



Ruokakesko Oy
Kanervanummen kaava-alue
Hakkila, Vantaa

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HULEVESIEN HALLINTASUUNNITELMA

1. YLEISTÄ

Suunnittelualue sijaitsee Vantaan Hakkilassa, kortteli 66053. Alueella sijaitsee Keskon keskusvarasto KV2, jota on vuosien mittaan vaihteittain laajennettu. Nyt suunnitteilla on terminaaliaajennus, joka tulee sijoittumaan olemassa olevien rakennusten länsipuolelle. Hulevesien hallintasuunnitelma tehdään kaavavaiheen suunnittelua varten.

KV2:n korttelissa rakennetuilta pinnoilta hulevedet on johdettu kunnalliseen verkostoon. Suunnittelun laajennuksen osalta edellytetään, että hulevesien virtaamaa tulee hidastaa ja hulevesiä viivyttää sekä mahdollisuuksien mukaan imeyttää tontilla Vantaan hulevesiohjelman mukaisesti. Lisäksi piha-alueen hulevedet tulee käsitellä siten, etteivät ne aiheuta haittaa maaperälle.

2. HULEVESIEN MITOITUS JA JÄRJESTELMÄT

KV2:n alueen hulevesien mitoituskalkelmat on tehty koko korttelia kattavana kokonaisuutena. Laaja alue on asemapiirustuksen perusteella jaettu pienempiin valuma-alueisiin. Valuma-alueille on määritetty painotettu valumakerroin alueiden maankäytön perusteella. Hulevesivirtaamat on laskettu ennen ja jälkeen laajennusalueen rakentamista erikseen kattovesien ja piha-alueen osalta. Laskelmat ja yhteenveto saaduista arvoista ovat liitteessä.

2.1. Nykytilanne

Laajennusalue sijoittuu luonnontilaiselle tontin osalle, joka on metsäistä kallioaluetta. Sadevedet osittain imeytyvät maastoon ja osittain valuvat Kanervantien ja Jokiniementien viereisiin painanteisiin.

Nykytilanteessa korttelin kattopinta-ala on 6,4 ha ja hulevesivirtaamiksi on kattovesien osalta laskettu 536 l/s. Asfaltoidun alueen pinta-ala on 11,8 ha ja virtaama pihan osalta 515 l/s.



2.2. Kaavatilanne

Laajennusalueelle rakennetaan yksi rakennus ja lähes koko piha-alue lukuunottamatta kapeita viherkaistoja tontin reunoilla tullaan päällystämään asfaltilla. Piha-alue tulee toimimaan kuorma-autojen liikennöinti-, lastaus ja parkkipaikka-alueena.

Rakentamisen jälkeen kattopinta-ala on 7,6 ha ja kattovesien virtaamaksi on laskettu 593 l/s. Päällystetyn alueen pinta-ala on 16,6 ha ja virtaama asfalttipinnoilta 617 l/s. Rakentamisen jälkeinen hulevesien virtaama korttelissa on 17 % suurempi kuin ennen rakentamista.

Huleveden hallintaratkaisut on tehty siten, että pohjaveden pintaa ei nosteta eikä myöskään lasketa alueella. Osa vesistä tullaan imeyttämään/viivyttämään alueella ja osa johdetaan kunnalliseen verkostoon.

Koska laajennusalue sijaitsee kallioisella tontilla eikä vesien imeyttäminen viherkaistoilla tule kyseeseen, louhitaan alueelle hulevesien tasaus/viivytyksallas. Allas täytetään louhitulla aineksella ja sepelillä, ja se toimii sekä viivytyksaltaana tasaamassa vesien virtausta eteenpäin verkostoon että imeytyksaltaana osan varastoituneesta vedestä imeytyessä ruuhjeiden ja rakojen kautta kallioperään.

Kattovedet johdetaan altaaseen suoraan ja osa piha-alueen hulevesistä ohjataan käsittelyn kautta verkostoon ja osa viivytyksaltaaseen. KV2:n korttelin pohjoisosaan rakenteilla olevan parkkipaikka-alueen hulevedet liitetään myös kaavatilanteen hulevesien hallintaan.

INSINÖÖRITOIMISTO POHJATEKNIikka OY

Seppo Rämö

Maarit Saresma

Report

| | Type of area | Site area, ha | Estimated duration of leakage of rain water, min | Rainwater consumption, l/sec | Average day consumption, m ³ /day | Actual capacity of accumulating tank, m ³ | Approximate length of the trays, m | Approximate length of the collector, m |
|-----------------------|--------------|---------------|--|------------------------------|--|--|------------------------------------|--|
| Before reconstruction | Roof | 6.422 | 17.41 | 536.01 | 3904.576 | 296.76 | 400 | 230 |
| | Asphalt | 11.803 | 41.3 | 514.495 | 7176.224 | 675.71 | 1200 | 400 |
| After reconstruction | Roof | 7.609 | 19.1 | 593.22 | 4626.272 | 359.6 | 450 | 250 |
| | Asphalt | 16.557 | 51.0 | 616.984 | 10066.656 | 1112.13 | 1500 | 500 |

Conclusion: After reconstruction rain water consumption from the territory will be increased by 17,0 %

Calculations of main indices are given below.

1. Before reconstruction

Roof area

Roof area – 6.422 ha

The intensity of rain is 80 l/sec per ha. The amount of precipitation during the warm period is 420 mm.

For the roof area rain water consumption is 536 l/sec. Estimated duration of leakage of rain water for longest pipe is 17,41 min.

Rain water quantity

$$q = \frac{z_{mid} \times A^{1,2} \times F}{t_r^{1,2n-0,1}}$$

Parameters of rain water flow

| № | | Graphical symbol | Unit | Value |
|----|---|------------------|--------------|-------|
| 1. | The intensity of rain 20 min duration | q_{20} | l/sec per ha | 80 |
| 2. | Average rainfall for the year | m_r | | 120 |
| 3. | The exponent | n | | 0.71 |
| 4. | Period exceeded the estimated one-time-intensity rain | P | | 1 |
| 5. | The exponent | y | | 1.54 |
| 6. | Site area | F | ha | 6.422 |
| 7. | Coefficient, which takes into account the uneven rainfall | K | | 1 |
| 8. | The average duration of rain | T | hour | 6 |
| 9 | The length of the trays | l_{can} | m | 400 |
| 10 | The estimated speed at the trays | v_{can} | m/sec | 0.8 |
| 11 | The length of the of collector | l_p | m | 230 |
| 12 | The estimated speed at the trays | v_p | m/sec | 1 |

Site characteristic

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, z | z×F |
|----|------------|-------------------|----------|------------------------|-------|
| 1. | Roof areas | ha | 6.422 | 0.286 | 1.835 |
| | Total | ha | 6.422 | | 1.835 |

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, ψ_0 | $\psi_0 \times F$ |
|----|------------|-------------------|----------|-------------------------------|-------------------|
| 1. | Roof areas | ha | 6.422 | 0.8 | 5.1376 |
| | Total | ha | 6.422 | | 5.1376 |

| | Formula | Value |
|---|--|---------------|
| Estimated duration of leakage of rain water, min. | $t_r = t_{con} + t_{can} + t$ | 17.41 |
| Rainwater consumption, l/sec | $q_r = \frac{Z_{mid} \times A^{1.2} \times F}{t_r^{1.2n-0.1}}$ | 536.01 |
| Annual rainfall, mm | H_r | 620 |
| The amount of precipitation during the warm period, mm | H_δ | 420 |
| Daily max, mm | H_c | 76 |
| The annual quantity of rain and melted water m ³ /year | $W_\delta = W_\delta + W_m + W_m$ | 34786.2 |
| | $W_\delta = 10H_\delta\psi F$ | 21577.92 |
| | $W_m = 10H_m\psi F$ | 7706.4 |
| | $W_m = 10mN_m\psi_m F_m$ | 5501.88 |
| The average day consumption, m ³ /day | $W_c = 10H_c\psi F$ | 3904,576 |

Actual capacity of accumulating tank

Tank's capacity depends on out coming water speed. For water speed 0.08 l/sec accumulating tank volume should be 296,76 m³, and for speed 0.01 l/sec – 918,26 m³.

Asphalt area

Asphalt area – 11.803 ha

The intensity of rain is 80 l/sec per ha. The amount of precipitation during the warm period is 420 mm.

For the asphalt area rain water consumption is 514.5 l/sec. Estimated duration of leakage of rain water for longest pipe is 41.3 min.

Rain water quantity

$$q = \frac{z_{mid} \times A^{1,2} \times F}{t_r^{1,2n-0,1}}$$

Parameters of rain water flow

| № | | Graphical symbol | Unit | Value |
|-----------|---|------------------|---------------------|---------------|
| 1. | The intensity of rain 20 min duration | q_{20} | l/sec per ha | 80 |
| 2. | Average rainfall for the year | m_r | | 120 |
| 3. | The exponent | n | | 0.71 |
| 4. | Period exceeded the estimated one-time-intensity rain | P | | 1 |
| 5. | The exponent | y | | 1.54 |
| 6. | Site area | F | ha | 11.803 |
| 7. | Coefficient, which takes into account the uneven rainfall | K | | 1 |
| 8. | The average duration of rain | T | hour | 6 |
| 9 | The length of the trays | l_{can} | m | 1200 |
| 10 | The estimated speed at the trays | v_{can} | m/sec | 0.8 |
| 11 | The length of the of collector | l_p | m | 400 |
| 12 | The estimated speed at the trays | v_p | m/sec | 1 |

Site characteristic

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, z | z×F |
|----|---------------|-------------------|----------|------------------------|-------|
| 1. | Asphalt areas | ha | 11.803 | 0.286 | 3.372 |
| | Total | ha | 11.803 | | 3.372 |

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, ψ_0 | $\psi_0 \times F$ |
|----|---------------|-------------------|----------|-------------------------------|-------------------|
| 1. | Asphalt areas | ha | 11.803 | 0.8 | 9.4424 |
| | Total | ha | 11.803 | | 9.4424 |

| | Formula | Value |
|---|--|--------------|
| Estimated duration of leakage of rain water, min. | $t_r = t_{con} + t_{can} + t$ | 41.3 |
| Rainwater consumption, l/sec | $q_r = \frac{Z_{mid} \times A^{1.2} \times F}{t_r^{1.2n-0.1}}$ | 514.5 |
| Annual rainfall, mm | H_r | 620 |
| The amount of precipitation during the warm period, mm | H_δ | 420 |
| Daily max, mm | H_c | 76 |
| The annual quantity of rain and melted water m ³ /year | $W_z = W_\delta + W_m + W_m$ | 59323.56 |
| | $W_\delta = 10H_\delta\psi F$ | 39658.08 |
| | $W_m = 10H_m\psi F$ | 14163.6 |
| | $W_m = 10mN_m\psi_m F_m$ | 5501.88 |
| The average day consumption, m ³ /day | $W_c = 10H_c\psi F$ | 7176.224 |

Actual capacity of accumulating tank

Tank's capacity depends on out coming water speed. For water speed 0.08 l/sec accumulating tank volume should be 675.71 m³, and for speed 0.01 l/sec – 2090.87 m³.

2. After reconstruction

Roof area

Roof area – 7.609 ha

The intensity of rain is 80 l/sec per ha. The amount of precipitation during the warm period is 420 mm.

For the roof area rain water consumption is 593.22 l/sec. Estimated duration of leakage of rain water for longest pipe is 19.1 min.

Rain water quantity

$$q = \frac{z_{mid} \times A^{1,2} \times F}{t_r^{1,2n-0,1}}$$

Parameters of rain water flow

| № | | Graphical symbol | Unit | Value |
|-----|---|------------------|--------------|-------|
| 1. | The intensity of rain 20 min duration | q_{20} | l/sec per ha | 80 |
| 2. | Average rainfall for the year | m_r | | 120 |
| 3. | The exponent | n | | 0.71 |
| 4. | Period exceeded the estimated one-time-intensity rain | P | | 1 |
| 5. | The exponent | y | | 1.54 |
| 6. | Site area | F | ha | 7.609 |
| 7. | Coefficient, which takes into account the uneven rainfall | K | | 1 |
| 8. | The average duration of rain | T | hour | 6 |
| 9. | The length of the trays | l_{can} | m | 450 |
| 10. | The estimated speed at the trays | v_{can} | m/sec | 0.8 |
| 11. | The length of the of collector | l_p | m | 250 |
| 12. | The estimated speed at the trays | v_p | m/sec | 1 |

Site characteristic

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, z | z×F |
|----|------------|-------------------|----------|------------------------|-------|
| 1. | Roof areas | ha | 7.609 | 0.286 | 2.174 |
| | Total | ha | 7.609 | | 2.174 |

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, ψ_0 | $\psi_0 \times F$ |
|----|------------|-------------------|----------|-------------------------------|-------------------|
| 1. | Roof areas | ha | 7.609 | 0.8 | 6.0872 |
| | Total | ha | 7.609 | | 6.0872 |

| | Formula | Value |
|---|--|---------------|
| Estimated duration of leakage of rain water, min. | $t_r = t_{con} + t_{can} + t$ | 19.1 |
| Rainwater consumption, l/sec | $q_r = \frac{Z_{mid} \times A^{1.2} \times F}{t_r^{1.2n-0.1}}$ | 593.22 |
| Annual rainfall, mm | H_r | 620 |
| The amount of precipitation during the warm period, mm | H_δ | 420 |
| Daily max, mm | H_c | 76 |
| The annual quantity of rain and melted water m ³ /year | $W_z = W_\delta + W_m + W_m$ | 40198.92 |
| | $W_\delta = 10H_\delta\psi F$ | 25566.24 |
| | $W_m = 10H_m\psi F$ | 9130.8 |
| | $W_m = 10mN_m\psi_m F_m$ | 5501.88 |
| The average day consumption, m ³ /day | $W_c = 10H_c\psi F$ | 4626.272 |

Actual capacity of accumulating tank

Tank's capacity depends on out coming water speed. For water speed 0.08 l/sec accumulating tank volume should be 359.6 m³, and for speed 0.01 l/sec – 1112.13 m³.

Asphalt area

Asphalt area – 16.557 ha

The intensity of rain is 80 l/sec per ha. The amount of precipitation during the warm period is 420 mm.

For the asphalt area rain water consumption is 616.98 l/sec. Estimated duration of leakage of rain water for longest pipe is 51 min.

Rain water quantity

$$q = \frac{z_{mid} \times A^{1,2} \times F}{t_r^{1,2n-0,1}}$$

Parameters of rain water flow

| № | | Graphical symbol | Unit | Value |
|-----|---|------------------|---------------------|---------------|
| 1. | The intensity of rain 20 min duration | q_{20} | l/sec per ha | 80 |
| 2. | Average rainfall for the year | m_r | | 120 |
| 3. | The exponent | n | | 0.71 |
| 4. | Period exceeded the estimated one-time-intensity rain | P | | 1 |
| 5. | The exponent | y | | 1.54 |
| 6. | Site area | F | ha | 16.557 |
| 7. | Coefficient, which takes into account the uneven rainfall | K | | 1 |
| 8. | The average duration of rain | T | hour | 6 |
| 9. | The length of the trays | l_{can} | m | 1500 |
| 10. | The estimated speed at the trays | v_{can} | m/sec | 0.8 |
| 11. | The length of the of collector | l_p | m | 500 |
| 12. | The estimated speed at the trays | v_p | m/sec | 1 |

Site characteristic

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, z | z×F |
|----|---------------|-------------------|----------|------------------------|-------|
| 1. | Asphalt areas | ha | 16.557 | 0.286 | 4.730 |
| | Total | ha | 16.557 | | 4.730 |

| № | Site type | Graphical symbol. | Area, ha | Coefficient of flow, ψ_0 | $\psi_0 \times F$ |
|----|---------------|-------------------|----------|-------------------------------|-------------------|
| 1. | Asphalt areas | ha | 16.557 | 0.8 | 13.2456 |
| | Total | ha | 16.557 | | 13.2456 |

| | Formula | Value |
|--|--|---------------|
| Estimated duration of leakage of rain water, min. | $t_r = t_{con} + t_{can} + t$ | 51 |
| Rainwater consumption, l/sec | $q_r = \frac{Z_{mid} \times A^{1.2} \times F}{t_r^{1.2n-0.1}}$ | 616.98 |
| Annual rainfall, mm | H_r | 620 |
| The amount of precipitation during the warm period, mm | H_δ | 420 |
| Daily max, mm | H_c | 76 |
| The annual quantity of rain and melted water m3/year | $W_2 = W_\delta + W_m + W_m$ | 81001.8 |
| | $W_\delta = 10H_\delta\psi F$ | 55631.52 |
| | $W_m = 10H_m\psi F$ | 19868.4 |
| | $W_m = 10mN_m\psi_m F_m$ | 5501.88 |
| The average day consumption, m3/day | $W_c = 10H_c\psi F$ | 10066.656 |

Actual capacity of accumulating tank

Tank's capacity depends on out coming water speed. For water speed 0.08 l/sec accumulating tank volume should be 998.17 m³, and for speed 0.01 l/sec – 3088.68 m³.