ECO WIZARDS

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SOIL POLLUTION

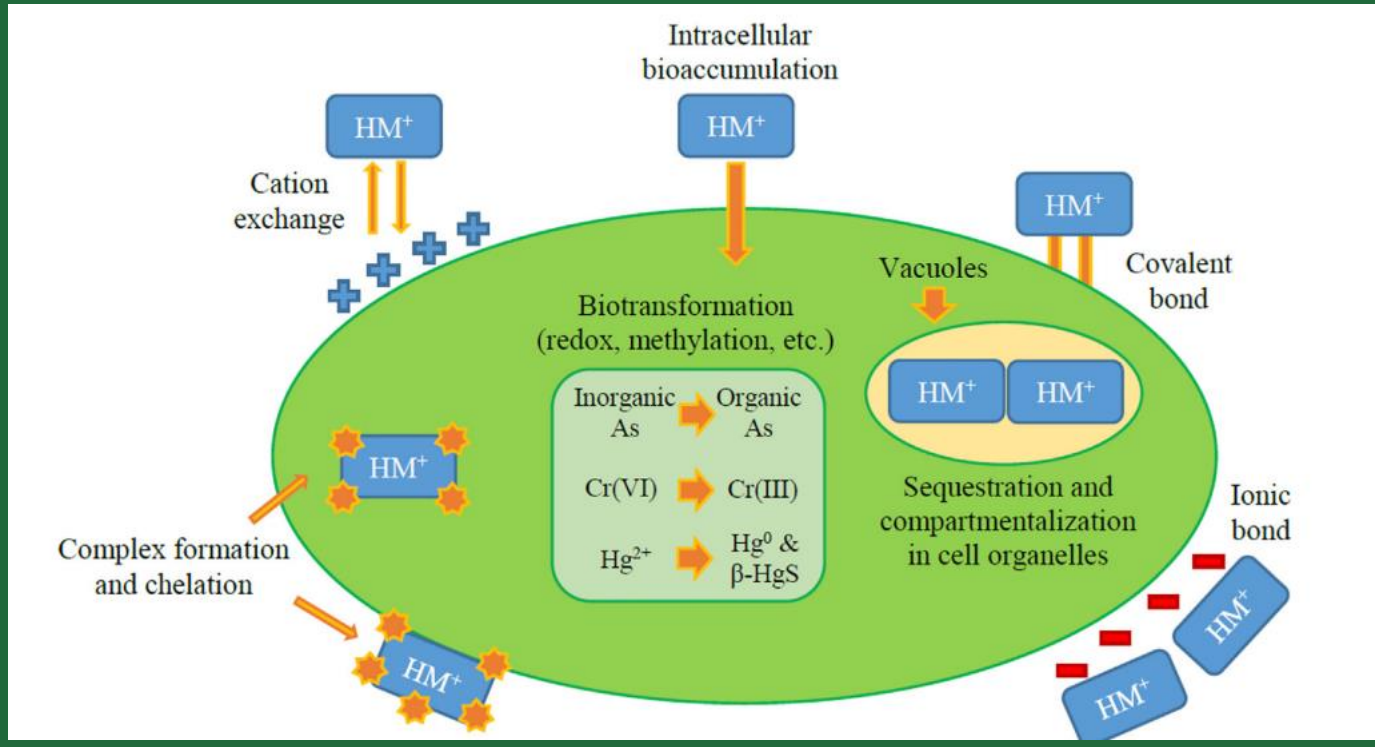
- **bioremediation → slag and water**
- **phytoremediation → soil**

Bioremediation

The use of microorganisms to remediate polluted environments (bioremediation) is sustainable and helps to restore the natural state of the polluted environment with long term environmental benefits and cost effectiveness. These organisms help to detoxify hazardous components in the environment.

Bioremediation

- Benefits:
  - abundant availability
  - inexepnsive
  - excellent metal removal efficiency
  - eco-friendly nature
- two-stage mechanism
  - rapid extracellular passive adsorption
  - slow intracellular positive diffusion
- *Desulfovibrio desulfuricans*



Bioremediation

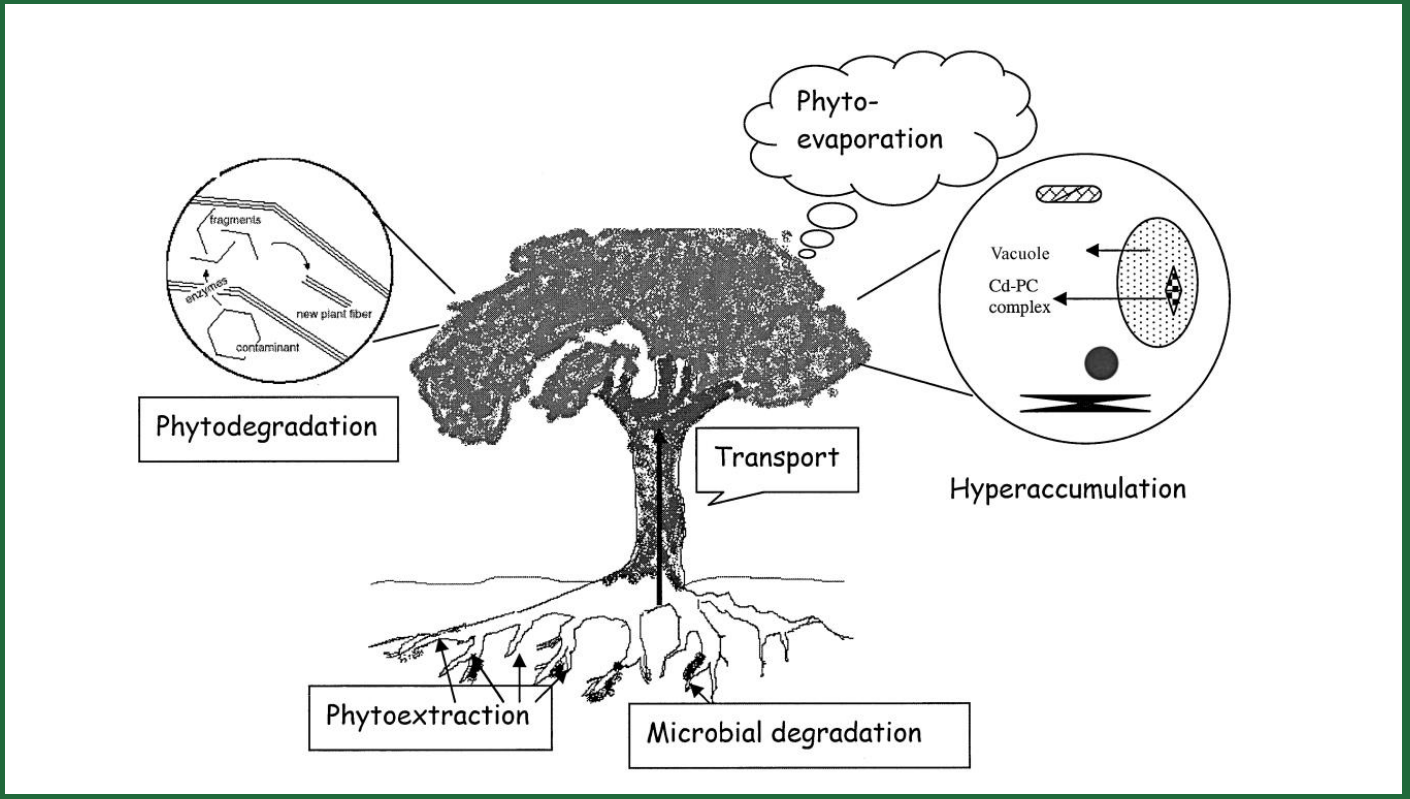
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5295344/table/ijerph-14-00094-t002/

Phytoremediation

Phytoremediation is an eco-friendly approach for remediation of contaminated soil and water using plants. Phytoremediation is comprised of two components, one by the root colonizing microbes and the other by plants themselves, which degrade the toxic compounds to further non-toxic metabolites.

Phytoremediation

Phytoextraction (or) phytoaccumulation: Plant roots take metal contaminants and store in stems and leaves (harvestable regions). This technique is generally used for metals like nickel, zinc, copper, lead, chromium and cadmium.



Examples of Various Heavy Metal Accumulating Plants

Metal	Plant
Cd	*Thlaspi caerulenscens* *Rubia tinctorum*
Cu	*Ipomea alpina* *Mimulus guttatus* *Elodea nuttallii*
Co	*Haumaniastrum robertii*
Mg	*Atriplex halimus*
Mn	*Macadamia neurophylla*
Cr	*Spirodela polyrhiza*
Si	*Oryza sativa*

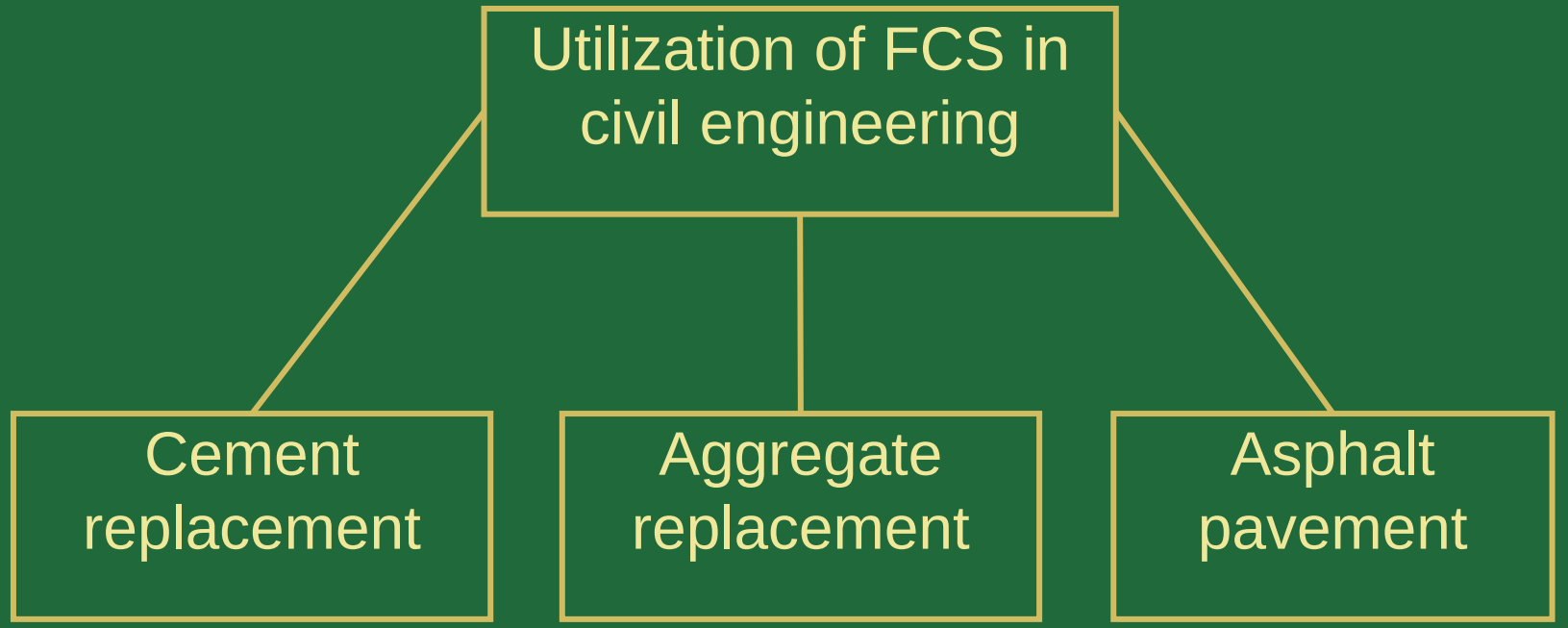
Sample categorization

	DR1	DR3	DR5	DR7	DR9
Ni	2	3	2	2	4
Cu	1	1	1	1	1
Zn	2	1	2	1	3
As	2	1	2	4	4
Cd	1	1	2	1	1
Hg	1	1	1	1	1
Pb	2	1	3	1	1
PAH	2	1	2	3	1
Cr (VI)	1	1	1	1	3

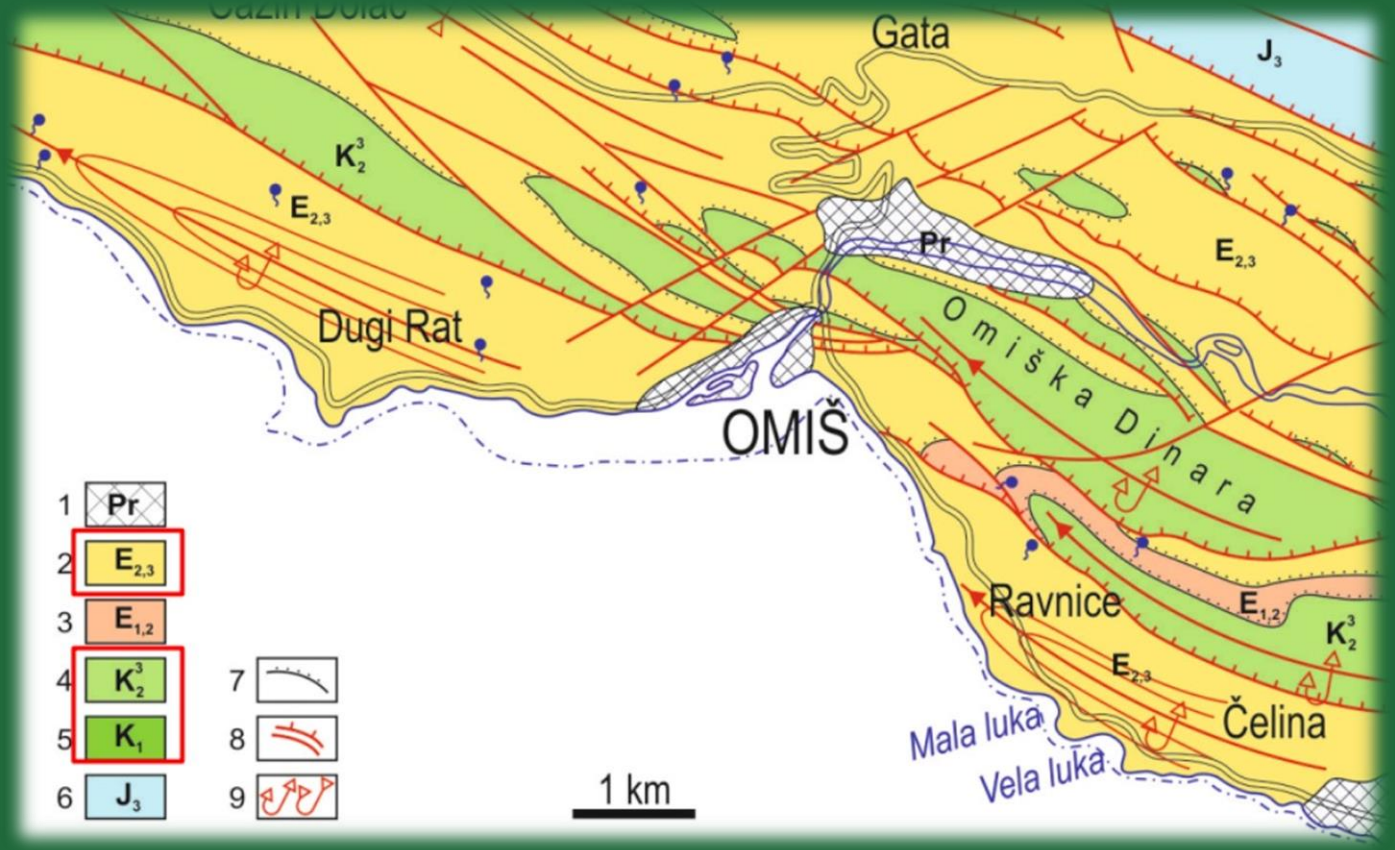
- City center / offices / shops – 3 or lower
- Industrial and traffic areas – 3 (4) or lower

1	**Very good**
2	**Good**
3	**Moderately**
4	**Bad**
5	**Very bad**

Sample categorization



Disposal



Geological map of Dugi Rat area

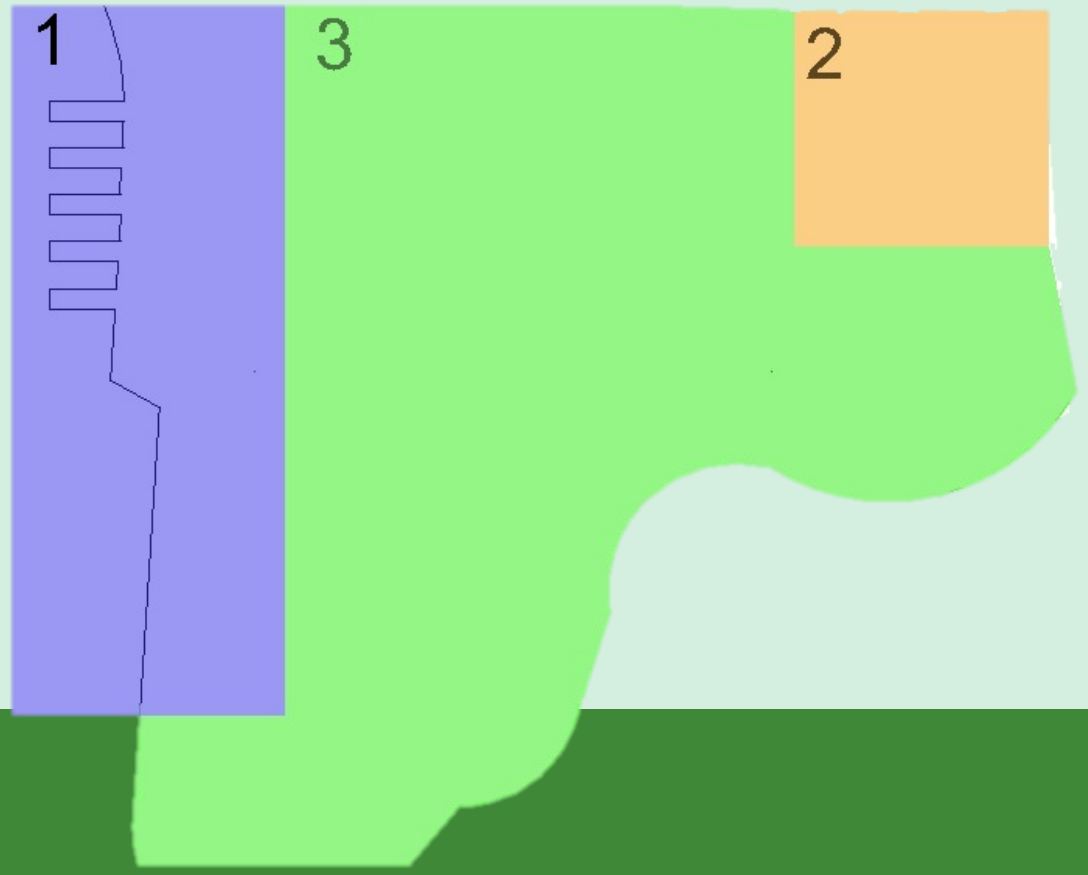
- Heavy metal tailings can be deposited in sealing layer
- Sealing layers are consisted of clay layers and synthetic materials

Conversion of the factory territory

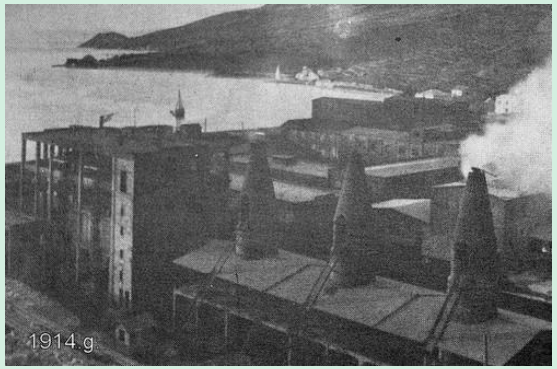
1) Marin with infrastructure and hospitality industry

2) Musem of factory history

3) Park with sport courtyards and promenades



Preservation of cultural heritage



Historical glory of the factory

Impact on the local community and health

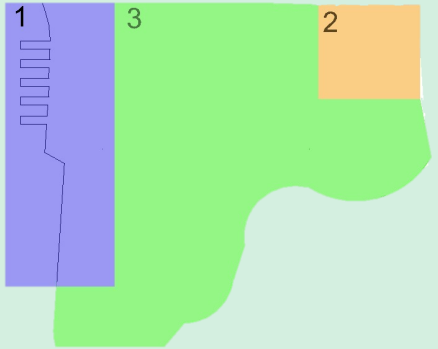
Plan A) using factory buildings for a museum (statics?)

Plan B) demolition of buildings and reuse of materials for new constructions

Plan B) billboards along the promenade

Economy aspects

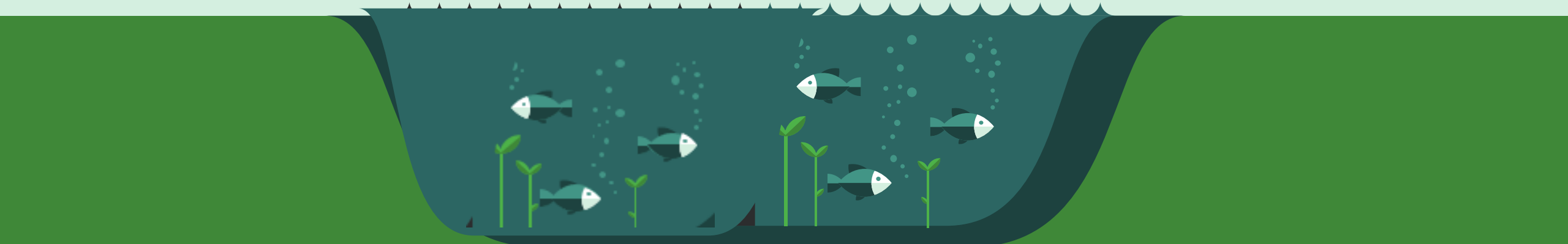
Recycling of building materials



Profit from marin, hospitality industry and museum

Small cost of bioremediation

New jobs for museum employees




The End