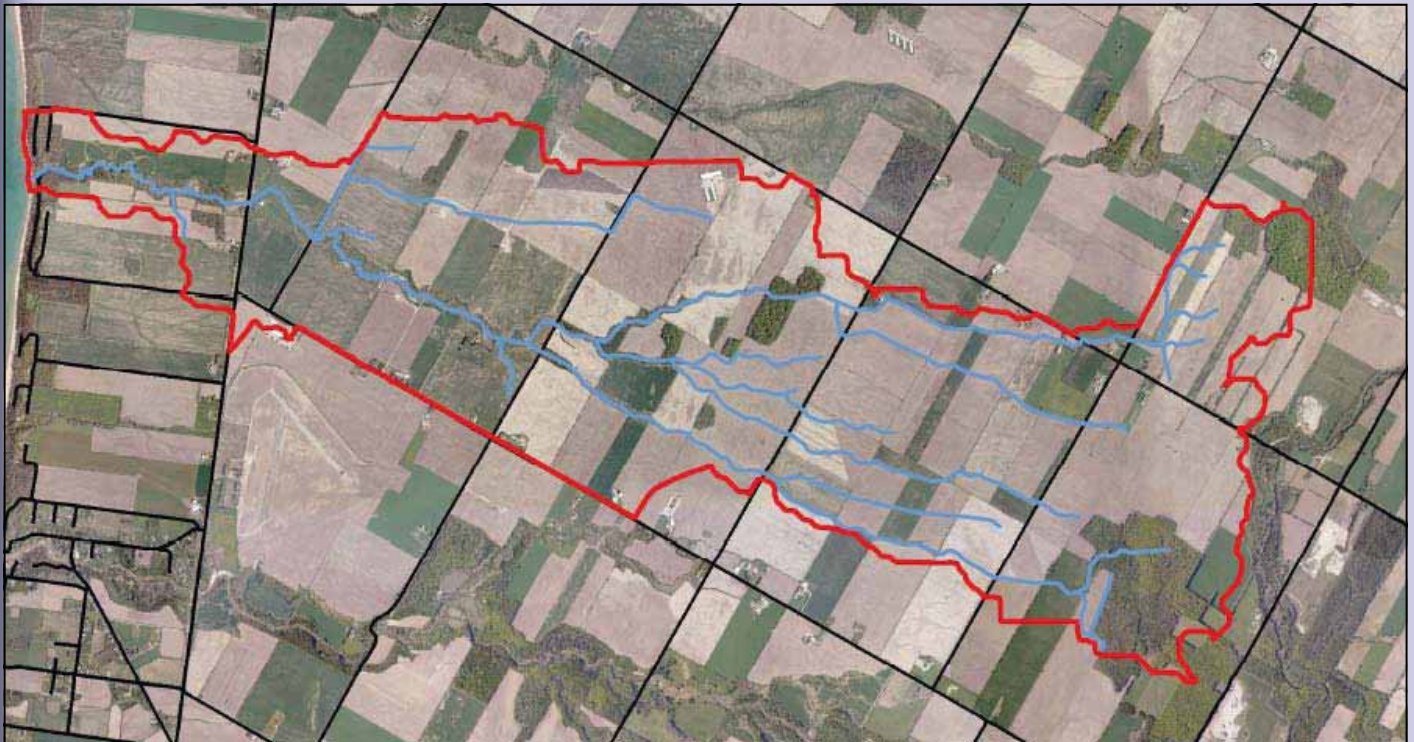




GARVEY GLENN SHORELINE WATERSHED PROJECT

SOIL AND WATER ENVIRONMENTAL ENHANCEMENT PLAN (SWEEP)



**Maitland Valley
Conservation Authority**

Working for a Healthy Environment!

Preface

This document is a working document which has been and will continually be updated as the project unfolds. All plans and timelines within this document are a best case scenario and subject to change based on landowner needs and approvals, and the availability of funding to complete the project. This 2012 edition of the SWEEP already shows the evolution this project has taken. Where once it was viewed that we must deal with headwaters first, then move downstream, it is now the view that we must deal with 12 different sub water basins because of the interconnectedness of these systems.

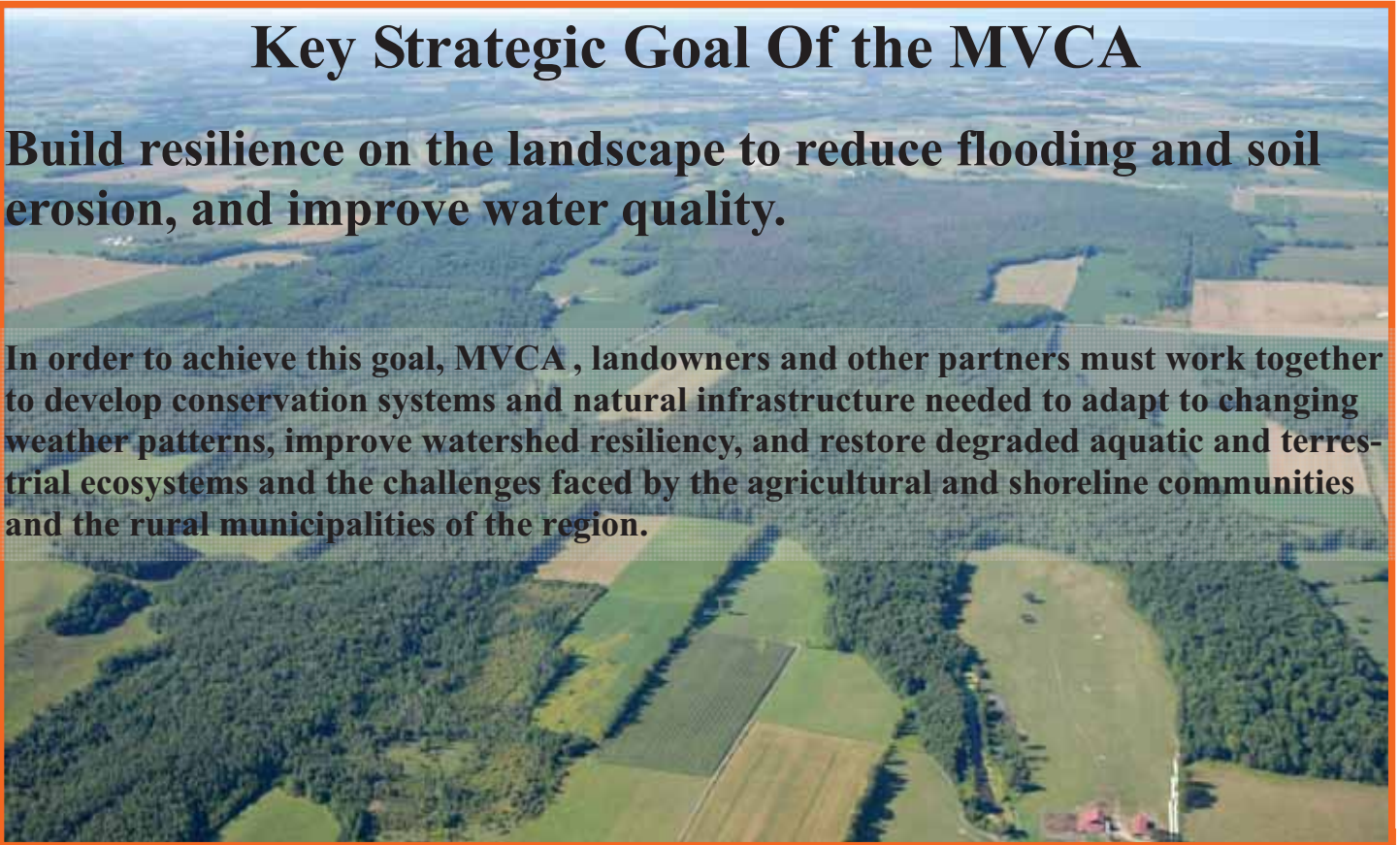
The targets and goals within must also be viewed as dynamic. This project is meant to demonstrate the practicality of a watershed approach to building resiliency and combating erosion problems. As such it is also a learning experience in the effectiveness of the approach and therefore some targets will change and become more defined as the knowledge of the watershed grows.



Key Strategic Goal Of the MVCA

Build resilience on the landscape to reduce flooding and soil erosion, and improve water quality.

In order to achieve this goal, MVCA , landowners and other partners must work together to develop conservation systems and natural infrastructure needed to adapt to changing weather patterns, improve watershed resiliency, and restore degraded aquatic and terrestrial ecosystems and the challenges faced by the agricultural and shoreline communities and the rural municipalities of the region.



Maitland Watershed Partnerships Terrestrial Team Targets

- Raise Natural Cover from 18.9-26%
- Reduce absolute loss of natural areas by 50% by 2020
- Increase Woodlots in good condition from 45%-60%
- Increase natural connections on the landscape from 8,700 ha to 21,000 ha
- There is potential in the watershed for 23,609 ha of marginal land and 21,000 ha of buffer strips to be naturalized.



Challenges Faced within the MVCA Region

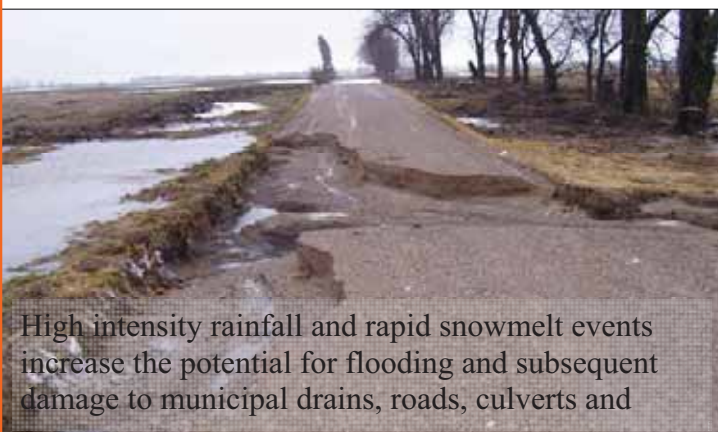
Changing weather patterns and loss of resiliency within the watershed has created challenges for all communities within the Maitland Valley Region. The Garvey/Glenn project is a test of the watershed approach as a way of dealing with these challenges.

Challenge: Rural Communities

Changing weather patterns and climate has increased the risk of soil and wind erosion. There is a demonstrable increased potential for high intensity, short duration storm events that increase runoff and the associated soil erosion and loss of crop inputs.



Challenge: Rural Municipalities



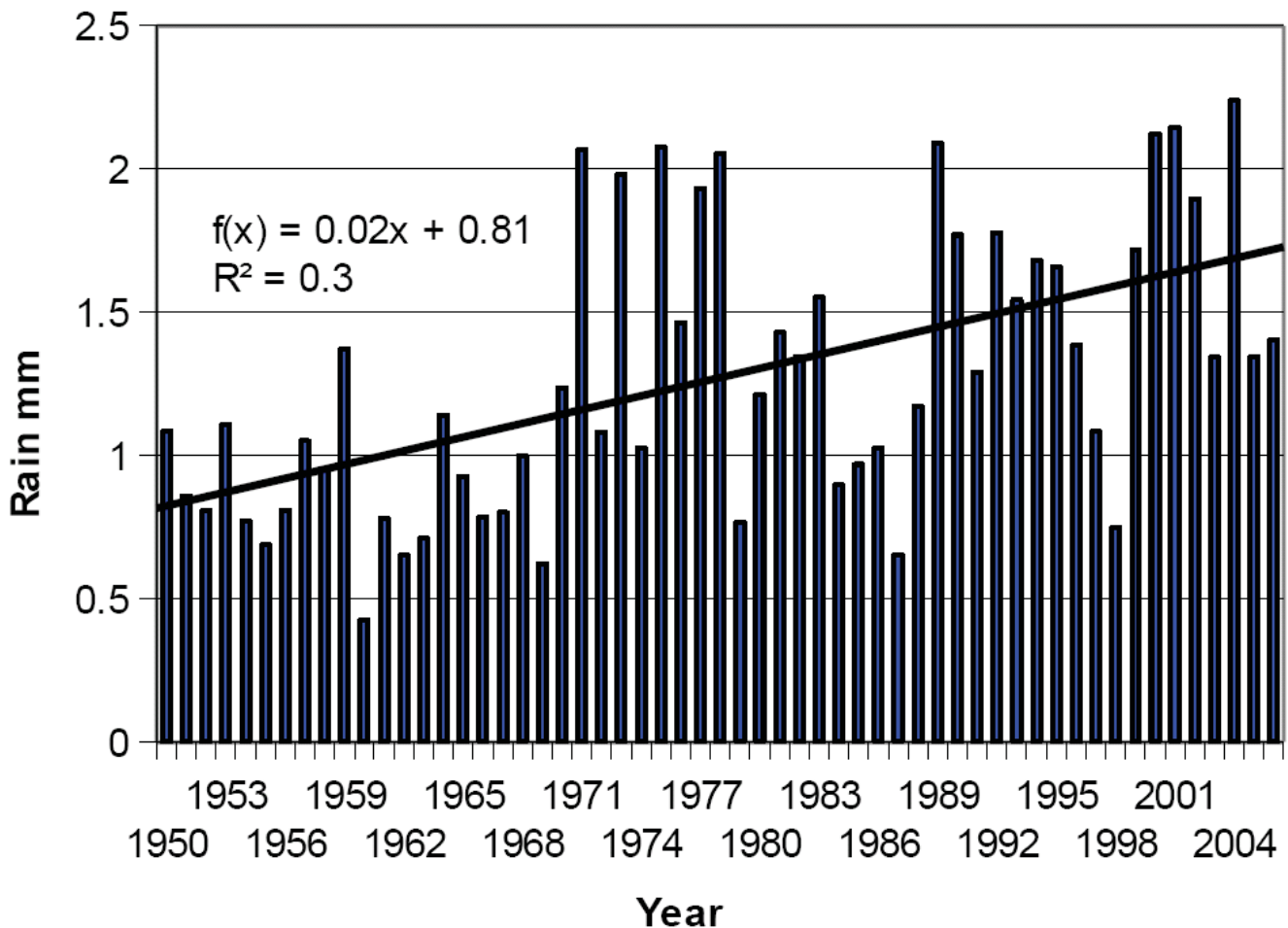
High intensity rainfall and rapid snowmelt events increase the potential for flooding and subsequent damage to municipal drains, roads, culverts and

Challenge: Shoreline Community



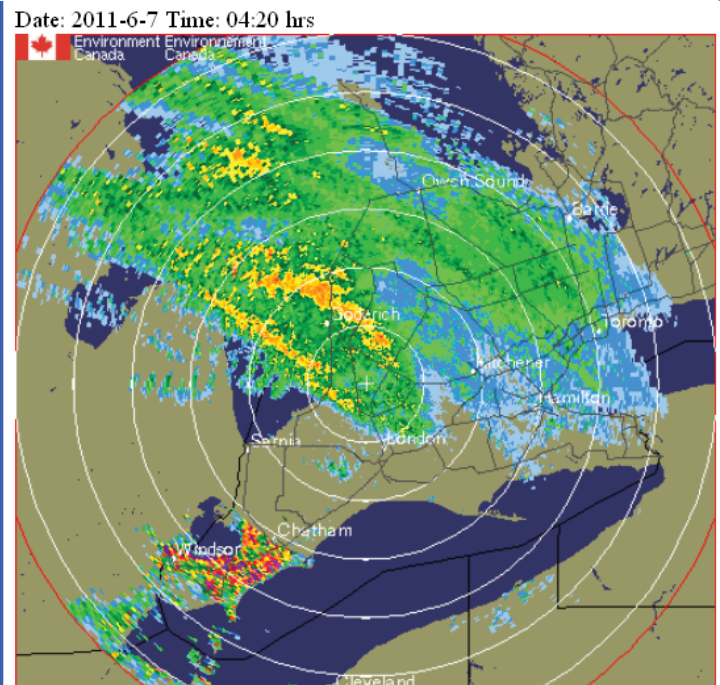
There are approximately 130 gullies in the MVCA that drain into Lake Huron that are increasing in size and rate and are affecting shoreline properties.

Goderich : Summer July - Sep Hourly Rain (mm)



Challenge of Changing Weather Patterns

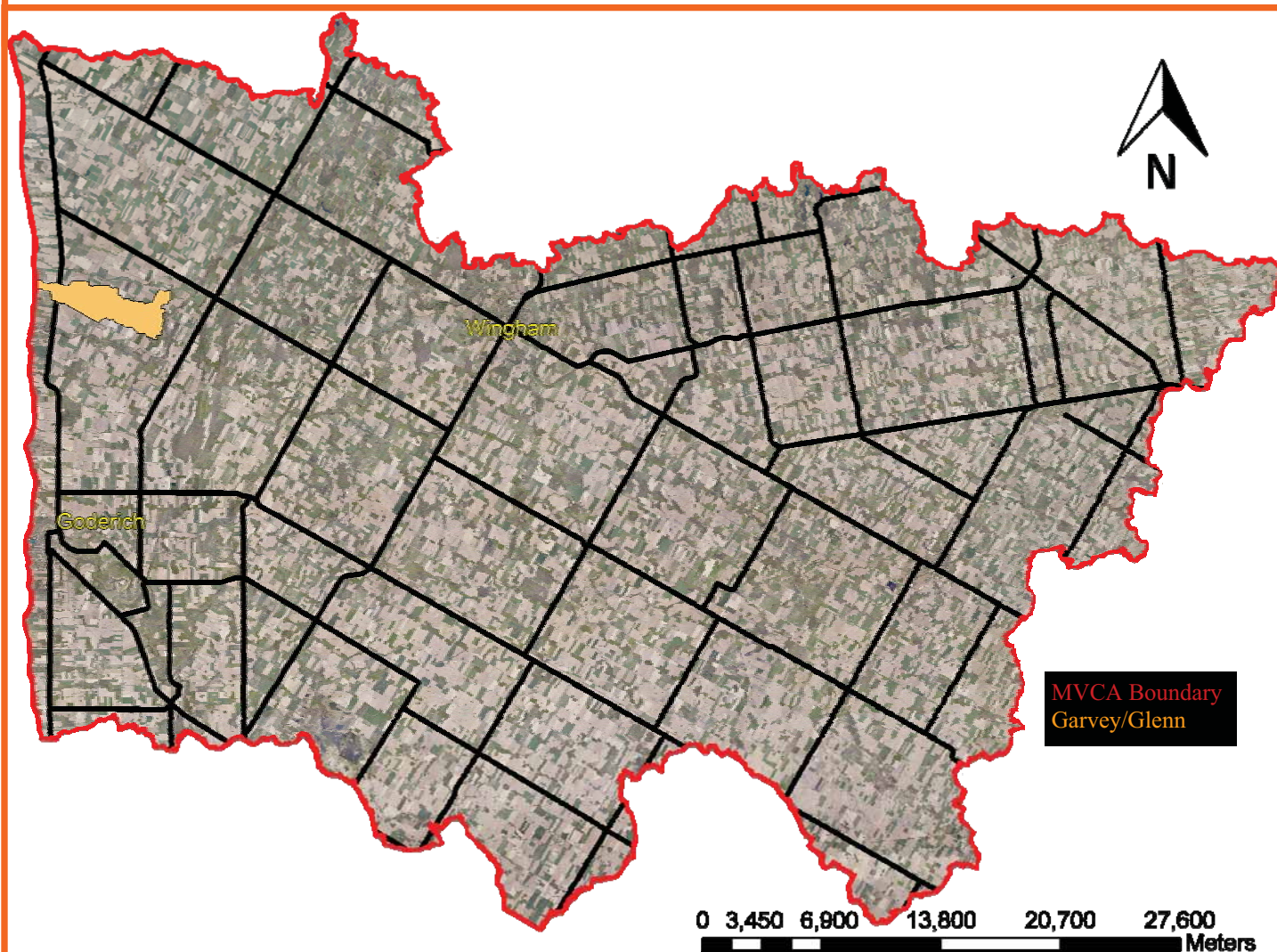
MVCA data is revealing that changing weather patterns, with the occurrence of more intense storms and larger rainfall events then in the past as well as less snow and more rain in the winter and fewer days below freezing. This increases the risk of runoff and erosion, increasing the importance of building watershed resiliency as it is large rain events which cause the most soil and bank erosion damage.



GARVEY GLENN PROJECT

The Garvey/Glenn drains 17.5 square kilometers of farmland and empties directly into Lake Huron, just North of Port Albert. In the upper reaches of the headwaters there is a large woodlot containing areas of wetland. Downstream of this natural area water flows both overland and through a network of open and closed drains. Through the middle of the watershed the water-courses merge and form more defined valleys which are often forested. Before entering Lake Huron, the creek flows through a deep forested gully which is actively eroding. The Watershed is located 15km North of Goderich Ontario and 31 km west of Wingham Ontario.

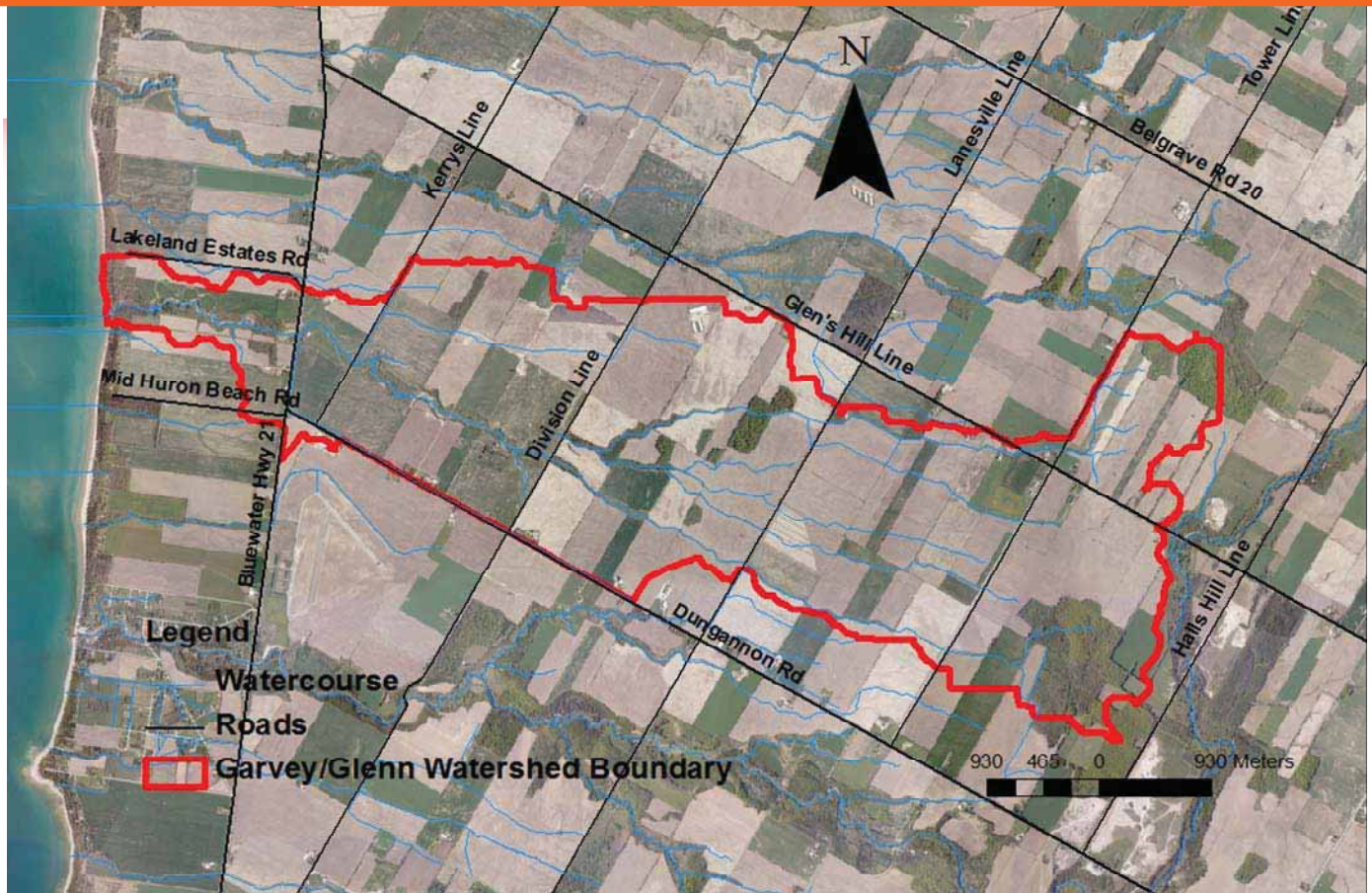
The Garvey Glen is mostly agricultural land with cottages at the mouth of the stream along the lakeshore. Agricultural row crops account for 68% of land use while pasture for cattle accounts for only 1%. 15.8% of the Garvey/Glenn land use is woodlots while 11% is classified as recreational (mostly along the lakeshore). 3.8% of the land is currently idle and this presents an opportunity to create wetlands or forest cover.



Garvey/Glenn Watershed

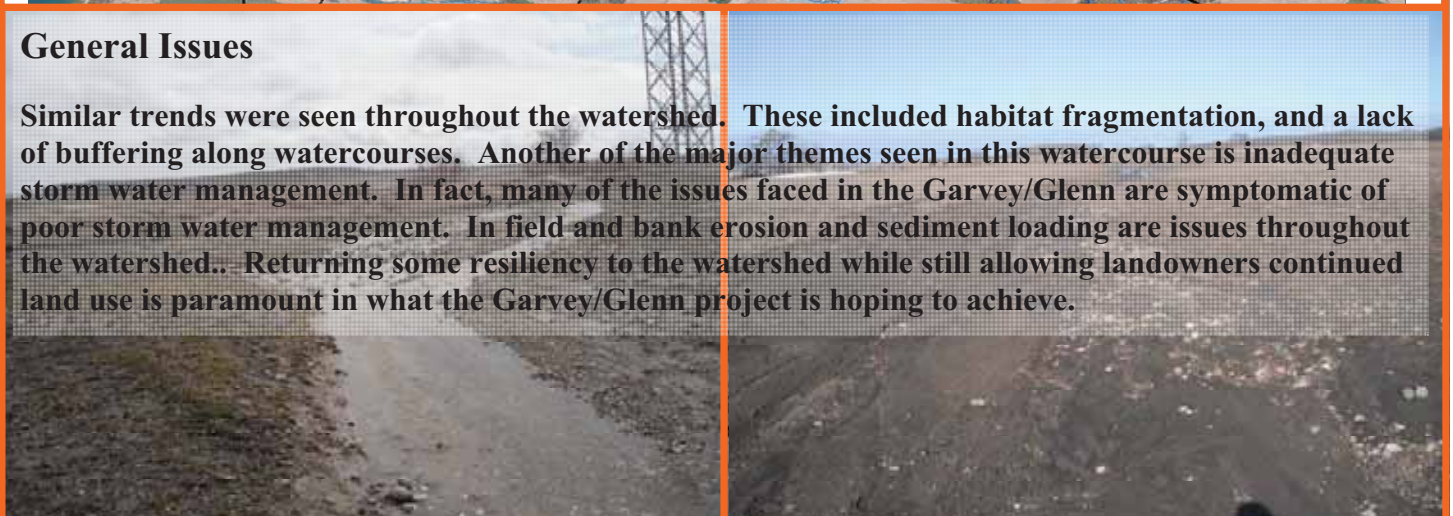
Garvey/Glenn Watershed Project, one of the key watersheds identified under the Healthy Lake Huron Initiative. Landowners in the watershed have identified storm water management and erosion control as priority issues .

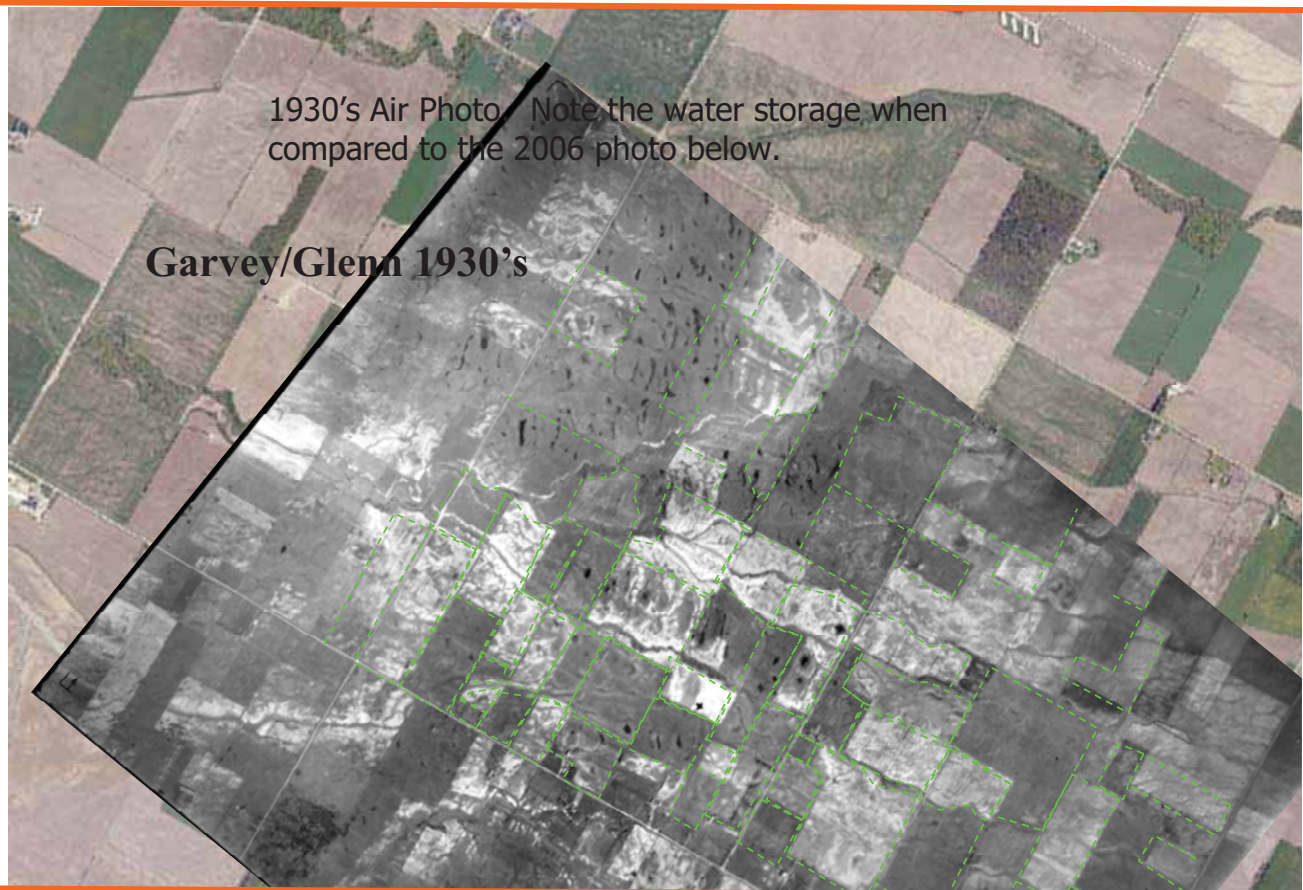
The Ontario Ministry of the Environment (MOE) has funded three projects in the southeast shores of Lake Huron with the intent of improving water quality along the Lakeshore. The Garvey/Glenn project was one of these projects. MOE has so far given \$70,000 to MVCA to initiate projects in the watershed for the improvement of water quality.



General Issues

Similar trends were seen throughout the watershed. These included habitat fragmentation, and a lack of buffering along watercourses. Another of the major themes seen in this watercourse is inadequate storm water management. In fact, many of the issues faced in the Garvey/Glenn are symptomatic of poor storm water management. In field and bank erosion and sediment loading are issues throughout the watershed.. Returning some resiliency to the watershed while still allowing landowners continued land use is paramount in what the Garvey/Glenn project is hoping to achieve.





Air Photos of the 1930s show smaller fields with fencerows preventing erosion, more pasture and forest also preventing erosion. There is also an abundance of wetlands which gave the watershed adequate water storage and resiliency.



Importance of a Watershed Approach

- Inclusive, allows all landowners effected input into the process
- Damage along watershed is cumulative, so reductions in the headwaters reduce damage throughout the watershed
- Lowers costs of projects in lower watershed by improving situation upstream
- Encourages landowners to collaborate effectively to solve larger problems instead of each landowner working independently to reduce only the problems they face
- Watershed approach allows for the consideration of all factors that contribute to water quality within the watershed

Failed berm is a landowner attempt to control erosion independently



Many of the watersheds issues extend across several farms



Goals to address in the Watershed

- Develop and test the systems approach watershed issues
- Educate and encourage the use and acceptance by landowners of soil conservation best management practices (BMP)'s and
- Stop or reduce soil erosion in the watershed through the education and adoption of BMP
- Build resiliency into the watershed for storm water storage.
- Be responsive to the needs of landowners to ensure they are included in the process



Monitoring

Currently there are 11 sites in the Garvey/Glenn being monitored for water quantity, nutrients, erosion and sedimentation. This monitoring has been ongoing since 2011 with the goal of reducing nutrients erosion and sedimentation in the Garvey/Glenn. Reduction targets are being refined as knowledge of the system is gained. There are also 3 data loggers monitoring water levels throughout the Garvey/Glenn. The flow and level data is being used in the creation of a model to predict the effects of weather events on water levels and the erosive forces created. Monitoring for 2012 will be increased as the Rural Stormwater Management Model begins in the Garvey/Glenn. This project, along with a possible Nutrient Management Plan for the entire Garvey/Glenn watershed (funding for which is being pursued at this time), will enable an increased knowledge of the watershed, and improve the watershed approach taken the MVCA in the future.



2011 Achievements

- Developed systems approach for dealing with watershed issues
- Educated landowners on importance of a watershed approach, and building resiliency into a watershed
- Talked to landowners individually and received input into SWEEP plans
- Mapped the watershed and issues
- Created a landowner steering committee to help ensure the project is responsive to landowner needs
- Created Watershed SWEEP plan and SWEEP plans for each individual land owner



2012 Goals

- Present and revise Watershed SWEEP Plan
- Present and discuss and revise individual SWEEPs with landowners
- Design projects proposed in the individual SWEEPs for the Garvey/Glenn's headwaters in preparation for future funding opportunities and allowing landowners to go forward with projects.
- Completion of the Kraft berm project
- Site tour(s) of the Kraft demonstration projects.
- Possible completion of additional headwater project(s)
- Possible tree plantings along watercourses throughout Garvey/Glenn
- Development of Soil Health Management Plan –Investigate funding
- Development of Rural Stormwater Management Project

Landowner Steering Committee

The approach to the Garvey/Glenn project has always been landowner driven, in order to maximize landowner participation and ownership of the project.

- Landowners have been included in public and individual meetings every step of the way
- Through public meetings landowners determined the direction of the project setting priorities of erosion reduction, storm water management, tree planting and nutrient loading reduction
- Landowners have opportunity to input ideas and express concerns and issues
- A group of volunteer landowners from throughout the watershed have agreed to be part of a steering committee to direct and approve the overall direction of the Garvey/Glenn project
- The Landowner steering committee currently has 9 members taken from throughout the watershed.
- All projects are discussed, and approved 100% by landowner before going forward



2011 Accomplishments

- **March 2011.** Landowner meetings help identify landowner priorities and shape direction of the Garvey/Glenn watershed.
- **Spring 2011.** Maitland Valley staff walk over 50km and take over 300 photos of the Garvey/Glenn watershed identifying all low draws and waterways.
- **Summer/Fall 2011.** Meetings with individual landowners take place to discuss the Garvey/Glenn project and what can be done on their individual properties and how these projects fit into the overall plan to improve the Garvey/Glenn
- **Summer 2011.** Garvey/Glenn Landowner Steering Committee formed
- **Fall 2011.** Soil and Water Environmental Enhancement Plans (SWEEP) for each individual landowner
- **Fall 2011.** Final designs for Kraft/Bollinger demonstration project go to tender
- **Nov/Dec 2011.** Completion of Watershed SWEEP plan

2012 Goals

- **Present and discuss individual SWEEPs with landowners**
- **Design projects proposed in the individual SWEEPs for the Garvey/Glenn's headwaters in preparation for future funding opportunities and allowing landowners to go forward with projects.**
- **Completion of the Kraft berm projects.**
- **Site tour(s) of the Kraft demonstration project.**
- **Potential completion of additional headwater project(s)**
- **Potential tree plantings along watercourses throughout Garvey/Glenn**
- **Potential watershed nutrient management project which will also address cropping/tillage in the watershed**
- **Rural Storm Water project development**

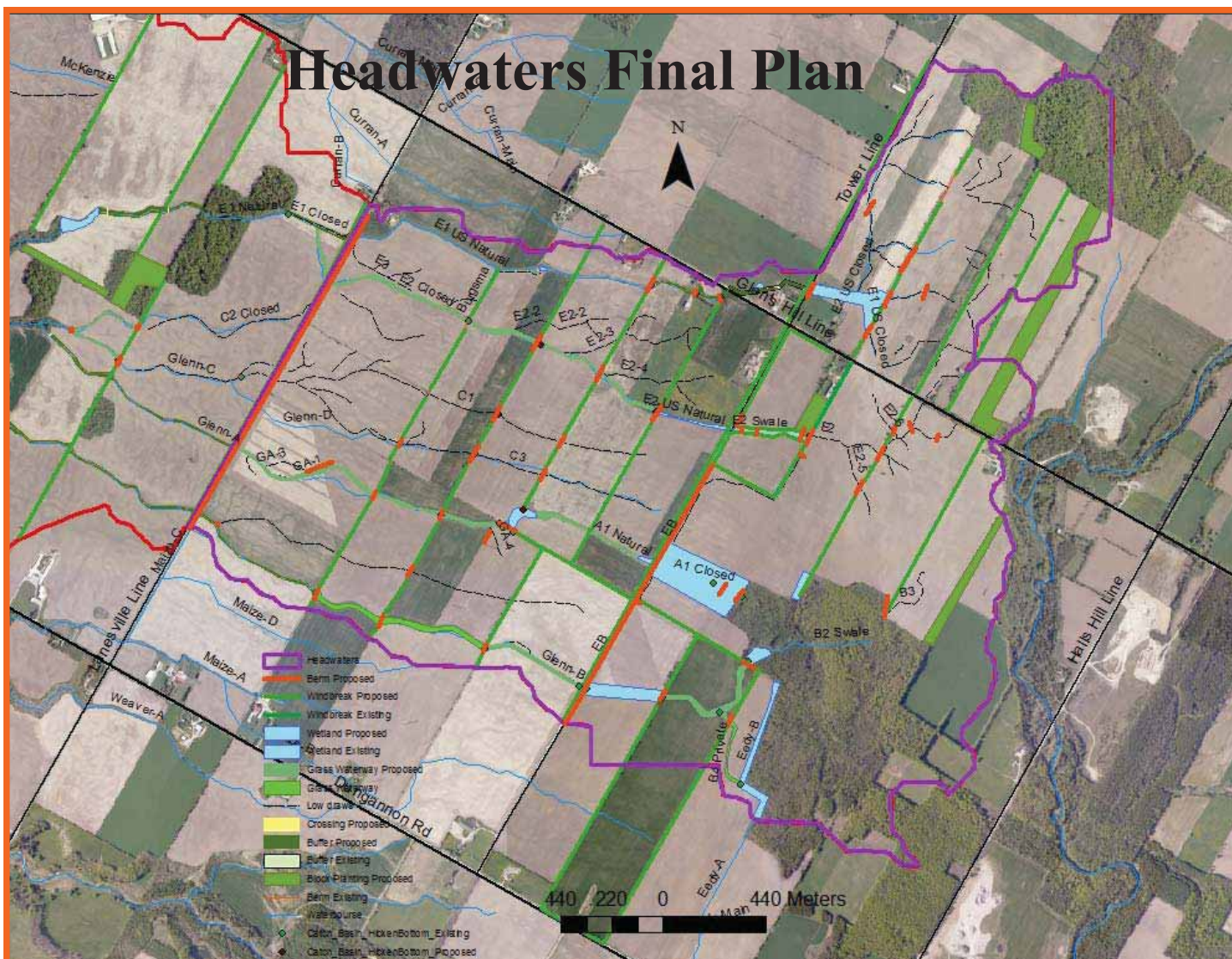
Headwaters

The Garvey/Glenn watershed can be broken down into three broad categories, headwaters, midwaters and the lower Garvey/Glenn or gully portion of the watershed. It will be important to store storm water in the headwaters and move it quickly through the other midwaters and lower Garvey/Glenn in order to ensure that the peak flows are minimized.



Taking a watershed approach to the issues of the Garvey/Glenn allows us to get maximum results for the resources spent. Therefore the decision was made that projects involving erosion control or water storage in the headwaters take precedent over projects farther along the watercourse. The headwaters of the Garvey/Glenn are approximately bordered by Halls Hill Rd to the east, Lanesville Line to the West, Dungannon Rd to the south. West of Tower line the watershed stays south of Glenn's Hill Rd, however east of Tower line the headwaters go north of Glenn's Hill Rd (see map on next page). This area is characterized by large fields without fence lines, a combination of open and closed municipal drain and little water storage capacity.





Overall Plan for Headwaters

Ideally close to 40 berms could be created in the headwaters to reduce sedimentation in the watercourse and store storm water for a short period of time, including using Lanesville line as one long berm for storing water. The creation of 9 wetlands covering 22.9 hectares (56.5 acres) on marginally productive agricultural land throughout the headwaters would increase resiliency storing water on the land allowing reducing the peak flows downstream.

Long low draws along the E2, A1 and Glenn B (see above) cannot be properly addressed by individual landowner and to effectively reduce or eliminate the erosion, must be dealt with as one project. Grass waterways along these draws would effectively deal with the erosion issues.

The estimated cost to implement the BMP's for the headwaters is \$706,000 (see areas 1 and 2 in the final budget estimates on page 27). Constructed berms (326,500) and wetlands (235,000) account for the majority of this cost. Further improvements in resiliency will be realized in cropping and tillage practices which will be addressed in the Nutrient Management Project planned for the Garvey/Glenn watershed. Costs may come down if landowners do not approve of some projects in the plan.

Kraft Demo Site

Construction on the Kraft Demonstration site should begin in Fall of 2012. This project is a series of professionally designed erosion control berms which slow water and reduce erosion. French drains associated with the berms will filter out any sediment. Currently the one berm present in this area is failing, and the water is diverted into another watershed causing severe erosion. Intensive monitoring of the area will also be included as part of the project.

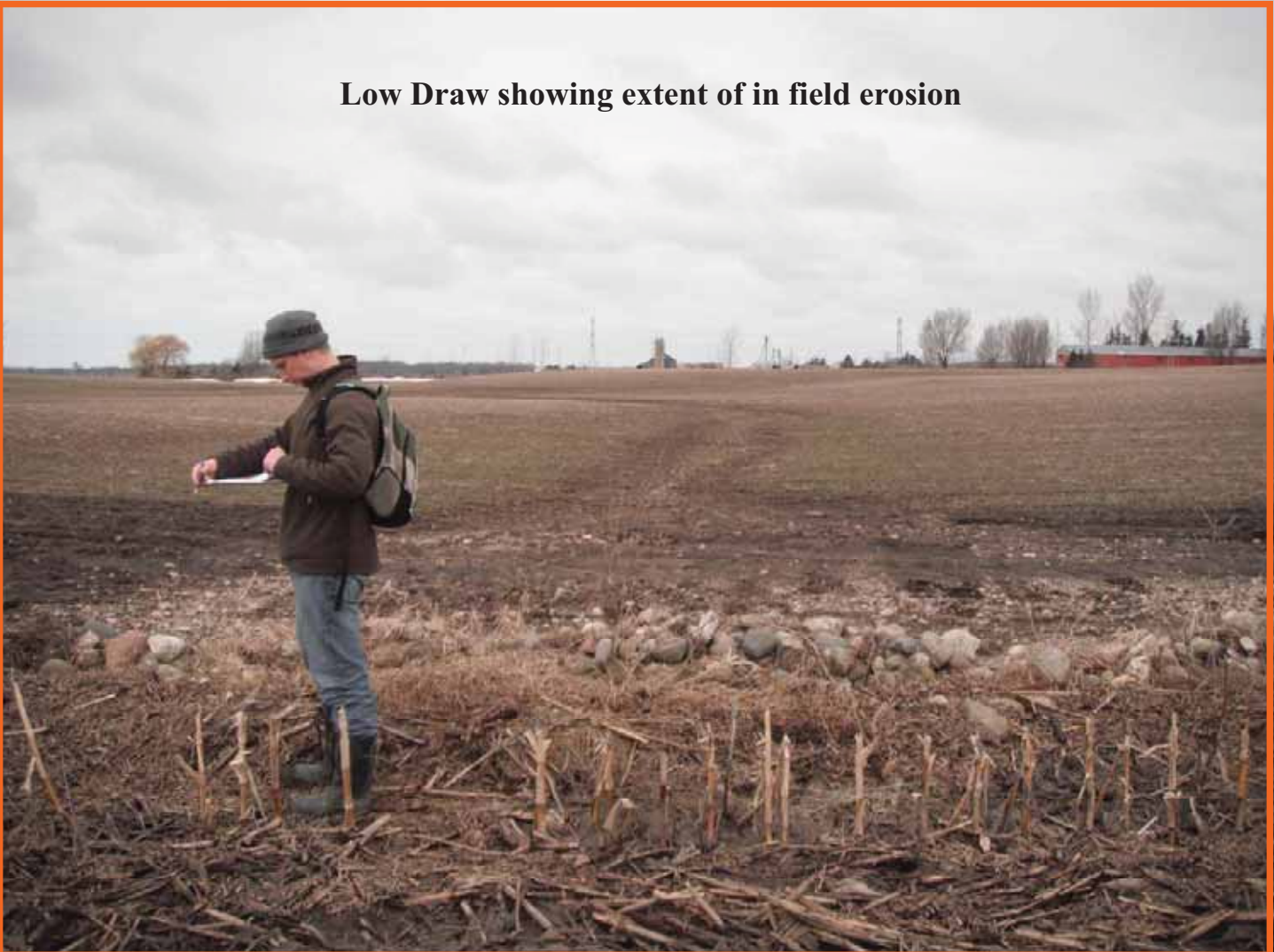
Area impacted by erosion



Erosion downstream of failed berm



Low Draw showing extent of in field erosion



Plans for the 2012 Kraft Erosion Berms Demonstration



The Kraft Demonstration Project to be completed Fall 2012



Midwaters

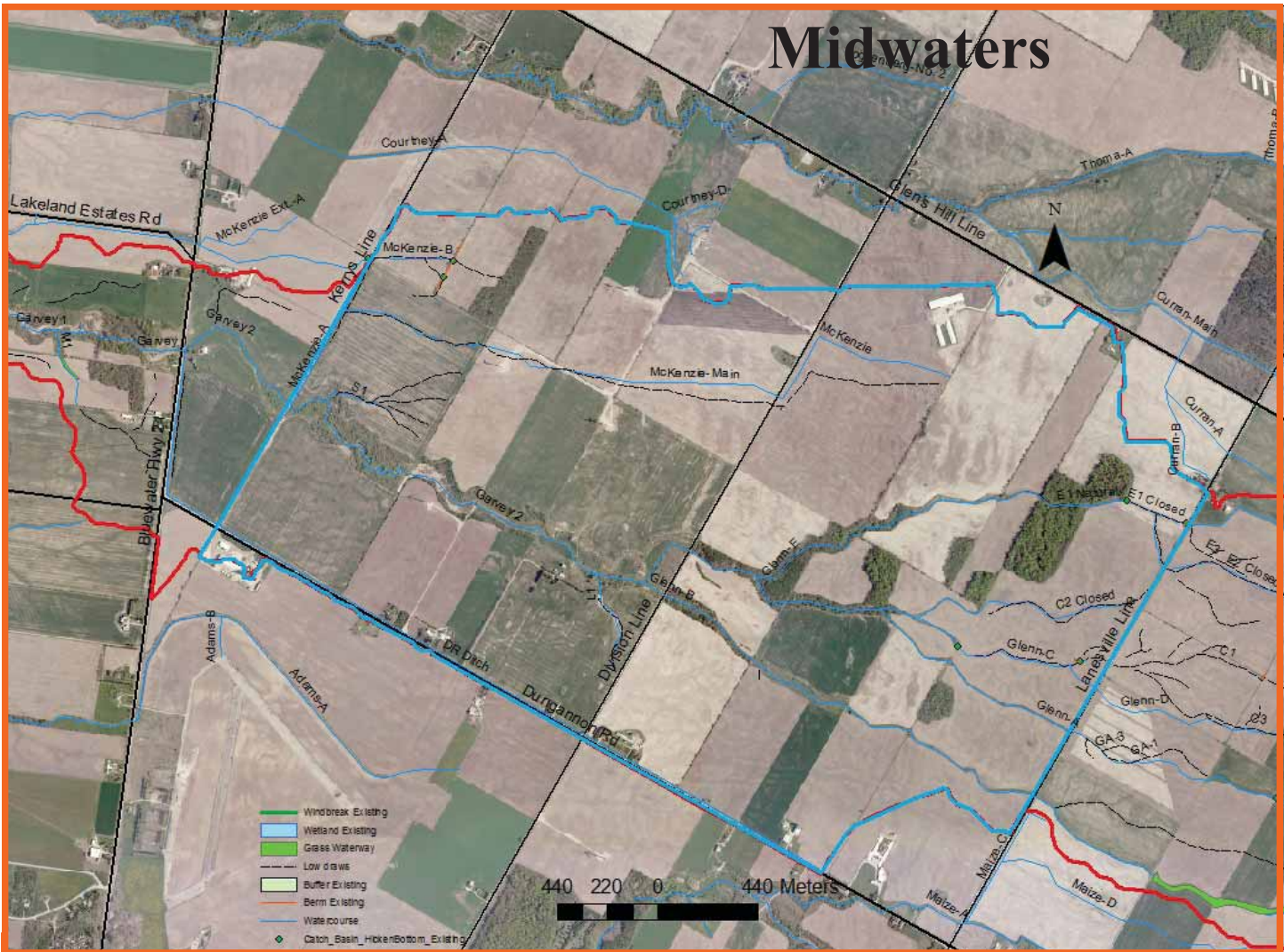
It will be important to allow water to quickly drain away from the midwaters before the water from the upstream headwaters reaches the area. This will reduce the erosive power of the storm water both here and downstream. It is important to note that any reduction in the erosive power of storm water here should have a positive benefit downstream in the lower Garvey/Glenn



Projects for the midwaters will mostly be characterized as plantings and buffers. There is need of some berms (14 in all) to slow the erosion of some low draws; however moving water out of this area before the stored waters in the headwaters arrive is important to reduce peak flows and the erosive power that accompanies them. The use of grass waterways designed to decrease erosion and filter out sediments while still quickly emptying into a watercourse will also be important. Windbreaks and watercourse buffers throughout the midwaters will also trap moving sediment and reduce wind erosion throughout this section of the Garvey/Glenn. Storm water management for the area will be further developed in the Storm Water Management Project.



Midwaters



Goals for the Midwaters

- To reduce infield and bank erosion
- Increase storm water ability to clear the system ahead of headwaters.
- Tree planting for erosion reduction bank stabilization and habitat creation



Midwaters Final Plan

Midwaters Final Plan

Legend:

- Berm Proposed
- Windbreak Proposed
- Windbreak Existing
- Wetland Proposed
- Wetland Existing
- Grass Waterway Proposed
- Grass Waterway Existing
- Low draws
- Crossing Proposed
- Buffer Proposed
- Buffer Existing
- Block Planting Proposed
- Berm Existing
- Watercourse
- Catch_Basin_HickenBottom_Existing
- Catch_Basin_HickenBottom_Proposed

Map Labels:

- Lakeland Estates Rd
- Bluewater Hwy
- Adams-B
- Garvey1
- Garvey2
- McKenzie Ext-A
- McKenzie-B
- McKenzie
- McKenzie-Main
- Garvey2
- Glenn-B
- Glenn-C
- Glenn-D
- Glenn-E
- Glenn-F
- Glenn-G
- Glenn-H
- Glenn-I
- Glenn-J
- Glenn-K
- Glenn-L
- Glenn-M
- Glenn-N
- Glenn-O
- Glenn-P
- Glenn-Q
- Glenn-R
- Glenn-S
- Glenn-T
- Glenn-U
- Glenn-V
- Glenn-W
- Glenn-X
- Glenn-Y
- Glenn-Z
- Glenn-AA
- Glenn-AB
- Glenn-AC
- Glenn-AD
- Glenn-AE
- Glenn-AF
- Glenn-AG
- Glenn-AH
- Glenn-AI
- Glenn-AJ
- Glenn-AK
- Glenn-AL
- Glenn-AM
- Glenn-AN
- Glenn-AO
- Glenn-AP
- Glenn-AQ
- Glenn-AR
- Glenn-AS
- Glenn-AT
- Glenn-AU
- Glenn-AV
- Glenn-AW
- Glenn-AX
- Glenn-AY
- Glenn-AZ
- Glenn-BA
- Glenn-BB
- Glenn-BC
- Glenn-BD
- Glenn-BE
- Glenn-BF
- Glenn-BG
- Glenn-BH
- Glenn-BI
- Glenn-BJ
- Glenn-BK
- Glenn-BL
- Glenn-BM
- Glenn-BN
- Glenn-BO
- Glenn-BP
- Glenn-BQ
- Glenn-BR
- Glenn-BS
- Glenn-BT
- Glenn-BU
- Glenn-BV
- Glenn-BW
- Glenn-BX
- Glenn-BY
- Glenn-BZ
- Glenn-CA
- Glenn-CB
- Glenn-CC
- Glenn-CD
- Glenn-CE
- Glenn-CF
- Glenn-CG
- Glenn-CH
- Glenn-CI
- Glenn-CJ
- Glenn-CK
- Glenn-CL
- Glenn-CM
- Glenn-CN
- Glenn-CO
- Glenn-CP
- Glenn-CQ
- Glenn-CR
- Glenn-CS
- Glenn-CT
- Glenn-CU
- Glenn-CV
- Glenn-CW
- Glenn-CX
- Glenn-CY
- Glenn-CZ
- Glenn-DA
- Glenn-DB
- Glenn-DC
- Glenn-DD
- Glenn-DE
- Glenn-DF
- Glenn-DG
- Glenn-DH
- Glenn-DI
- Glenn-DJ
- Glenn-DK
- Glenn-DL
- Glenn-DM
- Glenn-DN
- Glenn-DO
- Glenn-DP
- Glenn-DQ
- Glenn-DR
- Glenn-DS
- Glenn-DT
- Glenn-DU
- Glenn-DV
- Glenn-DW
- Glenn-DX
- Glenn-DY
- Glenn-DZ
- Glenn-EA
- Glenn-EB
- Glenn-EC
- Glenn-ED
- Glenn-EE
- Glenn-EF
- Glenn-EG
- Glenn-EH
- Glenn-EI
- Glenn-EJ
- Glenn-EK
- Glenn-EL
- Glenn-EM
- Glenn-EN
- Glenn-EO
- Glenn-EP
- Glenn-EQ
- Glenn-ER
- Glenn-ES
- Glenn-ET
- Glenn-EU
- Glenn-EV
- Glenn-EW
- Glenn-EX
- Glenn-EY
- Glenn-EZ
- Glenn-FA
- Glenn-FB
- Glenn-FC
- Glenn-FD
- Glenn-FE
- Glenn-FG
- Glenn-FH
- Glenn-FI
- Glenn-FJ
- Glenn-FK
- Glenn-FL
- Glenn-FM
- Glenn-FN
- Glenn-FO
- Glenn-FP
- Glenn-FQ
- Glenn-FR
- Glenn-FS
- Glenn-FT
- Glenn-FU
- Glenn-FV
- Glenn-FW
- Glenn-FX
- Glenn-FY
- Glenn-FZ
- Glenn-GA
- Glenn-GB
- Glenn-GC
- Glenn-GD
- Glenn-GE
- Glenn-GF
- Glenn-GG
- Glenn-GH
- Glenn-GI
- Glenn-GJ
- Glenn-GK
- Glenn-GL
- Glenn-GM
- Glenn-GN
- Glenn-GO
- Glenn-GP
- Glenn-GQ
- Glenn-GR
- Glenn-GS
- Glenn-GT
- Glenn-GU
- Glenn-GV
- Glenn-GW
- Glenn-GX
- Glenn-GY
- Glenn-GZ
- Glenn-HA
- Glenn-HB
- Glenn-HC
- Glenn-HD
- Glenn-HE
- Glenn-HF
- Glenn-HG
- Glenn-HH
- Glenn-HI
- Glenn-HJ
- Glenn-HK
- Glenn-HL
- Glenn-HM
- Glenn-HN
- Glenn-HO
- Glenn-HP
- Glenn-HQ
- Glenn-HR
- Glenn-HS
- Glenn-HT
- Glenn-HU
- Glenn-HV
- Glenn-HW
- Glenn-HX
- Glenn-HY
- Glenn-HZ
- Glenn-IA
- Glenn-IB
- Glenn-IC
- Glenn-ID
- Glenn-IE
- Glenn-IF
- Glenn-IG
- Glenn-IH
- Glenn-II
- Glenn-IJ
- Glenn-IK
- Glenn-IL
- Glenn-IM
- Glenn-IN
- Glenn-IO
- Glenn-IP
- Glenn-IQ
- Glenn-IR
- Glenn-IS
- Glenn-IT
- Glenn-IU
- Glenn-IV
- Glenn-IW
- Glenn-IX
- Glenn-IY
- Glenn-IZ
- Glenn-JA
- Glenn-JB
- Glenn-JC
- Glenn-JD
- Glenn-JE
- Glenn-JF
- Glenn-JG
- Glenn-JH
- Glenn-JI
- Glenn-JJ
- Glenn-JK
- Glenn-JL
- Glenn-JM
- Glenn-JN
- Glenn-JO
- Glenn-JP
- Glenn-JQ
- Glenn-JR
- Glenn-JS
- Glenn-JT
- Glenn-JU
- Glenn-JV
- Glenn-JW
- Glenn-JX
- Glenn-JY
- Glenn-JZ
- Glenn-KA
- Glenn-KB
- Glenn-KC
- Glenn-KD
- Glenn-KE
- Glenn-KF
- Glenn-KG
- Glenn-KH
- Glenn-KI
- Glenn-KJ
- Glenn-KK
- Glenn-KL
- Glenn-KM
- Glenn-KN
- Glenn-KO
- Glenn-KP
- Glenn-KQ
- Glenn-KR
- Glenn-KS
- Glenn-KT
- Glenn-KU
- Glenn-KV
- Glenn-KW
- Glenn-KX
- Glenn-KY
- Glenn-KZ
- Glenn-LA
- Glenn-LB
- Glenn-LC
- Glenn-LD
- Glenn-LE
- Glenn-LF
- Glenn-LG
- Glenn-LH
- Glenn-LI
- Glenn-LJ
- Glenn-LK
- Glenn-LL
- Glenn-LM
- Glenn-LN
- Glenn-LO
- Glenn-LP
- Glenn-LQ
- Glenn-LR
- Glenn-LS
- Glenn-LT
- Glenn-LU
- Glenn-LV
- Glenn-LW
- Glenn-LX
- Glenn-LY
- Glenn-LZ
- Glenn-MA
- Glenn-MB
- Glenn-MC
- Glenn-MD
- Glenn-ME
- Glenn-MF
- Glenn-MG
- Glenn-MH
- Glenn-MI
- Glenn-MJ
- Glenn-MK
- Glenn-ML
- Glenn-MM
- Glenn-MN
- Glenn-MO
- Glenn-MP
- Glenn-MQ
- Glenn-MR
- Glenn-MS
- Glenn-MT
- Glenn-MU
- Glenn-MV
- Glenn-MW
- Glenn-MX
- Glenn-MY
- Glenn-MZ
- Glenn-NA
- Glenn-NB
- Glenn-NC
- Glenn-ND
- Glenn-NE
- Glenn-NF
- Glenn-NG
- Glenn-NH
- Glenn-NI
- Glenn-NJ
- Glenn-NK
- Glenn-NL
- Glenn-NM
- Glenn-NN
- Glenn-NO
- Glenn-NP

Overall Plan for Midwaters

Properly designed and constructed berms and improved crossings are the two most expensive items in the plans for the midwaters of the Garvey Glenn, with the need for 11 improved crossings costing an estimated \$141,000 (see areas 3 and 4 in final budget estimates on page 27). The 14 berms needed to slow water and hold soil on the land have a combined cost estimate of \$94,000.

Wind breaks, the construction of grassed waterways, and bank stabilization make up the bulk of the rest of the \$756,750 estimated cost of the Garvey Glenn midwater budget.

If the plan for the midwaters could be achieved, it would greatly reduce erosion and soil loss through this section of the Garvey/Glenn. Planting trees could also create habitat and corridors for wildlife. Any reduction in the erosive force of storm waters here would positively impact gully reduction efforts in the lower Garvey/Glenn portion of the watershed.

Cropping and tillage targets will be obtained through the proposed Nutrient Management Project. Costs may come down if landowners do not approve of some projects in the plan.

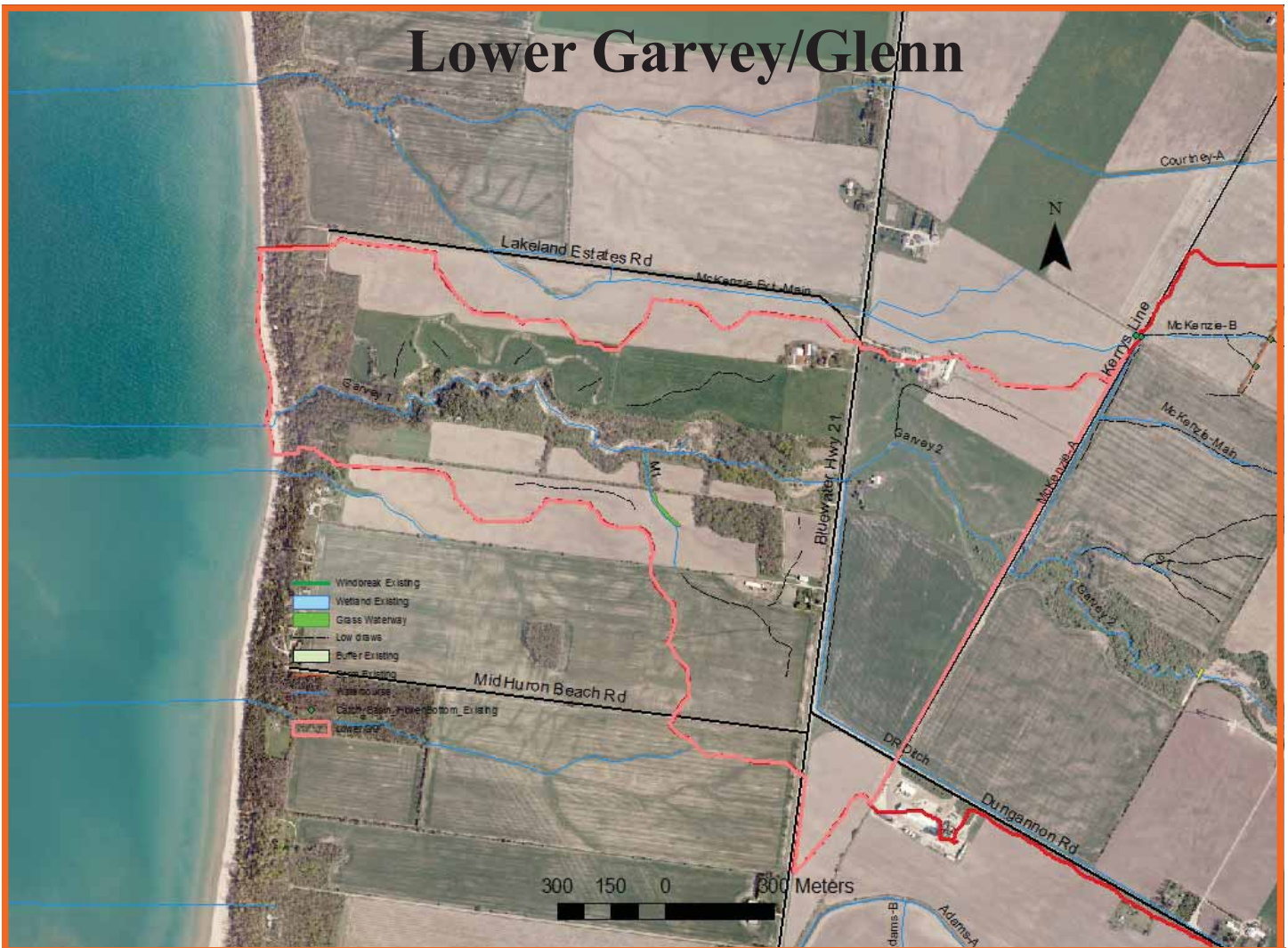
Lower Garvey/Glenn

Ever expanding gullies are a major issue all along the eastern shore of Lake Huron. There are over 130 gullies in the Maitland Valley Conservation Authorities jurisdiction, and the mouth of the Garvey/Glenn is a major one which may soon threaten Highway 21.



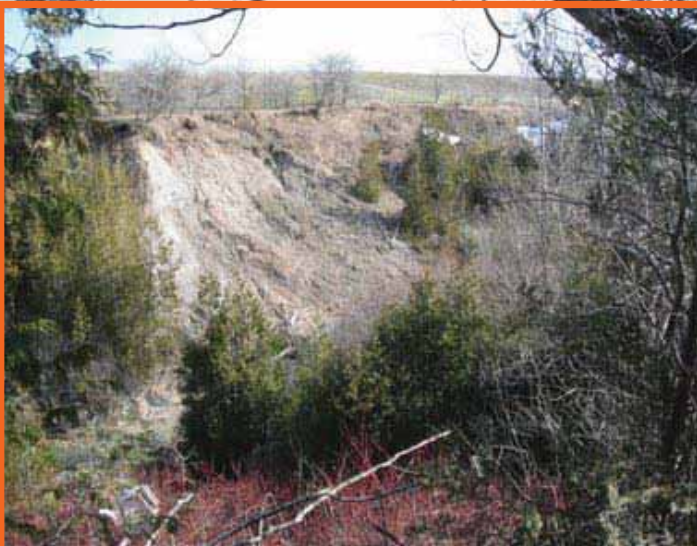
The largest undertaking in the gully area of the watershed is tree planting along the gully as bioremediation. Buffer Plantings along the gully should reduce further erosion along the banks as roots hold soil in place and reduce the force of peak waters along the banks. A few berms along low draws in the area will also help reduce erosion in the fields. The total for the work in the lower Garvey/Glenn is an estimated \$471,000. This area may seem to be of lowest priority in the watershed approach, but any work upstream should positively impact what happens in the lower reaches, reducing erosion and associated costs here.





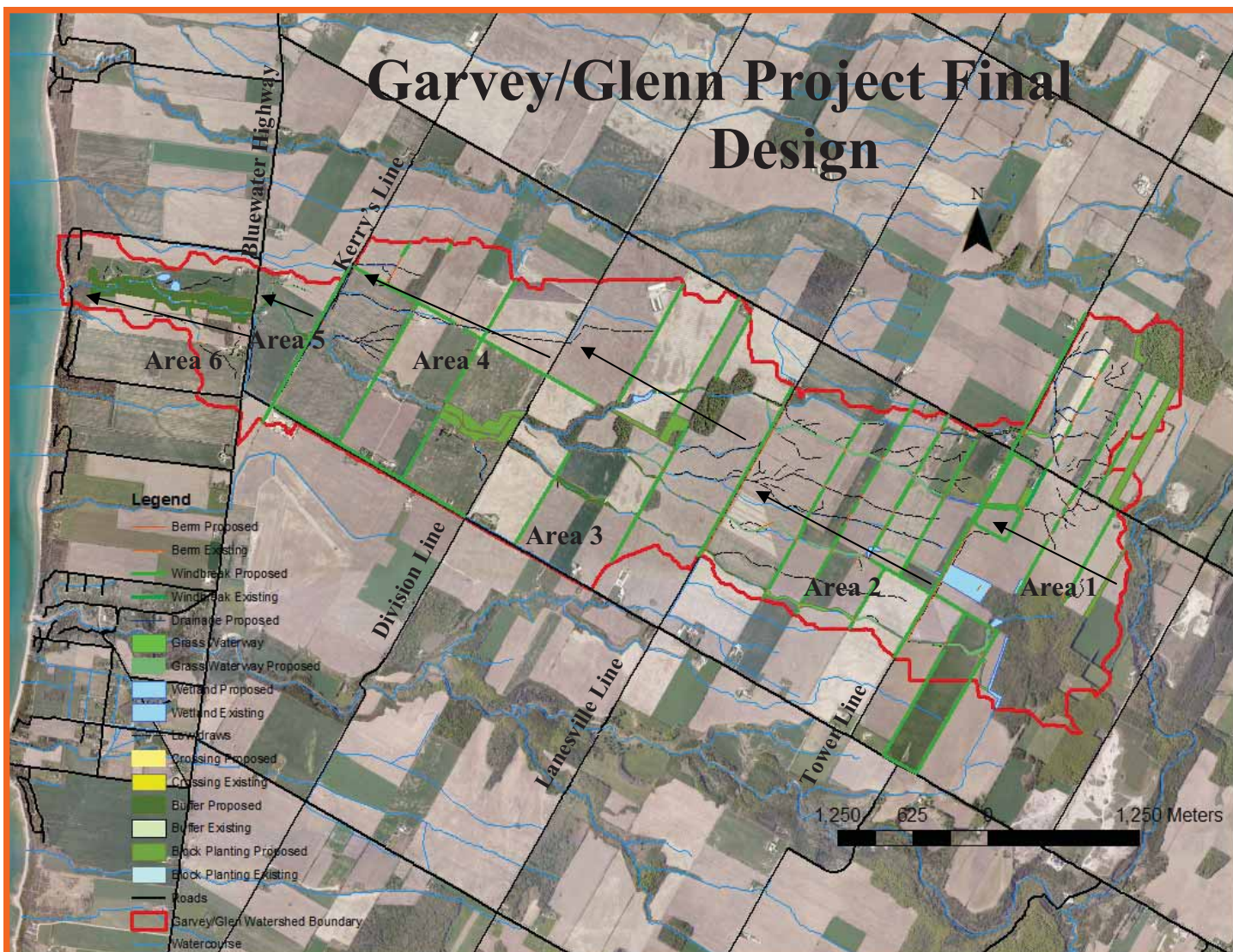
Goals for the Lower Garvey/Glenn

- Slow the growth of the gully
- Increase storm water ability to clear the system ahead of waters coming from upstream
- Tree planting for erosion reduction, habitat creation and bank stabilization
- Infield erosion reduction using erosion control berms
- Reduced nutrient introduction through improved septic systems



Garvey/Glenn Final Design





Budgets

The budget on the next page represents estimated costs if all the necessary work in the Garvey/Glenn were to happen. This budget may change based on landowner willingness for each project. Area 1 refers to the area east of Tower Line. Area 2 is the area between Tower Line and Lanesville Line. These two are considered the headwaters. The area between Lanesville Line and Division line is referred to as Area 3. Division Line west to Kerry's Line is Area 4. Areas 3 and 4 are the Midwaters. Area 5 is west of Kerry's line to Bluewater highway. Area 6 (Bluewater west to lake including the shoreline community) combined with Area 5 is considered the Lower Garvey/Glenn.

The budget estimates are also broke down into categories which include the cost of any work to be done, as well as the possible PEGS funding to take marginal land out of production for use in storm water management.

Costs may come down if landowners do not approve of some projects in the plan.

Shoreline Project BMP		Headwaters		Midwaters		Lower Garvey/Glenn	
Resilient Watershed - SWEEP Plan		Headwaters 1	Area 2	Area 3	Area 4	Area 5	Area 6
Erosion Berms		18	20	3	11	2	2
Total Cost		160,000	166,500	36,500	58,000	15,000	10,000
Constructed Wetlands		6	3	1	0	0	2
Acres		38.5	8	2			0.5
Total Cost		185,000	50,000	20,000			20,000
PEGS - Alternative Land Use - Wetland		38.5	8	2			0.5
\$250/acre/year/5 years		48,125	10,000	2,500			625
Grassed Waterways		3	3	4	0	1	2
Length		4,612	15,400	7,800		1,600	610
Acres		5	17	8		1	0.3
Total Cost		41,000	108,000	54,600		12,000	4,300
PEGS - Erosion Prone Lands - Grassed Waterway		5	17	8		1	0.3
\$250/acre/year/5 years		6,250	21,250	10,000		1,250	375
Block Plantings		4	1	3	1	0	3
Area Acres		46	4	14	32		10
Total Cost		39,000	4,000	12,000	27,000		9,000
PEGS - Retire Erosion Prone/ Corridors - Block		46	4	14	32	0	10
\$250/acre/year/5 years		57,500	5,000	17,500	40,000		12,500
Watercourse Buffering			3	4	1	1	
Total Feet			9,900	10,900	1,200	2,400	
Total Acres			3	3	1	1	
Total Cost			35,000	39,000	4,200	8,400	
PEGS - Retire Erosion Prone/ Riparian - Buffering			3	3	1	1	
\$250/acre/year/5 years			3,750	3,750	1,250	1,250	
Living Snow Fence Plantings - Feet		20,000	15,000	9,000	4,300	4,500	3,800
Number trees		500	375	225	109	110	95
Total Cost		13,000	9,400	5,700	2,800	2,800	2,400
PEGS - Living Snow Fence - km		6	4.5	1.7	1.3	1.3	0.7
\$3,600/km/10 years		21,600	16,200	6,120	4,680	4,680	2,520
Storm Water Management - Feet		5400	6000	0	0	0	
Total Cost		38,000	28,000				
Windbreaks		8	8	6	5	2	3
Length		27,000	30,000	20,500	26,000	3,300	13,500
Acres		18	20	14	17	2	9
Total Cost		41,000	45,600	31,000	40,000	5,000	20,500
PEGS - Retire Erosion Prone - Windbreaks		18	20	14	17	2	9
\$250/acre/year/5 years		22,500	25,000	17,500	21,250	2,500	11,250
Well Decommission		5	8	5	3	1	8
Total Cost		7,000	10,400	6,500	3,900	1,300	10,400
Well Upgrades		3	5	3	2	1	5
Total Cost		9,000	15,000	9,000	6,000	3,000	15,000
Septic Replacements		2	4	3	1	1	16
Total Cost		26,000	52,000	39,000	13,000	13,000	208,000
Manure Storage Decommission			1	1	1	0	
Total Cost			15,000	15,000	15,000		
Improved Crossing			5	8	3	0	
Total Cost			60,000	96,000	45,000		
Natural Channel Stabilization				1	0		
Length in Feet				900			
Total Cost				45,000			
Gully Stabilization - Bioengineering				8,000			20,000
Clean Water Diversion			7,000				
Total BMP Cost		714,975	687,100	474,670	282,080	70,180	346,870
Total BMP's SWEEP PLAN - Resilient Watershed		2,567,875.00					
Related Administration/ Design		719,005.00	28 %				
Total		3,286,880.00					
3.3 Million							



BMP	Description	Benefits	Estimated Projects	Target Area Re-stored	Estimated Total Costs
Erosion Control Berms	Earthen berm across a natural drainageway to intercept surface runoff, then slowly releasing the ponded runoff	<ul style="list-style-type: none"> • Reduces peak flows, rural storm water management • Removes high % of courser sediments • Filters surface water through French drain outlet if incorporated • Diverts water flow to a less erodible location • Possible wetland • Storage buffers peak flow expected downstream and reduces erosion • Reduces plugging of inlet grates. Ponding allows debris and sediment to settle out 	56	56 berms	\$446,000
Constructed Wetlands	Estimate that over 60% of the wetlands lost in Garvey/Glenn Watershed Controlled drainage structures used to store water on the Landscape. Can store both sub-surface and surface flows.	<ul style="list-style-type: none"> • Filter water • Moderate effects of drought, floods, climate change and erosion. • Offer recreational and learning opportunities • Essential habitat for over 600 species of wildlife. • Captures and stores greenhouse gasses 	12	25 hectares	\$275,000

BMP	Description	Benefits	Estimate d Pro- jects	Target Area Re- stored	Esti- mated Total Costs
Grass water-ways	Broad, shallow vegetative channel Short grass vegetation slows water and reduces erosion	<ul style="list-style-type: none"> • Reduce erosion caused by large water flows • Safely moves water over fields and draws • Low maintenance costs • Filters some nutrients and sediment • Provides cover for small birds and mammals • Farm equipment can cross 	13	14 ha or 9.4 km	\$219,700
Block Plantings	Trees planted together to form forest cover	<ul style="list-style-type: none"> • Improved water quality and storage • Trees can be viewed as long term economic investment • Improved wildlife habitat • Greenhouse gas storage 	12	43 ha	\$91,000
Water-course Buffering	Vegetative area alongside streams and wetlands	<ul style="list-style-type: none"> • Roots hold soil in place along banks • Filter sediment and nutrients from overland flow before they can enter the water-course • Rate of runoff reduced • Shade create keeps water cool • Wildlife corridors and habitat provided 	9	4 ha Or 7.5km	\$86,600

BMP	Description	Benefits	Estimate d Pro- jects	Target Area Re- stored	Esti- mated Total Costs
Living Snow Fence	Rows of trees or shrubs planting perpendicular to prevailing winds in order to reduce drifting snow	<ul style="list-style-type: none"> • Reduce snow cover on roads and highways • Protect bare soils from erosion • Create wildlife habitat • Esthetic value • Potential income 		17 km	\$36,100
Wind- breaks	A row of trees planted perpendicular to prevailing winds to lessen severity	<ul style="list-style-type: none"> • Reduce soil erosion • Protect/shelter livestock or buildings • Reduce moisture loss from soils • Create wildlife habitat • Esthetic value 		33 ha 17km	\$183,100
Storm Water Manage- ment/ Municipal Roads	Raising roads and putting in appropriate culvert to store water	<ul style="list-style-type: none"> • Slower release of storm water reduces erosive forces 		3.5 km	\$66,000

BMP	Description	Benefits	Estimate d Pro- jects	Target Area Re- stored	Estimate d Total Costs
Natural Channel Stabiliza- tion	stabilization of a eroding stream- bank using native material such as shrubs and trees	<ul style="list-style-type: none"> • Erosion reduction • Reduced sedimentation 	1	274 m	\$45,000
Gully Stabiliza- tion	Using vegetation or man made ma- terials to strengthen gully banks reducing gully growth	<ul style="list-style-type: none"> • Slow gully progress • Reduced sediment loads • Protect property/municipal Structure damage 	1	1067 m	\$28,000

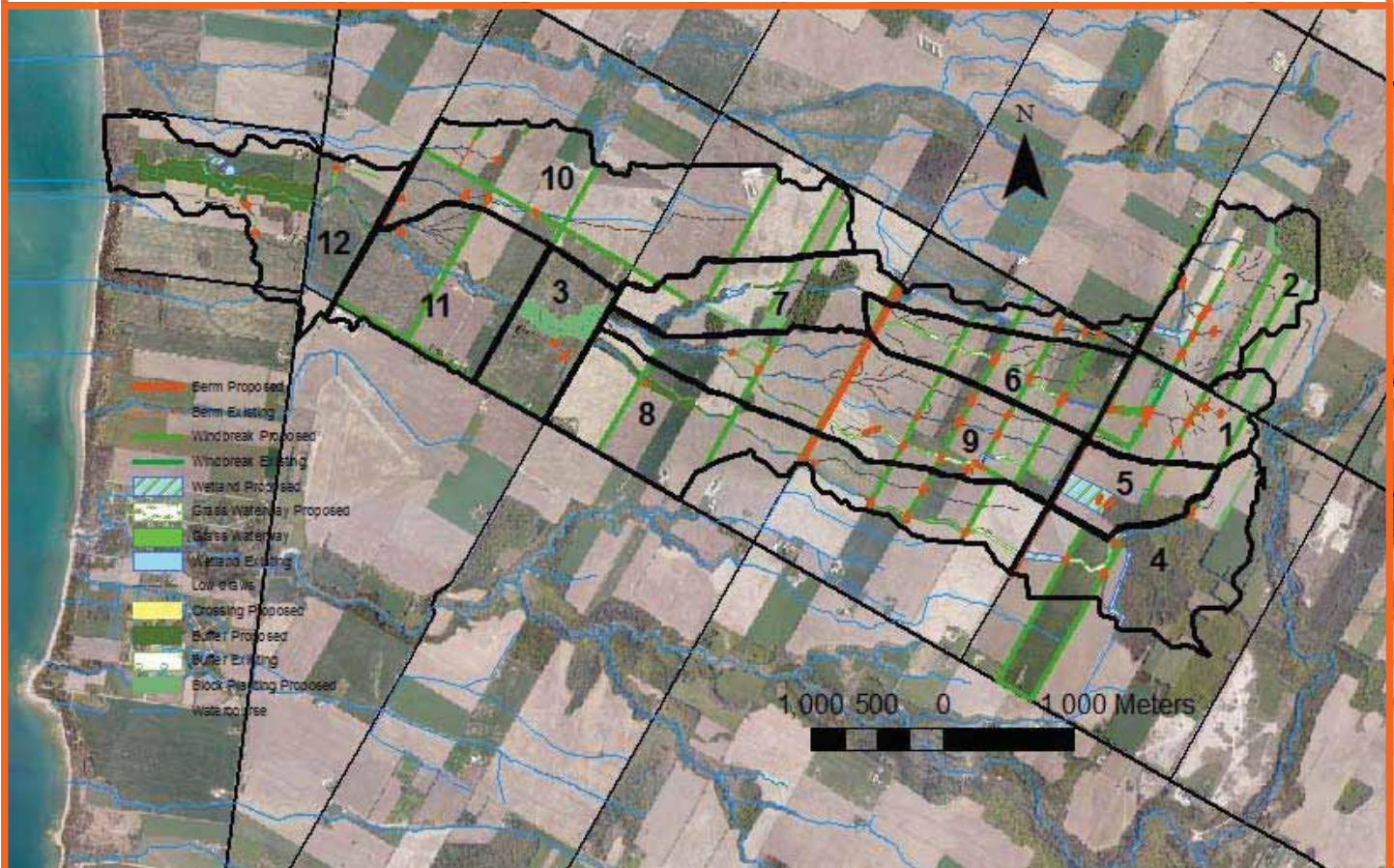


2012-2018

Realistic timelines for the Garvey/Glenn project have been developed. The approach the MVCA is taking to the Garvey/Glenn evolved from concentrating purely on headwaters down toward lower reaches to approaching projects in 12 distinct sub basins. Projects within these sub basins are better approached together from both a practical and economic sense because they have distinct boundaries from each other sub basin, but do not differ within the sub basin.

Each sub basin is represented by a number below and the chart shows timelines for design and construction.

	2012	2013	2014	2015	2016	2017	2018
Design	2,3,4	5,6	7	8,9	10,11	12	
Construction	1	2,3	4,5	6	7	8,9, 10,11	12

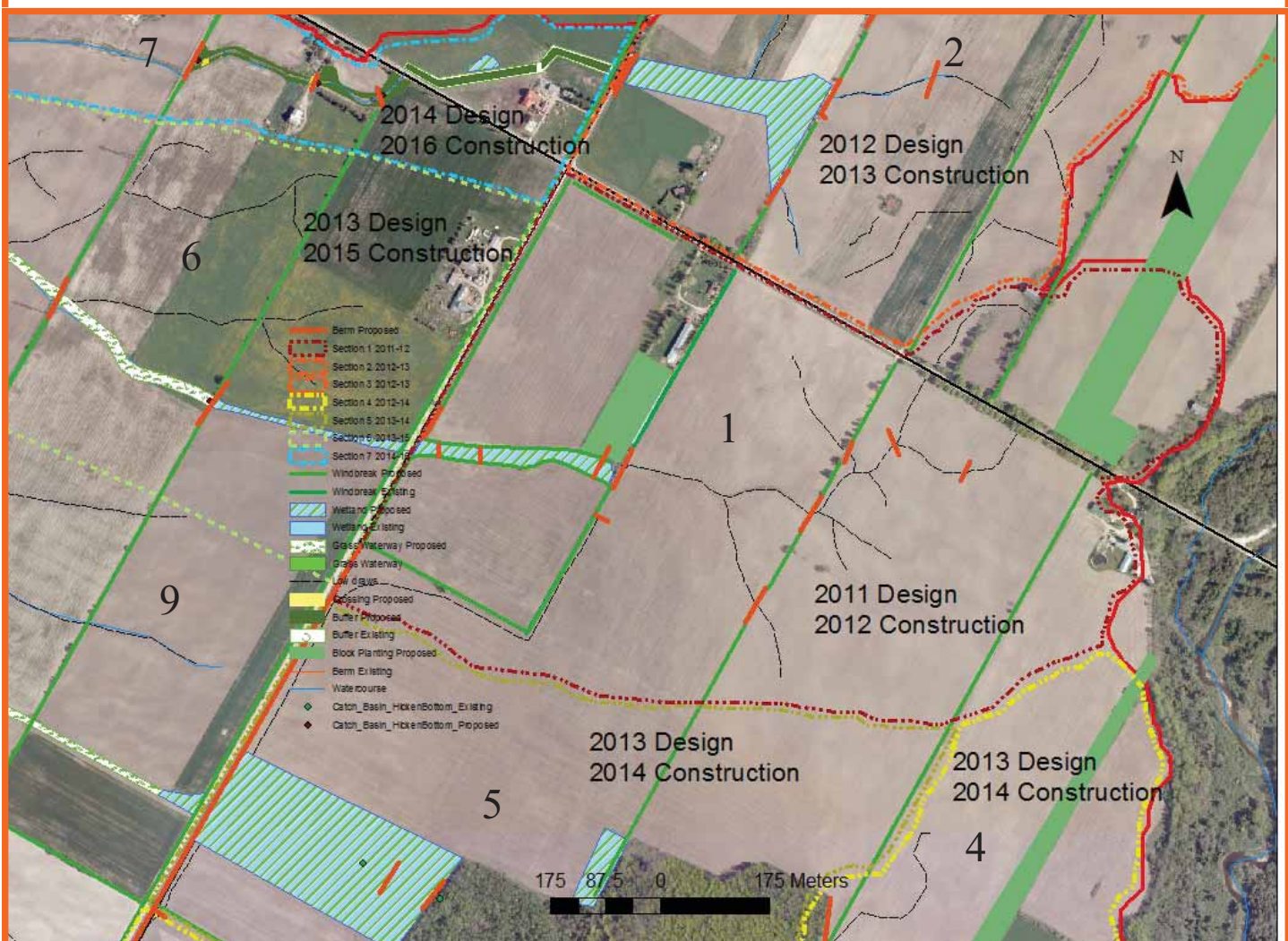


Sub Basin 1 Headwaters

Designs for sub basins 1 of the Garvey/Glenn watershed plan has been altered so the berm section upstream will be completed fall 2012 with the hope of the downstream section being completed in the near future. The breakdown of work to be done is as follows.

Sub basin # 1 is 62.7 ha. The plan will restore 1.4 ha of wetland. Total cost of the projects in sub basin 1 is \$107,000.

BMP	#	Area	Estimated Cost
Berms	5		\$52,000
Wetlands	1	1.4 ha	\$40,500
Wetland Plants	1580		\$7,000
Design			\$5,000
Signage			\$2,000

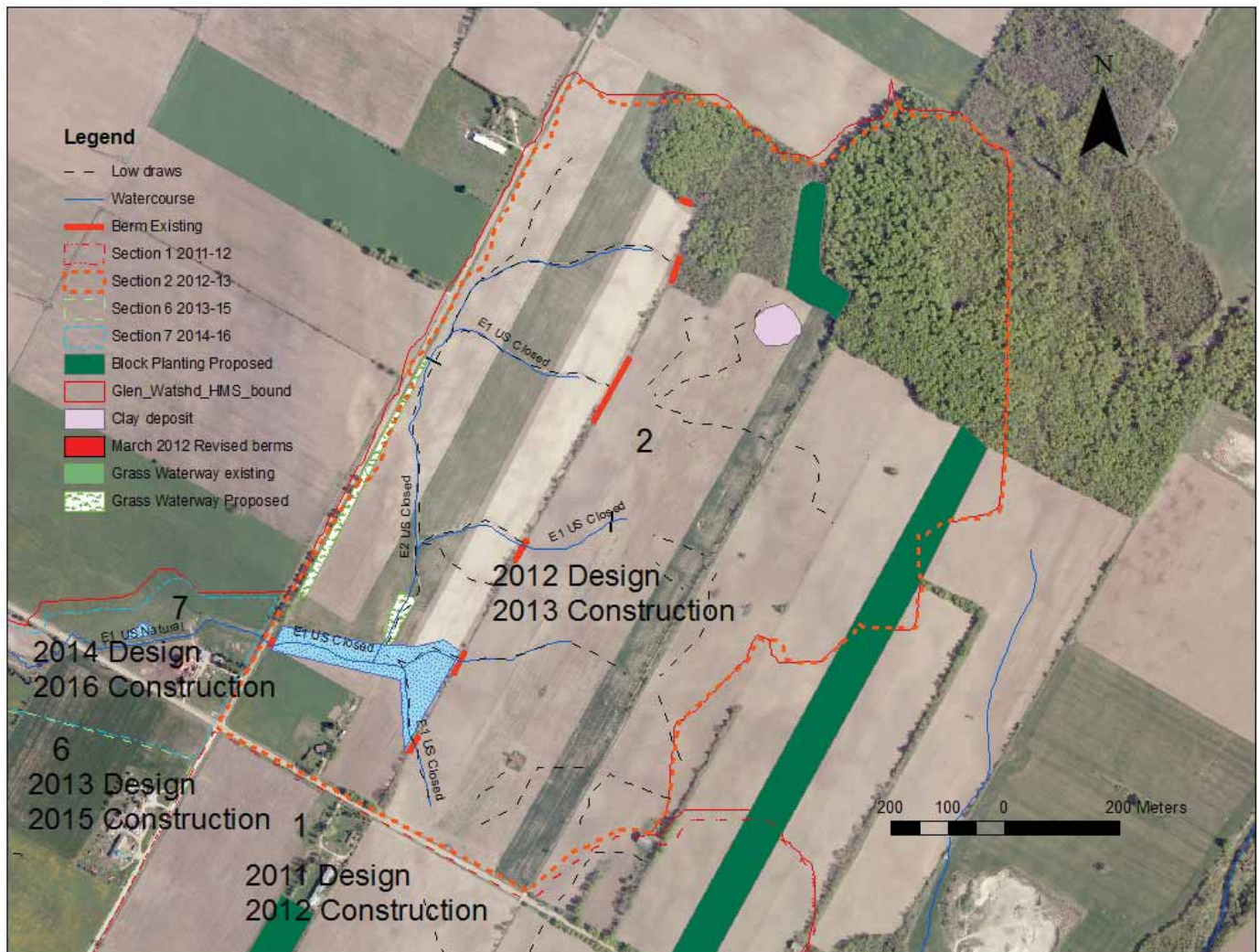


Sub Basin 2 Headwaters

Designs for sub basins 2, of the Garvey/Glenn watershed plan should be completed in 2012 with the construction to be completed in 2013.

Subbasin #2 covers 129.5 ha. The plan will restore 9.7 ha of land including a 0.85 ha wetland. Total cost of project in sub basin 2 is \$185,500

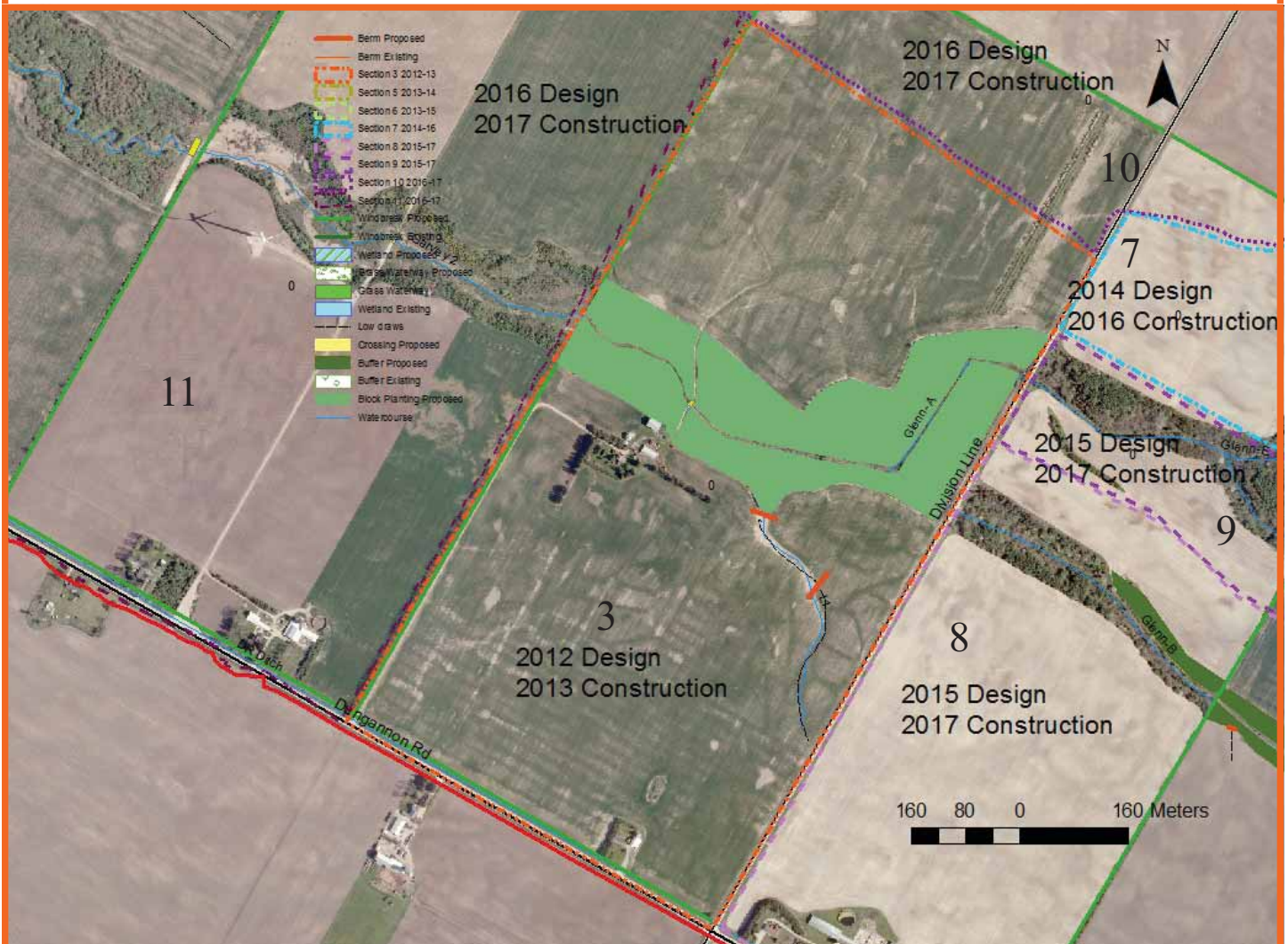
BMP	#	Area	Estimated Cost
Berms	7	7	\$75,000
Wetlands	1	0.85 ha	\$40,000
Grass waterways	2	0.8ha (562 m)	\$15,633
Windbreaks	3	2.4 ha (2713 m)	\$13,500 planting / \$7,500 pegs
Block Plantings	2	6.1 ha	\$13,500 planting/\$19,000 pegs
Design (2012)			\$8,000
Signage			\$2,000



Sub Basin 3 Midwaters

Designs for sub basins 3 of the Garvey/Glenn watershed plan will be completed in 2012 with the construction to begin in 2013. The breakdown of work to be done is as follows. Sub basin # 3 is 66.8 ha. The plan will restore 15.9 ha of forest cover. Total cost in sub basin 3 is \$136,000

BMP	#	Area	Estimated Cost
Berms	2		\$21,000
Block Planting	1	14.2 ha	\$32,000 planting/ \$43,750 pegs
Windbreak	2	1.7 ha/1954 m	\$9,800 planting/ \$54,00 pegs
Stormwater mgnt	1	89 m	\$2,000
Crossing improvement	1		\$15,000
Design (2012)			\$5,000
Signage			\$2,000

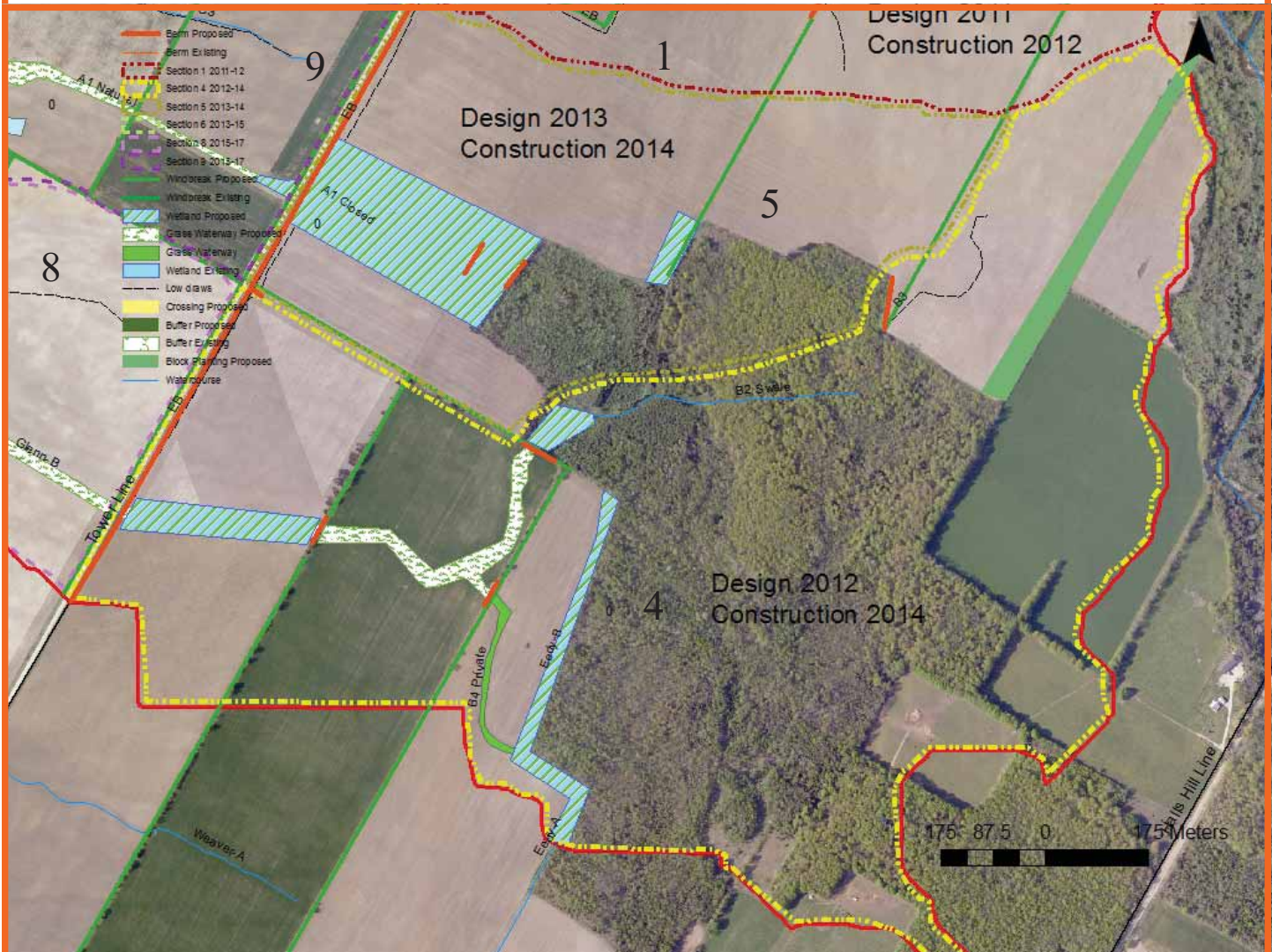


Sub Basin 4 Headwaters

Designs for sub basins 4 of the Garvey/Glenn watershed plan will be completed in 2012 with the construction to begin in 2014. The breakdown of work to be done is as follows.

Sub basin # 4 is 146 ha. Total cost in sub basin 4 is \$193,000

BMP	#	Area	Estimated Cost
Berms	4		\$42,000
Wetlands	3	5.7 ha	\$62,000 construction/ \$13,000 pegs
Windbreak	3	3 ha/ 3,353 m	\$17,000 planting/\$9,500 pegs
Grass Waterways	2	1.8 ha/912.6 m	\$24,000 construction/\$5,700 pegs
Stormwater mgnt	1	609.6 m	\$9,500
Design (2012)			\$8,000
Signage			\$2,000



Sub Basin 5 Headwaters

Designs for sub basin 5 of the Garvey/Glenn watershed plan will be completed in 2013 with the construction to begin in 2014. The breakdown of work to be done is as follows. Sub basin # 3 is 66.8 ha. The plan will restore 15.9 ha of forest cover. Total cost in sub basin 3 is \$148,000

BMP	#	Area (ha)	Estimated Cost
Berms	2	14 ha	\$21,000
Wetlands	2	5.5 ha	\$40,000 construction/\$16,875 pegs
Windbreaks	2	2.5 ha/2,836 m	\$15,000
Block Planting (sub 1)	1	2.6 ha	\$6,000 planting/\$8,000 pegs
Living Snow Fence	1	500 trees	\$13,000
Design (2013)	1		\$6,000
Signage			\$2,000

