

Liite 6: N170 x 9 x HH165 varjostusmallinnusten tulokset "real case, forest luke"

SHADOW - Main Result

Calculation: Suolakangas N170 x 9 x HH165 real case_forest luke

Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

Minimum sun height over horizon for influence 3 °

Day step for calculation 1 days

Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) []

| | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 1,00 | 2,63 | 4,23 | 6,60 | 8,87 | 9,10 | 8,97 | 6,81 | 4,67 | 2,54 | 1,17 | 0,59 |

Operational hours are calculated from WTGs in calculation and wind distribution:

MERRA_basic_E22.668_N62.500

Operational time

| | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-------|
| N | NNE | ENE | E | ESE | SSE | S | SSW | WSW | W | WNW | NNW | Sum |
| 689 | 508 | 419 | 421 | 537 | 789 | 973 | 1 264 | 979 | 800 | 633 | 630 | 8 643 |

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window.

The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: Korkeuskäyrät_Kauhajoki.wpo (1)

Area object(s) used in calculation:

Luke 8 km

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 10,0 m

All coordinates are in

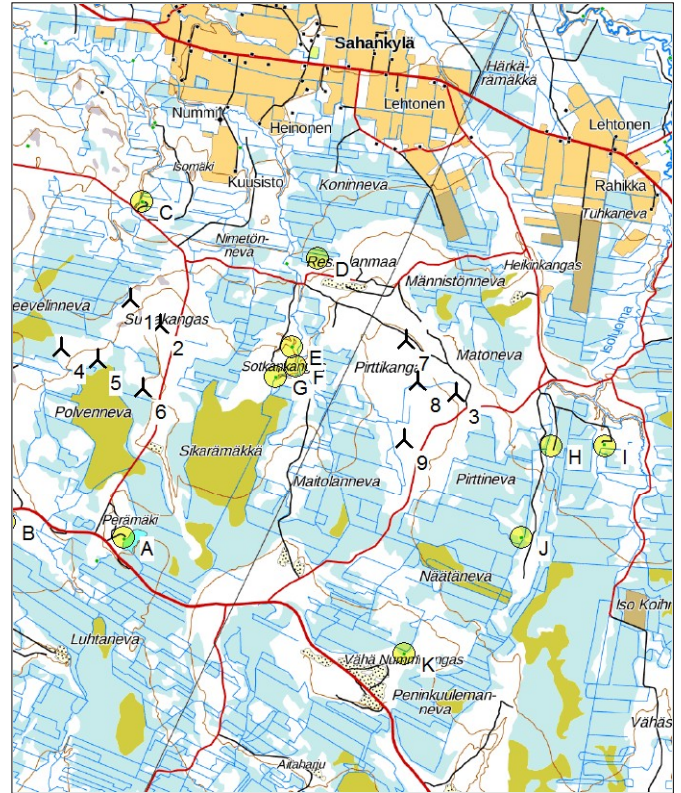
Finish TM ETRS-TM35FIN-ETRS89

WTGs

| East | North | Z | Row data/Description | WTG type | | | | Shadow data | | | |
|------|---------|-----------|--|----------|-----------|--------------------|-------------------|--------------------|----------------|--------------------------|-----------|
| | | | | Valid | Manufact. | Type-generator | Power, rated [kW] | Rotor diameter [m] | Hub height [m] | Calculation distance [m] | RPM [RPM] |
| 1 | 259 028 | 6 927 918 | 155,0 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 2 | 259 417 | 6 927 571 | 167,1 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 3 | 263 335 | 6 926 670 | 167,7 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 4 | 258 111 | 6 927 269 | 153,3 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 5 | 258 603 | 6 927 114 | 162,1 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 6 | 259 194 | 6 926 732 | 170,0 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 7 | 262 679 | 6 927 363 | 172,5 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 8 | 262 825 | 6 926 815 | 172,0 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |
| 9 | 262 650 | 6 926 058 | 172,5 NORDEX N170/4.0-4.5 4500 170.0...Yes | Yes | NORDEX | N170/4.0-4.5-4 500 | 4 500 | 170,0 | 165,0 | 1 805 | 10,7 |

Shadow receptor-Input

| No. | Name | East | North | Z | Width | Height | Height a.g.l. | Degrees from south cw | Slope of window | Direction mode |
|-----|-------------------------------------|---------|-----------|-------|-------|--------|---------------|-----------------------|-----------------|--------------------|
| | | [m] | [m] | [m] | [m] | [m] | [m] | [°] | [°] | |
| A | Lomarakennus (Perämäki) | 258 941 | 6 924 744 | 171,2 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| B | Lomarakennus (Nummikankaantie 218) | 257 371 | 6 924 948 | 149,3 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| C | Lomarakennus (Heikinkatu 25) | 259 185 | 6 929 195 | 135,0 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| D | Lomarakennus (Ressulanmaa) | 261 505 | 6 928 439 | 146,0 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| E | Lomarakennus (Sotkankangas I) | 261 168 | 6 927 279 | 162,5 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| F | Lomarakennus (Sotkankangas II) | 261 217 | 6 927 029 | 160,0 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| G | Lomarakennus (Sotkankangas III) | 260 951 | 6 926 878 | 160,8 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| H | Lomarakennus (Ruostetuoma) | 264 587 | 6 925 975 | 157,5 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| I | Lomarakennus (Heikinkankaantie 135) | 265 298 | 6 925 969 | 153,1 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| J | Lomarakennus (Pukinharju) | 264 198 | 6 924 751 | 163,2 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |
| K | Lomarakennus (Vähä Nummikangas) | 262 649 | 6 923 216 | 187,5 | 5,0 | 5,0 | 2,0 | 0,0 | 90,0 | "Green house mode" |



Scale 1:100 000
 ▲ New WTG
 ● Shadow receptor

SHADOW - Main Result

Calculation: Suolakangas N170 x 9 x HH165 real case_forest luke

Calculation Results

Shadow receptor

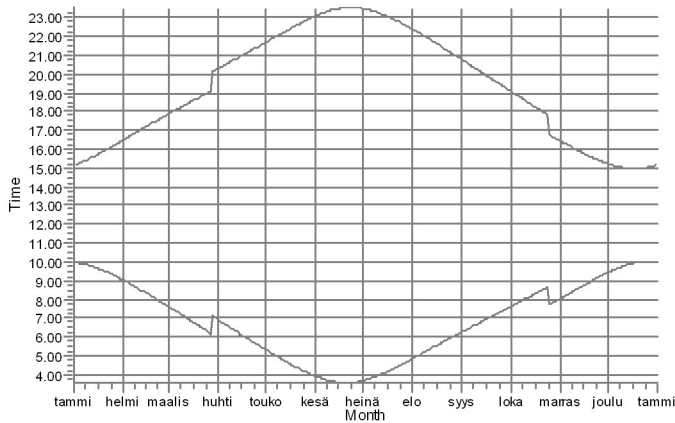
| No. | Name | Shadow, expected values | |
|-----|-------------------------------------|-------------------------|----------------------|
| | | Shadow hours | per year [h/year] |
| A | Lomarakennus (Perämäki) | 0:00 | 0:00 |
| B | Lomarakennus (Nummikankaantie 218) | 0:00 | 0:00 |
| C | Lomarakennus (Heikinkatu 25) | 0:00 | 0:00 |
| D | Lomarakennus (Ressulanmaa) | 0:00 | 0:00 |
| E | Lomarakennus (Sotkankangas I) | 0:00 | 0:00 |
| F | Lomarakennus (Sotkankangas II) | 0:00 | 0:00 |
| G | Lomarakennus (Sotkankangas III) | 0:00 | 0:00 |
| H | Lomarakennus (Ruostetuoma) | 0:00 | 0:00 |
| I | Lomarakennus (Heikinkankaantie 135) | 0:00 | 0:00 |
| J | Lomarakennus (Pukinharju) | 0:00 | 0:00 |
| K | Lomarakennus (Vähä Nummikangas) | 0:00 | 0:00 |

Total amount of flickering on the shadow receptors caused by each WTG

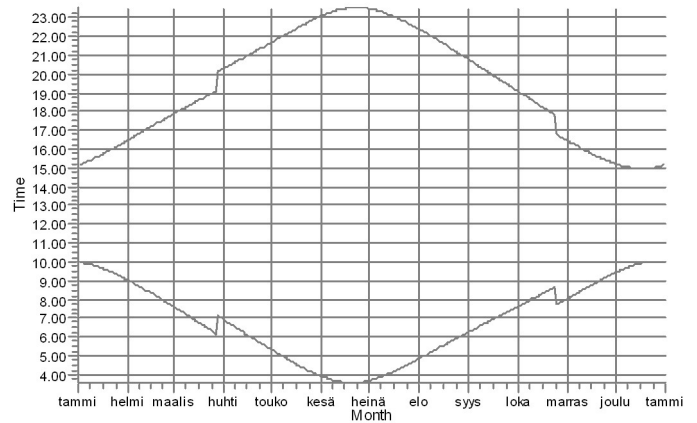
| No. | Name | | Worst case | Expected |
|-----|---------------------|---|------------|----------|
| | | | [h/year] | [h/year] |
| 1 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (75) | 0:00 | 0:00 |
| 2 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (76) | 0:00 | 0:00 |
| 3 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (77) | 0:00 | 0:00 |
| 4 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (78) | 0:00 | 0:00 |
| 5 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (79) | 0:00 | 0:00 |
| 6 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (80) | 0:00 | 0:00 |
| 7 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (81) | 0:00 | 0:00 |
| 8 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (82) | 0:00 | 0:00 |
| 9 | NORDEX N170/4.0-4.5 | 4500 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (83) | 0:00 | 0:00 |

SHADOW - Calendar, graphical**Calculation:** Suolakangas N170 x 9 x HH165 real case_forest luke

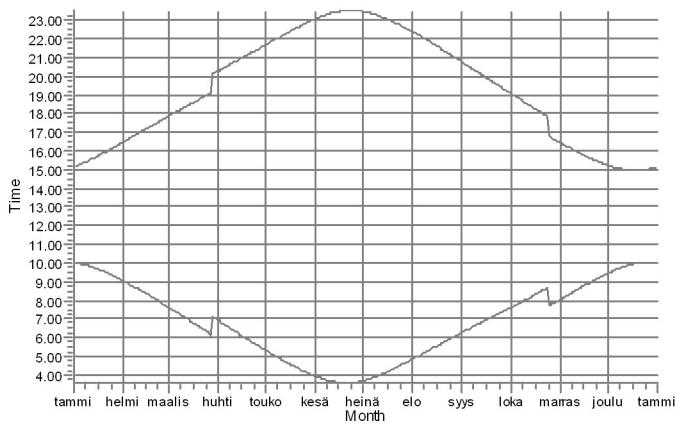
A: Lomarakennus (Perämäki)



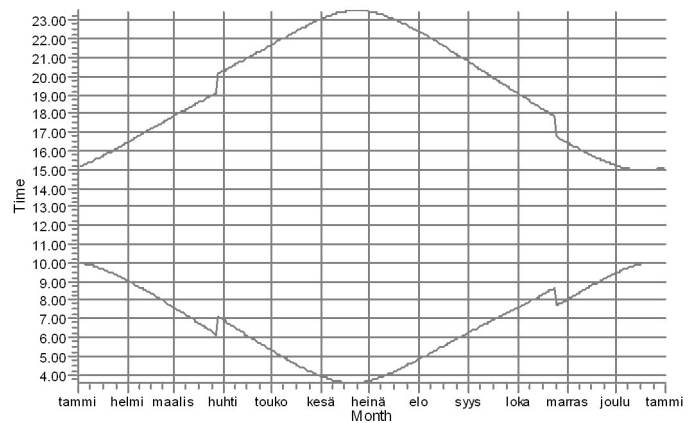
B: Lomarakennus (Nummikankaantie 218)



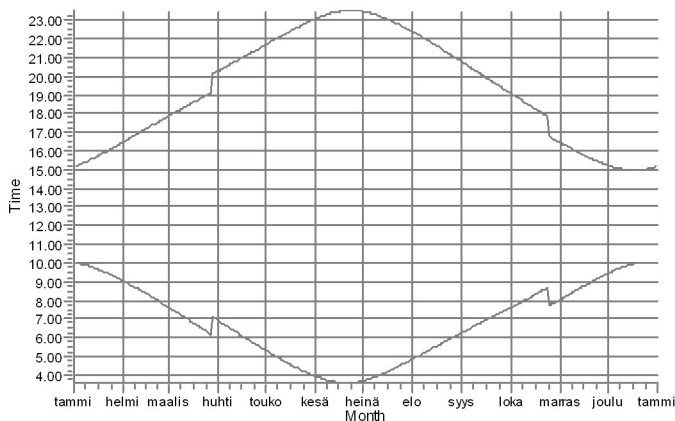
C: Lomarakennus (Heikinkatu 25)



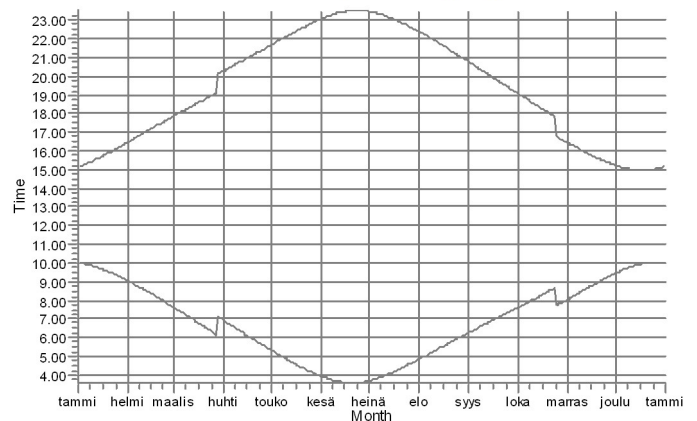
D: Lomarakennus (Ressulanmaa)



E: Lomarakennus (Sotkankangas I)



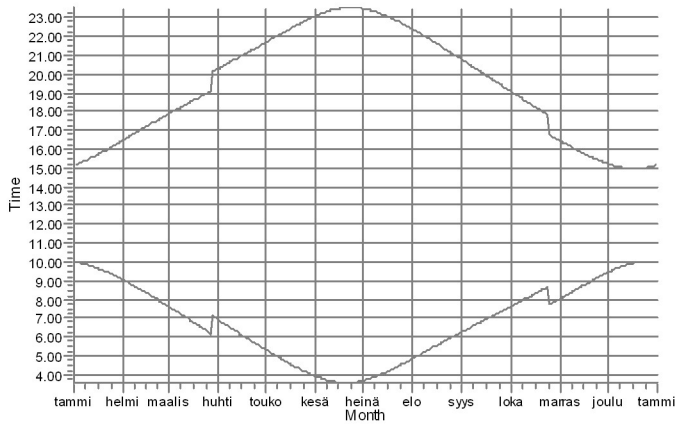
F: Lomarakennus (Sotkankangas II)



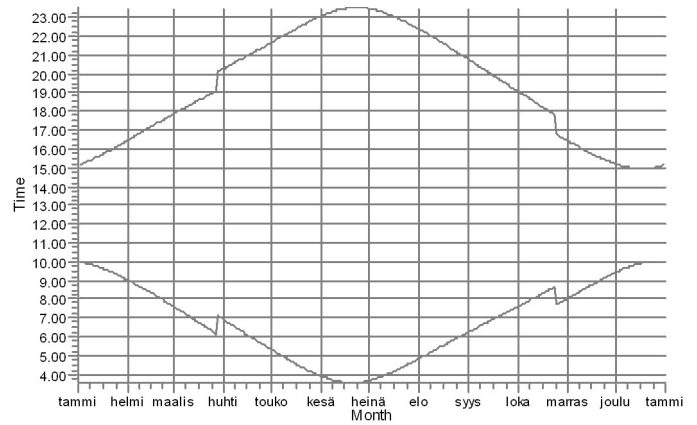
WTGs

SHADOW - Calendar, graphical**Calculation:** Suolakangas N170 x 9 x HH165 real case_forest luke

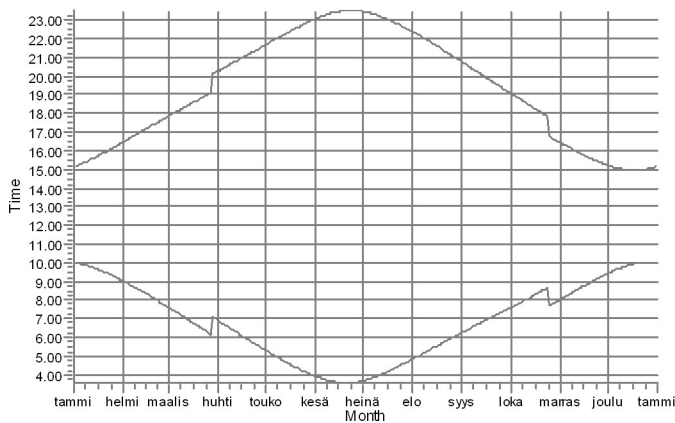
G: Lomarakenus (Sotkankangas III)



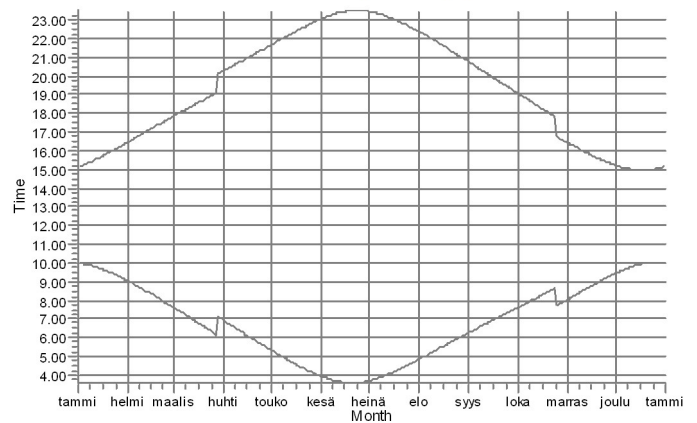
H: Lomarakenus (Ruostetuoma)



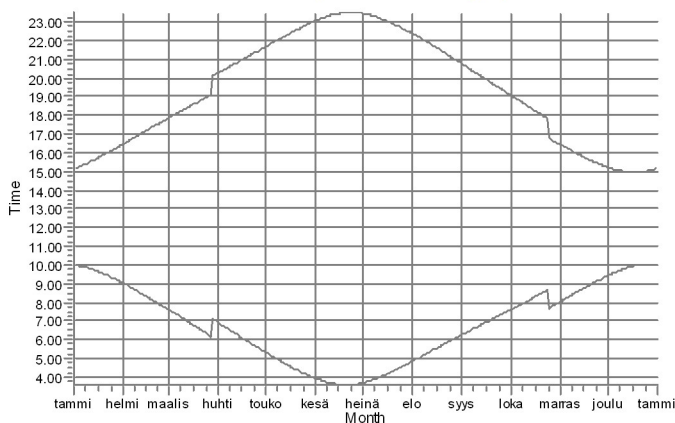
I: Lomarakenus (Heikinkankaantie 135)



J: Lomarakenus (Pukinharju)



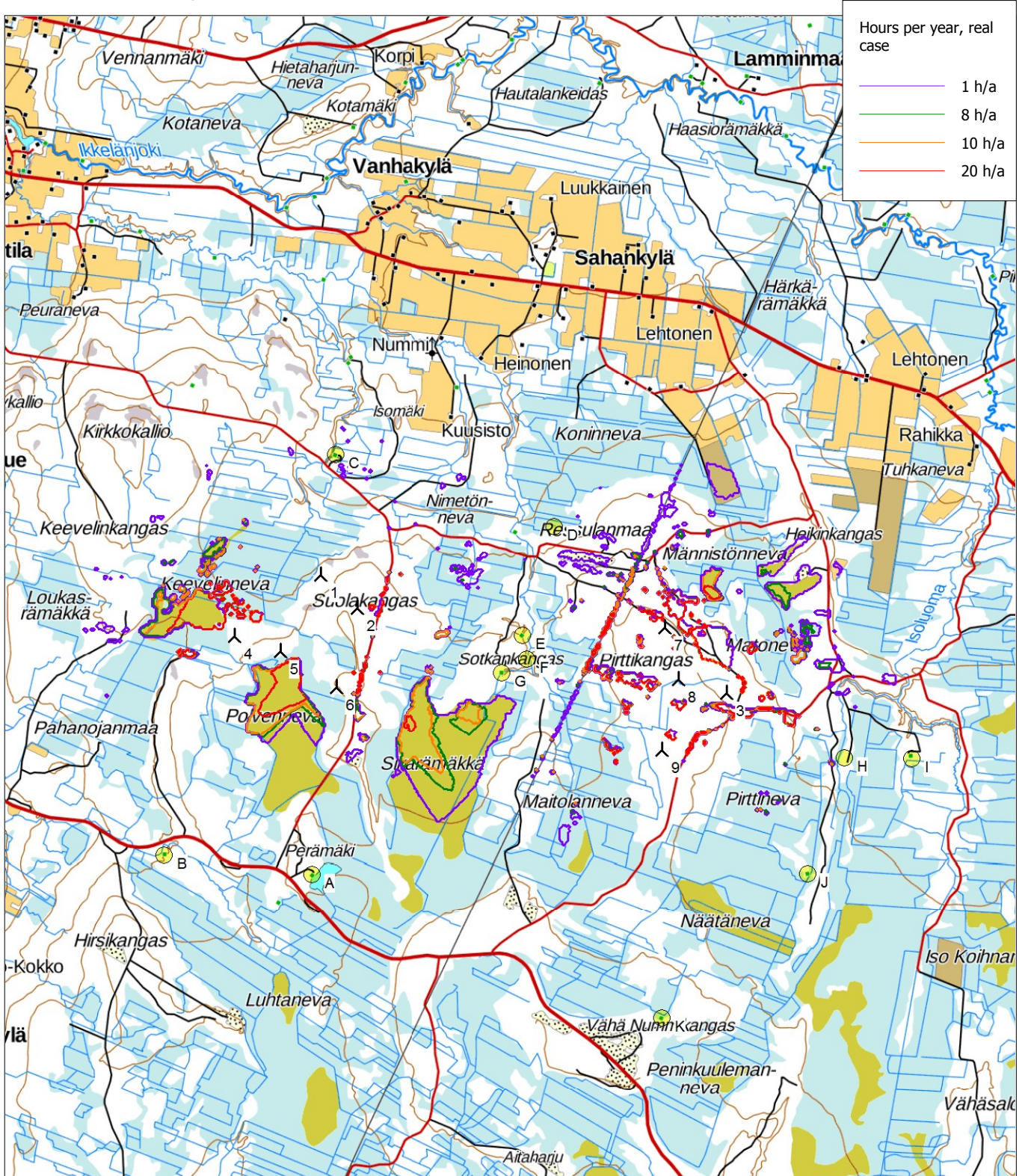
K: Lomarakenus (Vähä Nummikangas)



WTGs

SHADOW - Map

Calculation: Suolakangas N170 x 9 x HH165 real case_forest luke



0 1 2 3 4 km

Map: Maastokartta , Print scale 1:60 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 260 450 North: 6 927 214

▲ New WTG

● Shadow receptor

Flicker map level: Height Contours: Korkeuskäyrät_Kauhajoki.wpo (1)

