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EXPERIENCES OF UTILISING MASS STABILISED LOW-QUALITY SOILS FOR INFRASTRUCTURE CONSTRUCTION IN THE CAPITAL REGION OF FINLAND – CASE ABSOILS PROJECT

LIFE09 ENV/FI/000575

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EXPERIENCES OF UTILISING MASS STABILISED LOW-QUALITY SOILS FOR INFRASTRUCTURE CONSTRUCTION IN THE CAPITAL REGION OF FINLAND – CASE ABSOILS PROJECT

1. BACKGROUND AND CHALLENGES:
   FINNISH GEOLOGY AND SURPLUS SOFT LOW-QUALITY SOILS

2. SOLUTION: THE MASS STABILISATION METHOD

3. DEMONSTRATION: CASE PERKKAA DOG PARK

4. LESSONS LEARNED

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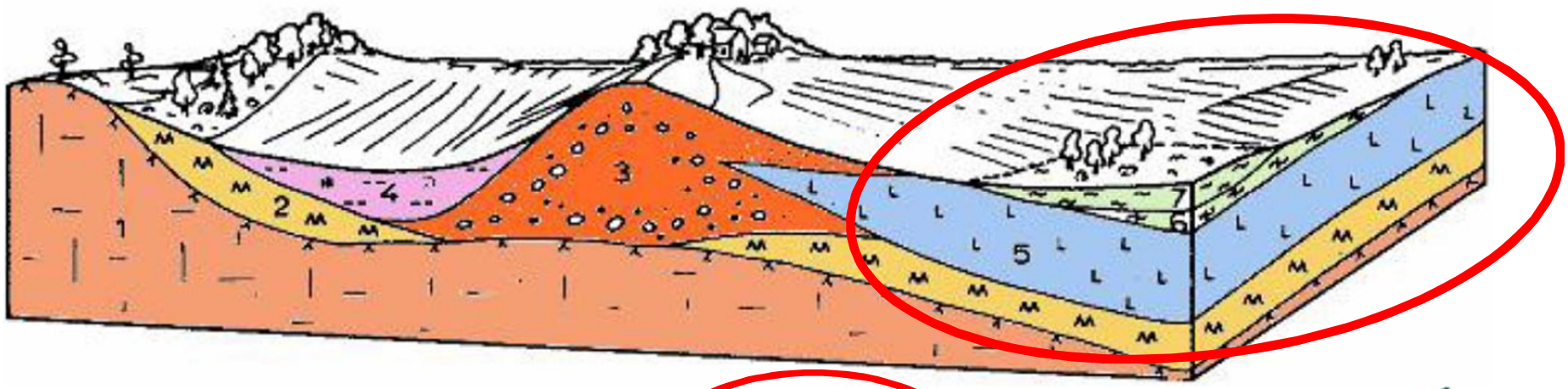
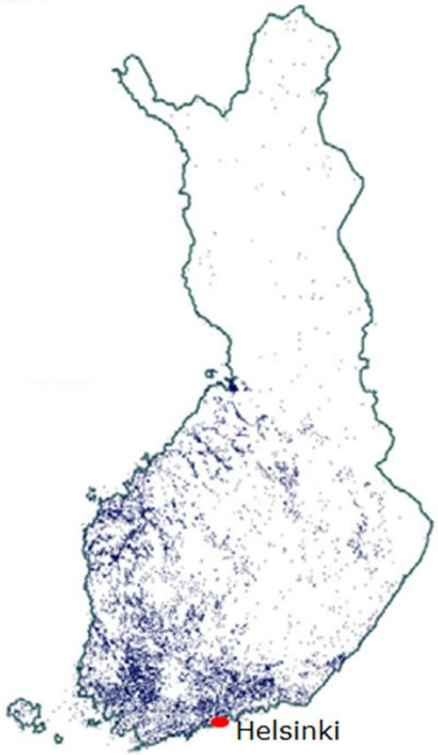
1. FINNISH GEOLOGY – TYPICAL FORMATIONS





<u>Clay...Mud...Peat (postglacial):</u>

w_o = 50 ... 2000 % (from dry weight)

τ_o = 1 ... 25 kPa

Organic content = 0...97 %

Bearing capacity = no capacity ... low

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1. THE USE OF AGGREGATES AND THE SITUATION WITH SURPLUS SOILS IN THE HELSINKI REGION

1. 17 MILLION TONNES OF AGGREGATES ARE ANNUALLY USED FOR CONSTRUCTION IN THE CAPITAL REGION OF FINLAND

2. ABOUT 3 MILLION TONNES OF SURPLUS SOILS ARE ANNUALLY TRANSPORTED TO LANDFILLS IN THE CAPITAL REGION OF FINLAND

3. 70% OF THE LANDFILLED SURPLUS SOILS ARE ESTIMATED TO BE OF POOR QUALITY: ABOUT 2,5 MILLION TONNES OF SILT, CLAY AND MUD ANNUALLY

4. "SURPLUS POOR QUALITY" IS DEFINED AS SOIL REMOVED FROM THE CONSTRUCTION SITE AND AS SUCH UNSUITABLE FOR CONSTRUCTION PURPOSES

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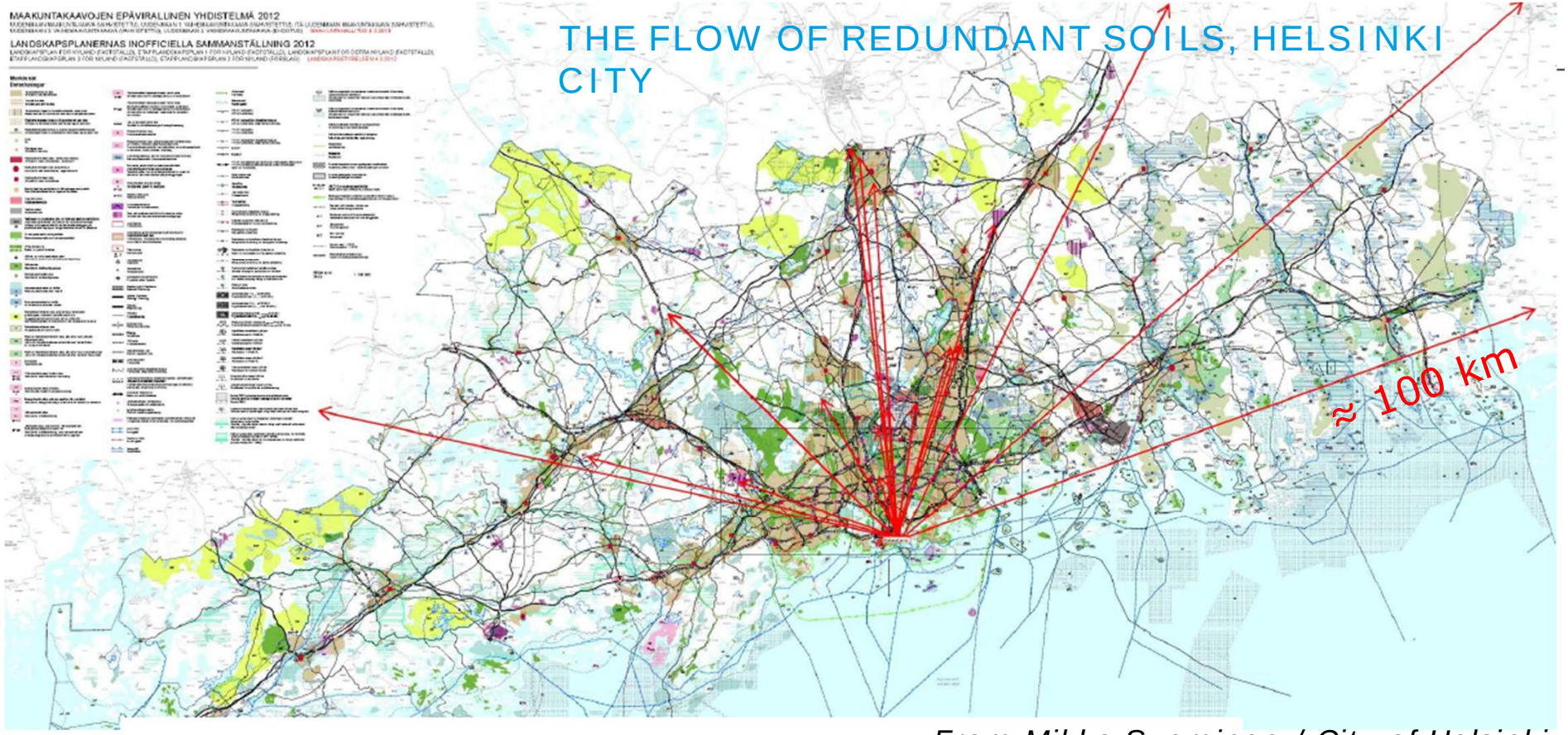
1. SURPLUS SOILS IN THE HELSINKI REGION – CHALLENGES

5. CURRENTLY THE CITY OF HELSINKI HAS NO LANDFILLS FOR SURPLUS SOILS => THE TRANSPORTATION DISTANCE OF SURPLUS SOFT SOILS IS ABOUT 50...100 KM!

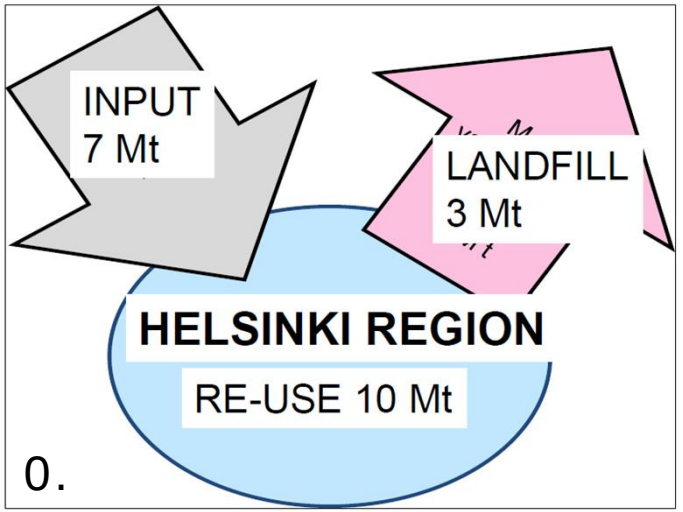


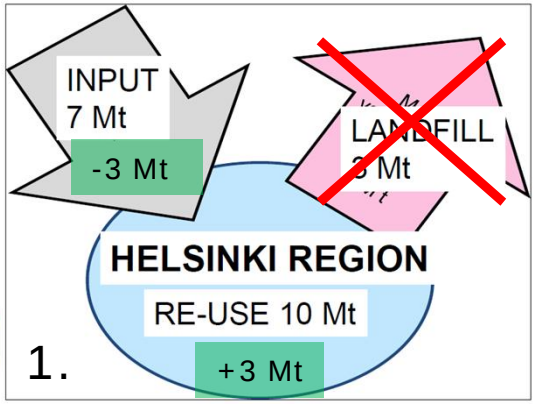
From Mikko Suominen / City of Helsinki

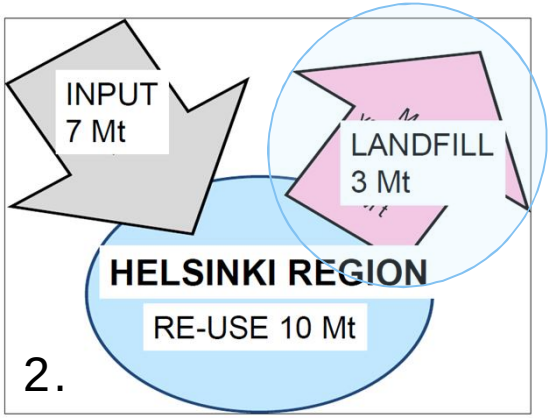
1. STRATEGY FOR THE RE-USE AND DEPOSIT OF SURPLUS SOILS IN THE HELSINKI REGION

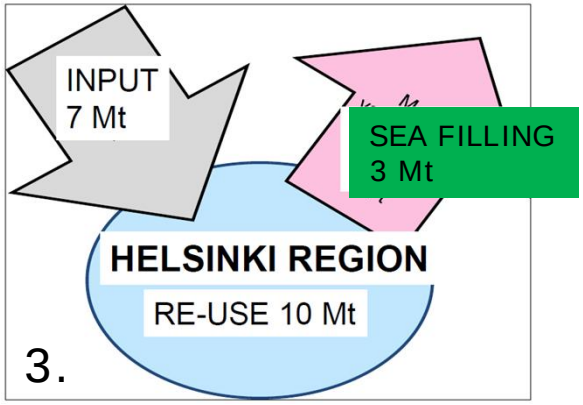
POSSIBILITIES:

0. CURRENT SITUATION
1. 100% RE-USE
2. LANDFILL SITES
3. SEA FILLING









1. STRATEGY FOR THE RE-USE AND DEPOSIT OF SURPLUS SOILS IN THE HELSINKI REGION

STRATEGY FOR RE-USE AND DEPOSIT OF SOILS

POSSIBILITIES

~~0. CURRENT SITUATION~~

1. 100 % RE-USE
2. LANDFILLSITES
3. SEA FILLING

(COMBINATION)

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ABSOILS

LIFE09 ENV/FI/000575

LIFE+2009 ENVIRONMENT POLICY AND GOVERNANCE STRAND

LIFE09 ENV/FI/575

Sustainable methods and processes to convert abandoned low-quality soils into construction materials. Demonstration project in Finland. (ABSOILS)

2. SOLUTION: STABILISATION OF SOFT SOIL

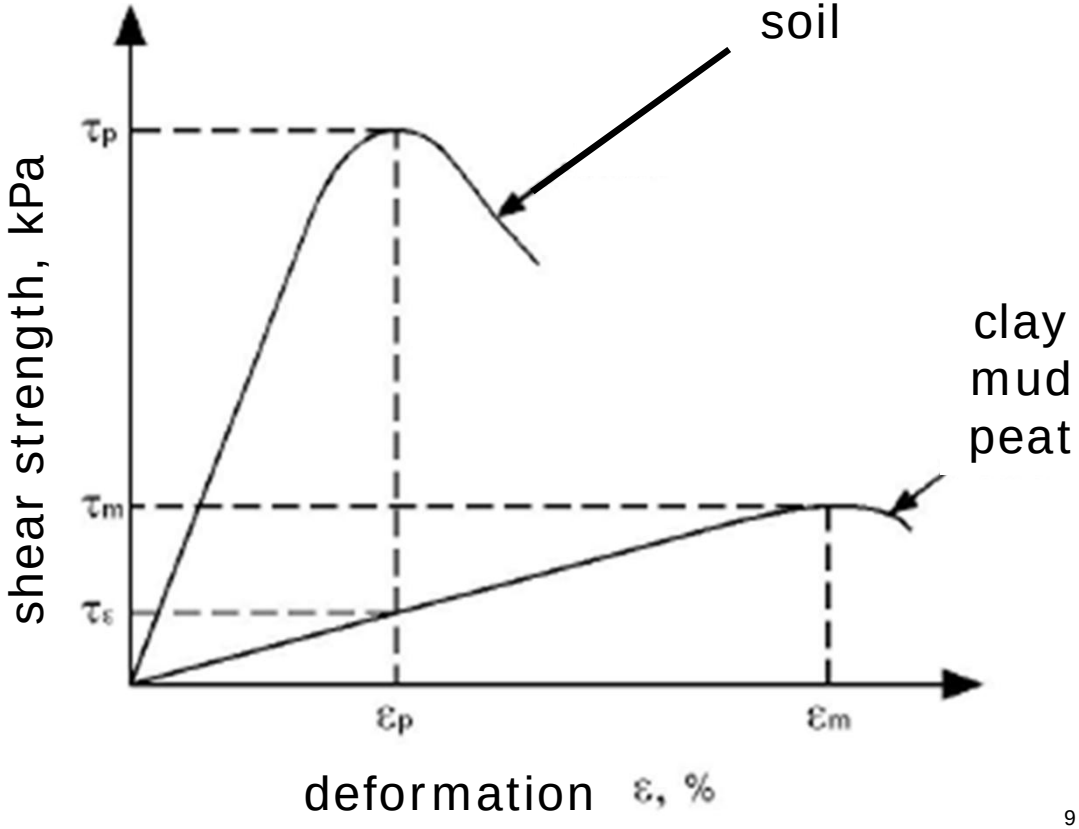
clay

binder

stabilised soil

mud

peat



2. POTENTIAL BINDERS IN STABILISATION

- “Traditional” binders Cement and Lime
- BY PRODUCS IN FINLAND:
  - Fly ash from coal burning (0,6 Mt/a)
  - Fly ash from biofuel incineration (0,35 t/a)
  - Industrial gypsum (1,5 Mt/a)
- BY PRODUCTS IN ESTONIA:
  - Oil shale ash as a potential binder in stabilisation of soft soils: contains a lot of lime which gives the material good strength development properties (5…7 Mt/a)
- CHALLANGES: ENVIRONEMTAL PERMIT REQUIRED FOR BY-PRODUCTS TO BE USED AS BINDERS OR BINDER MIXTURE COMPONENT

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2. APPLICATIONS OF THE MASS STABILISATION METHOD

1. Settlement reduction (embankments, structures, …)
2. Improvement of stability
3. Support of slopes and excavations
4. Improvement of bearing capacity
5. Immobilisation and/or confinement of waste deposits or polluted soils
6. Reduction of vibrations

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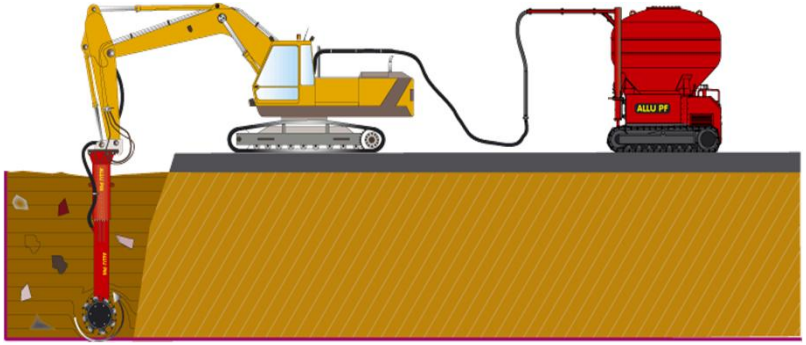
2. NORDIC DEEP STABILISATION METHODS (IN-SITU)



Mixing tool installed on an excavator machine and a binder storage tank

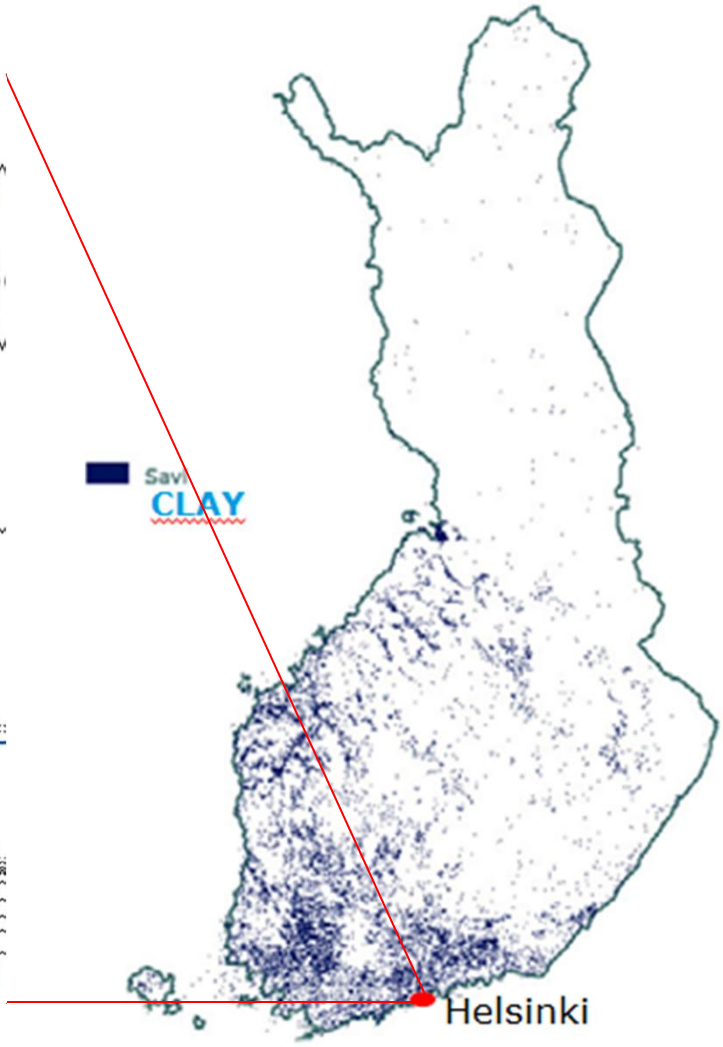
2. MASS STABILISATION METHODS (EX-SITU)

Windrow turner

Process stabilisation

Screener crusher

3. ABSOILS PROJECT DEMONSTRATION PILOT: CASE PERKKAA DOG PARK



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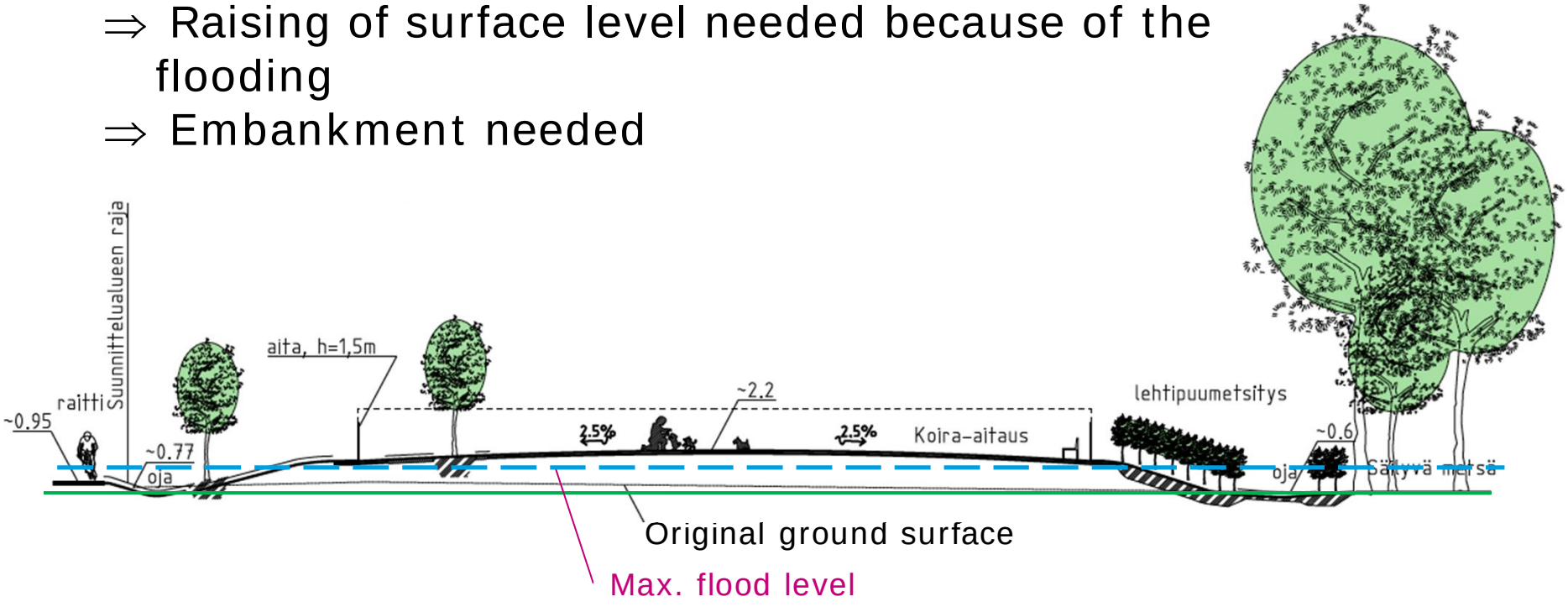
3. DEMONSTRATION: CASE PERKKAA DOG PARK

⇒ Raising of surface level needed because of the flooding

⇒ Embankment needed



Sub soil:
- thickness of clay 11 ... 14 m
- shear strength 5...10 kPa
- water content 80...130 %

Traditional aggregate embankment:

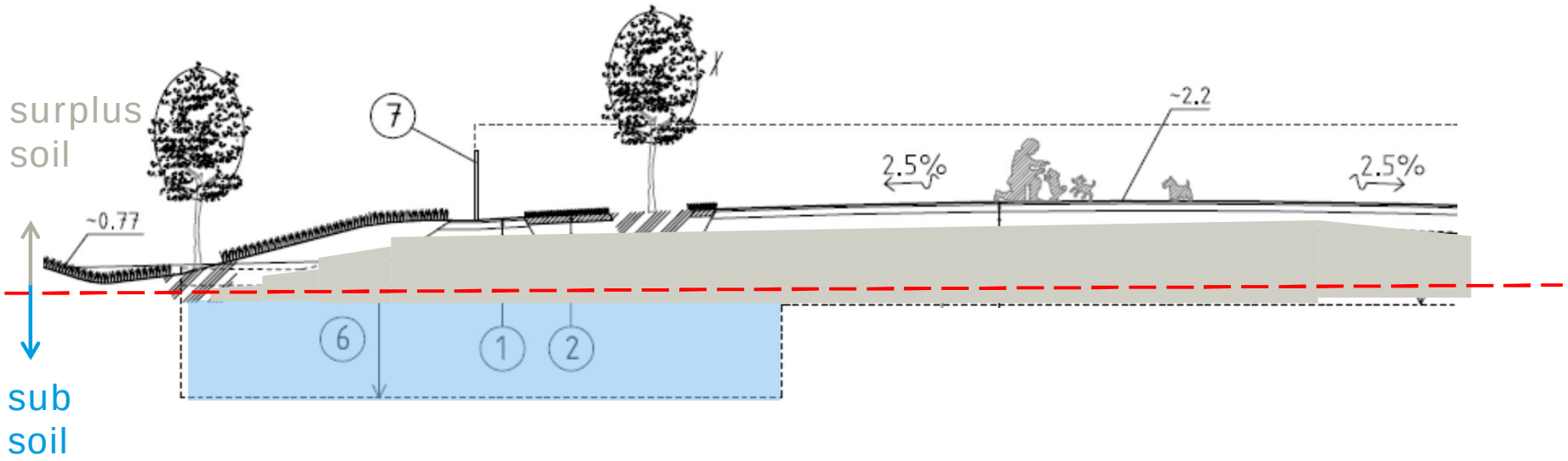
⇒ stability << 1,5

⇒ settlement 1 m

⇒ not acceptable

⇒ innovative and low-priced solution needed

3. “INNOVATIVE SOLUTION”



mass stabilised subsoil (clay and mud)

excavated clay from the neighbouring street construction project

Mass stabilisation binder = a mixture of cement and fly ash from coal combustion from Helsinki Energy

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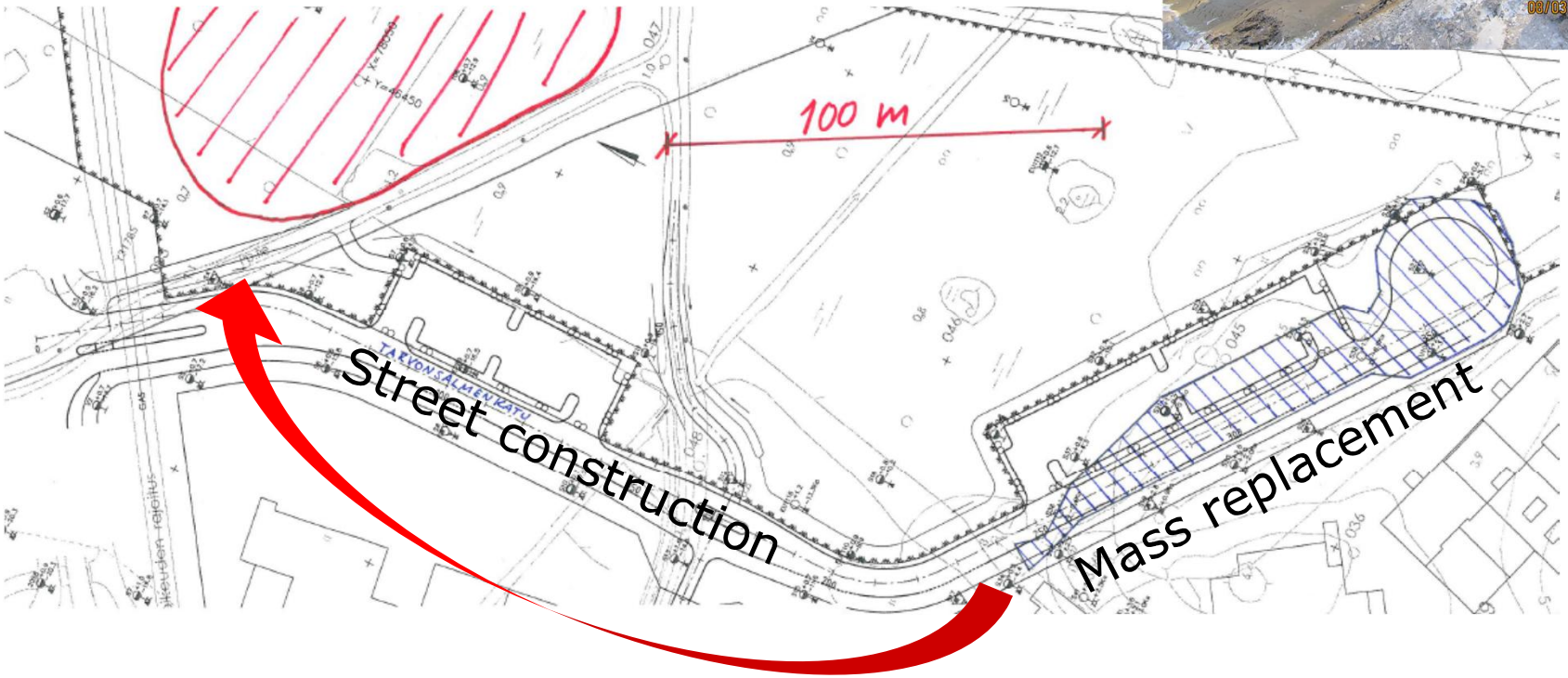
3. “INNOVATIVE SOLUTION”

Dog Park
Embankment



3000 m³ of soft clays transported 0,2…0,4 km to a neighbouring construction site instead of 25 km to landfill

=> 75 000 ton km less transport on public roads!

=> 3000 m³ less soft clay on public landfill!

=> 3000 m³ less aggregates to Dog Park embankment

=> “100 % RE-USE” OF SOFT CLAY

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3. CONSTRUCTION PHASES

CLEARING AND HARROWING 01/2012

TRANSPORT OF SOFT CLAY FROM NEIGHBOUR CONSTRUCTION SITE 01...02/2012

MASS STABILISATION 01...02/2013

QUALITY CONTROLL OF MASS STABILISATED LAYER 01...05/2103

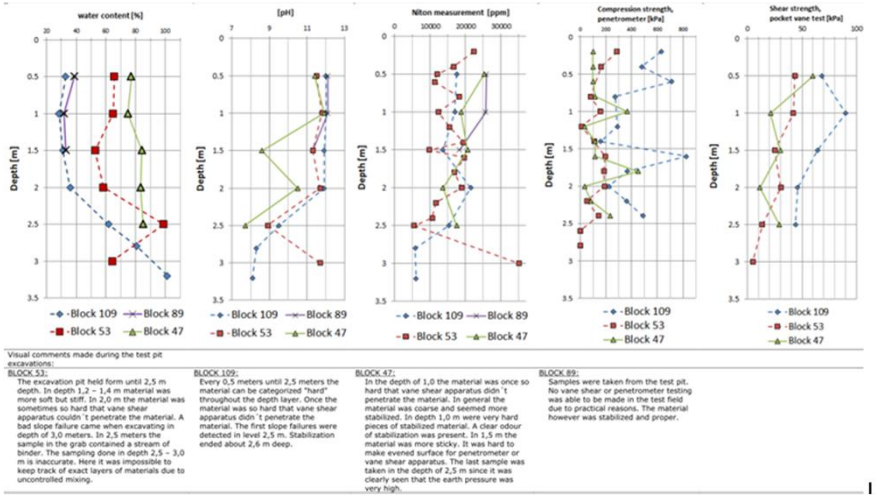
INSTALLATION OF LYSIMETERS 02/2013 (SAMPLING AND LEACHATE TESTS 2013...)

INSTALLATION OF SETTLEMENT PLATES 02/2012 (MEASURING 2013...2017)

CONSTRUCTION OF UPPER LAYERS 08...10/2013 (?)

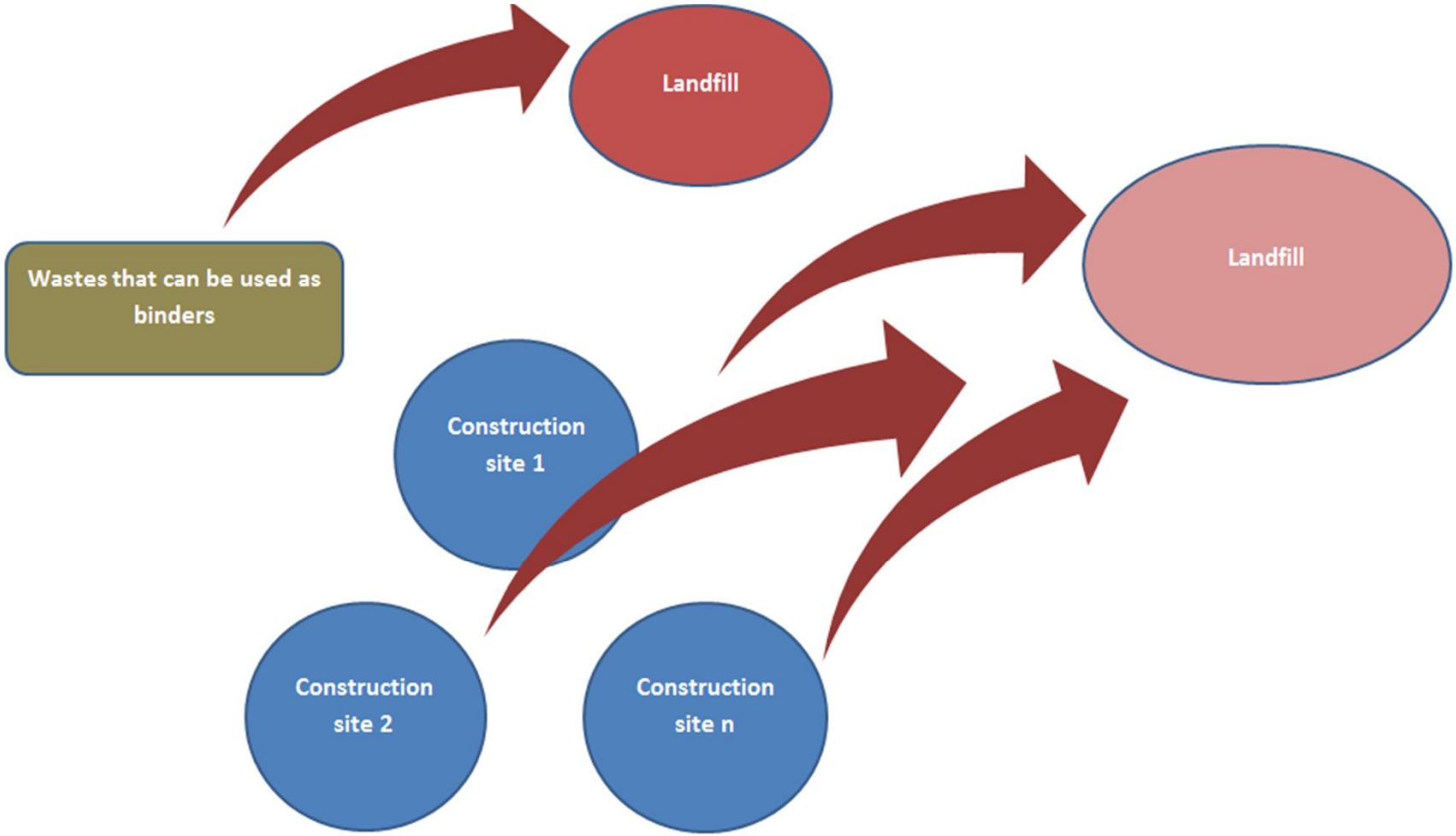
ANALYSING AND REPORTING OF THE TEST RESULTS 2013...2015

OPENING OT THE NEW DOG PARK 2014... (?)



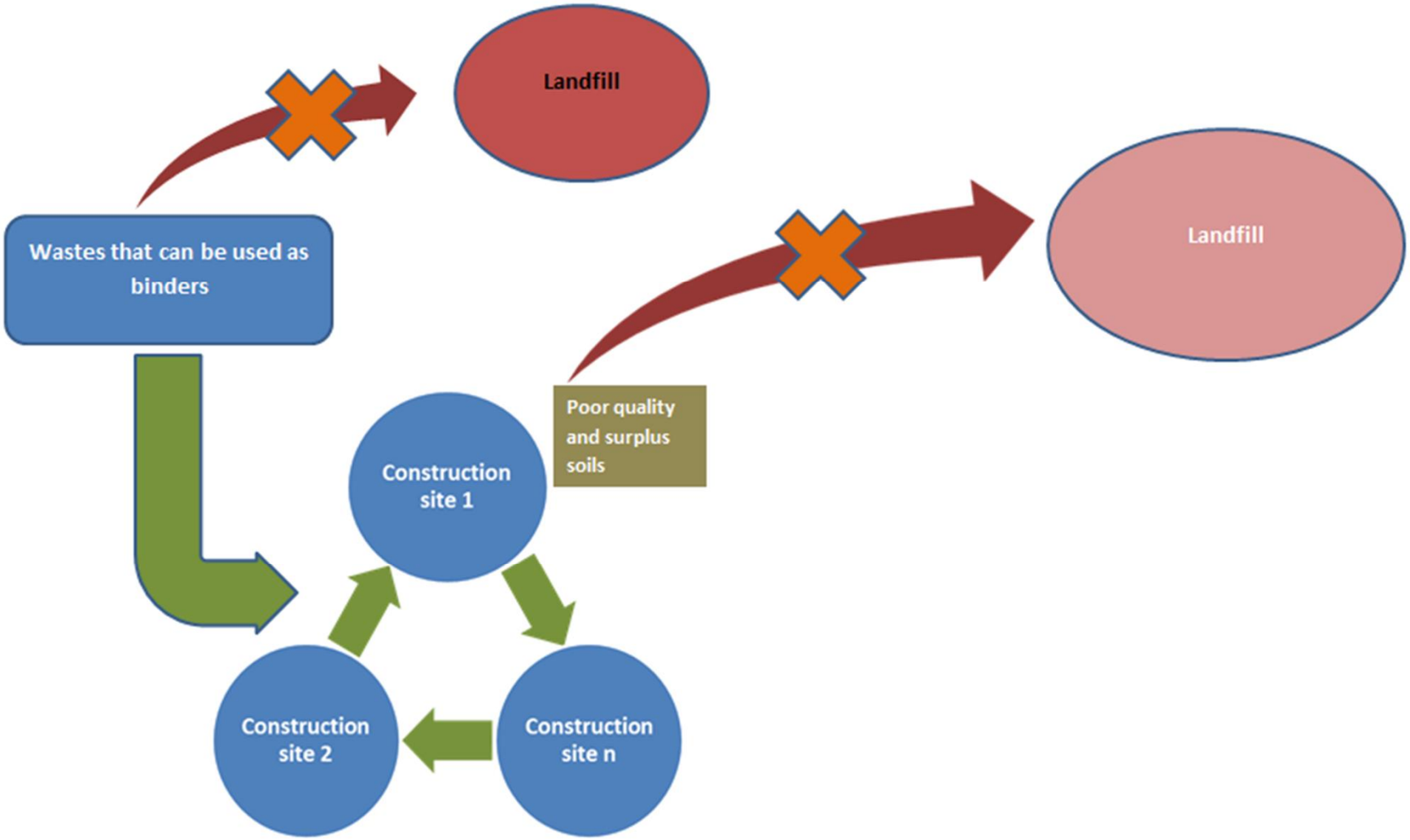
4. LESSONS LEARNED 1 / 3

THE PERKKAA DOG PARK PROJECT DEMONSTRATED THAT THE CURRENT WAY TO TRANSPORT LOW QUALITY SURPLUS SOILS AND BY PRODUCTS TO LANDFILL IS NOT THE BEST PRACTICE ...



4. LESSONS LEARNED 2 / 3

THERE IS A MORE SUSTAINABLE WAY TO DO – SURPLUS LOW-QUALITY SOILS AND WASTES FROM ENERGY PRODUCTION CAN BE PSOCESSED WITH MASS STABILISATION METHOD INTO CONSTRUCTION MATERIAL!



4. LESSONS LEARNED 3 / 3

MASS STABILISED SOFT SOIL IS A SUITABLE CONSTRUCTION MATERIAL FOR EMBANKMENTS, LANDSCAPE FILLINGS, SEALINGS, NOISE BARRIERS, HARBOUR FILLINGS, ...

before

after

Thank You!

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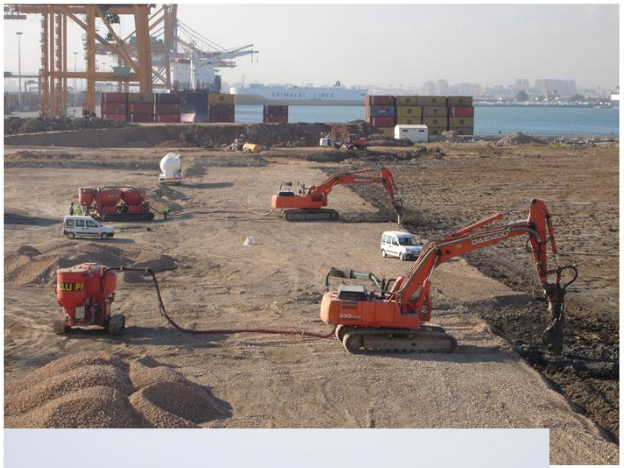
Some useful www-pages:

http://projektit.ramboll.fi/life/absoils/

http://simmccities.com/

http://uuma2.fi/

Thank You





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