

Groundwater Remediation Works in the Territory of „LDZ ritošā sastāva serviss” Ltd. (Daugavpils, 2.Preču iela 30)

State Ltd. “Vides projekti” (“Environmental projects”)

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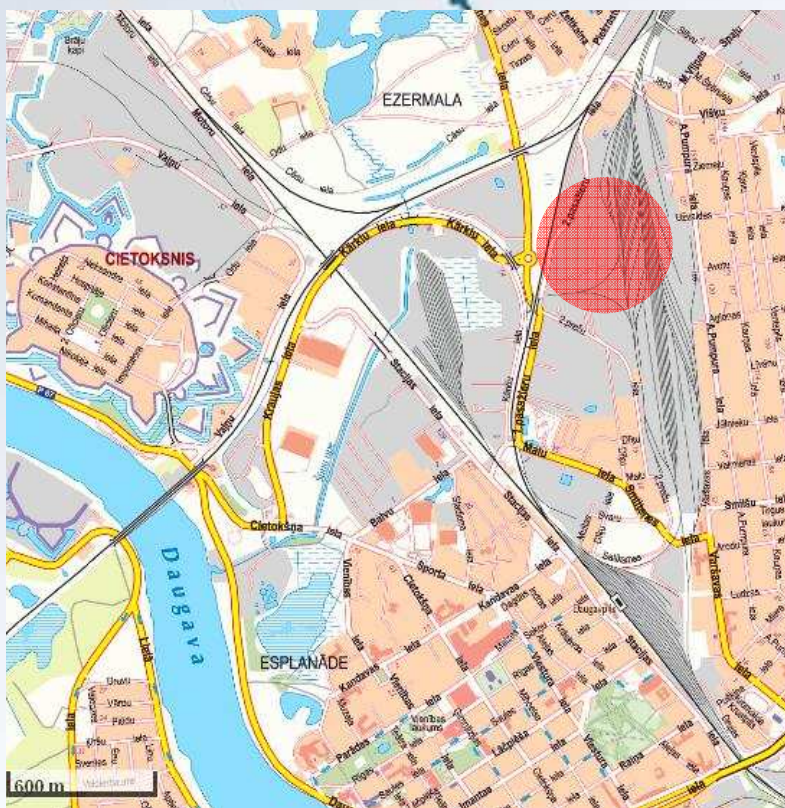
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Daugavpils, site location map



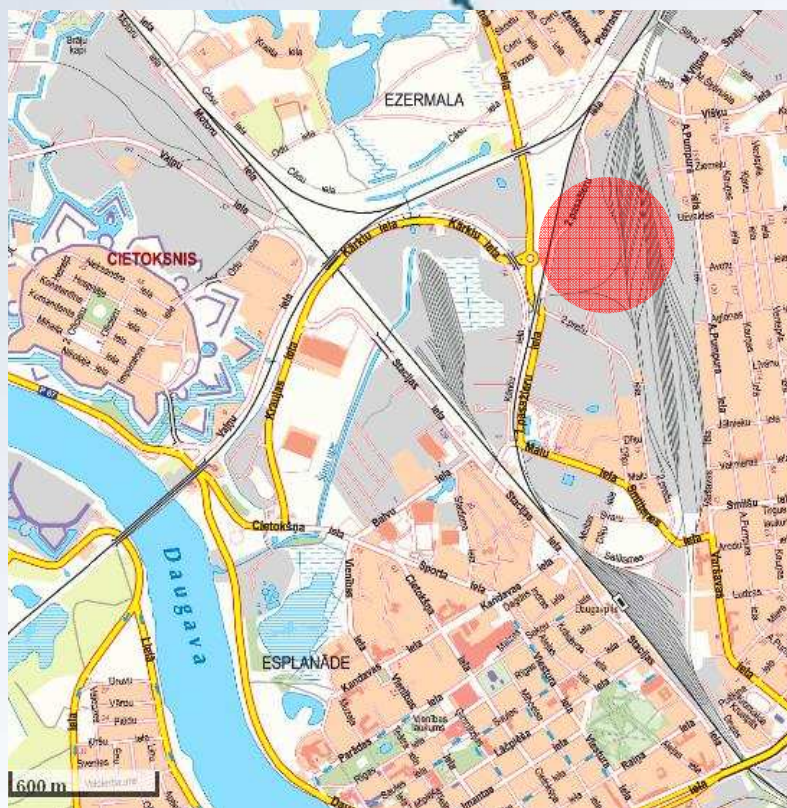
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**“LDZ ritošā sastāva serviss”,
site location map**

- „LDZ ritošā sastāva serviss” Ltd is located in the city of Daugavpils between the industrial and residential areas;
- Area of the industrial territory is 122 789 m²;
- Operation of the company is related to diesel-electric locomotive repair and technical maintenance, equipment with diesel, oil, water and dry sand;
- For equipment of locomotives 60 759 tons of diesel are used annually.

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“LDZ ritošā sastāva serviss”,
site location map

In the company’s territory there are:

- **23 oil product storage reservoirs** in all for storage of diesel and motor oil. Diesel is stored in 6 over-ground reservoirs, 5 of which have capacity 2000 m³ each, but 1 has capacity of 1000 m³. From 2004 to 2005 hydro isolation was installed under 6 reservoirs and their base was changed;
- **Motor oil** is stored in small reservoirs indoors;
- **Diesel pumping station**;
- **Fuel section**.



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Polluted areas database

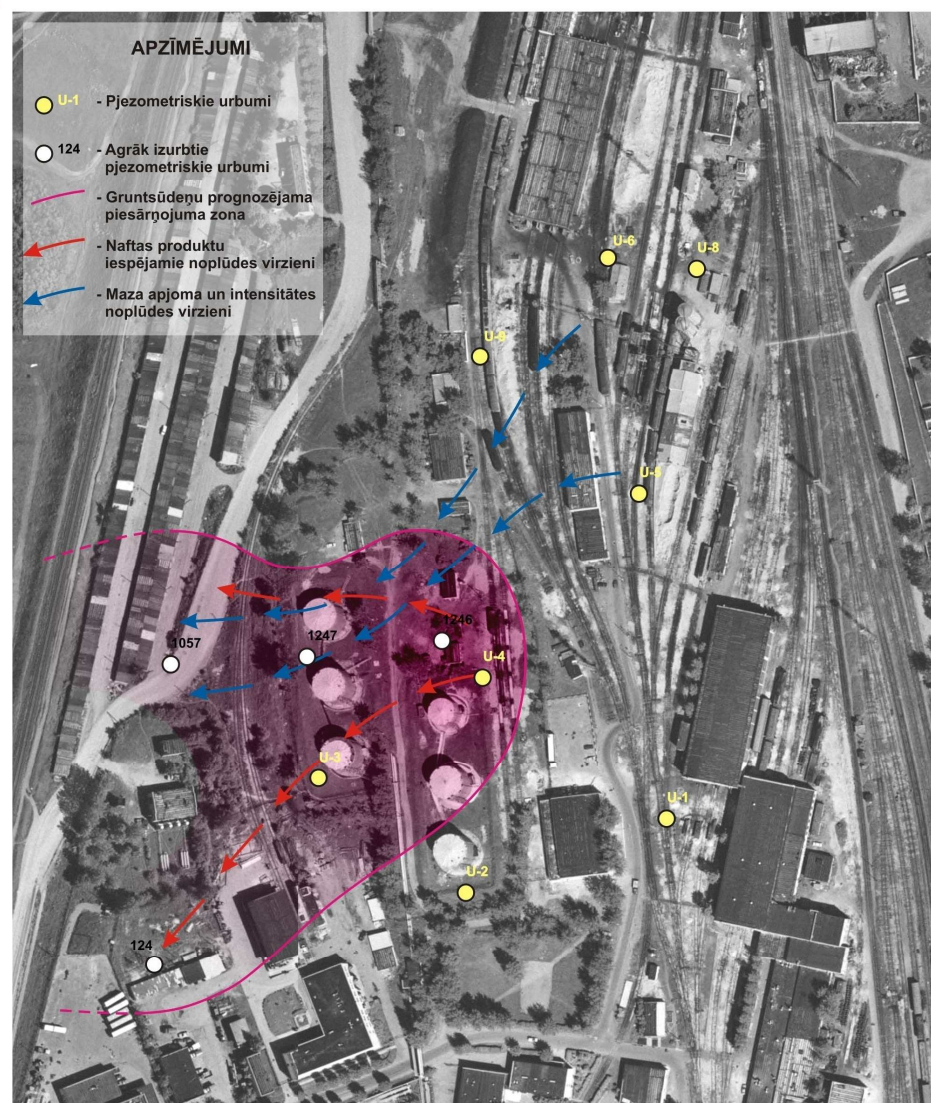
- The territory has been registered in the state polluted areas database and has been included in the Operation Programme 2007 – 2013. A separate section of the Operation Programme contains the polluted areas that are related to transportation services.
- Currently company complies with all environmental protection requirements and formation of new pollution is impossible.
- The company with its own finance resources without attracting the EU or National co-financing gave an opportunity to cleanup a historically polluted area.



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Pollution research I

- In the period from 2000 to 2004 research work on the soil and groundwater pollution was performed in the territory (“Balt-Ost-Geo” Ltd);
- In 2006 the State Ltd „Vides projekti” carried out additional research and monitoring in the existing 20 research wells;
- The territory polluted with oil products: floating oil layer atop the groundwater occupies **35 400 m²**;
- Thickness of the floating oil product layer atop the groundwater in this territory reaches **0.1 to 1.08 m**. Largest density was stated in the central part of territory, where the pumping station and fuel storage over-ground reservoirs are located.



M 1:2500

Results of groundwater pollution research, 1998-2004

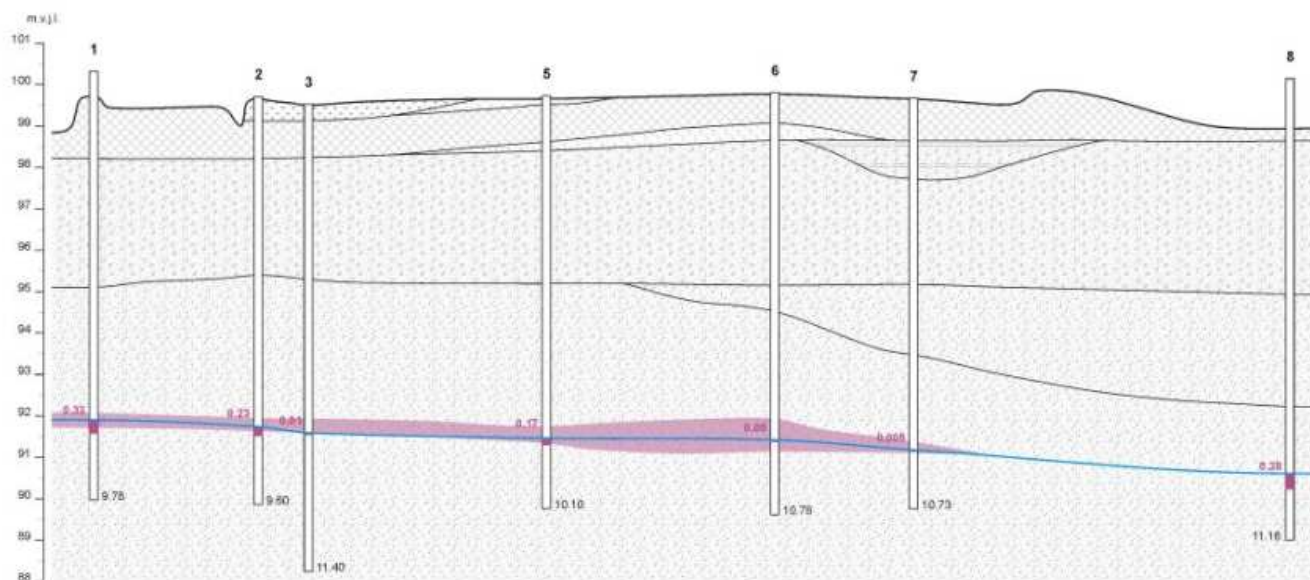
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Pollution research II

- The total free floating oil product fractions were estimated of **1085.3 m³**, the actual amount of “pure oil” products was estimated to be **488.4 m³**, ~ 45 % from the layer, because in the lowest part of the floating layer there is only oil product emulsion;
- The water containing part of geological cut is formed by fine limnoglacial sand with gravel addition.
- Filtration coefficient varies from **2.5 m/twenty-four hours** to **8.3 m/twenty-four hours**.
- At the western part of the polluted territory the water containing sand is coarse-grained with gravel addition.

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Geological and hydro geological conditions



M hor. 1:500
vert. 1:100

- Uzbertā grunts, smiltis ar sādzes atkritumiem, piesūcināta ar mazutu
- Vidēji rupja vai grantaina uzbertā grunts
- Augsne, smiltaina, apbēta
- Grantaina smiltis, galipēlīga vai brūngana ar oļiem, sausa

- Grantaina smiltis, galipēlīga vai brūngana ar oļiem, sausa, vietām mālaina
- Vidēji rupja smiltis ar grants graudiņiem
- Rupja smiltis ar grants graudiņiem
- Rupja smiltis ar grants graudiņiem, vietām ar naftas produktiem piesūcināta grunts

- 1 - Urbuma un tā numurs
- 8.33 - Naftas produktu slāņa biezums, m (2003.g.)
- 9.78 - Urbuma dziļums
- Gruntsūdens līmenis



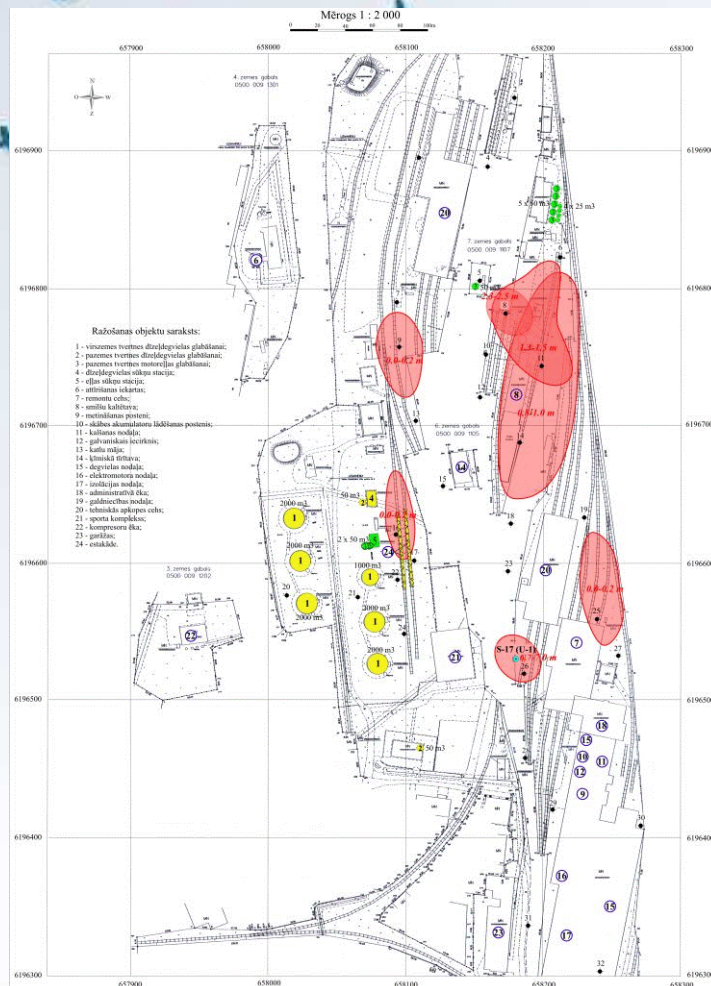
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Pollution research III

- The groundwater level in the territory is in the depth of **8.0 to 12.5 m** and the floating oil product layer above it – **7.9 to 11.4 m**.
- The largest amount of oil products leaked during the 1980ies;
- Oil products consist of diesel with various decomposition level and various physical properties. The diesel fraction aged > 10 years consists of viscous products and kinetic rate of 8.4 sSt;
- Depending on the age of oil it is possible that they contain **humic acid**. Humic acids are formed in the result of splitting of the oil product bacteria. They are more dense and viscous in comparison with the oil products with their gel-type consistency.

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Soil pollution

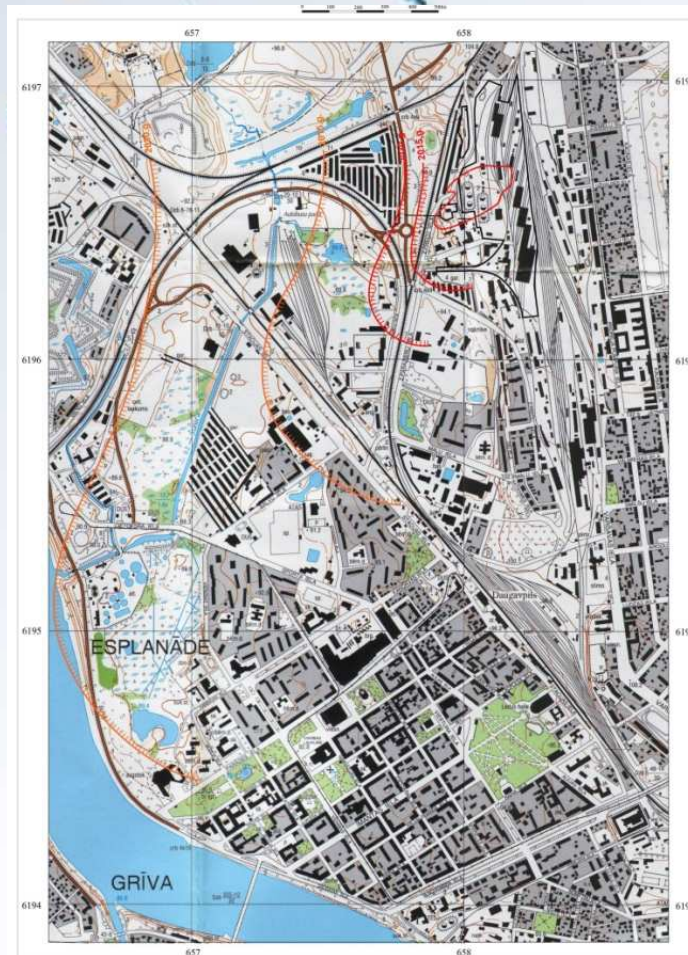


- Within the company's territory in various places oil product pollution was stated also in the upper layers of the soil.

- Owner of the territory has changed the more intensively polluted soil with clean soil, and the soil pollution cannot be regarded as a new groundwater pollutant, therefore the work task does not provide for soil purification.

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Oil products migration in 2015 and 2030



- The estimate of the free oil product fraction migration taking into account the rock filtration coefficient, oil product viscosity and slope of the groundwater flow indicated that migration speed in **southwest** direction is **12.8 m** per year, but in **western** direction – **6.3 m** per year;



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Strategy of decontamination works

- In 2006 “Feasibility Study for Remediation of the Territory of “Latvijas Dzelzceļš”” was developed for elimination of the floating oil layer (State Limited Liability Company “Vides projekti”).
- It has been coordinated with Daugavpils Regional Environmental Board.
- The tasks provided in the work task are:
 - liquidation of the oil product floating fraction located atop groundwater;
 - localization of the fraction that has dissolved in groundwater.



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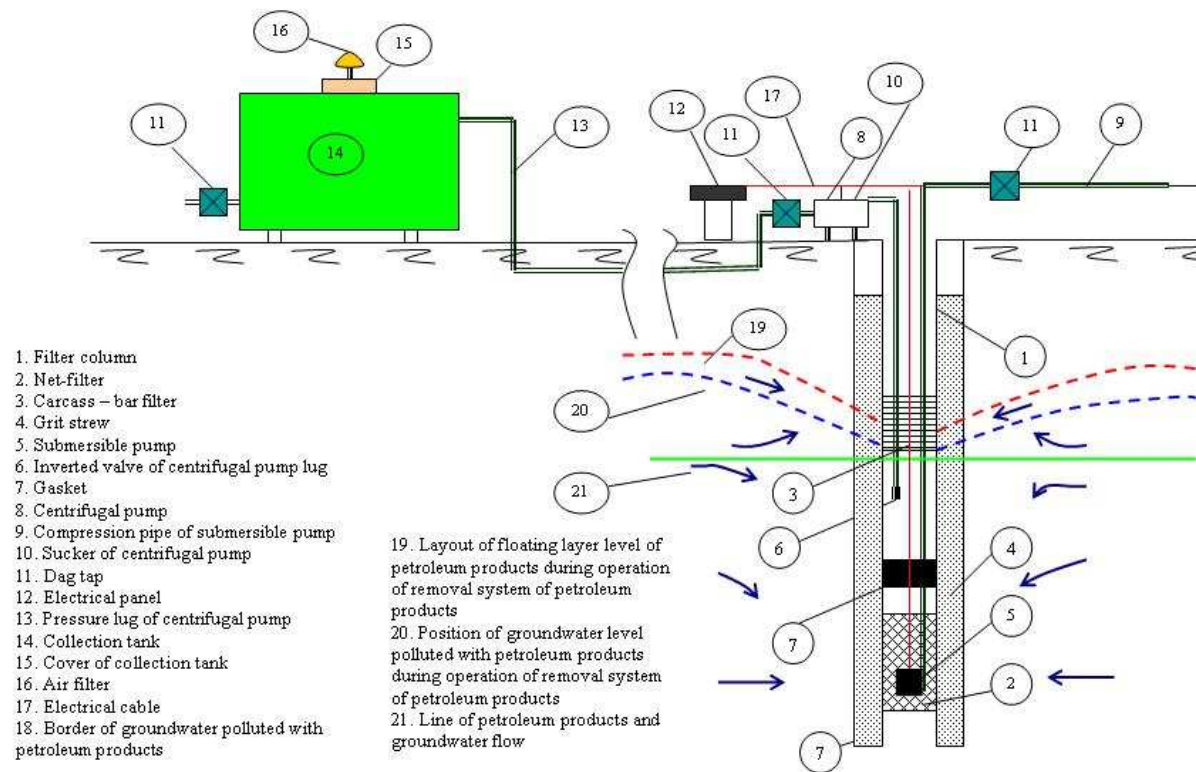
Structure and amount of decontamination works

- Taking into account the hydro geological conditions, composition of oil products it is planned to use “double pumping” method to liquidate the oil product floating layer.

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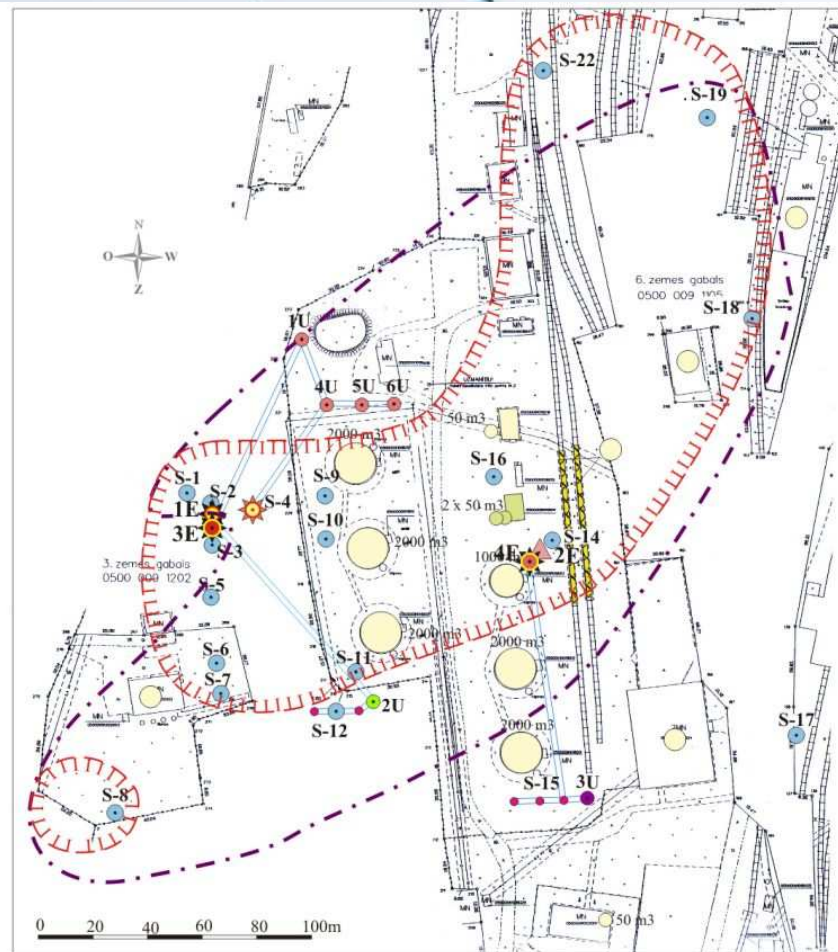
Double pumping method

Elimination scheme of Petroleum products
(double pumping method of the well)



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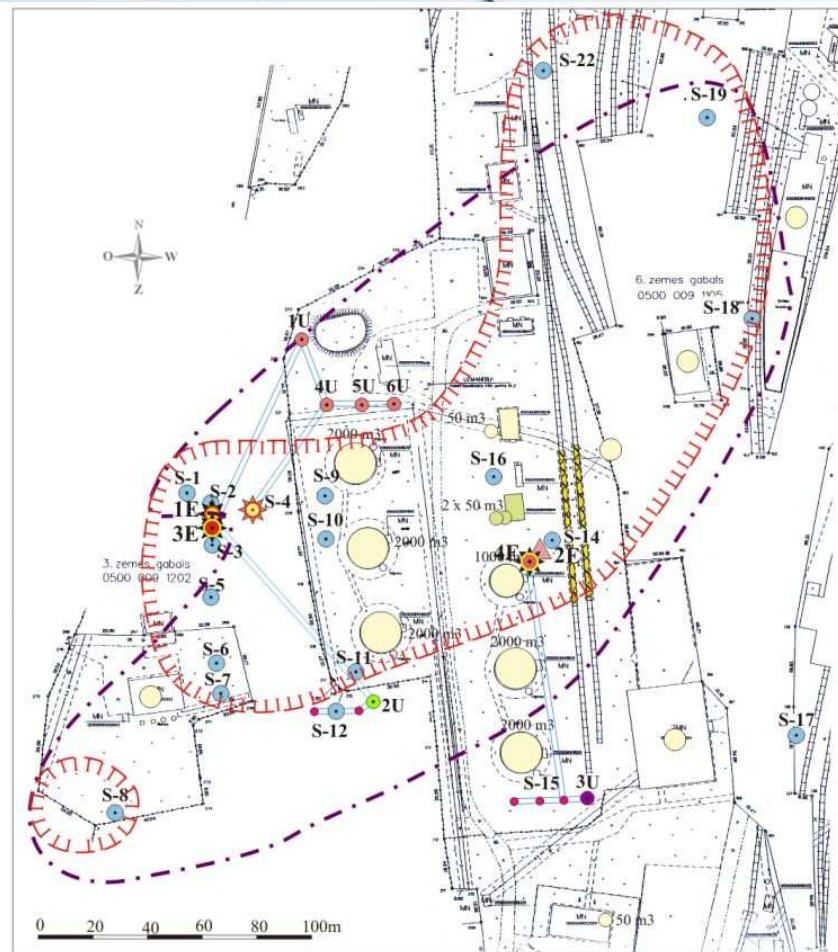
Pumping systems



- The first 2 pumping systems (1E and 2E) for pumping out of oil products were installed in 2007 followed by an experimental pumping.
- In 2008 additional 3 systems were gradually installed (3E, 4E and S-4).
- Depth of exploitation boring wells is 16.0 - 23 m.
- *For pumping of water and oil products from the upper part „Auto Pump” is used, but pumping out of water from the lower part of the boring well is carried out by immersion pump.*

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Pumping systems II



- Water pumped out by immersion pump is drained to absorption system.
- Infusion of the water back into the horizon stimulates running of oil products to the pumping system as the pressure gradient in the direction towards depression funnel increases.
- Absorption system uses 7 absorption boring wells.



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Measurements

- During the exploitation process regular lower and upper pump debit measurements are taken from all exploitation boring wells, as well as from oil product sediments in the settling reservoirs.
- Measurement of the level and floating layer thickness is carried out in observation boring wells that are located within range of the depression funnel.
- The task is burdened by the necessity to carry out periodical cleaning of the pipelines and absorption boring wells due to sedimentation of iron oxide. In the work area concentration of iron (II) oxide (Fe^{2+}) in the groundwater is 1 mg/l, but the total iron concentration 10 mg/l; that hinders water flow and reduces debit.
- Quality of water, drained in to absorption system, is regularly controlled in laboratory.

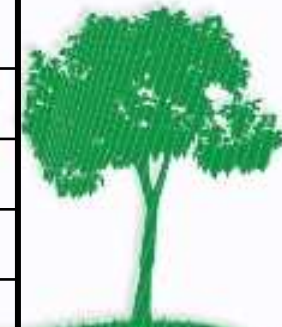
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Results

- Within the framework of the project implementation simultaneous operation of five pumping systems for a period of seven years has been planned to provide for pump-off in the pollution area epicentre.
- Since 2007 pump-off systems have been established. Double pumping method is used to pump-off oil products.
- Total **100.52 m3** of relatively “pure” oil products have been pumped-off in **2007 - 2009**.

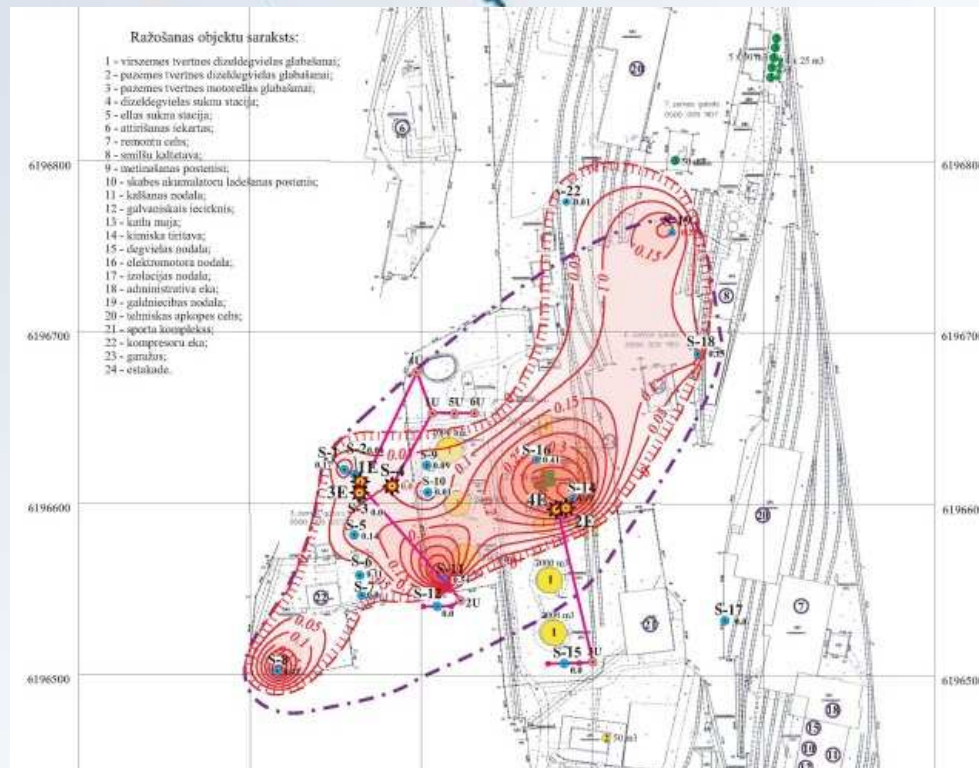
Year	Pumped-off water and oil product mix, m3	Pumped-off “pure” oil products, m3
2007	1209,4	4,9
2008	6072,4	42,56
2009	6406,7	53,06
Total:		100,52



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Results II





Thank you for your attention!

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