Tree Rescue on a Heritage Island and the shipyards Beck Holmen Royal National City Park

Gentle remediation of contaminated culture areas. Vacuum suction for effective removal of heavy contaminated soil adjacent to mature large trees!

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Responsible Environment Controller for remediation of contaminated Soil: Sweco Environment, Sweden
www.sweco.se

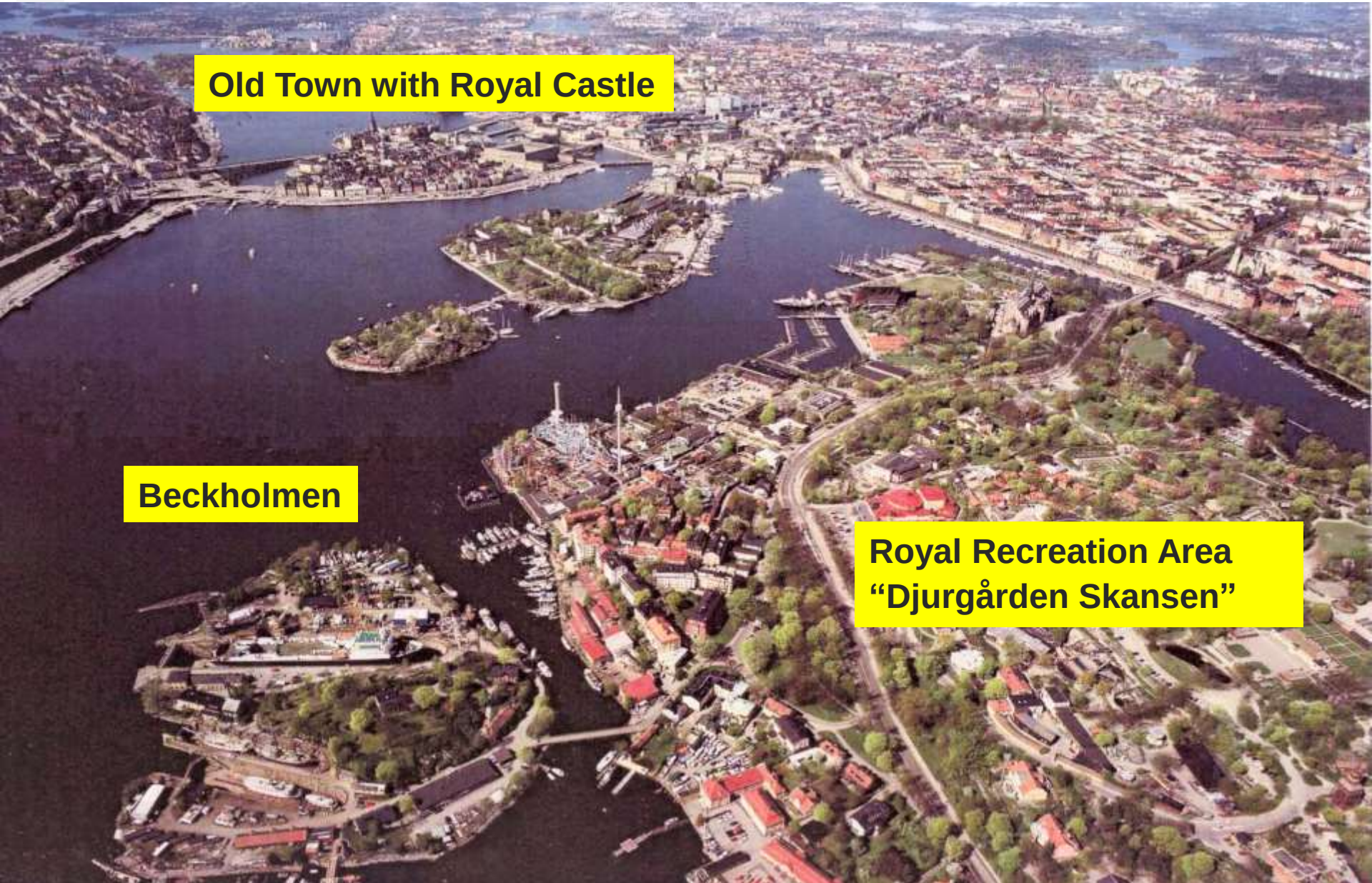
Royal National City Park
http://www.nationalstadsparken.se/default.aspx?id=1777

◄

This is Beckholmen:

- Part of a National Park in Stockholm
- Heritage building of national interest (the highest class)
- Owned by the state, managed by the Royal “Djurgården” Administration (royal household)
- Shipyard for modern and historic ships
- Rental apartments in historic buildings

Beckholmen is located in the hart of Stockholm



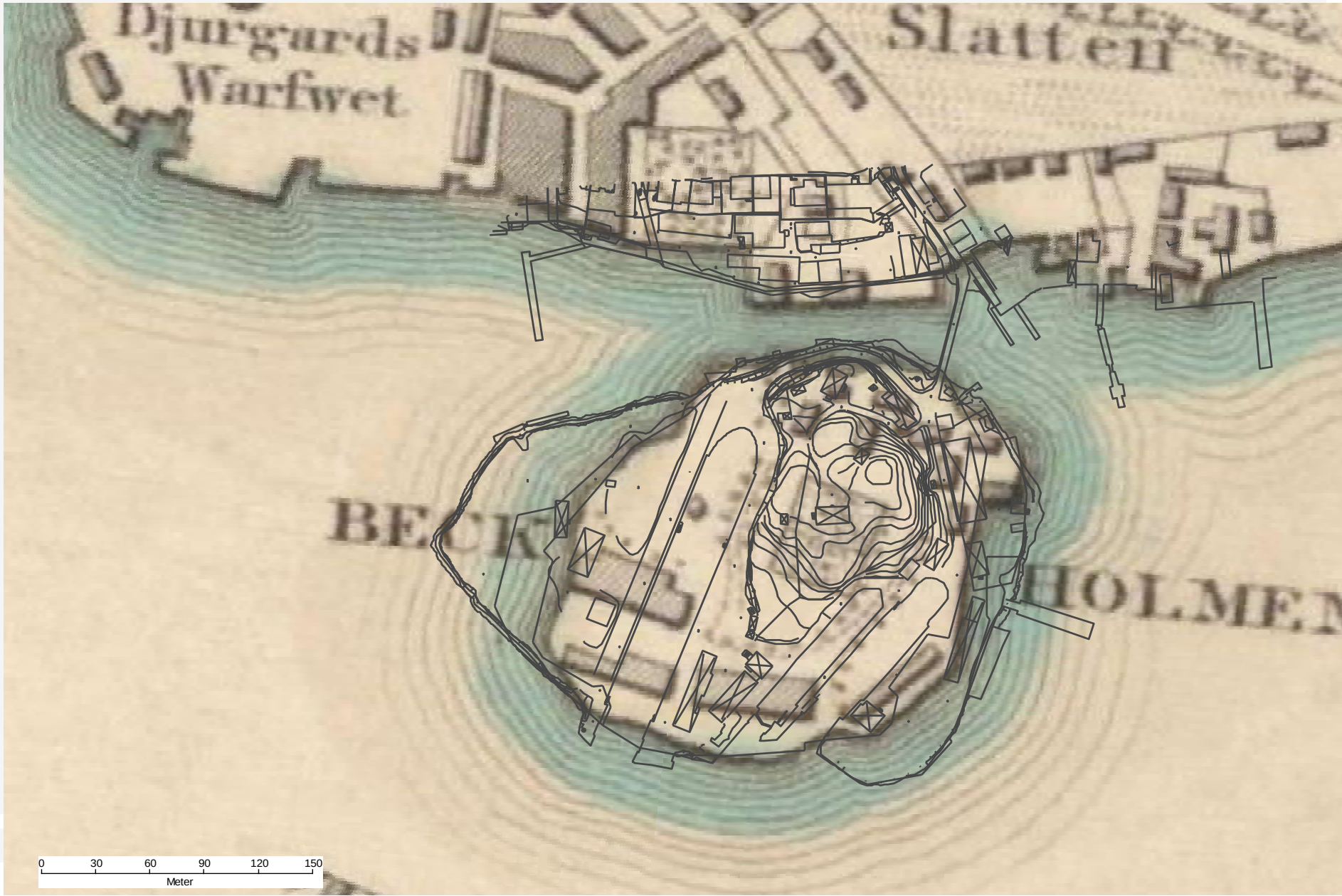
A national Heritage

A brief history of the Island of Beckholmens

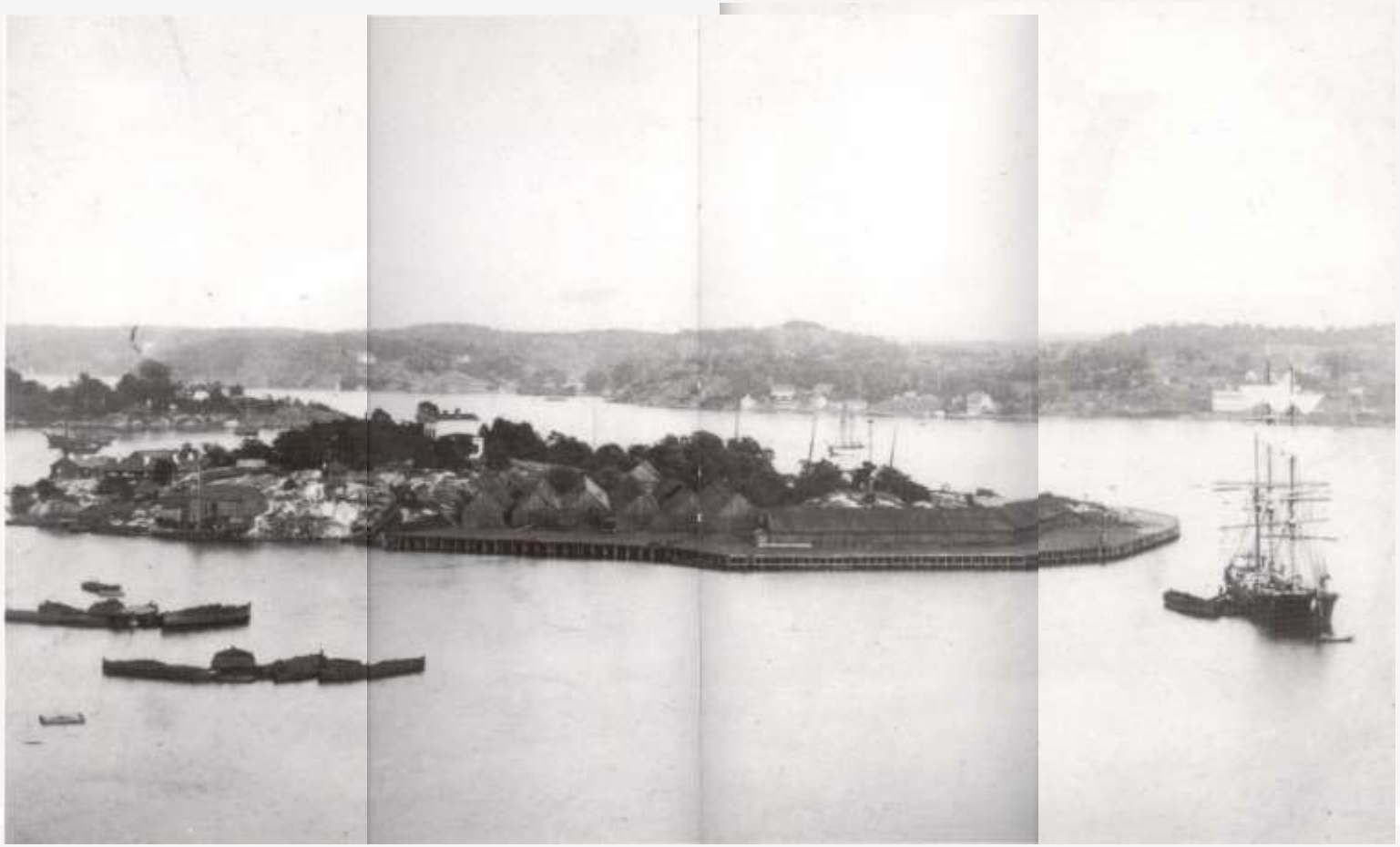
- Producing tar from 1633 to the mid 1900s
- Shipyards from the beginning of the 1900s
- Two fires in the 1700 - and 1800's
- Military area between 1918 and 1969

Dry docks constructed 1850-1875 and expanded 1918-1944. Excavation and landfill were needed to create those constructions on the island.

The island expanded with the building of the dry docks



Beckholmen approx 1900



1939

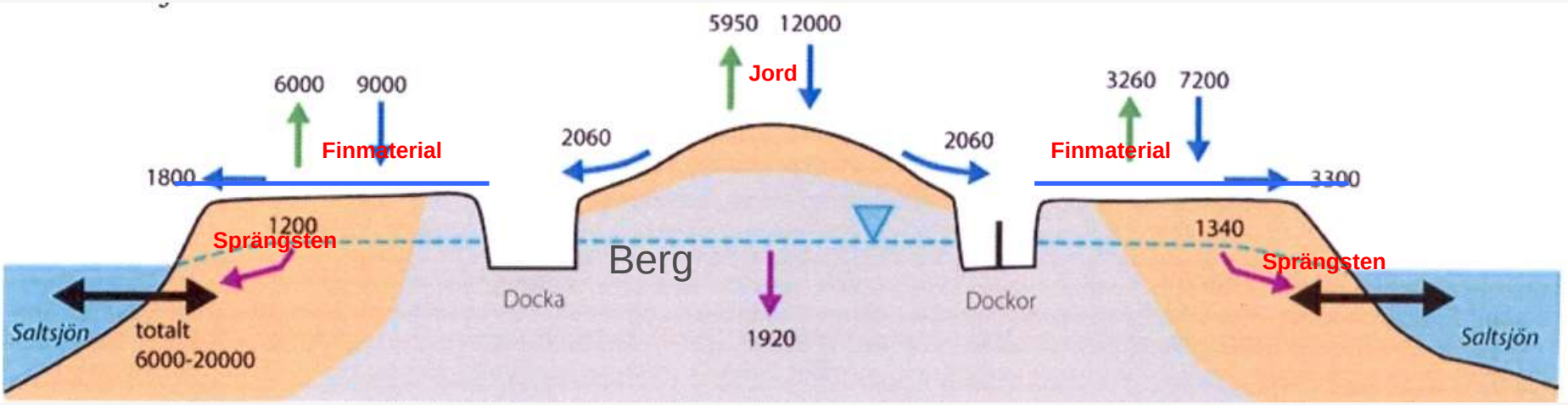
The warship Vasa sank at Beckholmen 1628

SWECO

Ship salvage of famous war ship Vasa in 1961

Beckholmen 2010

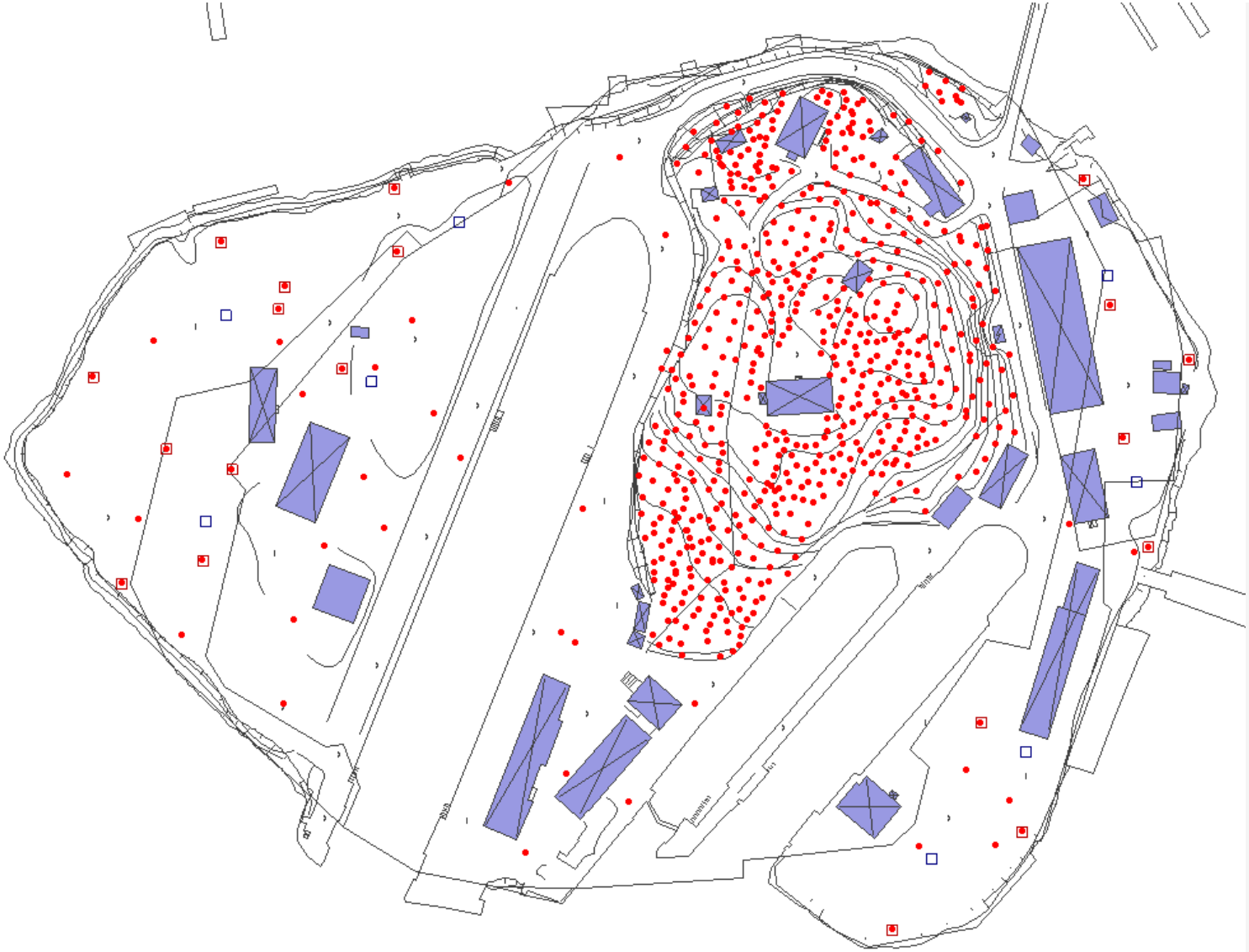
Sampling of water around the island showed high concentrations of heavy metals



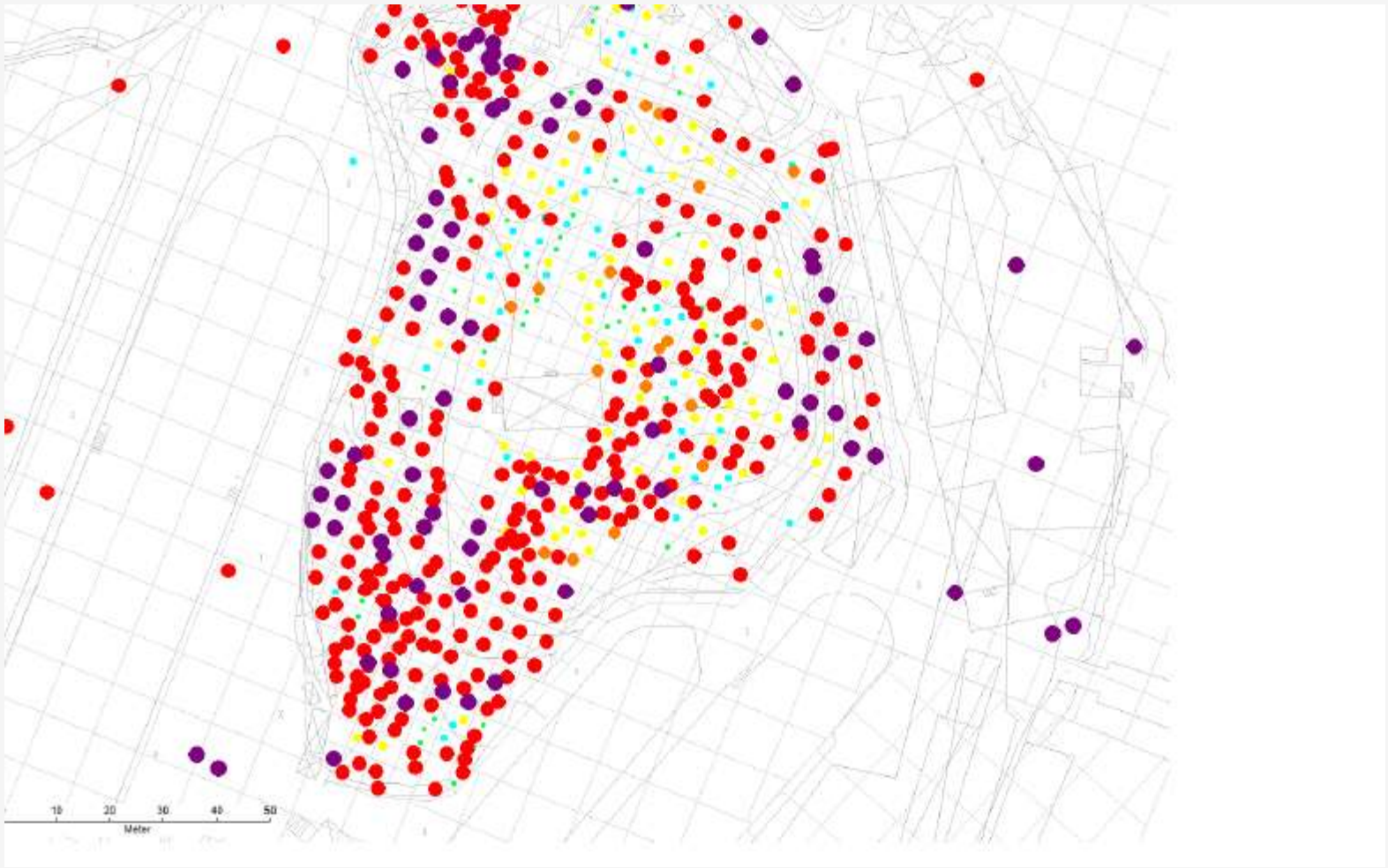
Continuous leakage of contaminants has occurred over many years from the island

Drilling for sampling of pollutant levels

Location of completed samplings



Classification of soil contaminants



Purple, considered as hazardous waste
Red, very high-level of contamination - not acceptable level
Yellow, high-level of contamination - not acceptable level
Blue, lower level industrial land - restricted land use

Maximum levels for soil contaminants

Polluting substance	Limit for humans mg/kg	Worst case on the Island mg/kg
Arsenic As	10	230
Lead Bp	80-150	90 000
Cadmium Cd	5-8	8
Copper Cu	2500	3 900
Mercury HG	5-10	240
PAHs	500	800

PAHs=Polycyclic aromatic hydrocarbons the substance are Carcinogenic

The requirement from the Environmental Protection Agency: Remove and clean all soil down to solid rock on the whole island

Contamination from old tar cover under the soil

Substance of contaminations are PAHs=Polycyclic aromatic hydrocarbons

Contamination coast by sandblasting of ship hulls

Rare plants and protected trees: how could they be protected during the sanitation of the island?

Knippnejlika

No sign of ill health, even with extremely high amounts of heavy metals in the rooting environment

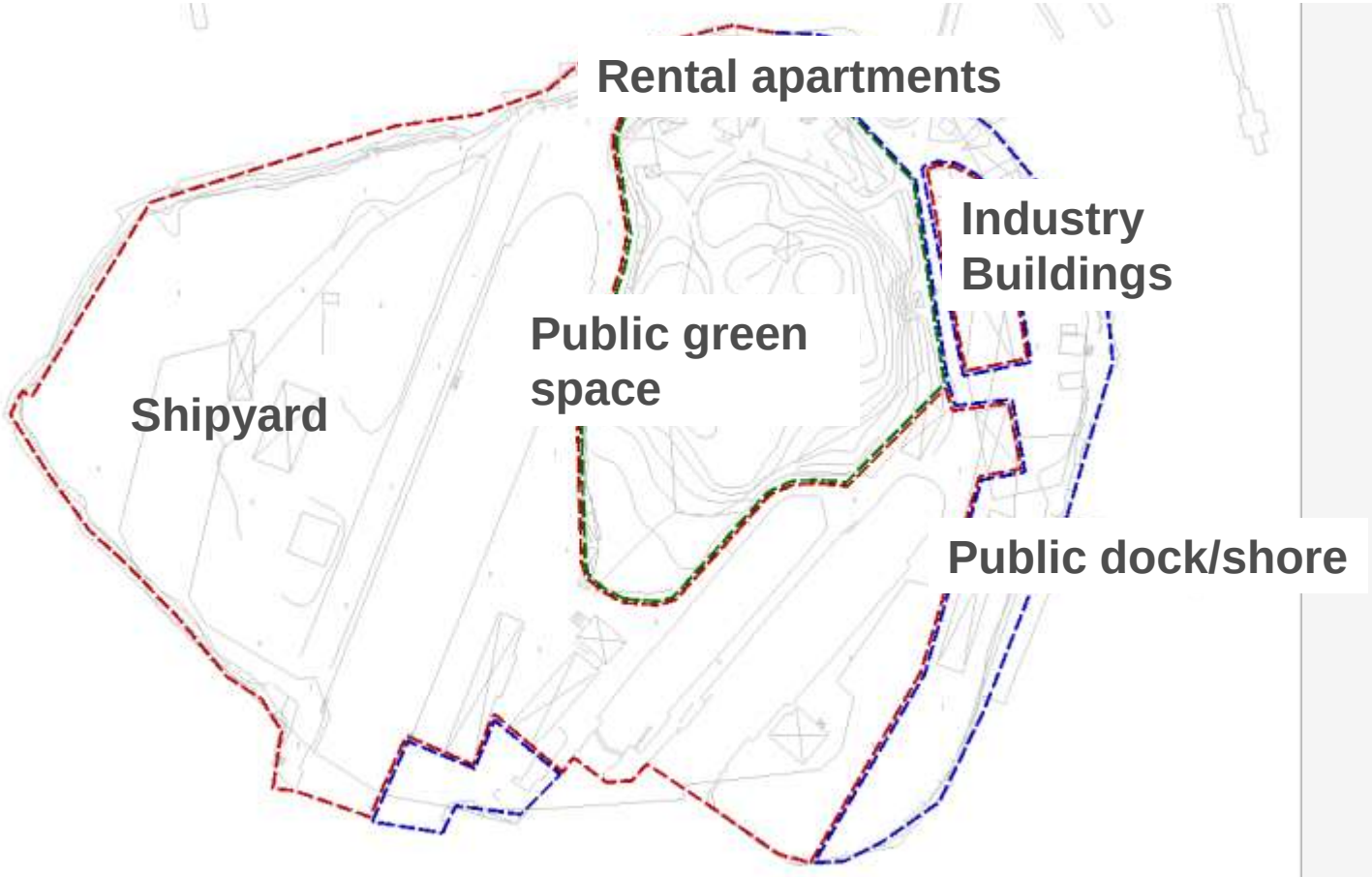
Polluting substance	Highest measured level close to trees mg/kg
Arsenic As	130
Lead Bp	70 000
Cadmium Cd	5
Copper Cu	3 900
Mercury HG	58
PAHs	800

Tree Spices
Acer platanoides
Acer psedoplatanus
Aesculus hippocastanum
Alnus glutinosa
Betula pendula
Fraxinus excelsior
Malus domestica
Populus tremula
Prunus avium
Prunus Padus
Quercus robur
Salix Alba
Salix Caprea
Salix fragilis
Sorbus aucuparia
Sorbus intemedia
Tilia cordata
Tilia Europea
Ulmus glabra

Spices of Shrubs
Amelancher Sp
Berberis Sp
Caragana Sp
Crataegus Sp
Forsythia Sp
Hydrangea Sp
Laburnum Sp
Lonicera Sp
Philadelphus Sp
Prunus Spinosa
Ribes Alpinum
Rosa Sp
Rubus fruticosus
Sambucus SP
Spirea Sp
Symphoricarpus albus
Syringa vulgaris
Rahmnus Cathartica

It was decided to save and protect twenty large trees during the sanitation of the Island. Most of those trees were linden trees approx. 150 years old. All other vegetation was removed.

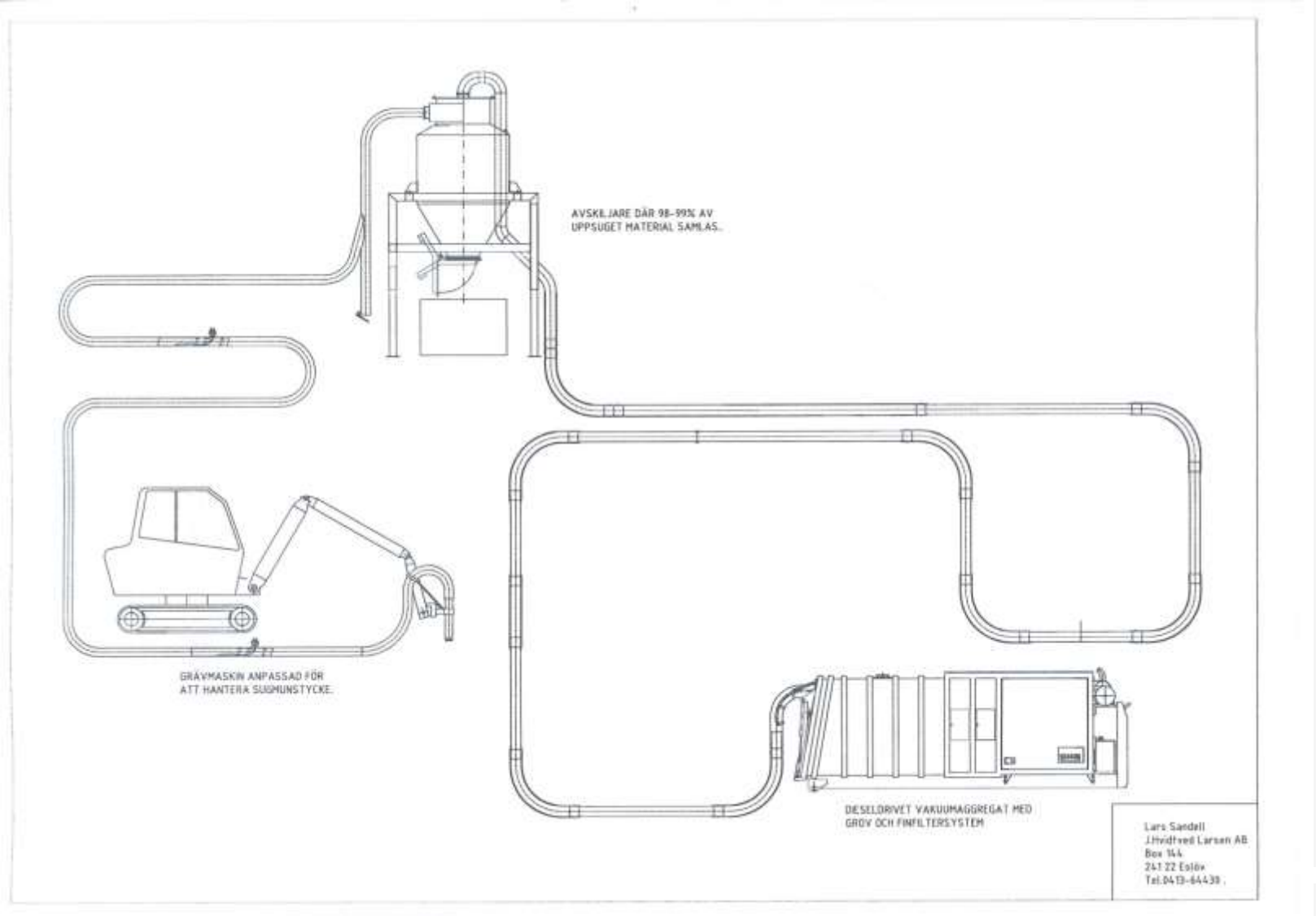
Special permission was given to leave higher contamination under the root system to save the remaining trees on the public green area



We have more than 15 years of experiences of vacuum suction on more than 500 trees!

The small scale, manual working techniques produce some poor ergonomics!

Improvements in current technology and methods are required for large scale vacuum suction of the soil




TB180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DISAB
MÄLARVAC AB
Tel.070-399 28 80

Soils suction more than 100m from the vacuum unit

In most of the cases the soil was removed to a depth of 30 – 40 cm.


HASSELFORS

In discussion with the His Majesty Carl- Gustav 16 on the restoration of the green area of Beckholmen

Woodchip made by the trees that had been removed.
British arborist was used fore this work

In situations with high levels of contamination deeper in the soil, all the soil had to be removed down to bare rocks


VIKING

Trees thinned out and anchored using guy ropes

Vacuum suction was shown to be effective so it was used even out side of the root zone of the trees

The underlying rock completely swept clean

Renewing plans for Beckholmen

Rebuilding of the green area should be so close to the original site layout and species mix as possible

New soil is placed on the bare rocks

Transplanting of 3 oaks moved from a road construction site

July 2012

September 2014

June 2012

June 2012

June 2014

The renewal of the green space is completed


July 2012

July 2012

July 2012

July 2012

June 2014

September 2014

What would the skyline be without the mature trees!

The soil sanitation in figures:

The amount of soil vacuumed in the rooting area of 20 trees	1 000 m3
The amount of soil vacuumed out side the rooting area	5 000 m3
The amount of soil removed by traditional excavator	145 000 ton
Total cost for excavation, replacement and renewal	20 million Euros!