



TURTLE TUNNEL PILOT REPORT

- 2022 / 2023 -



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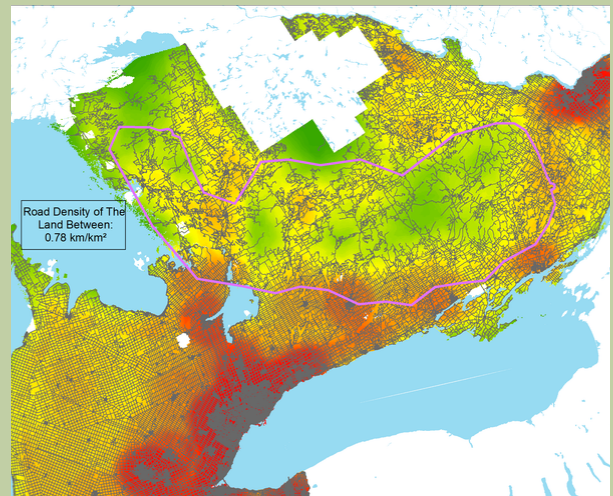
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BACKGROUND- THE NEED FOR MITIGATION

Freshwater turtles in Ontario play essential roles in our living worlds, and provide irreplaceable benefits to our planet, and our health and welfare. Turtles are keystone species, effectively "holding up" entire foodwebs of life. They are the best "janitors and gardeners" of our aquatic habitats, removing sources of pathogens, and spreading seeds as well as cycling nutrients so that lakes and wetlands are viable and thriving areas for fish, wildlife, recreation and potable water supplies. However, turtles are disappearing at alarming rates, with road trauma and mortality being the most serious and prevalent threat to their subsistence and recovery. The long recruitment rate of turtles (an average of more than 30 years) means that adults are essential for stabilizing populations, and losses within the populations are virtually impossible to reverse.

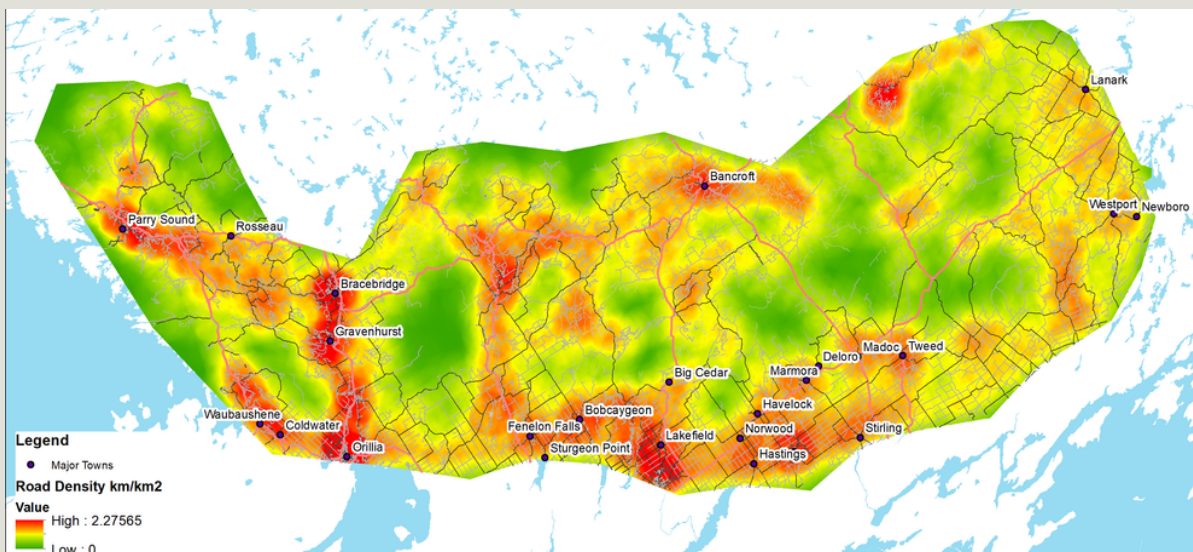
Meanwhile turtles cannot be readily redirected or relocated, and roads are found at an average density of 2 every kilometres within southern Ontario and The Land Between. Therefore, there exist thousands of "hot spots" or zones which need some form of mitigative adaptation. If ecopassages or underpasses are to be successfully used, research indicates that turtles require a degree of "openness" or visibility to the other side of these structures. Therefore, few existing culverts are of a sufficient diameter, coupled with corresponding and often limited lengths to



Picture 1.1 Density of Roadways in Southern Ontario and The Land Between (High to Low)

retrofit these areas as underpasses.

Furthermore, private lands and related features of driveways are barriers to contiguous exclusion fencing opportunities, making many potential efforts redundant. For turtle underpasses to have integrity and be effective each element; an underpass, exclusion fencing, and jump-outs, must be present. Jump-outs are areas that provide points of egress for wildlife that has inadvertently entered the roadway; whether the species is a turtle or a turkey. Additionally the ability for solutions to handle snow loads and freeze thaw is essential. Opaqueness is preferred, to limit the desire and attempts of turtles and other animals to cross along the exclusion areas. Materials chosen should ideally allow drainage along roadsides, or designs entirely should address drainage needs. Finally, installation of solutions needs to ensure that wetland areas are entirely encircled/bounded along the crossing zone, so that animals do not find ways to the roadway and then get "stuck" between fencing (another reason jump outs are essential).



Picture1.2 Road Density of The Land Between

REVIEW OF EXISTING DESIGNS/MATERIALS

Various designs and materials for freshwater turtle ecopassages and to improve road permeability have been tested throughout North America. Despite ongoing efforts and trials, each prototype has had some drawbacks:

- Half cut "big-o" pipes have been used as exclusion fencing in Florida and the highlands of Ontario. The half-pipe is approx 2.5 feet to 3 feet high to limit the ability of snappers to scale the fence. It is "sunk" below grade on the road shoulder and backfilled with the convex side facing the road, to be flush with the roadway, and making the fencing entirely a virtual "ramp" or "jump-out". This design is both effective as an exclusion fence but also provides a sinuous jump-out opportunity for wildlife, making it a failsafe design for inadvertent mortalities. However, these solutions are expensive to install (requiring heavy equipment to maneuver the material); durability is somewhat limited where the PVC that the pipes are made of breaks down in the environment and from solar radiation, and there is the likelihood of the PVC materials contributing to endocrine disruptors/particles in waters; and finally, the fact that the fence is a singular and very long unit, without a footing, has resulted in cumbersome and expensive maintenance requirements as the fencing tends to shift horizontally and also laterally. The inability to "weld" or bond other materials to the fencing to stabilize it can be problematic. The convex/concave design however is strong in terms of withstanding snow loads, if a good footing can be made and bonded to it; and the design as a jump-out solution is marvellous.
- Animex fencing is an easy-to-install and relatively inexpensive (\$40/metre) PVC fabric that is used for exclusion fencing. It is pliable and can be installed by hand. Animex is a vertical fence with a folded "lip" at the top to limit turtles climbing the barrier. Cont'd.



- Animex cont'd: Animex provides a visual barrier as well, which is important to limit attempts and subsequent frustration/confusion of animals. Issues with Animex are that as a vertical fence (although low profile), it lacks necessary drainage solutions required to maintain the integrity of roadways and road shoulders, and it cannot withstand snowloads. Therefore, placement of this fencing is best where culverts extend far beyond road shoulders and therefore snow loads. Animex's pliability, however, makes it a good solution for connecting other materials.
- Other designs use wire fencing and posts of various materials, which are durable and provide drainage, however they don't provide visual barriers and are easily scaled by turtles, snakes and other animals. At times turtles can get "stuck" while climbing these fences. Additionally, typical steel fencing rusts, especially when placed in water/wetlands that are dissected by or abut roadways, and which are the preferred crossing sites of many turtles.
- Some very effective low level walls have been tested in the USA with good results, however these are usually costly and therefore prohibitive

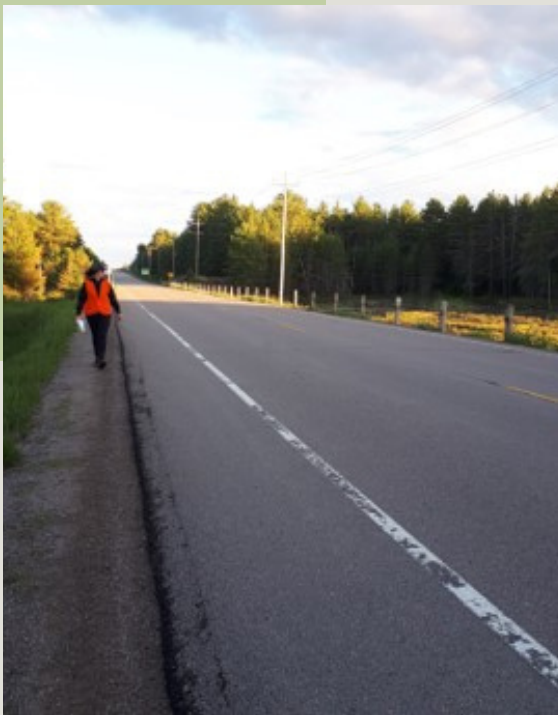


- Round pipe jump outs have been used in projects along Highway 69 in Ontario. These round pipes are placed perpendicular to fencing, The "butt" end/opening facing the marsh/opposite the road is raised to ensure that wildlife cannot enter the roadway from the abutting habitats, while the front end is an entrance that is flush with the roadways to allow animals to enter the "tunnel" and therefore exit the road. This design is effective, however it has proven to be unstable as the back end of the tunnel is not supported sufficiently and often falls to ground level making the tunnel an opening for animals getting onto the road and thereby making all other exclusion areas redundant.

Installations may be successful at first but often maintenance is neglected, meanwhile annual reconnaissance of ecopassages often reveal weaknesses in the design as well as upkeep required and related unforeseen costs.

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PROJECT OUTLINE

The goals of this project are to use features and elements that are known to work (such as half-pipes) and create new, sturdier prototypes for testing, which can be used in both fencing and jump-outs, in order to test their effectiveness both immediately and in the long term. Additionally, the project aims to use materials that are touted as effective against turtles' (and snakes') abilities to climb, and use these materials in new and innovative ways to limit their weaknesses. Essentially, the project will use mixed media to find adaptable solutions to road mortality.

Pilot sites will use mixed approaches to find adaptive solutions. Two initial phases, sites and approaches. Additional sites have been identified beyond these for implementing proven techniques.

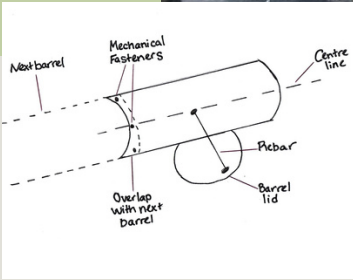
Methodology

The project begins by modelling "hot-spots" for potential ecopassages. GIS models highlight both potential (based on existing culverts and/or watercourses that cross roads, and areas where the road dissects wetlands) and then priority (calibrated by and based on Threatened and Endangered species presence and number counts). Numbers of turtles dead on the road are also used to assess need and priority. To truth the sites, Google Earth is used as a first remote assessment, and then in-field site reconnaissance is completed to ascertain barriers to implementation and to verify results related to priority (where turtle shell fragments are often very visible and prevalent).

Pilot Sites

Three project areas have been chosen where mortality rates are high and where existing partnerships are in place with Road Departments. Site reconnaissance in each of Muskoka, Haliburton and Peterborough County have revealed an average of 45 priority sites and 100 feasible sites per municipality.

Site reconnaissance has shown which sites are both a priority and have limited obstacles/high feasibility to implement solutions. Final selections, however, were made in consultation with Road Departments. One site in Haliburton, and one in Peterborough were selected for these trials. The sites are: Yellow Rock Road in Haliburton, Nassau Mills Road in Peterborough. A third site in Haliburton will be chosen from 7 options in Phase 3.



PHASE 1

2021-2022

Jump-out/Exclusion Barrels and Nassau Mills Design

Note: After modelling and reconnaissance are complete and site selections have been made, Road Occupancy Permits are obtained from municipalities for the infrastructure including signage.

Site A: To begin testing, we designed exclusion/jump-out sections that could be used entirely within a project (connected to underpasses) or as sections for jump outs.

Designs were vied through civil and road engineers. Food grade steel barrels were obtained from SoSoya in Toronto, and shipped by donation by Mercer Trucking. Lids and bottoms were removed using plasma cutters, and barrels were cut in half as well.

Lids/bottoms were welded to create a footing for the half-pipe structure.

Barrels were painted with rust-proof paint to increase resistance to salt and water exposure (rust and longevity of the structure is a suspected weakness in the design).

Jump out sections were installed at Yellow Rock Road to test durability in late 2021. Reconnaissance in 2022 revealed that jump outs were stable and had not shifted. Surprisingly little rust was present in this first year.

Sites B and C: Designs will be used at Highway 21 (exact site TBD) and Nassau Mills sites to test as nesting site exclusion fencing in conjunction with nesting mounds in 2023.

Presentations of the design were made to engineering firms in 2022 with success, where steel and rubber coated production of designs will commence.

Nassau Mills Road is a complex site that was chosen by the County Road Department as a focus area,. Volunteer recruitment occurred in order to gather data for nesting and hatchling activity, turtle migration and general presence/absence hotspot mapping. A draft mitigation plan and program which included ecopassage placements and related infrastructure was drafted.

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movements of the fence and posts, and also to snow plows and loads.

Stewardship Rangers and Conservation Corp Volunteers helped staff install fencing.

Nassau Mills: Reconnaissance and planning revealed that mitigation infrastructure could not commence and would be undermined, unless a larger culvert could be installed at Sawyer Creek Road to ensure an ecopassage was available and the remaining wetlands could be fenced in effectively. The proposal was delivered to partners (Peterborough County, Otonabee Conservation Authority, and Trent Severn Waterway) for approval. Funding submissions to Ontario Infrastructure Granters were made to support the cost of the culvert. Immediate and ongoing mitigation therefore included increased patrolling at the site by volunteers and staff. Outreach and awareness are equally important as mitigation tools, especially at sites with a high recreational value and a multi-use trail supporting cyclists and tourism. Therefore, permanent signs were designed to bound the Nassau Mills site as a "wildlife zone", and were passed to the committee of partners for approval.

Site C: Approvals for Highway 21 installation of nesting exclusion/jump out barrels are underway.

All sites: Billboard signs were designed and secured at high mortality zones within the pilot areas.

PHASE 2

2022-2023

ERTEC Exclusion Fencing Testing

Site A: Ertec fencing was procured and installed at Yellow Rock Road. Fencing was not tied into the underpasses or jump out features as we wanted to estimate how resilient it would be in the winter with snow loads and cold temperatures which could make the PVC material brittle. Ertec fencing is made as a temporary silt fence solution, however representatives have tested it for turtle ecopassage sites and have touted its success. Specifications were therefore too weak for durability at our site, and our team doubled the post spacing to add strength to the system. However, the Yellow Rock Road ecopassage site has very little room to install fencing within the road shoulders and adjacent wetlands, and the shoulders are entirely sand, making the installation vulnerable to erosion,

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PHASE 3

2023-24

Adaptive Management

Site A: Early signs of structural weakness in the Ertec fencing have appeared, where cold weather has shown the material to be too brittle and easily breakable; or where the fence has broken free from the posts. This is concerning given the proximity to the road shoulder and therefore snow loads and plows.

Adaptive management options, depending on how durable the material is over the winter entirely / how many weak points are revealed, would be:

1) Include horizontal bracing beyond wires, of 2x4 wood planks to effectively frame the material and give it more structural tenacity.

2) Alternatively, a regular chain link fence can be installed with Ertec or Animex fencing on the leeward/habitat side. The use of Ertec/Animex in addition to chain link fencing ensures the benefits of the materials' smoothness are available to prevent turtles from climbing the fence, while adding a second layer of more durable and porous material to encounter the snow loads and plows.

Should Ertec fencing be entirely weak and the latter retrofit be necessary, Animex fencing would be the preferred solution as this material is opaque as well as slippery, to prevent both attempts and success of turtles climbing the fence.

3) Entirely fencing the site with the jump-out barrels which are already made and proven effective.

Site B: Culvert replacement, and installation of barrel fencing and/or concrete/brick low walls, along the causeway. All barrels have been prepared and new prototypes are available with rubberized coating.

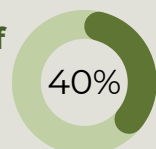
Site C: Road Occupancy Permit and barrel fencing installation in 2023, with alternative/improved nesting area on either side of the road.

All sites: continue with intensity of volunteer efforts and patrols. Increase signage along hotspots.

Status
of Site A



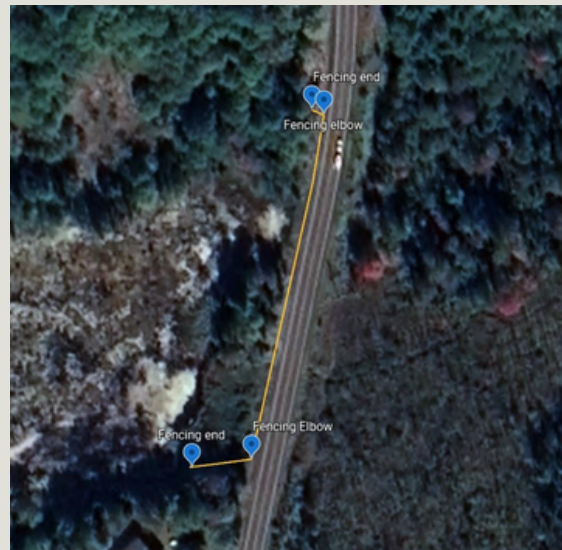
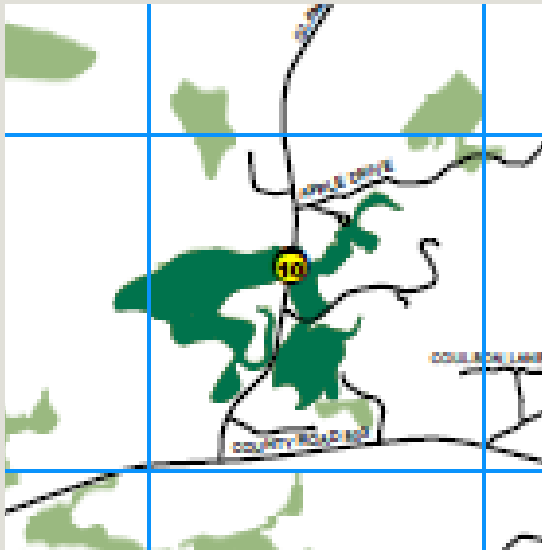
Status of
Site B



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TEST SITES



Site A: Yellow Rock Road



This site is known for high levels of mortality. It is on a main county highway used for travel between the Highlands and Peterborough City. Speed limits are 80km/hour, and many blind corners exist before and after the ecopassage area, giving rise to higher risks for crossing turtles and other wildlife. Two large culverts (2.5ft diameters) exist at the site which are open enough to be viable underpasses. The wetlands on either side are part of municipal lands. Only one impediment/barrier to exclusion requirements exist at Yellow Rock Road, where the wetland borders this side street. Turtles are likely to access the road from this point if the fencing does not encircle the wetland sufficiently at this point; if fencing can be extended down yellow rock road for a minimum of 50 metres, turtles will likely use this point to enter the roadway.. Therefore, sufficient jump outs at regular intervals are necessary along this site to ensure no animals are trapped on the roadway.

Another concern is the nature of the shoulders; erodible medium sand dominates these areas, and wetland basins are immediately adjacent (within 5 metres), leaving very little room to install post fencing such as Ertec; proximity to snow plows and related loads is also a concern.

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TEST SITES



Site B: Nassau Mills Road Mortality Zones, Mitigation Plan and Awareness Sign Prototype

Nassau Mills was a site that was brought forward to us by the Peterborough County Road Department, after a Turtle Guardian volunteer had approached them out of concern about the levels of turtle mortality, and including nesting sites and subsequent hatchling mortality. The site is extensive; a span of more than 2km of crossing and nesting activity occurs on this roadway, with significant areas of causeway and some blind corners. The majority of turtle activity is concentrated around Sawer Creek and two abutting wetland basins. The site entirely abuts the Trent Severn Waterway to the west. Speed limits are 60km/hour, however, the nature of the road as an alternative thoroughfare to Peterborough from northern communities and for industrial transportation means that speeds are often higher than posted. Additionally, the site is a tourist attraction with a pavilion and rest area, including parking areas within the Sawers Creek junction, and parkettes along the Trent Severn Waterway. A rail trail is also used by cyclist, joggers and for walking. The site has 3 connected aquatic habitats of the Waterway and wetland basins, as well as a swath of swamp habitat that runs the course of the roadway to the east. The high traffic, recreational uses, and multiple habitat features in a narrow band make this site complex. Solutions need to be fully integrated and adapted for this site. There are many points of entry for turtles on the roadway, but it is possible to limit activity and consequent mortality as most activity is concentrated. However, at Sawer Creek the culvert between the wetland basins is too small and submerged. Any ecopassage infrastructure would be null if the underpass feature could not be used. Therefore immediate replacement of this culvert is needed before major works commence. However, the nature of the site as a "destination" makes this site a candidate for immediate behaviour change solutions; interpretive signage and volunteer and ambassador presence in high visibility vests will be very effective until more permanent infrastructure retrofits are complete. The site is also near to Trent University; a source of volunteers.

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TEST SITES



Pancake Barn Underpass



Gelert Rd Underpass Retrofit

Site C Options: Highway 21 Boundary Nesting Area

We have identified 7 additional candidate sites in Haliburton, to pilot solutions as early as 2023 (after jump out and vertical fencing solutions have been tested).

One site includes Highway 21 Boundary, where a steep sandy gorge is used by turtles as a nesting site, but not as frequently as a crossing site. The nesting area is in very close proximity to the roadway. Here simple jump out half pipe barrels would allow nesting but restrict turtles from reaching the road base, and would also prohibit cars from "running over" nesting turtles (as has been witnessed in the past).

The Land Between Charity partnered with the Haliburton Land Trust from 2006-2013 to investigate turtle activity and potential sites for mitigating road mortality. A site in Gelert was retrofitted with a half pipe culvert system as an exclusion and jump out eco-passage design in 2014. The project was very successful at first, however major shifting of the infrastructure both laterally and horizontally has meant that maintenance has been cumbersome and costly. Once the Ertec/Animex fencing solution is tested, we will work with the Road Department to apply these solutions within the Gelert site infrastructure to limit maintenance costs while maintaining the eco-passage.

Another candidate is north of the land trust ecopassage, adjacent to the Pancake Barn. Here a similar barrel jump out fencing solution could be easily installed and viable. This site is a lower priority than the other pilot options.

Hastings County and City of Kawartha Lakes have been waiting to see the results of these trials and solutions, and sites in these counties are slated for retrofitting once adaptive and enduring designs are proven.

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BILLBOARDS

placed in high mortality



BUDGETS AND COSTS

Materials: \$32040.00 to date

Labour: \$82500.00 (approx. 50% in-kind donations) to date

Fencing and Jump Outs:

- Barrel fencing materials have cost approximately \$5/metre, as compared to Animex and Ertec at \$10-40/metre.
- Barrel fencing for all sites (and future sites) in sufficient amounts to bound all sites cost \$1800.00 and \$2000.00 for transport.
- Ertec fencing was \$2500.00 for site A.
- Utilities (to support welding, cutting etc) were \$4000.00.
- Posts, concrete, wire, welding wire, rebar and metal braces, screws, and pins for fencing installation at Site A were \$4780.00

Installation costs:

- These were comparatively minimal for barrels and Ertec fencing as hand digging saved on equipment rentals: mini-excavation rentals for 4 days; \$2560.00.
- Plants/rye grasses to secure soils; \$800.00

Signage:

- Active Monitoring board signs, volunteer vests, car signs/decals and Billboards cost \$3900.00 for each of three sites for a total of \$11700.00

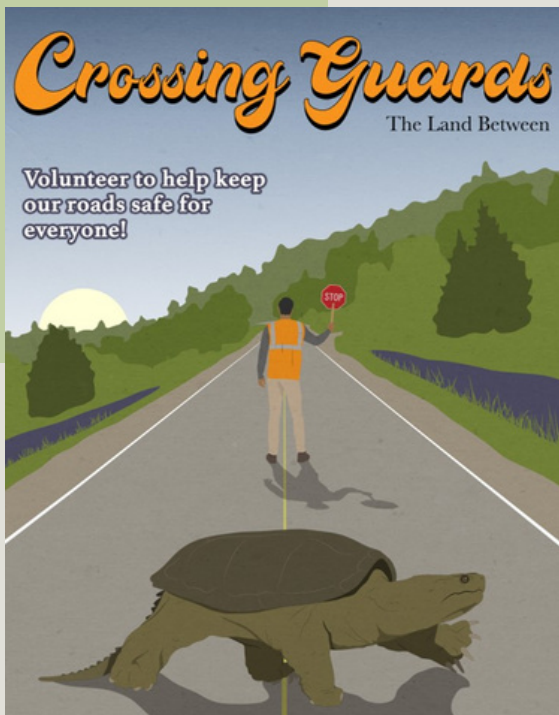
Mileage (higher rates in 2022) at \$6000.00

Note: despite less expensive materials, human hours are high in order to prepare the barrel fencing/jump out materials and to install Ertec fencing. These hours can be born by volunteers as well.

Adjustments and Retrofits are anticipated to cost and additional \$6000.00 in materials (steel fencing and Animex base) as well as cross beams.

Completion of Site B: Costs are estimated up to \$40,000.00 for culvert replacement; additional costs for signage and extended fencing/jump outs.

Completion of Site C: estimated to be minimal / less than Yellow Rock (Site A) Pilot at approx. \$10,000.00 for materials.



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Environnement
Canada

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PARTNERS AND THANKS

We would like to acknowledge and thank all the amazing volunteer "Crossing Guards" who helped raise awareness, leveraged interest and partnerships, monitored, and also directly saved turtles for these efforts.

We would also like to thank our invaluable partners and supporters for helping to advance the science and technology of reptile ecopassages in Ontario through this project as we continue to innovate and test solutions.



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Turtle Tunnel Pilot Report