

AQUALASTIC® CANAL REPAIR SOLUTIONS FOR URBAN, RURAL, DEGRADED AND LEAKING IRRIGATION CANALS

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ABSTRACT

The AquaLastic® Canal Repair System is a solution for severely degraded, leaking and potentially leaking concrete irrigation canals.

AquaLastic® was developed in response to an industry need, by two individuals from Washington State who thought of taking a known polyurea substance and developing it in specific ways to meet the unique, worsening conditions of aging irrigation systems.

Today, over 6 million linear feet of AquaLastic® has been applied to Western irrigation canals and the AquaLastic® technology has performed to flawless standards ever since the first installation over eight years ago. At Quincy Columbia Irrigation District, WA, it remains as effective in the canal as the day it was installed, even though AquaLastic® has since gone through subsequent product and application improvements.

There are many irrigation districts that have substantially benefited from AquaLastic®. These districts saved large dollar amounts when compared to other methods of canal repair or replacement, and AquaLastic® also stopped water leaks, thereby recouping much of the cost of installation via water sales that would otherwise have been lost.

AquaLastic® is an example of how products developed for other industry areas have, and continue, to be adapted in productive and useful ways for other uses.

INTRODUCTION AND BACKGROUND

AquaLastic® began over a quick lunch break on a windswept highway in Washington State.

Tom Matheson (Matheson Painting) and Jim Powers (Powers Equipment) were discussing the emergency situation at a nearby canal company. A main, high capacity feeder canal was leaking. The pressing fear was that the leaks might rapidly worsen and flood a populated area below the canal.

Tom Matheson's industrial painting company was, at the time, sealing metal gates using a polyurea product and the two men discussed applying the material to the cracks in the concrete canal liner.

They suggested it to the irrigation district's manager as a *temporary* solution to the impending emergency and he gratefully agreed. A few months later, with the temporary solution still perfectly in place, AquaLastic®, formerly known as Hydrolastic, came into being as a canal repair product.

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That was more than eight years ago and today, the original application site remains perfectly intact.

Several product revolutions and nearly a decade later, the AquaLastic® Canal Repair System remains the leading method of concrete canal repair throughout the northwest irrigation states and is rapidly growing in demand in many more states, including California, Utah, Arizona, New Mexico and Nevada. AquaLastic® is exclusively distributed worldwide by Cygnet Enterprises Northwest Inc. in partnership with Cairo Canal Solutions LLC.

The AquaLastic® name has also developed to be described as the AquaLastic® Canal Repair System. It was quickly understood that applicator experience and skill is an essential element of efficient use of polyurea substances on concrete for underwater applications and that other products, such as fillers, can be utilized to increase the places that AquaLastic® can be used to save money and prolong the life of canals, flumes and ditches.

These other products are a variety of state of the art industrial sealers and fillers that enable the experienced application crew to enhance the operation by chasing-down and filling and securing voids and leakage channels underneath and behind concrete panels.

As Dick Hapaala, Senior Engineer at Ch2M Hill remarked about an AquaLastic® installation crew that worked on a badly degraded flume at Union Gap ID in WA: “Those guys made it look easy, but on studying them at work, I saw that it takes experience and a high level of skill to do it right.”

AquaLastic® has been developed to offer a number of unique qualities. The most important of these is the product elongation factor of nearly 900% and its adhesive qualities and tensile strength. However, even the unique qualities of the AquaLastic® polyurea are only valuable when applied by experienced applicators with years of experience handling the materials. Polyureas are a two-part component application, mixed at the nozzle, and any movement off ratio, however slight, will greatly affect the performance and longevity of the material. An experienced applicator knows exactly how AquaLastic® should look, feel and perform and knows instantly if there is a change.

Later, we look at three different canal systems where Certified Applicator skills and the AquaLastic® Canal Repair System came together to make tremendous, cost-saving improvements to different canal situations.



AquaLastic® being applied using high pressure application equipment

AquaLastic® the Product

AquaLastic® is a state-of-the-art, high performance, sprayed, plural component pure polyurea elastomer. This system is based on amine-terminated polyether resins, amine chain extenders and MDI prepolymers. It provides a flexible, resilient, tough, monolithic membrane with good water and chemical resistance. It is applied using high pressure application equipment.

DRY PROPERTIES* @ 70 mils (1.77 mm)*	
Tensile Strength ASTM D 638	3400 psi (23.63 mpa) Avg
Elongation @ 77°F (25°C)	867% Average
Hardness (Shore A) ASTM D 2240	87 (0s)
Hardness (Shore D) ASTM D 2240	41 (0s)
Tear Resistance ASTM D 624	398 PLI (69.69 KN/m) Avg
Perms (MVT) ASTM E 96	.107
Service Temperature	-40°F - +200°F
	-40°C - +93°C

Figure 1. Dry Properties of AquaLastic®

Key Features of AquaLastic®

- 100% solids. No solvents, No VOC's
- Fast set: Handle in two minutes or less.
- Hydrophobic, therefore unaffected by damp, cool surfaces during application
- Proprietary adhesion enhancing additives ensuring excellent bond strength to concrete
- Extended tack time to allow deep surface penetration
- High temperature stability up to 250° F (121 °C) with intermittent temperatures up to 300° F (148 °C)
- High abrasion resistance
- ASTM E84-97a and complies with NFPA and UBC Class 1 Fire Rating

CANAL CASE STUDY 1 — ROZA IRRIGATION DISTRICT, WA

Roza Irrigation District AquaLastic® Application

Background

There were two sections of the main canal, approximately 3,598 linear feet that had been leaking excessively due to a large number of cracks caused by expansion and contraction from freeze-thaw cycles that rendered the concrete non-water tight. Once the water escaped through the cracks it entered drains under the concrete liner that were originally intended to carry water away from the liner. The amount of water that was leaking was known via a water meter.



Escaping water was metered at this point

The objective was to eliminate enough seepage to make application of the product, AquaLastic®, cost-effective once the next water shortage year came to pass. To do this, the project would have to eliminate at least 88% of the seepage.

The project entailed sandblasting a three to four inch strip each side of all the cracks and clearing the canal of debris. This work was carried out by the AquaLastic® Certified Applicator and the crew then applied approx 80 – 100 mils of AquaLastic® to the cracks, bridging the gaps to create a water-tight seal to eliminate the leakage.

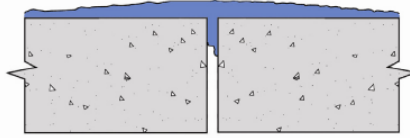


Figure 2. AquaLastic® bridges cracks to accommodate expansion and contraction from freeze-thaw and cool-heat cycles.

Upon Completion

Prior to the start of the project, the estimated water loss was approximately 1,220 acre-feet per irrigation season. After the completion of the project, not only did AquaLastic® eliminate 99% of the seepage, far exceeding the required 88%, but during the following 2007 season, the total water loss was approximately 14 acre-feet, for a net savings of 1,206 acre-feet. This saving is equal to \$145,500 annually and so the project more than paid for the application costs during the next drought season when the additional water could be marketed.



The metered site after AquaLastic® application. No water can be seen.

CASE STUDY 2 — THE BOISE PROJECT, ID AND URBAN CANALS



Urban development encroaching on canals

Background

Irrigation Districts have some special situations to deal with, such as when canals pass through urban areas. In many cases, canals were constructed before any urban residential or industrial construction. A main canal managed by the Boise Project Board of Control,

Idaho flows right through the center of Boise and numerous residential areas. Some real estate agents have even gone so far as to describe the properties as ‘water front’. Managers of The Boise Project have, as a consequence, wrestled with a number of problems concerning the proximity of urban build-up to their canals. In one such case, they were dealing with the problem of water leaking into the basement of a house that was situated well below canal level.



Photo taken from the backyard of the house. The canal flows above the level of the house behind the constructed retaining wall.

The Boise Project chose to utilize AquaLastic® in an experiment to try to establish where the water was originating from. The possibilities were that it was leaking out of the immediate canal stretch, from a different part of the canal, or flowing from the heavily ‘watered’ yards of an upscale residential area above the far side of the canal. As there were a number of cracks in the walls of the main canal and a large gap between the wall and floor and the first step in the elimination process was to seal them.



The canal prior to application



The canal during application

AquaLastic® crack sealer was applied to the stretch of canal most likely to be leaking, in spring '07. The Boise Project's own maintenance team undertook sandblasting the crack areas prior to application. The largest cracks between the walls and the bottom of the canal were filled first with specially selected industrial foam filler and then the coating was applied by AquaLastic® Certified Applicators to form a water-tight seal over the top.

The canal was very carefully scrutinized by teams from both organizations to ensure that every crack had been sealed.

After irrigation start-up, it was found that water was still leaking into the house. Manager, Paul Deveau said at the time: "We are very disappointed for the homeowners, but also now very confident that the water is coming from elsewhere. It is a process of elimination to find out where it is coming from and this has been a good start."

The following year, The Boise Project contracted the application of additional AquaLastic® to other areas in the same urban canals as part of their ongoing canal maintenance program.



The Boise Project New York canal

AquaLastic® has become a leading choice for the repair of urban canals where breaching would have particularly disastrous consequences.

Kennewick Irrigation District in Kennewick, WA has many parts of its system where urban development, industrial and residential, has encroached on aging canals. As a consequence, the management took the decision to use AquaLastic® on a rolling program and many miles have now been completed with potential urban flood areas treated as a priority.



A recent canal break in an area not yet treated with AquaLastic® caused severe problems for the district, demonstrating the potential consequences. In this case, farmland was flooded rather than housing, but the emergency reinforced the potential reality of a breach in a populated area of the City of Kennewick.



Photo courtesy of KNDU.com

Extract from KNDU.com website. “KENNEWICK, Wash. - Crop owners and Farmers are wondering when water will come after a Kennewick Irrigation District canal broke Monday.

The brake [sic] couldn't have come at a worse time. With the record heat and no water, orchards and crops have little to depend on and little time to survive.

John Pringle of Pringle Orchards in Kennewick has thousands of apple trees in danger of drying out..... ”

CASE STUDY 3 — FLUME AT NAMPA AND MERIDIAN IRRIGATION DISTRICT, ID



Degraded high level flume photographed early spring '08



The flume exhibited advanced deterioration in all areas with damaged joints and exposed aggregate.

Manager of Nampa and Meridian Irrigation District, John Anderson estimated that the flume was losing 25 Miner Inches or 1 Acre Foot per day. Water was visibly leaking and there was severe spawling on the concrete.

He explained that the Irrigation District had patched-up the flume many times and within one irrigation season, the patches were peeling away.



Example of patch peeling away

A complete re-build had been considered at a cost of \$0.75- \$1 million. A repair was effected with the AquaLastic® Canal Repair System in late spring of 2008 at a cost of around \$80,000.

The repair process included several steps before AquaLastic® was applied to the entire surface area. The flume was sandblasted throughout the inside circumference and across the top of the sides. It was then patched with a polymer cement and primed with Epoxy paint.



Several processes took place before AquaLastic® was applied



The flume is completed and ready for re-watering at a fraction of the cost of replacement

John Anderson says there have been no visible leaks throughout the irrigation seasons of 2008 and 2009 and that the flume over-wintered well in Idaho's harsh winter weather with no observed problems associated with the AquaLastic® coating.

NEW AQUALASTIC® LOW PRESSURE SYSTEM (ALPS)



Irrigation Districts can now undertake many of their own concrete canal repairs with the new, state of the art AquaLastic® Low Pressure System (ALPS).

The System allows districts to safely handle and apply a proven polyurea using their own maintenance crew, giving them the flexibility to repair areas of canals in selected places where a high pressure application with a Certified Applicator is not necessary.

Extensively tested on irrigation canals in the North West, the AquaLastic® Low Pressure System consists of a low pressure, self-contained system that is so compact, it will fit into the back of a standard sized pick-up and even onto the back of an ATV. The unit is mounted on wheels for easy loading and maneuvering into vehicles or directly into canals or onto access roads and tracks. Complete with a central heating system and elongated heated hoses, it is designed for use in canals any time of the year, including low temperature winter conditions.

Initial ALPS field tests took place with the help of several irrigation districts in winter 2008. Based on those trials, several modifications to the system were engineered and recent field tests have demonstrated the ease of operation and effectiveness of the system.

ALPS uses state of the art polyurea technology from the AquaLastic® product suite. AquaLastic® *high pressure* has a flawless 10+ year history with no product failure, in irrigation canals. This is due to its unique properties that have been optimized over many years for the specific requirements of irrigation canal systems. Many of these unique advancements exist in the low pressure polyurea which is so well developed, that it meets many of the standards currently found in other high pressure polyureas advertised on the market, that are more expensive to apply.

Use of ALPS requires a very short training program that covers equipment start-up, shut-down, and minimum maintenance requirements.

The ALPS equipment is highly affordable to purchase and a rental option is also available, making it especially approachable for smaller districts that might wish to utilize the technology in their concrete ditches.

ALPS is not intended as a direct replacement for the AquaLastic high pressure applications that have been used to repair major problems in canals and flumes and completed by experienced, AquaLastic® Certified Applicators. It is an additional option that is particularly suited to repair smaller canals and ditches and also as an emergency repair option that is especially beneficial for urban canal systems where unforeseen water leaks have potentially disastrous consequences.