

BEAVER SOLUTIONS™

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July 22, 2005

Michael Soraghan, Town Engineer
Town Hall
235 North Street
North Reading, MA 01864

Dear Michael,

Thank you for the opportunity to investigate the various beaver issues affecting both residents and town property in North Reading. Since Beaver Solutions has a tremendous amount of experience with long-term, cost-effective flow devices as well as trapping, we are able to recommend the best solution for each individual conflict site, and provide the town with the most comprehensive beaver management plan available.

Beaver damming can quickly cause serious public health and safety issues as well as thousands of dollars of property damage. Therefore it is highly cost effective for towns to have a comprehensive beaver management plan in place. This not only allows for prompt intervention of immediate threats, but also for prioritization for less immediate threats as well as potential beaver problems. This comprehensive assessment of the beaver issues in town should allow North Reading officials to minimize crisis beaver management, and budget your resources in a logical and efficient manner.

Beaver Solutions specializes in resolving human/beaver conflicts. Our highly successful flow devices usually offer the most cost-effective and long-lasting solution to beaver-related flooding problems. Since 1998 we have used flow devices to resolve over 400 beaver problems in five states. Our satisfied customers include town highway, water and conservation departments, State and Federal Agencies, railroads, private businesses and homeowners. Beaver Solutions also performs licensed beaver trapping for those sites where we do not recommend flow devices. See enclosed Beaver Management Study.

Flow devices can generally be classified as either beaver dam pipes or culvert protective fence systems. Pipe systems are often referred to as Pond Levelers as they control the size of a beaver pond to prevent damaging flooding. Specially designed culvert protective fence systems are typically utilized on road culverts to stop beaver damming of the culvert. When properly designed and installed these types of flow devices offer long term protection from beaver damming activity, thereby protecting roads, human health and safety, and saving significant amounts of time and money for years to come. They are also the most humane and environmentally friendly solution available for beaver problems.

Our flow devices are designed to remain effective for many years with minimal maintenance. They are designed to be very low maintenance, but the little maintenance that is required is very important. Culvert protective fences should be cleared of any floated leaves and sticks quarterly so that beavers will not dam against the fence.. Typically this is done after spring runoff, large debris-producing storms, and autumn leaves. Pond Leveler pipes should be inspected annually in the spring for winter ice damage and the pipes adjusted if necessary to ensure the proper pond level.

When this routine maintenance is performed as recommended, our flow devices will remain effective for many years. Since both your satisfaction and our reputation are very important to us, Beaver Solutions offers maintenance plans at a very low cost.

Beaver Management Plan North Reading, MA

Completed July 22, 2005
by Beaver Solutions™

Sites Evaluated

1. Haverhill St. / Foley Dr. / Duane Dr. Area
2. Haverhill Road to Eisenhower Road
3. Martins Brook / Fieldcrest Terrace Dam
4. Martins Brook / Beneventi Culvert
5. Martins Brook / Route 62 Culverts
6. Martins Brook / Berry Rehab. Dam
7. Marblehead Street - NE Power Co. Dam
8. Marblehead Street Culvert
9. 32 Marblehead Street Dam
10. Janice Avenue Drainpipe
11. Orchard St. / Route 62 Intersection
12. Route 62 / Riverside Cemetery Dam
13. Mill Street Bridge Dam
14. Forrest Street Culvert
15. Edgemere Road Culvert
16. a. Eisenhaure Pond Spillway
 b. Eisenhaure / Oscar Rd. Culvert

Town of North Reading

Beaver Conflict Site Assessments

The following site assessments were completed in 2005 and include the list of known conflict sites compiled by Michael Soraghan, Town Engineer. Also included in this comprehensive beaver management plan were other current or potential beaver conflict sites immediately upstream or downstream of these sites which were discovered during the site assessments. Valuable information was also obtained from written public surveys, as well as various discussions with affected residents.

1. Haverhill St./Foley Dr./ Duane Dr. Area

The stream that flows under Haverhill Street towards Duane Drive has been dammed by beavers deep in the wooded area. The resulting water elevation has affected at least 5 homes in this area. The topography is rather flat so a relatively small beaver dam can flood a large area.

Having walked the entire water course in this area I discovered one active beaver dam which is responsible for the current high water level. A Haverhill Road resident reported the existence of smaller dams in this stream, but these were not visible, apparently due to the elevated water level.

The primary problematic dam is located approximately 1/4 mile downstream of Haverhill Road, in a wooded area close to where the stream channel fans out into a marshy area. The dam height was only 20 inches at the time of the assessment, and created a very small and shallow ponded area. The potential for the beavers to raise this dam higher is real.

Unfortunately this dam is too small and the pond too shallow for beaver dam pipes to be effective. The beavers cannot be allowed to raise the height of the dam because human habitation is too low in the floodplain to permit coexistence with a larger beaver pond. In addition, there are many other potential damming spots along the stream which could also become problematic damming sites. Therefore the installation of a pipe system to control the water level would not adequately protect the residents from future beaver related flooding.

For these reasons I recommend that this area be deemed a "No Tolerance Zone" for beavers. I do not feel a long-term solution with flow devices is possible here. Trapping unfortunately will need to be done on an ongoing basis. This area is ideal beaver habitat with an abundance of woody vegetation for beaver food and building materials. It is likely that within a year or two of trapping that new beavers will recolonize this area and the trapping will need to be repeated indefinitely.

Another homeowner on Haverhill Road expressed concern that the beaver dam remnants would create a mosquito breeding problem. While typically shallow water rather than deep water fosters mosquitoes (deeper water has more predators for mosquito

larvae), if desired by the town the dam could be breached to restore a free running stream between Haverhill Road and Duane Drive. See enclosed Estimate for Beaver Solutions to breach all dams along this section of stream.

2. Eisenhauer Road to Haverhill Road

Beavers often dam road culverts because for a relatively small amount of work they can turn the entire road bed into a large dam. For this reason the Eisenhauer Road culvert had been dammed by beavers, and was subsequently protected with a trapezoidal culvert protective fence last year. This device continues to remain effective. However downstream of this culvert is a narrow drainage channel that beavers had also dammed last year. Due to this narrow channel and the proximity of houses, last year I recommended that this be considered a "No Tolerance Area" for beavers.

The Eisenhauer Road stream flows towards Haverhill Road. Apparently beavers have dammed the Haverhill Road culverts in the past, but at the time of the site assessment there was no active damming. Again in this area a Haverhill Road house is close to the stream and cannot tolerate beaver damming. A plugged culvert could quickly cause significant property damage.

Due to homes being low in the floodplain along this stream I recommend that the entire stretch from Eisenhauer Road to Duane Drive be considered a "No Tolerance Zone" for beavers and whenever beavers try to relocate here they be trapped.

The Haverhill culverts could be protected from beaver damming with a properly designed and constructed culvert protective fence, such as the one on Eisenhauer Road. However, I do not feel this is a high priority as the Highway Department seems to be closely monitoring these culverts. However, a cost Estimate can be provided upon request for the culvert protective fence.

3. Martins Brook / Fieldcrest Terrace Dam

The large Flexible Pond Leveler installed over a year ago near Fieldcrest Terrace remains operational. However, since the pipe was installed the beavers stopped working on this dam, so now there are many leaks in the dam. If beavers repair the dam so that water only passes through the pipe, monitoring will need to be done to ensure that the pipe capacity is sufficient to prevent problematic pond level fluctuations following very wet periods. No intervention is needed at this time however.

4. Martins Brook / Beneventi Culvert

This culvert has been dammed by beavers in the past. There is a very high water flow here. When the culvert is blocked by beaver damming water is backed up all the way to Martins Pond. Mr. Paul Cameron monitors this five foot wide culvert and has cleaned it out in the past. There was no active damming at the time of the site visit. This culvert should be protected with fencing. Due to the high flow a very large culvert protective fence would be required. See enclosed Estimate.

5. Martins Brook / Route 62 Culverts

This double culvert under Route 62 has been the site of beaver damming in the past. When dammed by beavers this also increased the water level in Martins Pond. It was cleaned out late last year and reportedly beavers in the general area were trapped. This Spring two large beavers who were relocating from downstream were killed by motor vehicles as they attempted to cross Route 62. The culverts were still free of damming materials this Spring but remained at risk from damming from other new beavers.

This May a large culvert protective fence was installed to protect the culverts from future beaver damming. This culvert fence will need to be maintained and kept clean of floated debris quarterly in order for it to remain effective at preventing beaver damming. Beaver Solutions is currently responsible for this maintenance. To date the device continues to keep the culverts open and free from beaver damming.

6. Martins Brook / Berry Rehab. Dam

Over 1/2 mile downstream of the Route 62 culverts is a large beaver dam and lodge. Apparently a trapper worked here this past trapping season and removed many beavers. There was no evidence of any recent beaver chewing or dam repairing in this area. The dam had multiple leaks and was only elevating the upstream area by a few inches. Therefore, this dam is not causing an elevated water level for the residents of Martins Pond.

There is a very high stream flow here. This flow would require a huge amount of pipe capacity which would be expensive and difficult to install. In addition, access to the dam is also challenging. For these reasons, even when new beavers relocate to this area, I do not feel this dam is appropriate for pipes to control the water level. If new beavers repair the dam and the water level rises significantly, I believe trapping should be repeated.

7. Marblehead Street - NE Power Co. Dam

A beaver dam on New England Power Company property has caused mild erosion damage to an access road, and a neighbor has complained about an increase in mosquitoes. At the time of the site visit the beavers were not actively repairing this dam, although it appeared the beavers had done some repairs to the dam earlier in the Spring. The dam was leaking but the pond level remained well above the roadbed. There was no evidence of any recent beaver chewing in the area either.

The installation of a Flexible Pond Leveler and a culvert under the access road would eliminate the erosion problem. However, since the beaver dam is on New England Power Company property and does not pose a threat to town property, I recommend no action at this time. A cost estimate can be provided to New England Power Company upon their request.

8. Marblehead Street Culvert

A makeshift chain link fence was installed on the inlet end of the culvert that runs under Marblehead Street near the NE Power Co. property. Apparently beavers have dammed this culvert in the past. However, there was no active beaver damming or chewing noted in this area. Nor was there any beaver damming against the chain link screen.

Note, the chain link screen on the culvert is very prone to becoming clogged with

floated debris, even in the absence of beavers. It is also very easy for beavers to dam against it. If this culvert becomes a target of beaver damming in the future, I recommend the installation of a small culvert protective fence with a pipe system. A written Estimate can be provided at which time this culvert becomes problematic. At this time I recommend continued monitoring.

9. 32 Marblehead Street Dam

Directly behind 32 Marblehead Street, downstream of the two previous sites, is a very large beaver dam. This dam has been there for many years as evidenced by the many old beaver chewed stumps, many of which are over four years old. However, the large pond that was created by this beaver dam was nearly completely drained. There was a large breach in the dam that the water was freely running through. Large piles of old beaver chewed sticks were piled up near the breach from repeated dam breaching over the years.

Beavers had made no efforts to repair the large breach which had drained the pond. This is clear evidence that beavers are no longer present here. Much of the woody growth that beavers use for food and building materials had been depleted by previous years of beaver harvesting. This makes this area less inviting to future beavers until the woody growth regenerates. Nevertheless, at some point in the future beavers are bound to relocate here and repair the dam.

When the beaver dam is repaired, another site visit could be done to examine at what level the pond begins to pose a risk to residents at 29, 32, and 33 Marblehead Street. I believe the installation of a Flexible Pond Leveler would be a long term solution here if a smaller pond were tolerable to the area residents. Input from these residents would be important before proceeding with any plans to install a Pond Leveler device at this beaver dam.

10. Janice Avenue Drainpipe

A survey completed by the resident at 20 Aspen Road indicated that a "18 foot pipe packed with mud" was posing a threat of flooding as it is in a 100 year flood zone. The pipe is located at the end of Janice Avenue. It is an old concrete culvert with an upright concrete inlet.

The culvert pipe capacity is reduced by approximately 50% with gravel and mud sediment. However, there was no evidence of beaver chewing or damming. I do not feel that the problem at the end of Janice Avenue is beaver related.

11. Orchard St. / Route 62 Intersection

The Ipswich River widens and slows down behind the homes on Route 62 near Orchard Street. The water level in the river was high, but as I walked along the river I was unable to locate any beaver dams upstream or downstream of Route 62. I suspect that the high water level was due to high season flows rather than beaver activity. However, if a dam has been located by others I would be willing to revisit the area.

12. Route 62 / Riverside Cemetery Dam

Across the road from the Riverside Cemetery the Ipswich River fans out over a large marsh, before being constricted to a narrow channel. At this constriction of the water course was the remnants of an old beaver dam. According to an abutting resident at 153 Elm Street, when active this beaver dam had created a huge pond. Currently this area is a grassy and shrubby marsh. This old beaver dam still slightly elevates the water level of the marsh, but it is apparently not causing any problems at the current level. No intervention is needed at this old dam.

13. Mill Street Bridge Dam

This granite block bridge over the Ipswich River between North Reading and Reading was reconstructed in 1998. It is the site of a large old beaver dam on the upstream side of the bridge. Half of this 4 foot tall dam had been removed and has not been rebuilt by the beavers. When intact this dam had raised the upstream water level and apparently negatively affected abutting residents. However, the breached dam currently is raising the river level only 12 inches due to constriction of the river by the remnant dam.

There was no beaver activity in the area, so this dam can simply be monitored. If beavers return and rebuild their dam so that upstream homes are negatively affected, the beavers should be trapped and the dam breached. I would not recommend that pipes be installed here to control the water level due to the very high flow of the river.

14. Forrest Street Culvert

This 3 foot diameter culvert has been dammed by beavers for a very long time judging from the huge piles of sticks on each side of the culvert inlet. Apparently even a small water level elevation causes problems for abutters. One North Reading resident had a shed surrounded by water at the time of my site visit.

This site continues to remain very active with beaver damming. The breached dam was still raising the water level 13 inches. In order to "beaver-proof" this culvert all the woody debris and the beaver dam need to be completely removed by the town with a backhoe to return the culvert opening to it's original condition. Then a culvert protective fence could be installed to keep the beavers out of the culvert.

Because beavers are so accustomed to damming at this culvert despite repeated dam breachings, I expect the beavers will dam against the culvert protective fence in an attempt to raise the water level again. For this reason, a Pond Leveler pipe would need to be installed through the culvert fence. The beavers could dam against the fence, but they would only be able to slightly raise the water level because the Pond Leveler pipe would begin to flow and prevent the pond level from rising too much. This system could be expected to lower the water level and maintain it at least 6 inches below it's present level. Fortunately this is not a high flow stream so only one pipe would be needed to control the water level. Please see the enclosed cost Estimate for this work.

15. Edgemere Road Culvert

The beaver damming at the Forrest Street culvert has raised the water level so that it is nearly on Edgemere Road. Lowering the water level at Forrest Street will help to protect this dirt road from flooding damage.

Fortunately, the culvert on this road is open and does not appear to have been a target of beaver damming. Therefore once the Forrest Street culvert is properly protected and the water level lowered on Edgemere Road, it is reasonable to simply monitor this culvert. However, a small culvert protective fence probably should be installed here as a preventative measure. See the enclosed Estimate.

Note: if this site is monitored and the beavers do begin to block this culvert, a larger culvert fence would be needed than that to prevent beavers from damming in the first place.

16a. Eisenhaure Pond Spillway

Eisenhaure Pond level has been raised by nearly two feet by beaver damming. The concrete spillway has been dammed by beavers at the outflow end. This has caused the path and footbridge over the spillway to be underwater. Water from the pond is also flowing over the earthen dam of the pond since it can no longer pass through the spillway.

A Flexible Pond Leveler can be installed to lower the pond level, and resume the normal flow through the spillway. Due to beaver damming on the outflow end of the spillway, the pipe would need to be extended past the spillway, and protected with fencing so that the beavers cannot plug up the end of the pipe.

16b. Eisenhaure / Oscar Rd. Culvert

There is a large grate system that collects the water flowing out of the pond and directs it into a culvert at the intersection of Eisenhaure and Oscar Roads. There is a great deal of vegetation on this grate system, but no evidence of beaver damming. For this reason I believe the culvert area can simply be monitored. If the beavers did dam it up the pipe from the pond could easily be extended to the grating. An Estimate for this work can be provided upon request.

Please review the enclosed proposals and feel free to contact me at your convenience regarding any questions or concerns, or to schedule any of this work.

Sincerely,



Michael Callahan, Owner

BEST MANAGEMENT PRACTICES FOR BEAVER PROBLEMS

MICHAEL CALLAHAN

ABSTRACT

The North American beaver (*Castor canadensis*) is an important "keystone" species, but its ecologically valuable dam building activities can result in extensive property damage. Traditionally, beavers were managed by trapping; however, this has resulted in the loss of many wetland benefits. Our recent study, reported in the April 2003 AMWS newsletter, demonstrated the efficacy of flow devices as a best management practice for beaver conflicts. This follow-up study expands upon those results, and also compares the efficacy of flow devices to trapping. A total of 482 beaver conflict sites were evaluated in this study. Of this, 413 (86%) sites were selected to be managed with flow devices, and 69 sites (14%) were selected for trapping. The results of this study are consistent with our 2003 AMWS study, and strongly support the use of flow devices as the best management practice for the vast majority of beaver conflicts. Trapping is best reserved for the limited number of conflict sites where flow devices are not feasible.

BACKGROUND

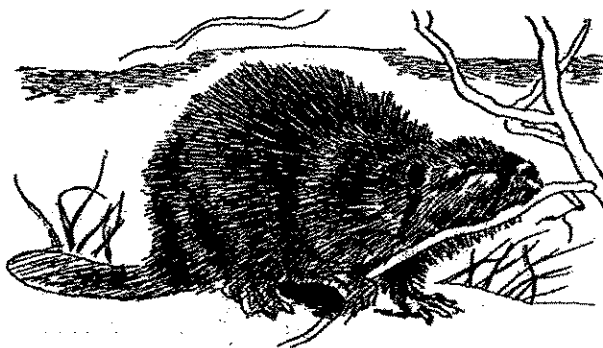
The North American beaver is our largest rodent, and was nearly driven to extinction 200 years ago by the unregulated fur trade. However, the fur trade declined and many abandoned New England farms have reverted to forest. As a result, beavers are common once again. Beavers are aquatic mammals that build dams on small and medium order streams to flood large areas because they are safer in the water than on land. They are second only to humans in their ability to transform their environment to meet their own needs. By creating ponds and opening the forest canopy, beavers create a variety of new habitats. Over many millennia, innumerable other species, many threatened or endangered, have adapted to these habitats and now depend upon them for their survival. This makes beavers a "keystone" species.

Beaver ponds also have other benefits including: aquifer recharge; decreased ero-

sion; reduction of waterborne particles, toxins, and excess nutrients; decreased downstream flooding; maintenance of the water table; sustaining downstream flows during dry periods; and the preservation of open space. However, better known are the problems that beavers sometimes cause: blocked culverts; washed out roads or railroad tracks; the flooding of buildings, wells, septic systems, or farms; and the loss of valuable trees. Traditionally, beaver conflicts were addressed by trapping and killing the beaver and breaching the dam. While this temporarily resolved the immediate problem, many wetland benefits were lost and new beavers would often return to the area and re-establish the colony and dam.

For decades, wildlife agencies and others have attempted to solve beaver conflicts with flow devices (e.g., beaver dam pipes or culvert protective fences) with poor results. In Massachusetts, flow devices were effective only 4.5% of the time (Langlois and Decker, 1997). In New York, a similar 3% success rate was reported (Hameltn et al., 1997). Due to these poor success rates, trapping remained the primary beaver management tool.

More recently, flow device design improvements led to reports of high success rates at Clemson University (Wood et al., 1994); in Ottawa, Canada (M. LeClair, unpublished data); and in New England (Lisle, 1999, 2001, and 2003). In 2003, the largest study of flow devices to date was published in the AMWS Newsletter by this researcher



(Callahan, 2003). That study clearly demonstrated that the use of modern flow devices is cost-effective, long-term, and represents an environmentally beneficial solution for most beaver-related flooding problems.

METHODS

The beaver conflict sites in this study consisted of either blocked culverts or high water levels resulting from beaver dams. Each blocked culvert was manually cleared of beaver damming materials, and then a Culvert Protective Fence (see Figure 1) was installed. In some cases, a Pond Leveler Pipe (see Figure 2) was also installed with the Culvert Protective Fence. High water from a free-standing beaver dam was lowered with one or more Pond Leveler Pipes. Some sites were selected for trapping. Data collection was the responsibility of the author, with assistance from Ruth Callahan and Donald LaFountain of Integrated Wildlife Control. All conflict sites in this study

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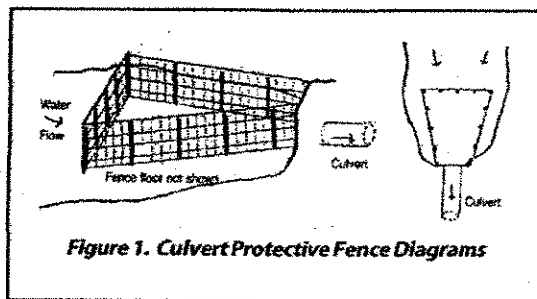


Figure 1. Culvert Protective Fence Diagrams

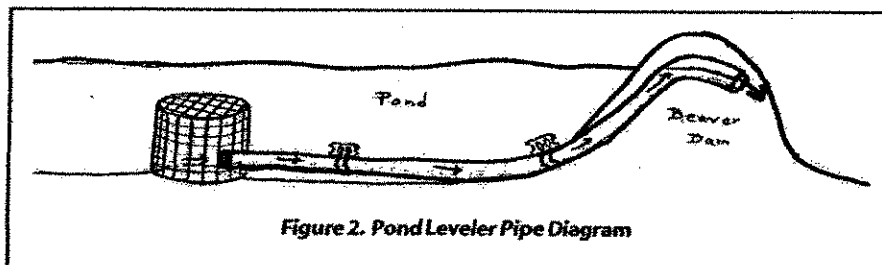


Figure 2. Pond Leveler Pipe Diagram

TABLE 4 - FLOW DEVICE COST ANALYSIS

	Average Cost	Annual Maintenance	Annualized Cost (10 yr)
Culvert Fence	\$750	\$200	\$275
Culvert Fence and Pipe	\$1,400	\$150	\$290
Flexible Leveler Pipe	\$1,000	\$100	\$200

tion is important for our economic and environmental health. Unfortunately, the cost per acre of most wetland restoration projects can be quite high and they are not always successful. Beavers have returned to our landscape and are successfully restoring historic inland wetlands at no cost unless a conflict occurs. When beaver conflicts are managed with flow devices, thousands of wetland acres may be restored at an extremely low relative cost.

CONCLUSIONS

This study provides further evidence that Culvert Protective Fences and Pond Leveler Pipes are the most cost-effective, long-term, and environmentally-friendly methods to manage most beaver/human conflicts. When compared to the cost per acre and the lower success rates of wetland restoration by humans, a very strong case can be made for promoting the use of flow devices to maximize restoration of historic inland wetlands by beavers. Nuisance beaver trapping is best reserved for those occasional conflict sites where a flow device is either not feasible or fails, the water level needs to be drastically lowered, or the landowner wants no beavers or ponds on their property.



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H O R I Z O N



**RED SOILS
 ALL OVER**

ARTHUR ALLEN III, CPSS

As south-central New England becomes a focus of land development activities, undeveloped land has become more scarce and prices continue to climb. As a result, in the last decade development of marginal areas that are steeper, rockier, and wetter has increased. Of particular concern to me are areas with Brimfield Schist-influenced soils.

The Brimfield Schist is a rock type that has a high iron oxide content. Iron oxide imparts a red color to the rock. As this rock weathers, it forms red soil. Because of the natural red color of soils formed in these parent materials, it is difficult to recognize the redoximorphic features that are typically seen in soils with seasonal high water tables. As development pressure continues to increase, it becomes imperative to recognize and understand the influence of red soil colors in identifying high water tables and delineating wetlands.

During the 13 years that I have been mapping, interpreting, delineating, and teaching about soils, I have witnessed the influence of red soil colors in Spodosols and Connecticut River valley soils with Mesozoic geologic parent materials. However, I have heard little discussion about the influence of Brimfield Schist parent materials on the soils of the region. In particular, soils in the central portion of Massachusetts, including the towns of Baldwinville, Barre, Brimfield, the Brookfields, Fiskdale, Holland, New Braintree, Sturbridge, Templeton, Wales, Warren, Williamsville, and Winchendon, are

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The Flexible Leveler by Beaver Solutions

In order for beaver dam pipes to work indefinitely, they must be designed so that beaver cannot detect the flow of water into the pipe. The Flexible Leveler concept was invented and successfully used for 20 years by Michel LeClair at Gatineau Park in Ottawa, Canada. It works by surrounding the inflow area of the pipe with fencing which prevents the beavers from getting close enough to the intake to detect the water movement. As a result, the beavers do not attempt to clog the pipe.

Flexible Leveler systems control the size of beaver ponds protecting human interests in a long term, cost-effective manner. Wherever feasible this is preferable to the short term solution of trapping. It is designed to prevent detection by the beavers and to keep normal water levels below the top of dam. Beavers will raise their dams only when the water level rises above the dam. When the water level is below the top of the dam, beavers will not continue to raise the height of the dam. Rains will then be held back by the dam and slowly released. Some normal fluctuation of the water level during wet and dry spells is expected, but the dam will not continue to rise and the pond size will be controlled.

The peak of the flexible pipe in the dam determines the pond level (see diagram). Water will flow through the pipe until the pond level drops below the peak of the pipe. This design not only permits control of the water level, but it also allows for the entire pipe to be hidden under the water and in the dam, out of sight.

Diagram - The Flexible Leveler



Notes

- The number of pipes needed is determined by the average stream flow. Usually 1 or 2 are sufficient.
- Keeping the water level as high as tolerable decreases the possibility of new problematic dams.
- In most states permits are necessary to work in a wetland or alter a beaver dam.
- The dam is breached a small amount for several days to gently lower the water to the desired level.
- The pond level can be raised or lowered by adjusting the peak of the flexible piping.
- Flexible Leveler will function for many years with minimal maintenance.
- Each Flexible Leveler comes with a Beaver Solutions guarantee.

Beaver Solutions

Ruth and Mike Callahan, Owners

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Beaver Solutions™
Flexible Pond Leveler™
Maintenance Guarantee

*If any Flexible Pond Leveler™ we maintain
is blocked by beavers,
we will repair or replace it at no charge, or
you will be offered a full refund of our labor.**

** Labor costs are typically half of the installation cost.
This Maintenance Guarantee does not cover flooding from other dams.
Minor repairs are included with routine maintenance at no additional cost.*

Culvert Protective Fences by Beaver Solutions

A culvert in a roadbed probably appears to a beaver like a hole in a dam. As the roadbed with a blocked culvert produces a large ponded area for minimal work, beavers are naturally attracted to these sites.

Beaver Solutions culvert protective fences are custom designed for each site and have a 98% success rate. They prevent culvert damming by beavers by decreasing damming stimuli (the sound and feel of moving water), and increasing the work needed to plug the culvert. Design factors considered include the intensity of damming stimuli, topography, length of time damming at the site, food supply, history of poor quality flow devices at site, stream flow and depth, among others.

The trapezoidal shaped fence (see diagram) was invented by Wildlife Biologist Skip Lisle and can be highly effective. This design both decreases dam building stimuli (water movement and noise) and creates a long perimeter to dam. Beavers may start damming near the culvert, but give up as they get farther away from the culvert as it is an unnatural direction for them to dam and the stimulus for damming is decreased. The typical cost to install a culvert protective fence is usually \$500 to \$600.

Diagrams - The Trapezoidal Fence

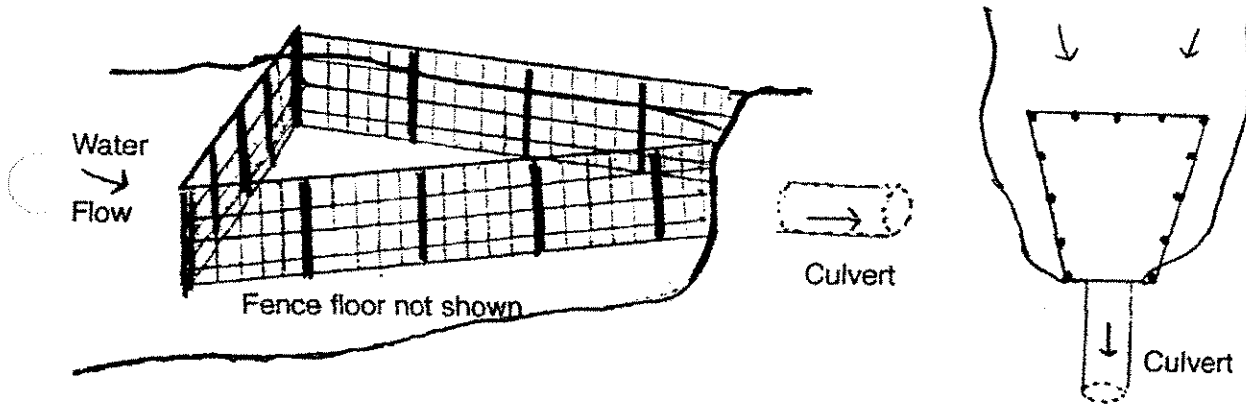


Figure A - Side View

Figure B - Top View

Proper maintenance is extremely important for the fence system to remain effective for many years. Quarterly, all floated leaves and sticks should be removed from the fence. Beaver Solutions fully guarantees every culvert protective fence we maintain, and offers this service at a very low cost. We are licensed and fully insured.

The downstream end of the culvert is also fenced to prevent the beavers from entering the culvert from that end. If the culvert is very noisy, building a small dam downstream (or on the fence) to backup water into the culvert can silence it, and will greatly decrease the beaver's motivation to dam on the fence.

Beaver Solutions

Mike & Ruth Callahan, Owners

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Beaver Solutions™ Culvert Maintenance Guarantee

*If any Culvert Protective Fence we maintain
is blocked by beavers,
we will repair or replace it at no charge, or
you will be offered a full refund of our labor. **

** Labor is at least half of the total cost.
This Maintenance Guarantee does not cover flooding from other dams,
vandalism, or catastrophic event damage.
Minor repairs are included with routine maintenance at no additional cost.*

SUMMARY of Beaver Solutions Assessment

Site #	Location	Beaver Activity	Recommendation	Flow Device	Cost	Importance/ Urgency	Recommended Cost FY 2006	Recommended Annual Maintenance Needed FY2007
1	Haverhill/Foley/Duane	Current, High	No Tolerance Zone Trapping	Would not be effective	\$100/beaver \$1,000 typical full colony removal	High	\$1,000	\$1,000
2	Haverhill/Eisenhauer	Current, High	No Tolerance Zone Trapping	Culvert protection in place, other areas would not be effective	\$100/beaver \$1,000 typical full colony removal. \$200 for Beaver Solutions to breach all dams after trapping.	High	\$1,200	\$1,200
3	Martins Brook/Fieldcrest	No current action	Monitor, flow device may be insufficient if beavers return to area	Large flexible Pond Leveler in place and working well	No action needed at this time	Low, unless beavers return		\$200? Need annual maintenance agreement
4	Martins Brook/Benevento Culvert	No current action	Monitor, habitually dammed area, protective fence installation recommended as preventative	Culvert protection recommended	\$1,115 for installation and 1st year maintenance. \$240 per year maintenance after that.	Medium, habitually blocked culverty	\$1,115	\$240
5	Martins Brook/Route 92 Culverts	No current action	Monitor	Culvert protection installed Spring 2005, must be maintained as agreed by Wilmington DPW	No action needed at this time	High importance for maintenance, No urgency at this time.		
6	Martins Brook/Berry Rehab	No current action	No Tolerance Zone Trapping	Would not be effective	\$100/beaver \$1,000 typical full colony removal if evidence of return of beavers	High importance for monitoring and trapping once beavers repopulate area	\$1,000	\$1,000
7	Marblehead Street/ NE Power Co. dam	Recent action Spring 2005, little current	No action. New England Power problem, no Town action required.	Flexible Pond leveler and culvert needed	NE Power's Problem. Would give them estimate if requested.	Low. Not urgent. Does not pose a threat to Town property.		
8	Marblehead Street Culvert	No current action	Continue monitoring. Culvert may become beaver target area, current fence prone to clogging.	If beavers become a problem, install small protective culvert fence	Estimate would be provided if becomes problem area.	Low. Not urgent.		
9	32 Marblehead Street dam	No current action	Continue monitoring. Beaver pond has been drained due to repeat breachings, however, beavers are bound to return to this area.	Flexible Pond leveler installed with water level input from neighbors if a small pond is tolerable.	\$1,505 installation and 1st year maintenance, \$125 per year annual maintenance after that.	Medium. No current activity but prime area for return of beavers.	\$1,505	\$125

Suitability of Beaver Solutions Assessment

Site #	Location	Beaver Activity	Recommendation	Flow Device	Cost	Importance/ Urgency	Recommended Cost FY 2006	Recommended Annual Maintenance Needed FY2007
10	Janice Avenue Drainpipe	Not beaver related	DPW issue. Culvert 50% blocked with gravel and mud.	n/a	n/a	n/a		
11	Orchard Street/Rt 62 Intersection	No dams seen, water levels high.	Monitor and if others do see a dam appear as levels drop, revisit area.	None required	n/a	Low. Monitor. No beaver activity seen.		
12	Route 62/Riverside Cemetery Dam	No current action	No intervention needed. Dam is old, but not currently causing problems.	None required	n/a	Low. Monitor. No beaver activity seen.		
13	Mill Street Bridge Dam	No current action. Old dam had at one time held back 4 feet of water. Currently old dam raises water levels 12 inches due to constriction.	Monitor. If beavers return, recommend breach and trapping. River flow too high for Flow Device.	Not recommended.	n/a	Low. Monitor. No beaver activity seen.		
14	Forrest Street Culvert	Current. High. Very active. Nearby resident's shed currently surrounded by water.	Use Town backhoe to remove all the woody debris. Install Flexible Pond Leveler and culvert protective fencing.	Flexible Pond Leveler and culvert protective fencing.	Flexible Pond Leveler and culvert fencing \$1,675 installation and first year maintenance. \$180 per year annual maintenance after that.	High. Even a small water level elevation causes problems for neighbors. High activity. System will drop water levels 6 inches and maintain it.	\$1,675	\$180
15	Edgemere Road Culvert	No current activity. Flooding here is due to dam activity at Forrest Street, #14	Install protective fencing as preventative measure around culvert.	Culvert protective fencing.	Culvert fencing installation and first year maintenance \$915. \$240 per year annual maintenance including quarterly clearing of debris after that.	Medium. Preventative measure.		\$915

Summary of Beaver Solutions Assessment

Site #	Location	Beaver Activity	Recommendation	Flow Device	Cost	Importance/ Urgency	Recommended Cost FY 2006	Recommended Annual Maintenance Needed FY2007
16a	Eisenhaure Pond Spillway	Current, High. Pond level has been raised 2 feet, causing footbridge to be under water.	Install pond leveler to resume normal flow through the spillway.	Flexible Pond Leveler and protective fencing.	Flexible Pond Leveler and pipe extension through spillway \$1,330. Need price on annual maintenance.	High. Earthen dam is at risk, footbridge and pathway under water. Work currently underway to install this solution per BOH.	underway	\$200? Need annual maintenance agreement
16b	Eisenhaure /Oscar Rd Culvert	Not beaver related. Grate is clogged with vegetation.	Monitor. If beavers did dam this area, the pipe from the pond could be extended to the grate.	n/a	n/a	Low. Monitor. No beaver activity seen.		
TOTAL							\$7,495	\$5,060
RECOMMENDED PLUS ANNUAL MONITORING EMERGENCY CONTINGENCY							need price	need price
							as needed	as needed