

THE STORMWATER KIDNEY™

A STORMPOND BIOFILTRATION SYSTEM



NORTH GLENMORE WETLAND,
CALGARY, AB, CANADA
DESIGNED by BERNIE AMELL
STORMWATER KIDNEY ANTECEDENT PROJECT

WHAT IS A STORMWATER KidNEY™

Wetlands and other natural biofiltration systems can be thought of as kidneys of a watershed. These systems are self sustaining and do not require human intervention to purify and cleanse water. The Stormwater Kidney™ system from Source2Source Inc.:

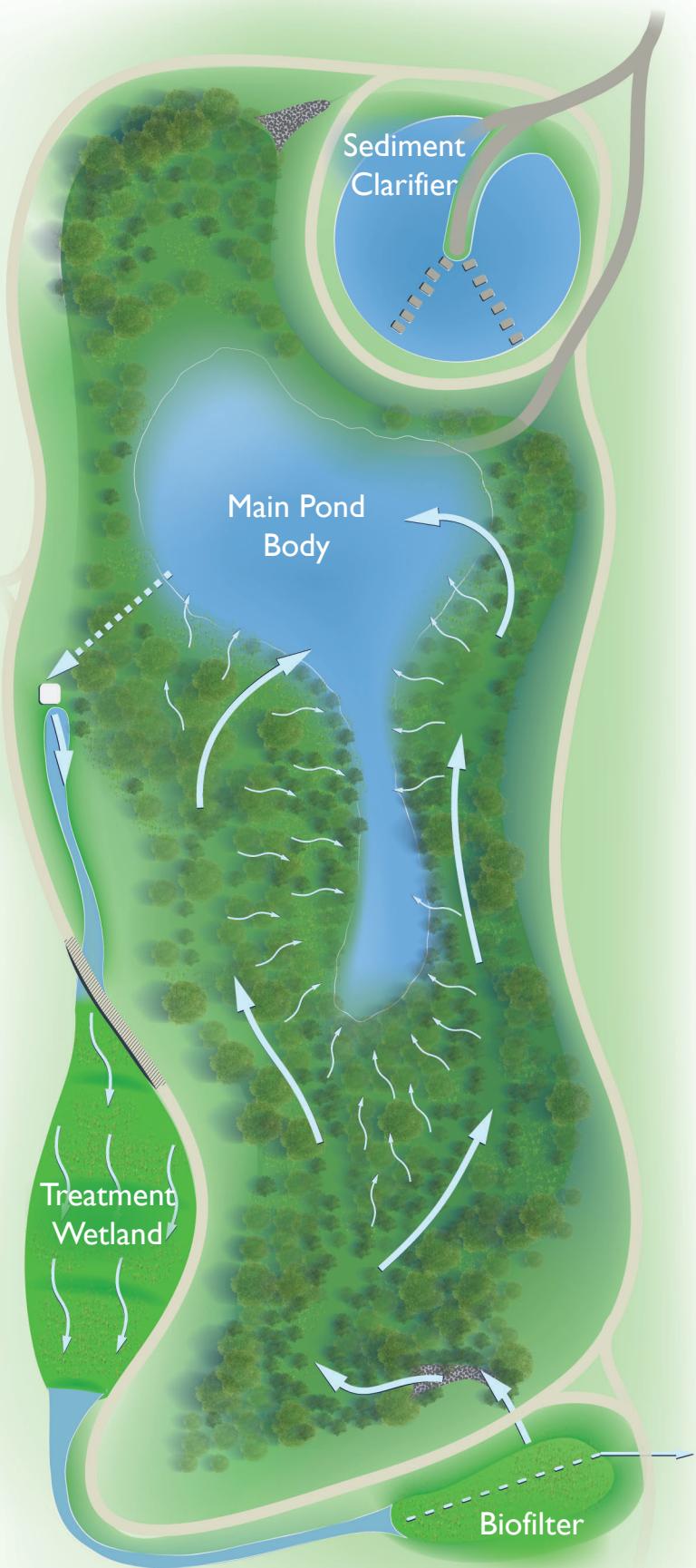
- is a self maintaining biofiltration system;
- utilizes low-energy recirculation;
- offers simplified sediment management;
- minimizes outbreaks of algae and weeds;
- is designed for human pathogen reduction, producing safe treated water for non-potable use;
- fits within the same footprint of a traditional stormpond (greenfield or retrofit);
- enables additional community flood and drought protection;
- is a beautiful addition to a community.

Normal Operation

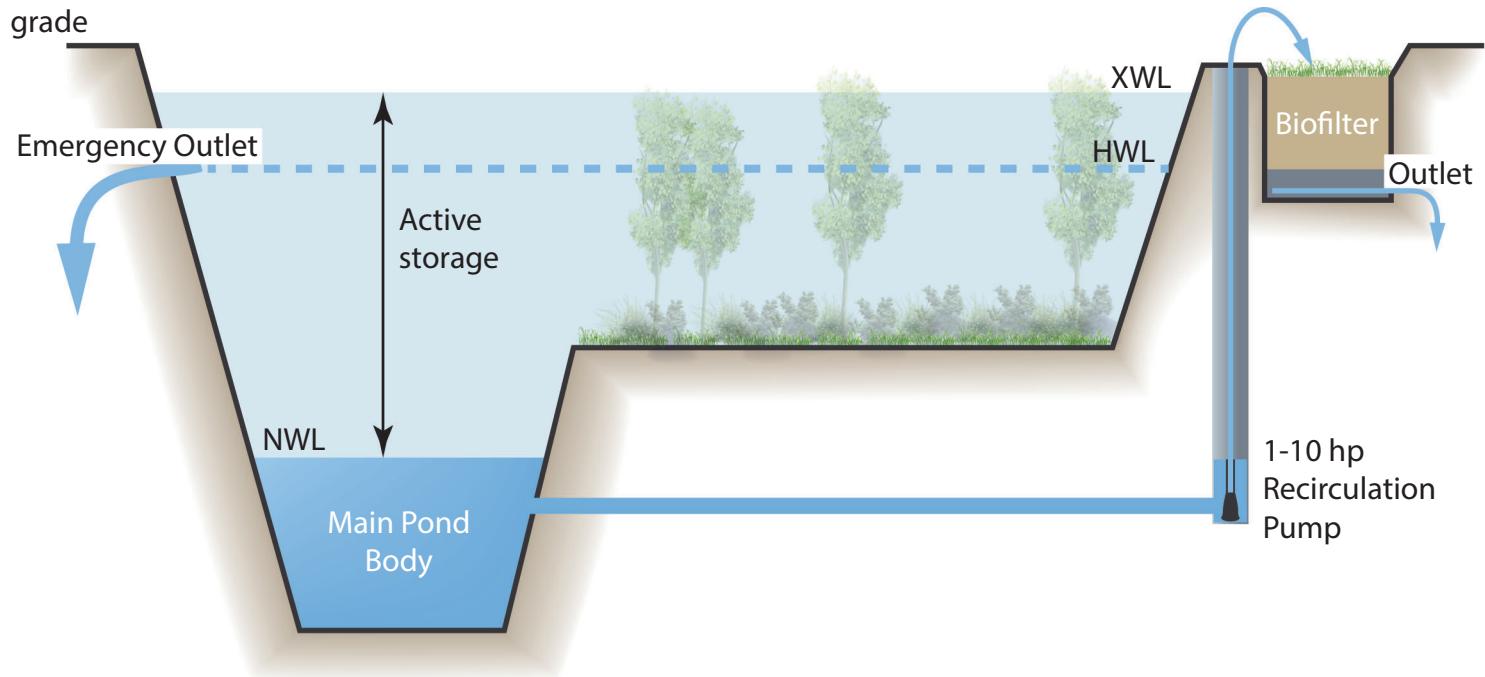
1. Water is circulated from the main pond body following a storm through the treatment wetland and biofilter
2. A portion of treated water is harvested from the biofilter
3. Gravity circulation back to main pond body for continuous cleansing

Storm Event Management (Occasional Operation)

1. Stormwater enters the sediment clarifier
2. Coarse particles settle out in the clarifier
3. Water with very fine particles and dissolved contaminants enters the main pond body to be cleansed as per normal operation



BENEFITS OF THE SYSTEM



The Stormwater Kidney™ system was conceived as a cost-efficient enhancement to stormwater infrastructure. For most of the year, conventional systems are under-utilized, as water in the ponds is stagnant and outlet pipes are empty. The Stormwater Kidney™ system is designed to recirculate and treat water and to continuously discharge treated water at lower flow rates, thus enabling high utilization. This enhanced performance leads to a variety of functional and economic benefits, as highlighted below.

Economic benefits

1. Less expensive than a conventional system;
2. No oil-grit separators required;
3. Smaller downstream infrastructure, flexible outlet elevations;
4. Inexpensive pumping and treatment;
5. Less excavation;
6. Reduced area that requires lining;
7. Simple and effective maintenance;
8. Monetary gains from water re-use.

Functional benefits

1. Clean water for re-use or discharge;
2. Flexible volume and flow management;
3. Minimal maintenance enabled by natural treatment systems ;
4. Reliable removal of pathogens, dissolved contaminants, and fine particles;
5. Increased active storage;
6. Effective and localized sediment capture;
7. Aesthetic and ecological value;

CASE STUDY

Stormwater Kidney™ System vs Conventional Stormpond

A Stormwater Kidney™ system fits within the same footprint as a conventional pond, while offering multiple benefits and unique features, such as additional active storage, resilient and attractive landscapes, and water cleansing biofiltration elements. A Stormwater Kidney™ system has smaller areas of permanent water thus requiring substantially less liner. This results in one of the many construction cost savings associated with a Stormwater Kidney™ system as compared to a conventional stormpond (see Capital Cost Comparison section).

A small recirculation system is used to constantly turn the water in the Stormwater Kidney™ over, thus allowing near continuous production of clean baseflow discharge. Continuously discharging clean baseflow to the environment at low flow means high utilization of a small outlet pipe. Much greater flexibility exists for optimizing outlet pipe sizes and discharge elevations compared to a conventional stormpond.

The following example illustrates an increasingly important scenario where a land developer or municipality wishes to safely harvest treated stormwater for an irrigation system. Safely supplying water for irrigation means achieving target Log₁₀ reductions of human pathogenic viruses, protozoa, and bacteria according to federal and local regulations.

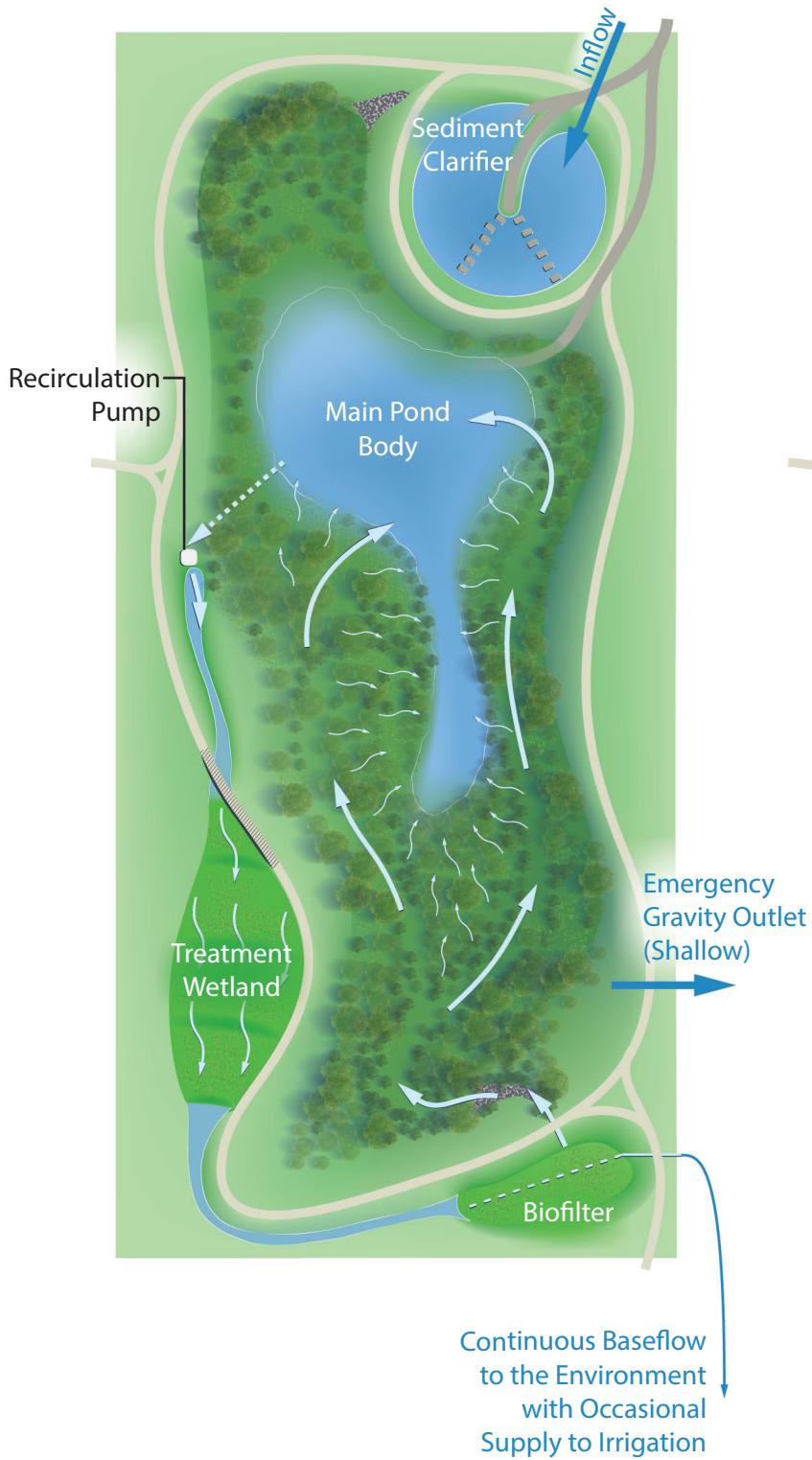
Example - Using Treated Stormwater for Irrigation

For a conventional pond, an irrigation system draws water directly from the main pond body, which may be subject to high turbidity, algal blooms, pathogens, and other trace contaminants. Because of this, a mechanical treatment system is typically required to utilize a conventional pond for irrigation. This typically means designing a system with oversized pumps, filters, membranes, disinfection systems, chemical supplies, etc. resulting in a relatively large capital cost for constructing a treatment system.

In contrast, a Stormwater Kidney™ system continuously circulates water through a self maintaining treatment wetland and biofilter to eliminate turbidity, algae, and human pathogens to enable beneficial stormwater uses downstream. A portion of the biofiltered water can be discharged as baseflow to the environment, while another portion gets returned to the main pond body. Water in the main pond body can be turned over multiple times a week, thus reducing nutrient levels, which could cause problematic algae outbreaks. At any time, clean treated water from the downstream end of the biofilter can be supplied to an irrigation system. When compared to the mechanical system associated with a conventional pond, the cost to construct and operate the circulation system, treatment wetland, and biofilter in a Stormwater Kidney™ system is substantially lower.

PLAN VIEW COMPARISON

Stormwater Kidney™ Pond multiple patents and patents pending

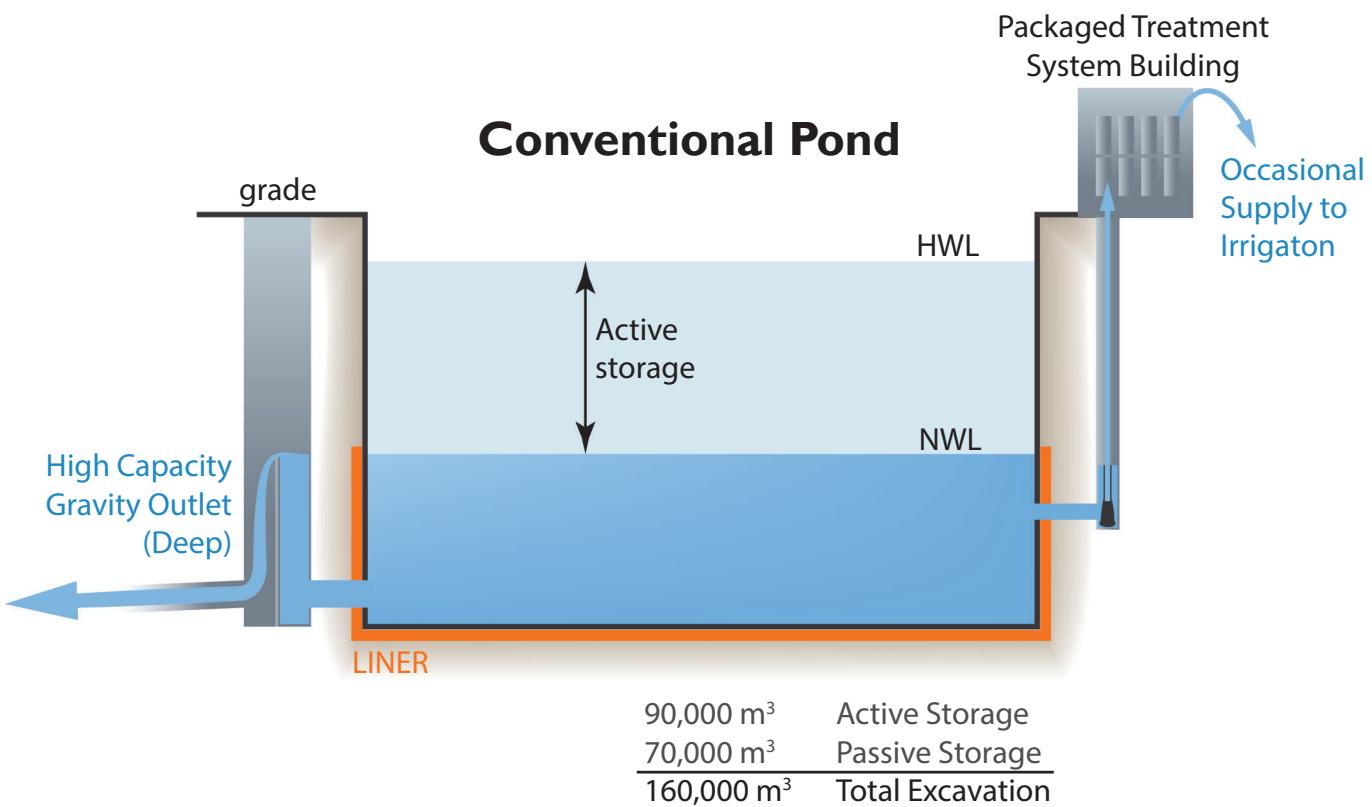
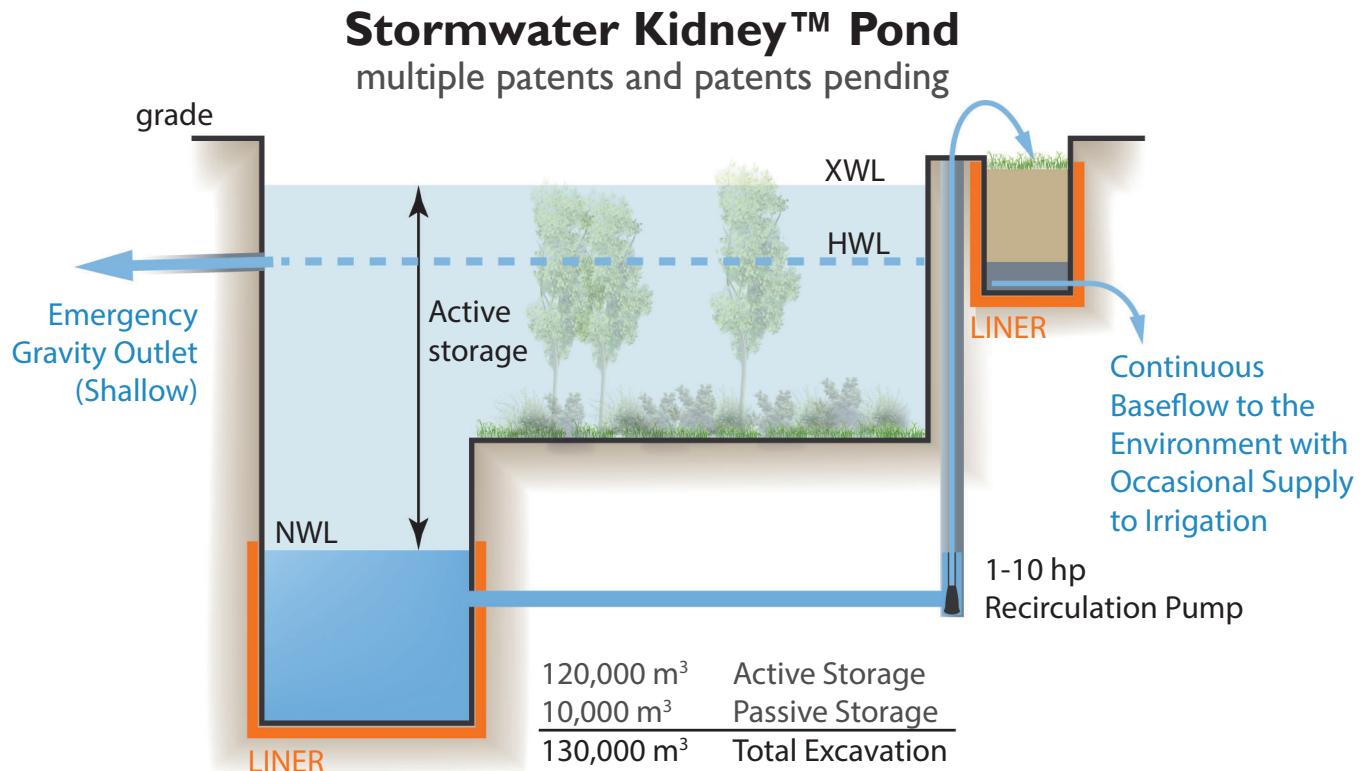


Conventional Pond



CROSS-SECTION COMPARISON

NOTE: Inlet infrastructure not shown for simplicity



CAPITAL COST COMPARISON

NOTE: Key differences highlighted only

Stormwater Kidney™ Pond

EXCAVATION

-130,000 m³ Total Excavation
-\$5/m³ = \$650,000

\$150,000 Savings

GEOSYNTHETIC CLAY LINER

- 2 ha total wet area requires 2 ha of liner
-\$21/m² = \$420,000

\$420,000 Savings

OIL-GRIT SEPARATORS

- not required

\$420,000 Savings

PLANTINGS

- \$350,000

\$200,000 Extra

IRRIGATION WATER TREATMENT

- circulation system = \$150,000
- biofilter system = \$100,000

\$500,000 Savings

Conventional Pond

EXCAVATION

-160,000 m³ Total Excavation
-\$5/m³ = \$800,000

GEOSYNTHETIC CLAY LINER

- 4 ha total wet area = 4 ha of liner
-\$21/m² = \$840,000

OIL-GRIT SEPARATORS

- very large and/or multiple vaults
-\$500,000 minimum

PLANTINGS

- \$150,000

IRRIGATION WATER TREATMENT

- \$750,000 including building

\$1,370,000 Total Capital Savings

ADDITIONAL SAVINGS

Not listed above are multiple savings associated with the reduction in size and depth of downstream infrastructure needed to drain a Stormwater Kidney™ system as compared to a conventional pond. Moreover, the long-term operation and maintenance costs are considerably lower due to utilization of natural, self-maintaining treatment systems. Lastly, there are numerous opportunities for monetary gains associated with water re-use opportunities made possible by a Stormwater Kidney™ system.

SOURCE2SOURCE INC.

The formation of Source2Source Inc. (S2S) reflects the emergence of a creative interdisciplinary practice at the forefront of environmental design and hydraulics engineering. As civic populations rise and increasing pressures are placed on our environments, Source2Source's philosophy is that innovative design approaches will be required. The need to provide a well-integrated, multidisciplinary approach to environmental design has never been more apparent.

S2S has experience as the principle designer of more than 100 biofiltration wetland systems. These constructed systems have been so successful and low maintenance that they have been mistaken for natural wetlands by communities and maintenance staff alike.

TECHNOLOGY LICENSING OPPORTUNITIES

S2S holds multiple patents and patents pending in Canada and the US. We seek opportunities to license the technologies to design firm partners who see how they can become more competitive in delivering innovative and low cost design solutions to their clients. E-mail cory.albers@source2source.ca or call (403) 966-5123 if you would like to discuss how S2S technologies can help you and your clients meet your current and future stormwater management needs.



www.source2source.ca

BERNIE AMELL



Mr. Amell has a 40-year career focusing first on "normal" landscape architecture relating to his bachelors degree from the University of Guelph, and in the last 20 years evolving into a specialty in environmental design. In the latter capacity, he has become recognized as an expert in the design of constructed wetlands for water treatment, in Low Impact Development landscapes, and in the restoration of streams and riparian habitats. He is active in various environmental and social committees in Calgary and Southern Alberta.

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CORY ALBERS



Mr. Albers has more than a decade of experience in a wide variety of water resources engineering projects. He specializes in advanced hydraulic engineering design and forensic systems analysis. By coupling his strong technical skills with an equally strong interest in larger systems interactions, Cory works very effectively with biologists, landscape architects, provincial and federal regulatory agencies, construction contractors, and both private and public sector clients.

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