

*Ivey International Inc.*



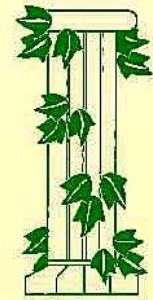
*Selective Phase Transfer Technology*

*Presentation*

*Remediation Technology Symposium*

*2002*










**IVEY**



***Ivey-sol***

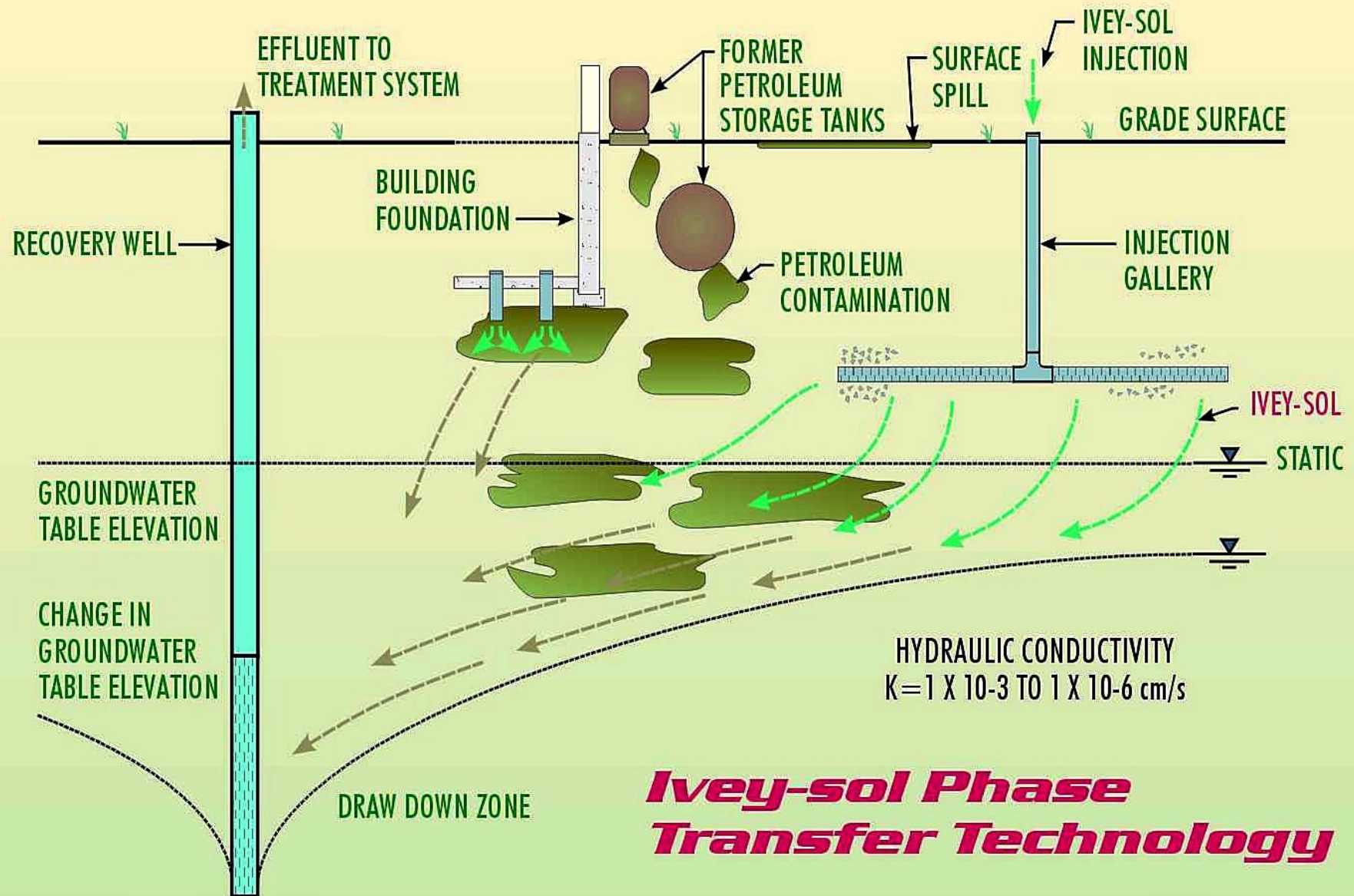
***Phase  
Transfer  
Technology***

## ***Ivey-sol = Success***

-  **75% faster** than Pump & Treat
-  **90-95%** of the sites are completed in **under 18 months** compared to the industry average of 5-7 years or more
-  **100% Success Rate**
-  The technology is accepted by Departments of the Health and Environment
-  Application Range includes:  
Total Petroleum Hydrocarbon (TPH), Full LNAPL's range and PAH contamination of soil, bedrock & groundwater.
-  Average cost savings are **>20%/project**
-  ***Ivey-sol*** mixtures are environmentally friendly as well as biodegradable.
-  Case studies and reference materials are available
-  Patent Pending obtained in 1998

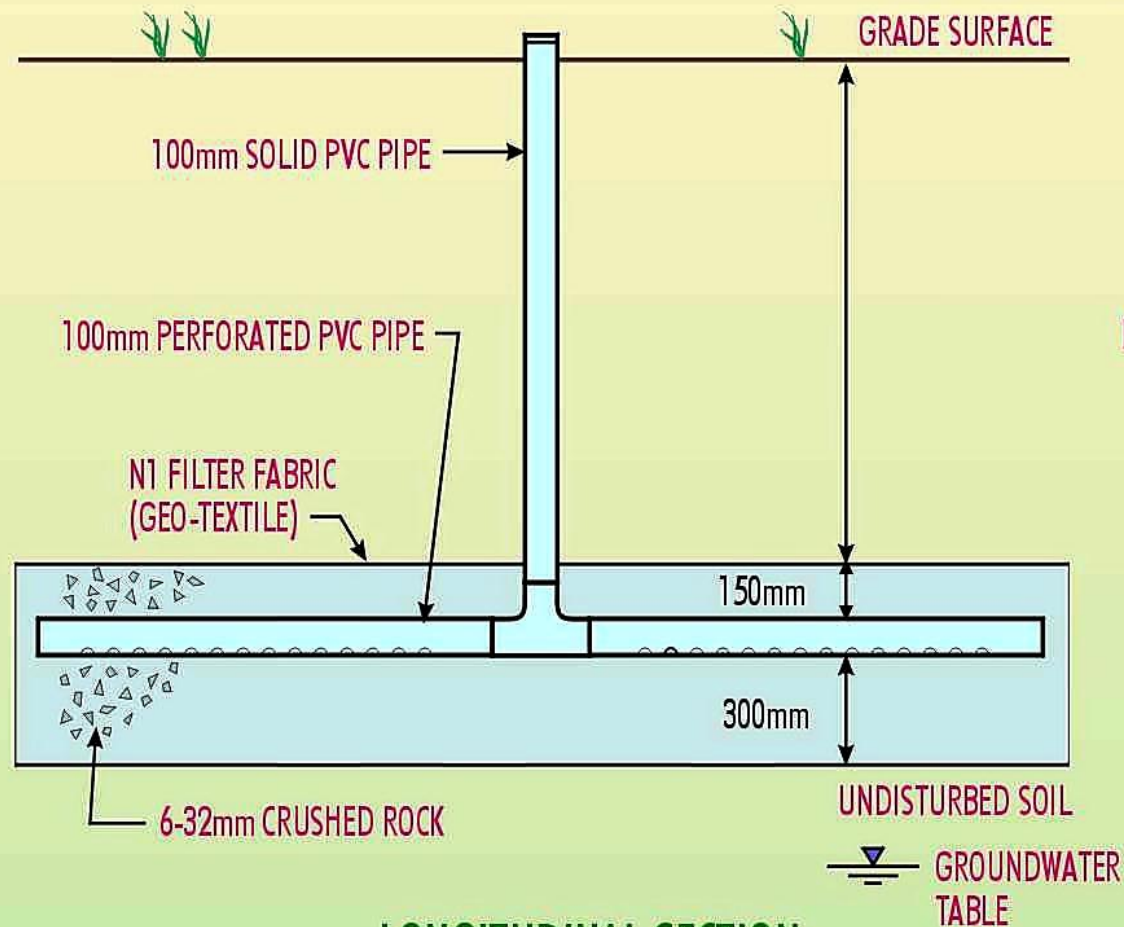


**Ivey-sol**

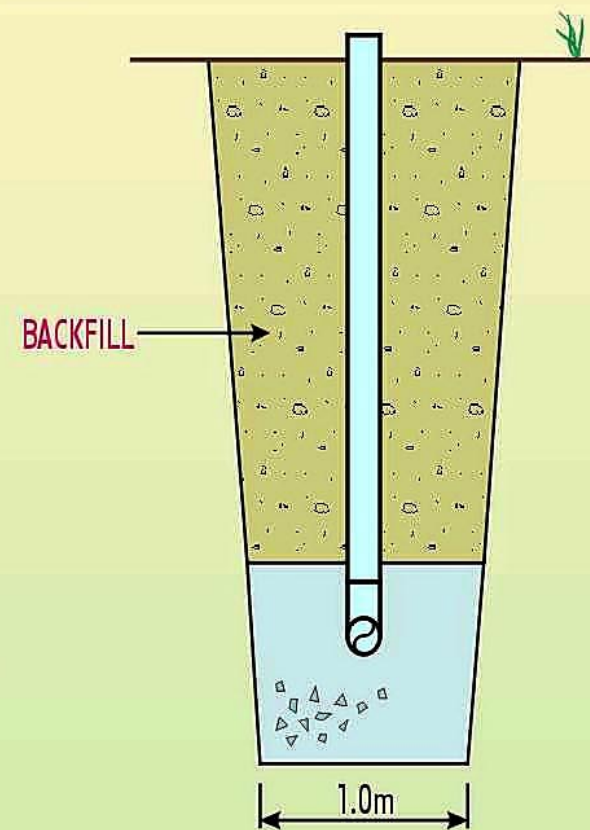


***Ivey-sol Phase  
Transfer Technology***

## ***Injection Gallery***



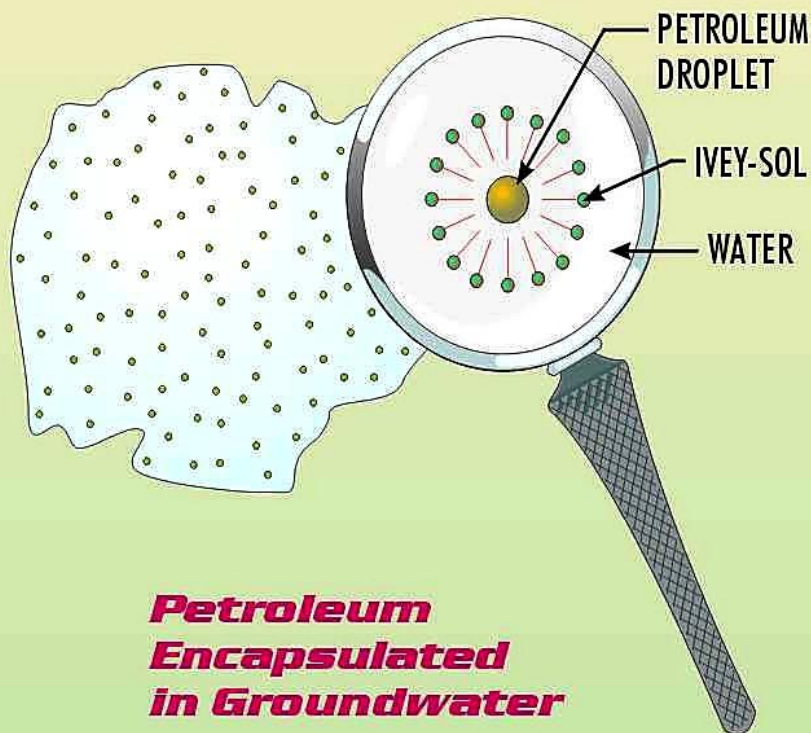
**LONGITUDINAL SECTION**



**CROSS SECTION**



## ***How the Technology works***



-  Incorporates designed phase transfer mixtures that interact with a specific type of organic LNAPL and PAH contaminants.
-  Contaminant is liberated and encapsulated (Micelle), allowing for rapid recovery at a pumping well on-site.
-  Injections conducted on monthly to bi-monthly basis according to site-specific conditions and requirements.
-  Clean-up time shortened, liability lowered, and project costs dramatically reduced.
-  More of the contaminated material is recovered easily, reducing the need for costly, extensive soil excavation.

***Ivey-sol***

## ***Phase Transfer Process***

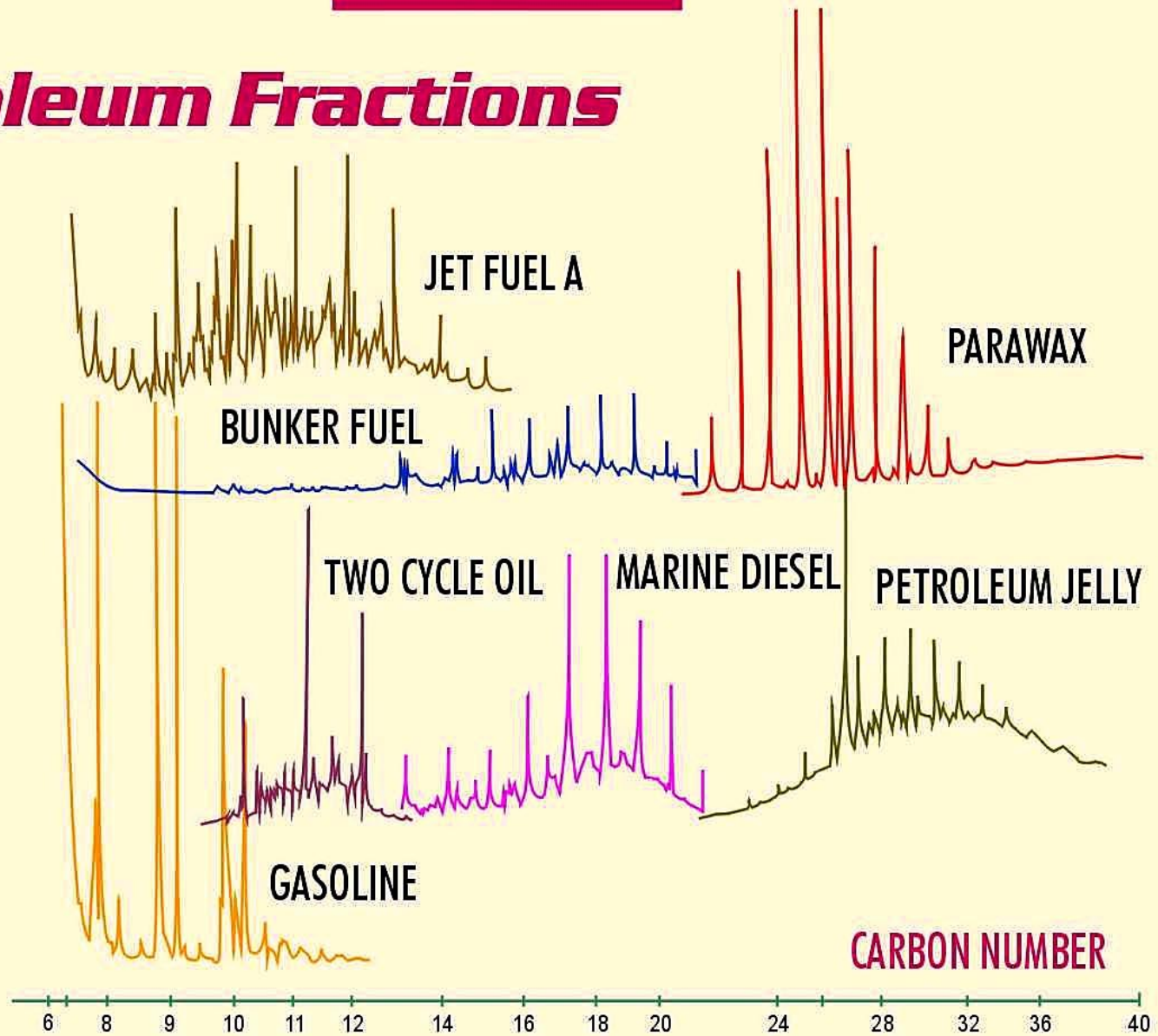


(c)



(d)

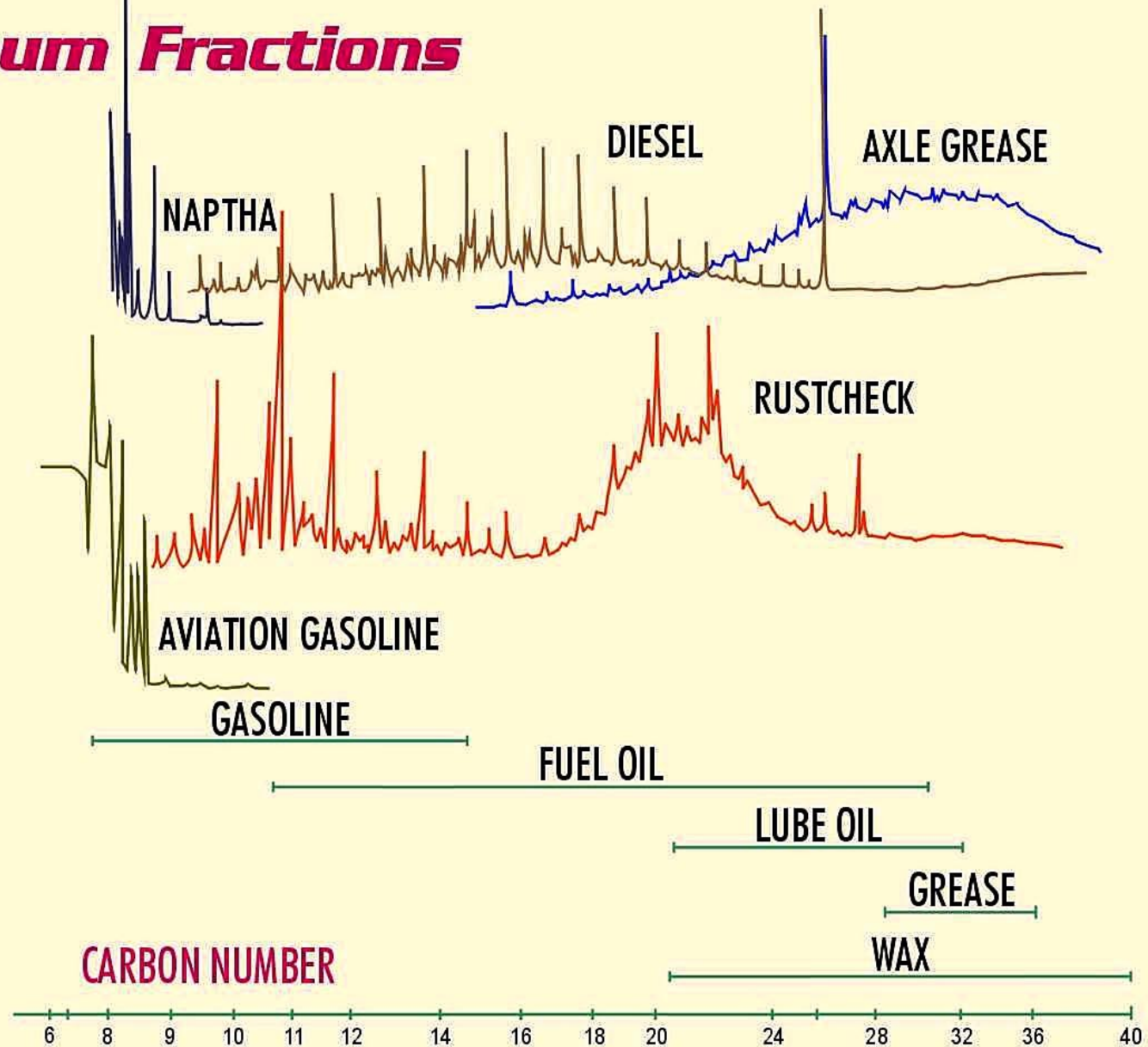
# ***Petroleum Fractions***



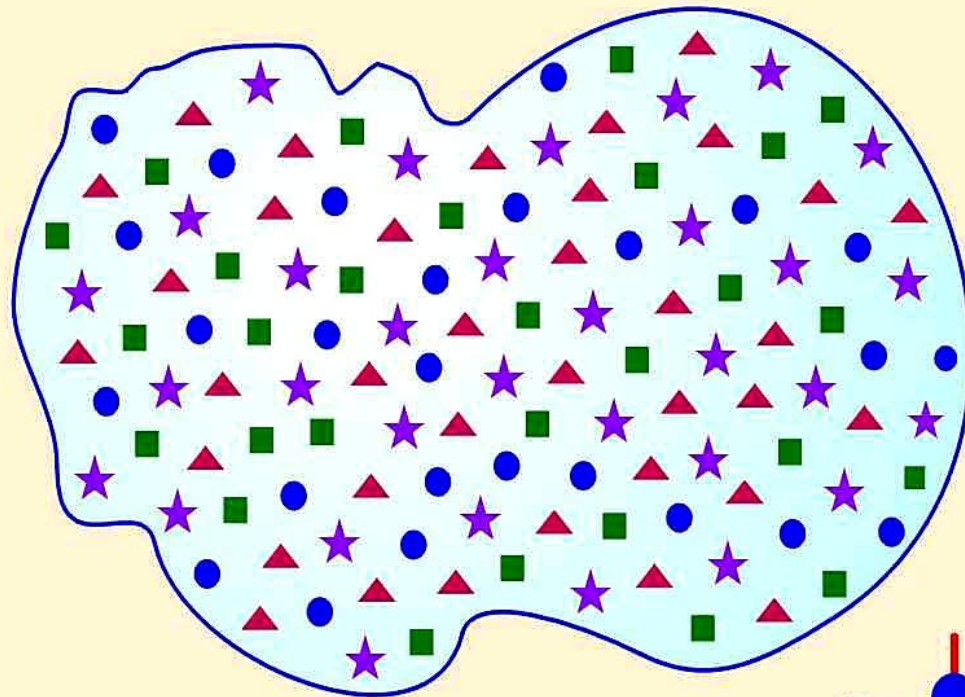


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## **Petroleum Fractions** **(cont.)**



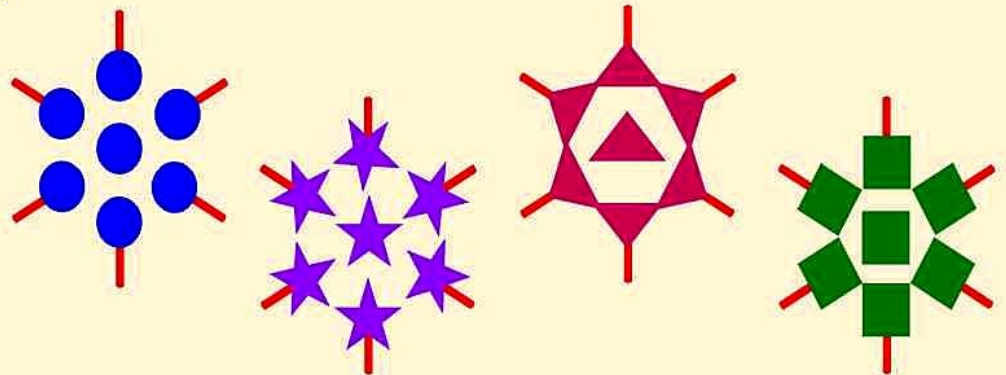
# ***Selective Micelle Encapsulation of Contamination***



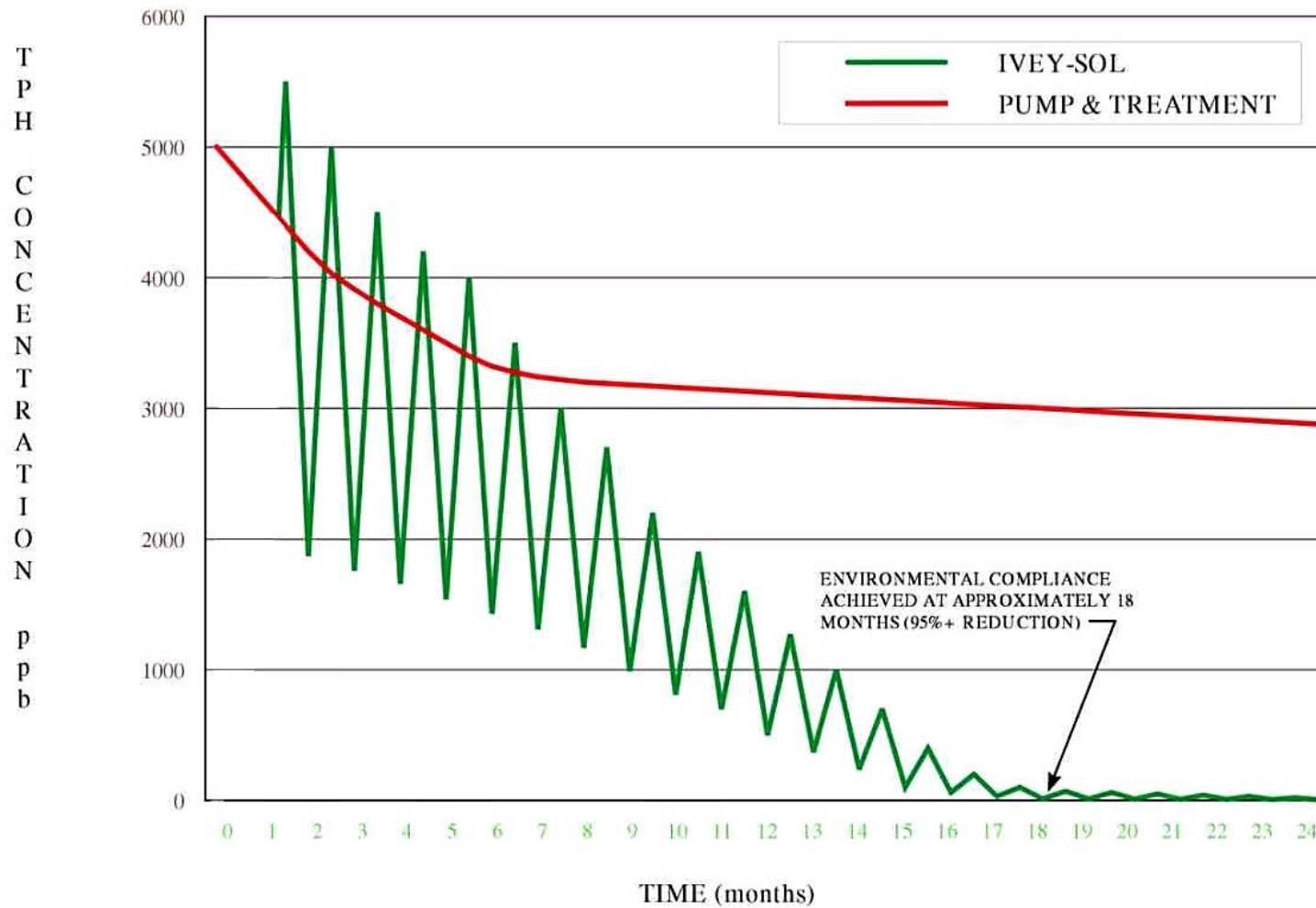
Legend:

- |             |                  |
|-------------|------------------|
| ● Aromatics | ■ Cyclic Alkanes |
| ★ Alkanes   | ▲ PAHs           |

-  **Selective Micelle Formation**
-  **Encapsulation and increased solubility**
-  **Applicable for full LNAPL and PAH range**
-  **Ivey-sol mixture is tailored to type/range of contamination being treated**



## Response Profile





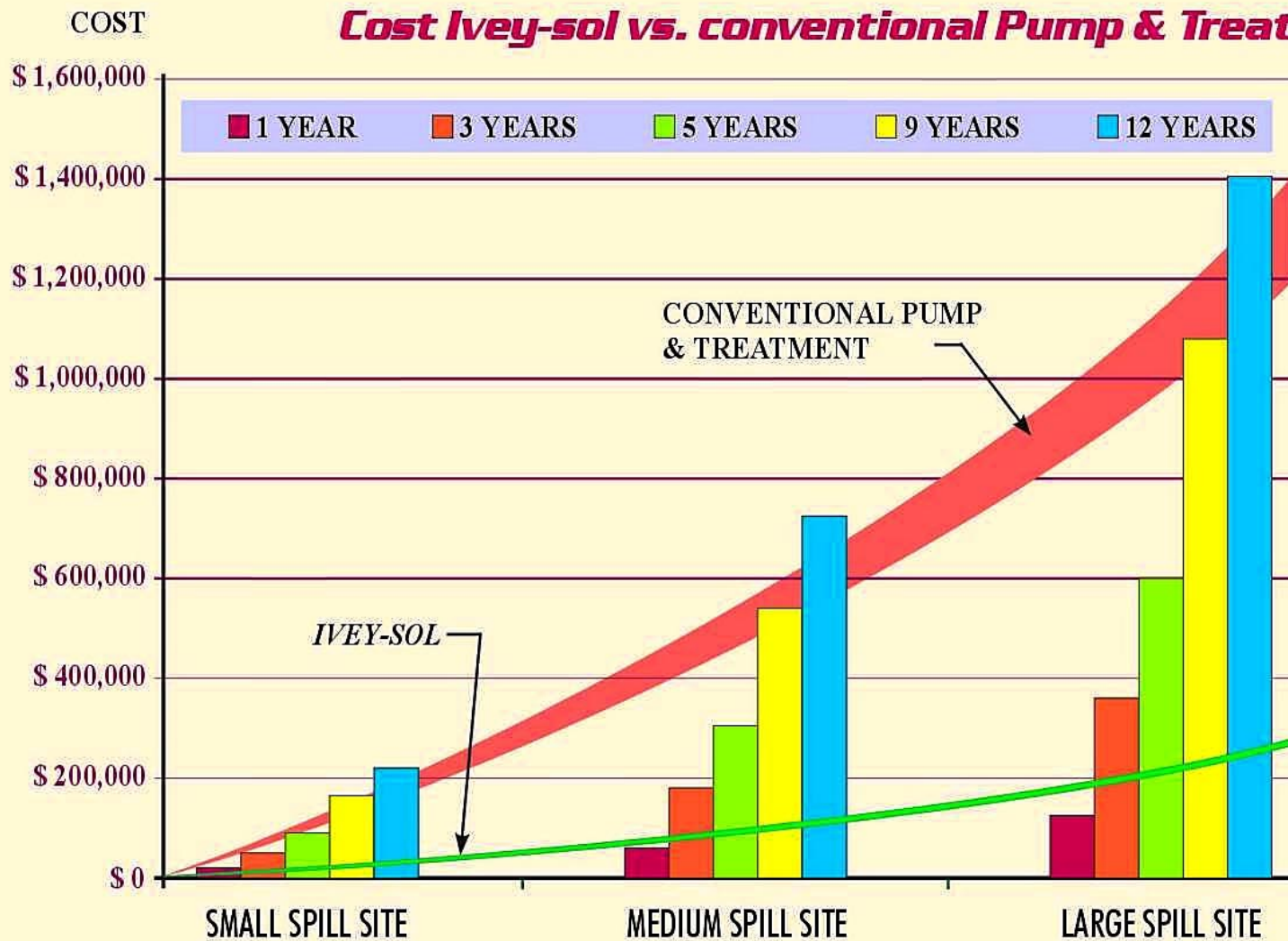
***IVEY-  
SOL  
FACT:***

***90-95%***

***of Ivey Environmental Services  
clients have their site cleaned up  
in under 18 months on average,  
and can claim cost savings of  
at least 20% - 40% compared to  
alternative technologies.***

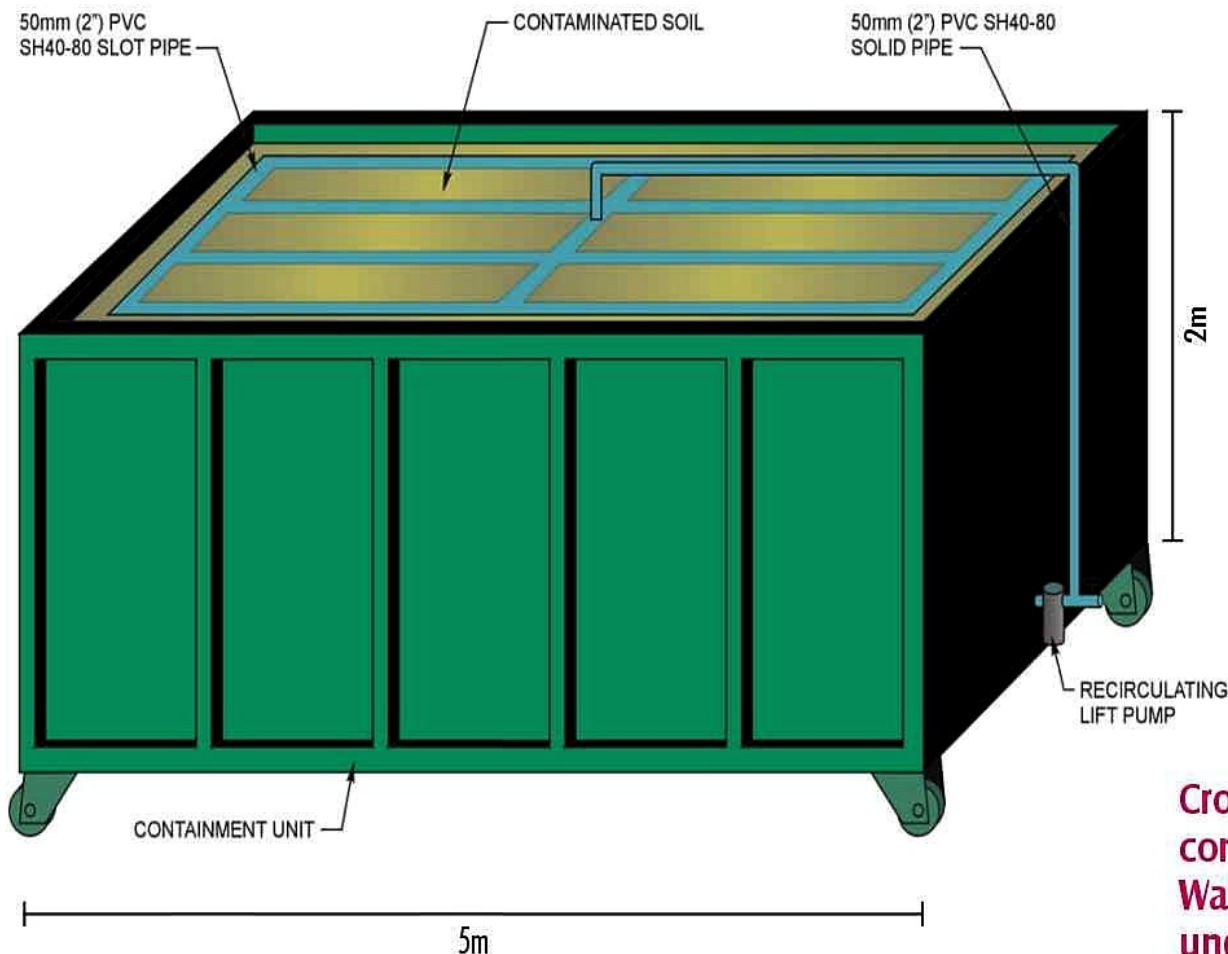
**Ivey-sol**

***Cost Ivey-sol vs. conventional Pump & Treat***



**Ivey-sol**

## ***Ex-Situ Ivey-Sol Remediation Unit***



Treats approx.  
35 tons of  
contaminated  
soil on-site  
and/or at  
a facility

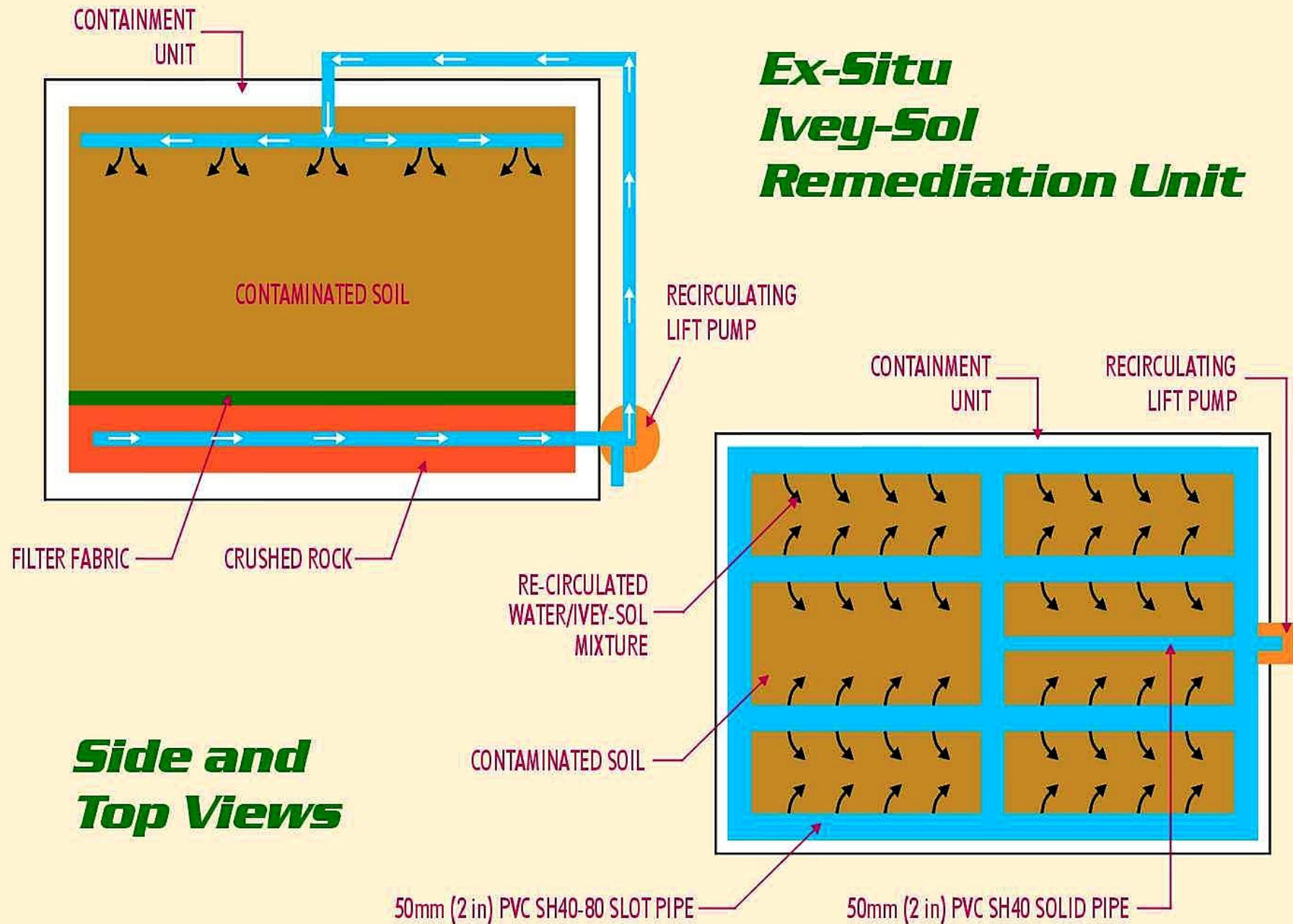


Treatment time  
is approx. 4 hrs,  
depending on  
concentration  
and type of  
contamination

**Cross-sectional view, showing  
contaminated soil in unit with  
Water/Ivey-sol mixture treatment  
underway**



# ***Ex-Situ Ivey-Sol Remediation Unit***



***Side and  
Top Views***





The logo for Ivey-sol, featuring the company name in a white, italicized, sans-serif font inside a red rectangular box. The background of the entire slide is a green-to-yellow gradient with a large, faint, stylized leaf graphic on the left side.

***Ivey-sol***

***This is  
what our  
clients  
have to  
say...***

**We used a combination of Ivey-sol technology and soil excavation. It certainly saved us the headache of having to do more by way of foundation excavation. The result was the important thing. Ivey-sol was a good add-on to the original excavation and we got the results we wanted.**

Mike Roy, Senior Claims Adjuster,  
Plant Hope Adjusters Ltd. (1-800-561-3936)

**The name of the game is satisfactory results and closing the file as quickly as possible. Ivey-sol technology is a big help when excavation isn't an attractive option.**

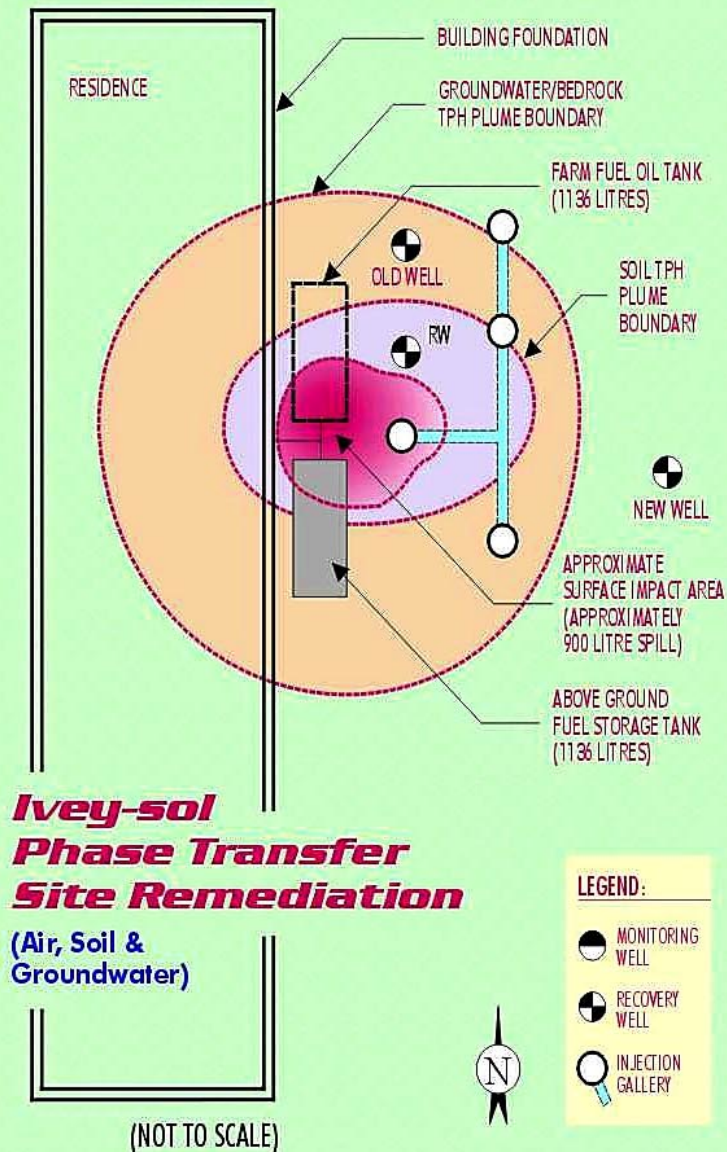
Bill McCann, Senior Claims Adjuster,  
Halifax Insurance (506-454-1564)

**A \$100,000+ bill ... and the insurance company wasn't prepared to cover it. Ivey stepped in and used their Ivey-sol technology ... in about 18 months at one-fifth of the cost.**




Peter L. Clark, President, Clark Oil Co. Ltd. (Ultramar)  
(1-800-222-9669)



**PROJECT NO. 93-156**

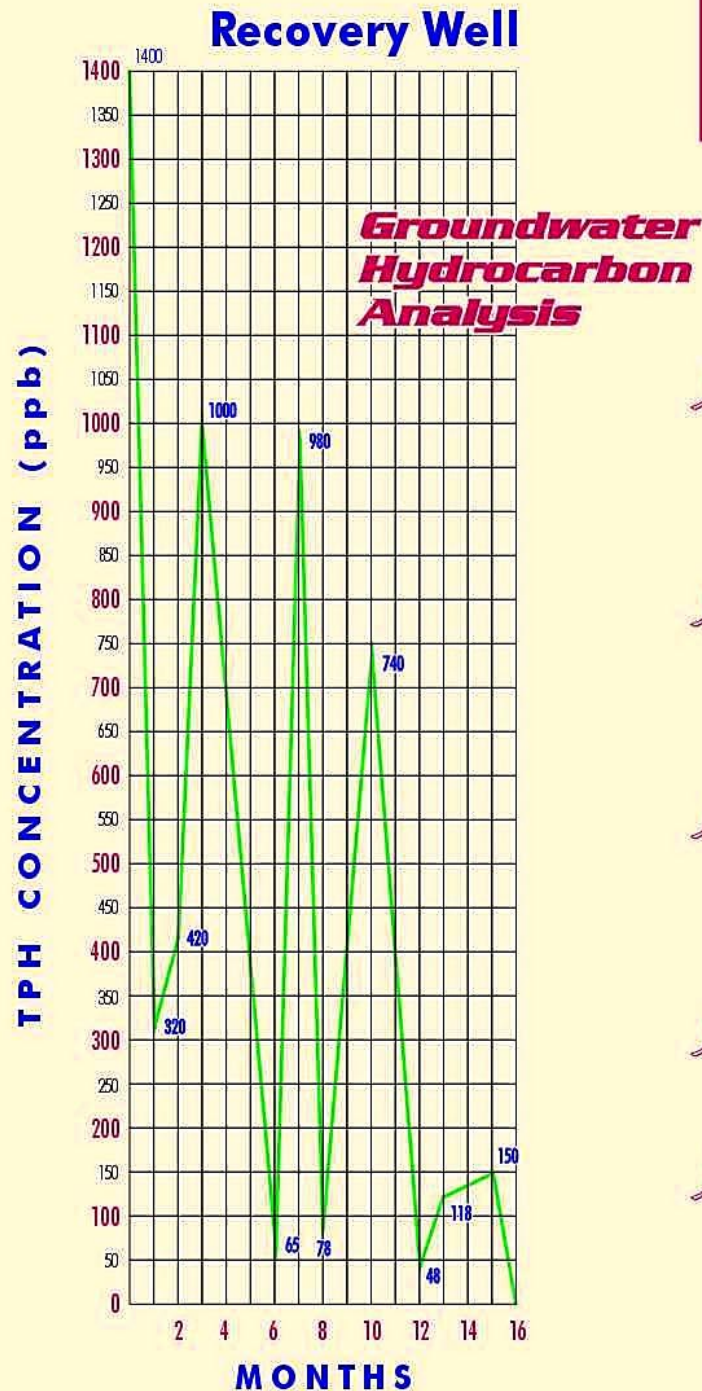


## ***Case Study I***

-  Approximately 900 L (200 gal) fuel oil spill at the above ground storage tank
-  Drinking water well and bedrock-aquifer were contaminated at 1400 ppb TPH
-  Classified as a Sensitive Site by the Department of Environment with a 10 ppb TPH groundwater clean-up objective

## Case Study I

**Ivey-sol**



Ivey Environmental Services installed a pump & treat system at the recovery well



Several Ivey-sol injection galleries were designed and installed



The site was successfully cleaned up to under 10 ppb in less than 18 months

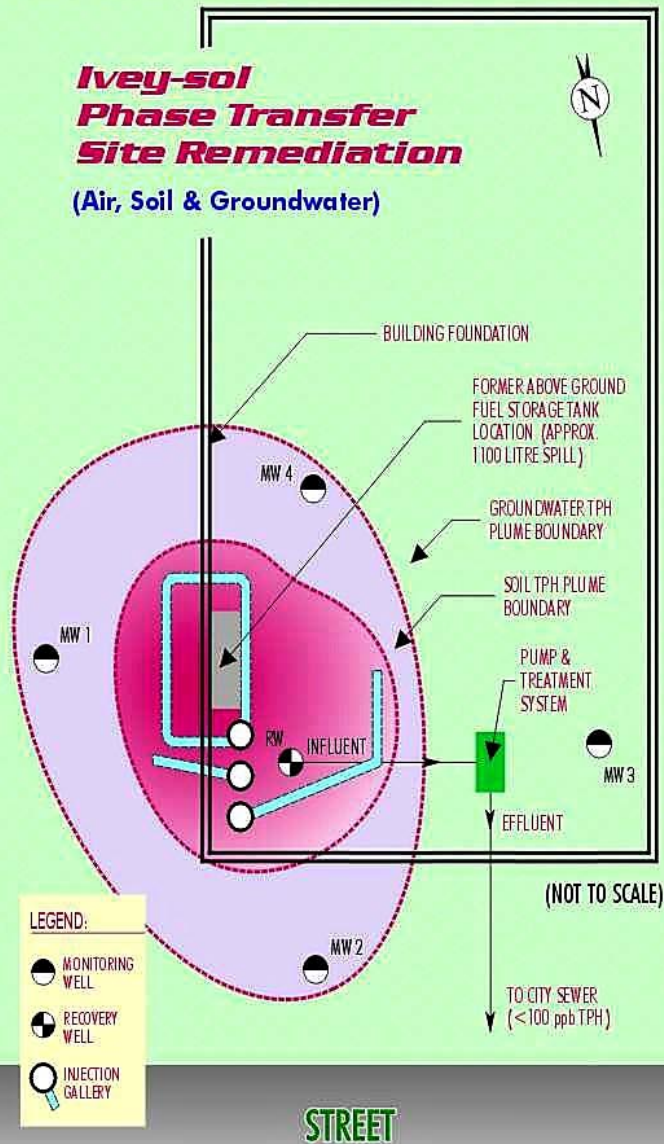


The client estimates the savings at **> \$50,000**



The Department of the Environment decommissioned the site



**PROJECT NO. 98-271**

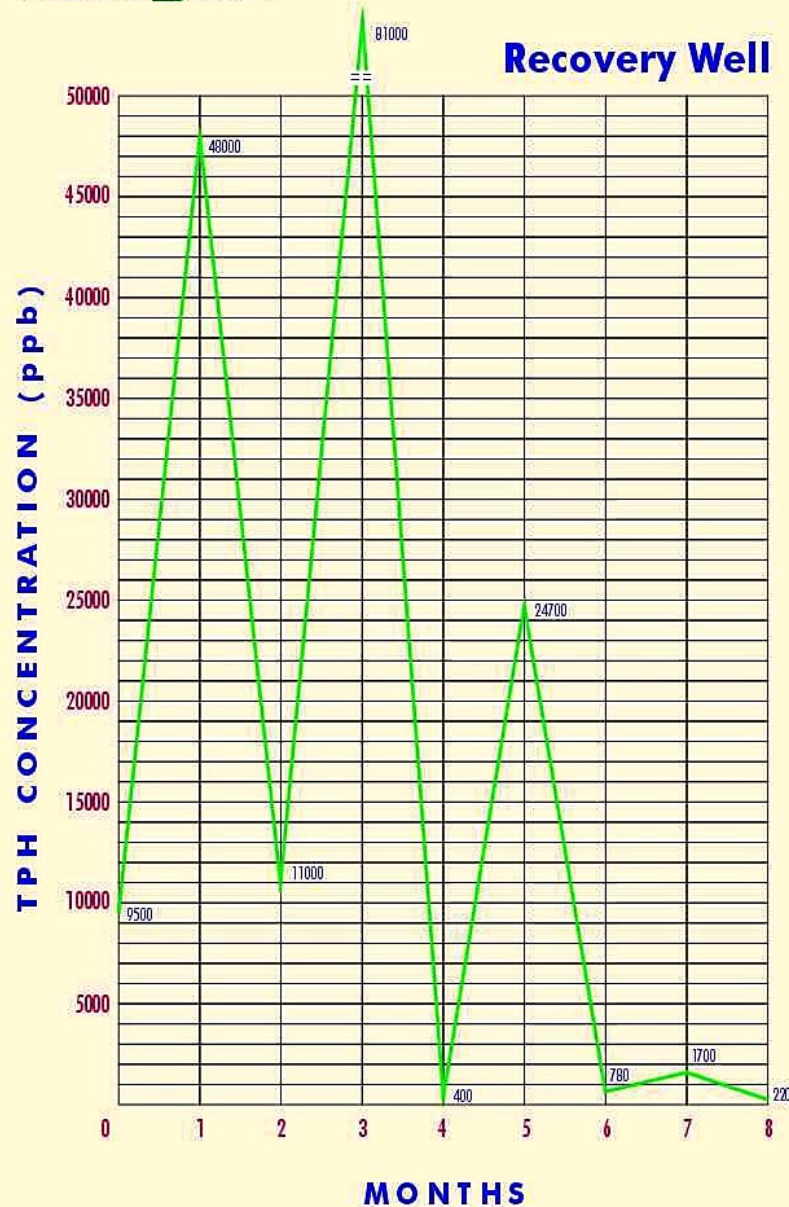
## ***Case Study II***

- Approximately 1100 L (240 gal) fuel oil spill from an above ground storage tank
- The water table was contaminated at 9500 ppb TPH; the soil under the building was saturated with free product
- Classified as a Non-sensitive Site by the Department of Environment, with clean-up objectives of 1000 ppb TPH for groundwater and 100 ppm TPH for soil



### Groundwater Hydrocarbon Analysis

**Ivey-sol**



Ivey Environmental Services designed and installed a recovery well and a pump & treat system within the building basement



Several Ivey-sol injection galleries were designed and installed in the vicinity of structurally sensitive foundation footings



The site was successfully cleaned up to 220 ppb in eight months



The Department of the Environment decommissioned the site

## ***Partial Client List***

- 
-  Allstate Insurance Company
  -  State Farm Insurance Co. Ltd.
  -  Irving Oil Limited
  -  General Electric
  -  Petro-Canada
  -  Ultramar
  -  Clark Oil Co. Ltd.
  -  McCain Foods Ltd.
  -  Business Development Bank of Canada
  -  Day & Ross Transport Ltd.
  -  NB Power Corporation
  -  North American Forest Products Ltd.
  -  New Brunswick Department of Environment
  -  Canada Mortgage and Housing Co. (CMHC)
  -  Stanley Mutual Insurance Co.
  -  NB Department of Transportation
  -  City of Saint John
  -  Precision Metal Works
  -  Knights of Columbus
  -  Laurentide Chemicals Ltd.
  -  Washburn & Gillis Associates Ltd.

# *Ivey International Inc.*

## *Contact Information*

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- **1-800-246-2744**
- **[iveyinternational.com](http://iveyinternational.com) *OR* [ivey-environmental.com](http://ivey-environmental.com)**



# *Ivey International Inc.*

## *Contact Information*

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- **United States**

- **26 Berkley Place Newington, CT USA 06111**

- **International**

- **1397 Stag Road Campbell River BC V9W 6C9**

***Ivey-sol • SPTT***

# ***Case Study***

***Monroe, Connecticut, USA***

PRESENTED BY:

***Dan Smith***

PROJECT MANAGER

HANDEX ENVIRONMENTAL, INC



**Handex Environmental, Inc.**  
PRACTICAL ENVIRONMENTAL SOLUTIONS










***Ivey-sol • SPTT***



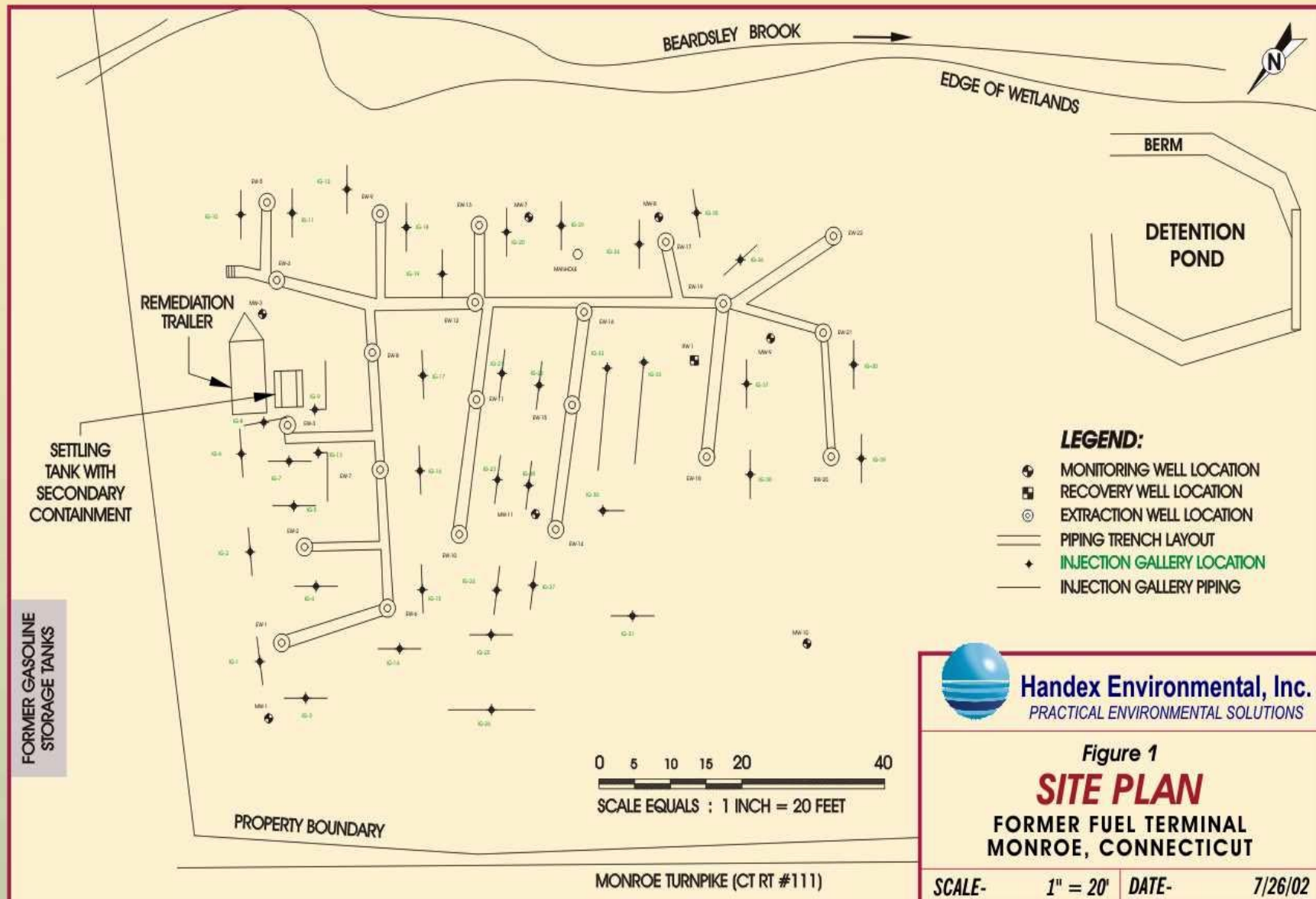
**Handex Environmental, Inc.**  
PRACTICAL ENVIRONMENTAL SOLUTIONS

# ***Fuel Terminal***

***Monroe, Connecticut, USA***

-  Former heating oil terminal from the mid-1950's to the late 1970's
-  No. 2 fuel oil was stored at the site
-  Multiple releases occurred over time
-  Site and surrounding area are wetlands, with the former terminal area elevated with fill material for commercial use
-  Irregular fill consisting of sand, silt, gravel and boulders with some timbers and metal buried throughout the site
-  Sensitive receptors are adjacent stream and down-gradient potable wells
-  High vacuum (dual phase) extraction system in use at the site since late 1999
-  Selective Phase Transfer Technology (SPTT) system installed in May 2002
-  Monthly SPTT injections commenced in May 2002





***Ivey-sol • SPTT***

## ***Fuel Terminal***

***Monroe, Connecticut, USA***



**Handex Environmental, Inc.**

PRACTICAL ENVIRONMENTAL SOLUTIONS





***Ivey-sol • SPTT***

## ***Fuel Terminal***

***Monroe, Connecticut, USA***



**Handex Environmental, Inc.**  
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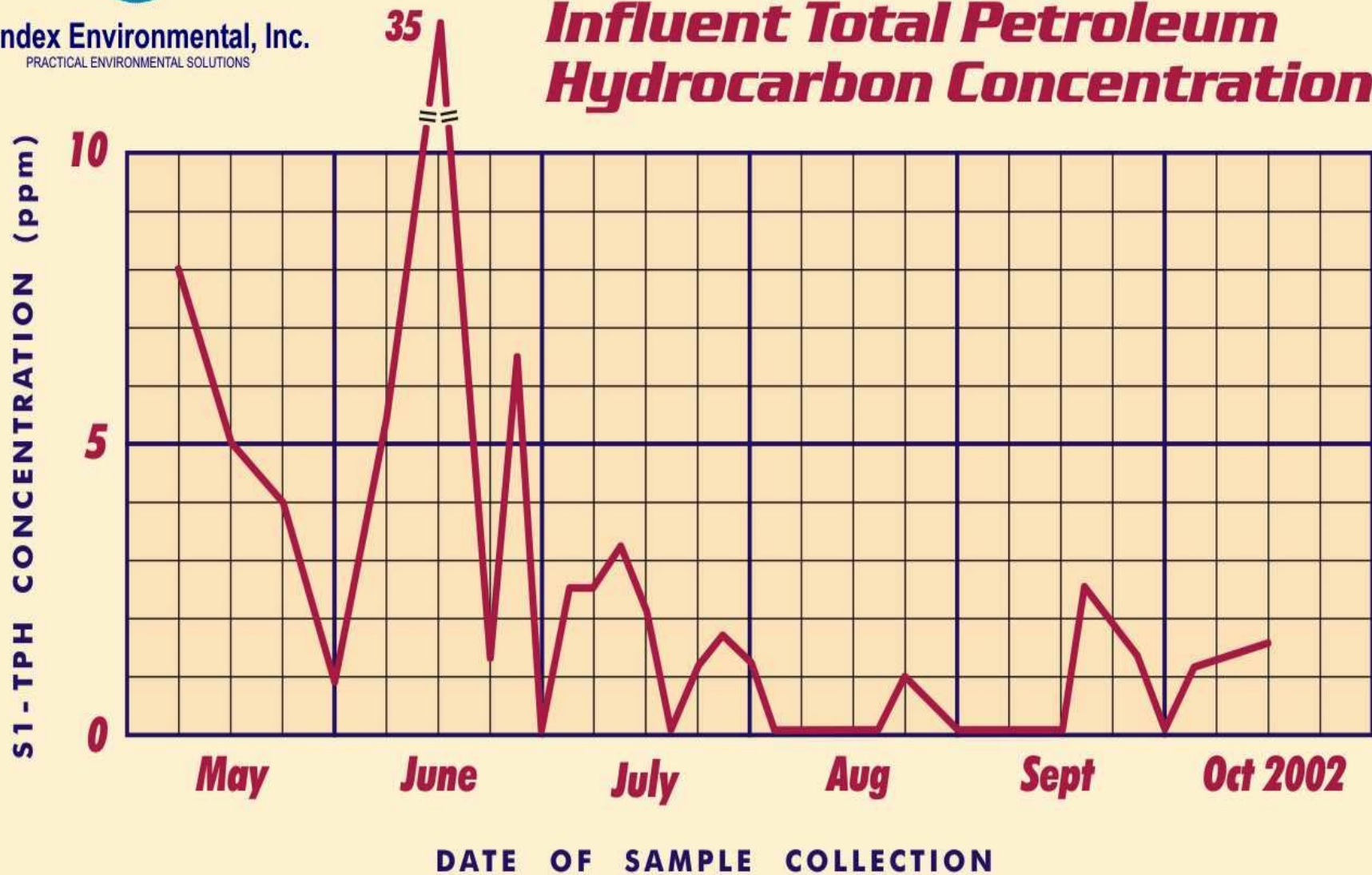




Handex Environmental, Inc.  
PRACTICAL ENVIRONMENTAL SOLUTIONS

***Ivey-sol • SPTT***









## ***Influent Total Petroleum Hydrocarbon Concentration***





# ***Fuel Terminal***

***Monroe, Connecticut, USA***

-  **Mass Recovery = Flow Rate x Concentration**
-  **Mass Recovery (pounds per day) =  
gallons per minute (gpm) x mg/l X 0.012**
-   **$3.785 \text{ l/gal} \times 1 \text{ lb/454,000 mg} \times 1440 \text{ minutes/day} = 0.012$**
-  **Mass Recovery prior to the injection period is based on an  
average influent concentration of 0.75 mg/l**
-   **$8 \text{ gpm} \times .075 \text{ mg/l} \times 0.012 = 0.072 \text{ lbs/day} = 3.269 \times 10^4 \text{ mg/day}$   
(prior to SPTT use)**
-  **Mass Recovery during the injection period is based on a concentration  
average calculated using the post injection peak concentrations of 3.07 mg/l**
-   **$8 \text{ gpm} \times 3.07 \text{ mg/l} \times 0.012 = 0.29472 \text{ lbs/day} = 13.38 \times 10^4 \text{ mg/day}$   
(during SPTT use)**
-  **Pre vs. post injection mass removal rates show an increase of 80.37%**