

Introduction

Advanced In-Situ Sediment Remediation Technology for Rivers and Lakes

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OBJECTIVE

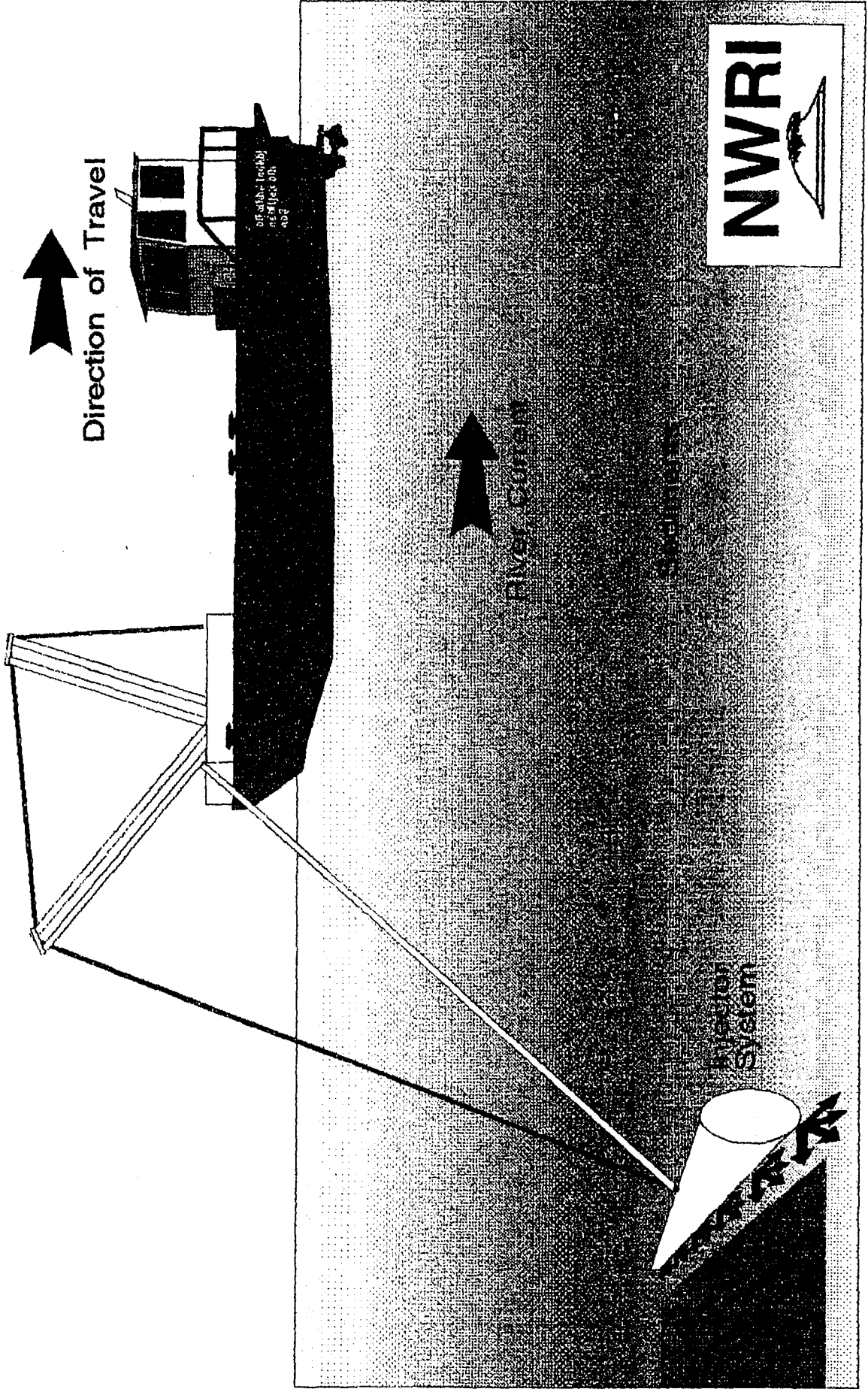
To restore polluted rivers, lakes, and harbors in Korea using advanced technologies such as the in-situ sediment remediation technology developed by the National Water Research Institute of Environment Canada and Limnofix Inc.

This treatment is environmentally superior and more cost effective than traditional treatment methods which require dredging and treatment or disposal of dredged material on shore.

In-Situ Sediment Remediation Technology

- **Direct injection of chemicals into aquatic or marine sediments to facilitate remediation**
- **Environmentally superior**
 - No dredging required
 - No disposal on shore
 - No transportation
 - No secondary treatment
 - Low impact on natural environment
- **Positive results worldwide**
 - e.g. Lake Biwa in Osaka, Japan
- **Cost effective treatment**

IN SITU SEDIMENT TREATMENT SYSTEM



CONTAMINATION



Excess Nutrients
{Eutrophication}

Sewage

Agriculture (fertilizer)

Industrial (Beer, liquor etc.)

Golf Courses

Sediments (in lake)

Urban Developments



Petroleum

PAHs

Metals

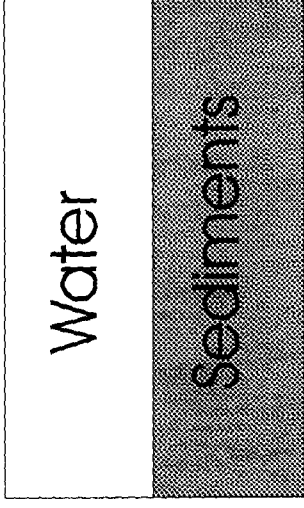
Organic (oxygen demand)

Toxins



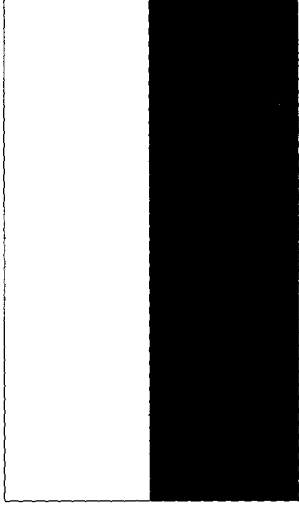
'Normal' Lake

High Oxygen
Low Nutrients
No Sulphides
Moderate Algae



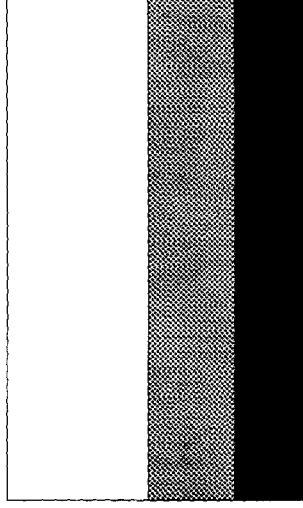
Eutrophic Lake

Low Oxygen
High Nutrients
High Sulphides
High Algae



Treated Lake

High Oxygen
Low Nutrients
No Sulphides
Moderate Algae



Treatment Method

Direct injection of treatment chemicals into surface sediments can be used for:

- **Bioremediation of organic contaminants**
 - e.g. oil, grease, PAHs, BTXs, TPH, wood wastes and other organic deposits (sources : steel mills, petroleum refineries, sewer outfalls, marinas and boat yards, and other sources of organic deposits)
- **Sediment oxidation to control problems created by anoxic sediments (oxygen deficient sediments)**
 - odors, nutrient release, and toxicity caused by sulfides , methane production and release of soluble metals (sources: agricultural runoff, beer factories, sewer outlets, anoxic sediments exposed by dredging, etc.)
- **Sediment consolidation and flocculation to produce stable marine sediment surfaces**

The following table lists some of the results of sediment treatment that we have achieved in bench- and pilot-scale treatability studies.

| SITE | CONTAMINANT | Initial (mg/kg) | Final (mg/kg) | % REMOVAL | INCUBATION TIME |
|---|-------------------|-----------------|---------------|-----------|-----------------|
| Lake Biwa (pilot scale) | Phosphorus (ug/L) | 72.5 | 75 | 90 | |
| | Iron (mg/L) | 4.2 | 0.25 | 95 | |
| | Sulphides (ug/g) | 2.4 | 0.2 | 90 | |
| Hamilton Harbour | TPHs | 20,000 | 4,400 | 78 | 44 days |
| | PAHs | 1,400 | 448 | 68 | 44 days |
| St. Marys River note: incubations without amendment | Retene (a PAH) | 260 | 130 | 50 | 1 year |
| | TPHs | 20,000 | 2,000 | 90 | 1.5 years |
| | PAHs | 20 | 8 | 60 | 1 year |
| Embayment A | TPHs | 1,750 | 385 | 78 | 150 days |
| | PAHs | 200 | 44 | 78 | 150 days |
| | TPHs | 27,500 | 2,750 | 90 | 44 days |
| Spadina Boatslip | PAHs | 150 | 27 | 82 | 44 days |
| | TPHs | 350,000 | 140,000 | 60 | 37 days |
| | PAHs | 5,300 | 2,173 | 59 | 37 days |
| Oil Company | BTXs | 1,600 | 528 | 67 | 37 days |
| | Sulphides | 1,383 | 97 | 93 | 17 days |
| | Phosphorus (mg/L) | 3.07 | 0.031 | 99 | 39 days |
| Venice | PAHs | 159 | 60 | 62 | 39 days |
| | TPHs | 1,000 | 490 | 51 | 39 days |

TPH- total petroleum hydrocarbons
PAH- polynuclear aromatic hydrocarbons
BTX- benzene, toluene, xylene