



Trajnostno upravljanje s padavinsko vodo

Zadrževanje in kontroliran izpust

Pri načrtovanju novega trgovskega centra sta se projektant in investitor srečala z izvivom trajnostnega upravljanja s padavinsko vodo. Mnenjedajalec in lokalne oblasti so namreč v projektnih pogojih zahtevali, da je lahko največja količina padavinske vode, s katero bo obremenjen bližnji potok, enaka količini, s katero je bil potok obremenjen pred izgradnjou novega trgovskega centra.

Projekt:

Izgradnja novega trgovskega centra v Lenartu

Izziv:

Upravljanje s padavinsko vodo pri izgradnji novega trgovskega centra. Želo slabo vodoprepustna glinena zemljinina onemogoča ponikanje, neugodni hidrološki pogoji v visoko podtalnico zahtevajo plitvo gradnjo.

Rešitev:

Izgradnja zadrževalnika iz ACO Stormbrixx geocelularnih elementov, ovitih v geomembrano z zvarjenimi stiki po sistemu izvajalca Sinteza lining d.o.o.

Odvajanje površinskih voda

Odvodnjavanje utrjenih površin je urejeno s primernimi prečnimi in vzdolžnimi nakloni v vtočne robnike Kerbdrain KD 305 dimenzijs 15/30,5 cm in linijski požiralnik širine 150 mm tip Monoblock PD 150 v antracit barvi.

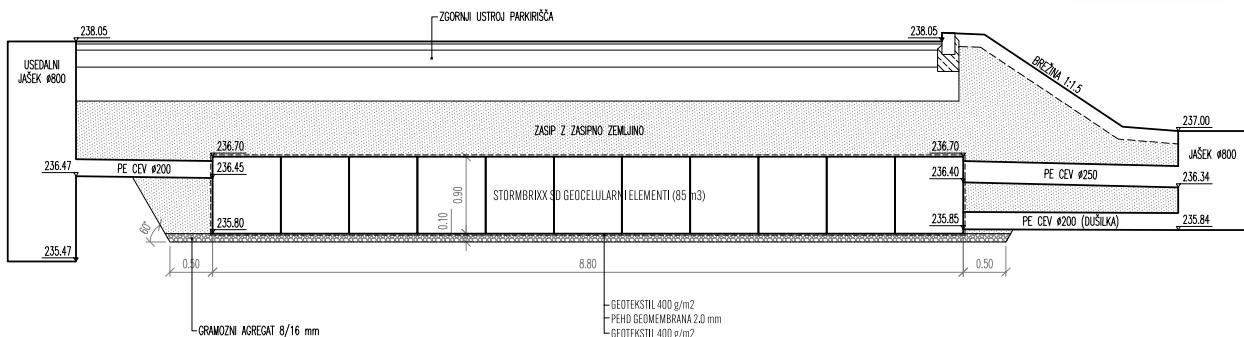
Za odvod padavinskih voda s parkirne ploščadi je zgrajena kanalizacija, v katero se le-te zberejo in se odvedejo na čiščenje v izločevalce lahkih tekočin NS 80 l/sec. Vgrajen je lovilec mineralnih olj z bypassom, integriranim usedalnikom, koalescentnim vložkom in avtomsatko zaporo iztoka, po SIST EN 858-1. Za izločevalcem lahkih tekočin so priključene na to kanalizacijo tudi padavinske vode s strehe objekta. Tako zbrane vode se odvajajo v podzemni zadrževalni objekt. Zadrževalnik preprečuje hipni dotok padavinskih vod v potok in zadržuje razliko odvoda vod v potok pred in po predvidenem gradbenem posegu. S kontroliranim odtokom padavinskih vod iz zadrževalnika v količini, kot jo je potok sprejel pred izgradnjo trgovskega objekta, se potok Globovnica ne bo dodatno obremenjeval.

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Projekt je bil izveden v sodelovanju s partnerskim podjetjem Sinteza lining d.o.o., vodilnim podjetjem na področju tesnjena, zaščite narave in prostora; strokovnjaki za vgradnjo tesnilnih folij (po ang. geomembrane), bentonitnih polsti (po ang. GCL liner) in zaščito betona pred agresivnimi snovmi; www.sinteza-lining.si.

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Vzdoljni prerez zadrževalnika iz Stormbrixx SD geocelularnih elementov ovitih v geomembrano.

Zadrževalnik

Zahteve mnenjedajalca z drugimi besedami pomenijo, da se mora za zadrževanje hipnega dotoka padavinske vode v potok pred izpustom zgraditi zadrževalnik z regulacijo pretoka, ki bo padavinsko vodo iz na novo zgrajenih vodoneprepustnih površin (streha 2,500 m² in asfaltne površine 3,300 m²) izpuščal v bližnji potok največ v količini 20 l/sek.

Zaradi varnosti pred zapolnitvijo zadrževalnika ob ekstremnih padavinah, je na zadrževalniku predviden varnostni preliv. Padavinska voda, ki odteče po dušilki oziroma prelivu iz zadrževalnika, se lahko odvaja v strugo bližnjega potoka.

Zadrževalnik je dimenzioniran na razliko dotoka padavinske vode v potok pred in po izgradnji, in sicer:

- dotok **po** izgradnji 105 m³ - dotok **pred** izgradnjo 20 m³ = 85 m³.

Potrebna velikost zadrževalnika za zadrževanje padavin s trajanjem 15 minut in povratno dobo 5 let, brez upoštevanja sprotnega odtoka v potok v količini 20,0 l/s, je 85 m³. Dimenzijs zadrževalnika smo prilagodili (glede na razpoložljiv prostor) na dimenzijo 10,8 x 9,0 x 0,91 m. Potreben čas za izpraznitev zadrževalnika znaša 1,18 ure.



Zadrževalnik dimenzijs 10,8 x 9,0 x 0,9 m, s prostornino 85 m³, je vgrajen pod parkirnimi prostori za kupce. Debelina prekritja (zasipa zemljin in zgornji ustroj parkirišča) znaša 1,4 m.



Natančno krojenje geomembrane po obodu zadrževalnika s premičljjenimi preklopi in sistemu avtomatskega ter ekstruzijskega varjenja za 100% vodotesnost.



Izvedba 100% vodotesnih cevnih prebojev oziroma vodotesnih navezav na cev.
Cevi morajo biti gladke in iz PEHD materiala.



Detajl obodnega zvara horizontalne geomembrane položene na tla in bočne geomembrane zadrževalnika.

Vodotesna geomembrana

Postopek vgradnje posameznih slojev in varjenja je sestavljen iz sledečih pozicij:

Poz 1: Dobava, krojenje, polaganje in termično spajanje zaščitnega geotekstila minimalne teže 400 g/m², minimalne prebodne trdnosti CBR = minimalno 3000 N in minimalne natezne trdnosti 19 kN. Geotekstil se polaga kot zaščita geomembrane pri stiku s Stormbrixx geocelularnimi elementi.

Poz 2: Dobava, krojenje, polaganje in 100% vodotesno varjenje obojestransko gladke PEHD geomembrane debeline 2,00 mm po sistemu avtomatskega in ekstruzijskega varjenja (sistem SINTEZA lining Celje d.o.o.). Vsa dela so izvajali certificirani varilci za varjenje geomembran.

Poz 3: Izvedba 100% vodotesnih cevnih prebojev oziroma vodotesna navezava na cev. Kanalizacijske cevi so PEHD gladke.

Poz 4: Dobava, krojenje, polaganje in termično spajanje zaščitnega geotekstila minimalne teže 400 g/m², minimalne prebodne trdnosti CBR = min. 3000 N in min. natezne trdnosti 19 kN. Geotekstil se polaga kot zaščita geomembrane pri stiku z nasutjem.

Potek same izvedbe – po naslednjem vrstnem redu:

Korak 1: Na pripravljeno podlago najprej položimo geotekstil iz Poz 4, v tlorisni površini predvidenega zadrževalnika in dodatkom potrebnim za zavihek.

Korak 2: Na ta geotekstil se položi in zvari geomembrana z zavihki iz Poz 2.

Korak 3: Na geomembrano se položi še geotekstil iz Poz 1.

Korak 4: Na tako pripravljeno podlago se sestavi sistem geocelularnih modularnih elementov po predvidenem projektu. Izvedejo se tudi priklopi za dotočne in iztočne cevi. Objekt se nato zavije v geotekstil iz Poz 1 še na zgornji in bočnih straneh ter spoji z geotekstilom iz koraka 3.

Korak 5: Izvede se krojenje in varjenje geomembrane in vodotesna izvedba priključkov ter spoj z geomembrano iz koraka 2.

Korak 6: Izvede se pregled vodotesnosti vseh varov po sistemu podtlaka (vacuum bell testing) in z visokofrekvenčnim testerjem (high frequency spark testing).

Korak 7: Izvedbo zaključimo še z zaključnim slojem geotekstila, ki ga spojimo s tistim iz koraka 1. Podzemni zadrževalni objekt je pripravljen za zasip.

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Sustainable rainwater management

Retention and controlled release

While planning new shopping center the designer and investor met with the challenge of sustainable rainwater management. Namely authorities demanded in project condition that the highest quantity of rainwater, discharged in nearest stream, should not extend the rainwater quantity, the stream was filled before the construction of the new shopping center.

Project:

Construction of the new shopping center in Lenart, Slovenia

Challenge:

Management of the rainwater when building new shopping center. Very poorly permeable clay soil is disabling the infiltration, unpleasant hydrological conditions with high groundwater require shallow installation.

Solution:

The construction of underground water retention basin, made from ACO Stormbrixx geocellular elements, wrapped in geomembrane with welded joints according to the system of the subcontractor company Sinteza lining d.o.o.

Surface Water Drainage

Drainage of the paved surfaces is arranged with suitable transverse and longitudinal slopes into KerbDrain KD 305 elements and line drainage elements Monoblock PD 150, anthracite color.

For the drainage of the rainwater from parking area there is sewerage system built in, into which the waters are collected and from there are taken for cleaning in light-liquid separator NS 80 l/s. Therefore mineral oil separator with bypass, integrated sludge trap and coalescent filter with closure device, according to SIST EN 858-1 was installed. Water collected in this way together with roof water is released in underground retention facility.

The retention tank prevents the instant inflow of rainwater into the stream and retains the difference in the discharge of water into the stream before and after the planned construction intervention. With the controlled outflow of rainwater from the tank in the amount, accepted by the stream before the construction of the commercial facility, the Globovnica stream will not be additionally burdened.

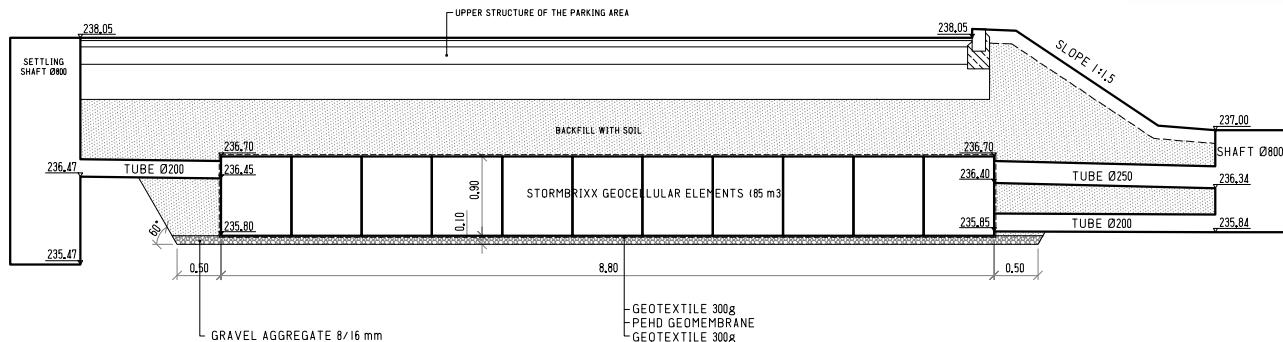
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Project was implemented in partnership with Sinteza lining d.o.o., leading company on the field of sealing, nature and environment protection, experts in installation of sealing foils (geomembranes), bentonite liner (GCL liner) and protection of the concrete from aggressive substances.

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Longitudinal retention tank cross section made of Stormbrixx SD geocellular elements wrapped in a geomembrane.

Retention tank

Requirements of consent authority with other words mean that in order to retain momentarily inflow of the rainwater into the stream before release retainer with flow regulator must be built, which will release rainwater from the newly, watertight surfaces (roof 2.500 m² and asphalt surface 3.300 m²) into the nearest stream in the amount of maximum 20 l/sec.

Because of the security before filling of retention tank during extremely heavy rainfall safety overflow was provided.

Rainwater – that flows down the throttle or overflow from the retention – can drain into the bed of the stream.

The retention is dimensioned according to the difference of the rainwater inflow into the stream before and after construction, namely:

- Inflow **after** construction 105 m³ – Inflow **before** construction 20 m³ = 85 m³
- The required retention volume is 85 m³ and was calculated with 15 minutes rainfall intensity and return period of 5 years, without taking into account regularly outflow in the amount of 20 l/sec. The dimensions of the retention were also adjusted (according to available space) to dimension 10.8 x 9.0 x 0.91 m. The time needed to empty the basin is 1.18 h.



A retention with dimensions 10.8 x 9.0 x 0.91 m and volume of 85 m³, is installed under the customers car parking area. The thickness of the cover (backfill soil and the upper road structure of the parking area) is 1.4 m.



Precise tailoring of the geomembrane around the perimeter of the retention with thoughtful switches with combination of automatic and extrusion welding for 100% waterproofing.



Preparation of 100% waterproof pipe breakthrough for waterproof connections to the pipe. The pipes have to be made of PEHD and smooth from outside.



Detail of the longitudinal weld of horizontal geo membrane laid on the floor and side geo membrane of the retainer.

Waterproof Geomembrane

The process of the installation of individual layers and welding is consisted of next positions:

Pos. 1: Supply, cutting, laying and thermal bonding of the protective geotextile with a minimum weight of 400 g/m², a minimum piercing strength CBR= 3000 N and min. tensile strength 19 kN. Geotextile is laid as a protection of the geomembrane in contact with Stormbrixx geocellular elements.

Pos. 2: Supply, cutting, laying and 100% waterproof welding of double-sided smooth PEHD geomembrane thickness of 2.00 mm according to the system of automatic and extrusion welding (system Sinteza lining Celje d.o.o.). All work was done by certified geomembrane welders.

Pos. 3: Pipes are made of PEHD and smooth outside.

Pos. 4: Supply, cutting, laying and thermal bonding of protective geotextile minimum of weight 400 g/m², a minimum piercing strength CBR=min. 3000 N and tensile strength 19 kN- Geotextile is laid as a protection of geomembrane in contact with filling material.

Workflow - In the following order:

Step 1: On the prepared ground first geotextile was placed (Pos. 4), in the floor area of the intended retention and addition needed for the fold.

Step 2: A geomembrane with folds from Pos. 2 is laid and welded on this geotextile.

Step 3: The geotextile from Pos. 1 is also placed on the geomembrane.

Step 4: On the basis prepared on this way geo cellular modular elements can be placed according to the planned project. Connections for inlet and outlet pipes are also made. The object is wrapped in geotextile groom Pos. 1 also on upper and side sides and connect with the geotextile from Step 2.

Step 5: Cutting and welding of the geomembrane and waterproof performance of the connections and connection with the geomembrane from Step 2 are performed.

Step 6: A test of water tightness of all welds is performed according to system of vacuum (vacuum bell testing) and with high-frequency tester (high frequency spark testing).

Step 7: Installation has to be completed with the final layer of the geotextile, connected with the one from Step 1. Underground retention object is ready for backfilling.

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