METSÄ FIBRE OY

KEMI BIOPRODUCT MILL

ENVIRONMENTAL IMPACT ASSESSMENT PROGRAMME

8.5.2019

Cover image:Sweco Industry Oy

Map photos:
National Land Survey of Finland (MML)
Finnish Environment Institute (SYKE)

VIEWING AND CONTACT INFORMATION

The evaluation programme is available at the following locations:

City of Kemi
Valtakatu 26, Kemi

Kemi City Library
Marina Takalo Street 3, 94100 Kemi

Lapland Centre for Economic Development, Transport and the Environment
Valtakatu 28, Kemi

Keminmaa Municipal Hall
Rantatie 21, Keminmaa

Keminmaa Main Library
Väylätie 6, Keminmaa

In addition, the evaluation programme is available electronically at:
www.ymparisto.fi/keminbiotuotetehdasYVA.

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SUMMARY

Project and project manager

Metsä Fibre Oy is investigating the construction of a bioproduct mill of approximately 1500000 tonnes of pulp in Kemi's integrate. The project is called the Kemi bioproduct mill.

The plant would be located on the north and east of the current pulp mill in Pajusaari and Sahansaari.

Rationale and objectives of the project

The aim of the project is to meet the growing demand for bioproducts and to enable the efficient utilisation ofwood raw material as a whole into valuable bioproducts. New bioproducts will replace products made from fossil raw materials. The bioproduct mill will bebuilt to be energy- and material-efficient, renewable energy efficient and functional without fossil fuels.

The bioproduct mill processes wood sustainably and resource-efficiently in addition to pulp, biomaterials, bioener gia, biochemicals and fertilisers. Raw material and side streams are utilised as products and bioenergy.

The factory's equipment solutions and choices emphasise energy efficiency and clean technology (cleantech). The plant operates without fossil fuels.

The environmental targets of the bioproduct mill have been set in such a way that the new bioproduct mill is able to operateaccording to the permit conditions defined for the plant integration and its wastewater treatment plant in 2007. When it comes to water discharges, this means a very strict closing rate of internal water cycles in the pulp production process and the renewal of the wastewater treatment plant. In terms of air emissions, the target can be achieved using BAT.

EIA procedure

The objective of the environmental impact assessment procedure is to promote the assessment of the environmental impacts of projectsand the integrated integration of projects in planning and decision-making.

The purpose of the EIA procedure is not to make decisions on the project, but to provide information on the basis of the decision-making process. All those interested in the project may participate in the EIA procedure.

The notification by the contact point of the EIA procedure on the completion of the EIA programme provides more detailed information on howand when opinions can be expressed. The contact point is the-Centre for Economic Development, Transport and the Environment in Lapland.

This EIA programme is a plan for the organisation of the environmental impact assessment procedure and the studiesrequired in it. An environmental impact assessment report (EIA report) is drawn up on the basis of the EIA programme and the opinions and opinions given on it. The evaluation report provides detailed information on the project and its alternatives and an assessment of their environmental impact. The report provides information on existing environmental studies and those carried out in the course of the procedure.

Options under consideration

The EIA process examines the following project options:

VE1: Build a new bioproduct mill. 1.3 million tonnes/a of new pulp capacity will be built.

The old unbleached bottom mass line is left in operation and has a capacity of around 180 000 t/a. Bioproduct plantscan be built later on, such as:

- lignin plant
- biofibre plant
- biogas plant
- composite plant
- shell pellets.

VE 0: The current pulp mill.

Before the start of the environmental impact assessment, it has been decided in principle that the aim is tobreak down a large factory instead of renovating the existing factory department at a time with the same productioncapacity teat.

Description of the project area and its environment

Location

The new bioproduct mill will be located in the current plant area, which is locatedon the western side of Kemi's urban agglomeration. The current pulp mill will be dismantled once the new mill has started, with the exception of the current base mass line.

The nearest residential buildings are located north-west of the project area (factory area), approximately 300 m from the border of the factory area. About 500 m in the east direction is inhabited.

Zoning

The current factory area is indicated in the provincial plan as an industrial and storage area where a plant-that manufactures or stores marine hazardous chemicals may be located.

In the current town plan, the project area is mainly a block of industrial buildings. The industrialdistrict plan has been amended with a phase plan, which was approved by the Technical Board on 19 March 2019 and the City Council of Kemi on 1 April 2019. The changes concerned the elevations of the factory site, the conservation status of the buildings and the land boundaries within the factory site. This is expected to become final on 13 May 2019.

In addition, the planning of Sahansaarinkatu will start at the same time as the EIA process.

Environmental conditions

The project area is by nature a built environment that has been heavily shaped by industrial activities. There are, among other things, factory buildings, tanks, sewage treatment plant pools, wood chips and wood storage areas and waste management areas. The area has changed dramatically in its natural state. The area is not located in an important or other groundwater area suitable for water supply.

Today, traffic to the factory area mainly runs north of the city centre. The car transports to the factory will be directed to the factory area via Sahansaarinkatu, Pajusaarintie and Tehdastiti.

According to the integrated noise survey, the average noise levels of daytime and night time have been exceeded in a few residentialbuildings around the world with the current factory integrator operating.

According to the most recent monitoring report (2013-2014), air quality in the Kemi area is mostly industrial at the level ofthe local mouths. The annual nitrogen dioxide content is in the same range as in

largecities near roadways.

Environmental impacts to be assessed

Environmental impacts refer to the direct and indirect impacts on the environment caused by the planned bioproduct mill. The evaluation examines the effects of both construction and use.

In accordance with the EIA Act, the assessment examines the environmental impacts of the project:

- population and human health, living conditions and comfort
- soil, water, air, climate, vegetation, organisms and biodiversity
- urban structure, buildings, landscape, urban landscape and cultural heritage
- exploitation of natural resources
- interactions between these factors.

According to preliminary estimates, the most significant environmental impacts of the plant project are related to water and airemissions, noise and the transport of raw material and products. Other key environmental aspects include possible accidents and disruptions.

The significance of environmental impacts is assessed, among other things, by comparing the environmental resilience of each environmental burden, taking into account the current environmental load on the site. The assessment of environmental resilience is based on, among other things, the given guide values, such as the noise level guideline values and available research data.

Participation and information plan

Residents and other interested parties can participate in the project by presenting their views to the LaplandCentre for Economic Development, Transport and the Environment acting as the contact authority, as well as to the project manager or consultant.

In order to monitor the EIA procedure, a monitoring group will be set up to promote the flow and exchange of information between the authorities and other stakeholders responsible for the project.

On 22 May 2019, a public information and discussion session on the EIA programme will be held in Kemi, where the assessment programme ofthe county will be presented. At the event, the public will have the opportunity to present their views onthe assessment of environmental impacts. A second information and discussion session will be held afterthe EIA report has been completed.

During the EIA procedure, a tenant survey will be carried out with the aim of increasing interaction and providing the project manager with information about the residents' attitude towards the project and, on the other hand, giving the residentsa road to the project and its impact on their living environment.

Schedule

The environmental impact assessment procedure for the project started in spring 2019 with the EIA-programme. The EIA procedure will officially start when the EIA programme is submitted to the contact point in May 2019. Environmental impact assessments will be carried out between May and September-2019. The EIA report is expected to be submitted to the contact point in September 2019, when the project's EIA-meeting would end with its reasoned conclusions in January 2020. An environmental permit would be issued in April 2020. The aim is that the bioproduct mill's investment decision would be made in summer 2020, when the plant could be started in autumn 2022.

TERMS AND ABBREVIATIONS

a	year (1a = 365 d), time unit
AOX	Adsorbable organically bound halogens or adsorbable organically bound halogens- (organic chlorine compounds)
Bat biosludge	
BREF COD COD_{Cr}	
d dB	
DD washer DS	Best Available Techniques (Best Available Techniques)
ELY	European Commission's BAT Reference Document – Chemical Oxygen Consumption,
EC	Waste Water Quality Parameter
FINIBA areas GJ	chemical oxygen consumption, determined by the dichromate method
i-m^3 IBA zones k-	day (1d = 24 hours), time unit
m^3 ka kPa kWh	decibel, unit of measurement of sound intensity
MAALIs MW	Drum Displacer Drum Scrubber
digestion	Dry Solids Dry Solids
	Centre for Economic Development, Transport and the Environment
	The European Community (now the European Union)
	Important bird areas in Finland (IBA areas, internationally important bird areas)
	gigajoule (= 1 000 MJ), energy unit
	cubic metres (chips, shells or bites)
	Important Bird and Biodiversity Areas (IBA) solid cubic metres of dry matter
	kilopascal (1 kPa = 1 000 Pa), pressure unit
	kilowatt-hours, unit of energy
	Provincially Important Bird Areas
	megawatt, energy power unit
	anaerobic treatment, commonly used for municipal wastewater treatment plant sludges. Digestion of sewage sludge generates biogas (mainly methane and carbon dioxidesidia), phosphorous humus and nitrogen-rich rejective.
Nm^3	cubic metre of gas at normal atmospheric pressure of 101.3 kPa and at 0 °C.
No_x	No and NO2,i.e. nitrogen oxides. Compounds of nitrogen from combustion resulting from nitrogen contained in fuels and combustion air.
p.k.a	daily average
primary sludge	Fibre sludge, usually containing all wood-based substances; long fibers, lignin, cellulose intakeand fibre mass
Reach Regulation	The Regulation has established a system for the registration, evaluation and- authorisation of chemicals (2006/1907/EC).
SO_2	Sulphur dioxide. Sulphur dioxide is produced when the sulphur contained in the fuel reacts with combustion oxygen.
stripping t	
TRS TS TSS	removal of volatile organic compounds (VOCs) from dirty condensates by steam tonne
TUKES v.k.a V	Total Reduced Sulfur Compounds
(or kV) VE0	tonnes of pulp (90 % dry matter)
	solids
	Finnish Safety and Chemicals Agency
	annual average
	volt (1 kV=1000 V), electric voltage unit
	Option 0, the so-called 'zero option', the non-implementation of the project and the continuation of the existing plant
VE1	
YSL	Option 1, Implementation of the project, implementation of a new bioproduct mill
EIA	Environmental Protection Act Environmental Impact Assessment

1. KEMI BIOPRODUCT MILL

Metsä Fibre Oy is investigating the construction of a bioproduct mill of 1500000 tonnes of pulp in Kemi's plant integration. The project is called the Kemi bioproduct mill.

The bioproduct mill consists of a pulp mill and other bioproduct plants that process its products and/or ancillary products. The plant would be located north of the current pulp mill as well as in Sahansaari. The plant will replace the pulp mill inits area, which will cease to operate when the new mill starts. In terms of the plant's overall performance, the aim is to operate in accordance with the permit conditions defined for the current plant integration and its wastewater treatment plant in 2007. From this point of view, the EIA procedure for the project under the EnvironmentalImpact Assessment Procedure Act (the EIA Act, 252/2017) and the environmental permit application process are initiated.

In addition to good management of environmental issues, investments will be made in high energy precipitation, especially electricity in terms ofenergy, and the conditions for diversified bioproduct production will be created.

The integrate will utilise the ability of a large factory to produce goods and services efficiently. It will-further process side streams into products and raw materials. A significant advantage in the profitable production of bioproducts will be the excess heat.

The zero option is to continue using the current pulp mill.

1.1 Project manager

Metsä Fibre Oy is responsible for the project according to the EIA Act.

Metsä Fibre Oy is the world's leading producer of softwood pulp for high-quality paper, paperboard and softtissue manufacturers in Europe and the Far East. Metsä Fibre manufactures bleached Botnia pulps with four factoriesin Finland. The combined production capacity of the Joutseno, Kemi, Rauma and Äänekoski plants is 3.2 million tonnes. Metsä Fibre is also a significant producer of sawn timber for the component, furnitureand carpentry industry. Sawn timber is produced at Vilppula, Rengo, Kyrö, Merikarvia,-Lappeenranta nan and Podporoze sawmills. The combined production capacity of sawn timber is 1.9 million cubic metres. Metsä Fibre is part of Metsä Group.

After the implementation of the project proposal, Metsä Fibre's total pulp production capacity is4.0 million tonnes.

1.2 Background and purpose of the project

The balance between demand and supply of coniferous pulp is stable and high. Demand for softwood pulp will grow evenlyin the future. In particular, growth takes place in emerging markets. The growth of the new bioproducts market also needs pulp.

The Kemi pulp mill was mainly renovated in 1990. The factory is still technically and economically competitive. However, a significant increase in the capacity of the existing plant is not justified, but a longer-term extension of the life cycle of the plant would require a major investmentprogramme to renovate.

The bioproduct mill project will replace the current pulp mill, enabling the production of new bioproducts in the area and the involvement of other operators.

1.3 Exploratory study

Metsä Fibre Oy has carried out a preliminary study in 2018-2019 that mapped out the possibilities to replace the current pulp productionin Kemi by building a large bioproduct mill in the factory area and creating a platform for versatile bioproduct production. The objectives of the preliminary study were as follows:

- Sufficient and sustainable wood is available throughout the plant's life cycle.
- Wood can be transported to the factory, i.e. possible bottlenecks and development needs of the road and railway network were examined.
- The finished products can be transported to the market, i.e. the bottlenecks and development needs of land transport and the maritime fairway in the port of Ajos were examined.
- The town plan in the factory area is suitable for the construction of a large bioproduct mill.

If the conditions for the construction of a large bioproduct mill had not been met, the current pulp mill moder would becut with the current capacity.

The preliminary study concluded that it is possible to achieve the conditions for the construction of a bioproduct mill.

1.4 Options to be assessed

The project options to be evaluated are located in the industrial mouth area ofthe city of Kemi in the district of Karihaara, where the current factories of Metsä Fibre Oy and Metsä Board Oy Kemi (Figure 1-1) are located.

Figure 1-1. Project area now.

The options to be assessed are:

VE0 Current pulp mill

VE1 Build a new bioproduct mill with a capacity of 1.5 million tonnes per year

Option 0

The comparison option is that Kemi's current pulp mill will continue to operate.

Option 1

Option 1 is a bioproduct mill concept in which wood is processed sustainably and resource-efficiently in addition to pulp, biomaterials, bioenergy, biochemicals and fertilisers.

The most significant product in tonnes is sulphate pulp made from coniferous and hardwood, which is produced annually by approximately 1.5 million tonnes. 1.3 million tonnes are produced on the new fibre line and the so-called K1 line 180000 tonnes of brown pulp. This plant can later implement processes developed in the Metsä Spring test plant unit in Äänekoski, for example, to produce new biomaterials. New biomaterials can replace fossil oil-based products such as textiles.

In addition to fibre products, biochemicals such as tall oil, starch and product gas are produced fromthe components extracted from wood. The bioproduct mill does not use fossil fuels at all. All the energy required by the plant is produced from wood and the excess heat produced by the process is utilised efficiently. The choice of equipment solutions emphasises energy efficiency and maximises the bioelectricity produced.

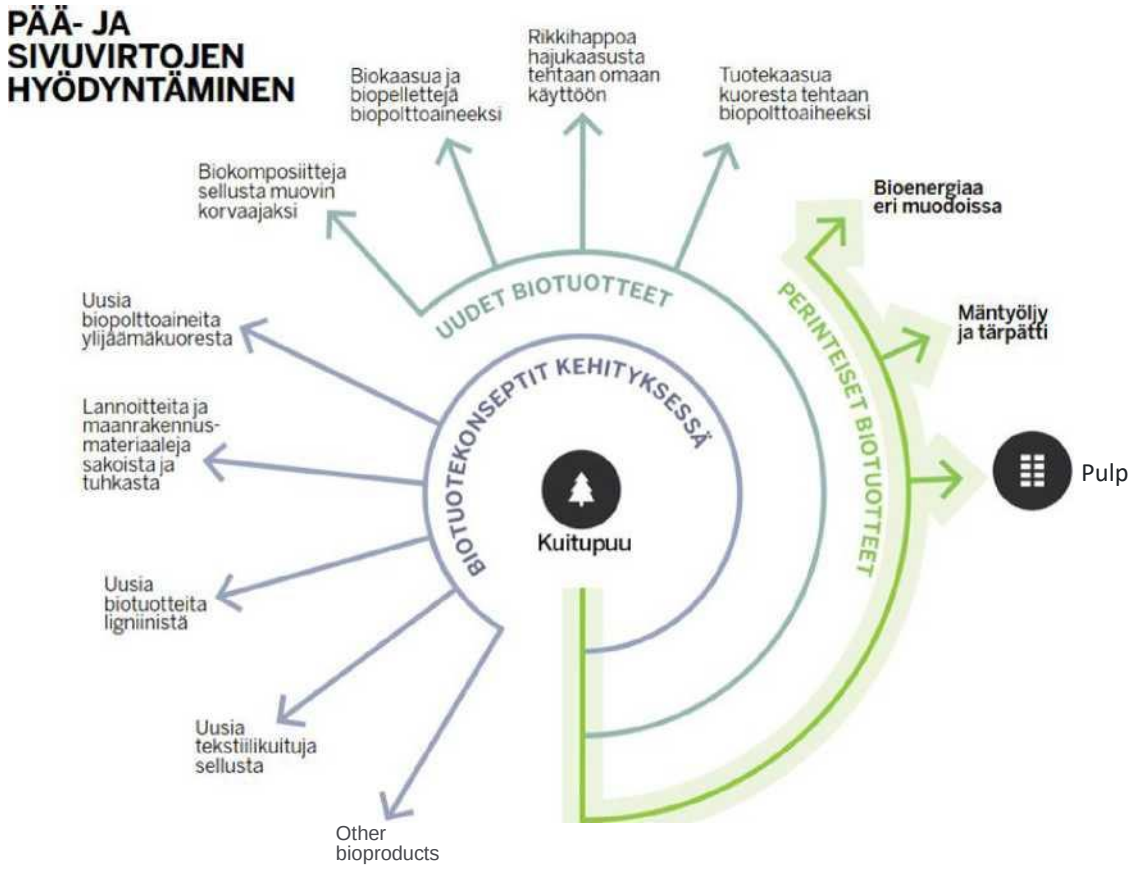

Figure 1-2. Bioproduct mill concept.

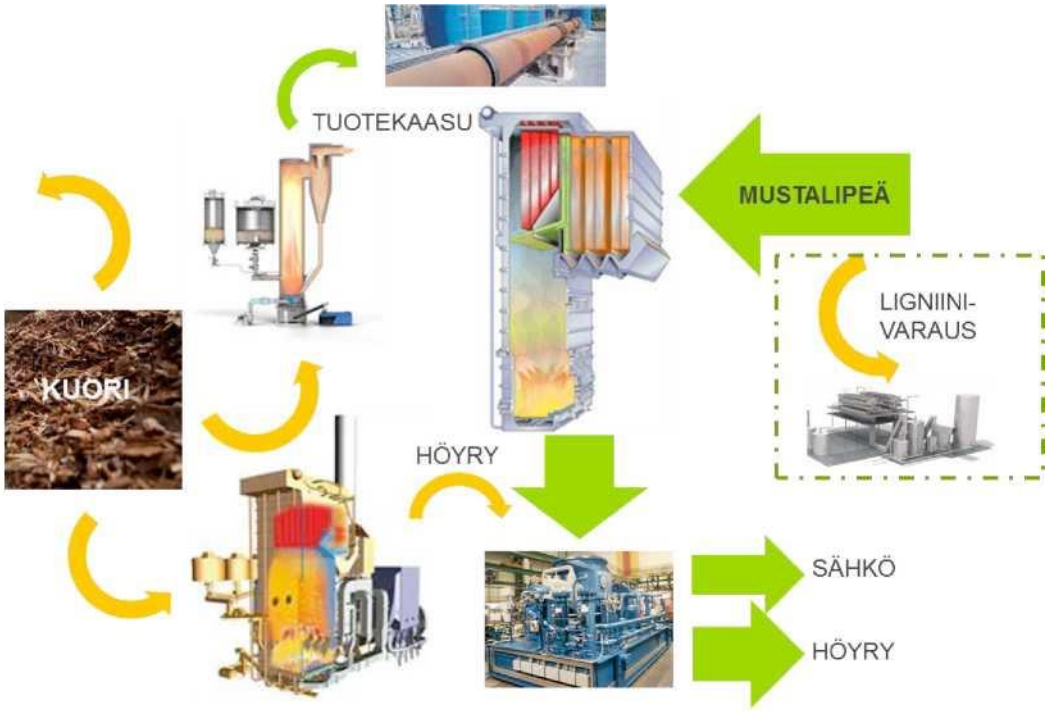

Figure 1-3. Energy concept of the bioproduct mill.

The bioproduct mill produces the energy needed by the integrate (Figure 1-3). The product gas is fumigated from the shell for use in the lime furnace. About half of the crust and disassembly remain for sale to partners or to be burned with their own shell boiler together with the sludges of the refinery. The project examines the construction of a new shell pot, which would leave the current 115 MW shell boiler as a reserve boiler (the current boiler is used for emission calculations).

The factory prepares for the separation of lignin from black liquor as an area reservation.

2. OPTION 1

Option 1 is a bioproduct mill. The bioproduct mill is described separately by plant as follows:

- bioproduct mill, section 2.2
- lignin plant, paragraph 2.3
- biofibres, paragraph 2.4.
- biogas, paragraph 2.5.
- composites, paragraph 2.6
- shell pellets, paragraph 2.7.

The bioproduct mill will be built first. When the current plant is discontinued, the plants in paragraphs 2.3-2.7 can be built in the integrate area depending on the commercialisation of the new products.

2.1 Location and land use needs

The bioproduct mill will be located north of the current pulp mill and in the area of the former sawmill.

The total area of the new plant available in Pajusaari and Sahansaari is approximately 60 hectares.

The project can mainly be implemented within the framework of the existing town plan. The need to change the town plan was related to road and rail connections, construction elevation positions and buildings protected by the town plan, whose phase status plan has been approved by the City Council (the decision has not yet become final when the EIA programme is published).

The following pictures show the very preliminary investment of the new plant and the need for space required by the factory. The factory plan is built with the EIA process at the same time during project planning. There willbe plenty of space for future bioproduct units once the new plant has started and the current tehdasta has been dismantled.

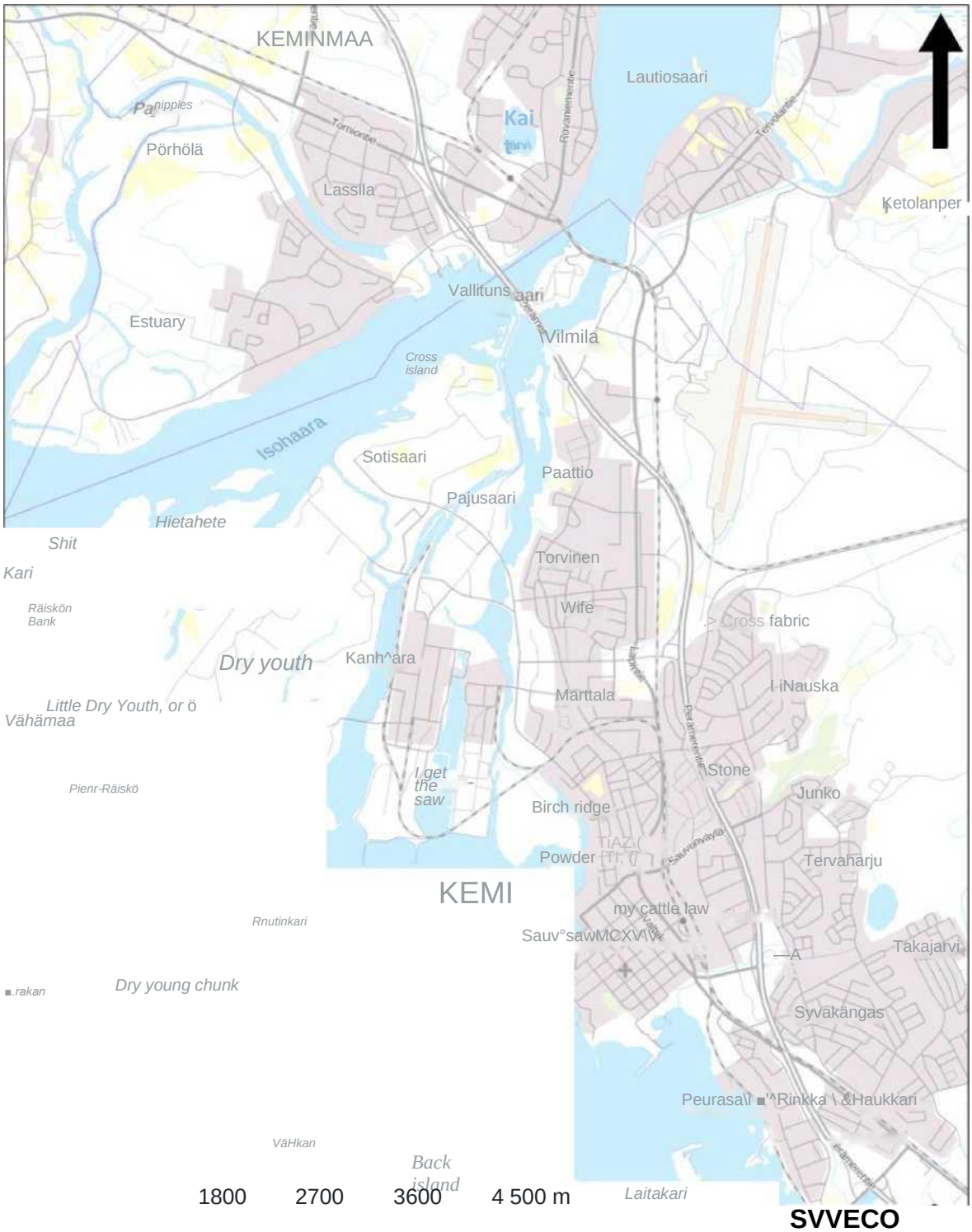

Figure 2-1. The Kemi River Delta. The integrate is located in Paju- and Sahansaari.

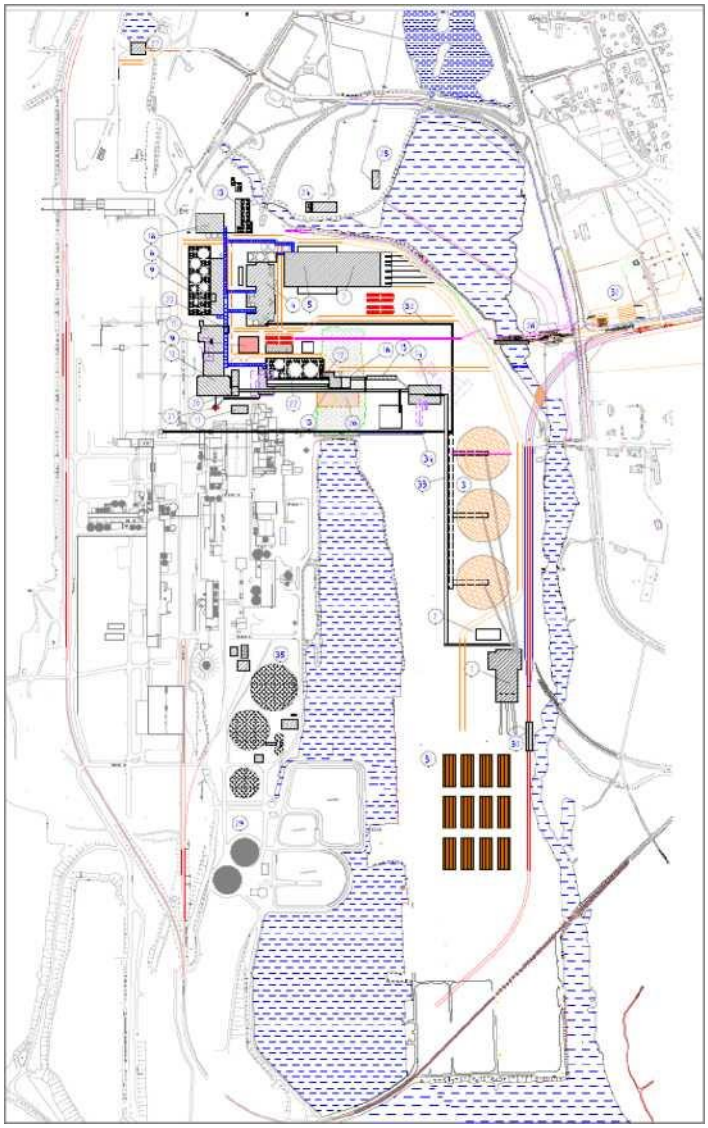

Figure 2-2. The very preliminary location of the new plant in the factory area.

2.2 Bioproduct mill

2.2.1 Balance sheets

The capacity of the new fibre line is about 1320000 tons and brown pulp is produced at 180 000 t.

Based on a very preliminary energy balance calculation, the plant's steam consumption will be 11 GJ/ts and electricity consumption of 550 kWh/i.e. the steam produced in the recovery boiler will be sufficient for other companies locatedin the area.

According to the preliminary calculation, the new plant would develop a total of approximately 265 MW of electricity, of which approximately 165 MW would be sufficient for sales, i.e. production would be approximately 2.65 times more than its own needs.

The following table shows the products of the bioproduct mill when the new plant is started. New bioproduct lines can be built after the current plant has been dismantled, as has been done in Äänekoski.

Table 2-1. Bioproduct mill products and preliminary production volumes.

• Coniferous pulp	1 000 000	TS/a
• Birch pulp	320 000	TS/a
• Unbleached pulp	180 000	TS/
• Development of	265	MW
• Sale of electricity	165	MW
• Tall oil	86 000	t/a
• Turpentine	7 000	t/a
• Methanol	15 000	t/a

Partner companies located in the area can buy steam from a bioproduct mill.

2.2.2 Processes

The main differences to the current pulp mill in Kemi are as follows:

- Capacity of the plant
- New device types
- Water cycles can be closed better and wastewater discharges are significantly lower per selluton
- Air emissions from processes can be reduced
- More electricity is produced and less consumed per tonne of pulp
- The Meesa furnace burns gaseous gas from the shell rather than fossil fuel
- The factory has a sulphuric acid plant
- The factory prepares for lignin separation
- The bioproduct mill concept offers opportunities for new bioproduct operators.

At the time of the publication of the EIA programme, the pre-planning of the plant has not yet been carried out and the requirements arising from the environmentalimpact assessment can be considered in the pre-planning process.

The following figure shows the stages of pulp production. The tree is peeled and chopped into a chip. Chips from the Hakeka swamps are transferred to the soup with conveyors. After the soup, the pulp is brown, but with oxygen whitening the pulp is already quite light. The final lightning is achieved in the actual bleaching. After that, all the pulp is dried and baled or the part is delivered as pipe pulp to integrate customers.

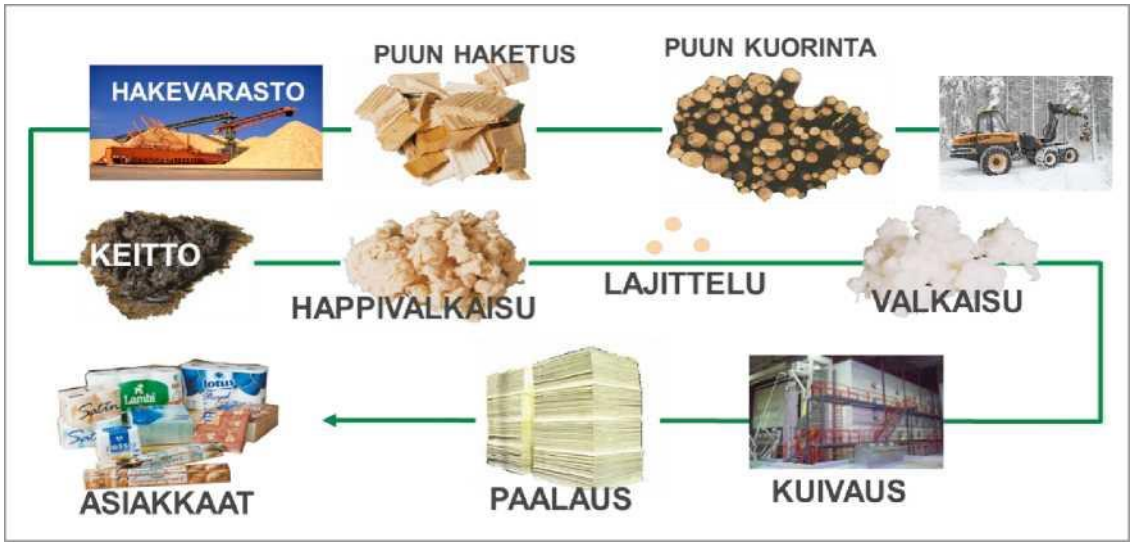

Figure 2-3. Pulp manufacturing process.

The other half of the plant is recovery, which refers to the recovery, regeneration and energy development of cooking chemicals from dry matter dissolved from wood in pulp soup. Recovery includes a black liquor evaporation plant, tall oil separation, methanol separation, sulphuric acid plant, recovery boiler and turbine, caustisation and lime kiln, as well as bark drying and gasification as fuel for the lime furnace.

In addition, the plant requires different water treatment processes, such as raw water, chemically purified water, feed water, condensate, filtrates and wastewater treatment processes.

Wood storage and treatment

The wood is stored in a field where there is no irrigation system. In wood treatment, the wood is peeled in others and searched for.

Wood treatment is carried out on two debarking/chipping lines for coniferous wood with a capacity of approximately 450 m³/h. The defoliation is preceded by defrosting of trees with warm water or low-pressure vapour, where the use of fresh water is approximately 0.02-0.1 m³ per cubic meter of wood.

Only one peeling and chipping line is required for birchwood, which is identical to conifer lines. The capacity of birch peeling is about 300 m³/h.

For Havu 2-3 and birch wood chips with a capacity of approximately 60000 cubic metres will be reserved. A covered warehouseis built on the shell.

Fibre line

The starting point for the fibre line will be the Äänekoski fiber line. Some exceptions may be made in pre-planning, such as polysulphide soup, branch separation placement, and the operation of a bleaching reactor A.

The current fibre line K1 remains largely unchanged.

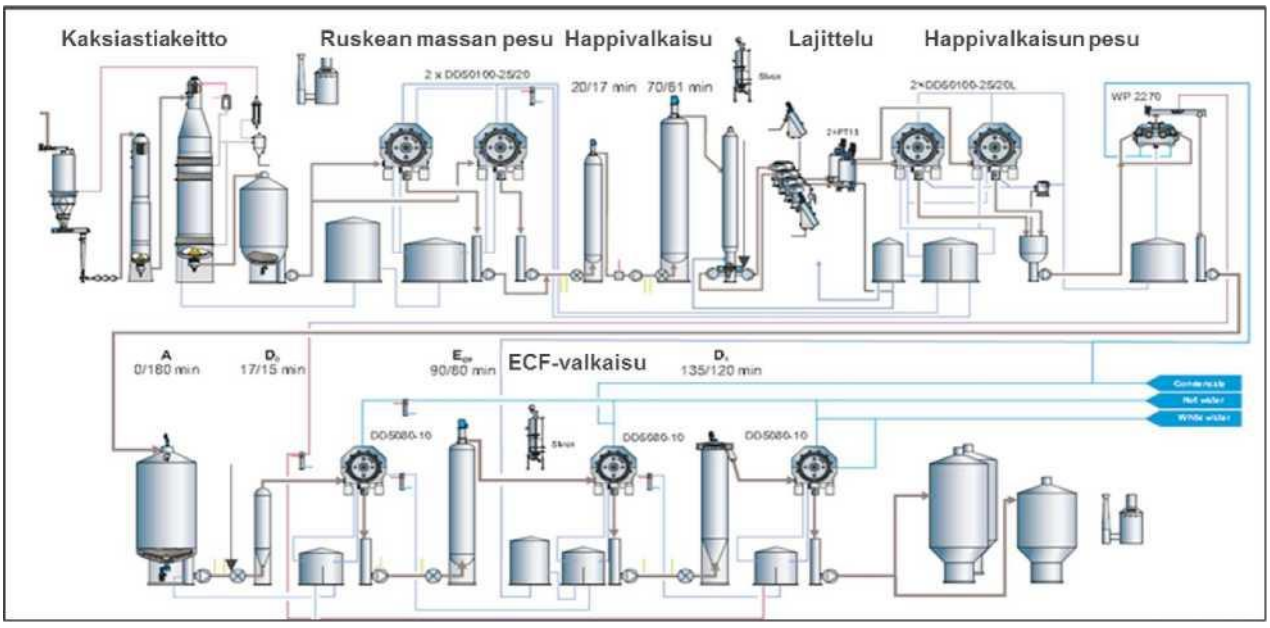

Figure 2-4. The Fiber Line Example.

Pulp soup

Pulp soup refers to the soup of chips at approximately 150-170 degrees Celsius in white liquor. Hakdissolves slightly more than half of the dry matter, lignin and some carbohydrates (hemisel block). The broth removed from the soup is called black liquor. Cellulose and the rest of the hemicellulose differas a fibre mass, which is led to washing and bleaching.

The cooking method is either a modern sulphate soup or a polysulfide soup PS. In sulfate soup, the cooking chemical is similar to the white liquor in Kemi's current plant, sodium hydroxide and sodium sulphide. In Polysulfide soup, white liquor is oxidised to so-called orange liquor.

In the soup stands out the turpentine contained in the chip, which is recovered and sold. Concentrated odour gasesare discharged into combustion and processed into sulphuric acid. Methanol can also be cleaned at the plant.

The soup broth, i.e. black liquor, is led to the evaporation plant and from there to incineration with a recovery boiler.

Washing of brown mass

Wash the pulp after soup and lead to oxygen whitening. In oxygen bleaching, theremaining lignin is removed from the mass. Chemicals are oxygen, oxidised white liquor and magnesium salt.

The brown mass is washed completely upstream, which means that the filtration of the scrubber is always used as a washing broth in the previous washing phase. For the latter phase scrubber, both the alkaline filtrate of the bleaching (as or possibly treated) and secondary condensation from the evaporation plant shall be used. In this way, the effluents can be sealed to the best possible extent and the amount of filtrates and organic matter to bedischarged to the wastewater plant can be minimised.

Bleaching

The purpose of bleaching is to remove the remaining dyes from the pulp.

The best available technology for bleaching pulp is sulfuric acid, chlorine dioxide, lye, ha betrayedwhite liquor and hydrogen peroxide. The bleaching has three stages for conifers and three or four stages for birch. Washing between the bleaching steps takes place either with DD scrubbers or presses. Some hot water is

also used in the bleaching process. The final washing process is done by drying the pulp and/or using a filtrate returned from the paperboard.

Special attention will be paid to bleaching water cycles that optimise the quantity and quality of filtration from bleaching to wastewater. The alkaline filtration of bleaching replaces part of the wash after oxygen bleaching, either as it is or when treated.

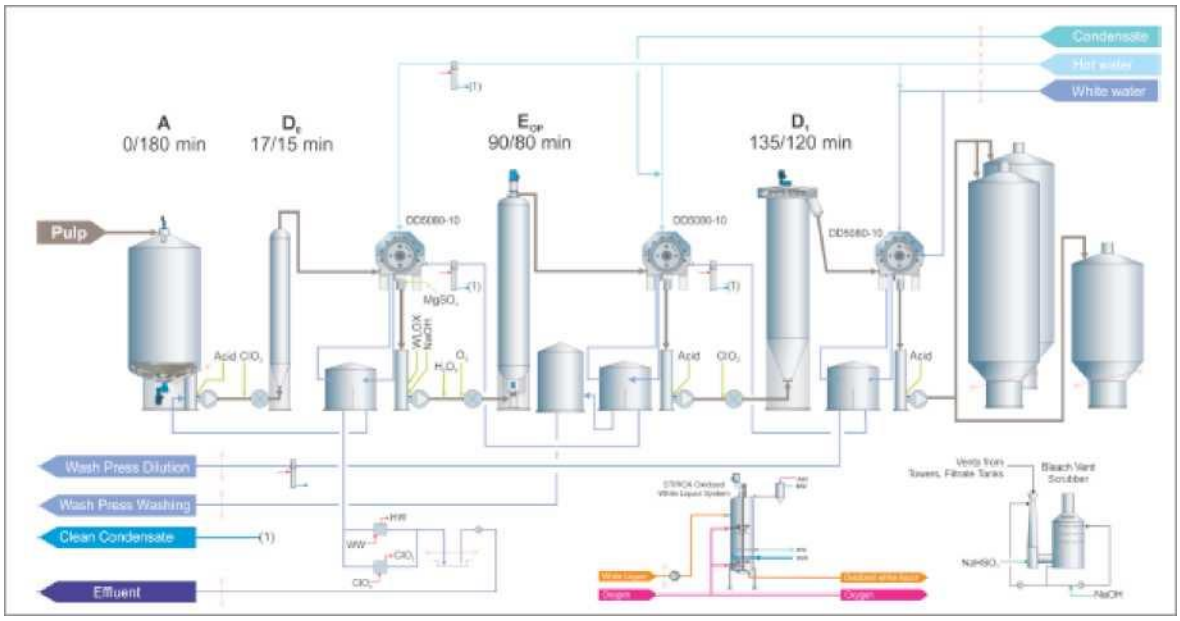

Figure 2-5. Example of bleaching.

Unbleached pulp line

In Kemi's integration, some of the pulp produced at Metsä Board is used to makeboard unbleached. The current cooking plant 1 is kept for the production of brown pulp.

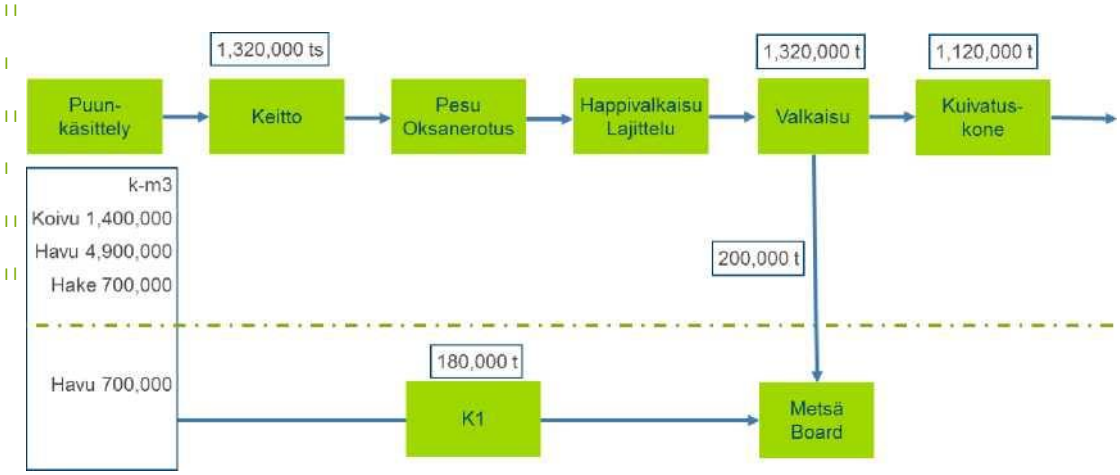

Figure 2-6. Preliminary

Pulp drying and baling

The bleached pulp is pumped onto the wire part of the drying machine, pressed to approximately 52 % dry matter and dried in the drying section to the final dry matter approximately 90 %. Celluraina is cut with a cutter into sheets, which Paalais automatically cut. The principle of drying is shown in the following figure (Figure 2-7).

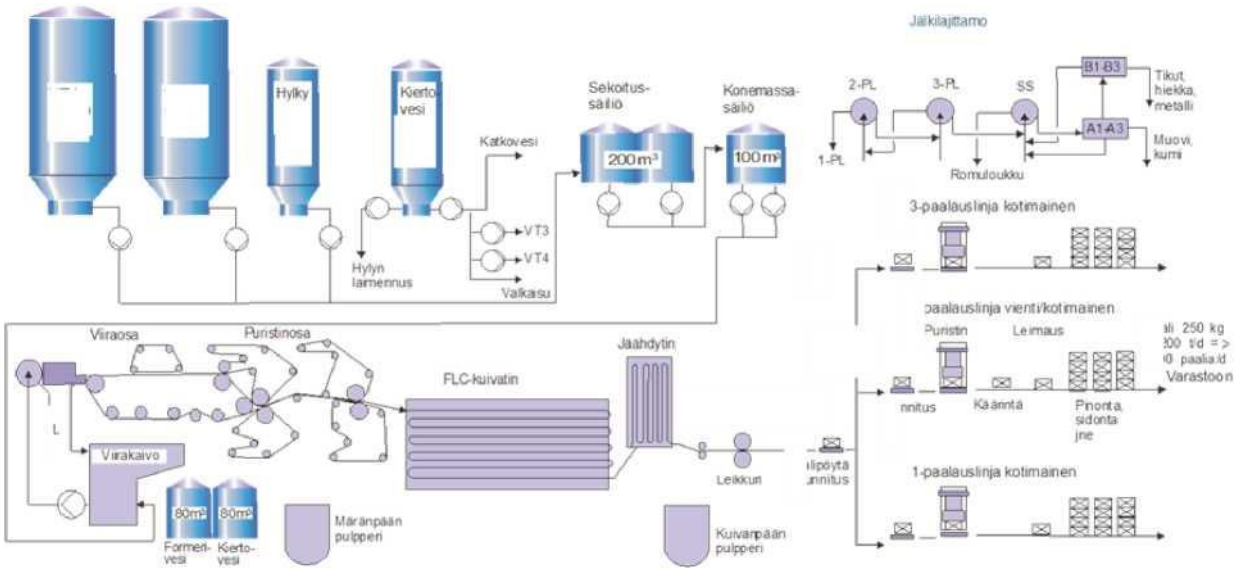

Figure 2-7. Pattern of pulp drying.

Pulp storage and logistics

More than half of the coniferous pulp produced is market pulp, which is transported by cars to the export portfor storage.

Birch pulp is used in the integration and delivered to customers outside the integrator by car.

Recovery line

Black liquor evaporation and condensation control

The evaporation plant evaporates the black liquor obtained from the soup, which is also a mass of washing broth, from 15 to 17 % dry matter to more than 83 % dry matter. The water evaporated from black liquor is condensed and usedas a secondary condenser at the factory.

The condensate of fresh steam used for evaporation is reused to make steam sodas onthe farm.

From the point of view of the energy balance, it is important to reconcile the production of the boiler and the evaporation plant. In order to maximise the steam production of the recovery boiler, the dry matter content of the evaporation plant must be 83-85 % before increasing the ash.

One option for the evaporation plant is a 7-phase evaporator serial evaporator. In condensation management, the aim is to maximise the proportion of pure secondary condensate. The liquid condensation isdistilled by stripping. The methanol is recovered and liquefied.

Black liquor stands out in the process, which comes from wood extractives. It is used to boil tall oil, which is sold to factories that refine tall oil.

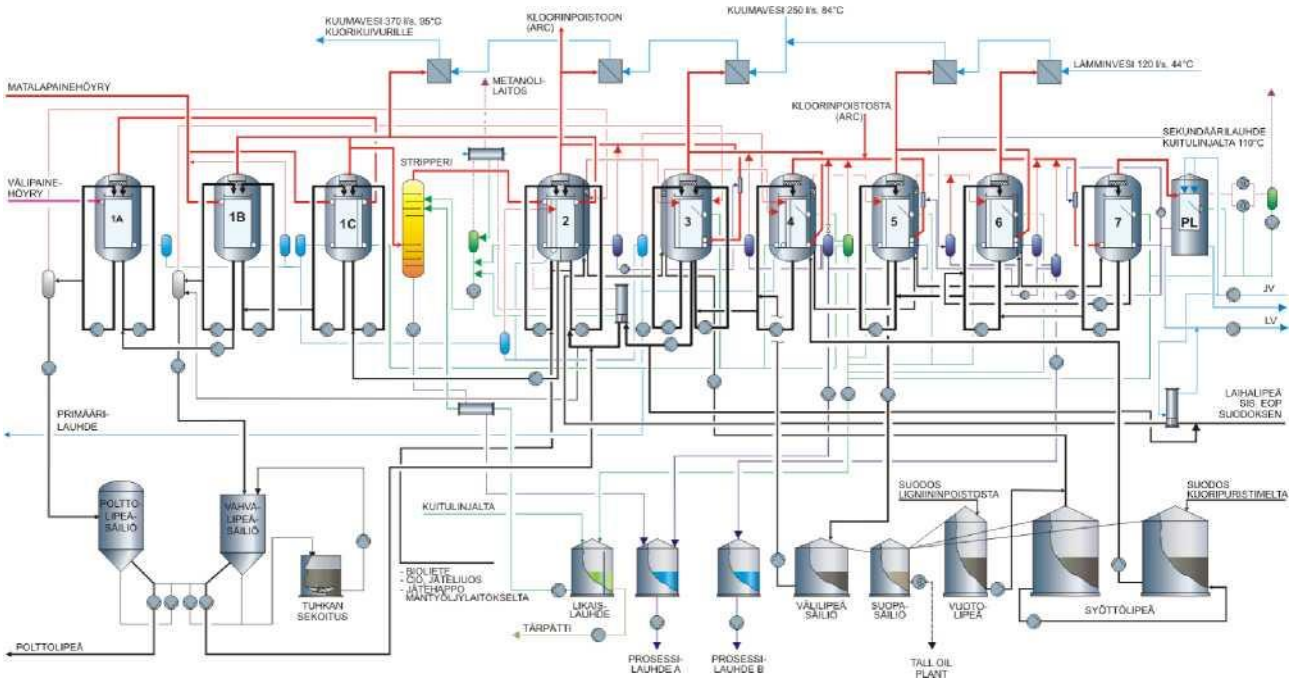

Figure 2-8. Example of a black liquor evaporator.

Recovery boiler and turbine

Evaporated black liquor is burned in a recovery boiler. During combustion, the chemicals in the lye flow molten to the bottom of the recovery boiler, from which it is transferred to the molten solution. The organic substance in the lye burns and produces heat. The heat is recovered in the fireplaces at the top of the recovery boiler as ahigh-pressure steam. The steam is discharged to a steam turbine, the generator of which generates more than twice the electricity required by the bioproduct mill. In addition to black liquor, bio-sludge, concentrated odour gases, methanol and pitch oil can be burned in the recovery boiler. Dilute odour gases are used as part of the boiler combustion soil.

The turbine provides the intermediate and low-pressure vapours needed for the factory's processes. The recovery boiler has ahigh energy efficiency of different lice compared to, for example, CHP power plants.

The steam values of the recovery boiler are determined to be high, within the limits of corrosion, to the maximum amount of electricity production. The current maximum is 505 °C/105-110 bar. For the same reason, investments will be made in the high dry matter content of the burning liquor, heating of combustion air and feed water, and optimising the pressure ofchimney steam.

The turbine is equipped with a condensate, i.e. the steam that is not used in the integral as a process vapour is condensed to almost vacuum pressure to generate condensate electricity.

No fossil fuels are used in the recovery boiler.

In order to control the levels of potassium and chloride in the chemical cycle, i.e. corrosion, potassium and chloridesare selectively removed from the fly ash of the recovery boiler. Ash is dissolved, sodium sulphate is crystallised and returnedto the chemical cycle. The solution, rich in potassium and chlorides, is passed on tosewage. The method minimises the amount of sodium sulphate discharged into the water body. This will bringboth economic benefits and reduce the impact on water bodies.

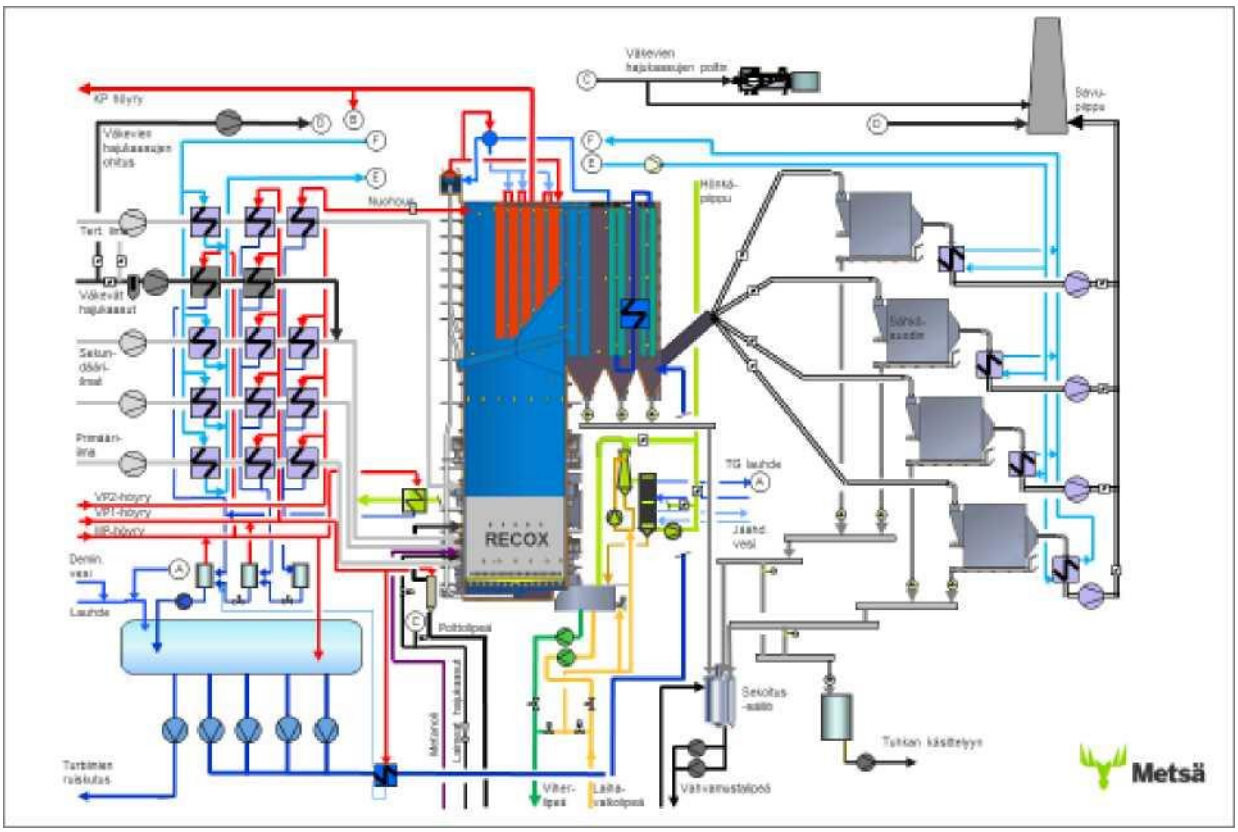

Figure 2-9. Example of a modern recovery boiler.

The flue gases from the recovery boiler are discharged into an efficient electric filter to recover fly ash. The flue gases then pass through the combustion air preheater to the chimney.

The flue gases are discharged into a common 105-metre-high chimney with its own channels forthe soda pot, lime kiln and concentrated and dilute odour gases. A channel or channels for future needs (such as a new bio boiler) can also be reserved for the chimney.

Concentrated odour gases are discharged into the chimney only in exceptional circumstances, i.e. to prevent the risk of explosions. Depending on the weather, this smell can travel very far away. This situation is very rare in new factories.

Manufacture of white liquor

White liquor is mainly a mixture of sodium hydroxide and sodium sulphide, which is used in pulp soup. Soda from the black liquor burned from theboiler is recovered and dissolved into green liquor. Thegreen liquor is separated from the green liquor produced in Liuotuk, which is the only solid waste from the mill for which no suitable applications have been found on the scale at which it is generated. Green liquor or soo dasaka has been used, for example, in the surface structures for the closure of landfills.

Brightening of the green liquor is carried out either by filtering or clarifying.

The green liquor is causticised by adding lime, resulting in white liquor used in soup and oxidation of white liquor.

In addition to white liquor, the caustisation process produces meesa (calcium carbonate) which is burned back to lime (calcium oxide). The plant needs only very small quantities of additional chemicals in the form of lye and lime for this chemical cycle (category less than 1 % of the total cycle). The lime circulation cannot be completelyshut down, because contaminants such as phosphorus and silicate are accumulated in the

lime. There are other products for lime, e.g. in soil improvement due to its phosphorus content.

The white liquor is filtered and the lime washed before entering the lime kiln. The secondary condenser obtained from the evaporation plant is used primarily for washing. Wash filtrates are used to dissolve the melt into green liquor.

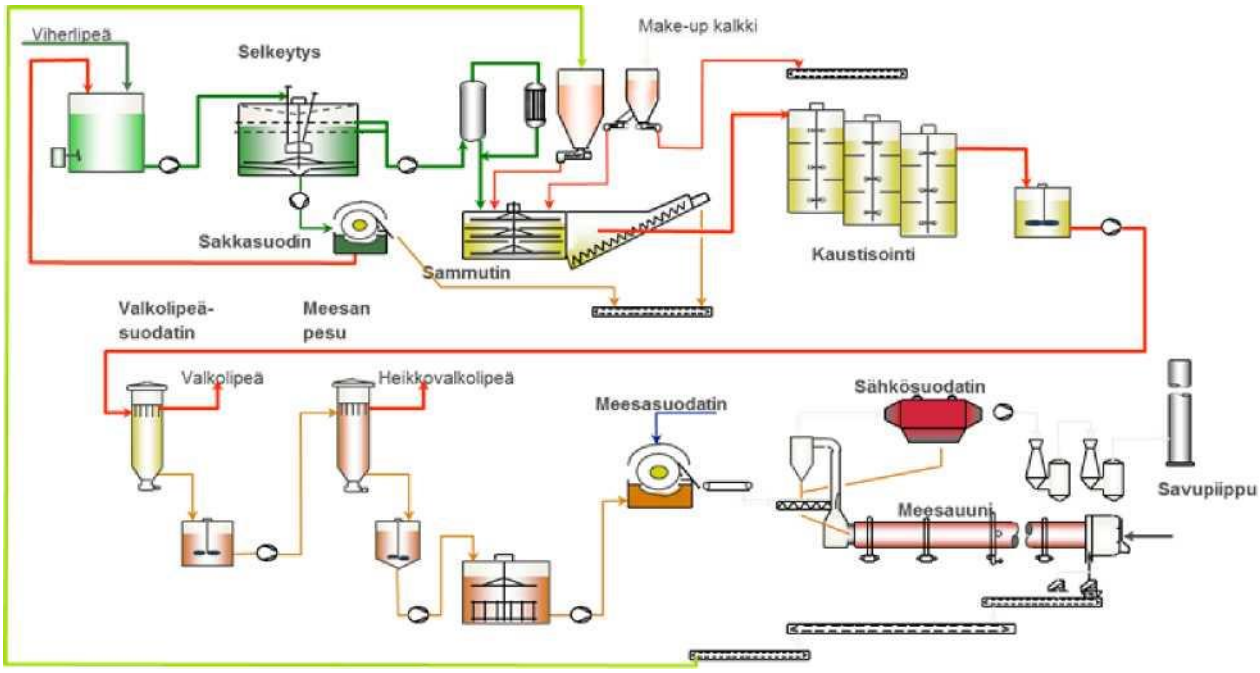

Figure 2-10. The principle of causticisation and lime circulation.

Lime kiln

Meesa is burned in a lime kiln with a combustion temperature of between 1 000 °C and $^{100\ °C}$.

The current pulp mills use significant amounts of fossil fuels only in the lime kiln. The lime furnace of the new plant uses the product gas obtained from the shell as well as Metsä Fibre's Joutseno and Äänekoski plants. The reserve fuel is pitch oil or other biofuel.

In addition, other parts of the process, such as methanol and turpentine, can be burned in the lime kiln. The high temperature of the lime kiln ensures clean combustion.

The lime oven is equipped with an efficient electric filter. The lime kiln chimney is in common with the recovery boiler.

Product gas plant

The product gas burned in the lime kiln is produced by gasification of biomass, such as shell and demolition. The Ka housing plant is a well-known technology that is already in use at Metsä Fibre's Joutseno and Äänekoski bioproduct mills. The planned gasification process has a thermal input of 110 MW.

The plant consists of raw material processing, drying unit, carburetor and ash removal.

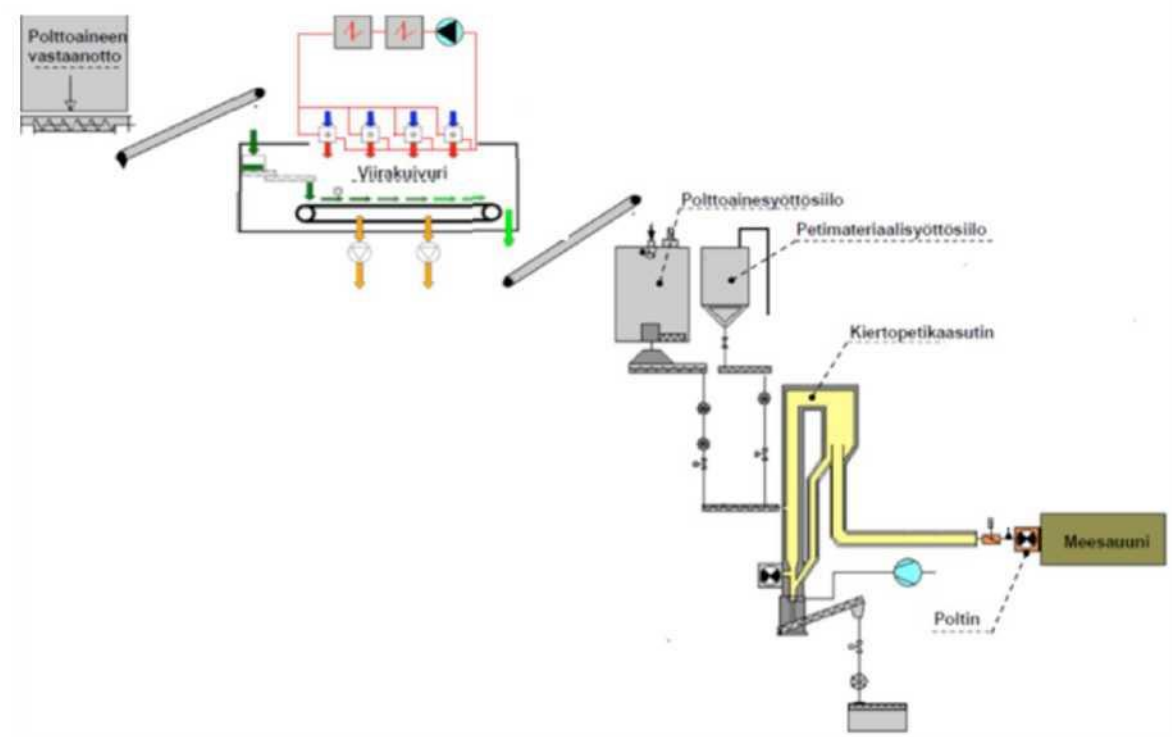

Figure 2-11. Example of a product gas plant.

The product gas consists mainly of hydrogen, carbon monoxide (CO) and carbon dioxide. Since the gasification ofsolid incineration takes place under air and at high temperatures, there is no oxygen in the product gas. The typical temperature for biomass gasification is 750-850 °C. The product gas is supplied to the lime kiln burners.

The bed material used in fumigation is lime, which is estimated to be used in a total of approximately 3000 tonnes per year.

Shell boiler

The current shell boiler is needed not only to produce steam, but also to burn sludge fromthe wastewater treatment plant. The new recovery boiler provides the necessary steam for the integrate, so the shell boiler could remain a bladder if it is not needed to incinerate the sludges. Additional steam may be needed in winter, especially whencooking birch pulp. The boiler would only be used when the bioproduct mill is out of use and when the bioproduct mill is running. The shell boiler is included in the air emissioncalculations in both replacements, as the boiler is now being driven. The bark is used in excess by partners.

Chemical plants

Chlorine dioxide, oxygen and sulphuric acid plants will be built in the factory area. Of these, chlorine dioxide and oxygen slates can be outsourced.

Chlorine dioxide plant

Chlorine dioxide cannot be transported and therefore must be manufactured in the factory. Chlorine dioxide can be produced by various processes from sodium chlorate. The methods differ in terms of the reduction agent used (sulphur dioxide, methanol, peroxide) and acid (sulphur acid, hydrochloric acid). One of the procedures thatdo not produce chlorine as an ancillary product will be selected for use, most likely a R10 plant using sulphuric acid and methanol.

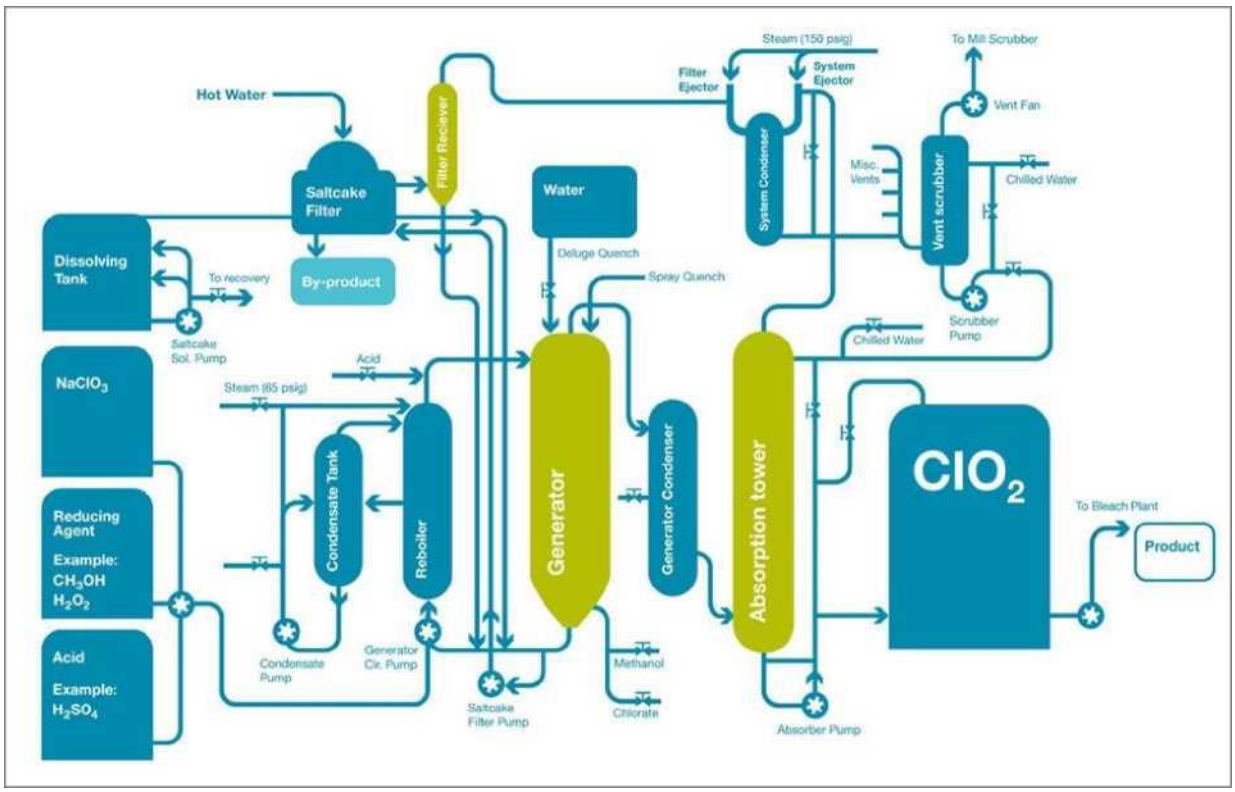

Figure 2-12. Principle of production of chlorine dioxide.

Oxygen plant

In an oxygen plant, oxygen is separated by a so-called molecular sieve. Air nitrogen, water vapour and carbon dioxide adsor arebattered with the filler and oxygen continues through. The oxygen plant can be monitored remotely.

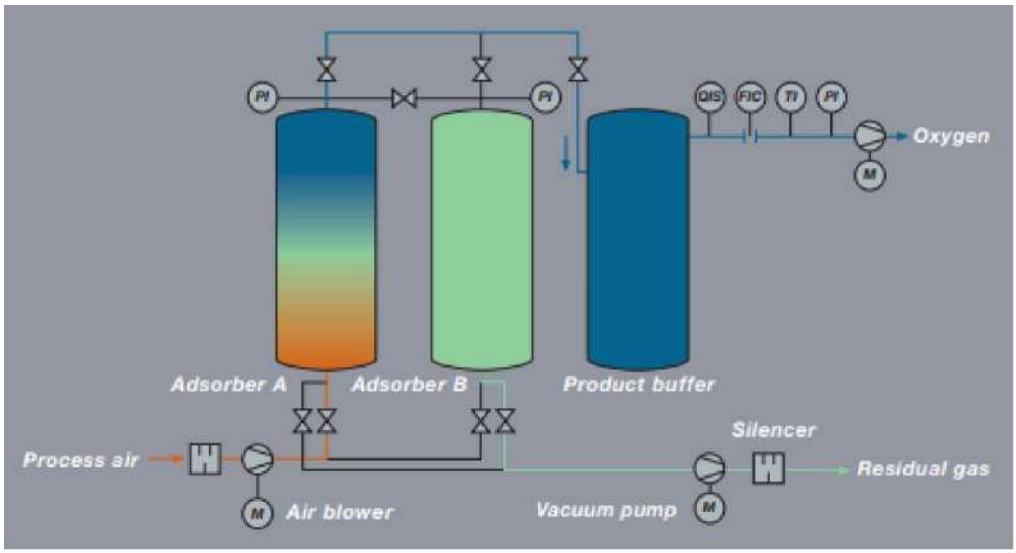

Figure 2-13. Example of a Vacuum Pressure Swing Adsorption (VPSA) oxygen plant.

Sulphuric acid plant

The plant manufactures sulphuric acid from the concentrated odour gases generated by the process, which

includes not onlythe odour gas incineration plant but also the sulphuric acid manufacturing plant.

The plant has a capacity of about 45 tons of sulphuric acid per day. With the help of the sulphuric acid plant, the bioproduct mill will be able to reduce the sulphate load in the waterways compared to the current pulp mill in Kemi, even thoughthe production capacity will more than double. The production of sulphuric acid reduces chemical transport by around 400trucks per year.

The combustion plant can also be used as a back-up boiler for process vapour production by burning tall oil pitch or liquid methanol.

The sulphuric acid plant is closely linked to the control of air emissions from the factory.

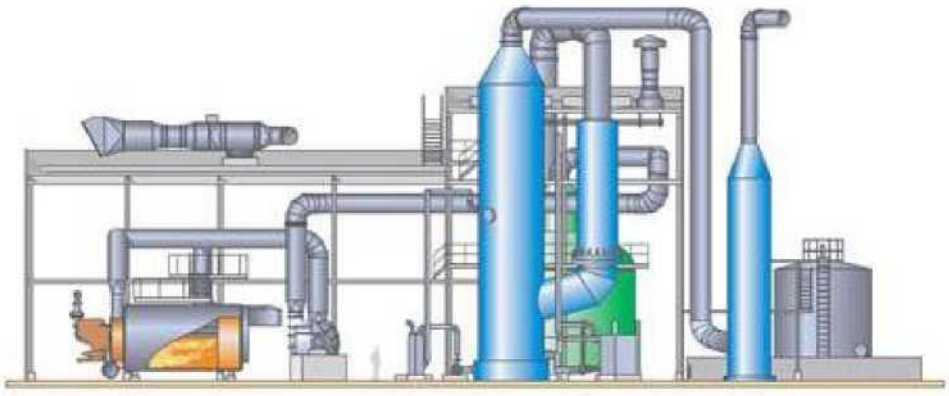

Figure 2-14. Sulphuric acid plant.

2.2.3 Raw materials

The plant's planned capacity is 1 180 000 t of conifer pulp and 320 000 t of birch pulp per year. Correspondingly, the amount of wood raw material needed is approximately 6.3 million k-m³ coniferous fibre wood and saw chips and 1.3 million k-m³ birch fibre wood. The use of wood will increase by approximately 4.5 million k-m³ compared to the current option 0.
In total, the bark is produced in option 1 of approximately 350 000 t per year. There's no bite because it's not alota.

Table 2-2. Wood flows and daily volumes coming to the factory in different transport modes in different options, preliminary estimate.

1 000 m 3,with shell	**VE0**	**VE1**	**Change**
Pulpwood			
Automobile	1 000	1 600	600
Train	1 700	4 900	3 200
Ship	0	500	500
Search			
Automobile	400	500	100
Ship		100	100
Total total	3 100	7 600	4 500

2.2.4 Chemicals

In tonnes, most of the chemicals used by the bioproduct mill are regenerated in the chemical cycle and used again and again.

Outside the process area of the dense bioproduct mill, but in the integrate area, a chemicaltreatment area for the production, reception and storage of the stove will be built. The aim isto find an external operator

for the region, which also serves other bioproduct companies entering the region. Additional lime and water and wastewater treatment chemicals are not transported through this treatment area, but they are exported directly to theirsites.

The chemicals sold from the bioproduct mill include tall oil and turpentine and possibly also methanol.

The chemicals used and stored at the bioproduct mill are presented in the table below (Table 2-3). Intermediate products stored at the bioproduct mill are presented in Tables 2-4.

Table 2-3. Chemicals used and stored at the bioproduct mill in different options, preliminary estimates.

Chemical		**Consumption t/a**	**Production at the factory (on site)**	**Gas/liquid/ solid**	**VArasto VE0 m³**	**Warehouse VE1 t or m³**	**Use**
Magnesium sulphate	$MgSO_4$	3600	Not	Fixed	60	100 m³	Oxygen bleaching
Oxygen	O_2	40 000	Yes	Liquid	50 42	150 t	Oxygen bleaching, bleaching
Resin soap		7 200	Not	Liquid		10 t	Oxygen bleaching
Hydrogen peroxide	H_2O_2	7 500	Not	Liquid	45 100	300 m³	Bleaching
Lye, 50 %	NaOH	43 000	Not	Liquid	110 140	1 500 m 3	Bleaching, replacement cabbage
Sulphuric acid	H_2SO_4	54 000	VE0 No VE1 Yes	Liquid	60	500 m³	Bleaching, tall oil
Talc		1 200	Not	Fixed		200 m³	Bleaching
Carbon dioxide	CO_2	3 500	VE0 No VE1 Perhaps	Gas	102		Bleaching, tall oil
Sodium chlorate	$NaClO_3$	32 000	Not	Liquid	80 100	500 t	Ready-made chlorine-dioxide
Methanol	CH_3OH	3 400	Yes and No	Liquid		100 m³	Ready-made chlorine-dioxide
Bisulphite	NaHSO3	3 000	VE0 No VE1 Yes	Liquid	—	100 m³	Bleaching
Peracetic acid	CH_3COOO H	0	Not	Liquid	30	—	Bleaching
Replacement lime	Cao	28 000	Not	Fixed	130	300 t	Kaustistamo Gas tray
Sulfamic acid			Not	Fixed		50 m³	Washing
Hydrazine orleft, 35 %	N_2H_4		Not	Liquid		2 t	Feed water chemical, oxygen binding
PAC		500	Not	Fixed		2 m³	Water purification
Ferric sulphate	$Fe_2(SO_4)_3$		Not	Fixed		28 t	Water purification
Polymer		200	Not	Liquid		3 m³	Water purification
Aluminium hydroxide	$Al(OH)_3$	4 000	Not	Fixed	20		Water purification
Urea		600	Not		80		Water purification
Antifoaming agent		500	Not	Liquid		20 t	Water purification, fiber line, evaporation plant

Table 2-4. Intermediate products stored at the bioproduct mill in different options are provisionally stored.

Intermediate product	VE0 $_m$3	VE1 $_m$3	Storage
White liquor	3000+ 2700	About 7500	Continu
Slender liquor	2x5000+ 2000	Approximately	Continu
Liquid condensation		About 1200	Continu
Vuotolipe		About 5000	Continu
Methanol	19	19	Continu
Swamp		About 3500	Continu
Solid black liquor	2x500	Approximat	Continu
Burning liquor		About 1800	Continu
Green liquor	10500+ 755	Approximately 20000	Continu
Meesa			Temporarily
Lime		Approximat	Temporarily
Sulphuric acid		About 100	Continu
Chlorine dioxide	2x225+ 500	About 500	Continu

Table 2-5. CAS numbers and hazard statements for chemicals used at the bioproduct mill in different-exchanges.

Name	CAS number	Warning markings	Hazard statements	Alternatives
Magnesium sulphate	7487-88-9	GHS07	H315, H319, H335	VE0, VE1
Oxygen, liquid	7782-44-7	Ox.Gas 1; H270, Press.Gas; H281		VE0, VE1
Resin soap				VE1
Hydrogen peroxide	7722-48-1	GHS 03, 05, -07, Dgr	Acute tox. 4; H302, Skin Irrit 2; H315, STOT SE3; H335, Eye Dam. 1; H318	VE0, VE1
Sodium hydroxide, 50 %	1310-73-2	GH 505	Met.Corr.1;H290 Skin Corr 1A.,H314	VE0, VE1
Sulphuric acid	7664-93-9	GHS05, Dgr	H314, H318	VE0, VE1
Talc				VE0, VE1
Carbon dioxide	124-38-9	GHS04, WgR	H280	VE0
Sodium chlorate	7775-09-9	GHS03, -07, -09	Ox.Sol. 1 H271, Acute tox 4; H302, Aquatic Chromic 2; H411	VE0, VE1
Methanol	67-56-1			VE0, VE1
Sulphur dioxide	7446-09-5	GHS04, GHS06, GHS05	The Press. Gas; H280, Acute tox 3; H331, Skin Corr 1B; H314	VE0
Peracetic acid	79-21-0	GHS02 GHS05 GHS07	H242, H314, H335-H336	VE0
Burned lime	1305-78-8	GHS05, -07, Dgr	Skin.Irrit.2; H315, Eye Dam.H318	VE0, VE1
Formic acid	64-18-6			VE0
Sulfamic acid				VE0, VE1
Hydrazine orleft				VE0, VE1

Name	CAS number	Warning markings	Hazard statements	Alternatives
Polyaluminium chloride	1327-41-9	H290, H318		VE0, VE1
Ferric sulphate				VE1
Polymer				VE0, VE1
Aluminium hydroxide				VE1
Urea	57-13-6	H332, H335		VE0, VE1
Antifoaming agent				VE0, VE1

The chemicals manufactured at the factory are registered in the REACH Register. The following table (Table 2-6) shows the chemicals registered by Metsä Fibre. New bioproducts will be registered accordingly.

Table 2-6. REACH registration of chemical manufacturing at Metsä Fibre.

Chemical	Registration number	EC number	CAS number	Registration type
Turpentine	01-2119502456 – 45-0011	232-350-7	8006-64-2	Full
Pine marsh	01-2119538009 – 40-0005	266-037-1	65997-01-5	Full
Crude tall oil	01-2119494863 – 23-0018	931-433-1	8002-26-4	Full
Green liquor	01-2119539462-39-0010	268-612-2	68131-30-6	Intermediate product
White liquor	01-2119582793-25-0015	268-615-9	68131-33-9	Intermediate product
Black liquor	01-2119541681 – 41-0011	266-111-3	N/A	Intermediate product
Chlorine dioxide	01-2119492305 – 37-0022	233-162-8	10049-04-4	Full
Meesa	01-2119486795-18-0042	207-439-9	471-34-1	Full

2.2.5 Products and accessories

The products and accessories produced at the bioproduct mill are listed in the following table. The following table shows all options.

Table 2-7. Products and accessories, preliminary estimate.

Products	VE0	VE1
Havusulfate pulp	400000 TS/a	1180000 TS/a
Birch sulphate pulp	200000 TS/a	320000 TS/a
Bioelectricity, of which for sale	65 MW 23 MW	265 MW 165 MW
Sale of steam	470 GWh/a	500 GWh/a
Tall oil	30 000 t/a	86 000 t/a
Turpentine	1 500 t/a	7 000 t/a
Accessories		
Shell	10 000 t/a	170 000 t/a
Product gas	—	80 MW
Methanol	5 000 t/a	15 000 t/a
Sulphuric acid	—	16 000 t/a

Soil improvers (shell sand, oxal injection, lime)	16 000 t/a	30 000 t/a
Fertiliser (K10 fly ash)	2 800 t/a	2 900 t/a
Chemicals (Meesa, lime dust)	10 000 t/a	45 000 t/a

2.2.6 Water supply, treatment and cooling water cycle

Raw water

The integrate takes raw water from the main stem of the Kemijoki river through the freshwater canal to the main pump station, from which the water is passed to the mill's pump station for mechanical cleaning. Some of the water is chemically purified and further diverted to its applications.

Table 2-8. Preliminary total water balance.

Future water, m³/d	**VE0**		**VE1 (1.5 MT)**	
Wood water		3 600	MF	8 500
Mechanically purified water	MF MB	64 650 7 000	MF MB Other	415 000 7 000
Chemically purified water	MF MB	40 000 22 000	MF MB	64 000 22 000
Water in, total m³/d		137 250		516 500
	VE0		**VE1**	
For biological cleaning	MF MB	40 000 21 400	MF MB others	67 000 21 400
Freshly removed coolingwater (estimate)	MF MB	69 850 6 000	MF MB Other	418 100 6 000
Evaporates + with products		1 600		4 000
Total out, m³/d		137 250		516 500

Cooling water

When water taken from Kemijoki is used for the cooling needs of the plant (condensing turbine, evaporator surface condenser, bleaching effluent cooling) the plant's summer-time cooling water needs are maximally-7.5 m³/s or more (if the cooling water temperature ^{rises}15 °C). The need for cooling will be assessed in both summer and winter in pre-planning.

Cooling of the process could also be carried out with a closed cooling water cycle, which would be cooled by

cooling towers in Rauma. In this case, the seasonal changes intotal water use would be eliminated and water use at a level of less than 2 000 l/s. The challenge of the cooling tower solution is the strongformation of water vapour, which may become a risk for safety and comfort in the locality in winter.

The amount of heat removed is the same regardless of the cooling method.

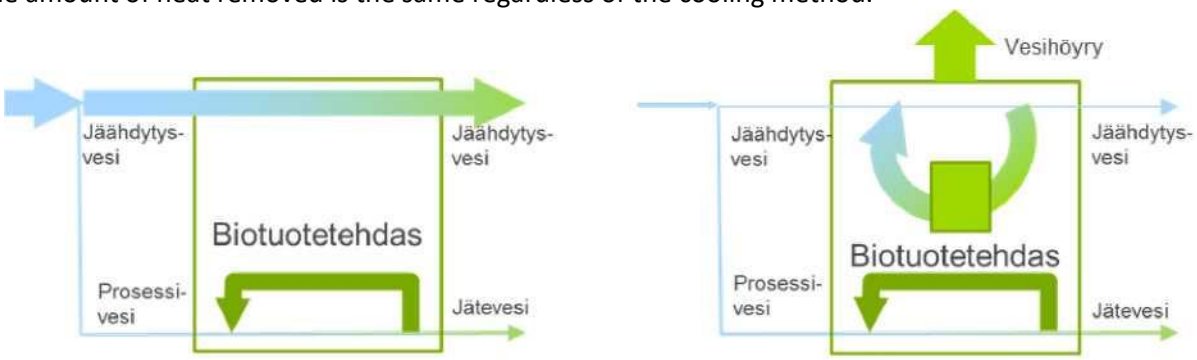

Figure 2-15. The amount of water taken from the water body relative to the process water. Options: the plant has or does not have a cooling tower.

Chemically purified water

The capacity of chemically purified water must be sufficient for the entire integrate.

The plant is planned in such a way that the current use of process water will be significantly reduced by approximately 25-30 m³/ts. The aim is to achieve less than 15 m³/ts of process water consumption. Other plants in the bioproduct millrequire only small quantities of fresh water.

2.2.7 Emissions to the environment and waste

The starting assumption is that the emissions of the bioproduct mill are such a large part of the emissions of the entire integrate, so that its emissions can be used directly for the environmental impact assessment. Plant-specific emissions have been assessed in the paragraphs of the new alternative bio-installation plants. Emissions from Metsä Board Kemi Oy's board mill havebeen assumed to remain at the current level (the level of the 2015 permit application) and are included in bothoptions.

Wastewaters

The BAT conclusions on pulp, paper and board production can be foundin Implementing Decision 2014/687/EU for Directive 2010/75/EU of the European Parliament and of the Council.

Metsä Fibre commits to ensuring that discharges into the water system will remain within the current permit conditions of the Kemi integrate and itswastewater treatment plant. For example, COD in water remains below 40 t/d.

Emissions will meet the BAT conclusions very well. For phosphorus, the emission is at the BAT floor, which already poses a small risk to the operation of the biological treatment plant.

The AOX emissions depend more or less directly on the use of chlorine dioxide in bleaching, i.e. thevolume of bleached pulp production, and therefore cannot remain in previous years as the production of bleached pulp increases.
The AOX emissions will also meet the best available techniques (Table 2-9).

Table 2-9. Bat-associated emission levels for direct discharges of waste water from a whitetua sulphate pulp plant to water (Table 1 of the 2014/687/EU Decision).

Range	CODCr	TSS	N	P	AOX

kg/t, a	7	0,3	0,05	0,01	0
	20	1,5	0,25	0,03	0,2

Table 2-10. Monthly averages of waste water discharges to be used in the environmental impact assessmentcompared to the current environmental permit of the integrate.

Parameter	**The current integrate lu-pawns**	**VE0**	**VE1**
Cod_{Cr}, kg/d	40 000	40 000	40 000
Solids, kg/d	—	3 100	5 500
Total nitrogen, kg/d	—	650	700
Total phosphorus, kg/d	45	45	45
AOX, kg/d	—	350	700

When effluent amounts in the water balance are used (Table 2-8), the concentrations of parameters in the water balance are in accordance with the following table.

Table 2-11. Preliminary concentrations of waste water.

Parameter	**VE0**	**VE1**
Amount of waste water,	61 400	88 200
Cod_{Cr}, mg/l	650	450
Solids, mg/l	50	60
Total nitrogen, mg/l	11	8
Total phosphorus, mg/l	0,73	0,5
AOX, mg/l	6	8

Wastewater discharges are managed by closing the plant's water cycles and by means of wastewater treatment processes.

In parallel with the EIA process, different combinations of processes are examined, in addition to active sludge treatment, chemical pre- and/or post-treatments. A good reference is wastewater treatment at the Äänekoski bioproduct mill.

The sludges from the activated sludge plant are either dried by thermal drying and burned in a biopot or asoda pot with black liquor.

In order to reach the proposed waste water flow, it is necessary that the waste water comes mainly from the bleaching plant during the factory's normal operation. The COD from bleaching comes from the black liquor residue that comes with the oxygen bleached pulp and the organic matter dissolved in the bleaching process. Cod is in the range 35 to 45 kg COD/ts (before the treatment plant). Some of the COD for bleaching will bind to the mass, but mostwill be removed from the bleaching filters.

Substances dangerous and harmful to the aquatic environment

Small concentrations of metals such as cadmium, mercury, nickel and lead are present in waste water. The metals are mainly derived from wood used as raw material and, to a small extent, from filler andcoating pigments used at the board mill.

The following table shows the heavy metals measured in the current Kemi plant in option VE0. Because

- the volumetric flow rate of waste water in option VE1 per tonne of pulp is lower than it is now; and

- the amount of wood used is about 2.5 times the current rate,

it is assumed that the concentrations of these metals in the waste water will be approximately fivefold in-exchange for VE1.

Table 2-12. Substances hazardous to the aquatic environment in the wastewaters of the bioproduct mill in different alternatives.

Parameter			**Environmental quality standard VNa 1308/2015**	
	VE0 µg/l	VE1 µg/l	Year-ka µg/l	Maximum length µg/l
Cadmium	0.12-0.61	0,5-3,0		
Cadmium soluble***)	Lt;0,0	Lt;0,0	0.2 *)	0.45-0.6 *)
Mercury	0.007-0.1	Lt;0,3		
Mercury soluble***)	Lt;0,0	Lt;0,0	—	0.07 *)
Nickel	2.0-3.0	10-15		
Nickel soluble***)	1,5	7,5	8.6 **)	34 **)
Lead	0.27 –	1,5-40		
Lead soluble***)	0,32	1,5	1.3 **)	14 **)

*) soluble concentration in seawater
**) soluble and bioavailable content in seawater
***) measurements in 2016

Other priority substances in the Aquatic Hazardous Substances Regulation are not relevant for pulp and other bio-products. The new substances in the Regulation are plant protection products, biocidal products and industrial chemicals used outside the forest industry. Dioxins or similar compounds produced as a by-productof combustion are not produced in essential quantities under normal conditions and are not likelyto occur in waste water either.

Emissions to air

The most significant sources of air emissions at the bioproduct mill are flue gas emissions from the recovery boiler and lime kiln, as well as dilute and concentrated odour gases. The flue gas emissions of the bio boiler will remain at the current level.

Sulphur emissions from air are estimated to remain at the current level in absolute terms and dust emissionsare reduced (calculated tons per year). Nitrogen dioxide emissions will increase because even the current plant importedat the BAT level in this regard, and emissions will rise relative to the increase in capacity. Emissions of stinking sulphur compounds are expected to decrease with the introduction of new technologies.

The generation of odour emissions from the waste water treatment plant is prevented or reduced by using the best available techniques and efficient process control.

Under Option 1, the plant will not use fossil fuels at all, so there will be no fossil CO2emissions, with the exception of transport-related emissions. Chlorine-containing gaseous emissionsfrom the manufacture of bleaching chemicals are estimated to remain at the current low level. Inexchange, 0 lime furnace uses fossil fuel.

Table 2-13. Bat emission levels for direct effluent discharges to water from a bleached sulphatepulp mill (Tables 1011 of the BAT conclusions). p.k.a daily average, v.k.a annual average, DS dry fuel liquor.

Bat Heads	**(concentrations of dry smoke pergas)**	**Recovery boiler**	**Lime kiln**	**Concentrated ha-jugases**	**Dilute odour gases**
SO_2	mg SO_{2/Nm^3}, 6 % O_2	when DS 75-83 % p.k.a. 10-50	v.k.a., not a.hk: 5-70	v.k.a, 9 % O_2 20-120	
		v.k.a 5-25	v.k.a. 55-120		
TRS	mg S/Nm^3, 6 % O_2	p.k.a.1-10 v.k.a 1-5	v.k.a, lt;1-10 (40, if any)	v.k.a, 9 % O_2 1-5	0.05-0.20
Gaseousnen sulfur (SO2+TRS)	kg S/ts	when DS 75-83 % v.k.a. 0.03-0.13	v.k.a., not a.h.h.: 0.005-0.07 v.k.a., d.o.b. 0.055-0.12	v.k.a. 0.002-0.05 (100200 Nm3/ts)	
No_x	mg/^{Nm} 3.6 % O_2	v.k.a. 120-200, when DS> 83 %, can be-considered	v.k.a, liquid: 100200-(bio-350)	v.k.a, 9 % O_2 50-400 (1000)	
			v.k.a, gas: 100350-(bio-450)		
	kg/ts	when DS 75-83 % conifer v.k.a. 1-1.6	v.k.a liquid: 0.1-0.2 (bio 0.35)	v.k.a. 0.010.1 (0.2)	
		magazine v.k.a. 1-1.7	v.k.a gas: 0.1-0.3 (bio 0.45)		
PM	mg/^{Nm} 3.6 % O_2	v.k.a. new or basic-upgraded facility 10-25	v.k.a new or pe rus-healed lawtos: 10-25		
	kg/ts	v.k.a. new or basic-upgraded plant 0.02-0.20	v.k.a new 0.0050.02		

Table 2-14. Preliminary air emissions for modelling, kg/ts as an annual average.

Recovery boiler	**Current integrate-permit conditions**	**VE0**	**VE1 (1.5 MT)**
Gaseous sulphur (SO_2+ TRS), broken	—	0.13 S	0,13
No_x		1,7	2,0
PM	50 mg/Nm^3	0,4	0,2
Lime kiln	**Current integrate-permit conditions**	**VE0**	**VE1 1.5 MT**
Gaseous sulphur (SO_2+ TRS), broken		0,12	0,07
No_x		0,5	0,45
PM	50 mg/Nm^3	0,05	0,02
Chlorine discharge	50 mg Cl_{tot}/Nm^3	50	30

Wastes and their treatment

The waste generated at the bioproduct mill is:

Peel/Sand Waste, Screening Reject (03 03 01)

Peel/sand waste and wood spraying is generated in the wood treatment area and yard area of the debarking plant. In wood treatment, sand is separated from circulating water, which comes with the wood.

The chipping lines are equipped with stone traps, the task of which is to protect logging from foreign objects thatbreak them. The rocks and scrap of metal collected in the traps are removed at regular intervals. The chips used in the cooking process are screened prior to the soup after field storage. The screening reject consists mainly of oversized chips and wood pieces, stones and different types of scrap.

Bark/sand waste is stored in an interim storage facility in the waste management area of the factory site.

In wood treatment and sorting, the bark/sand to be removed is primarily utilised in the mill's own fellingfor landscaping or, alternatively, for other green construction.

Sorting sand (03 03 99)

During the sorting phase of pulp production (the scrap trap of the knotwashing screw and the sand anchor for fine sorting), there is acontinuous separation of the reject, which consists mainly of aggregates, metal and plastic particles and, in the event of disturbance, an uncooked branch separated from the mass. The amount of metal and plastic, if any, is low.

The injection is slightly alkaline. Sorting sand is primarily utilised in green construction.

Green liquor (soda) (03 03 02)

Green liquor or soda sand is formed when the recovery plant is separating insoluble solids from the green nest. Insoluble solids contain inorganic salts such as oxides, carbonates and sulphides, as well as metals. Green liquor precipitation is washed to recover sodium compounds and dried. The dry matter content of the lees is about 40-50 %. Green liquor precipitation does not contain biodegradable material. The green liquor precipitationis stored in a container equipped with a precautionary tank. For the time being, it is not possible to use green liquor precipitationas a waste or energy, and it will be placed in a landfill of industrial waste from the factory integrated.

Gasification plant ash (10 01 01)

The ash of the gasification plant is mainly fine dolomite lime used as bed material and ash mixed with it. The fraction meets the quality requirements for non-hazardous waste.

The ash is stored in an interim storage facility in the waste management area. The utilisation of carburetor ash will bepromoted in fertiliser use.

Primary sludge (03 03 10) and biosludge (19 08 12)

The primary sludge is generated by the pre-clearance of the wastewater treatment plant, in which the solids of the wastewater are discharged. This fraction contains fiber, shell, fillers and additives, as well as pigments. The resulting primary sludge is dried with car thio screw presses and burned with the crust in a lime oven. Biosludge is generated by the biological purification ofwastewater. The microbial mass to be removed (so-called surplus sludge) also contains wood extractives, lignin compounds and small amounts of fibres. The biosludge is burned in a recovery boiler or digested. The biodegradable fraction of sludges is about 50-80 % of the dry matter.

Industrial cleaning waste (20 03 01)

Cleaning waste is generated continuously from the mill's process and maintenance facilities and is collected

in specifiedcollections. Cleaning waste is delivered to municipal or non-hazardous waste landfills.

Scrap metal (17 04 07)

Metal scrap contains, among other things, metal maintenance waste. Metal scraps are collected on a pickup. Metal scrap is delivered as a material for recovery.

Recyclable paper (20 01 01) and glass (20 01 02)

Recyclable newspapers and office paper are collected from the factory's office and controlrooms. Glass waste consists mainly of laboratory glass and glass waste from canteen operations. Paper and glass are delivered for useful use.

Canteen biowaste (20 01 08)

Biowaste in the canteen is conventional waste generated in connection with canteen operations, which is delivered tomunicipal waste management.

Hazardous waste

Hazardous waste is oil and solvent waste generated by the factory's own operations, as well as waste-containing heavy metals. Oil waste is the engine, transmission and turbine oils of equipment generated in the factory's own use and transportequipment. Oil separation wells and oil tanks are drained andcleaned if necessary due to inspections and repairs. Solid and paste oil wastes contain oil filtrates and oily and greasy trassels. Dirty solvents and wash water containing organic substances are produced in the factory's machine and hand wash sites.

Hazardous waste is stored in a locked or controlled space. Each hazardous waste type has its own labelled collection container. The hazardous waste collection point contains instructions on the sorting andstorage of hazardous waste. Hazardous waste is delivered regularly, at least once a year, to anappropriate reception point. Lead-acid batteries and fluorescent tubes are delivered for recovery so thatthe heavy metals they contain are recovered and recycled. Otherwise, the batteries and fluorescent tubes are broughtfor disposal at the hazardous waste treatment plant.

Table 2-15. Preliminary assessment of the waste generated at the factory and its further use.

Codenumber EWC code	**Waste heading**	**Place of birth**	**Use ofobject**	**VE0 t ka/a**	**VE1 t ka/a**	**Ka, p-%**
03 03 09	Ashes of the gasification	Capture	Fertiliser use		6 000	100
03 03 99	Sorting sand	Mass factory	Landscaping	Included intable figures	50	40
03 03 01	Peel/sand waste	Wood treatment	Landscaping	6 000	1 000	40
03 03 99	Cleaning waste (garden area)	Wood treatment	Landscaping	Included intable figures	500	50
03 03 10	Primary sludge	Wastewater-treatment	For incineration or composting field	6 000	5 000	90
10 01 01	Bottom ash		Composting field	300	500	

Codenumber EWC code	Waste heading	Place of birth	Use ofobject	VE0 t ka/a	VE1 t ka/a	Ka, p-%
10 01 03	Fly ash		Composting field	1 000	10 000	
19 08 12	Biosludge	Wastewater-treatment	Incineration or otherconcept	4 000	10 000	90
20 03 01	Industrial cleaning waste	Factory common	Municipal landfill	100	30	90
20 01 01	Waste paper and—board	Offices	Collection	60	20	100
17 04 07	Scrap metal	Maintenance	Collection	200	500	100
17 02 01	Waste wood	Maintenance/real estate	Collection	350	100	75
20 01 08	Canteen-biowaste	Canteen	Collection	35	200	80
03 03 02	Green liquor precipitation	Capture	Landfill	6 200	15 000	50
170107	Non-combustible		Recovered or landfilled	1 000	EIA	
170504	Earth and stone-nectars		Recovered or landfilled		EIA	
200301	Mixed industrial waste		Landfill	100		
170504, 170506	Contaminated land		Landfill		EIA	
170605	Wastecontaining asbestos		Landfill	100	EIA	

Table 2-16. A preliminary estimate shouldbe made of the hazardous waste generated below, VE0 and VE1.

Codenumber EWC code	Waste heading	Place of birth	t ka/a	Ka, p-%
13 08 99	Solid oily	Maintenance	10	100
13 01 13	Waste oil	Maintenance	20	100
13 02 05	Lubricating oil	Maintenance	10	100
07 01 04	Solvent liquid lt; 35 %	Maintenance	0,1	100
16 06 05	Junk batteries and a coupletot	Maintenance	0,5	100
16 06 01	Lead-acid	Maintenance	0,4	100
15 01 10	Scrap barrels	Maintenance	31	100
20 01 21	Lamps	Maintenance	1,5	100
16 05 04	Laboratory waste	Laboratory	1,5	100
16 02 14	Electronic waste	Maintenance	3,0	100

External contractors are used in the collection and transport of waste. The waste to belandfilled in the factory integrated waste is weighed and the amounts of waste reported on the basis of horizontal booklets. Industrial cleaning waste is transported for final disposal to municipal landfillsof conventional waste.

Biowaste from the canteen is separately collected and composted at a municipal waste facility. Waste-fractions and hazardous waste recovered in the form of materiel are delivered for recovery or treatmentto an operator holding a permit.

Waste management area

The bioproduct mill has its own industrial waste treatment area, where the factory landfill is classified as a landfill for non-hazardous waste.

During the normal operation of the bioproduct mill, approximately 15000 tonnes of waste is generated per year in thewaste management area. The waste to be disposed of consists mainly of green liquor precipitation and fly ash used to stabilise it.

Reducing the amount and harmfulness of waste

Metsä Fibre Oy adheres to the priority order of the Waste Act in its operations through improveddun management of side streams and more precise process control. The above-mentioned means will help to reduce the amount of waste generated and to increase the number of production related products. Metsä Fibre Oy also reduces theamount of waste generated by improving the closure rate of the pulp process, so that less material isremoved from the process.

Hazardous wastes from the pulp industry are maintenance waste and their harmfulness is controlled by accurate use, collection, storage and transport. In addition, hazardous waste can be reduced if necessary, for example by stabilisation of hazardous waste before transport.

Ancillary products from production

The production process generates side streams because not all the substances contained in the raw materials end up in themain products. Of the process side streams, lime, lime and lime are classified as ancillary products. They should onlybe created as waste if they do not meet their quality and safety criteria. In such a case, they would be recovered as waste or properly landfilled.

Compliance with the requirements of section 5(2) of the Waste Act

Meesa, burned lime and lime dust are created as an integral part of the recovery process and meet the quality requirements set forfurther useful use in the standard soak. It is possible to dynamise and burned lime assuch in the pulp production process and in other applications suchas soil improvement neena, fertiliser or lime raw material. Lime dust can be used as a raw material for pigment.

Metsä Fibre Oy’s current mills have existing contracts for the further processing of lime, burned lime and lime particles with companies that utilise them. Meesa is delivered to companies engagedin fertiliser activities. Incinerated lime is supplied for stabilisation purposes tocompanies that handle waste and contaminated soil masses. In accordance with the agreements, lime dust will be delivered back to the lime supplier, whouses this lime dust as a raw material for pigment, among other things.

Meesa

The lime generated in the production process is utilised in the pulp production chemical line in the recovery process of cooking chemicals. However, it may be necessary to remove meesa (calcium carbonate CaCO3) from the lime cycle due to maintenance of the lime kiln or occasional disturbances in the lime kiln.

Due to the disruption, lime removed from the process is temporarily stored in the factory area for the soaking process. The primary use of intermediate storage lime is to return to the process or transfer to another Metsä Fibre Oy factory to be dissolved back. In this situation, the meesa has not been decommissioned, but rather the storage or transfer of the process chemical. Chemically meesa (CaCO3) is a

persistent compound that does not contain biodegradable substances.

Meesalime (type 2A2/4), which includes both meesa and burned lime) can also be used as a soil improver, fertiliser or raw material for fertilising products. Meesa lime is a liming agent in the national list of types of fertilising products in category 2, 2A2/4 as a liming agent. Metsä Fibre's factories are registered in the Evira register as a manufacturer of fertilising products. There is a well-established market for the use of lime as fertiliser. The mesa will not be stored at the site for a long time, but the fraction will be delivered as quickly as possible for recovery in situations where it cannot be sufficiently treated as a process chemical in the factories.

Burned lime

Burned lime is produced in the lime kiln in connection with the burning of lime (CaCO3). Burned lime (CaO) is used as a raw material forwhite liquor in the chemical line. Burned lime absorbs air of moisture and carbon dioxidesidia. Burned lime (CaO) reacts with water with fever and forms quenched lime (Ca(OH)2). The aqueous solution of quenched lime is alkaline.

Most of the lime generated is utilised in its own operations in the process of chemical recovery. Due to the disruption, burned lime removed from the process is temporarily stored in the factory area asfeed back into the process. The primary use of stored incinerated lime is the restoration of the process. In this situation, the incinerated lime has not been decommissioned, it is the storageof the process chemical.

Burned lime removed from the chemical cycle can be directed for recovery as such andstored on site only temporarily. Metsä Fibre Oy's factories have valid contracts for the supply of incinerated lime for stabilisation purposes to a company dealing with waste and contaminated soil masses.

Lime dust

The flue gases of the lime kiln are discharged to an electric filter, in which the lime dust carried through the flue gases is separated and returned to incineration. Calcium oxide (CaO) content of lime dust approximately 20 % and potassium carbonate (CaCO3) content approximately 80 %.

Lime dust may need to be removed from the process due to the contaminants accumulated in the process. Lime dust is removed from the lime filters in the lime kiln due to the phosphorus accumulated in the lime kiln. Phosphorus impairs the caustic capacity of burned lime and increases the energy consumption of the lime lime. However, the concentrations of harmful metals in lime dust are generally low. Lime dust removed from circulation will be delivered to the lime supplier in accordance with the reception agreement with the supplier.

Noise

As far as noise is concerned, the objective is to remain within the existing permit limits for all options.

Table 2-17. The maximum sound power levels of the factories in the surrounding residential areas.

LWA [dB]A	**Current**	**VE0**	**VE1**
Metsä Fibre, bioproduct mill, estimate			
Day	55	55	55
Nig	50	50	50
Metsä Board Corporation			
Day	55	55	55
Nig	50	50	50

The noise in the factory is constant and continuous 24 hours a day. Noise emitting inlet and exhaust air blowers, air ducts, etc. The most obvious noise spikes are caused by the warning sounds of heavy equipment and machinery. There is also noise caused by the transport of raw materials and products.

The aim is to select the external noise sources and their location in such a way that environmental noise does not increase significantly from the current level and that the noise guide values laid down in the legislation are not significantly increased.

2.2.8 Transport

Changes in traffic volumes caused by the project in Kemi and neighbouring areas are assessed in the EIA report.

The traffic routes to the factory area are shown in the following figure (Figure 2-16).

Table 2-2 presented the necessary quantities of wood. In order to deliver the corresponding quantities of wood, it is necessary to:

- wooden trains 10 trains a day
- pulpwood cars 90 to 100 cars/day
- pick-up trucks from 22 to 30 cars/day
- shipwood from Ajos to factory 25-30 cars/day

A total of 140-160 cars/days will be transported by wood by car in the future.

In addition, approximately 500 tons of chemicals per day are needed for pulp production and come by car (10-15 cars per day).

All fiber products leave the integral car, which means about 70 cars a day (calculated with a payload of 70 tonnes.) The quantity includes pulp, paperboard and any other fibre products.

Tall oil and turpentine also leave by car, in total about 10 cars a day.

The shell that is not fumigated as a product gas is either burned in a bio boiler or delivered to an internal or external user of the integrate. When calculating traffic emissions, this shell is burned with a shell boiler with corresponding discharges.

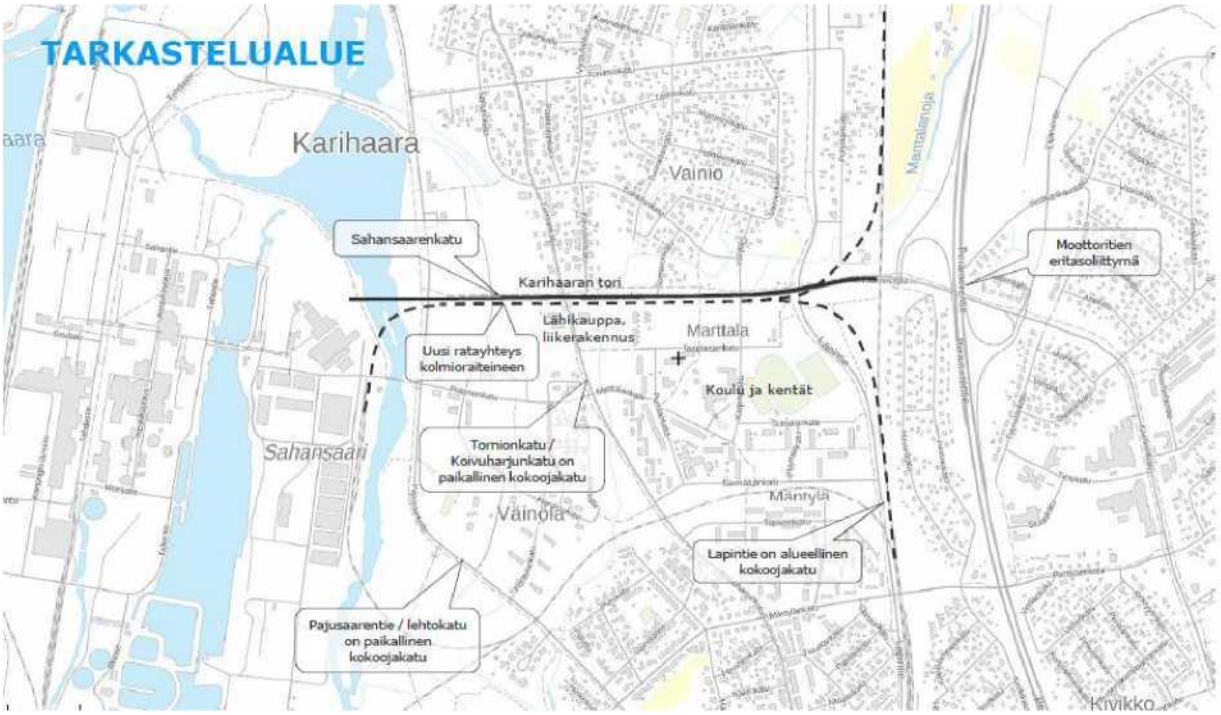

Figure 2-16. Traffic routes to the factory area.

Passenger transport

Passenger traffic is controlled via the current Pajusaarintie/Tehdastie connection.

Other road transport

Heavy-duty car traffic is directed from Perämerentie via E75 Karihaaranväylä and Sahansaarinkatu, either via the new bridge directly to the factory area or via Pajusaarintie and Tehdastiti. A tree measuring gate is placed at the gate.

The pulp is transported to the Ajos harbour warehouse by car via Sahansaarinkatu and then via Perämerentie E75 and Ajoksentie.

Rail connections

Rail traffic passes through Sahansaarinkatu or remains the same.

2.2.9 Interfaces

The area has the following interfaces:

- Bioproduct mill delivers steam to other operators in the industrial area
- Bioproduct mill delivers demolition, shell and/or biosludge to other operators in the industrial area
- Pulp delivered to Metsä Board
- The chemical area is shared by the operators
- Bioproduct mill cleans integrate wastewater or outsources
- Water supply to partners
- The bioproduct mill will be connected to Fingrid's 110 kV electricity grid
- The bioproduct mill uses either Sahansaarinkatu or an existing railway connection
- The bioproduct mill uses existing road interfaces. A new bridge is needed for Sahansaari.

2.2.10 Energy efficiency

Particular attention will be paid to energy efficiency. Metsä Fibre's energy efficiency system will be implemented as soon as the factory has started and its requirements will also be taken into account in the design of the plant.

Improvements in energy efficiency include:

With recovery boiler:

- Increase in the dry matter content of black liquor
- Significantly higher vapour pressure and temperature
- More efficient preheating of combustion air and feed water, raising pressure in the feed water tank
- Use of condensateurbine
- Heat recovery after the electric filter

Elsewhere in the factory, attention is paid to the following:

- Number and type of equipment
- Pulp sorting concept
- Number of bleaching steps, heights of bleaching towers
- Manufacture of bleaching chemicals
- Energy efficiency of drying and heat recovery
- Number of phases of evaporation
- Lime kiln fuel selection, lime kiln control
- Design of secondary heating system (temperatures, piping)
- Prescribed uses
- Optimised pump and pipe design
- Compressed air solutions
- Space heating and cooling solutions
- Utilisation of excess heat, e.g. for drying the shell
- Supply of district heating.

2.3 Lignin plant

Kemi is preparing for an investment in lignin plants.

The wood contains 20-30 % lignin, which dissolves in pulp soup and oxygen bleaching and ends up in black liquor, from which lignin can be recovered. The difference between black liquor reduces the organic load on the recovery boiler, so less steam and electricity can be produced.

2.3.1 Process

Black liquor is imported from the evaporation plant at an appropriate concentration. The pH of the black liquor is calculated with carbon dioxide and thickened with a press. Sodium is separated from lignin by washing lignin with washing broth and acid in the process. The lignin is precipitated and washed again with acidified wash water. Lignin-free washing broth will beshipped into the factory's lye cycle.

There are other variations in the difference between lignin, but the main principle is the same.

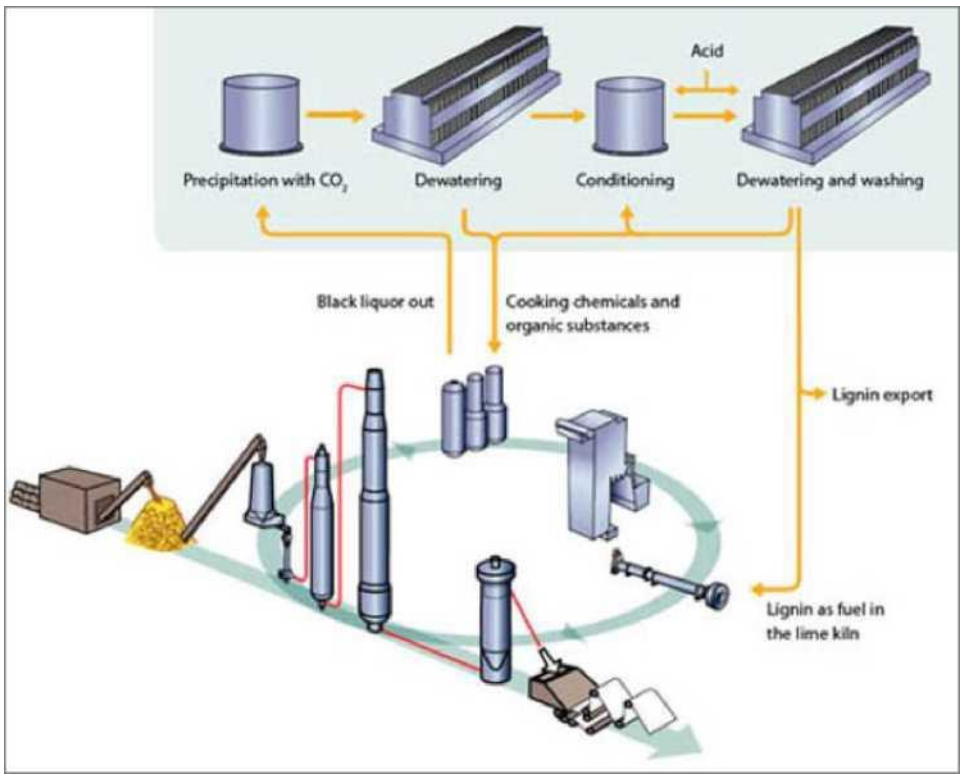

Figure 2-17. One of the lignin separation plants (Lignoboost).

2.3.2 Raw materials

Lignin raw materials are black liquor, carbon dioxide and sulphur or other acid.

Table 2-18. Raw materials for lignin.

Chemical	Production factoryin the area	Provisional useamount	Gas/liquid/solid	Warehouse t or m^3	Use
Black liquor	Yes		Liquid		Raw material
Sulphur or other acid	Yes		Liquid		Acidification
Carbon dioxide	Yes		Gas		Acidification

2.3.3 Products and accessories

Lignin is produced for example by 50 000 t/a, which would reduce electricity sales from 10 to 15 MW.

Lignin is primarily supplied as a raw material for bioproducts. Possible lignin-derived products include carbon fibres, resins, adhesives and various chemicals.

Second, lignin is burned into bioenergy.

The waste broth is returned to the factory's lye cycle.

2.3.4 Emissions to the environment and waste

Process odour gases are led to the treatment of dilute odour gases.

Rinsing waters are led to the treatment of wastewater.

2.3.5 Interfaces

The connection of the Lignin factory to the rest of the plant is as follows:

- Lignin is separated from black liquor
- Lignin separation broths are returned to the evaporation plant
- The plant uses integrate chemically purified water
- Effluent is directed to a joint treatment plant (as a rule, no waste water will be provided)
- Odour gases are led to the treatment of dilute odour gases
- The plant uses integrate steam
- The electricity is purchased from 33 kV switchgear (in the factory area).

2.4 Biofibres

Textiles are now mainly made from oil-based artificial fibres and cotton, but wood-based textile fibres are considered a very promising material for the future. Wood-based materialsare already used as a raw material for textiles, but their share is still small, about 5 %. Population growth and rising living standards increase not only food and energy consumption, but also textile consumption. There is little room for increasing cotton production, as cotton is in competition with the farmland needed to produce food. In addition, a lot of water and pesticides are needed to grow cotton.

2.4.1 Process

In fibre-making processes, the cellulose is first dissolved either as it is or chemically modified in a suitable solvent and regenerates back into fibre.

In the direct extraction process, undried wood-based paper pulp and dissolving pulp is modified to suit the-dissolving process during the pre-treatment stage. The molar mass and the metal content ofthe cellulose material shall be adjusted enzymatically and/or by acid treatment. The acidic filtrates ofthe pre-treatment process are led, for example, to the pulp process to be used as bleaching washes. The pre-treated paper pulp pulp presented herein is dissolved in an ionic liquid, which is a new type of direct solvent. The cellura raw material used by the process is undried and the ion liquid used for reconstitution also contains water when faced with pulp. Pulp dissolution occurs when a sufficient amount of water has been removed. Thishe is typically used in the dissolving process of continuous operation of the so-called Kneader-type device. During reconstitution, a spinning solution is formed, typically containing 5-25 p-% cellulose/hemicellulose dissolved and lopbolus is a solvent. The spindle solution is very viscous, but can be pumped between 80 °C and 100 °C and it is possible to filter out solid and gel-like impurities.

The spinning of textile fibre strands takes place in the so-called bladder bladder. The strands are solidified in the air gap and thewater in the solution (so-called spinning bath) to which the strands are directed after the air space. The bouquets are washed with water according to the principle of left-current washing, after which a cutting into staple fibres is carried out. The resulting mat staple fibre material is washed and, if necessary, bleached. Bleaching of staple fibres is typically done withhydrogen perok Sidi in alkaline conditions, which are much milder than e.g. the white wolf ofpulp. Before drying and mechanical opening of staple fibres, a fatty acid based chemical is added to the fibres for further processing. Its purpose is to remove static electricity and to facilitate the spinning of the actual textile yarn. The finished staple fibre is baled and packed into long packetsof cotton bales.

The solvent used in direct extraction processes is recycled at > 99 % efficiency (typically up to 99.5 % efficiency). The recycling of the solvent starts with the spinning bath solution, to which the solvent has beentransferred during coagulation of the oats and to which also the filters of strands and staple pulp are collected using the principle of countercurrent washing. In the recycling process, the solvent-containing

water is first removed from themechanical impurities, e.g. by filtration. The spinning bath solution is then fortifiedby e.g. evaporation at the concentration of 80-90 p-% solvent, after which the concentrated solution is ready to be re-used for reconstitution of pulp. The solvent recovery line typically includes other unit processes to remove impurities.

The direct extraction process has almost closed water circulation. The condensates for evaporation during the dissolving phase are returned to the washing of strands and staple fibres. Staple fibre bleaching filtration streams are led to wastewater treatment. This filtrate contains a small amount of biodegradable solvent residues. Another point where solventmen losses may occur is solid cellulose-derived waste from the treatment of fibre injections.

2.4.2 Raw materials

The main raw material is unbleached softwood pulp. The necessary chemicals consist of cellulose solvent (ionic liquid) as well as pre-treatment, bleaching and post-treatment chemicals. Pre-treatment chemicals are sodium hydroxide, sulphuric acid and an enzyme solution for pH adjustment. The bleaching uses sodium hydroxide, hydrogen peroxide and stabilisers. The after-treatment chemical is a fatty acid-based marriage agent.

2.4.3 Products and accessories

The product is cellulose staple fibres (the fibres also contain hemicellulose). The production capacitywill increase later, but it will be at the level of 50 000 to 100 000 t of staple fibres/a.

2.4.4 Emissions to the environment and waste

Any odour gases in the process are led to the treatment of dilute odour gases.

Wastewater and rinsing water from the washing and bleaching process are led to biological wastewater treatment or to a clear process.

Rinsing waters are led to biological wastewater treatment. COD emissions to the treatment plant provisionally 20 kg/t of fibre. It does not significantly increase the COD load to the environment from the treatment plant in relation to the integ wastewater load.

2.4.5 Interfaces

The connections of the biofibre plant to the rest of the plant are as follows:

- Cellulose or bleached pulp is obtained from bleaching
- Process waste broths are led into the textile fibre process’s own chemical cycle
- The plant acquires chemically purified water from a bioproduct mill
- Wastewaters are directed to a joint treatment plant
- Steam sourced from bioproduct mill
- The electricity is purchased from 33 kV switchgear (in the factory area).

Figure 2-18. Textiles made of Metsä Fibre pulp.

2.5 Biogas plant

The biogas plant is one of the possible production concepts of the bioproduct mill, which has been implemented atÄänekos ke's bioproduct mill. Its alternative is the burning of biosludge in a recovery boiler or in a bio boiler.

2.5.1 Process

Anaerobic treatment is a commonly used sludge treatment method from municipal wastewater treatmentswith many sludges. It produces biogas (methane and carbon dioxide), phosphorous humus and nitrogen-containing rejective under oxygen-free conditions.

Treatment is usually carried out at a mesophilic temperature between 30 °C and 38 °C.

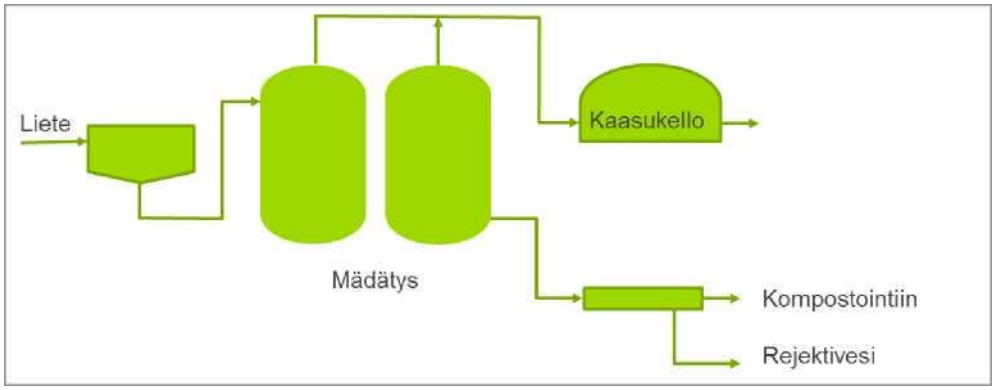

Figure 2-19. Biogas plant in simplified form.

The anaerobically treated sludge is dried mechanically. Drying significantly reduces the volume of sludge and thus the amount of sludge transported elsewhere. However, mechanically dried sludge does not meet the hygiene requirements for agricultural sludge. Therefore, the treatment of sludge should be continued, for example, by composting. The amount of humus generated is 30-40 % of the weight of the original sludge after composting the sludge.

The plant's rejective can be produced as bionutrients or used in a wastewater treatment plant.

2.5.2 Raw materials

The raw material of the plant is the biosludge of the sewage treatment plant. The amount of sludge to be treated is in the range 30 to 40 t/d.

2.5.3 Products and accessories

Biogas plant products include biogas and treated and/or composted sludge and ancillary product rejective.

- Biogas, stored in gas clock, volume about 5 000 m 3, working pressure about 3 kPa
- Processed biosludge or treated and composted humus
- Rejectives or bionutrients.

2.5.4 Emissions to the environment and waste

Digestion can cause some odour to the environment. An estimate of the amount of odour gas is presented in the EIA lost.

2.5.5 Interfaces

The interfaces of biosludge treatment with the rest of the plant are as follows:

- The sludge comes from the sewage treatment plant with a pump
- The factory procures chemically purified water from the pulp mill
- Steam sourced from pulp mill
- The chemical area is shared by the operators
- Electricity to be procured from 33 kV switchgear (factory area)
- Biogas can be used as fuel.

2.6 Composite

Composites are one of the possible products of Kemi's integrate. For example, Metsä Fibre's integra in Rauma already has Aqvacomp as a composite-producing partner.

2.6.1 Process description

The pulp is mixed with plastic. In this case, pulp improves the properties of the composite.

2.6.2 Raw materials

The raw materials are pulp and various plastics.

2.6.3 Products and accessories

The product is mainly granulate.

2.6.4 Emissions to the environment and waste

The amounts are assessed in the EIA report.

2.6.5 Interfaces

The connections to the rest of the factory are as follows:

- Pulp comes from a bioproduct mill
- The factory procures chemically purified water from the pulp mill
- Steam sourced from pulp mill
- The chemical area is shared by the operators
- Effluent is directed to the integrate treatment plant

- The electricity is purchased from 33 kV switchgear (in the factory area).

2.7 Shell pellets

Shell pellets or torrefied shell pellets are one of the possible products of the bioproduct mill. Under this-condition, the shell and, possibly, the sludges are dried, charred and pelleted.

Figure 2-20. Charred pellets.

2.7.1 Process description

Biocarbon has similar fuel characteristics to other biomass fuels, but due toits manufacturing process, its calorific value is significantly higher. Biochar is produced by roasting wood pulp ata temperature of 250 300 °C for 10-30 minutes, when part of the biomass is removed as gas and the wood's fibre structureis tightened. About 70 % of biomass energy ends up in the final product. Torrefied fuel can be prepared from awide range of biomasses, but still achieve the same properties for the end product. The main reason for this is that biomass of wood and plant origin consists of the same building materials such as cellulose and lignin.

The exhaust gas can be used for steam and electricity production.

The roasted material resulting from the process can be pelleted for further use. The bulk density of pellets is twice as high as non-pelled biocarbon, so pelleting reduces thecost of transporting biochar by half.

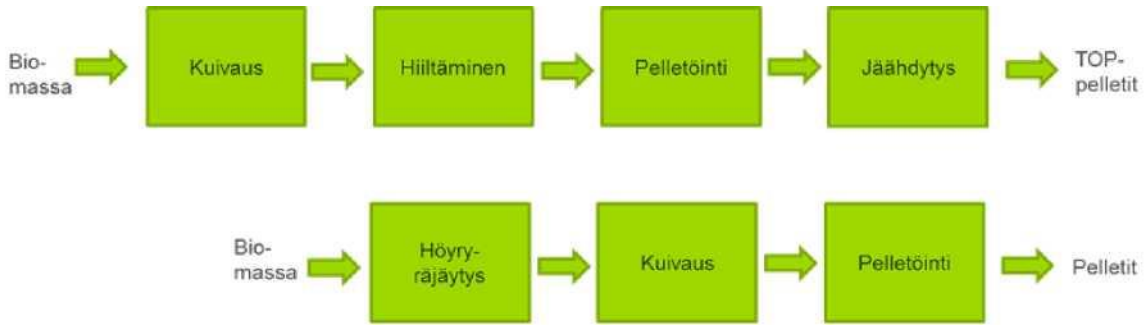

Figure 2-21. Production options for biocarbon pellets.

2.7.2 Products and accessories

For example, 100 000 t/a of biochar would be produced.

The moisture content of biocarbon is typically between 1 % and 10 %, the sulphur content is 0.02 % to 0.1 % and the ash content is 1 to 4 %. Its net calorific value is 15-16 GJ/t, which is about 60 % of the calorific value

of coal (depending on the quality of coal).

A co-product of carbonisation is a gas that can be burned for steam production.

2.7.3 Raw materials to be used, their procurement, handling and storage

All the bark produced by the pulp mill, which is not used for bark gasification, which is approximately-170000 t per year, could be used for the production of biochar.

No other raw materials are needed in the production of biochar.

2.7.4 Emissions to the environment and waste

Dust is generated in the treatment of the shell.

Any effluent contains an easily degradable organic substance.

The amounts are assessed in the EIA report.

2.7.5 Interfaces

- The shell is mainly purchased from a pulp mill
- The plant acquires chemically purified water pulp mill
- Effluent is directed to the integrate treatment plant
- Steam sourced from pulp mill
- Electricity to be procured from 33 kV switchgear (factory area)
- Biocarbon transport is mainly carried out by road.

2.8 Construction and demolition work

The environmental impact of construction works is assessed, see section 8.2.1.

At the start of the bioproduct mill, the current pulp mill will be dismantled in order to create space for the production of potential new bioproducts in the area.

2.9 Joining other projects

The bioproduct mill does not have direct connections to external projects.

From the point of view of the use of wood, there are links to the biofuel refinery in Kemi and the Kemijärvi biorefinery if one of the projects is implemented. No investment decision has been made for both projects.

3. Option 0

So, the zero option is to continue operating the current plant. The plant has a capacity of approximately 600000 ts/a.

3.1 Processes

The processes for the pulp mill are almost the same as in option VE1 (section 2.2) with the exception of the rice plant and the gasification of the shell. There are no bioprocesses (paragraphs 2.3 to 2.7).

3.2 Raw materials

The current pulp mill uses approximately 3.1 million solid cubic metres each year as raw material (see Table 2-2). The wood is stored in the form of knives and chips. Other quantities of raw materials to be used and stored arepresented in the table (Table 2-3).

3.3 Products and accessories

The main products are bleached and unbleached sulphate pulp.

In the production process, the co-products of tall oil, sodium bisulphite, turpentine and bark are produced. The production volumes are shown in the table (Table 2-7).

3.4 Emissions to the environment

Emissions from the current plant to water bodies are presented in the table (Table 2-10) and the emissionsto air in the table (Table 2-14).

A large part of the waste generated is delivered for recovery or recycling. Wood is used for combustion and energy production. The most significant waste fractions generated from pulp mill operations are so-called green liquor, soda sand, meesa and limestone waste. Only small quantities of other industrial or hazardous waste are generated. The waste data can be found in the table (Table 2-15).

4. EIA procedure

The Environmental Impact Assessment (EIA) Directive (85/337/EEC) adopted by the Council of the European Communities (EC) was implemented in Finland under the Agreement on the European Economic Area in 1994. The regulations governing the EIA procedure have been reformed. The current Act on Environmental Impact Assessment 252/2017 and its corresponding Decree 277/2017 entered into force in May 2017.

The project requires the application of an assessment procedure in accordance with the EIA Act, as according to section 5a ofthe EIA Act, the assessment procedure laid down in the EIA Act is applied to mass factories. The granting ofan environmental permit and building permit requires a completed EIA procedure.

Parties to the EIA procedure

Metsä Fibre Oy is responsible for the EIA procedure project. The project manager is the operator responsible for the preparation and implementation of the planned project. Metsä Fibre is also responsible for implementing the EIA procedure. Sweco Industry Oy is the consultant in the assessment.

The contact point for the EIA procedure is the Lapland Centre for Economic Development, Transport and the Environment (ELY Centre). Contact point means an authority that ensures that the environmental impact assessment procedure for a project is organised in accordance with the EIA Act. The contact point is responsible, inter alia, for providing information on the environmental impact assessment programme and the report, as well as forcollecting opinions and opinions. The contact point shall issue an opinion on the evaluation programme in which it shall take a position onthe scope and accuracy of the guidelines. The contact point checks the adequacy and quality of the EIA report and then draws its reasoned conclusions on the significant effects of the project aroundthe project.

4.1 Objectives and content of the EIA procedure

The objective of the environmental impact assessment procedure is to promote environmental impact assessment andthe integrated integration of impacts in planning and decision-making.

All interested parties may participate in the EIA procedure. Citizens' access to information andparticipation are the cornerstones of the EIA procedure. The environmental impact of a project must be assessed in accordance with the lawful procedurefor the evaluation of the environmental impact before any action is taken that is relevant to the environmental impact.

The authority may not grant permission to carry out a project or make any other comparabledecision until it has received the evaluation report and the reasoned conclusion drawn up by the contact point. The purpose of the EIA procedure is not to make decisions on the project, but to provide the basisfor decision-making.

The programme and descriptive phases of theEIA procedure (Figure 4-1). The Environmental Impact Assessment Programme (EIA) is a plan for the organisation of the environmental impact assessment procedure andthe necessary studies. The environmental impact assessment report (EIA report) presents the project's own wolves, technical solutions and a uniform assessment of the project's effects, as a result of the assessment-procedure.

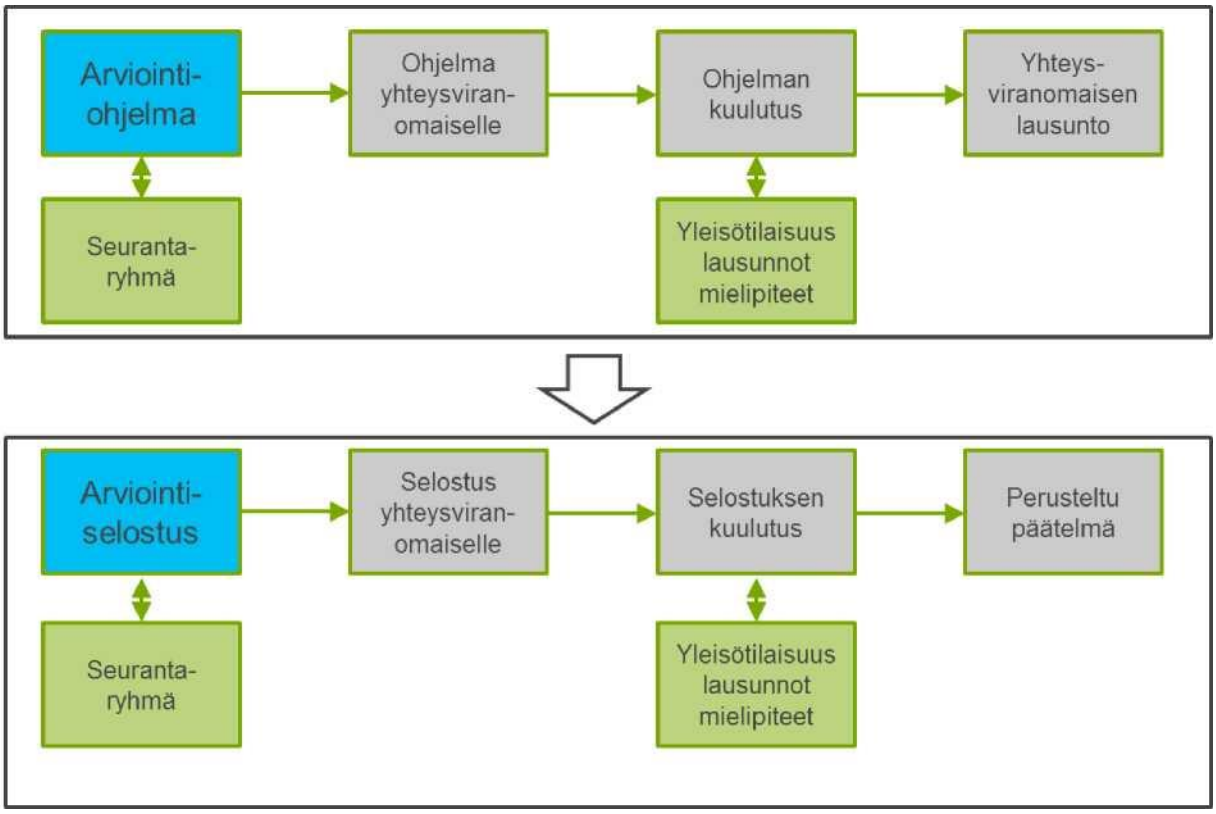

Figure 4-1. Phases of environmental impact assessment.

4.1.1 Evaluation programme

The EIA programme (i.e. in this document) presents a description of the current state of the environment in the project area, as well as a plan (work programme) on what impacts are being investigated and how the studies will be carried out.

The programme presents, among other things, basic information on the project, the options to be examined, a plan for information during the project and an estimate of the project's timetable.

The EIA procedure is officially initiated when the EIA programme is submitted to the contact point. The contact point for this project is the Lapland Centre for Economic Development, Transport and the Environment (ELY).

The contact point informs about the evaluation programme by stating the likely impact of the project on the notice board ofthe municipalities in the area and, in addition, electronically and in at least one newspaper spreading overthe project's impact area.

The evaluation programme shall be made available to the public. Citizens can submit their views on the EIA programme to theJoint Authority. The contact point shall request the necessary opinions from the authorities on the programme. At least 30 days from the time the alertis published.

The contact point shall compile opinions and opinions on the programme and, on the basis of them, give its opinion to the project manager within one month of the expiry of the timelimit for issuing opinions and opinions.

4.1.2 Evaluation report

The environmental impact assessment report shall contain, to the extent necessary, the following information necessary to reach a reasoned conclusion, taking into account the knowledge available at the time and the

methods for conductingthe assessment:

1) a description of the project, its purpose, location, size, land use needs, main assetsincluding energy sourcing and consumption, materials and natural resources, likely emissions and residues such as noise, vibration, light, heat and radiation, and emissions and residues that may cause pollution of water, air, soil or subsoil, and the quantity and quality of waste generated, taking into account the construction and use phases of theproject, including possible dismantling and exceptional situations;

2) information on the timetable for the design and implementation of the project, the plans, permits and similar decisions preceding the implementation, and the connection of the project to other projects;

3) a description of the relationship between the project and its alternatives and the land use plans and programmes relevant to the project;

4) a description of the current state of the environment in the catchment area and its likely evolution if the project is notcarried out;

5) an assessment of the potential accidents and their consequences, taking into account the high vulnerability of the project to the risks of neutralityand natural disasters, the related emergency situations and the measures taken to prepare for such situations, including prevention and mitigation measures;

6) an assessment and a description of the likely significant environmental impacts of the project and its reasonablealternatives;

7) where applicable, an assessment and description of the transboundary environmental impacts;

8) a comparison of the environmental impact of the alternatives;

9) information on the main reasons, including environmental impacts, which led to the choice of the option(s) chosen;

10) a proposal for measures to avoid, prevent, limit or eliminate identified significant adverse effects onthe environment;

11) where applicable, a proposal for possible beach arrangements related to significant adverse effects on the environment;

12) an explanation of the stages of the evaluation procedure, including the participation procedures and the accession of the project, you will design thebone;

13) a list of the sources used for the preparation of the descriptions and assessments contained in the report, as well as the methods used to identify, forecast and assess significant environmental impacts, as well as information on shortcomings andmain uncertainties in compiling the required data;

14) information on the competence of the authors of the assessment report;

15) an explanation of how the opinion of the contact authority on the evaluation programme has been taken into account; and

16) a non-technical and illustrative summary of the information set out in points 1 to 15.

The assessment and description of likely significant environmental impacts shall cover the direct and indirect, cumulative, short, medium and long-term permanent and temporary, positive and negative impacts of the project, as well as synergies with other existing and approved projects.

The contact point shall announce the completed evaluation report, request the necessary opinions and arrange forthe opportunity to express its views. The evaluation report shall be displayed and the time for the submission of opinions and opinions shall be at least 30 days from the date of publication of the alert.

4.1.3 Reasoned conclusion

The contact point will check the adequacy and quality of the EIA report and then draw a reasoned conclusion on the significant environmental impacts of the project. The reasoned decisionmust be given to the project manager within two months of the expiry of the deadlinefor making statements and presenting the pleasures. The reasoned conclusion shall contain a summary of the other opinions and opinions expressed on the evaluation report.

The contact point shall forward the reasoned conclusion, as well as any other opinions and opinions, to the project manager. At the same time, the reasoned conclusion must be communicated to the authorities dealing with the project, to the municipalities affected by the project and, if necessary,to the regional councils and other officials concerned and published on the website of the contact point.

- If the contact point is unable to reach a reasoned conclusion due to the lack of an EIA report, it shall inform the project manager of the extent to which the assessment report shall be supplemented.

The permit authorities and the project manager use the assessment report and the opinion of the contact point as the basis for their own decision-making. The permit decision for the project shall indicate how the assessment report and the opinion on it have been taken into account in the decision;

4.2 Timetable for the EIA procedure

The key steps of the EIA procedure and the planned timetable are presented in the following figure. The implementation of the EIA procedure is accelerated by the extensive monitoring of the environment in Kemi and the surroundings of the project area for decades. There is a lot of research data available in the area and the results of the monitoring have been publicly available.

The project manager has four bioproduct mills whose plant-specific environmental emissions are published annually in the Group's sustainability report. One of the factories is currently operating in the project location and another bioproduct mill corresponding to this project has been launched last year in Äänekoski. Thus, reliable information is available on emissions from bioproduct mills and their reduction potential as a basis for the EIA procedure.

Any additional tasks proposed in the EIA Programme Statement and proposed by the Monitoring Group will be taken into account in the evaluation in a relevant manner.

The timetable sets out the participation of the monitoring group and the public in the process. The Monitoring Group's contribution to this process is very important. In addition to the opportunities presented in the schedule, discussion sessions are organised mainly in Kemi. (For the organisation of participation see also 8.2.13)

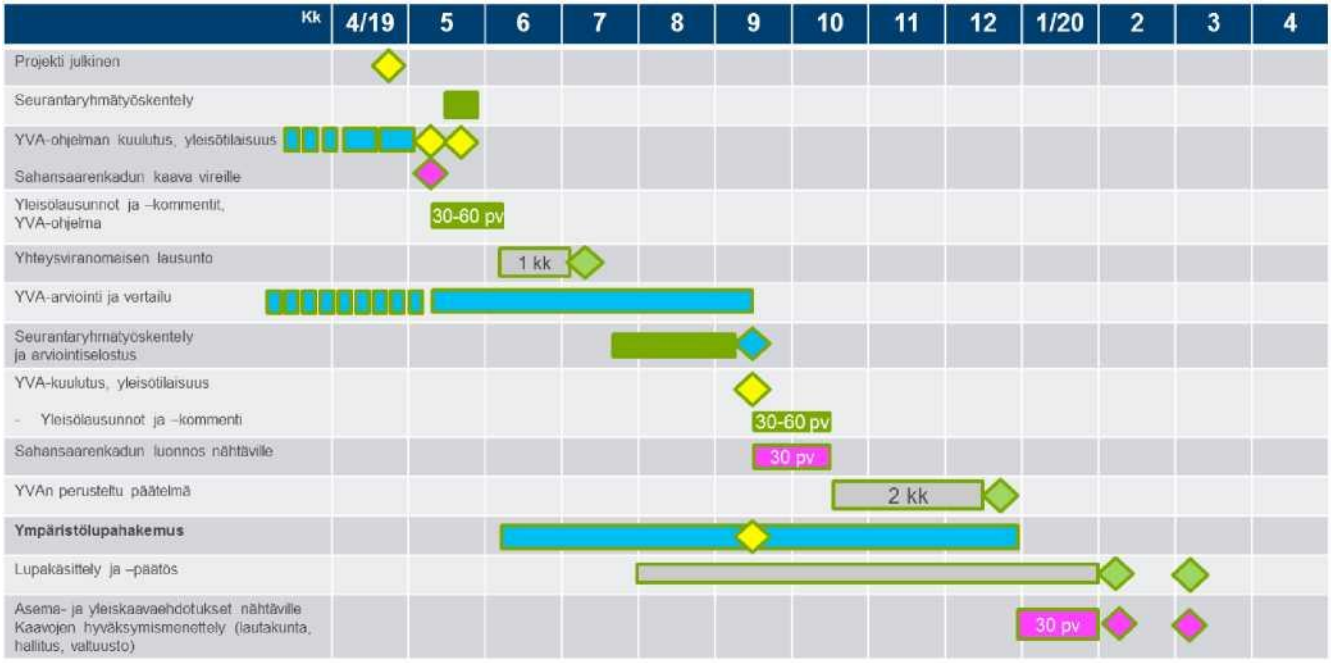

Figure 4-2. The planned timeline of the EIA procedure and the connection to the environmental permit process.

5. Information and participation plan

The EIA procedure is an open process in which different interest groups and the public have the opportunity to participate.

Residents and other interested parties can participate in the project by presenting their views to the Lapland Centre for EconomicDevelopment, Transport and the Environment (ELY Centre), which acts as a joint authority, and also directly to Metsä Fibre Oy or the EIA consultant responsible for the project. One of the key objectives of participation is to gatherthe views of different parties.

Parties in Sweden will also be given the opportunity to participate in the EIA process.

5.1 Information and discussion sessions for the public

The project will provide information to the public. The first briefing took place at the startof the preliminary study in summer 2018 and the second one in the same year before Christmas.

An information and discussion session on the environmental impact assessment programme will be open to the public after the publication of the EIA programme. The event will present the project and the evaluation programme. The public has the opportunityto express their views on the environmental impact assessment work, to receive information and theCentre for EIA with the project responsible for the project, the contact authority and the experts who have draftedthe EIA programme.

A second information and discussion session will be held on the completion ofthe environmental impact assessment report. The results of the environmental impact assessment will be presented at the event. The public has the opportunity to express their views on the environmental impact assessment work carried out and its adequacy.

5.2 Monitoring group work

To monitor the EIA process, a monitoring group will be set up to promote the flow and exchange of information with the authorities responsible for the project, the authorities and other stakeholders. The representatives of the monitoring group will monitor the progress of the environmental impact assessment and present their opinions on the preparationof the environmental impact assessment study, the assessment report and the supporting reports.

Representatives of:

- contact point
- Lapland Centre for Economic Development, Transport and the Environment (Environmental, Business and Transport Responsibility Areas)
- Environmental Division of the City of Kemi
- Kemi-Tornio bird enthusiasts Xenus ry
- Lapland Federation
- Lapland fisheries Centre
- Lapland water and Marine Management Cooperation Group
- Lapland rescue Department Kemi
- Lapland nature conservation district
- Maritime Lapland Environment Health and Public Transport Section
- Naturvårdsverket
- Bothnian Bay fishing zone

- Sotisaari village Association Association

- Haparanda Stad
- Kalix stad
- Keminmaa
- Simo
- Tornio

- Kaidi Finland
- Kemi Digipolis Oy
- Kemi Energy and Water
- Kemi Association of Entrepreneurs
- Woods Board Plc
- Forest Centre
- Outokumpu
- Stora Enso Veitsiluoto Oy

5.3 Visibility of the evaluation programme

Upon completion of the evaluation programme, the Centre for Economic Development, Transport and the Environment will announce its presence. The notice indicates where the evaluation programme can be viewed and where the opinions and opinions concerning it should be submitted. Thetime limit for submitting statements and opinions starts from the date of publication of the notice and its duration is at least 30 days according to the EIA Act.

At a later stage of the EIA procedure, the assessment report will also be displayed accordingly, and opinions and opinions can be issued in a similar manner.

5.4 Resident survey and interviews

During the EIA procedure, a tenant survey is carried out to increase interaction and to provide the project manager with information about the residents' attitudes to the project and, on the other hand, by providing residents with information about the project and its impact on their living environment. The survey will also be supported by a theme ofinterviews with target groups using the project area.

5.5 Other communications

The project and its environmental impact assessment are also communicated in the context of general information, such as press releases, press articles and the project's own website (http://kemin-bioproductteh- das.fi/).

6. Permits, plans and decisions required by the project

6.1 Zoning

According to the Land Use and Building Act (132/1999), the plan must be based onplanning that affects the significant effects of the plan and on the studies and studies it requires. When determining the effects of the plan, the function and purpose of the plan shall be taken into account.

When drawing up the plan, the environmental impact, including the social, social, cultural andother impacts of the implementation of the plan and the options under consideration, shall be examined to the extent necessary. The surveys shall be carried out in the whole area where the plan can be estimated to have materialeffects.

When a plan is drawn up for the implementation of aproject referred to in section 3 of the Act on the Environmental Impact Assessment Procedure (252/2017), the environmental impact of the project may be assessed (instead of theprocedure referred to in Chapter 3 of the Act) in connection with the planning. In this case, the project manager shall submit the information referred to in sections 16 and 19 of the said Act to the authority responsible for drawing up the plan. The contact point is responsible forverifying the adequacy of the assessment and for drawing a reasoned conclusion in accordance with the Act on Environmental Impact Assessment.

The project area is mainly located in the district plan for industrial and warehouse blocks.

6.2 Environmental impact assessment

In accordance with the EIA Act (252/2017), the construction of a mass factory requires an environmental impactassessment procedure. The project manager has started the EIA procedure by drawing up this EIA programme. The EIA report and the reasoned conclusion issued bythe Joint Authority are a prerequisite for obtaining project permits (e.g. a constructionpermit and an environmental permit).

6.3 Environmental permit

An environmental permit is required for the operation.

The permit requirement for operations is based on the Environmental Protection Act (YSL 527/2014) and the Environmental Protection Decree issued under it (YSA 713/2014). The environmental permit covers all matters related to environmental impacts, such as emissions to air and water, waste matters, noise issues and other matters related to environmental impacts.

YSL was renewed in 2014. The main purpose of the reform was to implement the EU Industrial Emissions Directive at national level. The Directive strengthened the role of the Pan-European BAT Reference Documents (BREFs). The BAT sets out the best applicable techniques and emission levels. Bat-AELs have become binding since they were previously indicative.

According to the Environmental Protection Act (527/2014), permit regulations must therefore be based on the BAT (Best Available Technology) (Best Available Technology) level in accordance with the EU's Industrial Emissions Directive and emissionlimit values, monitoring and other permit regulations must be based on so-called BAT conclusions. The first BAT "Reference document on Best Available Techniques in the Pulp and Paper Industry" was published in 2001. It was published in 2015 as "Best Available Techniques (BAT) Reference Document for the Production of Pulp, Paper and Board".

The environmental permit must also take into account the Water Framework Directive, which entered into

force in December 2000 to harmonise European water protection, which covers both groundwater and surface waters.

Its overall objective is to protect, improve and restore waters so that their status does not deteriorate and that the status of water bodies is good throughout the EU by 2015 at the latest. The main responsibility for the implementation of the Directive lies with the regional ELY Centre, in this case the Centre for Economic Development, Transport and the Environment in Lapland.

The environmental permit authority for the project is the Regional State Administrative Agency for Northern Finland. The permit authority shallissue an environmental permit if the activity fulfils the requirements laid down in the Environmental Protection Act and other legislation. Furthermore, the project must not conflict with land use planning. The environmental impactassessment procedure shall contain a reasoned conclusion from the contact point before a permit can be granted.

6.4 Construction and demolition

A building permit under the Land Use and Building Act (132/1999) is applied for all new buildings. Demolition is requiredfor buildings that are crawled by PU.

The permit is applied to the city's building permit authority, which, when granting the permit, will check thatthe plan is in accordance with the confirmed town plan and building regulations. A building permit is required before startingthe ramping process. The granting of a building permit requires that the environmentalimpact assessment procedure has been completed.

6.5 Aeronautical flight

According to the Aviation Act (864/2014), no mast, wind turbine, crane, lighting, radio or other device, structure, or sign may be set, arranged or directed in such a way that it can be mistakenly regarded as a device or sign serving aviation. In addition, the construction or equipment shall not interfere with aviation equipment or air traffic or otherwise pose a risk to aviation safety. The licence application submitted to the Finnish Transport Safety Agency Trafi must be accompanied by a statement by the air traffic services provider ANS Finland (Air Navigation Services Finland) on the obstacle.

The chimney rig was applied for in December 2018 and Trafi approved the application in January 2019. In additionto this, you should apply for permission for a group flight barrier when the layout is sufficiently advanced.

6.6 Chemical authorisation

The Chemicals Act 599/2013 lays down provisions on the implementation of the European Union's chemicals legislation and on certain national obligations concerning chemicals. The Act also contributes to the implementation of Regulation (EC) No 765/2008 of theEuropean Parliament and of the Council setting out the requirements for accreditation and market surveillance relating to themarketing of products.

For example, the following chemicals-related laws and regulations are related to the project:

- Reach Regulation EC 1907/2006
- CLP Regulation EC 1272/2008
- Chemicals Act 599/2013
- Act on the Safety of Hazardous Chemicals and Explosives Handling 390/2005
- Decree on Industrial Handling and Storage of Dangerous Chemicals 856/2012

- Decree on Control of the Handling and Storage of Hazardous Chemicals 685/2015
- Act on the Transport of Dangerous Goods 719/1994
- PIC Regulation EC 649/2012 (export and import of dangerous chemicals)
- Pop Regulation EC 850/2004
- radiation Act 592/1991
- environmental Protection Act 527/2014
- maritime Environmental Protection Act 1672/2009
- waste Act 646/2011
- health Protection Act (763/1994)
- occupational Safety and Health Act (738/2002).

The permit referred to in the Chemical Safety Act must be applied for before detailed implementation decisions are made well in advance of the start of the construction work of the production facility.

TUKES shall be provided with a safety report sufficiently in advance of the commencement of operations and shall present:

1) the necessary information on the organisation and safety of themanagement system needed to implement the policy;

2) an explanation of the identification of major-accident hazards at the establishment and the necessary-measures to prevent them and to limit the consequences of such accidents on humans, the environment and property;

3) an explanation that the safetyrequirements laid down in the Chemical Safety Act and the regulations adopted pursuant to it have been taken into account;

4) an explanation that an internal emergency plan has been drawn up;

5) sufficient information to draw up an external emergency plan;

6) sufficient information for the location of the plant and for planning the use of the surrounding land.

Tukes inspects the production facility before commissioning.

TUKES is also subject to notifications under the REACH Regulation (2006/1907/EC) on chemicals produced-and used.

6.7 Emission permit and allowances and project permit

All installations under the Emissions Trading Act 311/2011 must hold a greenhouse gas emission permit, the installationof which has the right to release carbon dioxide into the atmosphere. Permission is granted by the Energy Market Authority. The permitconditions include annual reporting to the Agency of CO2 emissions from the authorised installation. The permitmust be submitted to the Energy Market Authority at least six months before the plannedstart of operations.

In addition to the emission permit, the operator involved in the emission trading may apply for free of charge access rights to be allocated. The amount of allowances allocated per installation depends on the industry and thecalculation of allowances is based on the provisions of the Emissions Trading Act. Applications for emission allowances are processed by the Ministry of Economic Affairs and Employment. Free allowances shall be applied for for a new installation within nine months of the start of normal

operation of the installation. The application shall include only information that has been approved by independent verification and shall be accompanied by an electronic form from the Commission, a verification report and an opinion.

A project permit for the construction of a high-voltage power line must be applied for from the Energy Authority. The project permitis required for lines belonging to the main grid or high voltage distribution system, interconnectors and connecting lines with a nominal voltage of at least 110 kilovolts. However, a project permit is not required forthe construction of an internal power line within a fixed or similar building group.

6.8 Other authorisations

A permit in accordance with the Water Act (587/2011) is required for the construction and abstraction of water related to the project.

Other permits that have interfaces with environmental issues are mainly technical permits, such aspermits for receptacles.

7. Current state of the environment

Two environmental impact assessments have been carried out in the Kemi environment:

- Forest Federation and Vapo Biodiesel Project, 31.8.2010
- Forest BtL Biodiesel Project, 10 April 2012.

Metsä Group has been responsible for the projects in both these assessments.

In addition, industrial companies in the area (Metsä Fibre Oy, Metsä Board Oy, Stora Enso Oyj, Veitsiluoto plant) have submitted new permit applications in 2015, and Sunshine Kaidi (Finland) New Energy Co. Oy has submitted a permit application forthe Kemi biofuel plant in 2016. For all these applications, information on the current state of the environment has been further updated.

7.1 Land use and built environment

7.1.1 Activities in the area

Companies operating in and around Metsä Fibre's Kemi plant integration are listed in the following table (Table 7-1). The new plant will be located on the site of the current pulp mill and the previous sawmill.

The goal is to have more business partners in the area if option VE1 is implemented.

Table 7-1. Companies and real estate operating in the factory area.

Function	**Company**	**Property ID**	**Property owner**
Pulp mill	Metsä Fibre Oy	240-28-2801:2 240-28-2801:4	Metsä Fibre Oy
Cardboard factory	Metsä Board Oy	240-28-2801:3	Metsä Board Oy
Former sawmill		240-28-2801:1	Metsäliitto Cooperative
Maintenance services	Oy Botnia Mill Service Ab		
	YIT		
	Caverion		
Cleaning	ISS		
Staff restaurant	Eurest		
	Cargotec		

7.1.2 Settlements and Sensitive Destinations

Tothe east of Sahansaari, there are buildings still under construction, designated by Metsä Fibre as protectedby the National Museums Agency. The workers' quarter in the northern part of Pajusaari still houses twoblocks of flats owned by the company and the former Pajusaari school, which currently has association activities (less than a kilometre away). In the west there is a so-called Karula district near the current peeling plant. In Sotisaari, the properties at the beginning of Uitontie are also close to the factory. To the north-west and south, there is nosettlement in immediate proximity. The following picture shows the sensitive locations in the surrounding area, such as kindergartens, residential buildings and holiday homes.

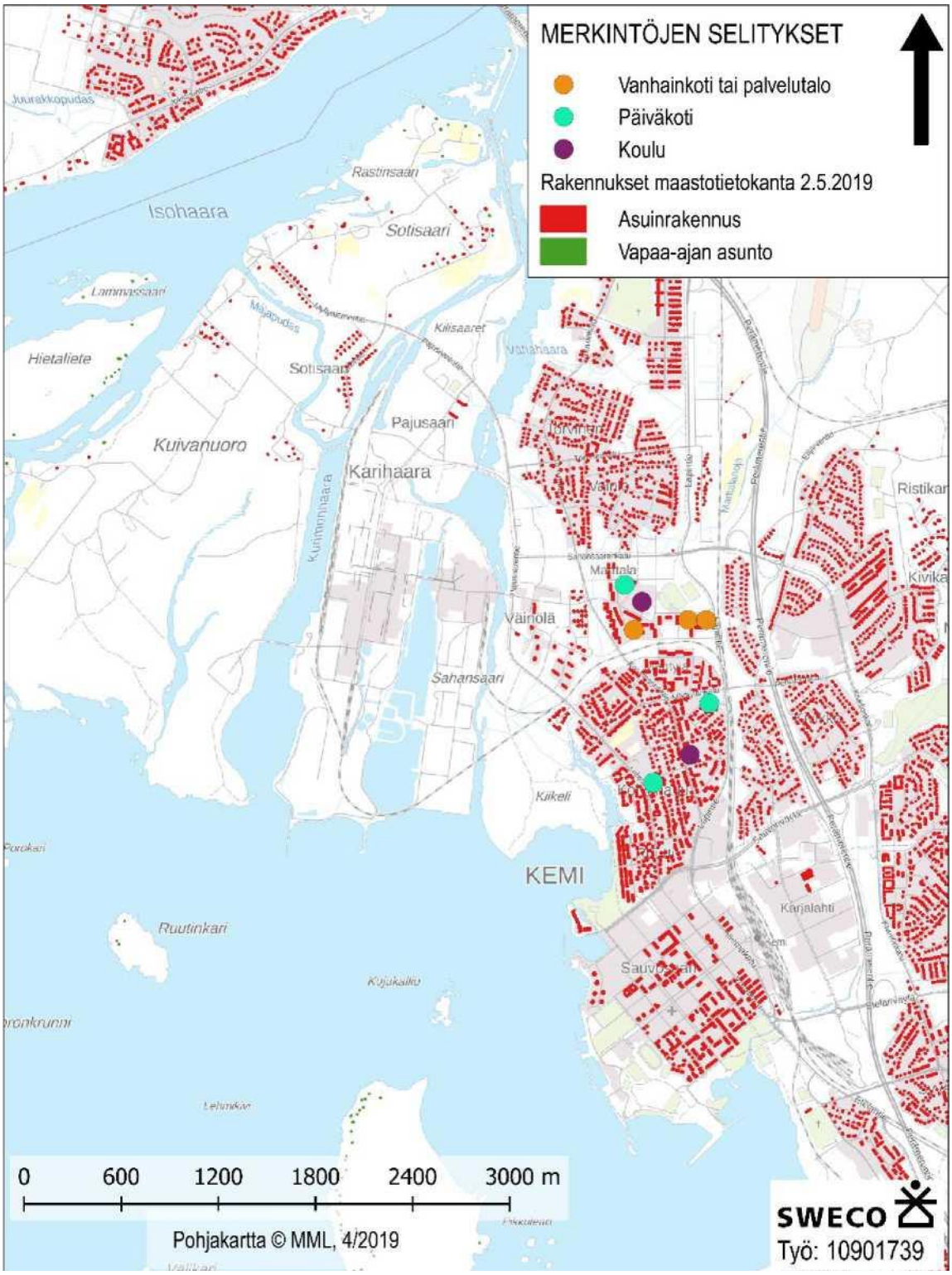

Figure 7-1. Sensitive objects and settlements in the environment.

The nearest school, Karihaara school, is located about 900 m away and the nearest kindergarten, Marttala kindergarten, about 800 m from the bridge leading to Sahansaari. The nearest service home, Purola's virekoti, is about 850 m from the bridge. The health centre and hospital are about 2 km south-easterly. There are plenty of areas reserved for recreational use in Kemi. The recreation area has been designated for example by the easternshore of Ajos, the main part of the island of Selkäsaari, the southern shores of Kuivanuoro, Kiikeli area and some of the smaller areas ofthe sea. The nearest recreation areas are located

in Kiikeli, Kuivanuoro and Mustakarinnokka area about 1.5 km from the current factory area.

The sea area off Kemi is used for domestic and recreational fishing, boating, swimming and outdoor activities. There is one EU swimming beach (strawberry nose), Paavonkari public beach and a winter swimming site for the sailing centre on the north-west side of Mansikkanokka (living 2 km from the current wastewater discharge point).

The sea area between the Ajoss-Selkäsaari mainland, the area west of Selkäsaari and the area east of Ajos in the Gulf ofVeitsiluoto are the free recreational fishing area of the city of Kemi. The area's holiday settlements are concentrated on the Kemijoki mouth and the largest islands, Selkäsaari, Täikko and Ajos. Summer cottages and holiday residents use seawater as sauna and washing water mainly during the summer.

7.1.3 Zoning and other land use plans

The Kemi integrate area in different formulas is presented in the following chapters.

Regional plan

In the regional plan for western Lapland, the integrate area is marked 'T', an industrial area. The plan also includes merkintä SR, a nationally significant built cultural environment, "Karihaara factory community and Mäntylä". It is stated in the plan order that the cultural heist of the site/area must be protectedin the design. New and additional construction must be adapted in terms of location, scale and construction to-the valuable building stock and the built cultural environment. Most of the buildings in the factory association are located outside the factory area.

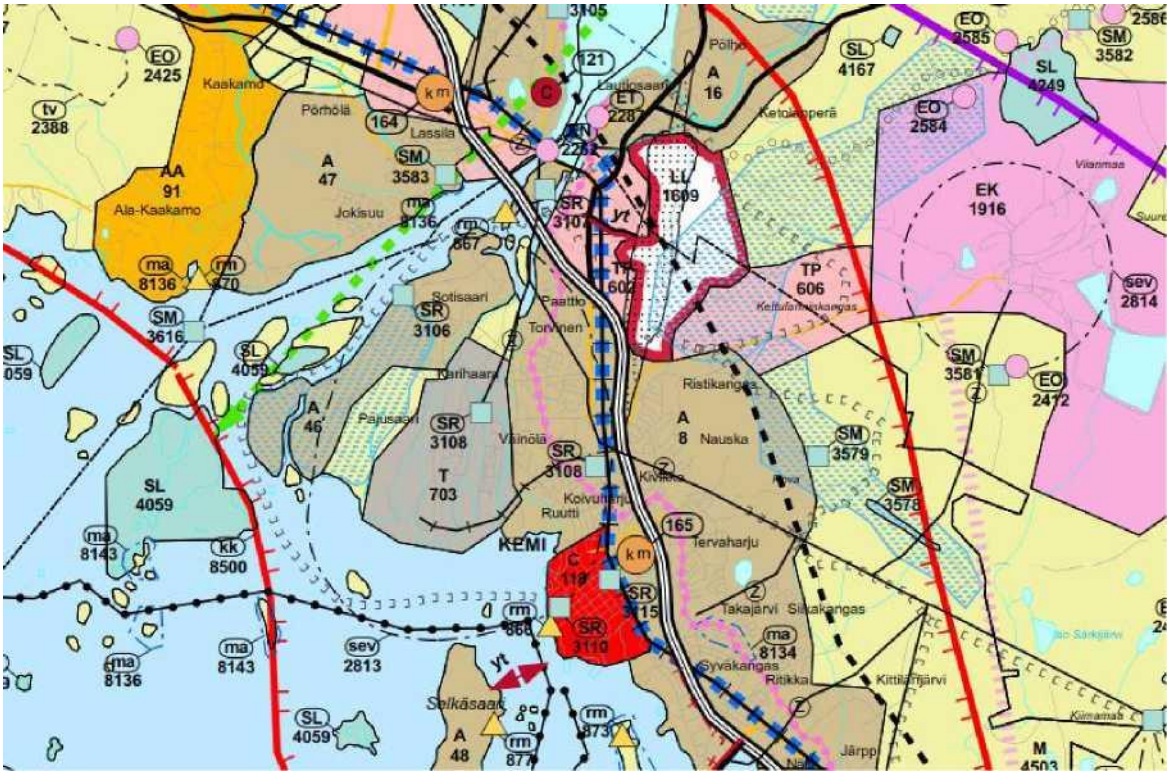

Figure 7-2. Extract from the regional plan for western Lapland, 2015.

Master plan

In Kemi's master plan, the factory area is marked TT/sr, which is an area of industrialactivities with significant environmental impact. The wood processing industry and related activities may be carried out inthe area. The area includes an area or object protected or protected under the Land Use and Building Act.

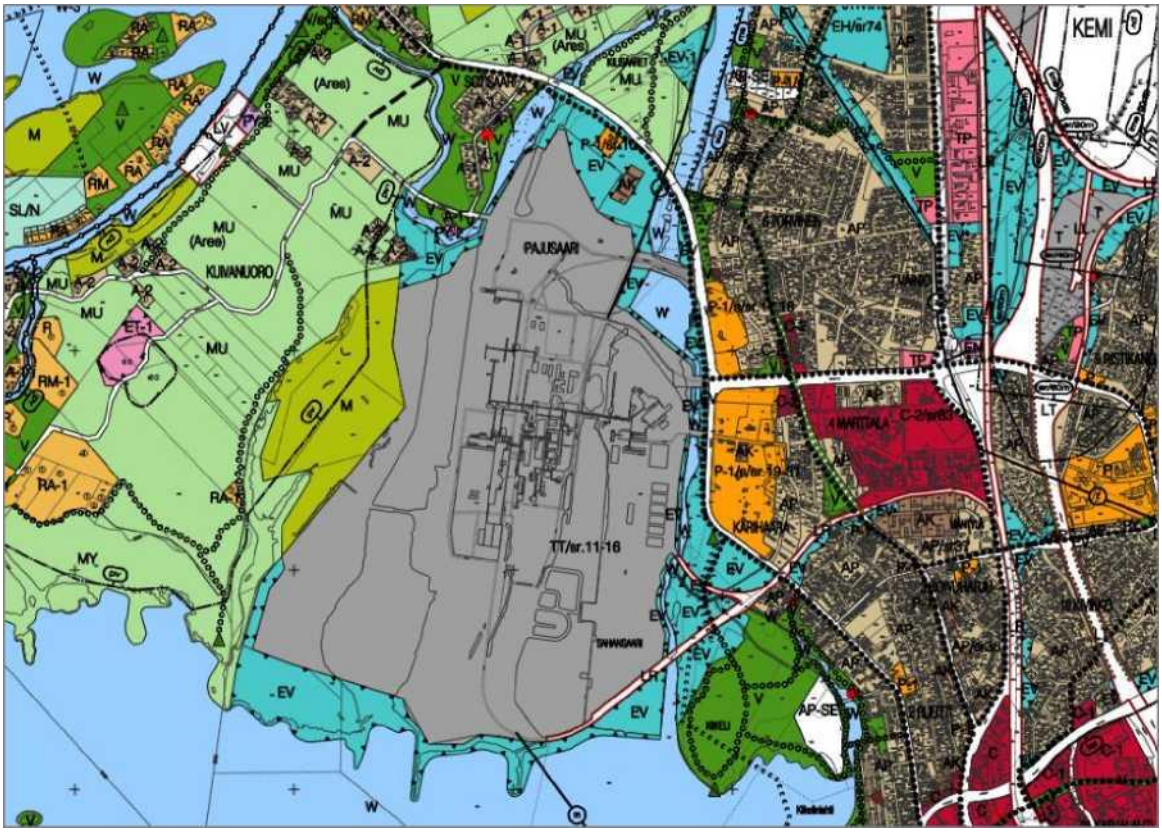

Figure 7-3. Extract from the current master plan of Kemi.

Town plan

In the current city plan in the central area of Kemi, the area is marked 'T', 'industrial' and 'the thief' in the-block area of buildings.

In both the general plan and the town plan, the periphery of the watercourses in the factory area is marked with an EV mark, i.e. a protective green area.

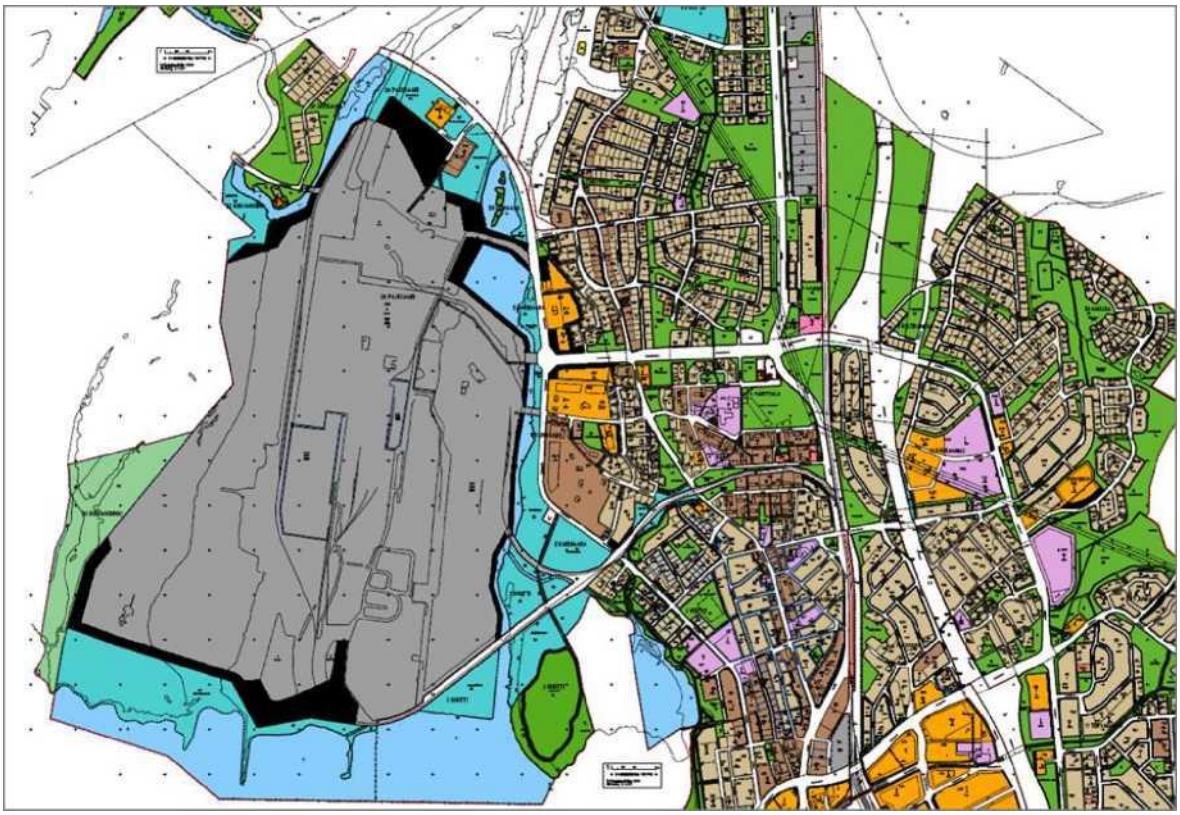

Figure 7-4. Extract from Kemi's up-to-date town plan.

Phase station plan

In November 2018, the City of Kemi launched the preparation of a phase station plan for plots 1-4 of the 2801 block in the 28th district. This area includes Metsä Group's industrial area. The phase-station plan was used to create the prerequisites for future land use needs. Here:

- The boundaries of building areas and plots were studied and arranged.
- The altitudes of the plan area were investigated and arranged.
- We investigated and resolved building protection issues.

Questions related to the built environment, air traffic and landscape were thus examined for the phase station plan. The participation and evaluation plan was available from 24 November 2018. The preparatory material for the phase station plan was made available from 19 December 2018 to 21 January 2019.

Statements were received from the Lapland Centre for Economic Development, Transport and the Environment, the Finnish Museums Agency, the Lapland Rescue Department, TUKES, the Transport and Communications Agency Traficom and the Tornio Valley Provincial Museum. No opinions were received from individuals. The Stage Status Plan was approved by the City Council of Kemi on 1 April 2019 and is expected to receive theforce of the Act on 13 May 2019.

Once the phase-station plan has been obtained in the area of legal force, there are two town plans in force, which are combined in the seu-draft image.

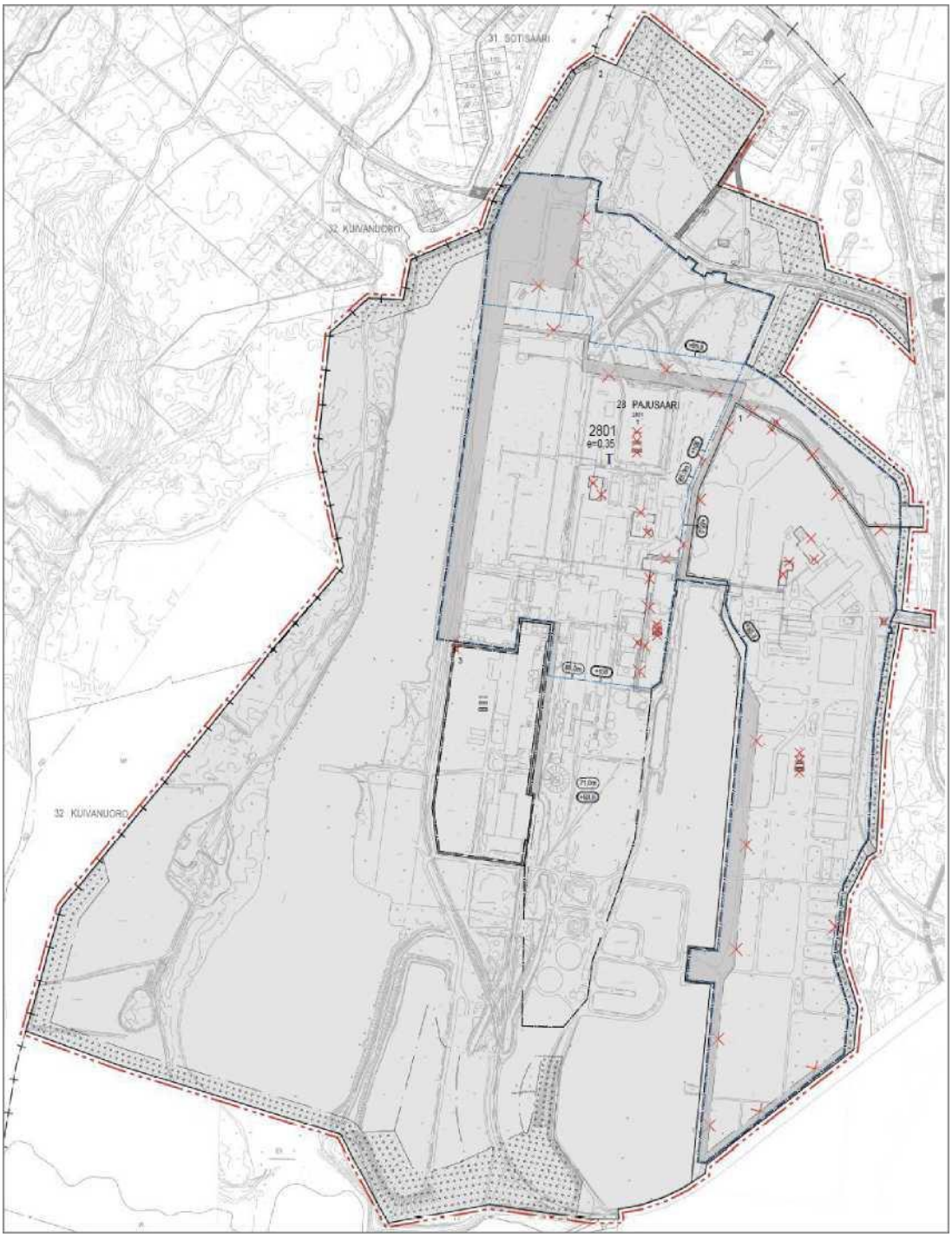

Figure 7-5. Proposal for a Combination Station Plan.

In order to ensure the safety of traffic, certain changes in road and rail traffic are beingapplied to Sahansaarinkatu. The plan amendment will be initiated as a parallel process with the environmental impact assessment procedure. The alternative is to continue traffic through the existing connections, adding the already wonSahansaarenkatu Bridge to Sahansaari Island.

7.1.4 Other land use plans

No other land use plans are known in the factory area.

7.2 Current state of water

Obligation monitoring has been carried out in the Kemijoki region and in the sea area off the coast of Kemi for decades due to river regulation and forest industry demanded by power plants. In addition to the purified waste water from the forest industry (Metsä Fibre Oy & Metsä Board Kemi Oy and Stora Enso Oyj) and the City of Kemi (Kemin Vesi Oy), the material flows from the Kemijoki River andsmaller rivers entering the area, as well as purified waste water from the municipality of Keminmaa that are discharged to Kemijoki mouth, areaffected by material flows from the forest industry (Metsä Fibre Oy & Metsä Board Kemi Oy and Stora Enso Oyj) and the City of Keminmaa (Kemin Vesi Oy). In addition, the sea area is burdened by, for example, natural leaching and diffuse loads coming directly from land areas. The report on the environment of Metsä Fibre Oy, Metsä Board Kemi Oy and Stora Enso Oyj Veitsiluoto plantwas carried out in early 2015 and is mostly up-to-date (Pöyry 2015). Following the drafting of the study, phytoplankton and benthic animal surveys have been carried out in 2015 and the concentrations of organic chlorine combinationroads in sediment have been investigated in the area between Selkäsaari and Ajos and in the Gulf of Veitsiluoto. Chlorine compounds wereall below the limit of quantification in 2015, but in the same order of magnitude as in 2012 (Töyry 2015).

7.2.1 Bay of Bothnia

The physical characteristics of the Bothnian Bothnian Sea include the shallow sea area (with a mean depth of about 40 m), low salinity in the water (2-5) and severe weather conditions characterised in particular by a long ice-covered period. The icy season of the Bothnian Bay lasts about six months. These factors contribute to limiting the area's pe rustyproduction and affecting the abundance of species in the area. The Bothnian Bay is also characterised by rapid land uplift and thus a rapidly changing coastal zone in shallow areas, as well as the openness of the coast. The construction of ports and fairways has changed the coastline and the seabed in front of Kemi. The regulation of waters enteringthe Bothnian Bay has changed the amount of fresh water discharged into the sea at different times of the year. Coastaland marine areas are under increasing pressure. A number of wind farms are planned in the Bothnian Bay, which would be located in shallow areas.

Depending on the location and physical characteristics of the Bothnian Bay, either solid ice or drift ice are present in the area. Solid ice is static ice, usually found near coasts and archipelagos, where the water depth is mainly less than 15 metres. On the other hand, sea ice in fowls usually consists of drift ice, which moves underthe influence of winds and currents. The ports of Kemi and the shipping routes leading to them are kept open during the winter season with the help of icebreakers. Both the Kemijoki River and the Tornionjoki river enter the Bothnian Bay, which bringthe area with a very large catchment area (280 000 km²). The salinity of the seawater is also very low in the outskirts of Kemi. In general, the deposition of water in the Bothnian Bothnian region during the open water is weak, as winds are able to mix saltiness and heat in the water in shallow water. However, in Pacific weather and in winter, stratification can happen.

The variation in sea water levels in the area is wide and fast. Fluctuations in water levels are caused by winds, air pressure and the amount of water brought into your head by rivers. Based on the results of the Kemi Ajos observation station of the Finnish Meteorological Institute in 1922-2013, the extreme values of the water level and their average values compared totheoretical mean water have been as follows:

- maximum HW + 201 cm
- average annual maximum MHW + 121 cm
- average annual minima MLW – 80 cm
- minimum LW – 125 cm

Fluctuations in seawater altitude affect water flows and turnover. Rising seawater dilutes any waste water

discharged into the sea area, but at the same time slows them down into the sea.

Falling sea water, on the other hand, emphasises the impact of wastewater on the coast, but on the other hand transports waste water that may have accumulated during high water to the outer sea. (Pöyry 2015)

7.2.2 Kemijoki river basin management area

Description of the river basin management area

The Kemijoki river basin management area consists of theluma areas of Kemijoki, Simojoki and Kaakamojoki that descend into the Bay of Bothnia, as well as the sea area of Kemi and Simon. The largest rivers are Kemijoki, Ounasjoki, Raudanjoki, Kitinen, Luiro and Simojoki. The largest lakes are Kemijärvi, Suolijärvi and Simojärvi, as well as the artificial lakes of Loka and Porttipahda. The river basin also includes several groundwater areas. (Räinä et al. 2015a)

The coastal waters of the representatives of Kemi and Simon municipalities at sea mile from the shore are part of the Kemijoki Ve fungi management area. The area of coastal waters is about 916 km².

River basin management and marine management plans

The aim of water management is to achieve and safeguard the good ecological status of waters. It is based on the Act on the Organisation of Water Resources and Marine Management (1299/2004). Accordingly, water management aims to achieve the followingbenefits:

- Surface and groundwater status does not deteriorate
- The ecological and chemical status of surface waters is at least good
- The chemical and quantitative status of groundwater is at least good
- The ecological status of artificial and heavily modified waters is at least as good as the changed status of these waters allows
- Restrictions on the entry of pollutants and other harmful and hazardous substances into waters
- Reducing the adverse effects of floods and droughts

In order to achieve the objectives, a river basin management plan and a related programme of measures have been drawn up in the river basin management area, describing the status of surface waters and groundwater and the factors affecting it, as well as actions to achieve good status. On 3 December 2015, the Government approved the Kemijoki river basin management plan for 2016-2021 together with the river basin management plans of other river basin management areas. I am currently in theprocess of updating the plan for the period 2022-2027. Measures aimed at the industry include reducingaccess to the best available technology (BAT) level and good price of harmful substances(Räinä et al. 2015b). The management of the sea is closely linked to river basin management, for which a national marine management plan covering the territorial waters of Finland and the exclusive economic zone has been drawn up. The MMP programmecovers the period up to 2021. Marine management measures include, in particular, eutrophication and harmful substances, as well as measures related to the sustainable use of marine resources and the prevention of invasive alien species (Laamanen 2016).

Water quality

Kemijoki has a significant impact on the water quality and material balances of Kemi. To a lesser extent, the waters of the Tornionjoki and Simo rivers are also affected. The quality of river waters differs from sea waterin many ways. For example, river waters have lower electrical conductivity, darker colour and usually contain more humus, iron, solids and phosphorus than marine water. The quality of river waters changes seasonally and, for example, nutrients and solids are usually the highest in springflooding. In winter, the water mass has been stratified in such a way that lighter river water than seawater spreads over a wide area under ice on top of seawater. (Pöyry 2015)

The Northern Bothnian Bay is clearly phosphorus-restricted throughout the growing season, but in the vicinity of the coast, thepelvic varies depending on the influence of rivers and wastewaters, and both nutrients play a role in limiting basicproduction.

The following figure shows the status of surface waters in the Kemijoki river basin management area in 2013.

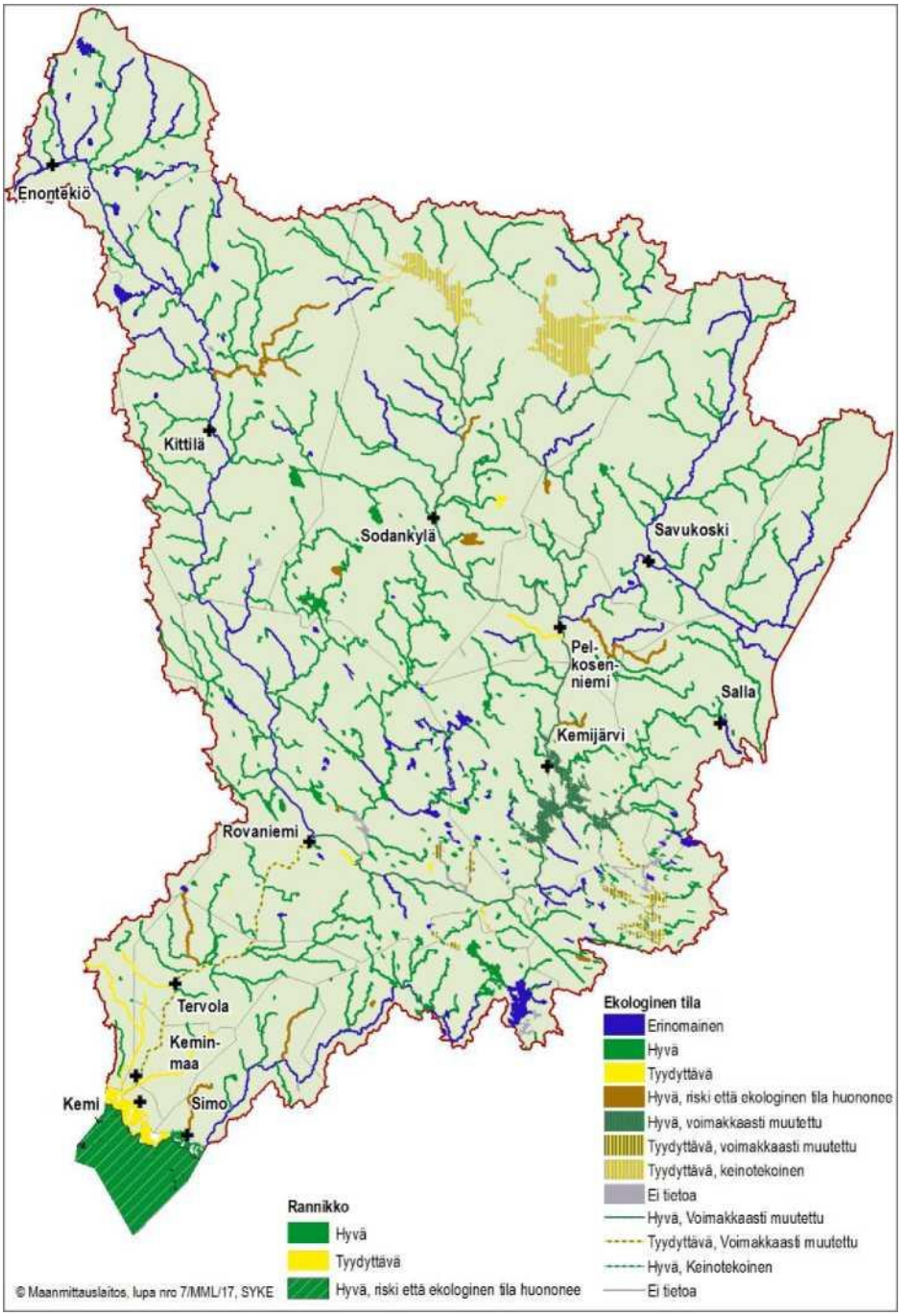

Figure 7-6. Ecological status of surface waters in the Kemijoki river basin management area in 2013 (Räinä 2017 (ed.)).

The inner coastal waters of the Kemijoki river basin management area were classified by Simon, with the exceptionof a positive ecological status. These water bodies close to the coast are subject to loads of both

river

waters and forest industry and city of Kemi wastewater (see Figure 7-8). The effectof the load is visible in the Ajos area, where the quality of water and the biomass of phytoplankton alsoreflect a satisfactory or avoidable condition. The outer coastal water body, Kemi-Simo outdoor,created satisfactory quality based on biological quality factors and good water quality. The ecological status of Simojoki is excellent, the Tornionjoki and Viantienjoki rivers are good and the Kemijoki and Kaakamo rivers are satisfactory. The chemical status of all rivers is good. (Räinä et al. 2015b)

Obligation monitoring

The annual obligation monitoring on behalf of Kemi is carried out on behalf of Metsä Fibre's Kemi mill, Stora Enso Oyj's Veitsiluoto mills and Kemin Vesi Oy. The parties in question are allowed to run waste water infront of us reen Kemi. Metsä Fibre's pulp mill also handles the wastewater treatment of Metsä Board board mill. The obligation monitoring points located in front of Kemi are shown in the following figure (Figure 7-7).

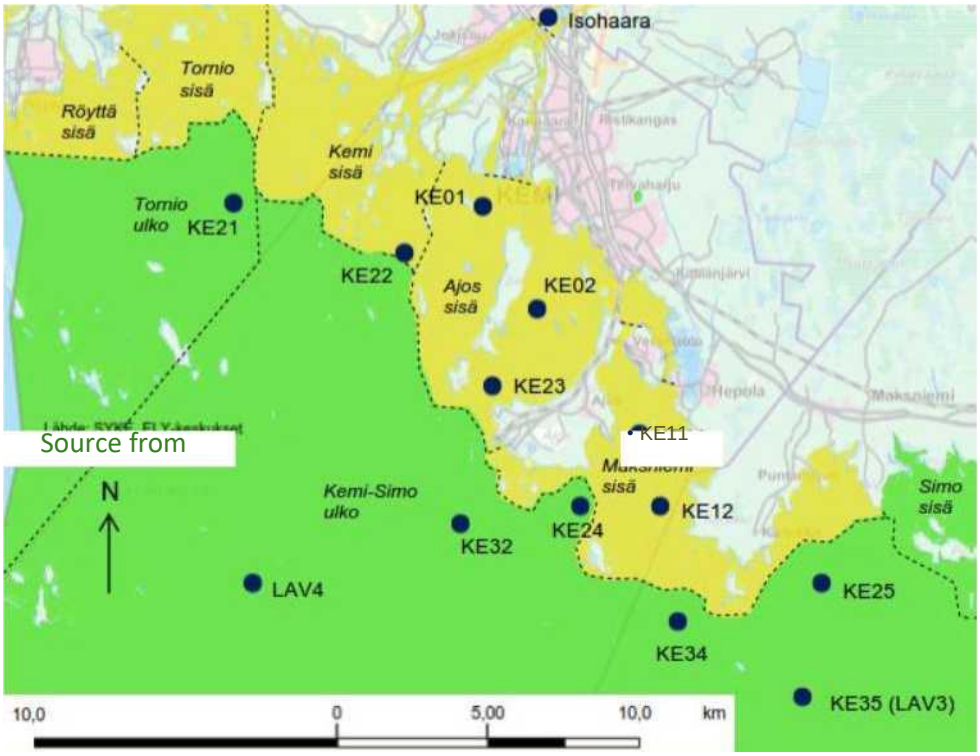

Figure 7-7. The state of coastal waters (green good, yellow satisfactory) and observation points in front of Kemi.

The treated wastewaters from Metsä Fibre and Metsä Board's Kemi plants are discharged off the Kemijoki river, where they are mixed to some extent with river water and are partly transported to the sea through the ratherswampy area between Selkäsaari and Ajos. The treated wastewaters of Kemin Vesi Oy are also introduced into the area in question. The treated wastewater from Stora Enso Oyj's Veitsiluoto plants will be led to the bottom of the Gulf of Veitsiluoto (Figure 7-8).

Figure 7-8. Kemi's current wastewater discharge sites are located in front of Kemi.

The combined water emissions of Metsä Fibre & Metsä Board's Kemi plants, Stora Enso Veitsiluoto mills and Kemi Water have been fairly steady between 2007 and 2017. In 2017, the phosphorus load ending in frontof Kemi was 39 kg/d, a nitrogen load of 1 071 kg/d and a solid load of3.0 t/d. In 2017, the chemical river's material flow rates were 514 kg/d for phosphorus, 18 153 kg/d for nitrogen and 162 t/d for solids (Eurofins 2018)

The quality of water in the sea area outside Kemi has improved over the past decades due tomore efficient sewage treatment. The oxygen situation has improved most clearly in the beginning between Selkäsaari andAjos. The decrease in the phosphorus load from the 1990s can be seen as a decrease in phosphorus concentrations in water almost throughout the monitoring area. There have been higher nitrogen concentrations at the mouthof the Gulf of Knife since 2013 and a slight upward trend in total nitrogen-concentrations is observed. At other points there is no clear trend in total nitrogen concentrations. The average concentrations of chlorophyll-a in the open water season have been typical of slightly lush and lush waters between Selkäsaari and Ajos in recent years. In other parts of the coast, concentrations have been mildly lush and outer, mainly in rough or slightly lush waters. The species of phytoplankton samples consist mainly of latent, gold algae and swallowings. In recent years, there have been no significant changes in species or biomass levels. (Eurofins 2018)

The obligation monitoring for Kemi has included surveys of benthic animals carried out every three years. The benthic benthic fauna of Kemi consist mainly of sparse*catarrhoids*(Oligochaeta) and a variety of surviaääski larvae*(*Chronomidae). The total density or taxon composition of benthic fauna does notdetect acute sewage-derived effects. Based on the 2015 sampling, there has also been a change in the ecological state in the worse direction, e.g. outer from the coast (Pöyry 2016). The composition of the benthic animal can vary considerably from year to year due to natural variations in the ecological factors of benthic benthic animals (this could also be caused by increased loads).

7.2.3 Fisheries and fisheries

The economically significant migratory fish in the sea area are salmon, whitefish and trout, which are mainly dependent on planting. The economically significant species of fish that spawn in the lugs in the sea area are earth, herring and herring. Significant catch species that rise to spawning in coastal waters or coastal inland waters include pike, perch, made bream and roach. Other fish species of low value or low catch include pike, rainbow trout, bark, mussel, kiwi, pole and secret.

In the 21st century, the number of domestic fishermen has decreased in front of Kemi, as the number of households fishing in 2000 was around 500 and in 2012 about 320. There have also been changes in the fishing culture, as net fishing has clearly decreased. In particular, fishing for small pigs with nets has decreased sharply in the long term. A significant proportion of the members of recreational fishermen's organisations are currently fishing for recreational fishing, by throwing rods and trolling, or simply by mocking and wormwood. In recent years, the most significant catch species have been perch and pike.

In the early 2000s, the total annual catch of fish species relevant to the use of domestic fishermen was 30 t, but has since fallen to 17 t. In the early 1990s, the large fish stocks have deteriorated in front of Kemi. Catches of salmon and trout have been small in the sea area throughout the observation period. Today, most of the salmon and trout catches of domestic fishermen are obtained from the Kemijoki mouth below the river Isohaa, instead ofin the sea area.

The number of professional fishermen has decreased significantly in the 21st century in the outskirts of Kemi; in 2000, 43 fishermen were registered in the professional fisherman register and 25 in 2012. Kemi's mainfishing gear, isorys, has also decreased as the number of fishers decreases. The decrease is especially directed to dense traps. The popularity of net fishing has declined sharply in recent years. As the number of fishermen decreases, the total catch in the 2000s has also decreased from 200 t to 115 t.

In the vicinity of Kemi, no direct conclusions can be drawn on the effects of wastewater on fishing. Some of the decrease in fishing and changes in catches of salmon, whitefish and herring, for example, are due to changed profitability factors, fishing limitations and a general change in the fishing culture. (Pöyry 2015)

7.2.4 Use of water bodies and beaches

There are plenty of areas for recreational use in the coastal area. For example, AJok's eastern shore,the majority of Selkäsaari, the southern shores of Kuivanuoro, Kiikeli area and some of the smaller islands of the sea have been designated asa recreation area. The nearest recreation areas are located in Kiikeli, Kuivanuoro and Mustakarinnokka area about 1.5 km from the current factory area.

The sea area off Kemi is used for domestic and recreational fishing, boating, swimming and outdoor activities. The area is home to one EU swimming beach (Mansikkanokka), Paavonkari public beach and a winter swimming site for the sailing centre in the north-west of Mansikkanokka.

The sea area between the Ajoss-Selkäsaari mainland, the area west of Selkäsaari and the area east of Ajos in the Gulf ofVeitsiluoto are the free recreational fishing area of the city of Kemi. The area's holiday settlements are concentrated on the Kemijoki mouth and the largest islands, Selkäsaari, Täikko and Ajos. Summer cottages and holiday residents use seawater as sauna and washing water mainly during the summer. (Pöyry 2015)

7.3 Air quality and climate

7.3.1 Air quality

Regulations on air quality

The Government Decree on ambient air quality (79/2017) lays down provisions supplementing the Environmental Protection Act (527/2014) necessary for the implementation of Directive 2008/50/EC ofthe

European Parliament and of the Council on ambient air quality and cleaner air.

Limit values for concentrations of sulphur dioxide (SO_2), nitrogen dioxide (NO_2), inhalable particulate matter (PM_{10}), fine particles ($PM_{2.5}$), lead (Pb), carbon monoxide (CO) and benzene (C_6H_6) inambient air are given for health protection purposes, which refer to the highest permitted concentration of air pollutants. The limit values also aim to prevent acidification and eutrophication of the environment.

In addition, there are stricter annual limit values for sulphur dioxide and nitrogen oxides to protect ecosystemsand wildlife.

In addition to the limit values, different air quality target and guideline values have been issued. Annual targets have been set forarsenic, cadmium, Nikke li and benzo(a)pyrene.

Table 7-2. Air quality limit values to protect health.

Substance	Average calculation time	Limit value	Authorised exceedanc
Sulphur dioxide (SO_2)	1 hour	350 pg/m^3	24
	24 hours	125 pg/m^3	3
Nitrogen dioxide (NO2)	1 hour	200 pg/m^3	18
	1 year	40 pg/m^3	*
Particles (PM^{10})	24 hours	50 pg/m^3	35
	1 year	40 pg/m^3	—
Lead	1 year	0.5 pg/m^3	—
Particles ($PM^{2.5}$)	1 year	25 pg/m^3^	*
Carbon monoxide (CO)	8 hours	10 mg/m^3	—
Benzene (CgHg)	1 year	5 pg/m^3	—

Table 7-3. Limit values for protecting ecosystems and vegetation forsex.

Aine	Keskiarvon laskenta-aika	Raja-arvo
Rikkidioksidi (SO_2)	kalenterivuosi ja talvikausi (1.10. - 31.3.)	20 µg/m^3
Typen oksidit (NO, NO_2)	kalenterivuosi	30 µg/m^3

Table 7-4. Annual air quality target values for metals and benzo(a)pyrenes.

Substance	Target value 1.1.2013
Arsenic (As)	6 ng/m^3
Cadmium (Cd)	5 ng/m^3
Nickel (Ni)	**20 ng/m^3**
Benzo(a)pyrene (C-12H20)	1 ng/m^3

In addition to the limit values, guidelines have been issued for carbon monoxide, nitrogen dioxide, sulphur-dioxide, total fluidised earth (TSP), inhalable particles and stinking sulphur compounds (TSR). In addition, a target value for sulphur deposition has been set to prevent acidification.

Table 7-5. Air quality guide values.

Substance	Guide value	Statistical definition
	(20 °C, 1 atm)	
Carbon monoxide (CO)	20 mg/m^3	hourly value
	8 mg/m^3	the highest eight-hour moving average of the day
Nitrogen dioxide (noj)	150 pg/m^3	99th percentile of hourly values of the month
	70 pg/m^3	second highest daily value of the month
Sulphur dioxide (SO2)	250 pg/m^3	99th percentile of hourly values of the month
	80 pg/m^3	second highest daily value of the month
Particles, total fluidised fluidised (TSP)	120 pg/m^3	98th percentile of day-ahead values of the year
	50 pg/m^3	annual average
Inhalable particles (PM^Q)	70 pg/m^3	second highest daily value of the month
Total stinking sulphur compounds (TSR)	10 pg/m^3	the second highest daily value of the month TSR is reported as broken

Air quality in Kemi

Systematic monitoring of air quality in Kemi-Keminmaa began in 1992. The monitoring system had three measuring stations in Kemi and one in Keminmaa. All stations measured sulphur dioxide and odour concentrates. In addition to the previous ones, one of Kemi stations also measured nitrogen oxides and weather data. Kemi's air quality measuring devices reached the end of its life cycle, after which air quality monitoring was given tothe external meter for 2013-2014 (Nablabs Ambiotica).

The environmental impacts of Kemi's pulp and paper industry's emissions into air have developed positively since the 1990s, including reduced sulphur emissions. Total sulphur emissions in the Kemi-Keminmaa region have decreased from around 1,800 tonnes (1990) to around 597 tonnes (2006).

According to the latest measurements, Kemi's air quality is below the limit values set for sulphur dioxide, nitrogen oxides and inhalable particles. The highest concentrations of NO_2were observed during winter

time, especially in the mornings from 06 a.m. to 09 a.m. on cold days, when mixing is low. For reduced sulphur compounds, the guide value was exceeded three times during the measurement period. Air quality is now mostly at industrial level. The annual nitrogen dioxide content is similar to that of large cities near transport routes.

Bioindicator studies have also been carried out in Kemi on the impact of sulphur emissions on pine needles in 1979, 1989, 1999 and 2009.

7.3.2 Climate

Kemi's weather is monitored at three different weather stations: Kemi-Tornio Airport, Kemi I beacon and-AJokse. In addition, there is also a mareographer, i.e. a sea level measuring station.

The average temperature of the Bothnian Bay coast is about + 1.5 degrees. The warmest month of the year is typicallythe month of July, when the average temperature in the Kemi-Tornio region is less than + 16 degrees Celsius. The average number of hot days between 1981 and 2010 was 4-8, and sometimes the temperature has risen by more than 30 degrees. Frost has occurred on averagebetween 2 and 10 nights during the summer.

The annual precipitation in southern Lapland is mostly between 500 and 600 millimeters. It rains least by the Bothnian Bayof Niko. The least rainy month is usually April, but in some cases also February. Rainfall is typically between 25 and 35 millimeters. It is rainiest in July, when the rainfall is between 65 and 85 millimetres. In the Bothnian Bay of Bothnia, August is almost as rainy.

The main direction of wind flow at Kemi Ajos measuring station is south-south-southwest.

In front of Kemi, south and south-western winds are unfavourable for the change of water. For example, during the 2007 open water season (May-July), the share of these winds at the Ajos measurement station in Kemi was 19-29 %, in August-October 40-61 % and in November 26 %.

7.4 Vegetation, fauna and protected sites

7.4.1 Vegetation and fauna

Vegetation

The plant area is located in the forest vegetation division in the central boreal zone and, more specifically, in the area of the Lapland Triangle (Figure 7-9). The central boreal zone is characterised by the abundance of peatlands and the extreme climatic conditions of the southboreal zone. In addition to Northern Kuusamo, the area of the Lapland Triangle is an important fly and grove centre. In addition to birch platters, the Lapland Triangle area has almost all the differenttypes of braids. The range of lush neva corpses, grasses and grasses is also very representative, but the specific characteristics of the area are birch trees.

The coniferous forests in the Kemi region consist of dry pine fabrics and fresh foliage-like spruces. In leaf-dominated areas, sand birch and a grey alder dominate. The areas of diverse vegetation include small fresh groves focused on streams and bedrocks, as well as abundant kos teagroves (mainly the eagle winged Matteuccia struthiopteris fern groves). In some places, the groves havesubdued cultural effects.

Theground uplift rate in the area is 7.3 mm per year. However, due to the abundant river water effect, the vegetation of the coastal areas is not typical of the botanical vegetation of the Bothnian Bay. For example, coastal meadows resemble flood meadows on the banks of chemicals. The shore meadows are lined with bushes and coastal forests. There are also small sandy and slush beaches in the area.

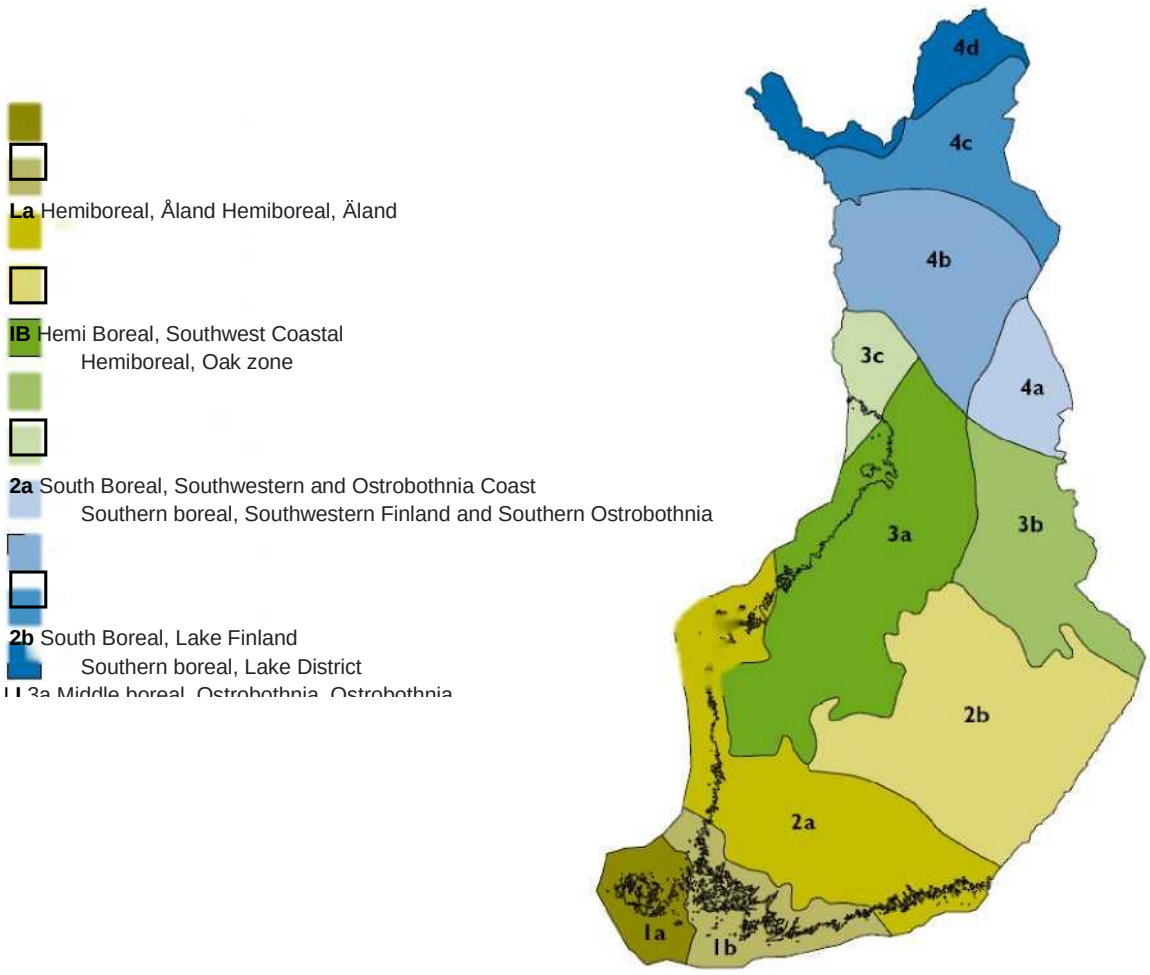

Figure 7-9. Vegetation zones.

Birds

There are areas in the Bothnian Bay that are suitable for different types of birds and thus maintain a diverse range ofbirds. Some of the species present on the shores of the Bothnian Bothnian Bay are linked to coastal waters either as a result of food sourcing or nesting. Of course, birds from meadows and forests can also be found on the islands of the Bothnian Bay.

Of the game chickens, there are groves, grouses, paws and grouses in the area. Among the waterfowls, game birdsinclude blue duck, hat, TV, aspen and soot.

Other fauna

There are two species of seals in the Bothnian Sea: Baltic seal (Phoca hispida botnica) and grey seal (Halichoerus grypus). The seal is better adapted to the conditions of the Bothnian Bay and its breeding areas include the Pea Seain addition to the Gulf of Finland and Riga. The breeding season of the seal in Kvarken takes place on the pearl-male moon, when the seal gives birth to its young on solid ice in snow caves. For most of the summer, the sealtakes this lonely life in a wide area, and it doesn't occur very often, like the grey sheath. The grey shelf thrives as large flocks near small islands and on rocks, making it easier to detect. Usually the grey seal moves far away from the coast on the outer pits or in winter on the edges of ice still further away from the shore. Unlike the seal, the grey seal gives birth to its chick directly on the ice at the end of February or March and is dependent on the proximity of open water, as it does not know how to keep the iceholes open, unlike the seal. As a result, the seal range extends northwards than the greyseal.

Kemi and the coast of Kemi are part of the Keminmaa Wildlife Management Association.

Analysis of the nature values of the factory site

The basic nature values survey of the Kemi Pajusaari plant site was carried out in 2010 (Suomen Naturetieto Oy 18/2010). The inventory area covered the plant area and the area north of the plant area. According to the report, there are no protected natural habitats in accordance with section 29 of the Nature Conservation Act, habitats of particular value in accordance with section10 of the Forest Act, or small waters, traditional landscape sites or traditional biotopes referred to in the Water Act. There are no flying squirrels in the area and the target does not matter as the potential habitat of the flying squirrel. No natural Annex IV species were observed inthe area, but the demersal bat was found to be potentially prey in the estuary area. The industrialbuildings in the Inve area were found to have plenty of accommodation suitable forbats.

Among the species in Annex I to the EU Birds Directive (Council Directive 79/409/EEC) were found to be included in the breeding site. The bird species mentioned in the national classification of endangered species are nestled with a laughter gull and a stone pouch. The northern part of the area is leafy, bushed and eutrophic former woodland,and the area's vascular flora is very culturally intensive.

7.4.2 Nature reserves and protected sites

In the sea area off the coast of Kemi there are several sites, nature reserves and nature conservation programmes attached to the national Natura 2000 protection programme. The Bothnian Bay National Park (Natura site FI 130 0301) was established under the Nature Conservation Act and is responsible for protecting the landscape of thearchipelago. The peculiarities of the national park include the biota of low-salt water and the vegetation characteristic of land uplift beaches. The Bothnian Islands complement the conservation of habitats and species of the Bothnian Bay National Park and the Bothnian Bay in general. The areas are significant in their bird population.

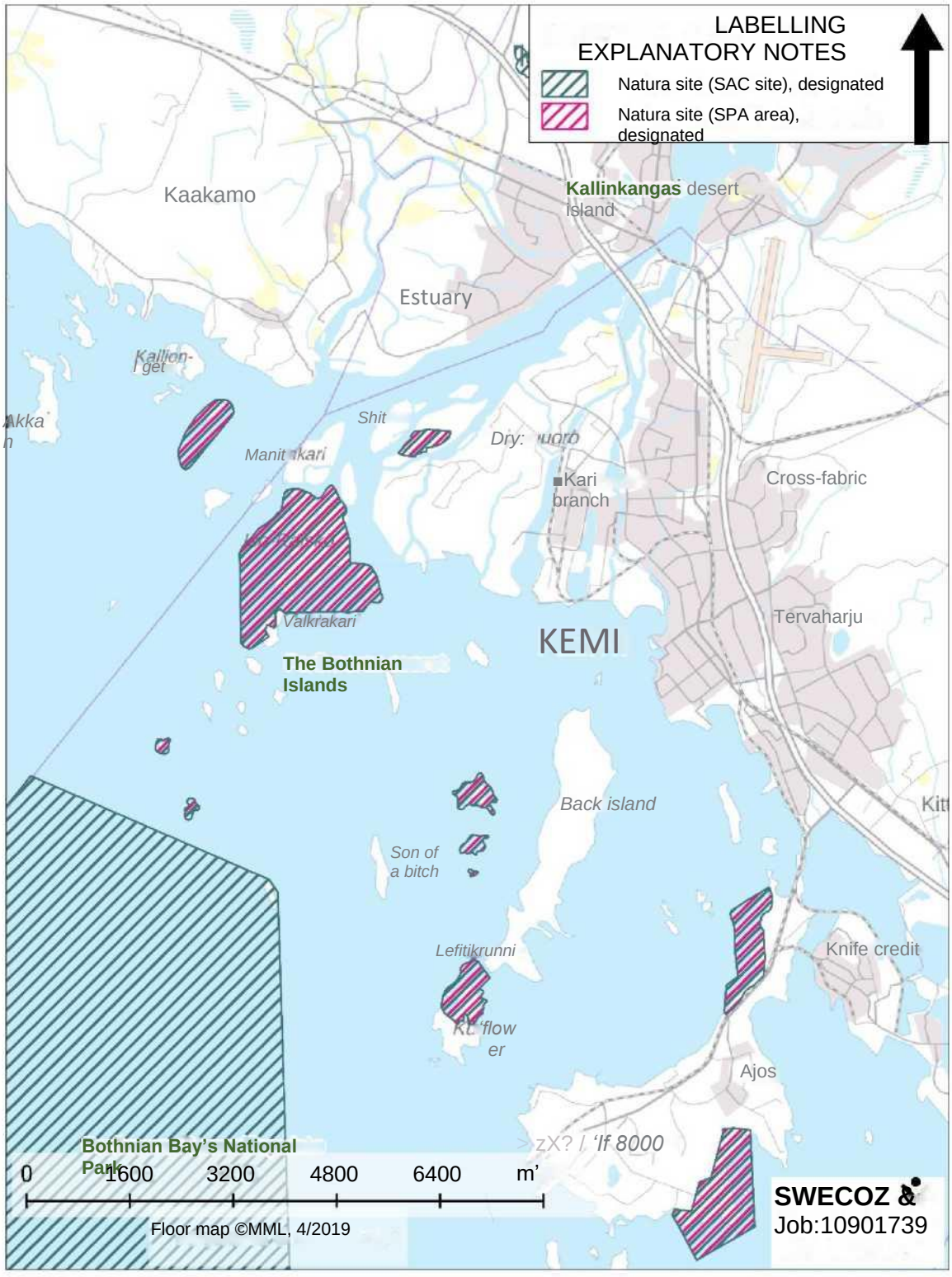

Figure 7-10. Natura-Environmental Areas.

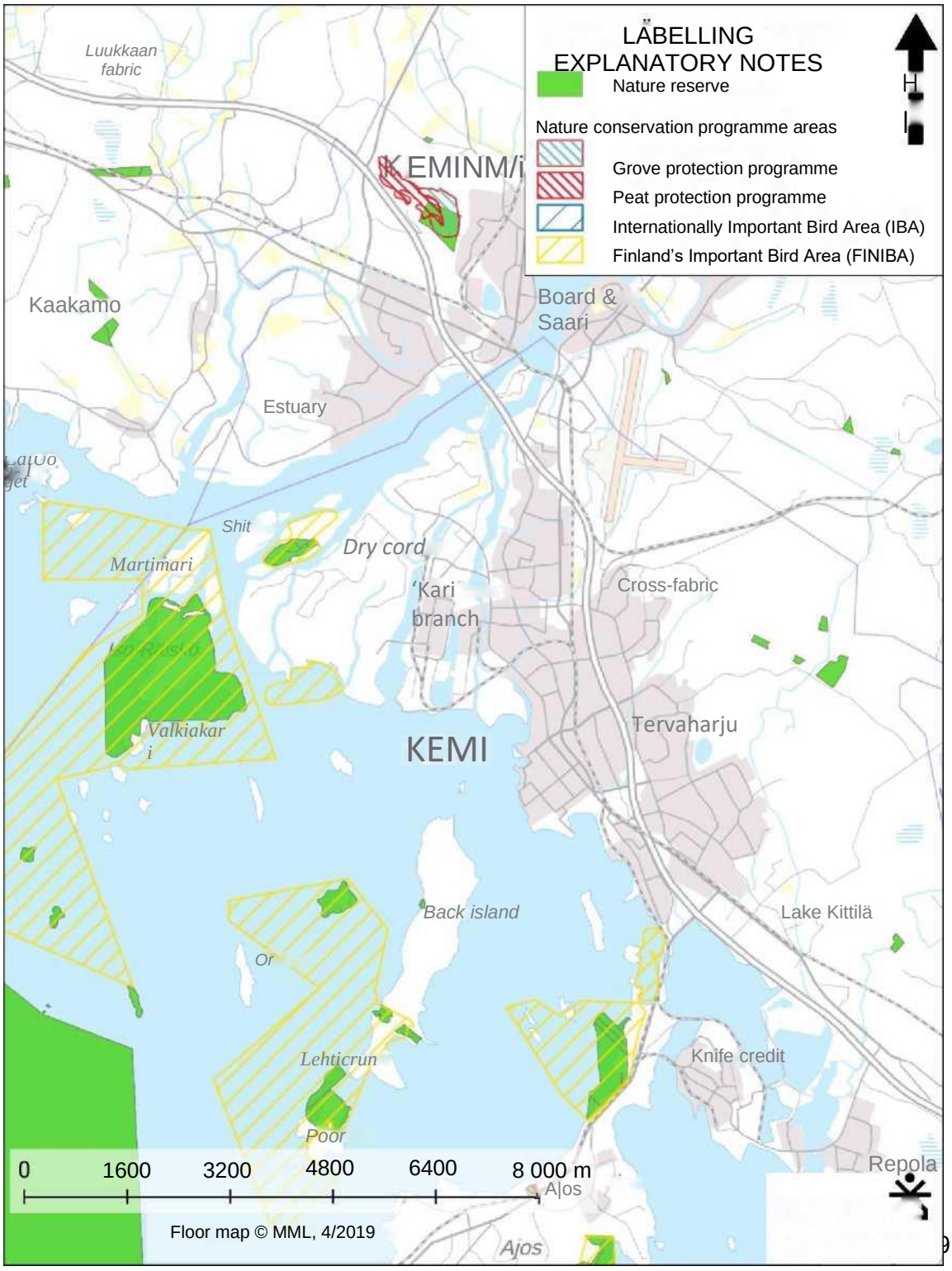

Figure 7-11. Nature reserves and conservation programmes.

7.5 Landscape and cultural environment

7.5.1 Landscape

Kemi's front is part of the Bothnian Bay's land uplift coast, a shallow coastal zone with itsown woman's own coastline breaking and large river estuaries. The River Tornionjoki falls into the Bothnian Bayin a long way to the sea in the form of tea, the estuary to the north is lowered by the Kemijoki River, and a slightly smaller Simo river runs to the east. The area belongs to the landscape region of Pe-Rähjola-Lappi and more specifically the Keminmaa region. The Keminmaa region has an altitude that islighter than the rest of the landscape region, with varyingly floating terrain.

Land uplift is one of the typical features of the Bothnian Bothnian coast. As a result of the land uplift, the vegetation of islands and beaches forms clear zones. As the land rises, the vegetationzones move and the pioneer species of the land rising from the sea are taken over. Gradually moving inland,the vegetation grows and turns from shrub to forest. The water area has shallow islands, ponds and shallows.

For almost a century and a half, the Kemi area has been the centre of strong industrial activity, so the landscape image is strongly dominated by industrial infrastructure and its various functions.

7.5.2 Cultural environment

The publication of Kemi's Cultural Environment Programme "City of Marine and Industry", 2013, has collected extensive cultural information about the region and presents the cultural environment sites of the City of Kemi. The thesis has assessed the cultural environment in terms of both the archaeological and the built cultural environment. The publication also includes a section on the use and management of the cultural environment, which presents ways, ways and opportunities to manage acultured environment: archaeological heritage, building heritage and landscape. The publication can be found in the appendices.

The nationally significant cultural environments of Kemi include:

- Isohaara power plant and Vallitunsaari power plant community
- Karihaara factory community
- Kemi's grid plan area and the surroundings of the church
- Bus stations at Lapland's central points, Kemi bus station.
- Lapland's floating and trekking bases, Myllyniemi sorter area.
- Fishing harbours and fishing bases in the Bothnian Bay, Valkiakari, Dry Youth Crane and Selkä-Sarvi.
- Ostrobothnia beach road, Kemi.

In the vicinity of Metsä Fibre's Kemi factories and partly also on the factory plot, there is the built cultural environment of Karihaara's teh-daysyskunta and the built cultural environment of Kemi Oy's industrial environment in Karihaara, the buildings protected by the town plan are listed in the table below (Table 7-6).

The Sorter Territory of Myllyniemi is located in Sotisaari, about one kilometer from the factory area. The new phase station plan removes protection from all five construction sites located in thefactory area. Metsä Group is committed to the following measures and practices:

1. Metsä Group does not apply for demolition of any of the five protected buildings immediately after the phase gun has become legally valid, but only when the project for the construction of a new bioproduct mill or the development of the existing plant begins.

2. If the construction project for a bioproduct mill moves to an indefinite time and it is obvious that the entire Pajusaari-Sahansaari area is not needed for the development of the current plant, Metsä Group will apply for anarea that has not been under construction by 2025. This plan amendment seeks to restore the protection of these five protected buildings.

Table 7-6. Karihaara factory community.

Factory area
Saw
Saw barrel and workshop, sr-1
Pajusaari Saw Gate
Workshop
Former SPRITIES
Outside the factory area
Old residential buildings in Mäntylä
Karila (office building)
Civil Service Club
CEO’s apartment
Canteen building
Kontula residential building
Kerhola (Kukkola)
Kemilä
Firehouse
Doctor’s apartment
Head office and garage
Manager’s Club
Pajusaari School

7.6 Soil, bedrock and groundwater areas

7.6.1 Soil and bedrock

The Kemijoki estuary area is characterised by ridge, estuary and beach deposits, which are mainly formed on top ofthe layer of moraine. Moreenia is visible on the ground mainly in a sheltered estuary in Rastinsaari, where leaching has been directed only at the edges of the streams.

In Pajusaari, in the Metsä Fibre area, moreen is covered by a typically thick river cedar in the area. The surface part of the layer is usually loose and medium-tight sand at a thickness of about 1-2 metres, and the lower part of the layer consists of moderately or strongly compressing silt or lean clay. The topsurface of moreen is usually at a depth of approximately 5-8 metres from the ground, and the moraine rises to the surface only in narrow areas around KUORIMO 3 and the current canteen building. Moree nilayers that cover therock are non-homogeneous and thick, and the rock surface is usually at a depth of 18-25 metres from the ground. The majority of the factory buildings in the area and all important machine units have been set up on poles on either dense moraine or rock.

The area of Pajusaari has been filled in many places in connection with construction operations. The shore zone of KUORIMO 3 and some of its wood-field areas are terraced with moraine-type masswamps dred on the basis of Kurimon branch. In the early stages of the operation, meesa (calcium carbonate) and muzzles have been deposited in the southern part of Pajusaari. The southernmost part, which still operates as a

landfill site and served as an ash dumping site (landscaped), has been separated from the sea by embankments, and the clay and silt layers at the bottom of the area act as a natural insulator forthe bottom of the waste facility.

In the Sahansaari region, the natural soil conditions are similar to those in the Pajunsaari region. Mo rhine areas are mainly found around old kiln buildings. The current northern edge of Sahansaari and part of the western edge has been formed in shallow waters with land fillings. Since the mid-1990s, the northern parts of the sawmill basin have been filled with excavation soils, ash and suction pads in the southern part of Vähähaara.

The surface of groundwater in the area is usually about 1-1.5 m deep from the ground surface. The main streamsof the groundwater are in the area west towards Vähähaara and east towards the strait between Kiikeli and Vähähaara. As the water level in Vähähaara is maintained by damage arrangements between Pajusaari and Vähähaara above the sea water level, the north-south subdivision of groundwater should be located closer to the west shore of the island.

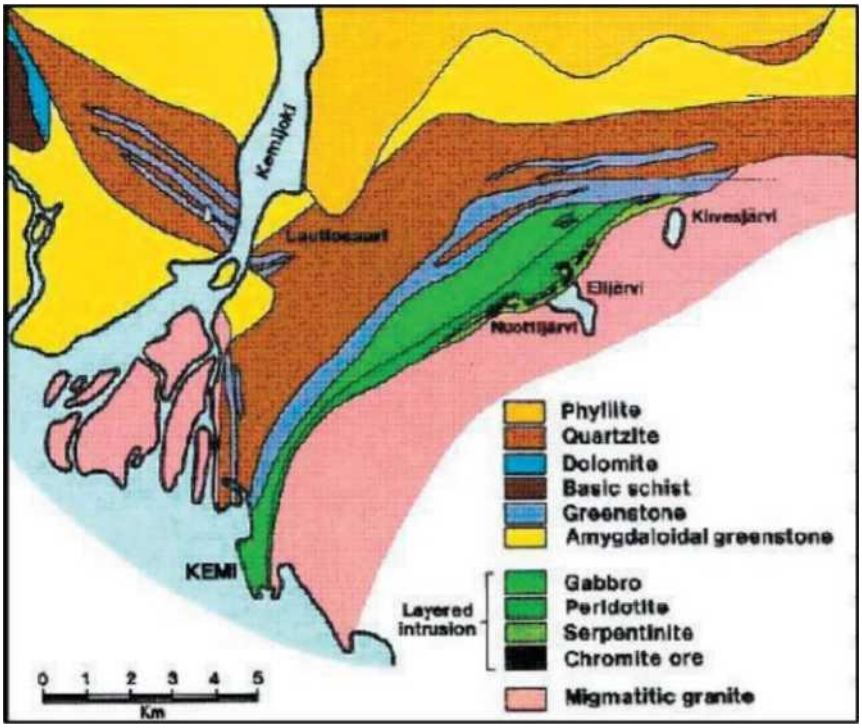

Figure 7-12. Bedrock map of Kemi area (Outokumpu).

7.6.2 Groundwater areas

The classified groundwater areas in the Kemi area are shown in the following figure. Dry yarrow (no. 1224002) and Vähä-Kuivanuoro (1224003) are groundwater areas suitable for water supply (category II), which do not, however, have water abstractions. To the north of the dry youth, the Sotisaari groundwater area (1224004) belongs to Class III. The groundwater in the factory area has no connection with the proposed groundwater areas. In addition,AJok on its island has an important groundwater area (Class I, 1224001).

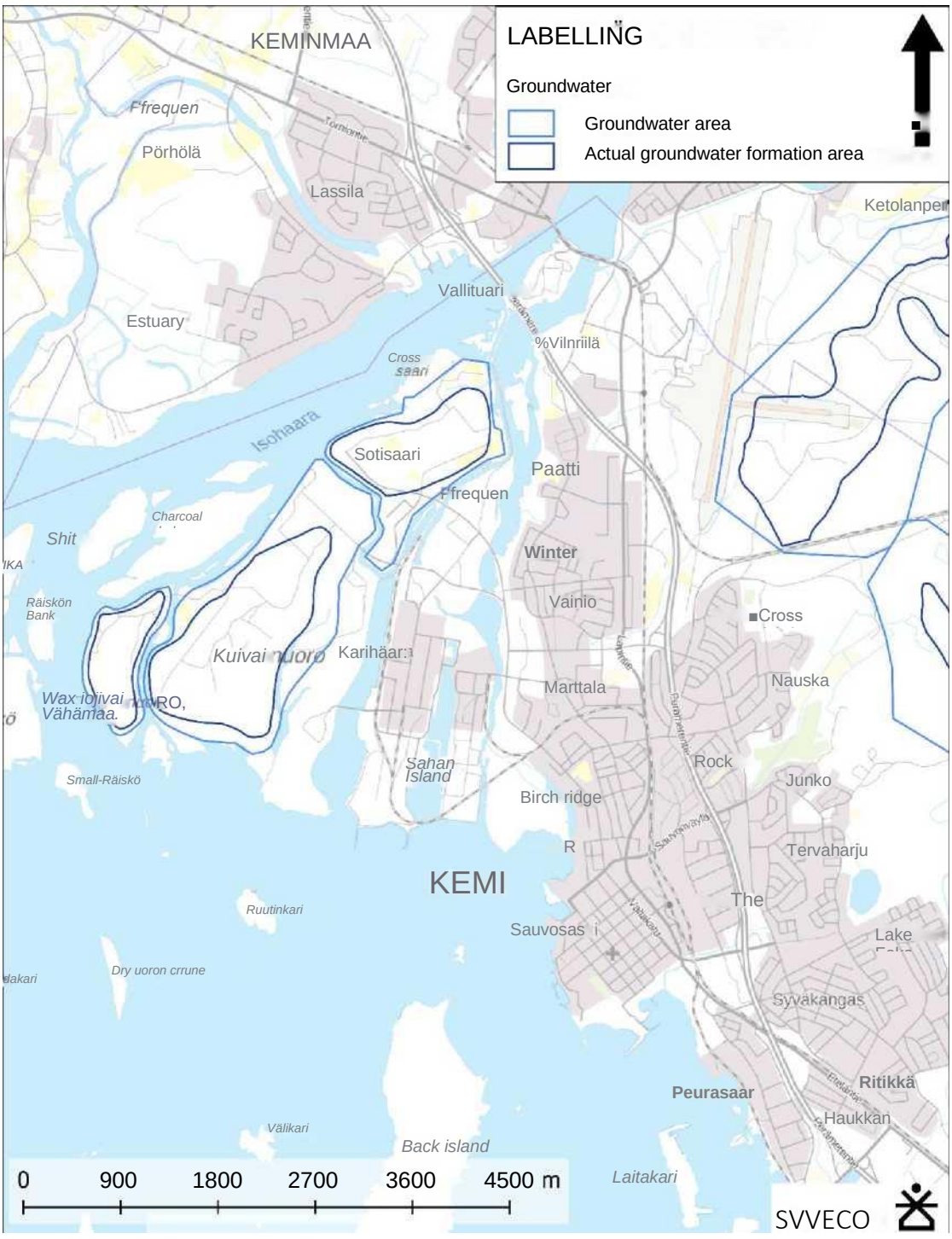

Figure 7-13. Groundwater areas.

7.7 Transport

7.7.1 Current traffic volumes

The transport of wood raw materials and consumables and outgoing products to the Kemi mills takesplace by road and rail. Most of the wood material comes by rail. Chemicals and other essential substances used inthe production process arrive at the factory by car. The factory's products are transported byroad to the port of Ajos, from where they will be delivered on board ships to users. Accessories, like talloil and turpentine, are transported away by cars.

The mills now have about 300 heavy-duty vehicles in full operation per day. Traffic is 24 hours aday. Heavy traffic has been steered from highway 4 along the shortest possible route. Light freight and passenger transport takes place along several routes, mainly via the main gate. Light vehicles in theteh das area run around 500 days mainly during daytime. Light-duty vehicles have been reserved for the patioareas, as a rule, near the gates outside the factory fence. On the inside there is a limited number of seats marked as temporary parking.

The following table and maps show the current traffic volumes in the environment.

Table 7-7. Traffic in the environment.

Road transport, vehicle/day	**in 2018**
Highway 4, near Kemijoki	15 264
Highway 4, Deep Fabric	10 686
Ajoksentie, to the island	1 727
Freight transport on lines, 1 000 t/a	**in 2016**
Oulu-Kemi	1 636
Rovaniemi-Kemi	1 021
Shipping, Ajos, million	**in 2017**
	1,5

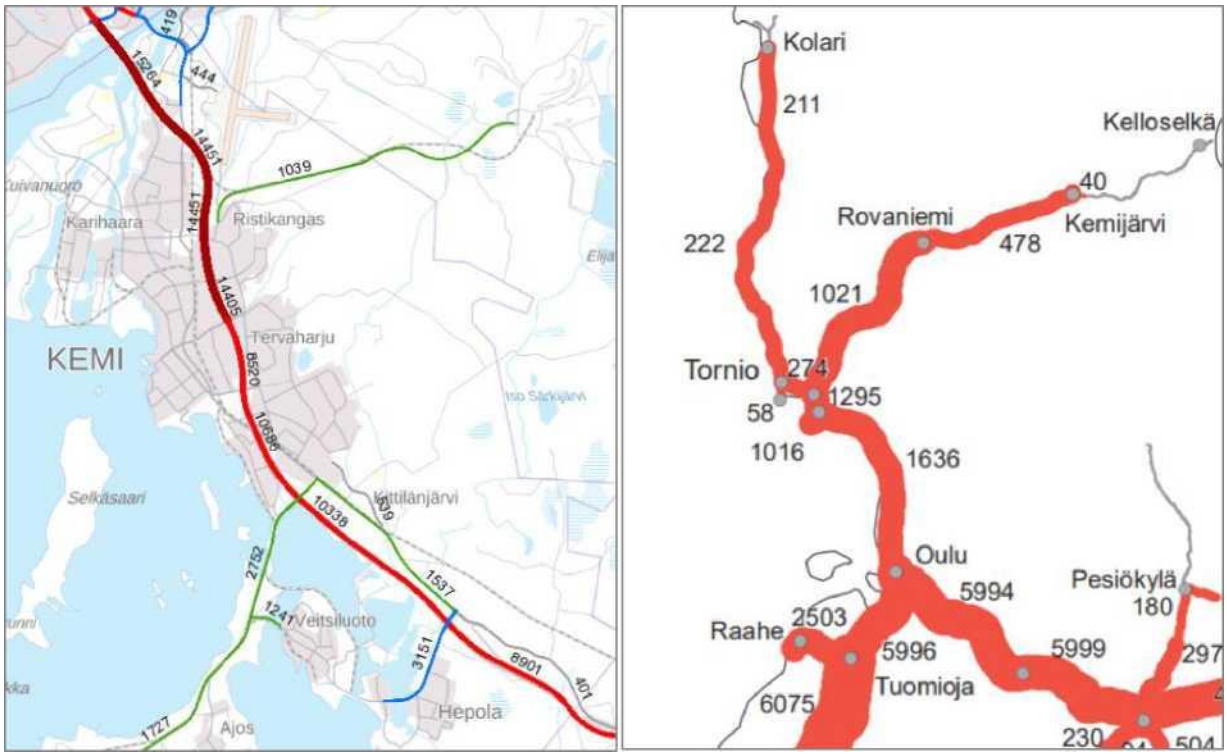

Figure 7-14. Average daily traffic volumes of Highway 4 and Ajoksentie in 2018 and net tons of railwaytea transported (1 000 t/a) by line around Kemi in 2016.

7.7.2 Major transport plans and projects in the region

Raw wood terminals

The rail transport network for roundwood will be developed jointly between the Finnish Transport Agency,the forest industry, the forest government and the railway company. The aim is to improve cost-effectiveness and security ofsupply by shifting to full train transport and centralising loadings.

The target is that a network of 14 terminals and 32 loading points will be in place in 2019 with24 sp wagon full trains with sufficient intermediate storage areas. The following picture shows the situation in Northern Finland in April 2016.

Figure 7-15. Rawwood terminals in Northern Finland.

Kemin Ajos fairway project

The current running depth of the Kemi Ajos fairway is 10.0 metres. At the moment, there is a need to deepen the route to a depth of 12.0 metres. Related dredging and spillage work and safety law related to the marking of the fairway. The implementation of the project is also related to the port's deepening work,

the planning and implementationof which will be carried out by the Port of Kemi. The deployment can take place at the earliest in 2021.

The fairway project has been related to the enrichment transport of planned mining projects in the Kolari region and Stora Enso's raw wood imports from South America. The total volume of transport is estimated to be slightly below 3 million tonnes per year, while the port's international transport volume in 2017 was approximately 1.5 million tonnes. Since the mining projects have not been completed, the fairway project has not progressed. The realisation of option 1 will resultin transport close to 3 million tonnes and the fairway project will be investigated.

7.8 Noise

Noise from the operations of the Karihaara forest industry area has been investigated several times; most recently in 2014. The report takes into account the operations of Metsä Fibre Oy's pulp mill and Metsä Board Kemi Oy's board mill and traffic related to their operations as sources of noise. Finnforest plc's sawmill inthe area has ended.

According to the study, noise caused by the operation of a factory in the environment is typical of the process industry with constant noise and humming, which due to the nature of the operation is quite even at different times of the day. A very small difference in noise maps can be seen in the surroundings of traffic routes, but the differences in them are also quite small. Traffic to and from the industrial area is fairly steady around the clock. Based on observations made in the environment, the noise caused by the forest industry areais not narrow or impulsive.

The noise guide values set out in the environmental permit are below the mid-day noise level (55 dB) and night time (50 dB) average sound level.

For measuring points used as the mean sound level of the measurement period caused by pulp and board mills, the measurement points were 40...51 dB(A). The sound level was highest in the Kuivajuoro/Sotisaari area at the points that are located at the bottom of the peeling plant. There are a total of ten residential buildings in this area. Based on the measurement results, the average sound level of the day or day does not exceed 55 dB(A) in any residential building. In the area of Dry Youth/Sotisaari, the average noise level during the night time peaked precisely in the target valueof 50 dB(A). In the nearest building (Karula), the average sound levels of the three measurement periods were measured at 51, 50 and 50 dB(A). In the National Land Survey's data, Karula is not marked as a residential building, but according to an on-site observation, the building may live in it. For other residential buildings, the average noise level during night time is below the target value of 50 dB(A). The following figures (Figure 7-16 and Figure 7-17) show the average noise levels of daytime and night time caused by the operation of the factories.

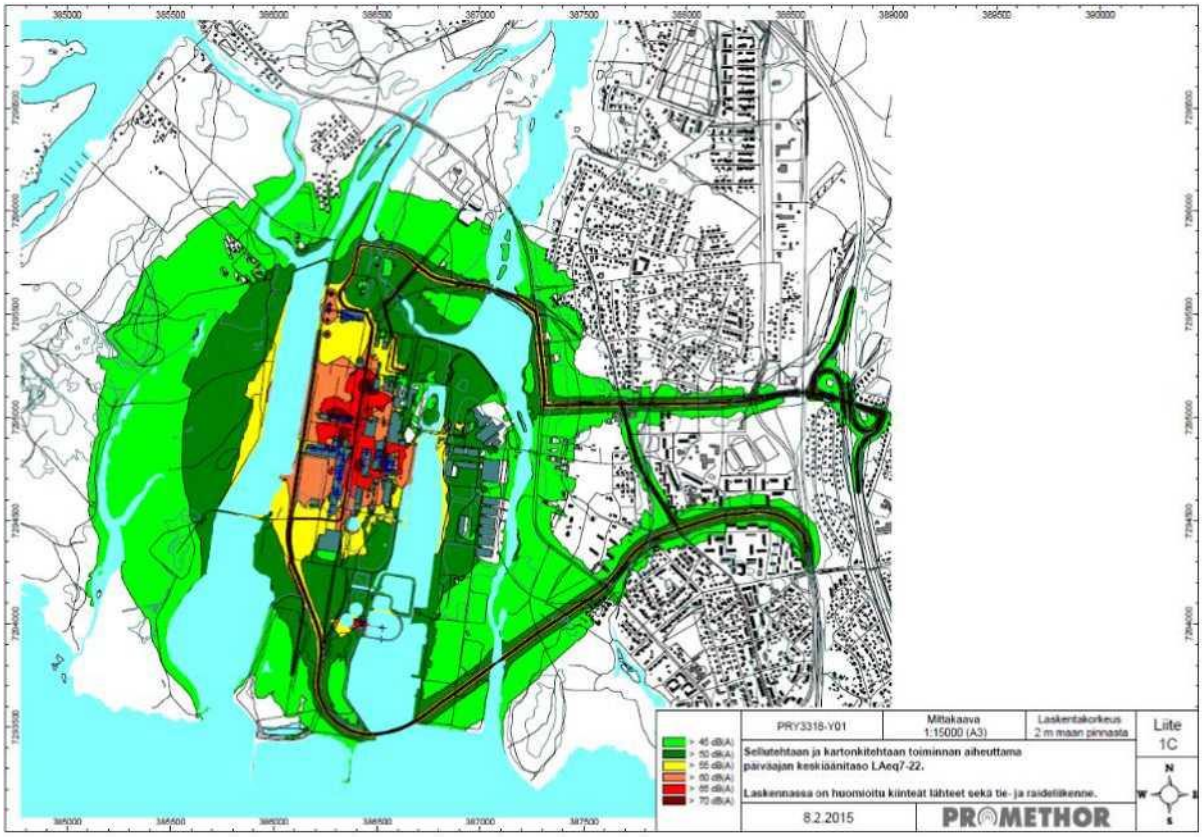

Figure 7-16. The average noise level of the daytime caused by the pulp mill and the operations of the board mill.

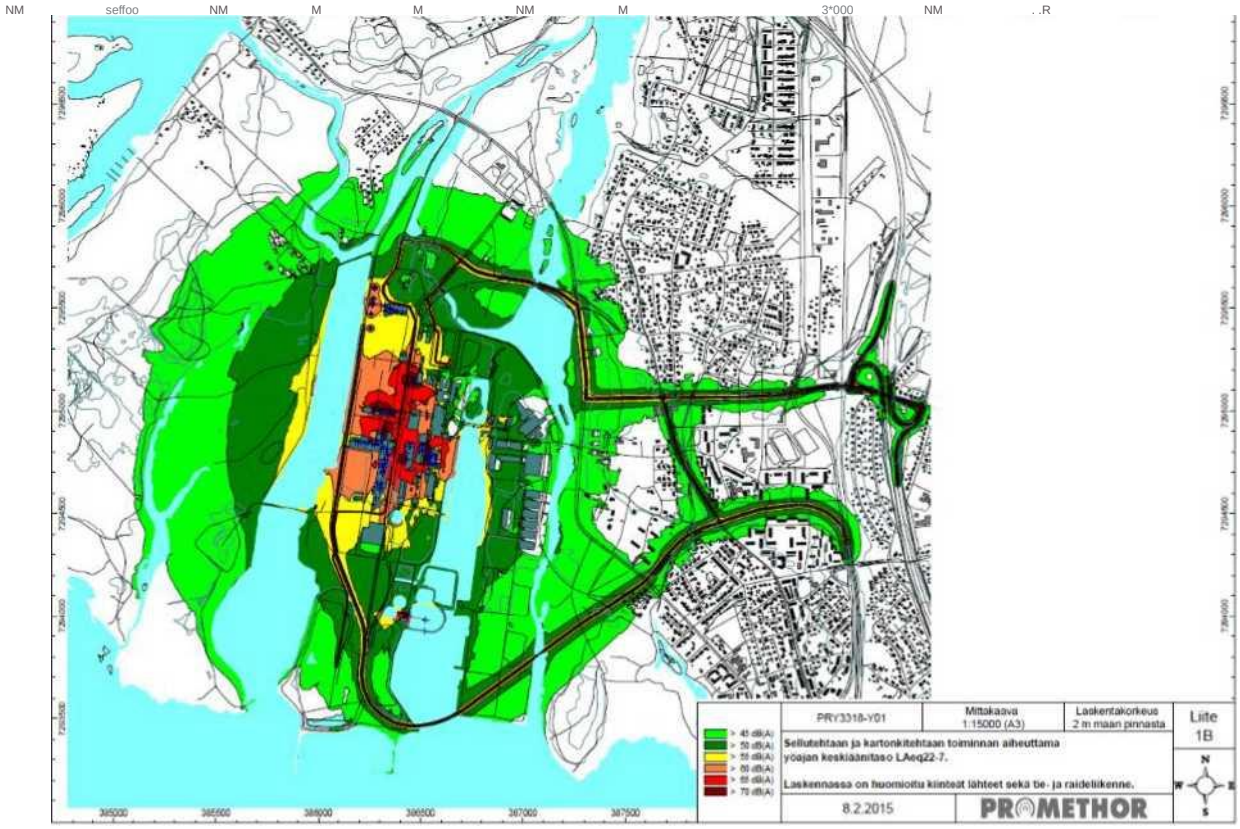

Figure 7-17. The night-time average noise level caused by the operations of the pulp mill and the board mill.

8. Plan for Environmental Impact Assessment

8.1 Starting points and limits of the assessment

In accordance with the EIA Act, the assessment examines the environmental impacts of the project:

- population and human health, living conditions and comfort
- soil, water, air, climate, vegetation, organisms and biodiversity
- urban structure, buildings, landscape, urban landscape and cultural heritage
- exploitation of natural resources
- interactions between these factors.

The assessment is based on information on the current environmental situation and the estimated changes resulting from the project. The environmental impact assessment takes into account the effects of construction, operations andactivities during the deception. The evaluation will focus on the analysis of the impact of the action in the course of the work.

When assessing environmental impacts, emphasis will be placed on the impacts assessed and perceived as significant. Informationon matters that citizens and various stakeholders have identified as important can be obtained in the context of, for example, a tenant survey and information and consultation procedures.

The significance of environmental impacts is assessed, for example, by comparing a certain amountof environmental loads with environmental resilience, taking into account the current environmental load on the site. The assessment ofthe tolerance of the environment is based on, among other things, the given guide values, such as the air quality and noise level guide values and available research data.

According to preliminary estimates, the most significant environmental impacts of the plant project are related to water and airemissions, noise and the transport of raw material and products. Other key environmental aspects include possible accidents and disruptions.

The evaluation report examines the environmental impactsof operations located in and outside the project area of the bioproduct mill. Activities outside the area include, for example, traffic built bythe factory and during operation, as well as the procurement of raw materials.

The scope of the assessment is presented in more detail in the following paragraphs on an impact-by-impact basis. For the zero option, the environmental load (noise, traffic volumes, etc.) is estimated and compared with theimplementation options.

The review area refers to the area defined for a particular type of impact in whichthe environmental impact in question is investigated and assessed. The extent of the scope of the review depends on the environmentalimpact under consideration. For example, the effects of air emissions are examined within a radius of about 10 km from the location ofthe bioproduct mill. The result of the assessment is an impact area where the environmental impact is estimatedto occur.

In accordance with theEIA Act, sufficient expertise must beavailable for preparing an environmental impact assessment programme and report. The persons participating in the assessment work in the EIA procedure are presented in the following table.

Table 8-1. Experts involved in the evaluation work.

Name and company	Training	Role	Qualification
Reetta Hurmekoski Sweco	Di (Energytekniikka) 2013	Project manager	Over 5 years of experience in industrial environmental issues and emissions-management. Participated in four EIA-meetings as project coordinator/project manager.
Mika Manninen Sweco	M.Sc. (environmental-Engineering) 2005, Environmental-Designer UAS 2001	Backup project head, expert	Over 15 years of experiencein the environmental field. He has been involved in more than 20 EIA successes mainly as a project manager and in the scarcity of traffic and climateimpacts.
Aija Degerman Sweco	M.Sc. (Biology) 2001	Nature surveys, assessmentof the impact on nature	More than 10 years of experience in carryingout nature and spawningsurveys. He was involved in several EIA procedures.
Pekka Source Sweco	Environmental-Designer UAS 2005	Noise modelling and noise effects	Over 10 years of experiencein the environmental field. He has been involved in more than 20 EIA operations,
Pinja Mäkinen Sweco	M.Sc. (Biology) 2012	Assessment of the impact of fisheries	About 4 years of experiencein the environmental field. He participated in approximately 10 EIA-meetings as a designer doing, for example, surface
Johanna Lehto Sweco	FM (Design-Geography) 2002	Effects onthe health oftea and living conditions and comfort, social-impacts	Approximately 13 years of experience in areas such as landuse strategies, planning and socialimpact. Participated in several EIA-meetings.
Kaisa Mäkiniemi Sweco	TKT 2012, sheet madein 2002	Landscape and cultural environment-impacts	Approximately 15 years of work experience iscultured in research and research related to the environment and culturallandscape. Over 6 years of experience inzoning related tasks.
Sirpa Torkkeli Sweco	Di (Manufacturing) 1993	Expert	About 25 years of experiencein the environmental field. Participated in several EIA-meetings.
Ari Tamminen Enwin Oy	FM (Environmental-gienia) 1984	Air emission modelling, assessment of the impact of air quality	30 years of experience in modelling air emissions and assessing air quality impacts. Enwin Oy has produced air quality models for a number of EIA procedures.
Tarja Tamminen Enwin Oy	TKL (Chemical-Engineering niikka) 2003, FM (Working and Industrial Hygiene) 1985		
Name and company	**Training**	**Role**	**Qualification**

Kai Rasmus Bullet Consulting Oy	Ph.D. (geophysics), 2009	Water system modelling	The participants have several years of experience in demanding waterway projects and modelling.
Jose Mykkänen Luode Consulting Oy	Di (water economy), 2007		
Harri Perälä, KVVY Research Ltd	FM (hydrobiologist)	Assessmentof water impact	Over 25 years of experience in water-research. Extensive experience in water-impact assessment. Participated in-several EIA procedures.

The environmental impacts to be considered on an impact-by-impact basis, the scope of the environmental impact assessment and the methods used for the assessment are presented below.

8.2 Effects to be assessed and methods to be used

8.2.1 Effects during construction

The environmental impacts during construction are considered as a separate entity, as they differ, for example, in their temporal duration and other characteristics from the effects during the plant's operation.

The assessment describes the construction work of the factory, the traffic arrangements and volumes during construction, and the means and routes to be used. Impacts related to traffic during construction will beexamined in the surroundings of roads, railways and shipping routes leading to the factory. The impacts of the construction phase on soil and bedrock, vegetation and animals, employment and the comfortof people will be assessed. The construction phase involves the treatment of contaminated soils.

The effects associated with demolition work are similar to those resulting from construction. In addition, demolition work involves, among other things, the effects of the treatment of demolition waste. The quality assurance of the environmental performance of construction and demolition waste is described in the assessment report. Water system construction can cause, forexample, impacts on water quality and fishing. The above-mentioned impacts will be examined in the evaluation report.

The evaluation will be carried out as an expert assessment on the basis of the project plans and the-experience gained from other similar projects. Feedback from interactions will be used in the evaluation.

8.2.2 Effects of waste and cooling water

The EIA report presents estimates of the quantity and quality of waste and cooling water, water treatment procedures and the locations of entry and discharge sites.

The new bioproduct mill will increase the cooling water flow and heat load of the plants into the waterways. Waste water emissions willalso increase from the current level, and the goal is still to act within the limits of the current COD and phosphorus permit conditions. The impacts of waste and cooling water discharges are assessed by comparing the emissions with the Kemiintegrate and historical emissions data and the corresponding monitoring data on the state of the environment.

The impact of waste and cooling water on water temperature and ice conditions is assessed with the help of modelling. The modelling also aims to find the optimal place for cooling water discharge. Modelling is

usedto examine oxygen consumption (COD), nutrients (nitrogen and phosphorus) and AOX (adsorbable organically bound halogens or adsorbable organically bound halogeenits).

First, the modelling consists of a water quality and flow model for the area, which includes the coastal area surrounding Kemi and part of the Kemijoki River. 3D software is used for modelling. In this thesis, wastewater and heat loads are modelled both in the current situation (VE0) and in a new situation, i.e. extended production (VE1). Both scenarios are modelled with representative summer and winter scenarios. The result graphsof the modelling show the change in waste water content, temperature and ice thickness compared to the current state. The modelling results are presented within a radius of at least 10 km from the factory area.

With the help of water system modelling, alternative discharge sites of cooling water are also examined. The selected locations are modelled with representative summer and winter scenarios. The analysis of alternative locations is based on the new situation with extended production.

The assessment of the impacts on water bodies is based on existing research, measurement and research data, as well as on the results of water system modelling concerning waste and cooling water. The assessment takes into accountpossible impacts on water temperature, quality and ecological status, biota (phytoplankton, benthic animals and aquatic plant mouths), fishing and fishing, ice conditions and the use of water bodies. The impacts onthe ecological objectives of water bodies and river basin management will be assessed as an expert assessment.

The Government Decree onsubstances dangerous and harmful to the aquatic environment (NNa 1022/2006 and its amendment VNa 868/2010) and the environmental quality standards issued for them (NNa 1308/2015) will be taken into account in the assessment of the effects on water bodies. Substances that are hazardous and harmful to the aquatic environment at the bioproduct mill, as listed inthe Annexes to the Regulation at Community level and in the national procedure, will be mapped as expert assessments and presented in the evaluation report.

The results of the water impact assessment will be taken into account in the planning of the project. In the planning and monitoring and maintenance of operations during use, care shall be taken to ensure that the activities do not result in consequences contrary to the Act on the Organisation of Water and Marine Management (1299/2004), such as the deteriorationof surface water quality classifications.

The effects of water abstraction are also examined as expert work.

The area under review is from the factory site and the environment of the take-off and dismantling sites, including the sea areasurrounding Kemi up to a maximum distance of 10 km from the project area. The sea will officially continue in the Kemijoki estuary about 3.5 kilometres north of the project area until the end of the Kemijoki River untilthe Isohaara power plant. If significant water quality and temperature impacts are found to extend beyondthis area, the water body impact assessment area can be expanded.

8.2.3 Effects of air emissions

The impact of air emissions from production is assessed by comparing emissions with current and historical emission datain the factory area and their corresponding environmental monitoring data with air quality measurements, for example.

Air quality impacts related to air emissions are assessed with the help of modelling and expert assessments. Il man quality modelling is done with AERMOD spreading modelling software. The model is suitable for examining the spread of both gaseous and particulate pollutant components and it can be used to examine the combined effect of endsources on outdoor air concentrations in the area. This thesis examines the impact of the production and transport air emissions of the Kemi biofactory project on the

outdoor air concentrations of odour sulphur compounds, sulphur dioxide, nitrogen dioxide and particulate matter PM_{10} (respirable dust) and $PM_{2.5}$ (small particles) in Kemi and the presence ofTRS perfumes in the environment of the mill. Comparisons are made with previous air quality models and air quality measurement data made in Kemi.

The impact assessment also takes into account emissions to air caused by the transport of the bioproduct mill. Air emissions from factory traffic are estimated using the traffic emission factors published on VTT's Lipasto – Transport Emissions website for truck traffic and rail traffic. The irrigation area for the impact of the plant's process emissions is the environment of the project area at a distance of about 10 km.

8.2.4 Impacts of greenhouse gas emissions

The impacts of the project on greenhouse gas emissions and climate are assessed by presenting an estimate of the factory's carbon dioxide emissions calculated using the factories' emissions calculation method. The bioproduct mill will not use fossil fuels, so fossil CO2 emissions in the region will be significantly reduced.

Greenhouse gas emissions are also taken into account in the transport and handling of raw materials.

8.2.5 Impact of transport

As a result of the project, both maritime, rail and road transport will increase. Raw wood is transported from the forest to the factory by train and trucks. The products are transported to the port of export on trucks. The factory does not store the products, alreadythe port serves as the factory's export product warehouse.

Because the traffic caused by the new plant is considerably higher than that of the current factory, Sahansaarinka- dulle has been designed to replace the existing connections due to traffic safety. Its zoning begins at the same time as this environmental impact assessment.

The following table shows estimates of changes in the number of different modes of transport for the different options.

Table 8-2. Increase in traffic volumes.

	VE0 Current status	**VE1**
Transportation by car, wood	No changes	+ 12500 truck-car loads/y
Transport by car from Ajok- to/from Ajok	No changes	+ 27000 truck-car loads/y
Transport by car, other	No changes	+ 11000 truck-car loads/y
Transport by train	No changes	+ 2100 trains/y

The evaluation report will present a description of the current state of transport, both for road transport, rail transport andwaterborne transport. Description of the transport network, transport connections, traffic volumes and general growth forecasts, as well as accident statistics.

The impacts of traffic on noise level, safety and comfort are assessed on the basis of traffic changes. Special attention will be paid to sensitive destinations, such as housing, kindergartens and schools, as well as recreation areas, which may be located along the transport routes.

Transport routes and changes in traffic volumes are presented as illustrative mappings.

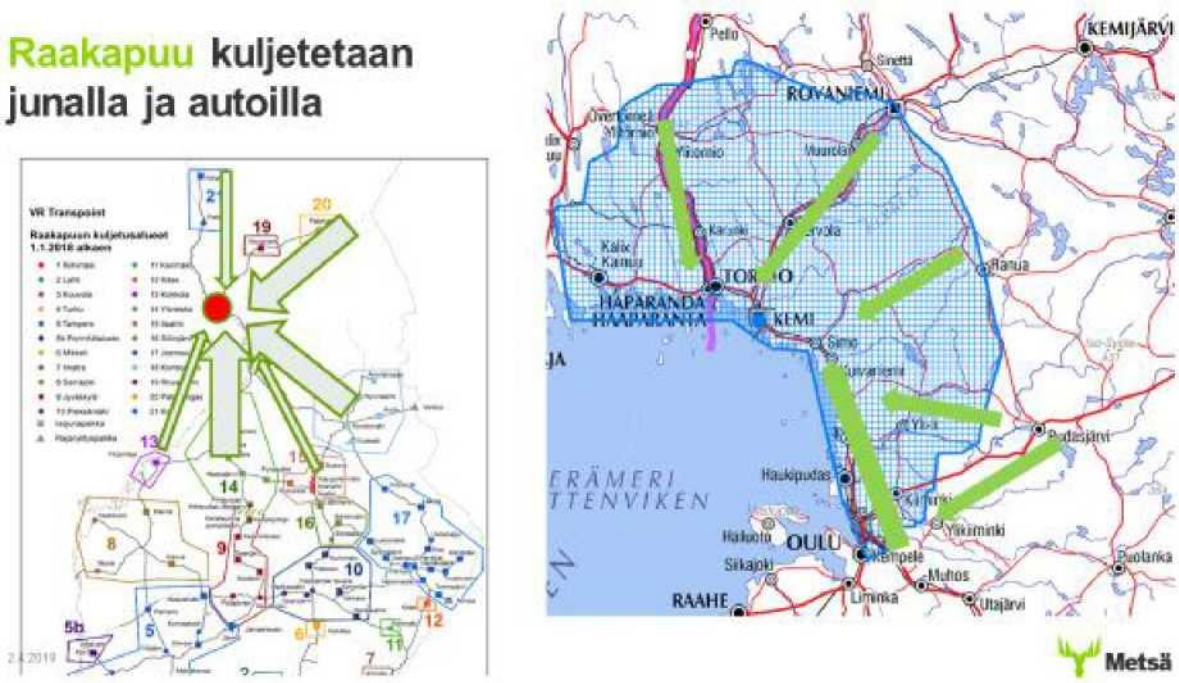

Figure 8-1. Transportation of roundwood by train and car preliminary.

The assessment of the effects of emissions from transport is described in section 8.2.3 and the assessment of the effects of traffic noise in section 8.2.6. According to the preliminary plan, the impacts of transport will beexamined in more detail around the traffic routes leading to the area at a distance of about 10 km from the project area. The assessment of the transport impacts will help to determine how far away the theoretical effects ofthe project will extend.

8.2.6 Noise effects

The noise impact assessment is based on the plant's design data, transport volumes, experience fromother similar operations and information on the current noise level in the surroundings of the site. Traffic volumes in the region are increasing, which may affect noise levels in the environment.

Noise impact assessment is carried out with the help of noise modelling. The modelling examinesthe noise caused by the factory's operations and transports related to its operations. The modelling includes noise from the various functions of the factory, as well as noise from rail and road traffic.

The starting noise levels of the bioproduct mill's noise sources are determined on the basis of measurements madeand data from plant suppliers and other similar projects. The measurements of Äänekoski's bioproduct production in particular provide good information for this project. The current noise situation is assessed on the basis of the available measurement and modelling results of the current noise situation in the area

The adjacent area of the plant unit, including its buildings and the shape of the terrain, shall be included in the three-dimensionalterrainmal lithium. The modelling is carried out using common Nordic industrial, road and railnoise models for daytime and nighttime situations. The spread of noise into the terrain is illustrated by maps compiled with modelling software.

The noise spread is calculated conservatively so that the ambient conditions are favourable for the spread of noise (e.g. light wind from the noise source to each calculation point). The area in which the noise effects are examined is the area near the factory within a radius of about two to three kilometres.

In the impact assessment carried out on the basis of the modelling, special attention will be paid to sensitive sites such as housing, schools, kindergartens, recreation areas and disturbing natural sites.

8.2.7 Effects of the treatment and disposal of waste and ancillary products

The characteristics of the resulting fractions and ancillary products will be assessed on the basis of the factory's technical data and information obtained from other similar projects. Utilisation potentials and disposal options mappedin the project planning will be presented.

The assessment of the treatment, recovery and disposalof waste and ancillary products takes into account the possible impacts on the environment in the plant site and its waste management area, as well as on a general level outside the plant site.

8.2.8 Impacts on the use of natural resources

The project was launched with a preliminary study, which charted the sufficiency of sustainably sourced wood raw material for a large mill.

The project will increase the use of pulpwood in the area by about 4.5 million cubic metres.

According to the Natural Resources Institute Finland, the largest sustainable logging potential in terms of wood production for the 10-year period 2015-2024 is 84.3 million cubic metres of trunk wood per year. In the next 10-year period, the annual harvesting potential will continue to rise to 93 million cubic metres.

The 12nd of the forest. Inventory

The Natural Resources Institute Finland (Luke) updated Finland's forest resources data from the 12nd National Forest Inventory (VMI12) with the measurement data for 2014-2017. According to the latest measurements, the number of trees has continued to increase.

The latest measured stands are 2.5 billion cubic metres and an annual increase of 107.0 million moon-tiometers. This is 1.5 million cubic metres more than the growth according to the previous inventory (NMI11, measurement year 2009-2013). In the inventories, growth is measured five years backwards, so the growth data for the most recent imitation represent the years 2009-2017.

In terms of wood production, the largest sustainable logging potential for the 10-year period 2015-2024 is 84.3 million cubic metres of stem wood per year. In the next 10-year period, the annual harvesting potential will continue to rise to 93 million cubic metres. In the 2010s, fellings have averaged 80 per cent, and even in the past three years, only 83 per cent of the largest sustainable felling potential wasrecorded.

If fellings would increase to a sustainable level in terms of wood production, efforts must also be made in nature management and conservation to preserve forest biodiversity.

Increasing fellings to sustainable felling opportunities would mean that the total number of trees would reach 2.7 billion cubic metres by 2045. In this way, in thirty years, forests would retain the amount of wood corresponding to the growth of about two years.

In recent years, fellings in the regions of south-eastern and central Finland have been close to thelargest logging potential. On the other hand, in northern Finland, forest resources have grown in the affected area of the project.

Harvesting volume E2018 and sustainable felling direction

50

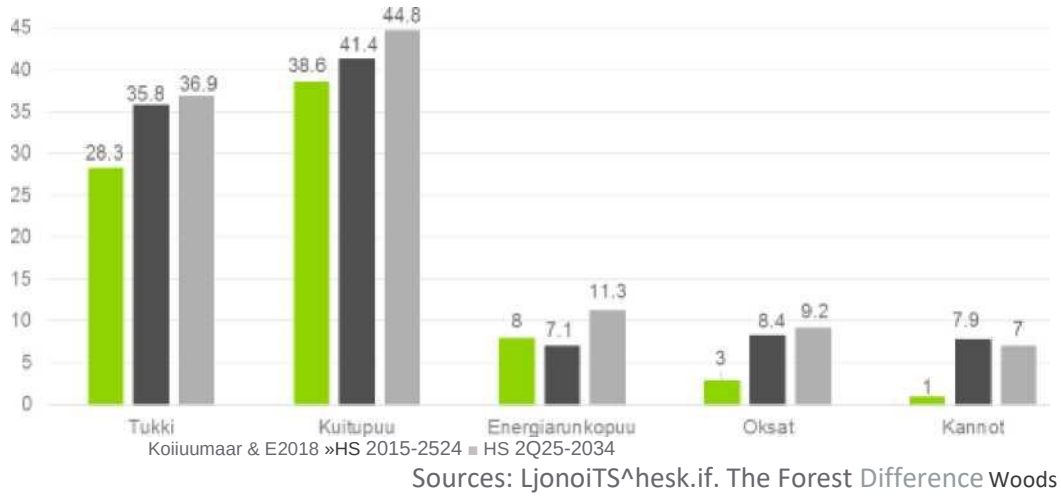

Figure 8-2. Availability of wood raw material.

8.2.9 Impacts on urban structure and land use

The evaluation examines the project's relationship with the current regional and urban structure, as well as withthe factory area and the existing plans in the neighbouring areas, as well as on ongoing planning projects and other known plans forthe use of wine. It will be assessed whether the construction and impacts of the project have been addressed in the plans in force in the area, whether the existing plans have demonstrated that land use which significantly affects thevalidity of the project has been demonstrated, whether the implementation of the project requires changes to existingplans or the development of new plans, and how the project has been or can be takeninto account in the land use plans for the site. Special attention will be paid to the nearest residential and recreational areas, cultural historically valuable sites and other potentially disturbing sites,as well as Sahansaarinkatu.

The impact of the project on the implementation of the national land use targets will also be assessed.

8.2.10 Impacts on the landscape and the cultural environment

The landscape effect consists of changes in the structure, nature and quality of the landscape. Visual influences areone of the elements of landscape effects. Awareness of changes in the nature of the sub-areas of the landscape may also affect the perception of the landscape in areas where there is no prospect towards the area. In turn, the significance of adverse landscape effects can be reduced by disturbances already present in the area, such as smoke, noise or odour. (Ministry of the Environment, 2006).

The effects on the landscape and the cultural environment are examined using landscape image analysis, elements of the landscape structure and visualisation of the project's plans. The landscape effectsare described taking into account the other buildings and structures in the area, the shapes of the terrain and the size ofthe new structures. Special attention will be paid to the value areas and sites located in the area and its vicinity.

The description and assessment of the current state of the built cultural environment and ofthe archaeological heritage are based on existing surveys, inventories, registers (e.g. ancient relics register), map and aerial image examinations and field visits.

The project area already has heavy industrial activities, and the nature of the area will not change significantly with the project. As a result, the effects of the landscape will be examined in greater depth in the vicinity of the belt, initially within a radius of about two kilometres. In addition, the effects of

landscapes are examined more generally in the long-distance landscape zone, within a radius of about five kilometres. In terms of the cultural environment, the impact area is approximately two kilometres from the project area.

8.2.11 Effects on vegetation, fauna and nature conservation sites

The assessment will focus on the impact on valuable natural sites of the project area and their significance. Impacts on nature can be caused directly by land use changes during construction and indirectly by noise during construction and operation, including traffic noise and emissions into water and air.

For the purpose of nature impact assessment, the previously mentioned nature reports and other publicly available data are available. The impact assessment takes into account known nature conservation, nature conservation programme and Natura areas located in the affected area of the project (factory site), important bird areas (IBA, FINIBA and MAALI), legally protected habitat sites, endangered habitat types and other sites relevant to their vegetation or habitat type, places of occurrence of nationally and regionally endangered and legally protected species, such as breeding and resting sites of species listed in Annex IVa of the Habitats Directive. Natura sites are presented in the EIA programme at a distance of approximately 10 kmdella. Other nature reserves are presented at a distance of at least 7 km (Figure 8-6). At the stage of the EIA report, the scope of the examination may be expanded or reduced to reflect the impact ofthe project.

The assessment will take into account both the direct and indirect impacts of the project in the whole area to which they extend. The impact assessment is based on existing data (data on endangered species and previous nature surveys) and on the vegetation and habitat type survey carried out in connection with this projectin the project area (in the factory area and in the new logistical connection area). For the demarcation of the catchment area, noise modelling, water impact assessment and other impact studies are available during the EIA procedure. Some of the effects of the project may be short-term construction-related and some may be long-term during the operation.

The assessment of the impacts on natural sites and species is carried out in accordance with the Environmental Administration'sguidelines for nature surveys, using, for example, "Natural surveys and assessment of nature impacts in the planning, the EIA procedure and the Natura assessment" (Söderman 2003).

As regards Natura sites, a preliminary assessment will be made as to whether the project, alone or in combination with other projects, can have such impacts on the nature values underlying the protection of one or some of the Natura sites that it is necessary to carry out a Natura assessment in accordance with section 65 of the Nature Conservation Act.

8.2.12 Impacts on soil, bedrock and groundwater

The bioproduct mill is located in an industrial area and its normal operations have no pre-estimated impacts on the soil and bedrock or on geologically significant sites, so the need for an impact assessment is limited in this respect. Exceptional situations, such as chemical spills, may involve soil effects that are taken into account in the risk assessment. There is no groundwater level in the immediate vicinity of the industrial area(see chapters 8.6., Figure 8-7).

8.2.13 Effects on human health, living conditions and comfort

The impact of theproject on people and their living conditions is called social impacts. These refer to the impact of a decision, project or action on a person, community or society that causes changes in people's well-being or distribution of well-being (National Institute for Health and Welfare, www.thl.fi). This EIA procedure carries out a social impact assessment, which refers to the identification and assessment of the

impacts on people's living conditions and comfort caused by a project or activity. The social impacts are assessed, among other things, by:

- effects on human health and safety
- impacts on housing, living, leisure and recreational opportunities
- employment effects
- impact on the community (community, social problems, etc.)
- perceived impacts (how people experience the project, what impact they expect the project to have)

Assessments of noise and air quality impacts will be used to assess health impacts.

The evaluation will take into account, for example, increased traffic and possible other impacts of the project in residential andrecreational areas.

The assessment takes into account neighbourhoods, recreation areas and other key functions and sites, especially if they are considered sensitive to adverse effects. The employment effects of the project are presentedin terms of wood procurement and transport based on the project operator's estimates.

The perceived and expected impacts as well as residents' expectations of the impact of the project on the community will be assessed by means of a resident survey. The results of the survey are supplemented with the themes and comments that have emerged at various events. These events include a public event in the EIA programme phase and any other project presentations.

An important partner is the monitoring group of the project. In addition, we will take a look atthe views expressed on the evaluation programme, as well as the way to and discussion about the bioproduct mill,- which is relevant to the project. The consultations provide not only information on views and impacts, but also information on, for example, the current use of the area and the significance of the area to local residents. In practice, this information cannot be collected elsewhere, so by responding to the survey and thus participating in the planning, the participants have a real opportunity to influence the outcome.

The themes to be studied in the tenant survey include:

- attitudes to the project (expectations, fears, attitudes and potential conflicts)
- residents' assessment of the impact of the project on the living and living environment
- residents' assessment of the impact of the project on quality of life
- residents' estimates of the impact of the project on the wider area and, for example, on local economy and services

The tenant survey is carried out by utilising an internet survey. The questions are mainly drafted in the form of evaluation,nicholic and four-field questions. The questions are formulated in such a way that they are clear, unambiguous, non-directive and focused on the essentials. In addition, it is possible to leave the answers with a so-called traditional paper book, which is distributed centrally or the form can be requested for yourself.

The 2016 study "Better Kemi" (Kalle-Pekka Hietala and Helena Jaakola) is also taken into account. Its main research results were factors related to the quality and availability of services provided inthe municipality's territory. People also expressed the need for people to meet and to participate in decision-making. Insecurity was also an important area for research results. Mer'smost compelling factors for the well-being of people living in Kemi were human relationships, the environment and leisure time.

The answers to the survey will be compiled, analysed and draw conclusions on the impact of the project. The EIA report discusses, among other things, the general acceptability of the project and the fears and

concerns ofthe participants in the project. In addition, other statistics, literature, press and web-writing, and information on the effects of factories will be used in other projects.

Social impacts will be studied within a 10-20 km radius of the project area. The area covered by the-examination of the employment effects extends to wood sourcing areas. The economies closest to the project area will beinformed about the project and the survey directly, for example through local newspapers.

The Ministry of Social Affairs and Health's guide "Assessment of the impacts on people – Health and social impacts on people" is used to assess the impact on people. If necessary, assessments can be supplemented by e.g. spatial data analysis. In terms of evaluation, transparent information on the progress of the project is particularly important at the different stages of the project.

The evaluation will be carried out by experienced experts, the work will be steered by a monitoring group and the authorities, so that the evaluation becomes an objective view.

8.2.14 Effects of accidents and disruptions

The environmental risk assessment of the bioproduct mill identifies the most significant risks and describes the potentialimpacts associated with them on the environment. The evaluation will also identify the measures needed to reduce risks and mitigate impacts.

The evaluation will take advantage of the available roads from existing factories, plant manufacturers and otherprojects. Possible disruptions and accidents include, for example, interference emissions, chemical spills, whether there is alot and, as an extreme case, a recovery boiler explosion. The evaluation willbe assisted by the recommendations prepared for the environmental assessment of companies' environmental impacts in the report "Eco-risk analysis of disturbance emissions" (Finnish Environment Institute 2006).

The evaluation is carried out by an expert group involving an experienced expert in the risk assessment of-industrial processes.

8.2.15 Interactions

At this stage, the project has not been identified as having any other synergies with other known projects-to be carried out. This issue will be examined in greater depth in the context of the environmental impact assessment. Synergies with existing activities will be examined in areas such as noise, air emissions and-waste water as part of the impact assessment. For example, the assessment of the impacts of waste water includes various actionswhose combined effects of wastewaters through consideration of the current state of the water system. The impact of theaccompanying projects is described and assessed as appropriate in the evaluation report.

8.2.16 Effects of the decommissioning of the installation

The effects related to the demolition of the plant are similar to the effects relatedto construction and are assessed using the same methods as the effects during construction (see paragraph 9.2.1). PUR spawns involve, for example, the effects of the treatment of demolition waste. The environmental viability of demolition wasteis described in the assessment report. The long-term effects of decommissioning on the-environment are provisionally described on the basis of available plant data.

Demolition work is carried out in the project as soon as the project starts in order to free up spacefor new constructions. Similar impacts are assessed in connection with the effects during construction

8.2.17 Comparison of options

The different impacts of the project options and the significance of the impacts are qualitatively compared using atable. The table presents in an illustrative and harmonised way the key environmental impacts of the options, whether positive, negative or neutral.

The assessment of the significance of the project's impact will be discussed in the monitoring group. The views of the monitoring group, residents and operators are recorded in the evaluation report.

Based on the results of the environmental impact assessment, the environmental feasibility of the alternatives is assessed.

8.3 Harm prevention and mitigation

In connection with the assessment work and project planning, the means of preventing and limiting potential adverse environmental impactsrelated to the project will be investigated. A description of the mitigation measures is presented in the evaluation report.

8.4 Uncertainties in the assessment

Assumptions and generalisations are always associated with the starting materials and evaluation methods used in the assessment. The technical information available is still preliminary. Lack of information and inaccuracy cause uncertaintyto change the assessment.

Uncertainties related to the project and evaluation methods are identified during the evaluation work. I amthe most female insecurities, their significance and the reliability of the assessment are described in the evaluation report.

8.5 Monitoring of impacts

The evaluation report presents a proposal on the content of the environmental impact monitoring programme. The objectives of the monitoring shall be to:

- produce information on the impact of the project
- identify the consequences of the implementation of the project;
- examine how the results of the impact assessment reflect the reality;
- examine the adequacy of harm mitigation measures
- initiate the necessary action if unforeseen, significant disadvantages are identified.

As part of the planning of the monitoring programme, the necessary changes and supplements to the current monitoring programme of the factories will be assessed.

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