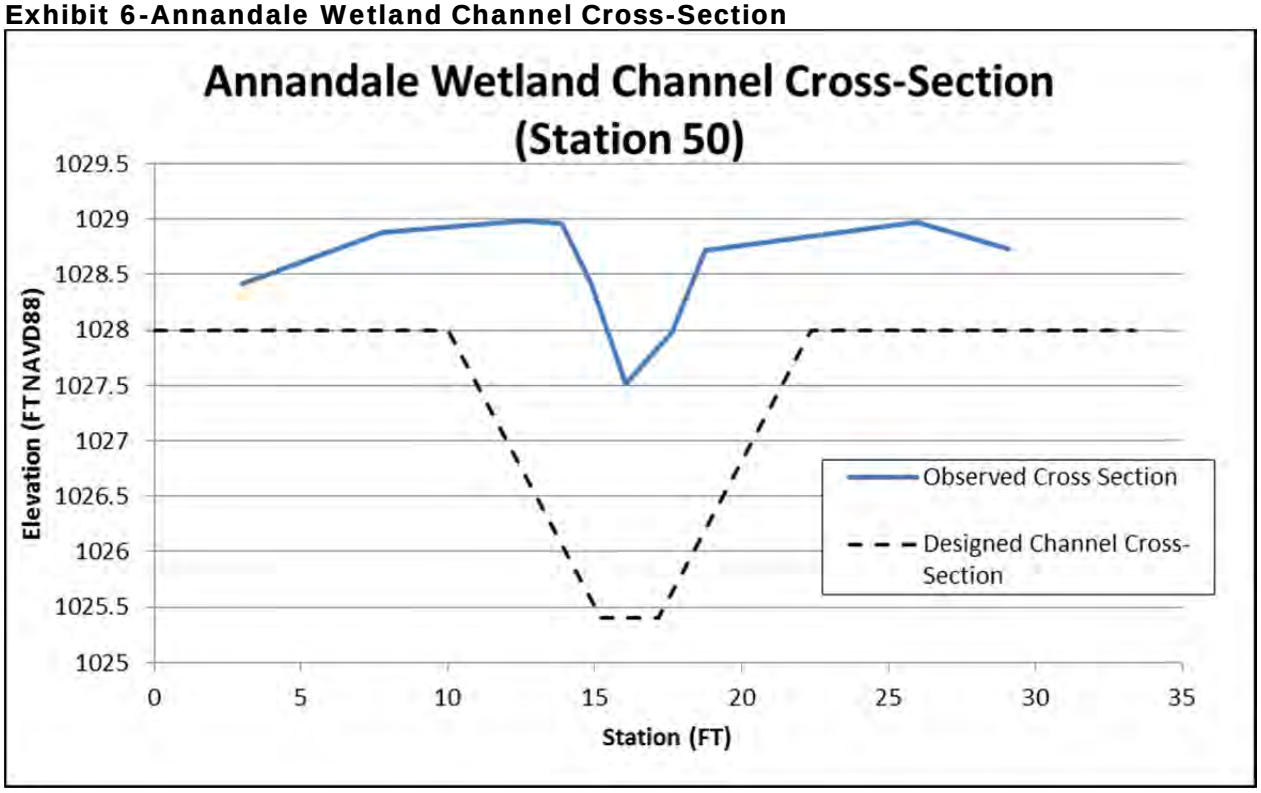
Exhibit 5-Annandale Wetland Treatment System Channel Profile



Significant sediment accumulation was observed in the beginning section of ditch channel (station point 0 to 600). An additional area of sediment accumulation was observed near station point 800. In these locations, sediment was observed to have nearly filled in the channel, except for a flow channel cutting through the sediment. Accumulated sediment depths of approximately 3 feet were observed in this portion of the channel. Trash and other debris were observed in the channel, indicating volumes of stormwater runoff from upstream.

The shape of the channel has changed from the original constructed dimensions and has narrowed and become braided as sediment has been deposited and the channel has cut a path through the accumulated sediment. The existing cross section of the channel is compared to the historic cross section in Exhibit 5.

Exhibit 6-Annandale Wetland Channel Cross-Section



Sediment accumulation was not as extensive in the portion of the channel north of station point 1100. In this portion of the channel, lowered water levels and minimal flows have resulted in the channel transitioning to a natural wetland condition, as stands of native emergent wetland species have become established.

4.2 BERM

A complete break in the berm was observed at station point 650. The washout of the berm occurred at a location where a port was previously located. Based on our field assessment, it is likely that the port became plugged and water continued to flow around the berm eventually causing material of the berm to slough and fail. Under its current condition, nearly all of the flow from the diversion channel upstream of this point is flowing to the east into the wetland, as the bottom elevation of the channel break is lower than the channel bottom in the diversion channel. Water was also observed flowing from the channel to the north back south into the channel break.

4.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Sediment has accumulated in the diversion channel, especially from the point from the beginning of the diversion channel to just downstream of the Hemlock Street road crossing. This has restricted the capacity of the channel but has not completely inhibited flow.
- The break in the berm results in nearly all of the upstream flow being routed into and through the wetland, reducing the operational function of the diversion channel downstream of the break.

- Most of the constructed ports in the berm are not operational as they are damaged or plugged.

Recommendations

- The effect of accumulated sediment on the project effectiveness should be evaluated in order to determine if and where sediment cleanout is necessary.
- A plan to repair the break in the berm should be developed to restrict water from flowing directly into the wetland. This plan could include the evaluation of potential options for project modification that would result in similar treatment as the original project.
- If the break in the berm is fixed, a plan to repair the ports or provide other ways for water to flow back into the wetland should be developed in order to reduce the risk of future berm failures.

Channel Upstream of Hemlock Street

Sedimentation in Channel (Station Point 100)

Breach in berm (Station Point 650)

Channel (Station Point 1400)

Native vegetation in channel (Station Point 1200)

Damaged port inlet

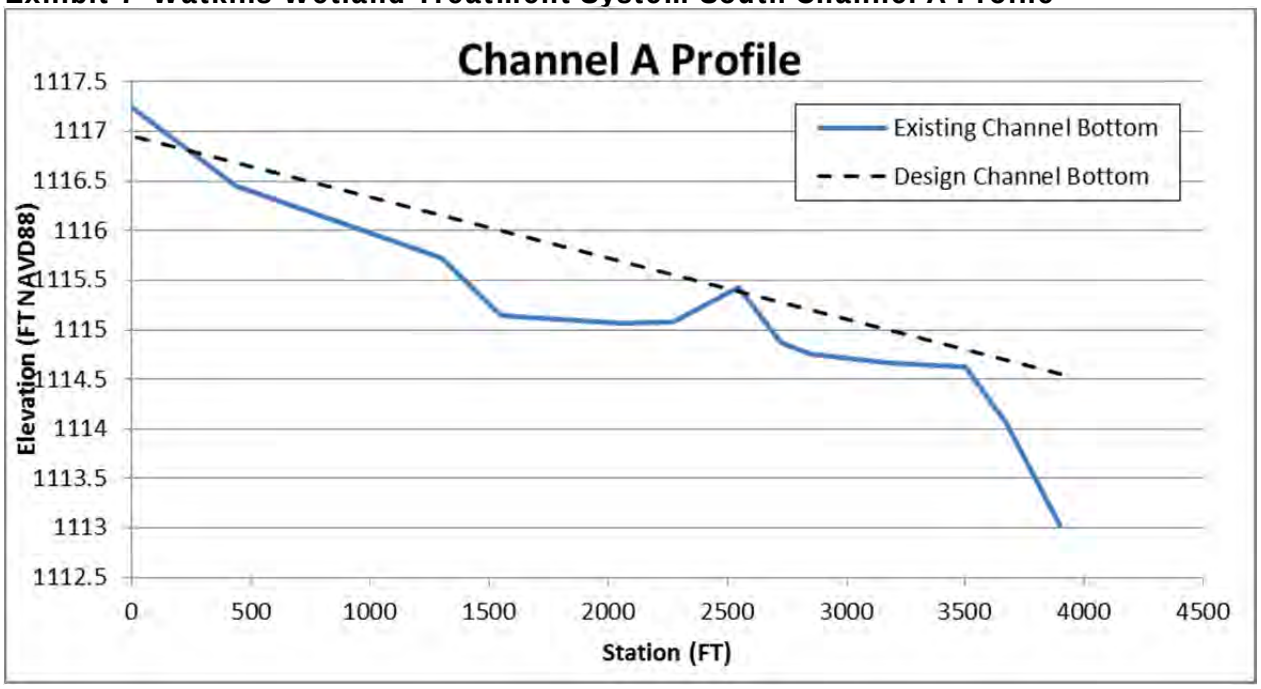
5.0 Watkins Wetland Treatment System South

Wenck and CRWD staff investigation of the Watkins Wetland Treatment System South focused on determining the extent of sedimentation in the diversion channels (Channel A and Channel B) around the wetland, locating and observing the condition of ports, observing and documenting the integrity of the berm and investigation of a known cut that recently occurred in the berm, and general project functionality. Project components and observations of the investigation are shown in Figure 5.

5.1 DIVERSION CHANNEL

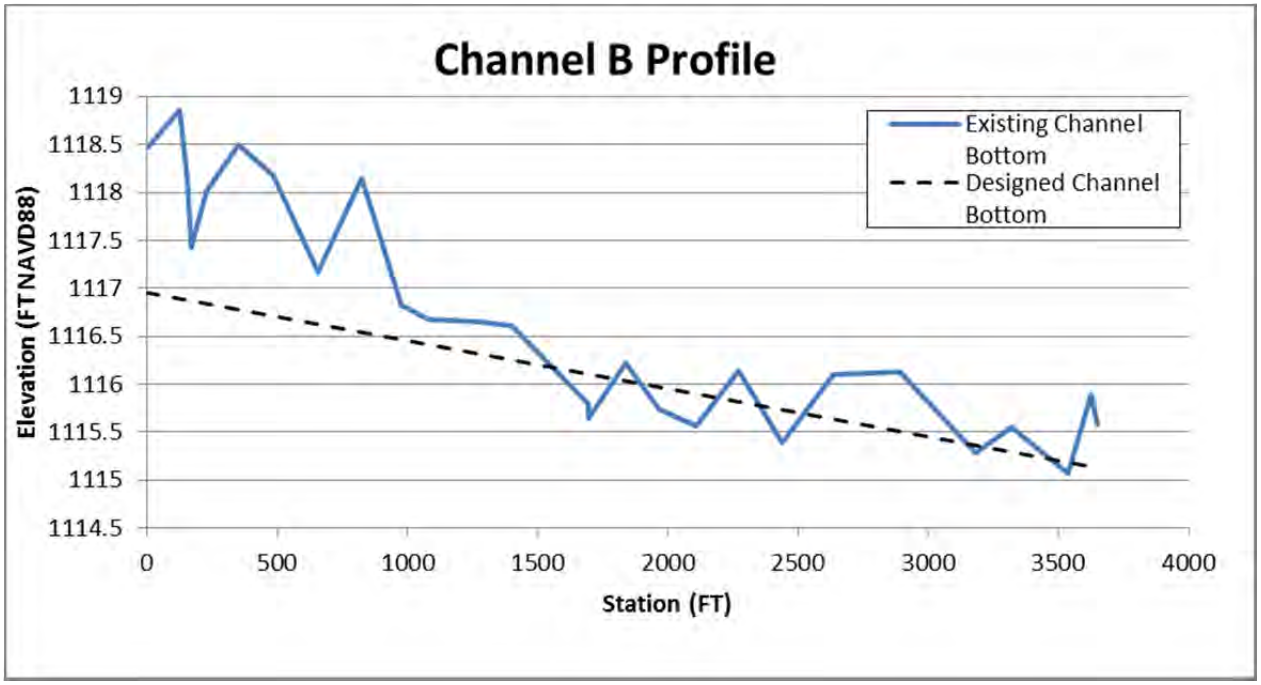
Generally, the survey of the bottom of the diversion channel found that very little sedimentation has occurred in Channel A in comparison to the design channel bottom as shown in Exhibit 6. The sedimentation does not appear to have impacted the function of the channel, as flow is maintained through the entire channel, with minimal obstructions present. The channel outlets to County Ditch 20 through a culvert installed at a channel crossing.

Exhibit 7-Watkins Wetland Treatment System South Channel A Profile



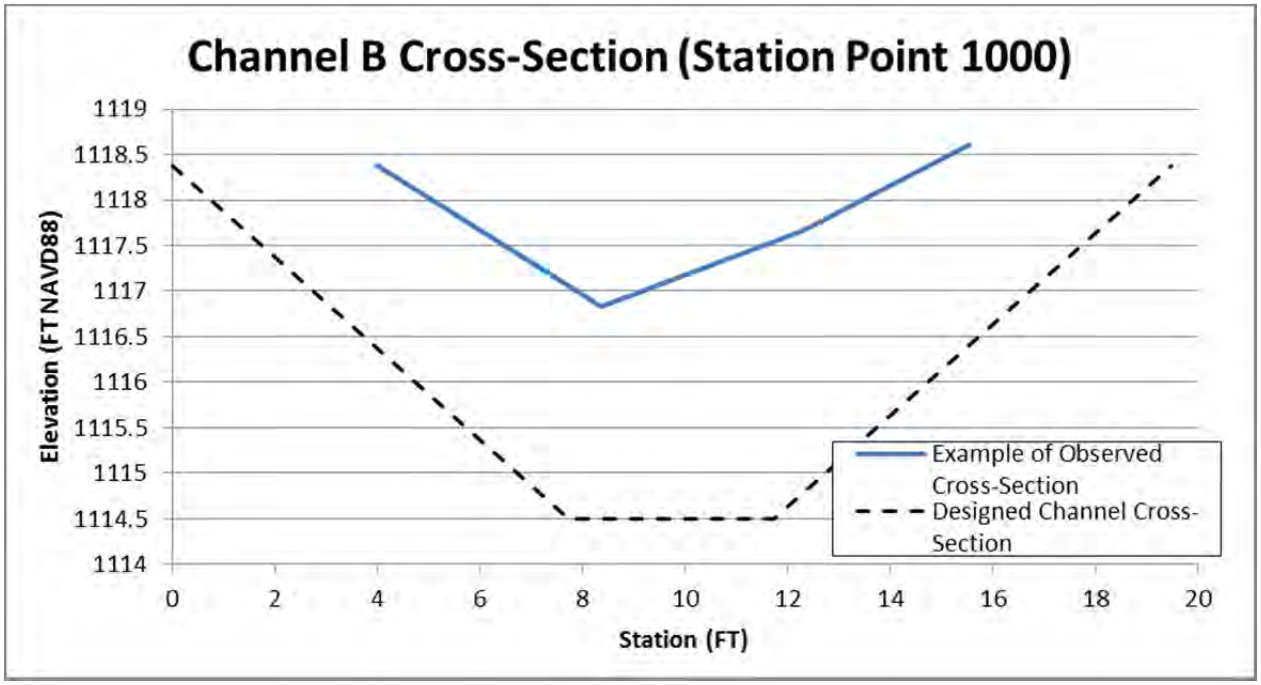
Investigation of Channel B demonstrates that some sedimentation has occurred that has limited capacity in the channel. This was especially apparent in the upper portions of the channel (station point 0 to 1000) but the sedimentation has not severely restricted flow in the channel. The profile shown in Exhibit 7 compares the design channel to the existing channel.

Exhibit 8-Watkins Wetland Treatment System South Channel B Profile



A comparison of the design and existing cross section of Channel B (at station point 1000) in Exhibit 8 demonstrates the change in channel shape as a result of sedimentation. While it appears that the channel has lost capacity, since the channel shape has changed from a straight channel with uniform slopes to a braided channel over most of the reach of the channel, flow appears to be maintained through the channel as designed.

Exhibit 9-Watkins Wetland Treatment System South Channel B Cross-Section



5.2 BERM

An intentional, unauthorized cut in the berm was observed at the end of Channel B (Station Point 3900) in an apparent attempt to route water to flow into the original ditch channel in order to lower the water elevation in this section of the diversion channel.

Other low spots were observed at several other locations in Channel B as shown in Figure 5. Rip rap overflow structures were installed at cuts in the berm by CRWD in two locations in the late 2000s to alleviate drainage concerns from landowners adjacent to the project. These overflow cuts essentially lower the water levels in the diversion channel and allow water to flow back into the wetland at the determined elevations. These structures appeared to be functioning as designed.

Most of the ports that were installed in the berm to connect flow in the diversion channel to the wetland when the project was constructed were found and surveyed. While some ports were found to be clogged or not functioning, most of the ports were free of obstructions and would likely function as designed if water levels were at the original design elevations.

5.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- Sediment has accumulated in Channel A and Channel B, reducing the channel capacity. However, the accumulated sediment has not significantly restricted flow in the channel.
- Overall, the majority of the berm is functioning, but several low spots or cuts in the berm in Channel B were observed, which allows water to flow from the diversion channel back through the wetland or to County Ditch 20.

- An intentional break in the berm was observed at Channel B, which impacts the intended design flow path of water through the system and provides a path for water to flow directly to County Ditch 20.
- Most ports are free of obstruction and would likely function if water levels were at the design elevations.

Recommendations

- Determine if accumulated sediment in channel affects overall project performance to determine if maintenance is required.
- Develop and evaluate a plan to repair the intentional cut in the berm that will allow the project to function while also considering drainage on adjacent properties.
- Develop and evaluate a plan to address low spots in berm.

Accumulated Sediment at Diversion Structure

Sediment in Channel B (Station 500)

Constructed RipRap Overflow Structure in Berm (Station 1100)

Channel B (Station 2200)

Port

Beaver activity on banks (Station Point 3300)

Cut in Berm (Station Point 3900)

Flow channel downstream of berm cut (Station 300)

End of Channel A (at junction with County Ditch 20)

Typical Channel A Conditions

Beginning of Channel A

6.0 Segner Pond

Wenck and CRWD staff investigation of Segner Pond included the collection of bathymetric data in the treatment basin to determine the existing depth in the pond, the surveying of the top of the limestone filter and diversion structure, and observations of general project functionality. Project components and observations are noted on Figure 6.

6.1 TREATMENT BASIN

Wenck used sonar equipment to collect water depth data at transects in order to develop bathymetric depth contours for the treatment basin. Survey elevations were also collected in order to tie water depths to elevations. The survey demonstrated that the bottom of the pond ranged from 5 to 6 feet in depth, which matches the design of water approximately 6 feet deep in the basin. This demonstrates that significant sedimentation has not occurred in the pond, as anticipated, since upstream wetlands perform well at removing accumulated sediment from inflow prior to it entering the basin. Dense stands of curly leaf pondweed were also observed growing in the treatment basin.

The inlet channel to the basin was also surveyed and it was determined that a small amount of fine sediment has accumulated, but the sediment does not impede flow in the channel.

6.2 LIMESTONE FILTER BERM AND DIVERSION STRUCTURE

The top elevation of the limestone filter berm was found to range from 999.7 feet to 1000.6 ft. This demonstrates that the filter is up to 1 foot lower than the design elevation of 1000.7 feet in some locations. The lowest elevations of the top of the berm are noted in Figure 6. Exhibit 9 shows a profile of the top of the limestone filter berm and compares it to the design elevation. This observed slump in the filter berm has been observed in previous years and maintenance has been conducted to fill in the low spots with additional limestone.

The top of the diversion structure was also surveyed and found to have a runout elevation slightly higher than the proposed design elevation. The diversion structure is functioning as designed with no indications that maintenance is needed.

6.3 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- A sonar survey conducted of the treatment basin confirms that the basin was excavated as designed and sedimentation has not occurred in the basin.
- Sedimentation has not occurred in the channel flowing to the treatment basin.
- The diversion structure is functioning as designed, with a runout elevation slightly higher than the proposed design.
- Several areas of the limestone filter berm were observed to be lower than the design elevation.

Recommendations

- Continue to monitor areas of lower elevation on treatment filter berm to determine if additional maintenance is needed in future years.

- Determine and evaluate if slightly higher runout elevation of limestone diversion structure needs to be addressed.

Limestone Filter Berm

Limestone Filter Berm and Pond Edge

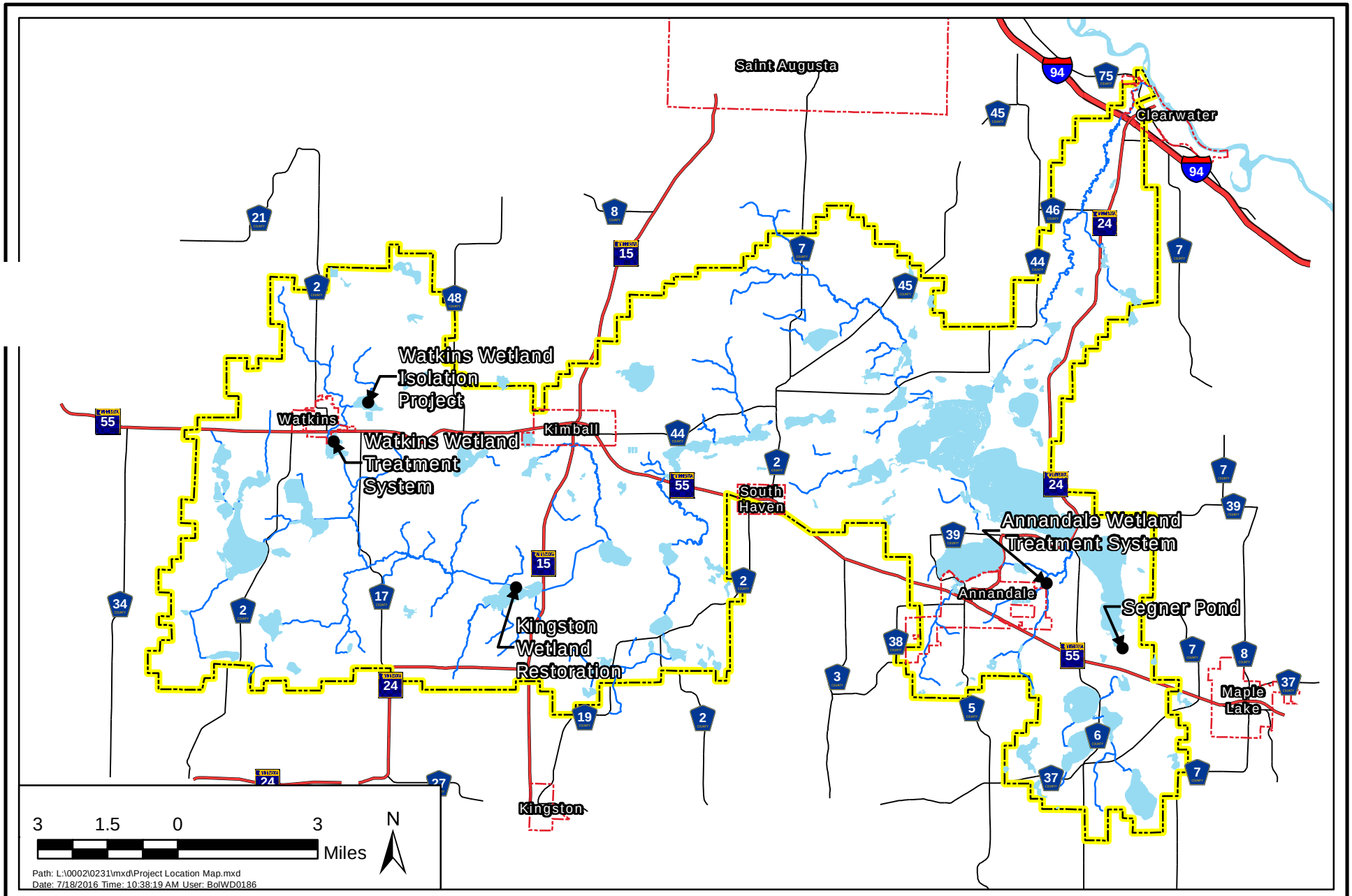
Diversion Structure

Channel upstream of treatment basin

Fish barrier

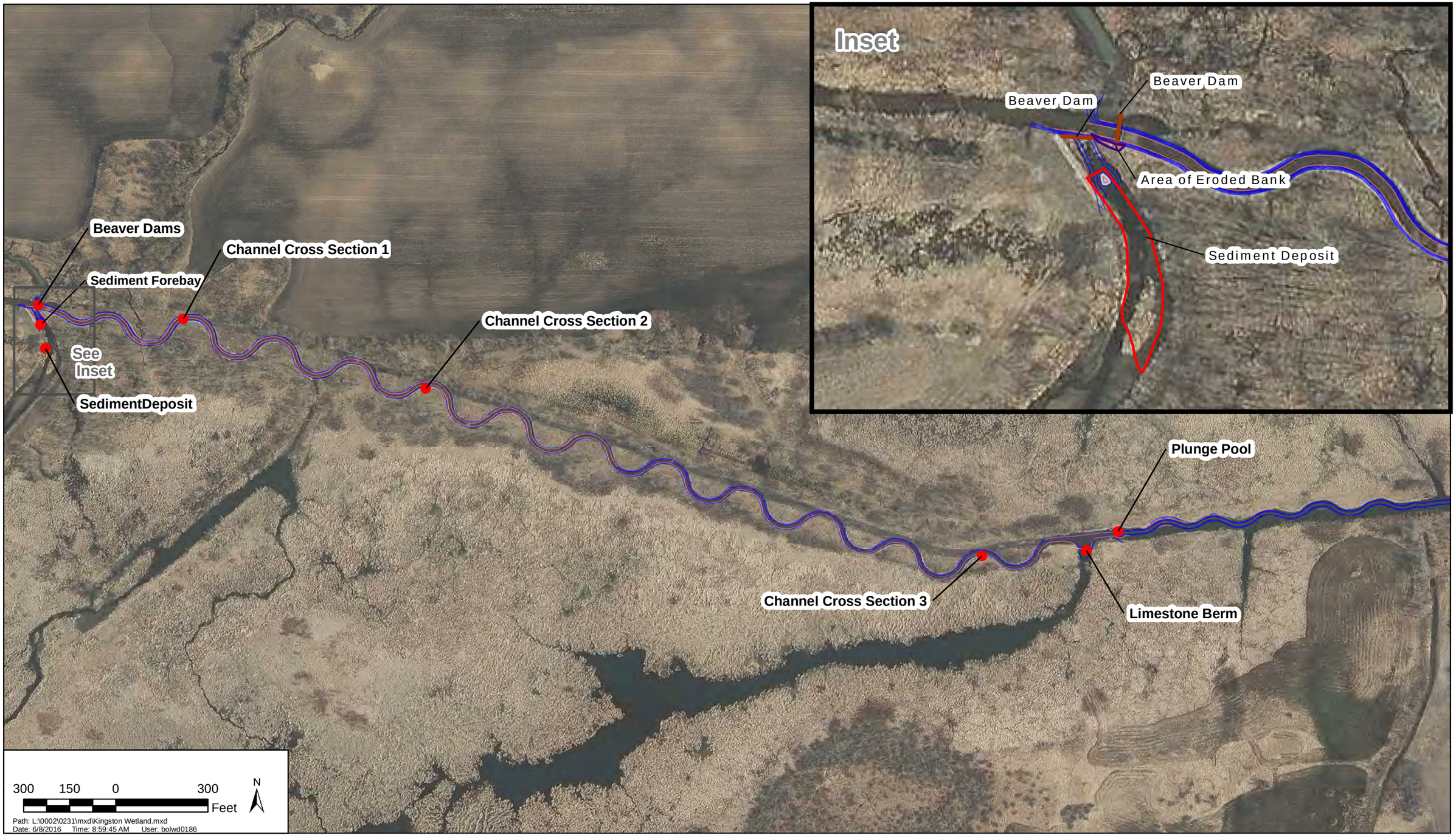
Eastern slope of treatment basin

Figures

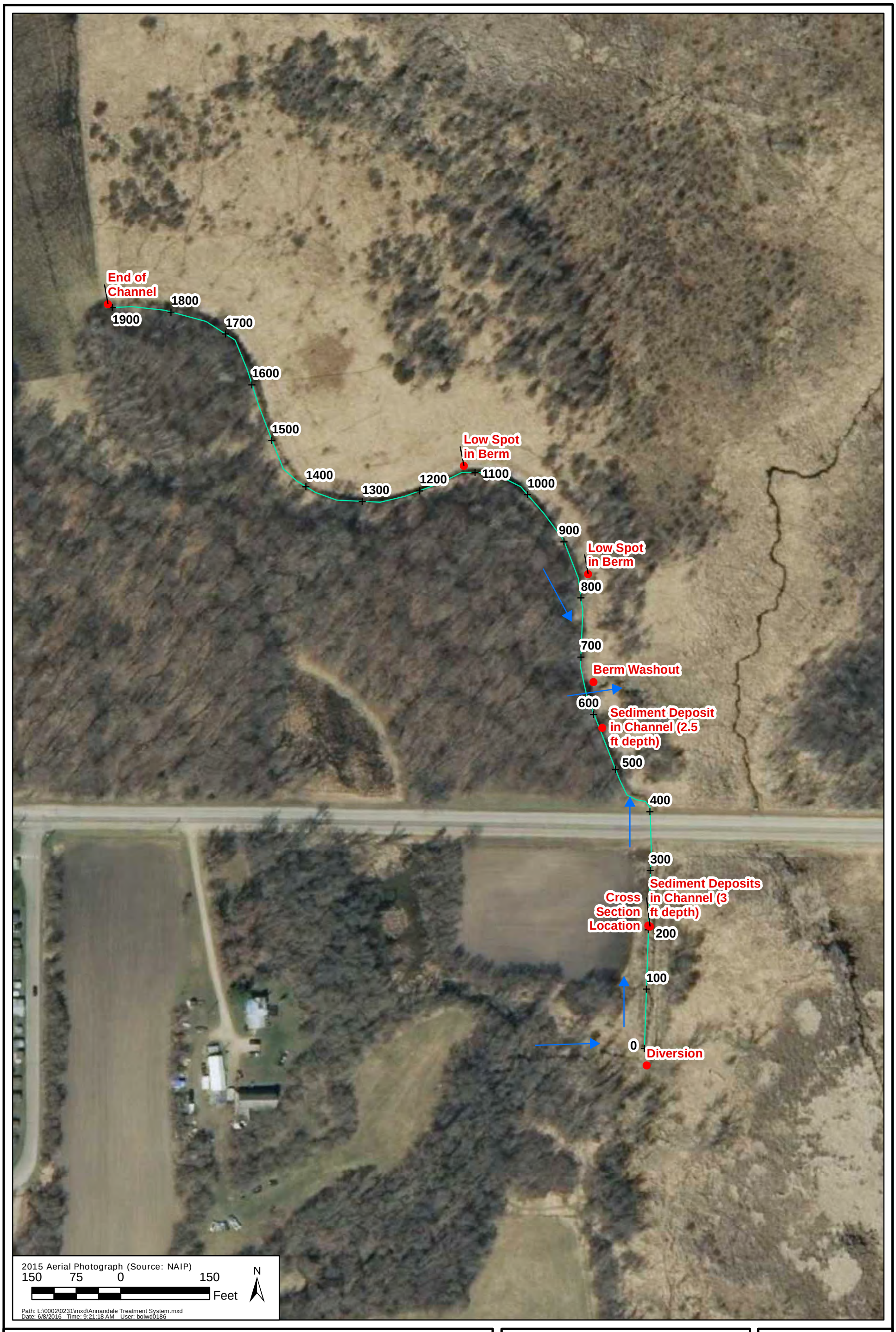


CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	JUN 2016
Project Location Map		Figure 1

CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAY 2016
Watkins Wetland Isolation Unit Investigation		Figure 2



CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAY 2016
Kingston Wetland Project Investigation		Figure 3



CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAY 2016
Annandale Wetland Treatment System Features		Figure 4

CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAY 2016
Watkins Treatment System South Investigation		Figure 5

CRWD	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAY 2016
Segner Pond Investigation		Figure 6

Responsive partner.
Exceptional outcomes.

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