

"Of the 170 Fish Habitat Enhancement Structures that were built on Canmore Creek in 1997 and 1998, all of them were still intact in the summer of 2008!"

Over a two years period, Canmore Creek underwent a major fish habitat enhancement make over! The small stream is located in the Town of Canmore, Alberta and it is a small tributary to the Bow River. At its headwaters, there is a seep collection gallery and culvert below the Rundle Canal that provides a consistent annual flow in the creek. The Rundle Canal is part of a hydro generating operation in the Town that diverts a large volume of water from the Spry Lakes down to a power facility in Canmore.

With not much of a watershed for Canmore Creek, there is limited annual run-off that would normally scour the streambed and create pool habitats for the resident brook trout. As part of an attempt to re-establish native cutthroat trout on the stream, BVHD completed a fish habitat enhancement program on the entire reach of the system. The project was funded by TransAlta Utilities Corporation, over a three year time frame. It was hoped that the newly created fish habitat on the small stream would facilitate the survival of a planned reintroduction of the cutthroat trout.

The enhancement program would involve the construction of pool habitats, deflectors, bank reclamation and the creation of spawning habitats on the lower reach of the creek. In total, 170 enhancement structures were built, 54 of which were rock and log v-weirs. For spawning trout, 14 cubic metres of spawning gravel of spread over key spawning habitats on the lower reach of the creek. Finally, numerous rock and boulder placements were created in the creek for both trout and the invertebrate populations that would use them.

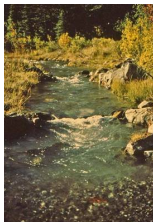
It was very rewarding to discover that large numbers of brook trout, from the Bow River, utilized the spawning habitats in the fall of 1998, just a month after the project was completed. A spawning survey was conducted on the lower reach of the stream in that fall, of 1998. Based on previous spawning survey records for the lower end of the creek, by brook trout from the Bow River, we had increased the fall spawning activity by 96% on Canmore Creek. Mature brook trout spawning was also substantial that spawning season!

BVHD monitored the stream over the years since the habitat was created on Canmore Creek. I am please to report that all of the structures are still intact and apart from some tampering by local residents whom seem intent on leaving their mark, the project has been a major success. As is the case with all fish habitat enhancement work, mother nature has the final brush strokes and riparian growth has shown this!

[HOME](#)

[Log Walls](#)

For more on pool habitats:  
[Click Here!](#)



Above: A photo of two rock v-weir pools constructed on Canmore Creek in 1997. Photo taken in 1999.



**Photos to the Left:**  
These rock and log v-weirs were built in 1997 and these photos were taken in the summer of 2008. You can see that the moss and shoreline cover has made it difficult to tell whether they were man-made or they are natural. This is what we had all hoped for!

There are two chapters dedicated to the Canmore Creek Project story in a new book titled

"Fly Fishing and Other Stuff"

written by the author Guy Woods

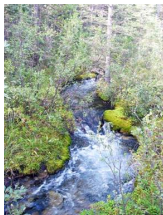
[Click Here for more information!](#)

[CHECK OUT THE VIDEO - CLICK HERE](#)



Above Photo:

These two brook trout were utilizing a spawning habitat created on the lower reach of Canmore Creek, in the fall of 1998. The large trout were suspected of being resident fish from that area of the stream.



Above Photo:

On the steep reaches of the creek, a series of rock deflectors were used.

**Opposing Rock Deflectors**  
A perfect design for stepping down a steep section of stream, is the opposing rock deflector placement! Just like a fish ladder on a hydro dam, by breaking the fast cascade of water flowing down a chute of high gradient stream, trout are able to migrate upstream.  
The small pool habitats created below each of these rock deflectors allows trout to pause and rest, before they continue their journey. In some cases, trout will adopt these small pool habitats for holding and feeding opportunities.

The structures are very easy to build for a worthwhile benefit. On Canmore Creek, there were enough available boulders in and along the banks of the stream, to provide the needed material. The large boulders that were used for the key rocks, were bedded into both the stream bank and the streambed to insure stability.

Small chunks of moss from the surrounding area, were placed in the gaps between the rocks and the bank, during construction. In 2008, when the photo to the left was taken, the opposing deflectors were still intact and the moss had hidden most of the previously exposed rock, from when the project was completed.

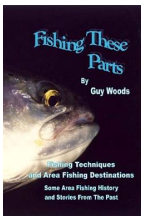
The pools below the deflectors have deepened over the years!

# FISHING BOOKS WITH FISH HABITAT ENHANCEMENT STORIES !

"If you like to fish and you have an interest in the topic of fish habitat enhancement and taking care of our trout waters, the books mentioned on this page will provide you with a good read!"

These books are now available for sale in ebook format at Google Play - [CLICK HERE](#)

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## Fishing These Parts By Guy Woods

This soft cover book is 184 pages with both color and black and white photos. The book has some basic techniques in fishing wet flies on spinning and spin casting gear, as well as some stories on fish habitat enhancement projects.

The book is priced at **\$19.95** CND plus tax

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Books are sold and shipped separately!



## Fly Fishing and Other Stuff By Guy Woods

This soft cover book is 236 pages, with both color and black and white photos. The book includes fly patterns, techniques and some history of the Bow River and area fishery. Also included in the publication, are two chapters that tell the story of the "Canmore Creek Fish Habitat Enhancement Project".

The book is priced at **\$24.95** CND plus tax

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Bow Valley Habitat Development, 85 Glenport Road, Cochrane, Alberta, Canada, T4C 1G8 Phone: 403-932-4467

## MORE PHOTOS

*Here are a few more photos of some v-weirs and other stuff!*

*A Few More Photos of Canmore Creek!*

**Click on this fish for more fish habitat stuff!**



**Above: A photo of the front side of the log wall with the planted trees and willows overhanging the wall. 2008**



**Above: This is a photo of the log wall looking downstream from the old beaver dam. 2008**



**Above: This is a close up of an opposing rock deflector site. Note how the moss has grown in! 2008**



**Above: This is a photo of a log v-weir pool on Canmore Creek, 10 years after construction. 2008**

# Bow Valley Habitat Development

Fish Habitat

Photo: A Stage One Native Willow Plant

Magazine Mission Statement

## Bio-Engineering Fish Habitat

Publisher/Editor Information

### Planting along the water's Edge

#### Important Links:

##### Fish Habitat

Below: Stream Tender Magazine is a stream magazine published quarterly by Bow Valley Habitat Development

##### Stream Tender Magazine

You can find some additional fish habitat enhancement techniques at the blog site below. Just click on the sites listed on the black link list.

##### Stream Tender Blog

##### Stream Tender Video Channel

#### Planting Tools

Depending on the soil conditions along the stream bank, a number of different tools are used for the planting process. All of the tools are used to create the hole in the ground for the placement of the rooted cutting. Drill bits, augers and hole punch tools make the job much easier and faster for the volunteers that do the planting. The power tools are only used when the ground is too hard for a hole punch tool. Both electric drills and gas powered augers do a great job of preparing a planting hole in hard packed soil, with gravel and sand present. The hole punch tools make the job much easier and faster for the volunteers that do the planting.

16oz punch tools. For the soil below, they work!

Electric power drill bits of various sizes are used

Photo: A Stage One Native Willow Plant

### Planting Along the Water's Edge and on Eroding Stream Banks

Native willows and trees require little to no water to get started. By planting along the water's edge, in the capillary fringe, the plants will do the best. This area of planting will also produce the best results for creating fish habitat on a stream channel.

The cuttings are planted with approximately 30 % of the shank under the ground, so once they are established in the soil the plants are less likely to be washed byigill Creek, due mainly to the reduction of annual silt loading into the stream channel. Presently, there are 58 stream bank stabilization sites that have been planted on the lower reach of Biggill Creek and these sites are near completion.

At a few of the stream bank stabilization sites on the Biggill Creek are approximately 8 feet or greater in height, so they will take years to stabilize.

#### What Are The Long Term Benefits of Riparian Planting?

When I look at a length of stream channel that is void of any native willows and trees, I can see the potential for what riparian planting could do to change the landscape. It can take a lot of work and time to transform a barren stream into a healthy riparian system, but the benefits are easy for me to visualize.

Planting seems a good part of my life in the outdoors and nature's paradise. I see a trout stream meandering in early morning hours of light in day, when clouds of mists are in the air.

Left and Right: You can compare the stream channel on the left and right, to see what a difference that a healthy riparian system can do to the landscape along a flowing trout stream. It is quite obvious, what looks better?

This extended season also is advantageous for planting on eroding stream banks. Much of the planting in eroding stream banks can be done after the spring runoff and rainy season. Some eroding stream banks will take a number of plantings to stabilize, but the cost effective method of using native cuttings to complete the task is well worth the effort.

I have noted a dramatic improvement in the water quality of Biggill Creek, due mainly to the reduction of annual silt loading into the stream channel. Presently, there are 58 stream bank stabilization sites that have been planted on the lower reach of Biggill Creek and these sites are near completion.

At a few of the stream bank stabilization sites on the Biggill Creek are approximately 8 feet or greater in height, so they will take years to stabilize.

I have found that it takes a few years before the root systems from a stage one willow plant are secured firmly into the stream bank. After the initial years of growing, the plants take off in their growth rates. Provided the soil pH is acceptable, A PH of between 5 and 7.5 is best suited for native willows and trees.

Where the stream banks are eroding the cost of having to plant willows right above water level during normal flow conditions. This will provide the greatest benefit for fish habitat, by creating overhead cover and some submerged cover for resident trout in the stream.

The submerged woody debris and the limbs will also provide great over/underbank habitat in the stream. Invertebrates that adapt to woody debris are less likely to be captured by the movement of silt.

but what a great goal it is to work toward. As time progresses and the planted native willows and trees start to grow toward their maximum, you will see a definite return to the once barren landscape.

It is quite obvious to witness the improved clarity of the water in the stream, as the riparian system of the soil along the stream channel. Fish and wildlife that once bounsd the stream's length will start to return. For me, I can take great satisfaction in knowing that we had a hand in the restoration challenge.

Photo: A Stage One Native Willow Plant

The Cutting is planted into the hole.

A Stage One willow plant after one year of growth

Photo: A Stage One Native Willow Plant

Above: A Stage One plant and one that has been planted.

Above: A Stage One Plant, ready for planting

Photo: A Stage One Native Willow Plant

Photo: A Stage One Native Willow Plant

Above: Willows grow the best when planted in the capillary fringe along the water's edge.

Above: Willows planted just above the water level, create the best habitat for both trout and aquatic invertebrates. The willows above were planted 5-6 years earlier at this site.

Stream bank stabilization sites like this one are found on the outside of banks in the stream channel. Some sites are over 8 feet in height.



[Boulders](#)

[Y-weirs](#)

[Deflectors](#)

[Fish Reefs](#)

[Log Walls](#)

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Bow Valley Habitat Partnership is an organization that forms partnerships to complete grassroots riparian and fish habitat enhancement projects in the Bow River Watershed. Since its operations began in the latter part of the 1980's, BVHD has been responsible for the successful completion of over 40 major fish and riparian habitat enhancement projects. This website is primarily designed to help educate readers about the various forms of both riparian and fish habitat enhancement techniques used in the field and to share information about some proven and tested approaches to enhancement design and methodology.

**Special points of interest:**

- **Freshwater Fish Reefs on a reserve**
- **The restoration of an entire trout stream.**
- **The full fish habitat make over on another trout stream.**

[Bow River Boulder Project](#)

[Snoary Lakes Fish Reef Project](#)

[Canmore Creek Project](#)

[Fish Habitat Video](#)

[Books by Guy Woods](#)

[A Few More Photos](#)

[Trout Stream Restoration](#)

[Fish Habitat Enhancement](#)

[Head Start Willow Planting](#)

[Riparian Zones](#)



Fish and Riparian Habitat Enhancement

Where the impacts of human activity have either directly or indirectly affected the natural state of fish bearing streams, mitigation or remedial measures may be required to compensate for those negative impacts. Methodology designed to repair or enhance both riparian and fish habitat has been used to facilitate the recovery of many streams in recent years. The technology used is still being developed, especially in the area of bio-engineering plants for the enhancement of riparian zones.

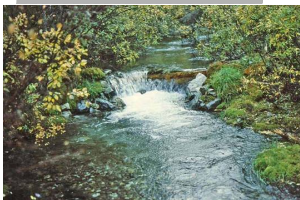
It is of major importance that any instream structures emulate the appearance of a natural stream habitat. This is achieved by the use of natural materials such as boulders, timber and living plants. The used of these materials adds a special challenge to the engineering and construction of structures that will stand up to the influences of high flow events, winter ice and frost conditions.

Also important, is the necessity of having all of the necessary permits and permissions from government agencies that are responsible for managing our flowing water ways. In some cases this can be a lengthy process, but it is required by law and common sense.

Riparian and fish habitat enhancement projects are not only beneficial to maintaining our streams, but they also arouse interest from the general public and help educate people of all ages about the importance of our flowing waters and how we all can protect them!

➔ [New!](#) ➔ [Stream Tender Magazine](#)

**Fish Habitat is the diverse aquatic environment in which fish live their lives.**



*Above: This is a photo of one of the many log y-weirs that were constructed on Canmore Creek in 1997 and 1998. Photo taken in 1999.*

Trout Stream Stewardship

With the rapid growth and development that our generation is experiencing, it is of paramount importance that we make sure that we safe guard our natural assets! For me, the clean flowing trout streams of my surrounding area have been the focus of my attention.

I have always believed that real results are achieved by a grass roots effort. After all, we do take care of our own backyards in everyday life and this is a matter of fact! All that it takes is an effort to expand those neighbourhood boundaries a little!

Like with many small organizations, with a good cause, this has been my experience that once you "get the ball rolling", plenty of support will soon follow. I have witnessed this first hand, over the last 25 years that I have been involved in fish habitat enhancement projects!

The primary object of this website is to stir up a little interest in this unique form of environmental stewardship and hopefully encourage its future!

A Season on the Water

This past summer was not as busy as it has been for me, but it turned out to be a rewarding one anyway! After three major and one smaller willow and tree planting events on Bighill Creek and Millennium Creek, I finished off the fish habitat part of my season with a spawning enhancement project, at the primary inflow spring on Millennium Creek. We had already had fair success with spawning habitat that had been created further down the system, but this years planned project would provide optimal spawning habitat for brook trout on the small stream, right where the clean spring water enters the system.

As is the case with many of the projects that I have been involved in, you are never sure of success until you see the results before your eyes! There is always a certain amount of anxiety after a project is completed, soon followed by anxious anticipation, if your waiting for some type of significant evidence that your hard labour has provided a good return. This is especially so, if you have created a spawning area for wild trout! A successful spawning habitat can provide a major benefit to a fishery if it is utilize to the full extent!

After Jake Gotta and I completed the spawning channel habitat in early September of 2010, I inspected the site on a regular basis in late September and into October. Then in the second week of October, the first sign of spawning was observed at the newly created spawning channel. The site became a more frequent destination for me in the following weeks, as I started to identify more trout holds (egg nests) and observe more spawning trout in the channel. The channel that we created was only 10 metres in length, but by the end of October, I had mapped 29 brook trout holds and every inch of the new spawning gutted had been disturbed by spawning trout.

I took a considerable amount of both photographs and video footage of the entire fall spawning event on the creek and you can see some of it on the Fish Habitat Video link on the left hand side of this web page. There is also a link on the [Millennium Creek Stream Reclamation page](#) that also can be found on the left side of this page. It has been a good season, but the success of this most recent of projects does help encourage me to continue in this field of work. It is my hope that you enjoy navigating around this website and because of the large number of photos, it may be a little slow. I will try to keep this website up to date in the years to come. I take great pleasure in watching how the many project sites change over the years!

" Small spring creeks are often overlooked in their importance to our main stream systems ! "

## MILLENNIUM CREEK PROJECT 2004-2008

BVHD



[Millennium Creek Pool Habitats](#)

[Millennium Creek Deflectors](#)

[Millennium Creek Trout and Sparrows](#)

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[Stream Tender site Info Pages](#)

A new book containing some fish habitat enhancement stories may be of interest to you!

The book is titled:

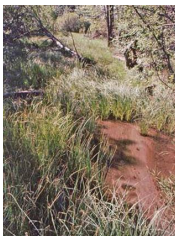
**"Fly Fishing and Other Stuff"**

written by the author Guy Woods

[Click Here to have a look!](#)



To contact us:



**Before and after photos of the same length of stream channel on Millennium Creek**

**Left Photo:**  
Was taken in 2004, before the stream restoration project was started.

**Right Photo:**  
This is a 2010 photograph of the same length of stream channel, two years after the stream channel restoration project which was completed in 2008.

**Check out the links to the left for further details on the success of this stream reclamation and fish habitat enhancement program!**



Small spring creeks are often overlooked in their importance to our main stream systems! In the Cochrane area, most small streams are dependant on feeder springs for their main supply of high quality water and fish habitat. In a time when water supply and quality is considered a priority, the protection and enhancement of these feeder springs should be of primary importance in the way we manage and protect our ground water supply.

In 2004, an initiative to restore a small spring creek located in the Town of Cochrane was undertaken. With the help from area business, both corporate and small, along with The Town of Cochrane and interested NGO's, this small spring creek was brought back to life. The program took four years to complete. A new, narrow - deep channel was created, the volume of flow was increased in the main channel and a fish habitat enhancement program was carried out to provide a living environment for trout. To achieve a positive and long term benefit to our natural stream resources and the aquatic environment that they provide, projects like the Millennium Creek Project are a good investment in our future.

On behalf of the residents of Cochrane, the managers of the Millennium Creek Project would like to acknowledge and thank the partners involved in this worthwhile program. We also would like to extend our special thanks to the volunteer team that contributed 429.5 hours or their time towards the successful completion of the four year project. The partners are as follows:

The Alberta Conservation Association (Funding) - \$56,281.12	Bow Valley Habitat Development (time contribution) - \$5,687.50
Town of Cochrane;	Cochrane & District Community Foundation (Funding) - \$1,999.99
Parks and Facilities (Equipment and personnel) - \$26,956.75	Spray Lakes Sawmills Ltd. (materials) - \$1,270.91
Operational Services (Funding) - \$10,000.00	MGM Developments Ltd. (materials) - \$800.00
TransAlta Utilities Corporation (Funding) - \$23,010.05	The Car Rental Store, Cochrane (equipment) - \$457.00
Inter Pipeline Fund (Funding) - \$21,660.82	Angel Enterprises Ltd. (equipment) - \$150.00
Cochrane Community Grant Program (Funding) - \$10,000.00	Shell Canada Ltd.
Volunteers (time contribution - 429.5 hours) - \$9,215.00	Jumpingpound Plant (Funding) - \$100.00

**Total Contribution - \$157,589.1**

Go to my web blog page at <http://streamtender.com/wordpress/> for more info!

Deflectors are a great stream training design to help constrict flow and deepen a stream channel!

HOME



Above Photo:

The overall gradient on Millennium Creek is very low. In order to effectively maintain pool depths after construction, a low profile log v-weir design was necessary for keeping the pool habitats clean.

The v-weir structures concentrate the flow into a core velocity that scours deep into the pool depths, with very minimal drop.

Pool Habitats on Millennium Creek  
Pool habitats on both large and small streams are vital environments in which trout live throughout the year! In the open winter months, the deep pool habitats provide both security and space for all life stages of resident trout populations. In the water seasons, when the ice covers the shallow areas of a stream, trout retreat to these deep pools to live out the winter season, below a covering of snow and ice.

The pool habitats built on Millennium Creek were constructed with undercut banks and cover habitat consisting of woody debris and boulders. The primary objective when constructing these habitats is to emulate a natural occurring and self maintaining deep pool that is hard to distinguish as being man-made.



Above Photos: Two log v-weirs that were constructed on Millennium Creek in 2007. Photos taken in the summer of 2010.

### Using a Flow Bypass Pipe

To minimize the impacts of silt loading downstream of a construction site, a flow bypass pipe is used to isolate the work area, during pool excavation. The flange secured to the upstream end of the pipe dams off the channel and results in the entire volume of flow being passed thru the corrugated plastic pipe. Sand bags are used to achieve this goal and they are also used to dam around the discharge end of the pipe.

There is a roughness factor which slows the velocity of flow in the pipe, which helps minimize the effects of erosion on the downstream end. The 10 inch pipe in the photo to the left weighs in at approximately 15 kg, so it is easily moved by hand to the various pool sites.

A number of silt fences were installed downstream of the construction area, so that any sediment created while installing the flow by pass or weir, would be trapped at the fence site. There were two silt trap pools created on two of the silt fence sites, to handle the collection of silt over time. These silt trap pools were cleaned out as required, using the flow by pass to accomplish the task.

All of the spoil and silt that was removed from the creek, was hauled to an isolated area and then trucked to a disposal site on a member of occasions during the entire restoration project. Approximately 58 cubic metres of spoil was hauled away from the isolation site, during the 3 year enhancement program.

### Pool Cover Habitat is Important!

In the pool habitat design, both engineered undercut banks and willow planting was used to provide good cover habitat for trout. The engineered undercut banks were constructed using timber frame construction and additional woody debris was also used to insure that refuge for all year classes of trout would be available.

Willow and tree live stakes were pre-rooted and planted around the perimeter of the pools after they had been constructed, so that in future years the added shade and cover would be attractive to resident trout. The root systems of these plants would also help stabilize the banks around the pools over time.

There was no rock present when the pools were excavated, so a mix of cobble and boulders was added to the bottom of all of the pools. This measure would enhance the invertebrate habitat and populations in the stream and provide an added food base for resident trout.

The larger cobble and rock will also provide added cover for both juvenile and adult trout that make the pools their home!



Above: A flow by-pass pipe is placed into the stream channel to isolate the work area and allow clean water to be diverted around the pool excavation site.

## MILLENNIUM CREEK DEFLECTORS

*"Deflectors are a great tool for the constriction of channel flow and the increase in velocity will depend the centre of the channel!"*

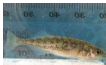
### Deflector Design

A simple deflector design was used in the Millennium Creek enhancement project. Additional woody debris was added to the basic post design to make the deflectors appear more natural and provide added cover for trout.

The posts are spruce or pine. They are striped of their bark, sharpened and driven horizontally into the stream bank on opposing sides of the stream channel. They are installed at or below the water level in the creek, so that frost heaving will be kept to a minimum.

Over time, the channel will narrow and deepen. Riparian foliage will encroach on the stream banks. The root systems of the riparian growth will elevate and stabilize the stream channels perimeter.

The woody debris is an attractive environment for various types of aquatic invertebrates, so the added habitat will contribute to the food base of resident trout as well.



Above: A five spine stickle back minnow. Common on Millennium Creek.



Above: A small brown trout which is also common on Millennium Creek.

## Constricting the Flow!

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### The use of Timber Bundle Deflectors

After the new channel was cut on Millennium Creek, there were certain areas of the stream channel that required further measures to create the narrow deep channel that was in the restoration plan. These areas of the creek had very soft bottoms, low gradient and no cover habitat for trout. The most cost effective and efficient method of remediation was determined to be the installation of deflectors to train the flow in the channel. This would achieve the narrow deep channel that was desired!

In the spring of 2007, a total of 48 timber bundle deflectors were installed into the stream channel on Millennium Creek. The results of this stream enhancement became quite evident by the following year, when the channel narrowed and deepened from a definite constriction in the flow velocity of the channel. By the spring of 2008, vegetation had slowly grown in from the established riparian plants already present on the stream banks and sub-emergent aquatic plants started to cover the shallow areas along the perimeter of the channel.



**Above Photo: Before Deflectors**

This is a photo of a length of stream channel that had been cut one year earlier. The photo was taken in the summer of 2006, before timber bundle deflectors were installed. Note the wide shallow depth of the silt covered bottom with no available fish habitat.



**Above Photo: After Deflectors**

This photo is of the same length of stream channel one year after timber bundle deflectors were installed in the stream channel. The photo was taken in the spring of 2008, one year after the deflectors were placed in the channel. Note the new riparian growth!

## Policeman Creek Deflectors

## Constricting the Flow and Providing Cover Habitat for Trout !

### 2002 Policeman Creek Deflector Project

In 2002, BVHD completed a timber bundle deflector project on Policeman Creek, in the Town of Canmore, Alberta. The project involved the installation of 11 timber deflectors along both sides of the stream channel. The objective was to constrict the flow in the channel, to scour and deepen a run in the centre of the creek.

The submerged timber bundles would also provide good cover habitat for resident mountain whitefish and trout. A track hoe was used to trench in the deflectors, with front anchors, rocks and steel pins to hold them in place.

The finished project was very natural in appearance and the structures successfully deepened the channel and increased the velocity of flow. Trout were observed holding in the cover that they provided, in the following years.



Above photo was taken after the project was completed in 2002. Far Left's photos were taken in 2008. Any disturbed areas had fully recovered by 2008 and no sign of heavy equipment was evident at the sites. The project was funded by ATPo Pipelines Ltd., as part of a fisheries compensation program, for a crossing on the Bow River.



Above: You can see a brown trout holding beneath the cover of a timber bundle deflector.





# BOW RIVER BOULDER PROJECT

## Providing Low Water River Habitat for Trout !

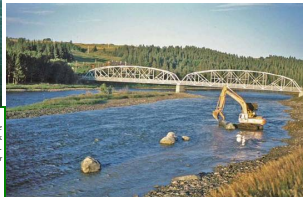
*Large boulders are the best habitat in large free stone rivers, where there is limited shoreline cover!*

### HOME



Above Photo:

This photo was taken from the Highway 22 Bridge over the Bow River. You can see the series of double rock placements installed on the riverbed in this deeper run. The double rock placement design is best suited for deeper areas such as this.



Left Photo:

You can see that the class 4 and class 5 quarry rock used in this project was very large, in comparison to the 355 Hitachi Track Hoe and Cat 980 loader that were used in this program.

The spoil from seating the rock into the riverbed was used to create low profile berms along the shoreline of the river. These berms would also create a current break and eddy, when the river levels are at normal height.



Above Photo:

The triple rock placement is the most effective boulder design for a small cluster of rocks. The single apex rock is always positioned in the center, upstream of the two lower wing rocks.



Above Photo:

This is a Bow River rainbow trout that was caught at one of the boulder sites in 2003. They are pretty unmarked trout that do not grow as large as the rainbow trout that have made the lower Bow River famous!



Right Photo:

This is a 2004 photo of a triple rock placement under low water conditions. A small pocket pool was excavated in 1996, when the project was carried out on the river. You can see that it has maintained its position and the pool is still evident.

Left Photo:

This is a double rock placement in a shallow riffle area. Note the scour around the large rocks. It is in this area around the boulders that sport fish utilize, during low flow conditions on the river. No pool was excavated below these boulders in 1996.



### Assessment of the Sites has Proven Very Positive Results!

The boulder sites have been assessed twice by electro fishing and once using underwater video equipment. The two electro fish programs were conducted during high flow events, but the results proved to be very positive. However, because the habitats were created for low flow conditions, it was necessary to conduct a video survey of the sites at low water conditions. This was completed in 1998 and 1999. The video footage at the site selected for assessment, showed hundreds of both mountain whitefish and rainbow trout utilizing the boulder habitats. The double rock placement shown in the photo above, left, had approximately 9 trout holding around it in the 1998 video and 14 trout and 6 whitefish holding around it in 1999! I have fished these sites over the years with good success, since the project was completed!

# MILLENNIUM CREEK TROUT AND SPAWNING

## Electro Fishing and Spawning Results !

*The fact that trout started to spawn in Millennium Creek ; add a considerable amount of importance to this stream!*

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### Millennium Creek Electro Fishing Results

Before the stream restoration project began, Alberta Fish & Wildlife and the Alberta Conservation Association electro fished the creek. The electro fish program was completed with an objective of collecting some baseline data on fish populations in the creek, before the restoration work commenced. The results of that electro fish program produced a catch of only 5 brook trout, on the lower 50 metres of the creek, with only a few stickleback minnows on the rest of the shocking reach.

In 2007, a year before the 4 year restoration project was completed, F & W once again electro fished the same reach of creek, as in their first program conducted in 2004. The results produced the following: 1 rainbow trout; 7 mountain whitefish; 25 brown trout and 19 brook trout. As is the case with all electro fishing programs, not all of the trout that were shocked were captured!

In 2008, Trout Unlimited electro fished a 100 metre unit of the creek as part of their electrofish training program. The results of their limited shocking produced the following: 1 rainbow trout; 2 mountain whitefish; 4 brown trout and 11 brook trout.

From the results of both of these electro fish programs, it is evident that the stream reclamation has produced the results that was hoped for. As time progresses and further riparian growth and stream bank cover continues to flourish, we can expect more available habitat to increase the resident populations.



### Spawning Occurred on Millennium Creek !

Just after the 4 year project was completed in 2008, brook trout were observed spawning in the creek. As part of the 2008 habitat enhancement program, spawning habitat was created at key locations on the creek. It was very rewarding to see brook trout utilize these spawning habitats soon after they had been created!

Also encouraging, was the migration of larger sized brook trout up into the system during the spawning season. This event added special significance to the importance of Millennium Creek as a spawning tributary to the Bighill Creek.

Not only was the creek important as a nursery habitat for juvenile trout, but now it would be responsible for recruitment of new generations of brook trout into the larger streams downstream. I suspect that even brown trout may return to spawn in Millennium Creek some time in the future!



### " New Spawning Channel Created on the Creek! "

With successful spawning observed on Millennium Creek in 2008 and 2009, it was determined by BVHD that further enhancement for spawning opportunities could only further benefit the stream's fishery! In 2010, with funding provided by Inter Pipeline Fund, a spawning channel was built on the inflow spring that enters the primary spring pond on Millennium Creek.

Following the September completion date of the 10 metre spawning channel, brook trout began their fall spawning in the new habitat created. In total, there were 29 trout redds mapped in the new spawning channel. The new channel was covered with brush to keep wintering ducks from the spring pond out of the water in the channel and it is working quite well so far.

BVHD will be starting a monitoring program in March of 2011, to establish whether the incubation of eggs was successful and document any hatch in the channel for confirmation.

Right Photo:

This is a photo of a spawning brook trout in the newly created habitat.



### Above Photo:

A large brook trout swimming in the Millennium Creek primary spring pond, below the new spawning channel. A number of large trout were observed staging below the spawning channel, including one brown trout pair!

## SPRAY LAKES FISH REEF PROJECT

## Creating a Freshwater Fish Reef!

Each concrete anchor weighed just over 200 lbs and had holes thru the side to add extra woody debris!

Some anchors had 4 holes and others had 6 holes so that more woody debris could be added!

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### Submerging over 300 Root Balls in Spray Lakes

In 1998, BVHD was contracted by TransAlta Corporation to finish a fish reef project that was started but not finished by another organization. The project involved submerging over 300 tree stumps that had been collected in piles, at a number of locations around the west side of the reservoir. Some anchors had been built by the group that first attempted to complete the job, but not nearly enough for the task at hand!

The first attempt involved the use of a helicopter, but it was determined that the project could be completed in a more cost effective manner with a specially designed raft. The raft would incorporate two collapsible rubber truck tubes on the back end, so that the back side of the raft would sink when required. This would be achieved by using an air manifold control operated from a tow boat.

Three sites were chosen for the submergence program, so that a number of reefs could be submerged in a cluster series. This would result in the creation of good fish habitat for lake trout on three different areas of the reservoir. The reefs would be positioned in a depth of 60 feet under maximum storage levels in the lake, so that during low seasonal levels, the reefs would still be 40 feet below the surface of the lake.

### Getting the Job Done!

A custom raft was constructed that could be towed to shoreline and loaded with anchors. Then the root balls could be cabled to the anchors and towed out to the submergence site, which was marked with a buoy at the appropriate depth. Fresh woody debris was threaded into the specially formed anchors to add extra stability for submergence and also provide added bio-mass and cover habitat (See photo below).

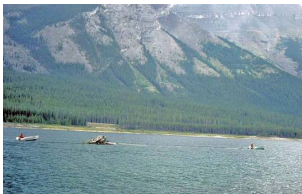
anchors that had been built by the previous group were used in addition to the custom built new anchors. A formula was created to determine the anchor weight required to submerge a given mass of wood in the root balls. Holes were drilled thru the base of the root balls and 1/4 inch galvanized steel cable was threaded thru the stumps and attached to the anchors.

An air line and tow rope connected the raft to the tow boat. A control valve was operated from the boat, to remove and inflate air in the truck tire tubes on the underside of the raft. When the back side of the raft was submerged far enough under the surface of the lake, the anchors and load slid off into the depths.



Above: Duncan McColl reads the anchors on the raft, after they have been loaded with a wheelbarrow.

Above: Duncan McColl loads the raft with the anchors using a plywood ramp.



Above: A load is submerged next to the marker buoy in 60 feet of water.

## CANMORE CREEK LOG WALL PROJECT

Creating a catch bench at the base of a sliding slope is a great way to prevent fine material from entering the creek!

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## Creating a Catch Bench for a Sliding Bank !

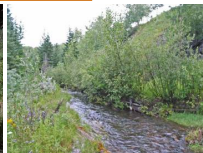
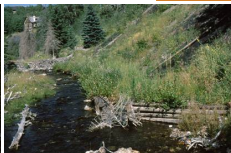
### Why Build a Log Wall ?

Just downstream of the historic Canmore Mines #1, there was a valley slope that consisted of old mine tailings left over from the mining operations. At one location along the creek, the tailings were sliding down into the stream annually and smothering the streambed with coal mine spoil. In order to remediate this problem, BVHD determined that constructing a log wall at the base of the slope, would catch any slippage before it entered the creek. The log wall would need to be approximately 150 feet in length and 2 feet in height. A design was created and the project was completed in 1998.

The log wall was constructed with peeled spruce and pine logs from a forest wood lot approximately 15 kilometres away. The top of the log wall was planted with indigenous willow cuttings that were pre-rooted before they were planted overhanging the log wall and stream channel.

This log wall project was a perfect solution to a problem that had been influencing the health of this trout stream for over 70 years. The photos tell the story!

[CHECK OUT THE LOG-WALL VIDEO - CLICK HERE](#)



## "Building a Rock Wall to Prevent Bank Erosion!"

[CHECK OUT THE ROCK-WALL VIDEO  
CLICK HERE](#)

TransAlta Corporation  
funded these projects on  
Canmore Creek!

## CANMORE CREEK ROCK WALL PROJECT

### A Rock Wall Did the Job!

It was a difficult task getting all of the rock that was needed down to the bottom of the valley, but we managed to get it there! The objective was to armour the outside of a bend in the stream channel, where fine material was being eroded. By constructing a rock wall with a few rock deflectors repelling the flow in the channel, the project turned out to be a successful one!

It was rewarding to return to the site in 2008 and see how natural everything appeared and beneath the riparian cover, you could still see some of the large rock that we used to get the job done. (Below: Eric Landzabala and Duncan McColl finish landscaping the site in 1998).

Above Photo:

This outside bend in the stream was experiencing erosion problems that resulted in harmful mining fines entering the stream. A plan and design was prepared by BVHD for remediation. The project would be completed in 1998, during the Canmore Creek Phase Two Program.



Left Photos Large rock was used to armour the outside of a stream bank on Canmore Creek. Willow plants were planted along the top of the rock wall in very poor soil. However, enough of the plants survived in the following years.

Right Top and Right Photos:

These two photos of the rock wall site were taken in 2008. It is hard to see the large rock hidden beneath the grass and willow, but the rock wall did the job.

Surprisingly, the willow plants did ok in the poor soil conditions at the site.

