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# *Ovjereni prijevod s engleskog jezika*

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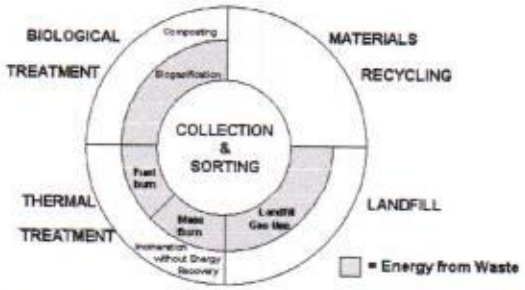
## 9.1 OPĆI OPIS ODABRANOG SUSTAVA ZA GOSPODARENJE OTPADOM

Integrirani sustav za gospodarenje krutim otpadom mora biti održivi sustav koji je ekonomski priuštiv, društveno prihvatljiv i ekološki učinkovit.

- Ekonomska dostupnost zahtijeva da troškovi sustava upravljanja otpadom budu prihvatljivi svim sektorima zajednice, uključujući kućanstva, trgovinu, industriju, institucije i vlasti.
- Društvena prihvatljivost zahtijeva da sustav gospodarenja otpadom zadovoljava potrebe lokalne zajednice te odražava vrijednosti i prioritete tog društva.
- Učinkovitost zaštite okoliša zahtijeva da se ukupna opterećenja okoliša gospodarenjem otpadom smanje u pogledu potrošnje resursa (uključujući energiju) i proizvodnje emisije u zrak, vodu i zemlju.

Integrirani sustav za gospodarenje krutim otpadom zauzima općenit pristup tome, uključuje upotrebu niza različitih opcija gospodarenja i obuhvaća cjelokupan tok krutog otpada.

Sljedeća slika prikazuje koncept integriranog sustava za gospodarenje krutim otpadom. Prikaz integriranog sustava za gospodarenje krutim otpadom prikazuje da su u središtu bilo kojeg uspješnog sustava za gospodarenje otpadom sakupljanje i sortiranje. Četiri glavne tehnologije za gospodarenje otpadom koje okružuju sustav za sakupljanje i sortiranje prikazane su kao četiri jednako velika kvadranta kako bi se pokazalo da ih je potrebno razmatrati u jednakoj mjeri pri razvoju strategije za gospodarenje otpadom na bilo kojoj lokaciji. Fleksibilnost u primjeni tehnologija za određenu lokaciju također je ključna komponenta koncepta integriranog sustava za gospodarenje krutim otpadom. Potpora za donošenje odluka koja se temelji na podacima upotrebom alata za procjenu životnog ciklusa olakšava odabir najprikladnijih tehnologija za gospodarenje otpadom (ne nužno svih četiriju) koje su potrebne za izgradnju ekološki optimiziranoga integriranog sustava za gospodarenje otpadom na određenoj lokaciji. U kombinaciji s ekonomskim i društvenim razmatranjima taj pristup pomaže pri oblikovanju održivijeg sustava za gospodarenje krutim otpadom.




**Slika 9-1: Elementi integriranoga gospodarenja krutim otpadom**

Zajedno s općenitom potrebom za održivim gospodarenjem otpadom jasno je da niti jedna metoda gospodarenja ne može samostalno upravljati svim materijalima u komunalnom krutom otpadu na ekološki prihvatljiv i financijski učinkovit način. Slijedom donošenja prikladnog sustava sakupljanja bit će potreban niz opcija gospodarenja. Te opcije uključuju oporabu materijala, biološku obradu (kompostiranje/biogasifikaciju), termalnu obradu (spaljivanje otpada povratom energije i/ili spaljivanje goriva dobivenog iz otpada, RDF-a) i odlaganje. Zajedno čine integrirani sustav za gospodarenje otpadom.

Programi učinkovitoga gospodarenja trebaju fleksibilnost za oblikovanje sustava, prilagođavanje i rukovanje njima na načine koji najbolje zadovoljavaju društvene, ekonomske i ekološke uvjete. Postoji vjerojatnost da će se mijenjati s vremenom i razlikovati se ovisno o lokaciji. Potreba za dosljednošću u pogledu kvalitete i kvantitete recikliranih materijala, komposta ili energije, potreba za potporom nizu opcija odlaganja i korist od ekonomije razmjera ukazuju na to da bi integrirani

sustavi za gospodarenje krutim otpadom trebali biti organizirani u velikom razmjeru te na regionalnoj osnovi. Svaki plan koji uključuje tehnologije recikliranja, kompostiranja ili dobivanja energije od otpada mora biti tržišno orijentiran.

Iako upotrebljava kombinaciju različitih opcija, definirajuća značajka integriranog sustava za gospodarenje krutim otpadom jest ta da zauzima *opći* pristup za gospodarenje svim materijalima u toku otpada na ekološki učinkovit, priuštiv i društveno prihvatljiv način.
Integrirani sustav za gospodarenje krutim otpadom sastoji se od sljedećih faza, koje se dublje analiziraju u poglavljima u nastavku:

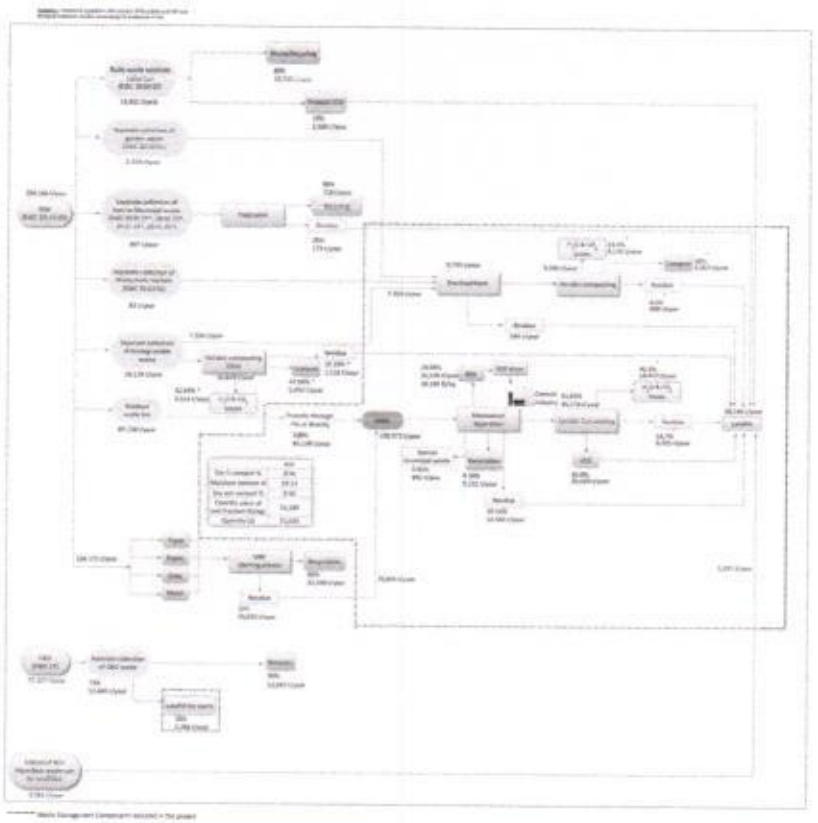
- sakupljanja otpada (dva/tri toka)
- prijevoza i prenošenja otpada (do pretovarne stanice, postrojenja za oporabu i reciklažu, postrojenja za obradu ili odlagališta)
- lokacija postrojenja za gospodarenje otpadom, tj. pretovarnih stanica i integriranog centra za gospodarenje otpadom
- obrade otpada (termalna, fizička, kemijska ili biološka obrada)
- zbrinjavanja na odlagalištu

Odabrani sustav za gospodarenje otpadom za Splitsko-dalmatinsku županiju uključuje sljedeće:

- **Sakupljanje otpada:** Sustav sakupljanja otpada uključuje tri toka sakupljanja otpada:
  - otpad koji je moguće reciklirati
  - ostatni otpad
  - biološki otpad.

- **Prijevoz otpada:** Uzimajući u obzir rezultate analize opcija koja je predstavljena u poglavlju 8. u pogledu pretovarnih stanica (PS), sakupljanje otpada putem pretovarnih stanica dovodi do prednosti i koristi za dionike projekta. Predložene pretovarne stanice koje će služiti Splitsko-dalmatinskoj županiji jesu:
  - PS Split
  - PS Sinj
  - PS Zagvozd
  - PS Brač
  - PS Hvar
  - PS Vis
- **Gospodarenje otpadom i odlaganje otpada:** Uzimajući u obzir sve elemente koji su predstavljeni u različitim poglavljima ove studije, preporučeni sustav gospodarenja otpadom i zbrinjavanja otpada jest Scenarij Sc.1, koji uključuje:
  - mehaničku obradu s izdvajanjem komponenti za recikliranje i izdvajanje goriva iz otpada (RDF)
  - aerobno kompostiranje za proizvodnju proizvoda sličnog kompostu CLO-a
  - odlagalište za konačno odlaganje ostataka otpada i CLO-a koje će se provesti u skladu sa zahtjevima Direktive 99/31/EZ
  - odlagalište za inertni otpad.

Na slici u nastavku nalazi se prikaz cjelokupnog sustava za gospodarenje otpadom (sakupljanje, obrada i zbrinjavanje) koji će se primijeniti u Splitsko-dalmatinskoj županiji.



**Slika 9-2: Pregled sustava gospodarenja otpadom u Splitsko-dalmatinskoj županiji**

U pogledu ispunjavanja zakonskih ciljeva tablica u nastavku prikazuje kvantifikaciju Direktive 2008/98/EZ kako je izmijenjena direktivama 2018/851 i 1999/31/EZ.

**Tablica 9-1: Kvantifikacija zakonskih ciljeva za predloženi sustav gospodarenja otpadom**

| | **Europska Direktiva 2008/98/EZ kako je izmijenjena Direktivom 2018/851 Članak 55. Zakona o održivom gospodarenju otpadom (NN br. 94/13)** | | | **Europska Direktiva 1999/31/EC Članak 24. Zakona o održivom gospodarenju otpadom (NN br. 94/13)** | | |
|---|---|---|---|---|---|---|
| | Postotak (%) | Količina (t) | Ispunjenje cilja | Postotak (%) | Količina (t) | Ispunjenje cilja |
| **Ciljevi** | ≥ 50 % (2023.)<br>≥ 55 % (2025.)<br>≥ 60 % (2030.)<br>≥ 65 % (2035.) | 64.479*<br>70.288*<br>74.966*<br>81.630* | | < 35 % | 28.054** | |
| ***Odabrani scenarij 1*** | 73,3 %<br>73,3 %<br>73,3 %<br>73,3 % | 94.531<br>93.681<br>91.589<br>92.060 | Da<br>Da<br>Da<br>Da | 12,5 % | 10.031 | Da |

*Napomena:*

** Ukupna količina otpada koji je moguće reciklirati (iz kućanstva i sličan komercijalni otpad) izračunata je na 128 957 t za godinu 2030. (50 % 128.957 = 64.479 t, 55 % 127.797 = 70.288, 60 % 124.943 = 74.966, 65 % 125.585 = 81.630).*

*** U skladu sa Zakonom o održivom gospodarenju otpadom, NN br. 94/13, člankom 55. stavkom 1. ukupna količina biorazgradivog otpada u Republici Hrvatskoj u godini 1997. iznosila je 756.174 t. Ukupni broj stanovnika u Republici Hrvatskoj u 2011. iznosio je 4.284,889 građana, a ukupan broj stanovnika Splitsko-dalmatinske županije u 2011. bio je 454.789. 454.789/4.284.889 = 10.6 %.*

*Na temelju navedenog postotka genenerirani biorazgradivi komunalni otpad koji je nastao u Splitsko-dalmatinskoj županiji u 1997. iznosio je 10,6 % * 756.174 t = 80.154 t. Do 2021. godine maksimalna dopuštena masa biorazgradivog otpada koju je na godišnjoj razini moguće deponirati u odlagalištu u Splitsko-dalmatinskoj županiji, u odnosu na masu biorazgradivog otpada nastalog 1997. u tim županijama iznosit će < 35 % (< 35 %*80.154 t = 28.054 t).*

## 9.2 PROGNOZA BUDUĆIH TOKOVA OTPADA

### 9.2.1 Prognoza za proizvodnju komunalnoga krutog otpada

Kako je analizirano u poglavlju 4., **ukupna količina proizvedenoga komunalnoga krutog otpada u Splitsko-dalmatinskoj županiji za 2015. iznosila je 246.396 t.**

**Tablica 9-2: Stopa proizvodnje otpada (2015. godina)**

| | Splitsko-dalmatinska županija |
|---|---|
| **Stalno stanovništvo** | 452 841 građanin |
| **Sezonsko stanovništvo** | 41 869 građana |
| **Ukupno stanovništvo** | 494 710 građana<br>498 kg / po glavi / godišnje ili<br>1,36 kg / po glavi / dnevno |

**Ukupno stanovništvo (stalno i sezonsko) za 2015. godinu za Splitsko-dalmatinsku županiju činilo je 494 710 građana [452 841 (stalno stanovništvo) + 41 869 (sezonsko stanovništvo)].**

Sljedeća tablica prikazuje prognozu proizvodnje komunalnog otpada (upotrebom **najgoreg scenarija** u pogledu stope proizvodnje otpada) te pruža sljedeće informacije:

- ukupna prosječna proizvodnja komunalnog otpada od 2023. do 2047. godine za Splitsko-dalmatinsku županiju iznosi **228.166 tona** s rasponom od 233.020 tona i 228.606 tona.

**Tablica 9-3: Predviđena proizvodnja komunalnog otpada (najgori scenarij u pogledu stope proizvodnje otpada)**

| | 2015. | 2016. | 2017. | 2018. | 2019. | 2020. | 2021. | 2022. | 2023. | 2024. | 2025. | 2026. | 2027. | 2028. | 2029. | 2030. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Stalno stanovništvo* | *452.841* | *452.750* | *452.660* | *452.569* | *452.479* | *452.388* | *452.298* | *451.438* | *450.581* | *449.725* | *448.870* | *448.017* | *447.166* | *446.316* | *445.468* | *444.622* |
| Broj turističkih noćenja | 15.282.126 | 17.113.025 | 16.001.440 | 16.589.760 | 17.178.080 | 17.766.400 | 18.354.720 | 18.943.040 | 19.531.360 | 20.119.680 | 20.708.000 | 21.296.320 | 21.884.640 | 22.472.960 | 23.061.280 | 23.649.600 |
| Sezonsko stanovništvo | 41.869 | 46.885 | 43.840 | 45.451 | 47.063 | 48.675 | 50.287 | 51.899 | 53.511 | 55.122 | 56.734 | 58.346 | 59.958 | 61.570 | 63.182 | 64.793 |
| Ukupno stanovništvo | 494.710 | 499.635 | 496.499 | 498.021 | 499.542 | 501.063 | 502.585 | 503.337 | 504.091 | 504.847 | 505.604 | 506.363 | 507.124 | 507.886 | 508.650 | 509.416 |
| **Proizvodnja otpada u tonama** | **246.396** | **246.423** | **242.489** | **240.860** | **239.240** | **237.629** | **236.027** | **234.076** | **233.020** | **231.969** | **230.923** | **229.882** | **228.846** | **227.815** | **226.788** | **225.767** |
| *Stope proizvodnje otpada (kg/cs/god.)* | *498* | *493* | *488* | *484* | *479* | *474* | *470* | *465* | *462* | *459* | *457* | *454* | *451* | *449* | *446* | *443* |

| | 2031. | 2032. | 2033. | 2034. | 2035. | 2036. | 2037. | 2038. | 2039. | 2040. | 2041. | 2042. | 2043. | 2044. | 2045. | 2046. | 2047. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Stalno stanovništvo* | *443.777* | *442.623* | *441.473* | *440.325* | *439.180* | *438.038* | *436.899* | *435.763* | *434.630* | *433.500* | *432.373* | 430.903 | *429.438* | *427.978* | *426.523* | *425.073* | *423.627* |
| Broj turističkih noćenja | 24.237.920 | 24.826.240 | 25.414.560 | 26.002.880 | 26.591.200 | 27.179.520 | 27.767.840 | 28.356.160 | 28.944.480 | 29.532.800 | 30.121.120 | 30.709.440 | 31.297.760 | 31.886.080 | 32.474.400 | 33.062.720 | 33.651.040 |
| Sezonsko stanovništvo | 66.405 | 68.017 | 69.629 | 71.241 | 72.853 | 74.464 | 76.076 | 77.688 | 79.300 | 80.912 | 82.524 | 84.135 | 85.747 | 87.359 | 88.971 | 90.583 | 92.195 |
| Ukupno stanovništvo | 510.183 | 510.641 | 511.102 | 511.566 | 512.033 | 512.503 | 512.975 | 513.451 | 513.930 | 514.412 | 514.897 | 515.039 | 515.185 | 515.337 | 515.494 | 515.655 | 515.822 |
| **Proizvodnja otpada u tonama** | **226.107** | **226.310** | **226.514** | **226.720** | **226.927** | **227.135** | **227.345** | **227.556** | **227.768** | **227.981** | **228.196** | **228.259** | **228.324** | **228.391** | **228.461** | **228.532** | **228.606** |
| *Stope proizvodnje otpada (kg/cs/god.)* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* |

### 9.2.2 Predviđanja u pogledu komunalnoga krutog otpada koji će biti dovezen u Centar za gospodarenje otpadom u Općini Lećevica

Kako je analizirano u poglavlju 4. i prikazano na sljedećoj tablici, prosječna količina komunalnoga krutog otpada koji će biti dovezen u Centar za gospodarenje otpadom u Općini Lećevica između 2023. i 2047. iznosi **109.973 t**, a kretat će se između 110.185 i 112.313 tona.

**Tablica 9-4: Komunalni kruti otpad koji će biti dovezen u Centar za gospodarenje otpadom Lećevica na buduću obradu (u tonama)**

| | 2023. | 2024. | 2025. | 2026. | 2027. | 2028. | 2029. | 2030. | 2031. | 2032. | 2033. | 2034. | 2035. | 2036. | 2037. | 2038. | 2039. | 2040. | 2041. | 2042. | 2043. | 2044. | 2045. | 2046. | 2047 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Količina komunalnog otpada koji će biti dovezen u Centar za gospodarenje otpadom u Općini Lećevica (u tonama) | 112.313 | 111.806 | 111.302 | 110.800 | 110.301 | 109.804 | 109.309 | 108.817 | 108.981 | 109.079 | 109.177 | 109.276 | 109.376 | 109.476 | 109.577 | 109.679 | 109.781 | 109.884 | 109.988 | 110.018 | 110.049 | 110.082 | 110.115 | 110.150 | 110.1 |
| Količina komunalnog otpada koji će biti dovezen u Centar za gospodarenje otpadom u Općini Lećevica i odvojen na temelju kvalitativnog sastava | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kuhinjski otpad i biootpad | 42.081 | 41.891 | 41.702 | 41.514 | 41.327 | 41.141 | 40.955 | 40.771 | 40.832 | 40.869 | 40.906 | 40.943 | 40.980 | 41.018 | 41.056 | 41.094 | 41.132 | 41.171 | 41.209 | 41.221 | 41.233 | 41.245 | 41.257 | 41.270 | 41.28 |
| Papir/karton | 15.632 | 15.561 | 15.491 | 15.421 | 15.352 | 15.283 | 15.214 | 15.145 | 15.168 | 15.182 | 15.195 | 15.209 | 15.223 | 15.237 | 15.251 | 15.265 | 15.279 | 15.294 | 15.308 | 15.312 | 15.317 | 15.321 | 15.326 | 15.331 | 15.33 |
| Koža i kosti | 198 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 192 | 192 | 192 | 192 | 192 | 193 | 193 | 193 | 193 | 193 | 193 | 193 | 194 | 194 | 194 | 194 | 194 |
| Drvo | 3042 | 3028 | 3014 | 3001 | 2987 | 2974 | 2960 | 2947 | 2952 | 2954 | 2957 | 2960 | 2962 | 2965 | 2968 | 2970 | 2973 | 2976 | 2979 | 2980 | 2981 | 2981 | 2982 | 2983 | 2984 |
| Tekstil | 11.891 | 11.837 | 11.784 | 11.731 | 11.678 | 11.625 | 11.573 | 11.521 | 11.538 | 11.548 | 11.559 | 11.569 | 11.580 | 11.590 | 11.601 | 11.612 | 11.623 | 11.634 | 11.645 | 11.648 | 11.651 | 11.655 | 11.658 | 11.662 | 11.66 |
| Staklo | 3699 | 3683 | 3666 | 3649 | 3633 | 3617 | 3600 | 3584 | 3589 | 3593 | 3596 | 3599 | 3602 | 3606 | 3609 | 3612 | 3616 | 3619 | 3623 | 3624 | 3625 | 3626 | 3627 | 3628 | 3629 |
| Metali | 2044 | 2035 | 2026 | 2017 | 2008 | 1999 | 1990 | 1981 | 1984 | 1985 | 1987 | 1989 | 1991 | 1993 | 1995 | 1996 | 1998 | 2000 | 2002 | 2003 | 2003 | 2004 | 2004 | 2005 | 2006 |
| Inertni otpad | 8000 | 7964 | 7928 | 7892 | 7856 | 7821 | 7786 | 7751 | 7762 | 7769 | 7776 | 7783 | 7790 | 7798 | 7805 | 7812 | 7819 | 7827 | 7834 | 7836 | 7838 | 7841 | 7843 | 7846 | 7848 |
| Plastika | 11.829 | 11.776 | 11.723 | 11.670 | 11.617 | 11.565 | 11.513 | 11.461 | 11.478 | 11.489 | 11.499 | 11.509 | 11.520 | 11.530 | 11.541 | 11.552 | 11.563 | 11.573 | 11.584 | 11.588 | 11.591 | 11.594 | 11.598 | 11.601 | 11.605 |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guma-koža | 4484 | 4464 | 4443 | 4423 | 4403 | 4384 | 4364 | 4344 | 4351 | 4355 | 4359 | 4363 | 4366 | 4370 | 4375 | 4379 | 4383 | 4387 | 4391 | 4392 | 4393 | 4395 | 4396 | 4397 | 4399 |
| Poseban otpad | 1138 | 1133 | 1128 | 1123 | 1118 | 1113 | 1108 | 1103 | 1104 | 1105 | 1106 | 1107 | 1108 | 1109 | 1110 | 1111 | 1112 | 1113 | 1115 | 1115 | 1115 | 1115 | 1116 | 1116 | 1117 |

| Polone | 8276 | 8239 | 8202 | 8165 | 8128 | 8091 | 8055 | 8019 | 8.031 | 8038 | 8045 | 8052 | 8060 | 8067 | 8075 | 8082 | 8090 | 8097 | 8105 | 8107 | 8109 | 8112 | 8114 | 8117 | 811 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 9.3 IDEJNO RJEŠENJE PROJEKTA

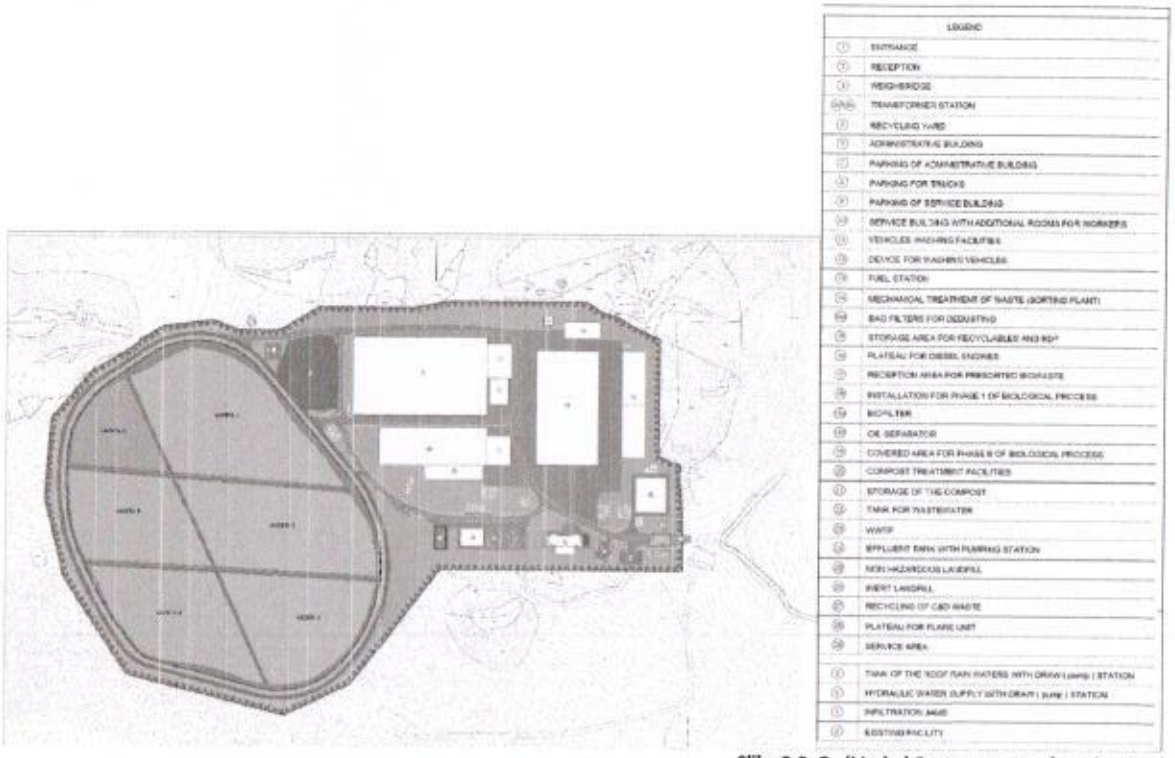
Za ispravno funkcioniranje Centra za gospodarenje otpadom u Općini Lećevica potrebni su sljedeći glavni objekti:

i) ulaz i kontrola
ii) postrojenje za mehaničku i biološku obradu sa skladištem za reciklirani materijal i biofiltrom
iii) odlagališne kazete 1 – 5
iv) odlagališna kazeta 6
v) površina za glomazni otpad – reciklažno dvorište
vi) prostor za zgrade (za zaposlenike, održavanje i druge svakodnevne aktivnosti)
vii) interne ceste
viii) uređaj za pročišćavanje otpadnih voda (UPOV)
ix) prostor za građevinski otpad i otpad od rušenja
x) zatvoreni spremnik za otpadne vode
xi) zatvoreni spremnik za efluent
xii) spremnik za gorivo, baklja, fotonaponski sustav

Ulaz u CGO nalazi se s jugoistočne strane, gdje se nalaze i portirnica, mosne vage i trafostanica. U središtu CGO-a bit će izgrađene odlagališne ćelije. Kamioni koji dolaze usmjeravat će se prema jedinici za prihvat MBO-a, a ostatni otpad od MBO procesa prenosit će se u odlagališne kazete. Pristup drugim radovima bit će olakšan putem interne ceste, odnosno do odlagališne kazete 6, uređaja za pročišćavanje otpadnih voda i površine za građevinski otpad i otpad od rušenja.

Opći prikaz Centra za gospodarenje otpadom predstavljen je u nastavku.

Analitički opis MBO postrojenja i lokacije odlagališta nalaze se u Prilogu 9.1. poglavlja 9.




**Slika 9-3: Opći izgled Centra za gospodarenje otpadom**

Područje dodijeljeno za izgradnju različitih dijelova jest:

**Tablica 9-5: Područje predviđeno za postrojenja Centra za gospodarenje otpadom (bez odlagališta)**

| POSTROJENJA CENTRA ZA GOSPODARENJE OTPADOM | POVRŠINA ($m^2$) |
|---|---|
| Transformatorska stanica | 72 |
| Portinica | 62 |
| Upravna zgrada | 790 |
| Parkiralište upravne zgrade | 340 |
| Postrojenje za mehaničku obradu | 9100 |
| Biofiltar uz postrojenje za mehaničku obradu | 780 |
| Skladište materijala za recikliranje i goriva iz otpada (RDF) | 3200 |
| Parkiralište za kamione | 420 |
| Parkiralište servisne zgrade | 340 |
| Servisna zgrada s pomoćnim prostorijama za radnike | 550 |
| Plato za pranje vozila | 300 |
| Površina za prihvat prethodno izdvojenog biorazgradivog otpada | 904,5 |
| Kompostiranje | 5164 |
| Biofiltar uz postrojenje za kompostiranje | 1100 |
| Dozrijevanje | 13.725 |
| Postrojenje za doradu komposta | 682 |
| Prostor za skladištenje čistog komposta | 1120 |
| Parkiralište za kamione | 440 |
| Reciklažno dvorište za građevinski otpad i otpad od rušenja | 5,186 |
| Plato za baklju | 414 |
| Spremnik otpadnih voda | 100 |
| Zatvoreni spremnik za efluent | 100 |
| UPOV | 1400 |
| **Ukupna površina za objekte (bez odlagališta)** | **46.294,5** |

**Tablica 9-6: Asfaltne površine**

| Asfaltne površine Centra za gospodarenje otpadom | POVRŠINA ($m^2$) |
|---|---|
| Plato za mehaničku obradu | 12.815 |
| Plato za kompostiranje | 2382 |
| Plato za dozrijevanje | 2153 |
| Plato za UPOV | 850 |
| Plato uz upravnu zgradu | 704 |
| Parkiralište uz upravnu zgradu | 340 |
| Reciklažno dvorište | 412,5 |
| Plato za baklju | 414 |
| Prometnice | 12.663 |
| **Ukupna površina** | **34.465,5** |

**Tablica 9-7: Površine za kazete odlagališta**

| Ćelije odlagališta | POVRŠINA ($m^2$) |
|---|---|
| Odlagališna kazeta 1 | 22.528 |

| | |
|---|---|
| Odlagališna kazeta 2 | 18.982 |
| Odlagališna kazeta 3 | 15.495 |
| Odlagališna kazeta 4 | 15.073 |
| Odlagališna kazeta 5 | 13.039 |
| Odlagališna kazeta 6 (inertni otpad) | 7145 |
| **Ukupna površina odlagališta** | **92.262** |

U tablicama u nastavku predstavljena je ukupna masena bilanca postrojenja za MBO i lokacije odlagališta.

**Tablica 9-8: Masena bilanca postrojenja za MBO**

| Ukupna masena bilanca za Scenarij 1 | Količine | Postotak |
|---|---|---|
| **Ulazni otpad za mehaničko razdvajanje** | **109.973** | **100,0 %** |
| Mehaničko razdvajanje | 109.973 | 100,0 % |
| *Komponente koje je moguće reciklirati* | 9222 | 8,4 % |
| *Ostatni otpad* | 22.543 | 20,5 % |
| *RDF* | 31.539 | 28,7 % |
| *Posebni komunalni otpad* | 891 | 0,8 % |
| *Na biološku obradu* | 45.778 | 41,6 % |
| **Ulazni otpad za aerobno kompostiranje** | **45.778** | **41,6%** |
| Aerobno kompostiranje | 45.778 | |
| *$H_2O$ &$CO_2$ gubici* | 18.452 | 40,3 % |
| *CLO* | 20.600 | 45,0 % |
| *Ostatni otpad* | 6725 | 14,7 % |
| **Ukupan ostatni otpad za odlaganje** | **49.868** | |

*Napomena: Količine koje su navedene u prethodnoj tablici odgovaraju prosječnim količinama za razdoblje 2023. – 2047.*

**Tablica 9-9: Očekivane količine i stope oporabe u mehaničkoj obradi**

| Frakcija | Obrada uz Scenarij 1 | % oporabe | % konačne oporabe |
|---|---|---|---|
| **Papir/karton** | 13,92 % | 19,7 % | 2,75 % |
| **Plastika** | 10.53 % | 33,8 % | 3,56 % |
| **Staklo** | 3,29 % | 20,0 % | 0,66 % |
| **Metali** | 1,82 % | 78,0 % | 1,42 % |
| **Ukupno** | **29,56 %** | | **8,39 %** |

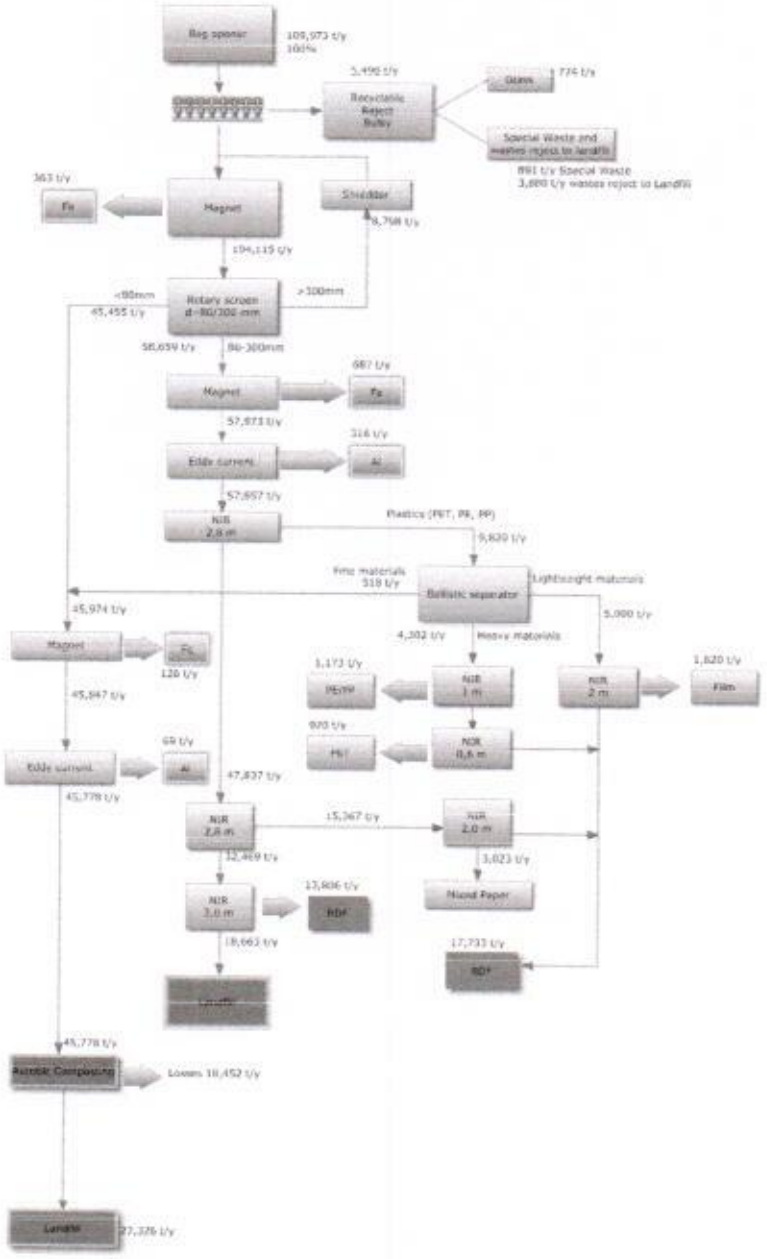
**Tablica 9-10: Ukupne količine koje će biti odložene**

| Ukupne količine koje će biti odložene (Scenarij 1) | Količine (t) | Postotak u ukupnom proizvedenom komunalnom otpadu | Postotak u ukupnom proizvedenom građevinskom otpadu | Postotak u ukupnom proizvedenom neopasnom industrijskom otpadu |
|---|---|---|---|---|
| **Ostaci od otpada EWC 20 i 15 01** | **54.853** | **24,0 %** | | |
| Ostaci od mehaničke i biološke obrade ostatnog otpada i ostaci dobiveni od procesa MRF (postrojenje za oporabu materijala) | 29.268 | 12,8 % | | |
| Ostaci od obrade odvojeno prikupljenog biootpada | 2120 | 0,9 % | | |
| Ostaci od obrade opasne frakcije komunalnog otpada | 179 | 0,07 % | | |
| Ostaci od obrade glomaznog otpada | 2686 | 1,2 % | | |
| CLO | 20.600 | 9,0 % | | |
| **Ostaci od građevinskog otpada** | **5784** | | **7,5 %** | |
| **Ostaci od industrijskoga neopasnog otpada** | **3291** | | | **2,0 %** |
| **Odlagališne kazete 1 – 5 (Scenarij 1)** | **58.144** | | | |
| **Odlagališna kazeta 6** | **5784** | | | |

*Napomena: Količine navedene u prethodnoj tablici odgovaraju prosječnim količinama.*

### 9.3.1 Mehanička obrada

Centar za gospodarenje otpadom u Općini Lećevici osmišljen je da može prihvatiti **109.973 t/god.** miješanoga komunalnog otpada. Dimenzioniranje postrojenja za mehaničko sortiranje i cjelokupna ravnoteža temelje se na količini miješanog otpada, a izračuni su napravljeni u pogledu količine materijala koje je moguće reciklirati, odbačenog otpada i biorazgradivog otpada koji ulazi u postrojenje za biološku obradu. Odabrani proces indikativan je i upotrebljava se u svrhe izrade studije izvedivosti. U dijagramu u nastavku predstavljene su faze procesa mehaničke obrade s količinama u tonama godišnje (prosjek za razdoblje 2023. – 20147.).




**Slika 9.4: Dijagram toka postrojenja za mehaničku obradu**

Vozila za sakupljanje otpada ulazit će od ulaza u Centar za gospodarenje otpadom i bit će vagana na mosnoj vagi.
Vaganje će se provoditi u vozilima koja ulaze u Centar i koja izlaze iz njega.

Kako je prikazano na prethodnoj slici, operativni sustav MBO-a jest:
nakon dovršetka vaganja i bilježenja otpad će se prevoziti u postrojenje za prihvat otpada, gdje će se istovariti u bunker za prihvat koji ima kapacitet prihvata od pet (5) dana za ulazni otpad.

Jedinica za prihvat opremljena je jednim mostom, odnosno dizalicom za svaku liniju za obradu (ukupno dva komada) za utovar ulaznog otpada u sljedeću fazu procesa obrade te za uklanjanje velikih predmeta. Uklanjanje opasnih/teških materijala jamči minimalne prekide rada postrojenja.

Svaka linija za obradu opremljena je jednim otvaračem vreća. Otvarači vreća imat će mogućnost otvaranja i pražnjenja vrlo velikog postotka otpada koji sadržava plastične vrećice i bit će prikladni za prihvat širokog raspona materijala, npr. ambalaže, biootpada, ostatnog otpada itd.

Kroz cjelokupni proces mehaničkog odvajanja materijali se prevoze od jednog procesa do drugog upotrebom sustava pokretnih traka.

Uklanjanje neželjenih i/ili glomaznih materijala koji nisu uklonjeni upotrebom dizalice provodi se unutar prve kabine za „ručno sortiranje" koja je smještena odmah iza otvarača vreća. Ta početna radnja potrebna je kako bi se izbjeglo preopterećenje pokretnih traka, bubnja itd. tim glomaznim materijalima, a koji bi mogli dovesti do blokiranja proizvodne linije te do prekida rada postrojenja. Kabina za ručno sortiranje također predstavlja priliku za uzimanje stakla jer se ono često „izgubi" dalje u procesu odvajanja zbog lomljenja.

Sljedeća faza jest magnetsko izdvajanje željeznih metala. To je prvi dio procesa izdvajanja kojim se izdvajaju veći metali koji su štetni za nastavak procesa.

Sljedeća faza obrade jest bubnjasto sito. Na temelju iskustva poznato je da je u miješanom otpadu suha frakcija sklona teškoj kontaminaciji zbog načina na koji se (miješani) otpad sakuplja, načina i vremena prijevoza do odlagališta. Stoga je prioritet ukloniti tu „organsku frakciju" iz glavnog toka otpada što je prije moguće u fazi obrade. To se postiže bubnjastim sitom, koje omogućuje odvajanje materijala u tri frakcije upotrebom dvaju sita različitih veličina:

- uglavnom organska „mala frakcija" (< 80 mm)
- frakcija materijala veličine 80 mm do 300 mm
- ostatak materijala veličine > 300 mm koji prolazi kroz kraj sita, nakon čega se prenosi pokretnom trakom do „uređaja za usitnjavanje ". Namjena je tog uređaja razlomiti materijale čije su dimenzije veće od 300 mm, a koje ne mogu jednostavno obraditi optički separatori. Nakon lomljenja na manje dijelove u tom uređaju materijali se vraćaju u proces odvajanja prije odvajanja na bubnjastom situ u pokretnoj traci.

Frakcija od bubnjastog sita (frakcije dimenzija 80 – 300 mm) prije prijevoza u separator za nemetalne materijale podliježe magnetskoj separaciji kako bi se izdvojili željezni metali i kako bi se izbjeglo oštećenje separatora aluminija s izmjeničnom strujom. Nakon izdvajanja neželjeznih metala iz toka za predmete dimenzija 80 – 300 mm oni se usmjeravaju u separator aluminija s izmjeničnom strujom.
Sljedeća faza jest optički separator (NIR) koji oporabljuje plastične materijale koji su prisutni u frakciji otpada dimenzija 80 – 300 mm. Taj separator prethodi balističkom separatoru koji tamo usmjerava uglavnom plastiku. Uklanja jedino plastične materijale, a povećava i učinkovitost balističkog separatora.

Nakon toga plastični materijali prenose se u balistički separator, koji se upotrebljava kako bi se ta plastična frakcija dodatno odvojila na temelju težine. Krupniji „3D" materijal (PET, mješovite boce, ostale plastike kao što su PE/PP) se putem vibracija separatora „kotrlja" prema nižem rubu kose površine za sortiranje, dok se lakši „2D" materijali (kao što su plastične folije) kreću uzduž i sakupljaju u gornjem kraju uređaja.

Te dvije frakcije otpada sakupljaju se s pomoću pokretnih traka koje vode do skupova optičkih separatora. Prolaskom kroz svaki NIR separator različiti tokovi otpada dodatno se odvajaju u čišće (kvalitetnije) proizvode (mješoviti papir, RDF, PP/PE, PET itd.).

Odvojeni materijal koji je moguće reciklirati bit će komprimiran i baliran u pojedinačna pakiranja putem uređaja za baliranje. U tim uređajima obrađivat će se sljedeći materijali:

- papir, karton i kategorije papira i kartona, tj. tiskani papir, papir za pakiranje itd.
- metali
- plastični materijali kao što su PET, komadi plastike i različite vrste plastike

Frakcija dimenzija < 80 mm prenosi se iz bubnja u biološku obradu. Prije toga podvrgava se magnetskoj separaciji i aluminijskoj separaciji kako bi se dobili željezni i neželjezni metali te kako bi se tijekom procesa kompostiranja izbjegla kontaminacija teškim metalima. Željezni metali prvi se uklanjanju, čime se ujedno štiti separator aluminija od mogućih oštećenja nastalih djelovanjem željeznih metala. Nakon odvajanja željeznih metala iz toka organskog otpada dimenzija < 80 mm oni se usmjeravaju u separator aluminija s izmjeničnom strujom. Nakon toga organska frakcija dovodi se do prihvata za biološku obradu.

Analitički tehnički opis mehaničke obrade nalazi se također u Prilogu 9.1. ovom poglavlju.

#### 9.3.1.1 Prostor za prihvat

Kako je prethodno spomenuto, prosječna dnevna količina otpada iznosi:

$$Q_{dsrednja} = 109.973 \text{ t/god.} / 250 \text{ d/god.} = 439,89 \text{ t/d}$$

Uzimajući u obzir čimbenik sigurnosti za dnevnu varijaciju od 10 %, dnevna količina ulaznog otpada na jedinici za prihvat jest:

$$Q_{des} = 439,89 \text{ t/d} \times 1,10 = 483,88 \text{ t/d}$$

Kako bi se zajamčila dostupnost dostatnog privremenog prostora za skladištenje, odnosno prostora za prihvat otpada od vozila koja dovoze otpad, količina otpada koji će se obraditi izračunana je pri procijenjenoj gustoći od 300 kg/m$^3$. Stoga, minimalna potrebna količina za svakodnevnu pohranu otpada jest:

$$V_d = 483.88 \text{ t} : 0,3 \text{ t/m}^3 = 1613 \text{ m}^3$$

Kako bi se zajamčila dostatna zapremnina za pohranu ulaznog otpada prije obrade tijekom razdoblja od tri dana, prostor za prihvat trebao bi imati zapremninu najmanje jednaku:

$$V_d(3 \text{ dana}) = 1613 \text{ m}^3 \times 3 \text{ dana} = 4839 \text{ m}^3$$

#### 9.3.1.2 Mehaničko sortiranje

Kapacitet postrojenja za obradu otpada određuje se na temelju masene bilance te osobito uzimajući u obzir količine koje su rezultat razvoja otpada za razdoblje 2023. – 2047., odnosno količine koje predstavljaju konačan kapacitet postrojenja. Sljedeće pretpostavke napravljene su za dimenzioniranje postrojenja za mehaničko razvrstavanje:

⇒ Djelovanje: Pet dana (5 dana) tjedno

⇒ Ukupan broj operativnih dana godišnje: 250 dana godišnje
⇒ Dvije (2) radne smjene (s dostupnošću od 75 %): 12 sati dnevno

Na temelju prethodno iznesenih podataka, odnosno pretpostavki sljedeća tablica prikazuje dimenzioniranje jedinice za mehaničko sortiranje koja će zajamčiti pravilno funkcioniranje jedinice.

**Tablica 9-11: Dimenzioniranje postrojenja za mehaničko razvrstavanje**

| Opis | |
|---|---|
| Otpad koji se dovozi | 109.973 t/god. |
| Broj radnih dana | 250 dana godišnje |
| Dnevni kapacitet | 439,89 t/d |
| Broj radnih sati (dostupnost od 75 %) | 12 sati |
| Kapacitet po satu | 36,66 t/h |
| Broj linija | **2** |
| Kapacitet linija | **18,33/h**<br>**2 linije pri 20 t/h svaka linija** |

Postrojenje za mehaničku obradu imat će sposobnost rješavanja sezonskih fluktuacija putem povećanog broja radnih sati.

Kako je spomenuto u prethodnoj tablici, dvije linije od 20 t/h daju godišnji kapacitet od 2*20*250*12 t = 120.000 t. To je minimalna količina koju će obrađivati postrojenje za mehaničku obradu. Ako će se radni sati postrojenja za mehaničku obradu povećati, na primjer, na 16 sati dnevno, to znači da jedinica ima kapacitet obrade 2*20*250*16 t = 160,000 t. Na taj način postrojenje za mehaničko razvrstavanje moći će nositi opterećenje sezonskih fluktuacija.

#### 9.3.1.3 Pohrana materijala koje je moguće reciklirati

Zgrada za pohranu osmišljena je na način da je moguće prihvatiti sve oporabljene materijale za razdoblje od 15 dana proizvodnje.

**Tablica 9-12: Površina za pohranu za proizvode koje je moguće reciklirati**

| Materijal | Balirka (postavljene izlazne dimenzije) | Površina po bali ($m^2$) | Specifična težina ($kg/m^3$) | Težina po bali (t) | Oporabljeni materijali (t/d) | Broj bala dnevno | Površina podloge za 15-dnevnu pohranu bala ($m^2$) |
|---|---|---|---|---|---|---|---|
| Papir | 1,10 m x 0,75 m x 1,10 m | 1,21 | 460 | 0,42 | 12,09 | 29 | 132 |
| Plastika | 1,10 m x 0,75 m x 1,10 m | 1,21 | 350 | 0,32 | 15,65 | 49 | 222 |
| Metali | 1,10 m x 0,75 m x 1,10 m | 1,21 | 600 | 0,54 | 4,70 | 9 | 41 |
| Aluminij | 1,10 m x 0,75 m x 1,10 m | 1,21 | 350 | 0,32 | 1,54 | 5 | 23 |
| RDF | 1,10 m x 0,75 m x 1,10 m | 1,21 | 400 | 0,36 | 126,16 | 348 | 1.579 |
| | | | | | | **Ukupno** | **1997** |
| | | | | | **Ukupno uz sigurnosni čimbenik 1, 2** | | **2396** |

Staklo će se pohranjivati u kontejnerima nazivnog kapaciteta od 30 $m^3$.

**Tablica 9-13: Površina za pohranu stakla**

| Opis | Količine |
|---|---|
| Količine stakla | 2,90 t/d |
| Procijenjena gustoća | 0,27 $t/m^3$ |
| Volumetrijski tok | 10,73 $m^3/d$ |
| Nazivni kapacitet kontejnera | 30$m^3$ |
| Čimbenik punjenja | 85 % |
| Učinkoviti kapacitet | 25,5 $m^3$ |
| Kontejneri za 15-dnevnu pohranu | 7 |
| Površina za svaki kontejner (d x š x v ) | 6,2 m x 2,55 m x 7 m |
| Ukupna površina za pohranu kontejnera | 111 $m^2$ |
| **UKUPNA POVRŠINA (sigurnosni čimbenik 20 %)** | **133 $m^2$** |

Na temelju izračuna vidljivo je da zgrada za skladištenje od **3200 $m^2$** služi za navedeni 15-dnevni proizvodni kapacitet koji uključuje i dodatnu površinu koja omogućuje jednostavno i sigurno kretanje.

### 9.3.1.4 Značajke i klasifikacije proizvedenog RDF-a

U tablici u nastavku prikazana je procjena značajki očekivane količine ukupno proizvedenog goriva iz otpada (RDF-a) u postrojenju na temelju sheme procesa opisane u prethodnim odjeljcima.

**Tablica 9-14: Značajke RDF-a**

| Frakcije | Tonaža mokrog otpada (t/a) | Tonaža suhog otpada (t/a) | Sadržaj Cl suhi (%) (*) | Postotak vlage (%) (*) | Postotak suhog pepela (%) (*) | Kalorijska vrijednost mokrih frakcija kj/kg | Kalorijska vrijednost suhih frakcija kj/kg |
|---|---|---|---|---|---|---|---|
| UKUPNO | 31.539 | 25.307 | 0,56 | 19,13 | 8,95 | 16.189 | 20.602 |

Prema navedenim značajkama proizvedeni RDF može se razvrstati na sljedeći način:

- u smislu neto kalorijske vrijednosti (NKV) u razred: 3
- u smislu udjela klora (Cl) u razred: 2

Potrebno je napomenuti da značajke proizvedenog RDF-a iz postrojenja za mehaničko sortiranje izravno ovisi o sastavu, vlazi i ostalim fizikalno-kemijskim svojstvima (tj. udio klora, udio pepela itd.) otpada koji se dovozi, o tehnologiji razvrstavanja koja se primjenjuje te mora biti u skladu sa zahtjevima i potrebama krajnjeg korisnika.
Stoga, u trenutačnoj fazi projekta svojstva koja su predložena da budu određena kao minimalni prihvatljivi zahtjevi za RDF i donesena u sljedećim fazama projekta prikazana su u sljedećoj tablici.

**Tablica 9-15: Minimalni zahtjevi predloženog RDF-a**

| SVOJSTVO | STATISTIČKA MJERNA | JEDINICA | VRIJEDNOST | STANDARDI KONTROLE |
|---|---|---|---|---|
| Čista kalorijska vrijednost (NKV, neto kalorijska vrijednost) | Srednja vrijednost | MJ/kg (kjp) | ≥ 17 | EN 15400:2011 |
| Udio klora (Cl) | Srednja vrijednost | % (s) | ≤ 0,5 | EN 15408:2011 |
| Vlaga | - | % težine | ≤ 20,0 | CEN/TS 15414:2011 |
| Udio pepela | - | % (s) | ≤ 10,0 | EN 15403:2011 |
| Udio žive (Hg) | (medijan) | mg/MJ (kjp) | ≤ 0,08 | EN 15411:2011 |
| | (80. percentil) | mg/MJ (kjp) | ≤ 0,16 | |

* (s): suha osnova
(kjp): kako je primljeno

Uz ove značajke predloženo je da proizvedeni RDF bude razvrstan na sljedeći način:

- u smislu neto kalorijske vrijednosti (NKV) u razred: 3
- u smislu udjela klora (Cl) u razred: 2
- u smislu udjela žive (Hg) u razred: 3

### 9.3.2 Biološka obrada organskog otpada dobivenog od miješanoga komunalnog otpada

Biološka obrada bit će namijenjena za organsku frakciju dimenzija 0 – 80 mm, koja izlazi iz bubnjastog sita dimenzija 80 – 300 mm, a koje će biti smješteno u zgradi za mehaničko odvajanje.

Proces biološke obrade prolazi kroz dvije različite faze. Prva faza (aktivno kompostiranje) odvija se u boksovima za kompostiranje kapaciteta 450 $m^3$. Boks za kompostiranje puni se uz pomoć utovarivača s kotačima. Nakon 25 dana materijal se preusmjerava putem utovarivača s kotačima u prostor za dozrijevanje. Faza dozrijevanja odvija se u otvorenim plohama s prirodnom oksidacijom.. Nakon 50 dana svježi kompost preusmjerava se uz pomoć utovarivača s kotačima na rafiniranje. Sito s bubnjem razdvaja materijal prekomjerne veličine od svježeg komposta. Proizvedeni kompost i ostaci od rafiniranja naposljetku se odvode u odlagalište na zbrinjavanje. Pretpostavke u pogledu dizajniranja koje se upotrebljava u predloženom postrojenju za kompostiranje opisane su u tablici u nastavku.

Analitički tehnički opis biološke obrade nalazi se u Prilogu 9.1. ovom poglavlju.

**Tablica 9-16: Ulazni parametri dizajna**

| Opis | Vrijednosti |
|---|---|
| Ulazna organska frakcija za biološku obradu | 45,778 t/god. |
| Ulazna organska frakcija uz čimbenik sigurnosti od 25 % | 57,222 t/god. |
| Djelovanje | 250 dana godišnje |
| Gustoće materijala | 0,55 t/m$^3$ |
| Faze kompostiranja | • Prihvaćeni materijal u prostoru za prihvat<br>• Kompostiranje u boksovima za kompostiranje (1. faza)<br>• Dozrijevanje (2. faza) u otvorenim ćelijama s prirodnom oksidacijom |
| Minimalno vrijeme kompostiranja (1. faza) | 25 dana |
| Minimalno vrijeme dozrijevanja (2. faza) | 50 dana |
| Smanjenje težine tijekom faze kompostiranja | 15 % |

U skladu s prethodno navedenim podacima minimalne značajke za svaku fazu biološke obrade izračunane su na sljedeći način.

**a. <u>Faza kompostiranja (1. faza)</u>**

U svrhu izrade ove studije izvedivosti faza kompostiranja (1. faza) odvija se u boksovima za kompostiranje zapremnine 450 m$^3$. Izračun u svrhu određivanja broja boksova za kompostiranje provodi se na sljedeći način:

**Tablica 9-17: Dimenzioniranje broja boksova za kompostiranje**

| Dimenzioniranje broja boksova za kompostiranje | |
|---|---|
| Materijal za aerobno kompostiranje | 45.778 t/god. |
| Materijal za aerobno kompostiranje (uz sigurnosni čimbenik od 25 %) | 57.222 t/god. |
| Određena gustoća | 0,55 t/m$^3$ |
| Volumen materijala za kompostiranje | 104.040 m$^3$/god. |
| Vrijeme zadržavanja | 25 dana |
| Broj radnih ciklusa godišnje | 15 ciklusa |
| Dimenzije boksova za kompostiranje | dužina 30 m / širina 5 m<br>visina 3 m<br>Volumen 450 m$^3$ |
| Materijal po ciklusu (m$^3$) | 6936 m$^3$/ciklus |
| Predložen broj boksova za kompostiranje | **16** |

Ispred jedinice za kompostiranje predviđeno je dovoljno prostora za kretanja utovarivača s kotačima.

**b. Faza dozrijevanja (2. faza)**

U svrhu izrade ove studije izvedivosti faza dozrijevanja odvija se u otvorenim ćelijama koje se prirodno pune kisikom. Broj potrebnih ćelija za dozrijevanje izračunava se na sljedeći način:

**Tablica 9-18: Dimenzioniranje broja hrpa u prostoru za dozrijevanje**

| Dimenzioniranje broja hrpa u prostoru za dozrijevanje | |
|---|---|
| Materijal namijenjen za dozrijevanje | 48.639 t/god. |
| Određena gustoća | 0,55 t/m$^3$ |
| Volumen materijala namijenjenog za dozrijevanje uz sigurnosni čimbenik od 15 % | 88.434 m$^3$/god. |
| Vrijeme zadržavanja | 50 dana |
| Broj radnih ciklusa godišnje | 8 ciklusa |
| Dimenzije hrpa za dozrijevanje | dužina 80 m<br>širina 6 m<br>visina 2,5 m<br>Volumen 600 m$^3$ |
| Materijal po ciklusu (m$^3$) | 11.054 m$^3$/ciklus |
| Predložen broj hrpa za dozrijevanje | **19** |

Nadalje, za jedinicu za dozrijevanje predviđeno je dovoljno prostora za kretanja utovarivača s kotačima.

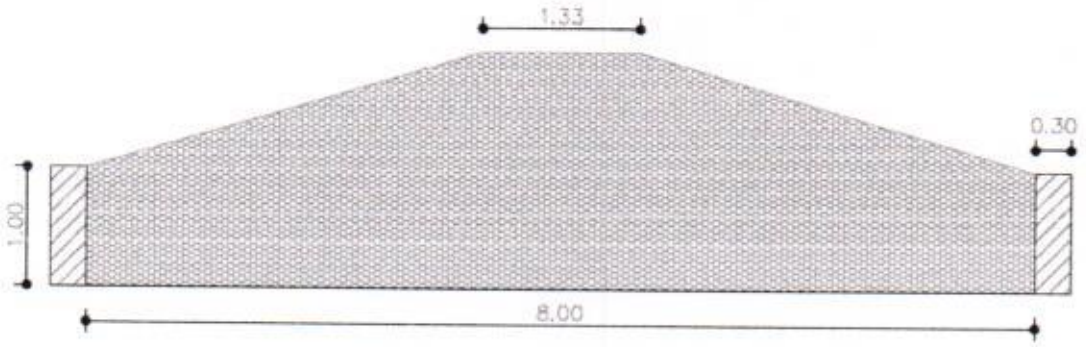
### 9.3.3 Biološka obrada prethodno izdvojenog biootpada

Postrojenje za kompostiranje bit će osmišljeno za obradu **9700 tona** prethodno izdvojenog biootpada godišnje. Proces kompostiranja prethodno izdvojenog biootpada provodi se u istom postrojenju u kojoj se provodi biološka obrada organskog otpada dobivenog od miješanoga komunalnog otpada. Odabrana metoda kompostiranja bit će ista kao i metoda kompostiranja organskog otpada dobivenog od miješanoga komunalnog otpada, a sastojat će se od dviju faza: (1) aktivnog kompostiranja, koje se odvija u boksovima za kompostiranje i (2) faze dozrijevanja koja se provodi u otvorenim hrpama koje se prirodno pune kisikom.

Minimalne značajke svake jedinice za biološku obradu izračunavaju se na sljedeći način.

**a. Prostor za prihvat**

Prostor za prihvat trebao bi imati dovoljno prostora da prihvaća najmanje 3 dana ulaznog nedrobljenog otpada. U svrhu izrade ove studije izvedivosti materijal će se oblikovati u trapezoidne hrpe s nagibima 1 : 4 kako je prikazano na slici u nastavku.




**Slika 9-5: Pohrana materijala u hrpama**

Izračun prostora za prihvat provodi se na sljedeći način:

**Tablica 9-19: Dimenzioniranje jedinice za prihvat otpada**

| Dimenzioniranje jedinice za prihvat otpada | |
|---|---|
| Dolazni materijal | 9700 t/god. |
| Broj radnih dana (dana/god.) | 250 dana/god. |
| Dnevni kapacitet | 38,80 t/d |
| Vrijeme skladištenja dolaznog materijala | 3 dana |
| Specifična gustoća neusitnjenog materijala | 0,35 t/m$^3$ |
| Volumen dolaznog materijala za 3 dana | 332.57 m$^3$ |
| *Površina za skladištenje (3 dana) = (8 + 0,3)*(10 + 0,3) * 3* | 256.47m$^2$ |
| *Ukupna površina uz sigurnosni čimbenik (10 %)* | *282.12 m$^2$* |
| *Površina za kretanje utovarivača s kotačima* | *150.00 m$^2$* |
| *Površina za drobilicu* | *250.00 m$^2$* |
| *Površina za smještanje materijala nakon usitnjavanja* | *210,00 m$^2$* |
| **Ukupna površina za prihvat** | **892.12 m$^2$ ≅ 905 m$^2$** |

**b. <u>Faza kompostiranja (1. faza)</u>**

U svrhu izrade ove studije izvedivosti faza kompostiranja (1. faza) provodi se u boksovima pokrivenima membranom. Izračun broja boksova provodi se na sljedeći način:

**Tablica 9-20: Dimenzioniranje prostora za kompostiranje**

| Dimenzioniranje prostora za aktivno kompostiranje | |
|---|---|
| Materijal namijenjen za kompostiranje | 9700 t/god. |
| Određena gustoća nakon drobljenja | 0,55 t/m$^3$ |
| Volumen materijala namijenjenog za kompostiranje | 17636 m$^3$/god. |
| Vrijeme zadržavanja = 25 dana | 25 dana |
| Broj radnih ciklusa godišnje | 15 |
| Dimenzije boksova | dužina 30 m<br>širina 5 m<br>visina 3 m<br>Volumen 450 m$^3$ |
| Materijal po ciklusu (m$^3$) | 1176 |
| **Broj boksova** | **3** |

Jedinica za kompostiranje trebala bi imati dovoljno prostora ispred ćelija za kretanje utovarivača s kotačima.

### c. Prostor za dozrijevanje (2. faza)

U svrhu izrade ove studije izvedivosti faza dozrijevanja odvija se na otvorenim hrpama koje se prirodno pune kisikom. Broj potrebnih hrpa za dozrijevanje izračunava se na sljedeći način:

**Tablica 9-21: Dimenzioniranje broja hrpa u prostoru za dozrijevanje**

| Dimenzioniranje broja hrpa u prostoru za dozrijevanje | |
|---|---|
| Materijal namijenjen za dozrijevanje | 8245 t/god. |
| Specifična gustoća nakon kompostiranja | 0,55 t/m$^3$ |
| Volumen materijala namijenjenog za dozrijevanje | 14991 m$^3$/god. |
| Vrijeme zadržavanja = 8 tjedana | 50 dana |
| Broj radnih ciklusa godišnje | 8 |
| Dimenzije hrpa za dozrijevanje | dužina 80m<br>širina 6m<br>visina 2,5 m<br>Volumen 600 m$^3$ |
| Materijal po ciklusu | 1874 m$^3$ |
| **Broj hrpa za dozrijevanje** | **3** |

Nadalje, za prostor za dozrijevanje predviđeno je dovoljno prostora za kretanja utovarivača s kotačima.

### d. Prostor za skladištenje

Prostori za skladištenje trebao bi imati dovoljno prostora da bude moguće pohraniti materijal na najmanje 2 tjedna (14 dana). Kapacitet za skladištenje stoga će biti sljedeći:

**Tablica 9-22: Dimenzioniranje prostora za skladištenje**

| Dimenzioniranje prostora za skladištenje | |
|---|---|
| Materijal namijenjen za skladištenje | 4563 t/god. |
| Broj radnih dana | 250 dana godišnje |
| Dnevni kapacitet | 18,25 t/d |
| Vrijeme skladištenja | 25 dana |
| Specifična gustoća komposta | 0,55 t/m$^3$ |
| Volumen pohranjenog materijala (tijekom 35 dana) | 829,5 m$^3$/d |
| Ukupna površina (uključujući manipulativnu površinu od 150 m$^2$) | 979,5 m$^2$ |
| Ukupna površina uz sigurnosni čimbenik (10 %) | 1077,5 m$^2$ ≅ 1100 m$^2$ |

### 9.3.4 Odlagalište otpada

Ukupna površina odlagališta podijeljena je u 6 kazeta, od kojih je 5 kazeta (kazete 1 – 5) namijenjeno za ostatni otpad, a šesta za inertni. Odlagališne kazete bit će međusobno odvojene nasipima. Pet kazeta za neopasni otpad bit će popunjeno putem pet faza, od kojih svaka traje pet godina, a kazeta za inertni otpad bit će popunjena tijekom dviju faza od kojih svaka traje 12,5 godina. Na kraju planiranog razdoblja, odnosno 2047., ukupna površina odlagališta zauzimat će prostor površine približno 10 ha.

#### 9.3.4.1 Odlagališne kazete 1 – 5

##### 9.3.4.1.1 Kapacitet

Kako bi se projektirale odlagališne kazete 1 – 5 (ostatni otpad), u obzir su uzete sljedeće pretpostavke:

- Gustoća ostatnog otpada: 0,85 t/m$^3$
- Čimbenik materijala za prekrivanje: 10 %

U sljedećoj tablici predstavljen je potreban kapacitet odlagališta.

**Tablica 9-23: Odlagališne kazete 1 – 5**

| Godina | Količine | Kompakcija ostatnog otpada (t/m$^3$) | Čimbenik materijala za prekrivanje (%) | Godišnji kapacitet (m$^3$) | Ukupan kumulativni kapacitet godišnje (m$^3$) |
|---|---|---|---|---|---|
| 2023. | 62.607 | 0,85 | 10,00 % | 81.020 | 81.020 |
| 2024. | 62.354 | | | 80.694 | 161.714 |
| 2025. | 62.103 | | | 80.368 | 242.082 |
| 2026. | 61.852 | | | 80.044 | 322.126 |
| 2027. | 61.603 | | | 79.722 | 401.848 |
| 2028. | 61.355 | | | 79.401 | 481.249 |
| 2029. | 61.109 | | | 79.082 | 560.331 |
| 2030. | 60.863 | | | 78.764 | 639.095 |
| 2031. | 60.945 | | | 78.870 | 717.964 |
| 2032. | 60.993 | | | 78.933 | 796.897 |
| 2033 | 61.043 | | | 78.996 | 875.893 |
| 2034 | 61.092 | | | 79.060 | 954.954 |
| 2035 | 61.142 | | | 79.125 | 1.034.078 |
| 2036 | 61.192 | | | 79.190 | 1.113.268 |
| 2037 | 61.242 | | | 79.255 | 1.192.522 |
| 2038 | 61.293 | | | 79.320 | 1.271.843 |
| 2039 | 61.344 | | | 79.386 | 1.351.229 |

| Godina | Količine | Kompakcija ostatnog otpada (t/m³) | Čimbenik materijala za prekrivanje (%) | Godišnji kapacitet (m³) | Ukupan kumulativni kapacitet godišnje (m³) |
|---|---|---|---|---|---|
| 2040 | 61.395 | | | 79.453 | 1.430.682 |
| 2041 | 61.447 | | | 79.520 | 1.510.202 |
| 2042 | 61.462 | | | 79.539 | 1.589.741 |
| 2043 | 61.478 | | | 79.559 | 1.669.300 |
| 2044 | 61.494 | | | 79.580 | 1.748.881 |
| 2045 | 61.511 | | | 79.602 | 1.828.483 |
| 2046 | 61.528 | | | 79.624 | 1.908.107 |
| 2047 | 61.546 | | | 79.647 | 1.987.754 |

U skladu s idejnim rješenjem minimalna površina potrebna za odlaganje 1.987,754 m³, ostatnog otpada iznosi približno 85,117 m² . Kako bi se zadovoljile potrebe prve faze projekta, točnije prvih pet godina, potrebna površina iznosi približno 22.528 m² (iskoristiv kapacitet od 402.522 m³ )
Životni vijek, površina u m² i kapacitet u m³ predstavljeni su u tablici u nastavku.

**Tablica 9-24: Odlagališne kazete 1 – 5**

| Odlagališna ćelija | Razdoblje (god.) | Površina (m²) | Volumen (m³) |
|---|---|---|---|
| Kazeta 1 | 5 (2023. – 2027. ) | 22.528 | 402.522 |
| Kazeta 2* | 5 (2028. – 2032. ) | 18.982 | 449.501 |
| Kazeta 3* | 5 (2033. – 2037.) | 15.495 | 441.656 |
| Kazeta 4* | 5 (2038. – 2042.) | 15.073 | 424.336 |
| Kazeta 5* | 5 (2043. – 2047.) | 13.039 | 312.365 |
| **UKUPNO** | **25** | **85.117** | **2.030,380** |

* Kazete će se financirati u sljedećim programskim razdobljima

Ako bi se povećale količine ostatnog otpada zbrinjenog u odlagalištu, životni vijek 1. kazete bio bi kraći od 5 godina. U tom pogledu osmišljen je rezervni plan:

1. pokretanje natječaja za sljedeće odlagalište može početi ranije. Budući da će cjelokupna infrastruktura biti uspostavljena te da je projektiranje cjelokupnog područja gotovo, natječaj i izgradnja 2. odlagališne kazete može se napraviti u kratkom roku (odnosno u roku od devet mjeseci).
2. Otpad na odlagalištu pratit će se na mjesečnoj osnovi kako bi se pružile informacije u svrhu procjene i izvješćivanja o stanju odlagališta, tj. o ukupnom odloženom ostatnom otpadu te preostalom kapacitetu odlagališta.

Analitički tehnički opis odlagališta u pogledu ostatnog otpada nalazi se u Prilogu 9.1. ovom poglavlju.

#### 9.3.4.1.2 Temeljni brtveni sustav

U skladu sa zakonskim odredbama i studijom PUO, temeljni brtveni sustav odlagališta provest će se na sljedeći način (vidjeti nacrt u Prilogu 9.6.):

- izravnavajući sloj s prirodnom bazom 20 – 30 cm debljine
- sloj gline od 50 cm i propusnosti gline $k \leq 1,0 \times 10^{-9}$ m/s
- bentonitni tepih s propusnošću $k = 1,0 \times 10^{-9}$ m/s
- HDPE geomembrana debljine 2,5 mm
- geotekstil kao zaštitni sloj za geomembranu (od najmanje 1200 g/m$^2$)
- drenažni sloj šljunka (granulacija 16/32) debljine 0,50 m s drenažnim cijevima za procjedne vode
- separacijski geotekstil (od najmanje 1200 g/m$^2$)
- sustav za dojavu curenja

Obloga u nagibima sastojat će se od istih slojeva kao obloga temeljnog brtvenog sustava. U slučaju strmih nagiba, tipično ispod 1 : 0,5, šljunak je moguće zamijeniti materijalom za geodrenažu istovjetne propusnosti.

#### 9.3.4.1.3 Pokrovni brtveni sloj

Pokrov kazeta 1 – 5 sastojat će se od sljedećih slojeva:

- izravnavajući sloj debljine 0,3 m
- drenažnog sloja, šljunka 16/32 mm, debljine 0,3 m i propusnosti k ≥ 1X10-3 m/s. Alternativno, moguće je izgraditi drenažni sloj od geosintetičkog materijala koji ima istovjetnu propusnost i koeficijent drenaže kao i sloj šljunka debljine 0,3 m i k > 1x10-3m/s.
- Separacijski geotekstil težine ≥ 300 g/m²
- sustav od gline debljine 0,5 m, koeficijent propusnosti k = 1X10-9 m/s.
- bentonitni tepih (GCL)
- sloj za drenažu oborinskih voda, granulacija 16/32 mm, debljina 0,5 m i propusnost k ≥ 1X10-3m/s.
- Separacijski geotekstil težine ≥ 300 g/m²
- površinski sloj (sloj za ponovnu kultivaciju) od 1,0 m, koji sadržava
- ozelenjena površina

### 9.3.4.2 Odlagališna kazeta 6 (inertni otpad)

#### 9.3.4.2.1 Kapacitet

U pogledu određivanja veličine kazete 6 (inertni otpad) napravljene su sljedeće pretpostavke:

- Gustoća ostatnoga inertnog otpada: 1,4 t/m$^3$

Stoga se potrebni kapacitet odlagališta izračunava na sljedeći način:

**Tablica 9-25: Odlagališna ćelija 6 (inertni otpad)**

| Godina | Količine | Kompakcija inertnog otpada (t/m$^3$) | Godišnji kapacitet (m$^3$) | Kumulativni godišnji kapacitet (m$^3$) |
|---|---|---|---|---|
| 2023. | 5399 | 1,4 | 3856 | 3856 |
| 2024. | 5399 | | 3856 | 7713 |
| 2025. | 5.399 | | 3856 | 11.569 |
| 2026 | 5399 | | 3856 | 15.426 |
| 2027. | 5399 | | 3856 | 19.282 |
| 2028. | 5399 | | 3856 | 23.139 |
| 2029. | 5399 | | 3856 | 26.995 |
| 2030. | 5399 | | 3856 | 30.851 |
| 2031. | 5399 | | 3856 | 34.708 |

| Godina | Količine | Kompakcija inertnog otpada (t/m³) | Godišnji kapacitet (m³) | Kumulativni godišnji kapacitet (m³) |
|---|---|---|---|---|
| 2032. | 5399 | | 3856 | 38.564 |
| 2033. | 5399 | | 3856 | 42.421 |
| 2034. | 5399 | | 3856 | 46.277 |
| 2035. | 5399 | | 3856 | 50.134 |
| 2036. | 5399 | | 3856 | 53.990 |
| 2037. | 5399 | | 3856 | 57.846 |
| 2038. | 5399 | | 3856 | 61.703 |
| 2039. | 5399 | | 3856 | 65.559 |
| 2040. | 5399 | | 3856 | 69.416 |
| 2041. | 5399 | | 3856 | 73.272 |
| 2042. | 5399 | | 3856 | 77.129 |
| 2043. | 5399 | | 3856 | 80.985 |
| 2044. | 5399 | | 3856 | 84.841 |
| 2045. | 5399 | | 3856 | 88.698 |
| 2046. | 5399 | | 3856 | 92.554 |
| 2047. | 5399 | | 3856 | **96.411** |

Prema rješenju Idejnog projekta minimalna površina potrebna za odlagalište 96.411 m³ inertnog otpada kako bi se zadovoljile potrebe ukupne faze izgradnje tijekom zahvata, odnosno razdoblje od otprilike 25 godina, iznosi 7145 m³ (iskoristivi kapacitet 99,618 m³).

Životni vijek, površina u m² i kapacitet u m³ prikazani su u tablici u nastavku.

**Tablica 9-26: Kapacitet kazete 6**

| Odlagališna kazeta | | Razdoblje (god.) | Površina, m² | Volumen, m³ |
|---|---|---|---|---|
| Odlagališna kazeta 6 (inertni otpad) | 6,1 | 12,5 | 3715 | 99,18 |
| | 6,2 | 12,5 | 3430 | |

### 9.3.4.2.2 Temeljni brtveni sustav

Sustav temeljnog brtvenog sloja kazetu 6 isti je kao i za kazete 1 – 5 kako je opisano u prethodnom odlomku jer će jedno odlagalište otpada obuhvaćati kazete 1-6.

### 9.3.4.2.3 Pokrovni brtveni sloj

Pokrov odlagališne kazete 6 sastojat će se od sljedećih slojeva (u skladu s Direktivom 1999/31/EZ):

- izravnavajući sloj sloja debljine 0,2 m
- sloja gline debljine 0,8 m, propusnosti k ≤ 1X10-9 m/s.
- bentonitnog tepiha (GCL)
- drenažnog sloja za oborinske vode, granulat 16/32 mm, debljine 0,5 m i propusnosti k ≥ 1X10-3 m/s
- separacijskog geotekstila težine ≥ 300 g/m²
- površinskog sloja (sloj za ponovnu kultivaciju) od 1,0 m, koji sadržava
- ozelenjene površine

Analitički tehnički opis odlagališne ćelije 6 naveden je u Prilogu 9.1 ovom poglavlju.

### 9.3.4.3 Sustav sakupljanja procjednih voda sa odlagališta

Primarne drenažne cijevi izrađene su od HDPE-a ili PVC-a nominalnog (vanjskog) promjera ∅315 mm, perforirane su u 2/3 promjera i imaju SN8 ili ekvivalentnu čvrstoću od 10 atm. Postavljene su duž osi donje ćelije. Cijevi su usađene u pijesak granulacije 0/8 mm i okružene slojem šljunka debljine 50 cm.

Sekundarne drenažne cijevi izrađene su od HDPE-a ili PVC-a nominalnog (vanjskog) promjera ∅250 mm strukture riblje kosti (pod kutom od 45°) te su postavljene na udaljenosti 20 – 40 m. Cijevi su također perforirane u 2/3 promjera i iste su čvrstoće. Mogu izdržati opterećenje od više od 40 m otpada.
Od donje najniže točke gravitacijom se procjedne vode usmjeravaju izvan odlagališta otpada cijelom dužinom cijevi DN315, kroz nasip do spremnika za prikupljanje te konačno prema postrojenju za obradu.
Nadalje, na dnu odlagališne ćelije izgradit će se sustav za otkrivanje istjecanja.

### 9.3.4.4 Postrojenje za obradu otpadnih voda

Postrojenje za obradu otpadnih voda koje će biti izgrađeno u CGO-u u Splitsko-dalmatinskoj županiji bit će sastavljeno od sljedećih elemenata:

- zatvorenog spremnika za otpadne vode minimalnog volumena 150 $m^3$ i površine 100 $m^2$
- bioreaktora
- spremnika za mulj
- crpne stanice
- spremnika za efluent

U budućnosti se, prema potrebi, može uključiti i postrojenje koje radi na načelu obrnute osmoze. U Prilogu 9.1 sadržane su detaljnije informacije o postrojenju za obradu otpadnih voda.

### 9.3.4.5 Radovi zaštite od oborinskih voda

Radovi zaštite od oborinskih voda provode se na mjestu zahvata u cilju izbjegavanja ulaska oborinskih voda u odlagalište otpada i njihova miješanja s otpadom i procjednim vodama, stabilnosti strukture odlagališta otpada i zaštite zgrada i cesta od erozije prouzročene vodom. Oborinske vode moraju se odvoditi i preusmjeravati izvan odlagališta otpada. Radovi zaštite od oborinskih voda na mjestu zahvata sastoje se od sljedećeg:

- upojnih bunara oko odlagališnih kazeta
- upojnih bunara za zaštitu objekata i nasipa
- upojnih bunara za zaštitu unutarnje cestovne mreže
- odlagališnog upojnog bunara koji se sastoji od bunara i kanalizacijskih cijevi.

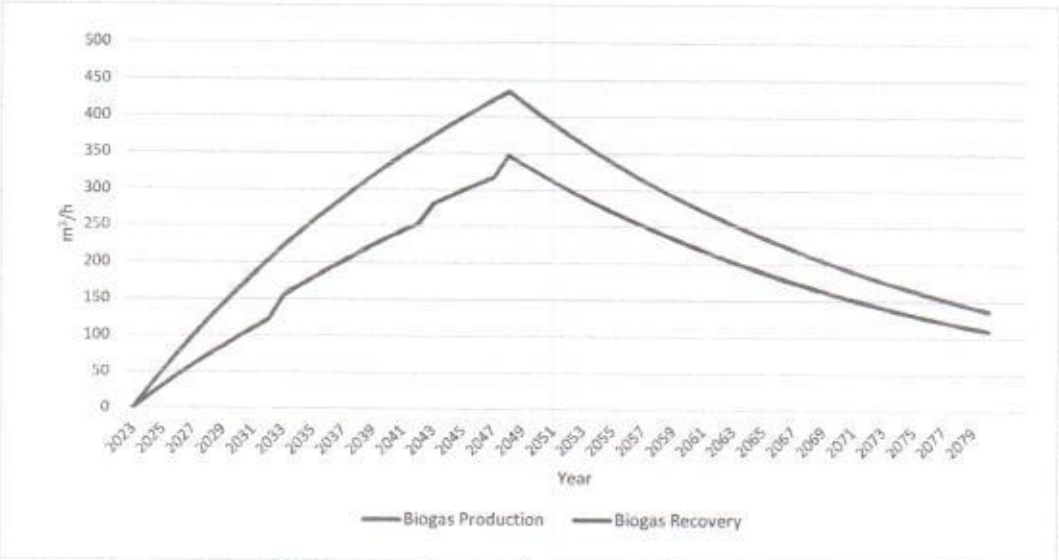
Upojni bunari mogu biti trapezoidnog ili pravokutnog oblika odgovarajućeg presjeka. Upojni bunari su obloženi crijepom. Oborinske vode koje se sakupljaju u upojnom bunaru napuštaju odlagalište otpada putem kanalizacijskih cijevi dostatnog promjera.

Za zaštitu završnog reljefa i sprečavanje korozije nakon sanacije odlagališta otpada bit će potreban drenažni sloj za oborinske vode pokrovnog sloja odlagališta otpada. Može se sastojati od HDPE cijevi koje su usmjerene u nasipe odlagališta otpada.

Oborinske vode sakupljat će se u otvorenoj laguni koja obuhvaća površinu od otprilike 100 $m^2$.

#### 9.3.4.6 Sakupljanje i obrada plina

Za izračun stvaranja bioplina iz otpada koji će se odložiti primjenjuje se model LandGEM. Ukupna količina stvorenog odlagališnog plina prikazana je na sljedećoj slici. Analitički izračuni i informacije prikazani su u prilogu 9.1 ovog poglavlja.




**Slika 9-6: Stvoreni/oporavljeni odlagališni plin ($m^3/h$)**

### 9.3.5 Infrastrukturni radovi

Infrastrukturne radove činit će sljedeći pojedinačni radovi

- zemljani radovi (sječa stabala, iskopi, nasipi, čišćenje zone sigurnosti od požara)
- izgradnja građevina i komunalni radovi (vaga, sustav za pranje podvozja, ograde, ulaz, portirnica, upravna zgrada, servisna zgrada, plato za pranje vozila, laboratorij, transformatorska stanica, spremnik za vodu, vodoopskrbna mreža, spremnik za oborinske vode, kanalizacijska mreža, sustav za zaštitu od požara, priključak elektroenergetske mreže, nadzorno upravljački sustav, , mreža unutarnje infrastrukture, benzinska postaja, odgovarajući softver)
- Obrada građevinskog otpada i otpada od rušenja (asfaltiranje površine za građevinski otpad i otpad od rušenje te površine za glomazni otpad, usitnjivač građevinskog otpada i otpada od rušenja)
- reciklažno dvorište (reciklažno dvorište, asfaltiranje, spremnici)
- radovi na cestama
- ostalo (zelene površine, uređenje krajobraza)

### 9.3.6 Pretovarne stanice

#### 9.3.6.1 Prijedlog rješenja za pretovarne stanice

Na temelju analitičke studije za pretovarne stanice iz poglavlja 8. zaključeno je da u našem slučaju opcija 1, koja obuhvaća kombinaciju pretovarne rampe s transportnim transporterom i tegljačem s poluprikolicom s potisnom pločom za zbijanje otpada ima više prednosti i da je bolje rješenje u odnosu na druga dva prijedloga rješenja (br. 2 i br. 3) na temelju sljedećih razloga:

- omogućuje najveću brzinu istovarivanja otpada: to znači da kamioni za prikupljanje otpada istovare otpad u roku od 3 do 5 minuta (kao pri istovarivanju na odlagalište otpada) i nije potrebno sudjelovanje u postupku istovara (za razliku od druga dva prijedloga rješenja) te stoga nema ometanja pri istovarivanju
- najbrže istovarivanje 20 t otpada, ovisno o broju pretovarnih lijevaka, jedan ili dva: ukupno 50 minuta u oba slučaja

- najbrže istovarivanje 20 t otpada u CGO-u: 3 – 5 min
- najniži troškovi izgradnje i velika fleksibilnost (svaka poluprikolica ima svoju potisnu ploču)
- dodatni prostor za privremenu pohranu otpada: kutije za istovar, remen
- broj točaka istovarivanja: fleksibilan, određuje se prema posebnim potrebama korisnika
- omogućuje i vizualni pregled sastava ulaznog otpada i time zaštitu opreme.

Osim pretovarne rampe, standardna oprema pretovarne stanice uključuje:

- pristupnu cestu koja se spaja s javnom cestom,
- cestovnu infrastrukturu unutar pretovarne stanice,
- vagu,
- kontrolne točke na ulazima gdje se otpad registrira, važe i plaća,
- manipulativnu površinu za pretovarnu opremu i vozila pretovarne stanice,
- parkiralište za vozila pretovarne stanice,
- tampon-zonu, uređeni prostor i ogradu oko područja pretovarne stanice (kao i prethodno navedeno).

### 9.3.6.2 Postupak pretovara otpada

Prije početka pretovara poluprikolica s potisnom pločom postavlja se ispod utovarne rampe. Nakon vaganja vozila za prikupljanje otpada vožnjom unazad dolaze do pretovarne rampe gdje otvaraju stražnja vrata i istovaruju komunalni otpad na ravni dio trakastog transportera. Trakasti transporter istovareni otpad prenosi se sve do utovarne rampe / pretovarnog lijevka gdje se otpad usmjerava u gornji otvor poluprikolice. Trakasti transporter povremeno se zaustavlja i potisna ploča neprestano potiskuje otpad cijelom dužinom poluprikolice sve dok ne dođe u dodir s prethodno zbijenim komunalnim otpadom. Kad se poluprikolica napuni, trakasti transporter se zaustavlja. Onečišćena voda iz otpada prikuplja se u posebnom spremniku (koji je sastavni dio trakastog transportera). Ta se voda prenosi iz spremnika u poluprikolicu (vozilo za prijevoz otpada) hidrauličkom crpkom putem tlačne cijevi kojom se potom vraća u otpad iz kojeg potječe (važno zbog računanja količine). Zatim se na poluprikolicu prikačuje kamion radi daljnjeg odvoza do odlagališta otpada, a ispod utovarne rampe postavlja se druga poluprikolica.
Sve te radove može izvesti jedan operator uz pomoć daljinskog upravljanja i kontrolne ploče koja se nalazi na ljestvama za inspekciju na strani trakastog transportera, odakle se može nadgledati utovar u poluprikolicu.

Kombinacija trakastog transportera, poluprikolice s potisnom pločom od 20 t i određenog broja pretovarnih lijevaka ima sljedeći kapacitet:

| Pretovarni kapacitet (brzina) t/h | |
|---|---|
| Standardni uređaj s jednim pretovarnim lijevkom i jednom poluprikolicom | 20 t/h |

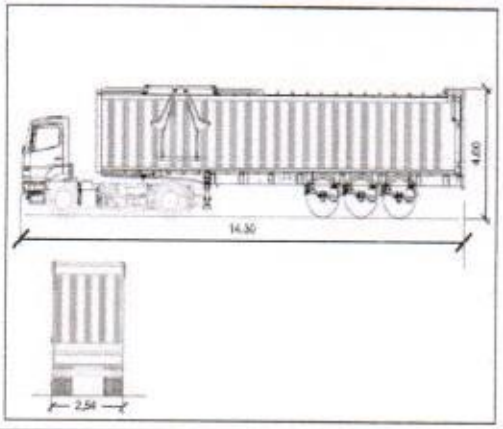
U sljedećoj tablici nalazi se sažetak tehničkih značajki odabranog tipa opreme za prijevoz i tehnologije pretovarne stanice.

**Tablica 9-27: Tehničke značajke standardne opreme za prijevoz / Tehničke značajke predloženog tipa / tehnologije pretovarne stanice**

| Standardna oprema za prijevoz | | Tehničke značajke predloženog tipa pretovarne stanice | |
|---|---|---|---|
| Tehničke značajke | POLUPRIKOLICA S POTISNOM PLOČOM | Tehničke značajke | TRANSPORTNI REMEN I SPREMNICI ZA ZBIJANJE OTPADA |
| Nosivost (t) | 20 | | |

| Standardna oprema za prijevoz | |
|---|---|
| **Tehničke značajke** | **POLUPRIKOLICA S POTISNOM PLOČOM** |
| **Ukupna dužina vozila zajedno s tegljačem (m)** | 16,1 |
| **Zbijeni otpad** | Da |
| **Autonomija u pretovarnoj stanici** | Da |
| **Prostor za upravljanje poluprikolicom/spremnikom** | Dimenzije cjelokupnog vozila |
| **Stupnjevi pretovara otpada** | 1 |
| **Svrha** | Utovar i zbijanje 20 t otpada (ugrađena preša), pretovar i istovar otpada |
| **Vrijeme pripreme otpada za pretovar iz transferne stanice (min)** | 50 (20 t) |
| **Vrijeme istovara otpada u Centru za gospodarenje otpadom (min)** | 4 – 6 |
| **Vozilo za vuču** | tegljač |

| Tehničke značajke predloženog tipa pretovarne stanice | |
|---|---|
| **Tehničke značajke** | **TRANSPORTNI REMEN I SPREMNICI ZA ZBIJANJE OTPADA** |
| **Broj stupnjeva utovara otpada** | Prijevoz se odvija na jednom stupnju i ne zahtijeva građevinske radove s velikim troškovima |
| **Broj pretovarnih točaka / pretovarnih rampi** | 1 rampa – nekoliko točaka istovarivanja, broj točaka istovarivanja određuje se prema stvarnim potrebama |
| **Brzina pretovara / primanja otpada iz kamiona za prikupljanje otpada** | 3 – 5 min / kamion za prikupljanje otpada |
| **Vrijeme potrebno za pretovar 20 t otpada/1 rampa** | Za pretovar 20 t otpada uz pomoć 1 pretovarne rampe s poluprikolicom za zbijanje otpada potrebno je do 50 minuta |
| **Pretovarna oprema** | |
| **Nosivost za otpad u t** | 20 t zbijenog otpada |
| **Površina potrebna za pretovar otpada (400 t/8 h) iznosi** | 4,166 $m^2$ |
| **Vrijeme potrebno za pretovar 400 t otpada** | 5 sati (rampa s 2 pretovarna lijevka) |
| **Istovar 20 t otpada, vrijeme u minutama** | Potisna ploča; 5 min |
| | |
| | |
| | |
| | |
| | |
| | |

| Standardna oprema za prijevoz | | Tehničke značajke predloženog tipa pretovarne stanice | |
|---|---|---|---|
| Tehničke značajke | POLUPRIKOLICA S POTISNOM PLOČOM | Tehničke značajke | TRANSPORTNI REMEN I SPREMNICI ZA ZBIJANJE OTPADA |
|  | | | |

### 9.3.6.3 Dijelovi pretovarne stanice

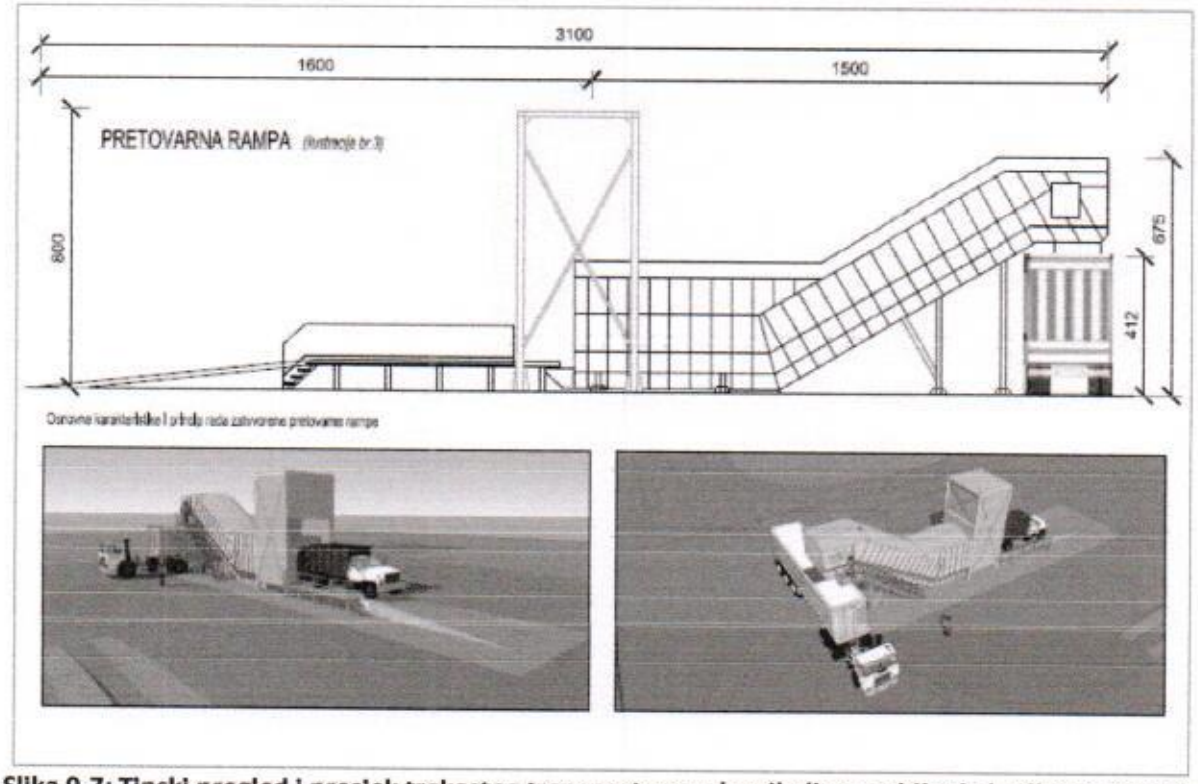
Pretovarna stanica sastoji se:

- od prokopa za prihvat otpada iz manjih vozila s pokrovom
- od pretovarne rampe
- od prilazne ceste spojene s javnom cestom
- od internih cesta manipulativne površine za prijenos opreme, vozila pretovarnih stanica i parkirališta
- od nadzemnih ljestvi
- od kontejnera za operatora - kontejner za kontrolu ulaska
- od kontejnera s opremom
- od ograde.

Trakasti transporter sastoji se:

- od ravnog dijela (istovarna rampa), na koji se istovaruje otpad iz voziła
- od nagiba
- od utovarne rampe – pretovarni lijevak opremljen gumenim zastorom za usmjeravanje otpada
- plitkog bazena opremljenog hidrauličnom crpkom ispod nagiba za prikupljanje otpadnih voda koje nastaju drenažom komunalnog otpada tijekom pretovara, a koje se nakon prikupljanja vraćaju natrag u poluprikolicu
- od pogonske jedinice (dizelski motor s elektro-hidrauličnom crpkom kao pogonski dio uređaja s jedinstvenom tipkovnicom za upravljanje cjelokupnim transporterom)

Trakasti transporter sastoji se od ravnog dijela (istovarna rampa) na koji se istovaruje otpad iz kamiona, nagiba, podignutog dijela i utovarne rampe – pretovarnog lijevka.




**Slika 9-7: Tipski pregled i presjek trakastog transportera poluprikolice za zbijanje i prijevoz otpada**

### 9.3.6.4 Količina pretovarnog otpada u pretovarnoj stanici

U sljedećoj tablici prikazane su prosječne godišnje količine otpada (za razdoblje 2023.–2047.) u šest predloženih pretovarnih stanica i kapacitet traka za otpad.

**Tablica 9-28: Količina otpada pretovarenog u pretovarnoj stanici**

| | PS Split | PS Sinj | PS Zagvozd | PS Brač | PS Hvar | PS Vis |
|---|---|---|---|---|---|---|
| Količina otpada (t/g) | 49.088 | 12.441 | 10.833 | 3739 | 4336 | 1367 |

### 9.3.7 Sustav sakupljanja

Predloženi sustav sakupljanja otpada sastoji se od odvajanja otpada u **tri toka, kako slijedi:**
Tok 1: odvajanje papira, stakla, metalnih i plastičnih materijala, uključujući pakiranje otpada u različite kontejnere; Tok 2: sakupljanje preostalog miješanog komunalnog otpada i Tok 3: zasebno sakupljanje biorazgradivog otpada. Ovaj sustav sakupljanja trenutačno se već provodi na projektnom području. Za izradu sustava zasebnog sakupljanja prethodno navedenih tokova prema utvrđenim potrebama, određen je odgovarajući broj standardnih kontejnera i kamiona za prijevoz.

Podaci su prikazani u sljedećoj tablici, a detaljni izračuni prikazani su u Prilogu 8.1 poglavlju 8.

**Tablica 9-29: Potrebna oprema za sakupljanje za projektno područje**

| | Postojeća infrastruktura | Dodatne potrebe |
|---|---|---|
| **Kante za skupljanje otpada 1,1m³** | | |
| Kante za sakupljanje miješanog otpada (1,1m³) | 9862 | 122 |
| Kante za skupljanje papirnatog otpada (1,1m³) | 969 | 3086 |

| | Postojeća infrastruktura | Dodatne potrebe |
|---|---|---|
| Kante za skupljanje staklenog otpada (1,1m$^3$) | 169 | 663 |
| Kante za skupljanje plastičnog otpada (1,1m$^3$) | 756 | 6668 |
| Kante za skupljanje metalnog otpada (1,1m$^3$) | 66 | 2636 |
| Kante za sakupljanje odvojenog biootpada | - | 2139 |
| **Kamioni za sakupljanje otpada** | | |
| Kamioni veličine 16 m$^3$ za sakupljanje oporabnih materijala | - | 19 |
| Kamioni veličine 12 m$^3$ za organski otpad odvojen na izvoru | - | 2 |
| Kamioni veličine 16m$^3$ za organski otpad odvojen na izvoru | - | 5 |

*Napomena: Izračuni za dodatne potrebe u pogledu kontejnera za sakupljanje otpada izrađeni su uz pomoć sljedeće formule: Dodatne potrebe = Ukupne potrebe – Postojeća infrastruktura za svaki grad/općinu obuhvaćenu projektnim područjem uz pretpostavku da ako grad ili općina imaju kontejnere s manje predmeta nego što je potrebno, trebat će ih dopuniti dodatnim predmetima, a ne kontejnerima drugog grada/općine u kojima postoji višak predmeta.*
*Postojeća infrastruktura uključuje kontejner za sakupljanje otpada kapaciteta 1,1 m$^3$ te kontejnere različitog kapaciteta (tj. 240 lt, 120 lt) nakon smanjenja kapaciteta od 1,1 m$^3$.*

## 9.4 LJUDSKI RESURSI I PROMICATELJ PROJEKTA

### 9.4.1 Organizacijski dijagram

Društvo Regionalni centar čistog okoliša d.o.o. za gospodarenje otpadom (RCČO), sa sjedištem u Splitu, Domovinskog rata 2, osnovana je 2005. od strane Splitsko-dalmatinske županije, s poslovnim udjelom nominalne vrijednosti 13.725.628,00 HRK, što čini 100-postotni udio kapitala.

Društvo je registrirano pri Trgovačkom sudu u Splitu, pod brojem društva: 060207999, OIB: 54045399638.

Svrha osnivanja društva utvrđena je u članku 1. u vezi s člankom 5. Izjave. Izjavama o osnivanju propisuje se da je društvo osnovano kao profitabilna gospodarska djelatnost za neopasni otpad koja obuhvaća:

- sakupljanje otpada za potrebe drugih strana
- prijevoz otpada za potrebe drugih strana
- posredovanje u organizaciji uporabe i/ili odlaganja otpada u ime drugih strana
- sakupljanje, oporabu i/ili gospodarenje (obrada, odlaganje, spaljivanje i druge metode zbrinjavanja otpada) te gospodarenje posebnim kategorijama otpada
- proizvodnju električne energije
- proizvodnju plina

Osim navedenih djelatnosti, društvo može obavljati druge djelatnosti povezane s njima, u manjem opsegu te koje se najčešće obavljaju zajedno s navedenim djelatnostima.

Sustav komunalne infrastrukture za gospodarenje otpadom prostire se na cijelom području Splitsko-dalmatinske županije zbog čega SPLITSKO-DALMATINSKA ŽUPANIJA, sa sjedištem u Splitu, Domovinskog rata, kao jedini osnivač, osniva društvo s ograničenom odgovornošću.

U trenutku osnivanja društva, komunalna infrastruktura za gospodarenje otpadom, uključujući Centar za gospodarenje otpadom u Kladnjicama, općina Lećevica i šest pretovarnih stanica u Splitsko-

dalmatinskoj županiji kojima će upravljati novoosnovano društvo, još nije bila izgrađena, međutim, prvi preduvjet za osiguranje pripreme projekta zadovoljen je angažiranjem radnika u prvoj fazi i sklapanjem ugovora s konzultantima.

### 9.4.2 Zahtjevi u pogledu osoblja

U ovom dijelu prikazani su indikativni zahtjevi u pogledu osoblja za upravljanje i normalan rad CGO-a i PS-a. Analitički podaci koji se odnose na pojedinu funkciju, kao što su opis radnog mjesta i potrebne vještine, prikazani su u prilogu 9.3 ovog poglavlja.

**Tablica 9-30: Zahtjevi u pogledu osoblja**

| ***Središnja uprava - RCČO d.o.o.*** | |
|---|---|
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Direktor | 1 |
| 2. Pomoćnik direktora | 1 |
| 3. Voditelj projekta | 1 |
| 4. Voditelj Odjela za tehničku provedbu projekta | 1 |
| 5. Voditelj financija i računovodstva | 1 |
| 6. Osoblje za tehničku pomoć za jedinicu za provedbu projekta | |
| 7. Suradnik za javnu nabavu | 1 |
| 8. Suradnik za odnose s javnošću | 1 |
| 9. Glavni inženjer građevine i infrastrukture | 1 |
| 10. Suradnik za financijsko upravljanje | 1 |
| 11. Suradnik za javnu nabavu | 1 |
| 12. Suradnik za pravne poslove i ljudske resurse | 1 |
| ***Minimalni zahtjevi potrebni za rad postrojenja za mehaničko-biološku obradu*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Glavni direktor | 1 |
| 2. Operator postrojenja za mehaničko-biološku obradu | 2 |
| 3. Tehnički stručnjak za električne instalacije | 1 |
| 4. Tehnički stručnjak za mehaničke instalacije | 4 |
| 5. Rukovatelj vagom | 4 |
| 6. Glavni tajnik / administrator | 3 |
| 7. Vozač kamiona | 8 |
| 8. Radnici na općim poslovima | 15 |
| ***Zahtjevi za rad odlagališta otpada*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Nadglednik odlagališta otpada | Zajednička funkcija s operatorom postrojenja za mehaničko-biološku obradu |
| 2. Rukovatelj uređajem za zbijanje otpada | 1 |
| 3. Operater buldožera | 1 |
| 4. Rukovatelj utovarivača | 1 |
| 5. Vozač kamiona | Zajednička funkcija s operaterom buldožera |
| 6. Radnici na općim poslovima | 3 |
| ***POOV – sakupljanje odlagališnog plina*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Voditelj | Zajednička funkcija s operatorom postrojenja za mehaničko-biološku obradu |
| 2. Službenik za usklađenost s okolišem | Zajednička funkcija s operatorom postrojenja za mehaničko-biološku obradu |
| ***Reciklažno dvorište*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Voditelj | Zajednička funkcija s operatorom postrojenja za mehaničko-biološku obradu |
| 2. Rukovatelj opreme | 1 |
| ***Reciklažno dvorište za građevni otpad*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Rukovatelj opreme | 1 |

| | |
|---|---|
| 2. Radnik na općim poslovima | Zajednička funkcija s operaterom buldožera |
| ***Zahtjevi za tehnički dio vozila*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Mehanički inženjer | 1 |
| 2. Mehaničar vozila | 2 |
| 3. Radnik na općim poslovima | 3 |
| ***Zahtjevi za zaštitu, kontrolu i nadzor*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Čuvar | 3 |
| ***Vozači vozila pretovarne stanice*** | |
| *Funkcija* | *Indikativan broj osoblja* |
| 1. Vozač kamiona | 24 |

***/Napomena prevoditelja: na zahtjev klijenta, prevedeni su samo pojedini dijelovi izvornika./***

Ja, Paula Jakus, stalni sudski tumač za engleski i talijanski jezik, imenovana rješenjem predsjednika Županijskog suda u Splitu broj 4 Su-686/2017 od 8. ožujka 2018. potvrđujem da gornji prijevod potpuno odgovara izvorniku sastavljenom na engleskom jeziku.

U Splitu, 16. 12. 2019., br. 462-2019.

PAULA JAKUS
Kralja Tomislava 23
21000 SPLIT

Paula Jakus

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# 9 PROPOSED INVESTMENT PROJECT

## 9.1 GENERAL DESCRIPTION OF THE SELECTED WASTE MANAGEMENT SYSTEM (WMS)

An integrated solid waste management system needs to be a sustainable system which is economically affordable, socially acceptable and environmentally effective.

- Economic affordability requires that the costs of waste management systems are acceptable to all sectors of the community served, including householders, commerce, industry, institutions, and government.
- Social acceptability requires that the waste management system meets the needs of the local community, and reflects the values and priorities of that society.
- Environmental effectiveness requires that the overall environmental burdens of managing waste are reduced, both in terms of consumption of resources (including energy) and the production of emissions to air, water and land.

Integrated Solid Waste Management (ISWM) takes an overall approach to this, involves the use of a range of different treatment options, and deals with the entire solid waste stream.

The following figure represents the concept of Integrated Solid Waste Management (ISWM). The ISWM "doughnut" demonstrates that collection and sorting are at the centre of any successful waste management system. The four main waste management technologies surrounding the collection and sorting system are shown as equal sized quadrants to illustrate that they must be considered equally when developing a waste management strategy for any location. Flexibility in technology application for a specific location is also an essential component of the IWM concept. Data based decision support using Life Cycle Assessment tools facilitates the selection of the most appropriate waste management technologies (not necessarily all four) needed to deliver an environmentally optimized IWM system for a specific location. In combination with economic and social considerations, this approach helps for the design of a more sustainable solid waste management system.

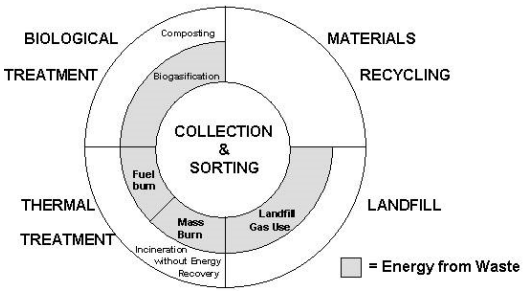



**Figure 9-1: The Elements of Integrated Solid Waste Management**

Along with the overall need for sustainable waste management, it is clear that no one single treatment method can manage all materials in Municipal Solid Waste (MSW) in an environmentally and financial effective way. Following a suitable collection system, a range of treatment options will be required. These include materials recovery, biological treatment (composting/biogasification), thermal treatment (mass-burn incineration with energy recovery and/or burning of Refuse Derived Fuel - RDF) and land filling. Together these form an Integrated Waste Management (WMS) system.

Effective management schemes need the flexibility to design, adapt, and operate systems in ways which best meet current social, economic, and environmental conditions. These are likely to change over time and vary by location. The need for consistency in quality and quantity of recycled materials, compost or energy, the need to support a range of disposal options, and the benefit of economies of scale, all suggest that ISWM systems should be organized on a large-scale, regional basis. Any scheme incorporating recycling, composting or energy from waste technologies must be market-orientated.

Whilst it uses a combination of options, the defining feature of an IWMS system is that it takes an *overall* approach to manage all materials in the waste stream in an environmentally effective, economically affordable, and socially acceptable way.
An integrated solid waste management system consists of the following stages, which are deeper analyzed in the following chapters:

- Waste collection (two/three way streams)
- Waste transportation and transfer (to transfer station, recovery and recycling facility, treatment plant or landfill)
- Locations of waste management facilities i.e. transfer stations and integrated waste management centre
- Waste treatment (thermal, physical, chemical or biological treatment)
- Waste disposal to landfill

The selected waste management system for Split - Dalmatia County includes the following:

- **Waste collection:** Waste collection system includes 3 waste streams collection:
  - Recyclable waste
  - Residual waste
  - Bio-waste.

- **Waste transportation:** Taking into consideration the results of the option analysis that was presented in chapter 8 regarding the TS, the collection of waste through TS results to advantages and benefits to the stakeholders of the project. The proposed Transfer Stations that will be serve Split - Dalmatia County are:
  - Split TS
  - Sinj TS
  - Zagvozd TS
  - Brač TS
  - Hvar TS
  - Vis TS
- **Waste treatment and disposal:** Considering all the elements which have been presented in various chapters of this study, the recommended Waste Treatment and Disposal System is Scenario Sc.1 which is including:
  - Mechanical treatment with recovery of Recyclables and RDF.
  - Aerobic Composting for CLO production.
  - Landfill for the final disposal of residues and CLO. Landfill will be implemented in line with the requirements of Directive 99/31/EC.
  - Inert landfill.

The next figure illustrates an overview of the total waste management system (collection, treatment and disposal) that will be applied in Split - Dalmatia County.

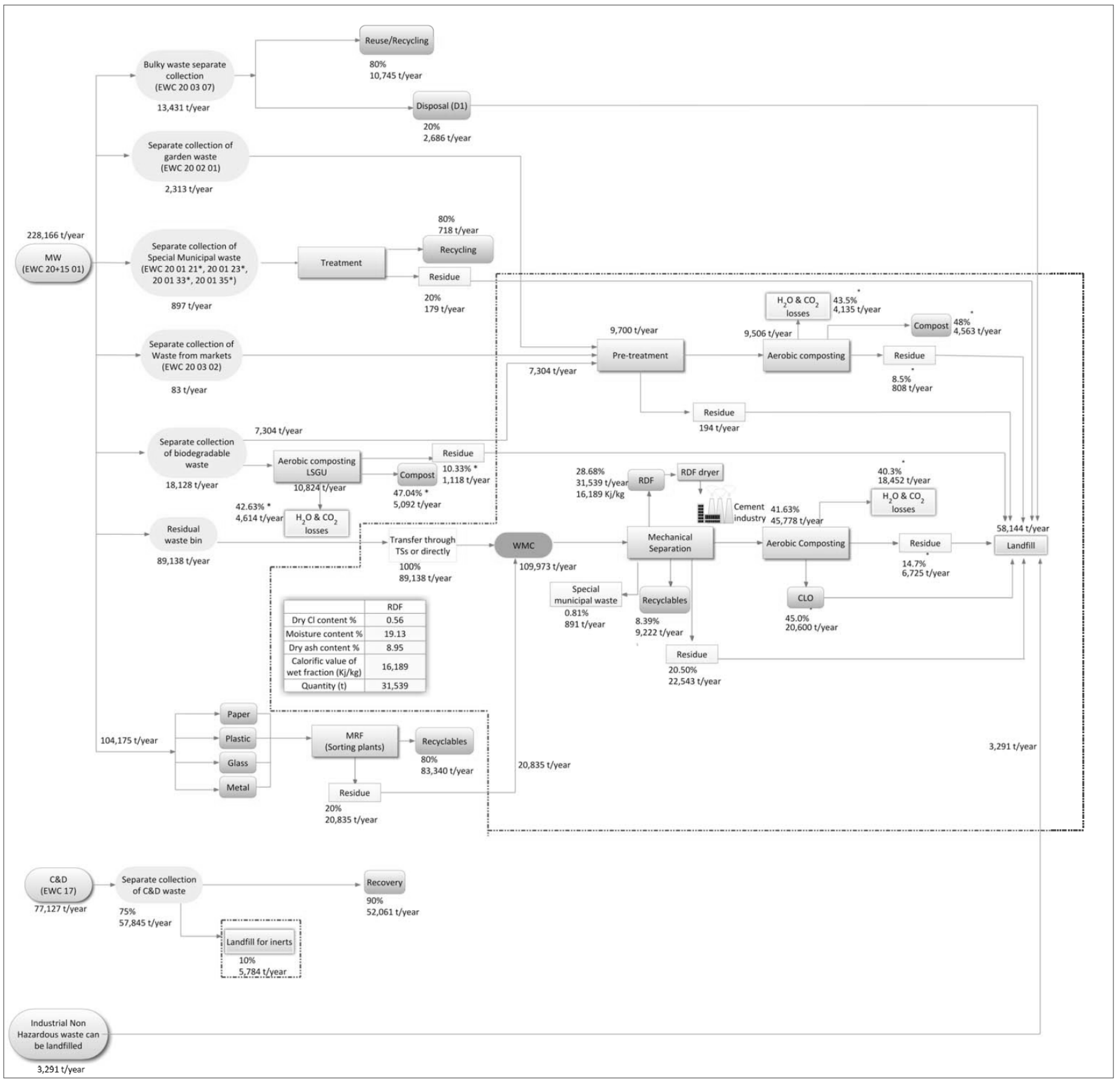



**Figure 9-2: Overview of waste management system in Split - Dalmatia County**

Regarding the fulfillment of legislation targets, the following table presents the quantification of dir. 2008/98/EC as amended by dir. 2018/851 and 1999/31/EC.

**Table 9-1: Quantification of legislative targets for proposed Waste Management System**

| | **European Directive 2008/98/EC as amended by Directive 2018/851 Article 55 of Act on Sustainable Waste Management (OG No 94/13)** | | | **European Directive 1999/31/EC Article 24 of Act on Sustainable Waste Management (OG No 94/13)** | | |
|---|---|---|---|---|---|---|
| | Percentage (%) | Quantity (t) | Achievement of target | Percentage (%) | Quantity (t) | Achievement of target |
| **Targets** | ≥50% (2023)<br>≥55% (2025)<br>≥60% (2030)<br>≥65% (2035) | 64,479*<br>70,288*<br>74,966*<br>81,630* | | <35% | 28,054** | |
| ***Selected Scenario 1*** | 73.3%<br>73.3%<br>73.3%<br>73.3% | 94,531<br>93,681<br>91,589<br>92,060 | Yes<br>Yes<br>Yes<br>Yes | 12.5% | 10,031 | Yes |

*Note:*

**The total produced recyclable waste (household and similar commercial) has been calculated to 128,957 t for the year 2023 (50%*128,957 = 64,479 t, 55%*127,797=70,288, 60%*124,943=74,966, 65%*125,585=81,630).*

***According Act on Sustainable Waste Management, OG No 94/13, article 55, paragraph 1, the total produced biodegradable waste in the Republic of Croatia in year 1997 was 756,174 t. The total population of the Republic of Croatia in 2011 was 4,284,889 citizens, the total population of Split-Dalmatia County in 2011 was 454,789 citizens. 454,789/4,284,889 = 10.6%.*

*According to this percentage the generated biodegradable municipal waste that was produced in Split Dalmatia County in 1997 was 10.6%*756,174 t = 80,154 t. By the year 2021 the maximum allowable mass of biodegradable municipal waste which may be deposited annually in landfill, in Split-Dalmatia County, in relation to the mass of biodegradable municipal waste generated in 1997 in this counties shall be <35% (<35%*80,154 t = 28,054 t).*

## 9.2 FUTURE WASTE FLOWS FORECAST

### 9.2.1 Forecast of MSW production

As analyzed in Chapter 4 **the total produced municipal solid waste at Split - Dalmatia County for 2015 was 246,396 t.**

**Table 9-2: Waste production rate (year 2015)**

| | Split - Dalmatia County |
|---|---|
| **Permanent Citizens** | 452,841 citizens |
| **Seasonal Citizens** | 41,869 citizens |
| **Total Population** | 494,710 citizens<br>498 kg/capita/year or<br>1.36 kg/capita/day |

**The total population (permanent and seasonal) for 2015 for Split – Dalmatia County was 494,710 citizens [452,841 (permanent population) + 41,869 (seasonal population)].**

The following table is the Forecast of municipal waste production (using **low case scenario** regarding the waste production rate) and provides the following info:

- the total average municipal waste production between years 2023-2047 for Split – Dalmatia County is **228,166 t** and range between 233,020 t to 228,606 t .

**Table 9-3: Forecast of municipal waste production (Low case Scenario, regarding the waste production rate)**

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Permanent population* | *452,841* | *452,750* | *452,660* | *452,569* | *452,479* | *452,388* | *452,298* | *451,438* | *450,581* | *449,725* | *448,870* | *448,017* | *447,166* | *446,316* | *445,468* | *444,622* |
| Tourist nights | 15,282,126 | 17,113,025 | 16,001,440 | 16,589,760 | 17,178,080 | 17,766,400 | 18,354,720 | 18,943,040 | 19,531,360 | 20,119,680 | 20,708,000 | 21,296,320 | 21,884,640 | 22,472,960 | 23,061,280 | 23,649,600 |
| Seasonal population | 41,869 | 46,885 | 43,840 | 45,451 | 47,063 | 48,675 | 50,287 | 51,899 | 53,511 | 55,122 | 56,734 | 58,346 | 59,958 | 61,570 | 63,182 | 64,793 |
| Total population | 494,710 | 499,635 | 496,499 | 498,021 | 499,542 | 501,063 | 502,585 | 503,337 | 504,091 | 504,847 | 505,604 | 506,363 | 507,124 | 507,886 | 508,650 | 509,416 |
| **Waste production t** | **246,396** | **246,423** | **242,489** | **240,860** | **239,240** | **237,629** | **236,027** | **234,076** | **233,020** | **231,969** | **230,923** | **229,882** | **228,846** | **227,815** | **226,788** | **225,767** |
| *Waste Production Rate (kg/ca/year)* | *498* | *493* | *488* | *484* | *479* | *474* | *470* | *465* | *462* | *459* | *457* | *454* | *451* | *449* | *446* | *443* |

| | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Permanent population* | *443,777* | *442,623* | *441,473* | *440,325* | *439,180* | *438,038* | *436,899* | *435,763* | *434,630* | *433,500* | *432,373* | *430,903* | *429,438* | *427,978* | *426,523* | *425,073* | *423,627* |
| Tourist nights | 24,237,920 | 24,826,240 | 25,414,560 | 26,002,880 | 26,591,200 | 27,179,520 | 27,767,840 | 28,356,160 | 28,944,480 | 29,532,800 | 30,121,120 | 30,709,440 | 31,297,760 | 31,886,080 | 32,474,400 | 33,062,720 | 33,651,040 |
| Seasonal population | 66,405 | 68,017 | 69,629 | 71,241 | 72,853 | 74,464 | 76,076 | 77,688 | 79,300 | 80,912 | 82,524 | 84,135 | 85,747 | 87,359 | 88,971 | 90,583 | 92,195 |
| Total population | 510,183 | 510,641 | 511,102 | 511,566 | 512,033 | 512,503 | 512,975 | 513,451 | 513,930 | 514,412 | 514,897 | 515,039 | 515,185 | 515,337 | 515,494 | 515,655 | 515,822 |
| **Waste production t** | **226,107** | **226,310** | **226,514** | **226,720** | **226,927** | **227,135** | **227,345** | **227,556** | **227,768** | **227,981** | **228,196** | **228,259** | **228,324** | **228,391** | **228,461** | **228,532** | **228,606** |
| *Waste Production Rate (kg/ca/year)* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* | *443* |

### 9.2.2 Forecast of municipal solid waste that will be delivered to WMC at Lecevica

As analyzed in chapter 4 and shown at the following table the average municipal solid waste that will be delivered in Lecevica WMC between years 2023-2047 is **109,973 t** and range between 110,185 to 112,313 t.

**Table 9-4: Municipal Solid Waste that will be delivered in Lecevica CWMC for further treatment (t)**

| | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quantity of MW to be delivered to Lecevica CWMC (t) | 112,313 | 111,806 | 111,302 | 110,800 | 110,301 | 109,804 | 109,309 | 108,817 | 108,981 | 109,079 | 109,177 | 109,276 | 109,376 | 109,476 | 109,577 | 109,679 | 109,781 | 109,884 | 109,988 | 110,018 | 110,049 | 110,082 | 110,115 | 110,150 | 110,185 |
| Quantity of MW to be delivered to Lecevica CWMC separated according qualitative composition | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kitchen and biowaste | 42,081 | 41,891 | 41,702 | 41,514 | 41,327 | 41,141 | 40,955 | 40,771 | 40,832 | 40,869 | 40,906 | 40,943 | 40,980 | 41,018 | 41,056 | 41,094 | 41,132 | 41,171 | 41,209 | 41,221 | 41,233 | 41,245 | 41,257 | 41,270 | 41,284 |
| Paper/Cardboard | 15,632 | 15,561 | 15,491 | 15,421 | 15,352 | 15,283 | 15,214 | 15,145 | 15,168 | 15,182 | 15,195 | 15,209 | 15,223 | 15,237 | 15,251 | 15,265 | 15,279 | 15,294 | 15,308 | 15,312 | 15,317 | 15,321 | 15,326 | 15,331 | 15,336 |
| Skin and bones | 198 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 192 | 192 | 192 | 192 | 192 | 193 | 193 | 193 | 193 | 193 | 193 | 193 | 194 | 194 | 194 | 194 | 194 |
| Wood | 3,042 | 3,028 | 3,014 | 3,001 | 2,987 | 2,974 | 2,960 | 2,947 | 2,952 | 2,954 | 2,957 | 2,960 | 2,962 | 2,965 | 2,968 | 2,970 | 2,973 | 2,976 | 2,979 | 2,980 | 2,981 | 2,981 | 2,982 | 2,983 | 2,984 |
| Textile | 11,891 | 11,837 | 11,784 | 11,731 | 11,678 | 11,625 | 11,573 | 11,521 | 11,538 | 11,548 | 11,559 | 11,569 | 11,580 | 11,590 | 11,601 | 11,612 | 11,623 | 11,634 | 11,645 | 11,648 | 11,651 | 11,655 | 11,658 | 11,662 | 11,666 |
| Glass | 3,699 | 3,683 | 3,666 | 3,649 | 3,633 | 3,617 | 3,600 | 3,584 | 3,589 | 3,593 | 3,596 | 3,599 | 3,602 | 3,606 | 3,609 | 3,612 | 3,616 | 3,619 | 3,623 | 3,624 | 3,625 | 3,626 | 3,627 | 3,628 | 3,629 |
| Metals | 2,044 | 2,035 | 2,026 | 2,017 | 2,008 | 1,999 | 1,990 | 1,981 | 1,984 | 1,985 | 1,987 | 1,989 | 1,991 | 1,993 | 1,995 | 1,996 | 1,998 | 2,000 | 2,002 | 2,003 | 2,003 | 2,004 | 2,004 | 2,005 | 2,006 |
| Inert | 8,000 | 7,964 | 7,928 | 7,892 | 7,856 | 7,821 | 7,786 | 7,751 | 7,762 | 7,769 | 7,776 | 7,783 | 7,790 | 7,798 | 7,805 | 7,812 | 7,819 | 7,827 | 7,834 | 7,836 | 7,838 | 7,841 | 7,843 | 7,846 | 7,848 |
| Plastic | 11,829 | 11,776 | 11,723 | 11,670 | 11,617 | 11,565 | 11,513 | 11,461 | 11,478 | 11,489 | 11,499 | 11,509 | 11,520 | 11,530 | 11,541 | 11,552 | 11,563 | 11,573 | 11,584 | 11,588 | 11,591 | 11,594 | 11,598 | 11,601 | 11,605 |
| Rubber-Leather | 4,484 | 4,464 | 4,443 | 4,423 | 4,403 | 4,384 | 4,364 | 4,344 | 4,351 | 4,355 | 4,359 | 4,363 | 4,366 | 4,370 | 4,375 | 4,379 | 4,383 | 4,387 | 4,391 | 4,392 | 4,393 | 4,395 | 4,396 | 4,397 | 4,399 |
| Special | 1,138 | 1,133 | 1,128 | 1,123 | 1,118 | 1,113 | 1,108 | 1,103 | 1,104 | 1,105 | 1,106 | 1,107 | 1,108 | 1,109 | 1,110 | 1,111 | 1,112 | 1,113 | 1,115 | 1,115 | 1,115 | 1,115 | 1,116 | 1,116 | 1,117 |
| Diapers | 8,276 | 8,239 | 8,202 | 8,165 | 8,128 | 8,091 | 8,055 | 8,019 | 8,031 | 8,038 | 8,045 | 8,052 | 8,060 | 8,067 | 8,075 | 8,082 | 8,090 | 8,097 | 8,105 | 8,107 | 8,109 | 8,112 | 8,114 | 8,117 | 8,119 |

## 9.3 THE WMC AND TS SITES AND THEIR CHARACTERISTICS

### 9.3.1 The WMC site and its characteristics

The construction of the Waste Management Center in Split-Dalmatia County was proposed to be located at the Lećevica-Kladnjice site in the Municipality of Lećevica. The Center will be developed as an integrated waste management facility. The anticipated setout and appearance of the Center will be important to surrounding and neighboring settlements, so it is important to provide good access for vehicles, protective embankments/vegetation and good architecture where buildings and infrastructure are visible.

The site in Lećevica is located in a natural valley (Šilovića Doci) approximately 1 km from the settlement of Kladnjice in the Municipality of Lećevica. The selection of the particular site in Kladnjice – Lećevica was justified in previous studies (site selection studies and EIA studies). The existing studies/documentation are listed briefly below;

An Environmental Impact Assessment Study (EIA) for the County Waste Management Centre Lećevica (2005-2006) by IPZ –Uniprojekt Ltd is existing.

The site selection for WMC location in Lećevica was justified in previous studies. Detailed information on the selection of the location and on the previous studies is presented in Chapter 8. The existing studies/documentation are listed briefly below;

- "Analysis of potential locations for construction of the Waste Management Centre for communal and technological waste with an associated waste disposal site in the County of Split-Dalmatia" (EKO-INA/ZGO, January 2001)
- Study on complex geo-research for the "Kladnjice"- Lećevica location, Books I and II", ECOINA, Zagreb 2004
- Request for the procedure of Environmental impact assessment (EIA) of the County Management Centre in the County of Split-Dalmatia at 10 February 2005, for the planned activity in the Municipality of Lećevica,
- Environmental Impact Study (EIS) for the County Waste Management Centre Lećevica (2005-2006) by IPZ –Uniprojekt Ltd[1].
- Geological and hydrogeological research in the proposed location of the WMC Split Dalmatian County near Lećevica, 2006
- Ministry of Environment Protection, Physical Planning and Construction - positive decision on EIS issued on 27 November 2006[2],
- County Physical Plan has been adopted with site Lećevica determined as the site for future WMC (2006),
- County Waste Management Plan of Split-Dalmatia County (OG 1B/08)[3], 2008
- Elaborate of sources of the rivers Jadra and Žrnovnica, Sanitary protection zones (2010)
- Results of the analysis of the morphological composition of mixed municipal waste in the area of Split-Dalmatia County (2014)
- Report of analyses of physical-chemical properties and biodegradation of municipal waste in the Split-Dalmatia County, Phase I and Phase II (2014)

[1] http://www.rcco.hr/Portals/0/docs/SUO-MBO_Lecevica.pdf

[2] http://www.rcco.hr/Portals/0/docs/Rje%C5%A1enje%20MZOPUG%20o%20prihvatljivosti%20namjeravanog%20zahvata.pdf

[3] http://www.rcco.hr/LinkClick.aspx?fileticket=hGWiaDWk1as%3d&tabid=63&mid=428

- Decision on determination of Sanitary protection zones of sources of public water supply of rivers Jadra and Žrnovnica (2014)
- Techno-economic background for the Feasibility study of the photovoltaic power plant within WMC Lećevica and Transfer Stations (2015)
- The WMC administrative building design solution (2015)
- Seismological and seismotectonic study of the wider environment of the county Waste Management Center in Lećevica Municipality (2010),
- Geotechnical study on the upper layer of earth research in the area of the Waste Management Center of Split-Dalmatia County - Kladnjice, 2016
- Examination of underground watercourses from the pit in Šilovići location in Kladnjice, Municipality of Lećevica, 2017
- Physical Plan of the Municiaplity of Lećevica has been adopted with site Lećevica determined as the site for future WMC, 2008
- Waste Management Plan of the Republic of Croatia 2017-2022 has been adopted (2017)
- Environmental Protection Report for the request for the evaluation of the need for the environment impact assessment of the WMC in SDC (May 2017), Hudec plan d.o.o. Zagreb,
- Decision of the Ministry of Environmental Protection and Energy on the procedure of assessment of the need to assess the impact of changes to the environmental project (2017),
- Preliminary design of the Waste Management Center in Split-Dalmatia County – (Geoprojekt d.d., Split and Brodarski institute d.o.o., Zagreb, 2017),
- Location permit for construction of Waste Management Centre in Split-Dalmatia County, issued on 26 September 2017.
- Report on air quality testing at the Lećevica measuring stations (2017)
- Construciton permit for 1st Road section to Waste Managment Centar in Lećevica (2016)
- Modification of the Location permit for the 1st road section to the Waste Managment Centar in Lećevica (2015)
- Construction permit for the 2nd Road section to the Waste Managment Centar in Lećevica (2016)
- Location permit for 2nd Road Section to Waste Managment Centar in Lećevica (2012)
- Location permit for 3rd Road Section to Waste Managment Centar in Lećevica (2013)
- Preliminary design for reconstruction of intersection and entry into the WMC (2015)
- Main project for reconstruction of intersection and entry into the WMC (2015)
- Construction permit for reconstruction of intersection and entry into the WMC (2016)
- Previous electricity approval for customer connection with own electric photovoltaic power station in WMC.
- Spatial Plan of the Split Dalmatian County (1/03, 8/04, 5/05, 5/06, 13/07, 9/13)

Split-Dalmatia County has a total area of 14,106.40 km$^2$. Most of the land area consists of the hinterland (59.88%), while the islands make up a lower proportion of the land surface area (19%). Geographically it is located in the central part of the Adriatic coast. It stretches from Vrlika in the north to the furthest Croatian island of Palagruza in the south, and from Marina in the west to Vrgorac in the east.

The site of future WMC in Kladnjice - Lecevica is located in an area covered with bush in a natural valley (Šilovića Doci). It is a sparsely populated area without any industrial facilities. The area is located at an altitude of 470 m, surrounded by hills (which go up to 550 m of altitude) on two sides. It is a relatively flat, long area of oval shape, the greater diameter of few kilometres in length, and the useable width of approximately 500 m.. It is in the immediate vicinity of the local Lećevica-Unešić road.

The settlement of Lećevica is located approximately 10 km to the southwest and connected with Split by a county road via Konjsko and also with highway via Vučevica.

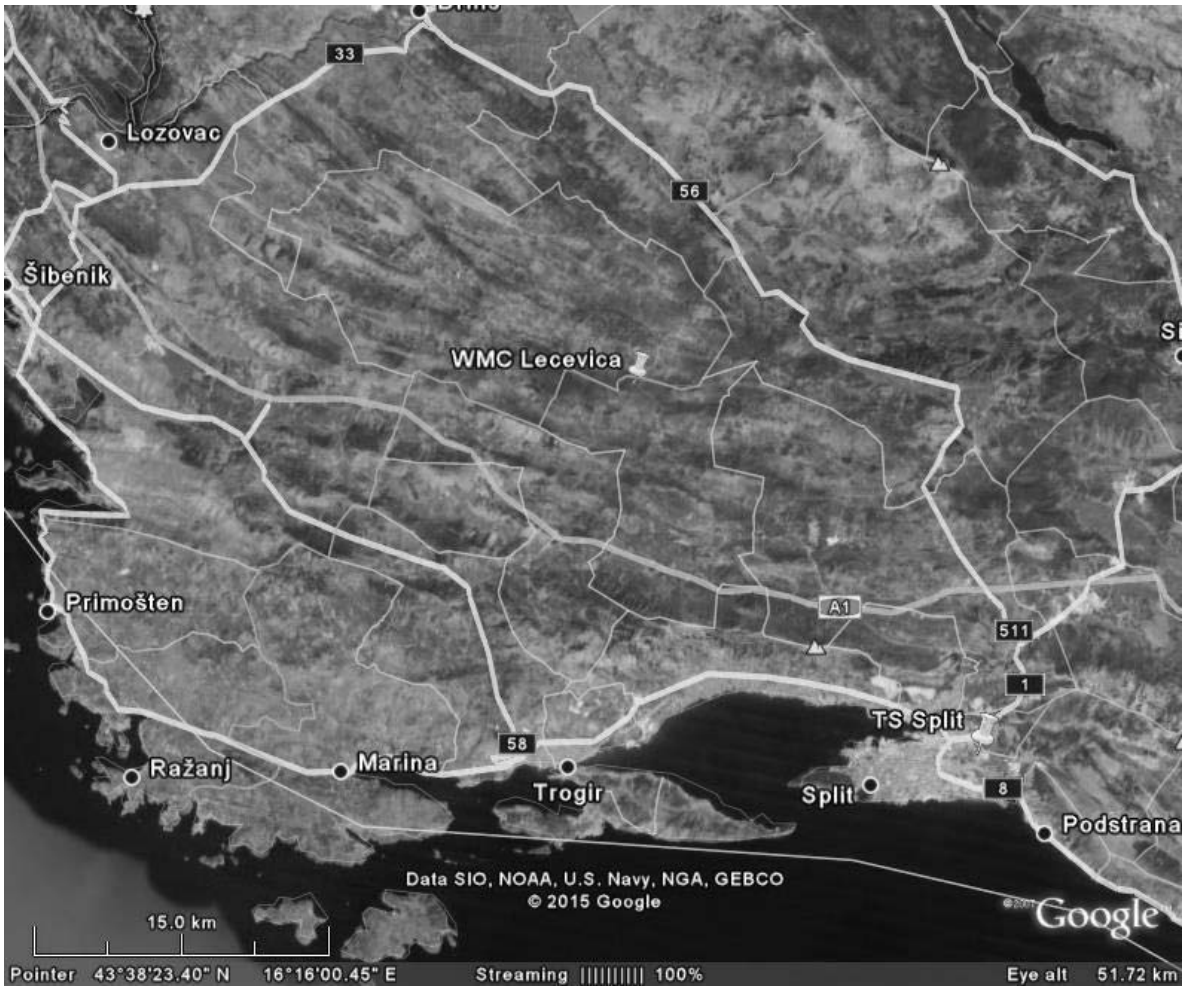



**Figure 9-3: Satellite image of WMC Site Lećevica surrounding area**

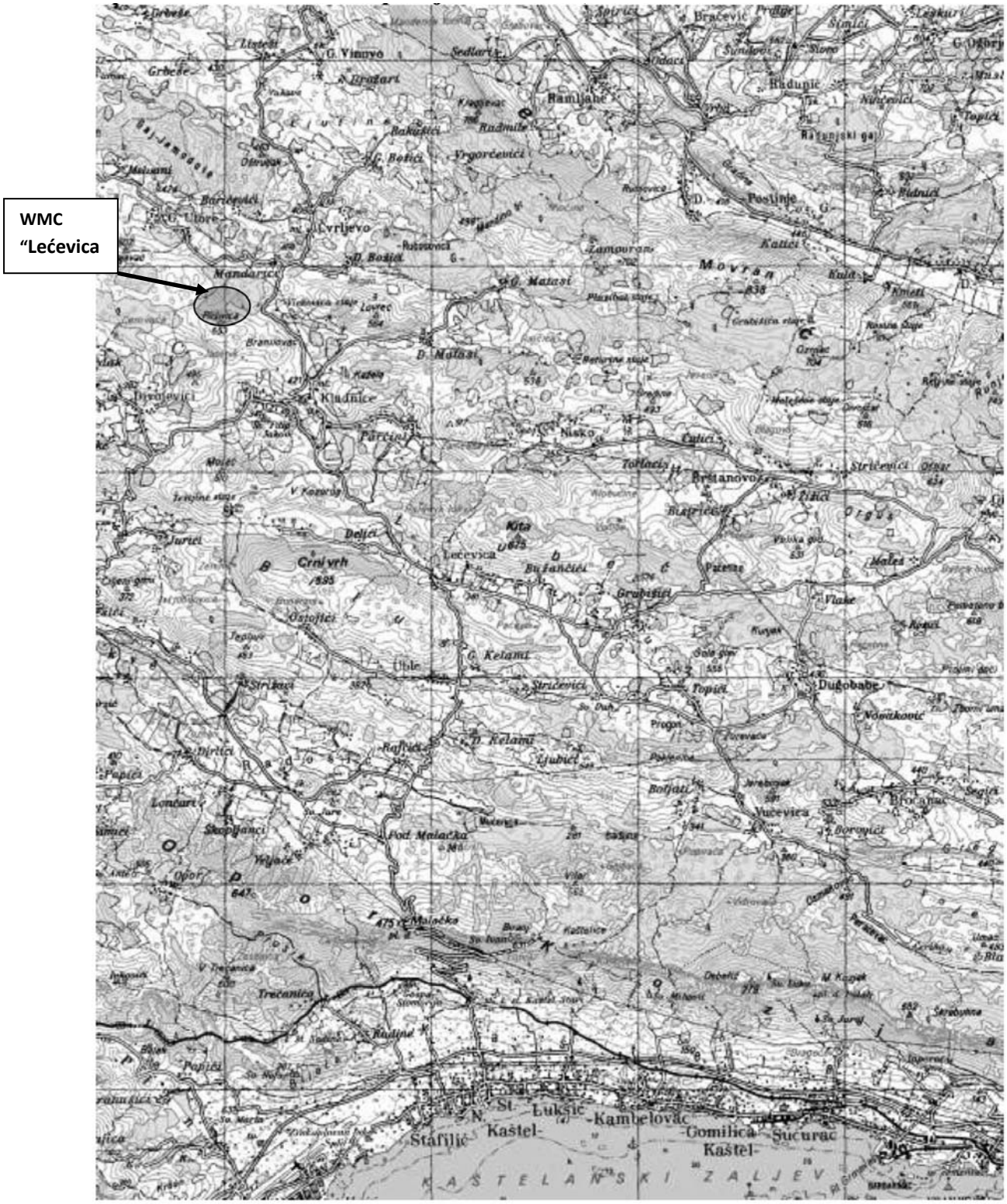



**Figure 9-4: Overview map of WMC Site Lećevica (original scale 1:100.000)**

The nearest settlements to the landfill are the settlements Kladnjice Miškovići and Šilović, Baričevići, Vickovic are stables located approximately 1 km away from the Center location. Outside of the county, the nearest village, Mandarići, is also about 1 km away.

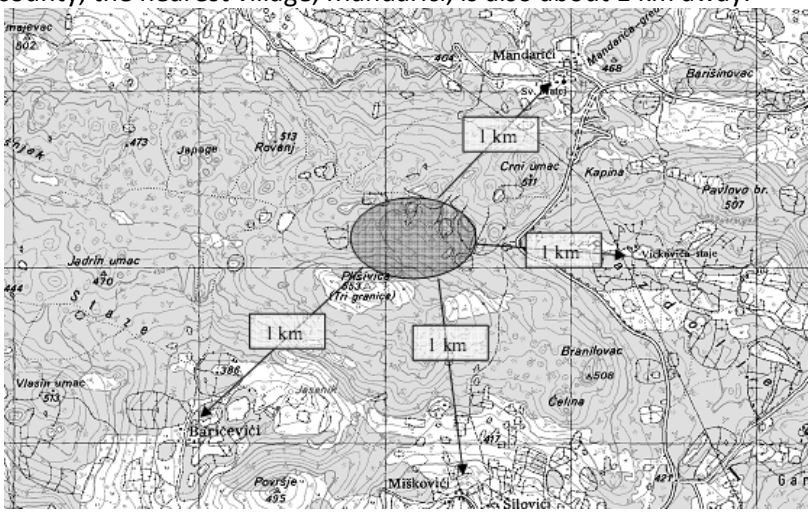



**Figure 9-5:Geographical position of WMC Site Lećevica**

The future WMC site is located close to the local road Lećevica – Unešić. A new 100m long and 6m wide asphalt road shall connect the Centre to the main road Lećevica – Unešić.

County Administration for the Roads has been preparing the project of reconstruction and partial relocation of Ž 6098 and Ž 6155 (Kladnjice – Lećevica – Korušce/L 67061/) in total length of 13,8 km. That road connects future WMC with the highway (exit Vučevica). For that purpose following documentation has been prepared:

- Section I,4,24 km in length: location permit issued due 7/2015; change of location permit 12/2015.and 6/2016., main design and land subdivision prepared; construcion permit issued in 5/2016;
- Section II,3,16 km in length: location permit issuded 6/2012, main designs completed, land subdivision has been preprared; construction permit issued 10/2016,
- Section III,6,4 km in length: location permit issued, due 4/2013; main designs and land subdivision elaboration are prepared, request for construction permit in process;
- Reconstruction of the crossroad for the entrance to the WMC: location permit issued; main designs and land subdivision elaboration are prepared. Construction permit 11/2016,
- Reconstructed road will be 7,10 m (2 x 3,25 m + edge trails 2 x 0,30 m) wide, and there will be 3 lanes at the crossroad to the entrance of the WMC.

Reconstructed road will be 7,10 m (2 x 3,25 m + edge trails 2 x 0,30 m) wide, and there will be 3 lanes at the crossroad to the entrance of the WMC.

Existing road is of satisfactory condition and 6 m wide, and the first phase of the works shall be the construction of the crossroad at the entrance to the WMC and the construction of the new ring road of the settlement Lećevica of 2,4 km in length.

The Centre will be connected to the nearest possible water supply connection which is 10km away from the Centre. The WMC will be not connected to the public sewage system, due to the fact

that there is no sewage system in the vicinity. All wastewater which will be produced in WMC will be treated in WWTP within the Centre. There is no high voltage network at the site. Connection to high voltage network at the nearest settlement is viable.

The study area consists of a variety of sedimentary rock of Lower Triassic to Quaternary. stratigraphic range. The terrain of Kladnjice - Lecevica is located in a karst valley with cretaceous limestone with layers of dolomite, with some eocene-foraminifer limestone.

The location is not included and is not near to any protected areas (Natura sites, water protection areas etc).

More detailed information in combination with the environmental assessment of the location is presented in chapter 10.

### 9.3.2 The TS sites and their characteristics

Taking into consideration the needs of the present project, the travel distances and the waste quantities. It is proposed to establish six (6) TS, as follows:

- Split TS
- Sinj TS
- Zagvozd TS
- Brač TS
- Hvar TS
- Vis TS


**Figure 9-6: Satellite image of TS Sites in Split – Dalmatia County**

An overview of all potential TS locations and their served towns/municipalities is presented in the following table and figure.

**Table 9-5: Capacities of all potential TS**

| TS | Distance of TS to WMC (1-way, in km) | | Total distance in km | Served towns / municipalities | Capacity (t/year) Average 2023-2047 |
|---|---|---|---|---|---|
| | More* | Land | | | |
| **Split** | | 46 | 46 | Split, Kastela, Solin, Dugopolje, Podstrana, Omis, Dugi Rat, Zadvarje, Sestanovac, Klis, Solta | 49,088 |
| **Sinj** | | 42 | 42 | Sinj, Hrvace, Dicmo, Trilj, Otok, Vrlika | 12,441 |
| **Zagvozd** | | 84 | 84 | Imotski, Vrgorac, Baska voda, Brela, Makarska, Tucepi, Podgora, Cista Provo, Lovrec, Lokvicici, Prolozac, Podbablje, Zmijavci, Runovici, Zagvozd, Gradac | 10,833 |
| **Brac** | 17 | 78 | 95 | Pucisca, Nerezisca, Selca, Bol, Sutivan, Postira, Milna, Supetar | 3,739 |
| **Hvar** | 43 | 53 | 69 | Stari Grad, Hvar, Jelsa, Sucuraj | 4,336 |
| **Vis** | 56 | 54 | 110 | Vis,Komiza | 1,367 |
| *The stated distances are those between the ports of arrival and departure on the islands and in the City of Split connected by Jadrolinija boat service | | | | | |

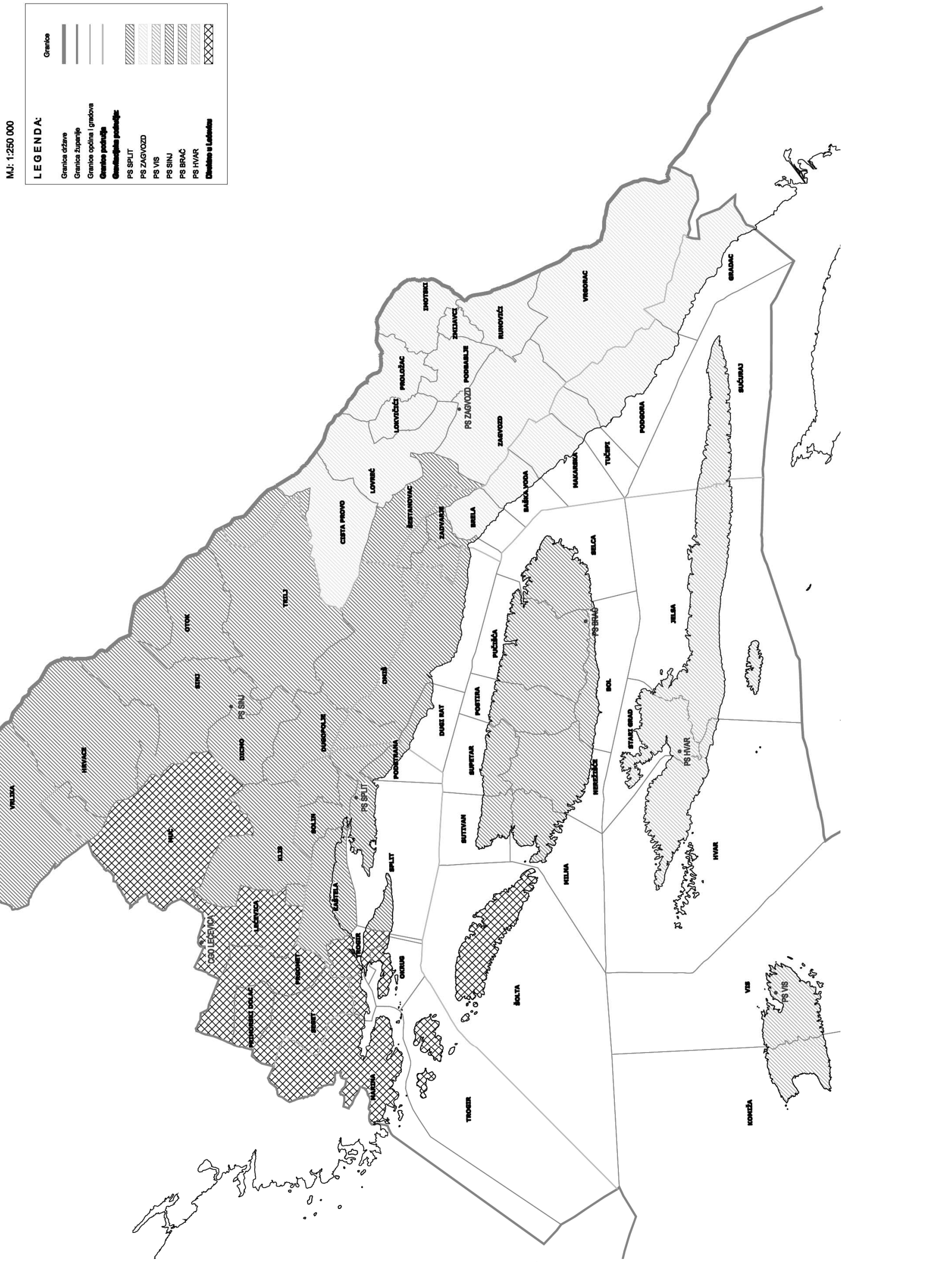



**Figure 9-7: Transfer stations and respective serviced towns / municipalities**

1. **TS Split** is proposed to be located in the present Karepovac landfill, in the eastern part of the City of Split, in the urban region of Mejaši. The intended area for the construction is around 5,700 km2. The distance between the Split Transfer Station and the Lećevica WMC is approximately 46 km.


**Figure 9-8: Satellite images of Split TS**

2. **TS Sinj** is proposed to be located at the Mojanka landfill. The location is determined by the physical planning documents of the Town of Sinj and SDC. TS is located on cadastral plots 1718/5, 1717/6,2006/11, Cadastral Municipality of Brnaze, all owned by the Town of Sinj. The intended area for the construction of TS is around 4,800 $m^2$. The distance between the location and the WMC is around 42 km.


**Figure 9-9: Satellite images of Sinj TS**

3. **TS Zagvozd** is proposed to be located in the Municipality of Zagvozd in the northwestern part of the future Golo Brdo business zone on cadastral plot 9274/105. The distance between the location and the WMC is around 84 km.


**Figure 9-10: Satellite images of Zagvozd TS**

4. **TS Brač** The construction of a transfer station for the island of Brač is envisaged within the greater location of the present Brdo-Košer landfill in accordance with the physical planning documents of the Municipality of Pučišća and SDC. The macro-location for the Brač Transfer Station is envisaged on land registry plots 4338/1, 4346 and 4347/2, Cadastral Municipality of Gornji Humac. The transfer station is 19.4 km away from the port in Pučišća and 97 km from the Lećevica WMC (by sea and land via the Split Ferry Port).


**Figure 9-11: Satellite images of Brač TS surrounding area**

5. **TS Hvar** is proposed to be located in the Town of Stari Grad, Tusto brdo site, Hvar island, is envisaged by the physical planning documents of the Town of Stari Grad and SDC. The site is 3 km from the Town of Stari Grad and around 96 km from the Lećevica WMC (by land and sea). The distance between the site and the port in Stari Grad is around 2.4 km


**Figure 9-12: Satellite images of Hvar TS**

6. **TS Vis** is proposed to be located in the Island of Vis as part of a project for the rehabilitation of the present Wellington landfill on Vis and is envisaged by the physical planning documents of the Town of Vis and SDC. The distance between the TS and the Town/Port of Vis is around 3.28 km and 110 km to the Leće vica CWMC (by sea and land via the Split Ferry Port).


**Figure 9-13: Satellite images of Vis TS**

## 9.4 EXISTING INFRASTRACTURE CONDITIONS AND REQUIREMENTS

### 9.4.1 WMC infrastructure conditions and requirements

In the area of the site of Leće vica there is currently no infrastructure works available. More specific there is no high voltage network nor water network. Connection to high voltage network at the nearest settlement is viable.

The needs for the operation of the project are the followings:

- The Leće vica WMC should be connected to the MV electrical power network.
- The location must be connected with a drinking water supply, having the necessary length and pipeline material.
- Technical water supply (washing, fire protection, etc.) can be done through a drilling and the respective reservoir with pumping station. Water is transported to the various consumers (MBT, administrative building, car wash station, tyre wash, etc) via PE pipes ∅50 and 32. The reservoir will be constructed of reinforced concrete and will have a volume about 100 m3.
- There is no sewage network in the location of the WMC. Wastewater is proposed to be purified up to high quality and either recirculated as industrial water. Alternatively it can be temporarily stored in a tank and transferred to a municipal wastewater treatment plant in the region with trucks.

More detailed calculations for infrastructure needs, will be provided in the technical design study.

### 9.4.2 TS infrastructure conditions and requirements

The locations of four out of the six Transfer Stations are proposed to be build within already existing landfills. Therefore, there are already available connections to the State roads (Zagvozd, Hvar, Brač). However, some of the access road should be reconstructed as part of the existing landfill rehabilitation project (Split, Sinj, Vis).

**Table 9-6: Locations intended for TS**

| | Location | Within a landfill | | Outside of a landfill | Micro-location |
|---|---|---|---|---|---|
| 1 | Split | Karepovac | 5 | Island of Hvar | Tusto Brdo |
| 2 | Sinj | Mojanka | 6 | Zagvozd | Livodine |
| 3 | Island of Brač | Brdo – Košer | | | |
| 4 | Island of Vis | Welington | | | |

Based on the development of alternative solutions for photovoltaic power transfer stations by NPC criterion of the total cost of the system in the life of 25 years as well as other specific conclusions and recommendations, the following table shows the recommendations for the solution of power for each transfer station.

According to the report analyzing the transfer stations, (Izvještaj analize varijantnih rješenja napajanja pretovarnih stanica u sklopu ZČGO Lečevića) Split, June 2015 there were 4 basic variants considered for power supply for loads in the planned transfer stations:

- Variant 1) Common connection to distribution grid, TS is a consumer of electric energy – two possible sub options:
  - Variant 1a) All loads are powered by electric energy.
  - Variant 1b) Only basic loads are powered by electric energy and machinery is powered by diesel fuel.
- Variant 2) Grid connection with additionally installed PV system. TS is consumer/ producer of electric energy - two possible sub options:
  - Variant 2a) All loads are powered by electric energy.
  - Variant 2b) Only basic loads are powered by electric energy and machinery is powered by diesel fuel.
- Variant 3) Off-grid system. Basic loads are powered by electric energy and machinery is powered by diesel fuel.
- Variant 4) Off-grid system. All loads are powered by electric energy from PV system, batteries and diesel generators.

Infrastructure conditions and requirements regarding road connections, energy supply, sanitary water and fire protection are presented in the following table:

**Table 9-7: TS Infrastructure Conditions**

| | Road Access | Recommended Energy Supply Variant * | Water supply/ Waste water | Fire protection | Storm water drainage |
|---|---|---|---|---|---|
| Split | The location is within the site of the active Karepovac landfill, there is access road available. However, for tractors of high gross weight, a more adequate access road is needed with route set from the entrance of TS station to the connection with D1 Road (Split-Dugopolje). | Variant 2a) Grid connection with PV system. All loads are powered by electric energy.<br><br>-95 kWp PV system | Sanitary and drinking water connection is available at the TS entrance.<br>Waste water drainage will be done in waterproof collection septic tank of 3,0 $m^3$ minimum capacity or with connection to the Business park sewage network. | There is a hydrant network in the transfer station area envisaged in the landfill restoration project.<br>Fire protection will be done by fire extinguisher for the initial fire extinguishing. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=129.5$m^3$ |
| Sinj | The location is at the Mojanka landfill which has a connection to the D1 State Road that needs to be reconstructed and an access road needs to be built within the landfill. | Variant 2a) Grid connection with PV system. All loads are powered by electric energy.<br>-30 kWp PV system | Sanitary and drinking water connection will be through the designed infrastructure network of the Business Park.<br>Waste water drainage will be done in waterproof collection septic tank of 3,0 $m^3$ minimum capacity or with connection to the Business park sewage network. | There is a hydrant network in the transfer station from the Business park.<br>Besides the hydrants, the fire protection will be done by fire extinguisher for the initial fire extinguishing. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=117 $m^3$ |
| Zagvozd | The site is located next to the Zagvozd – Imotski state road, from where a connection should be provided. | Variant 3) Off-grid system. Basic loads are powered by electric energy and machinery are powered by diesel fuel.<br><br>- 14 kWp PV system<br>- 6 kW inverter<br>- 7 kW Diesel generator<br>- 24x1695 Ah Batteries | Water supply will be through a pipeline connection (located near the D76 state road) with a tank dimensioned for monthly needs, then filled by a cistern. | Fire protection will be done by fire extinguishers for the initial fire extinguishing. The area has no fire protection and hydrant network. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=67.2 $m^3$ |
| Brac | The site is located 3 km away from D3 state road connection. A conceptual design for the connection road exist . | Variant 3) Off-grid system. Basic loads are powered by electric energy and machinery are powered by diesel fuel.<br>- 12 kW PV system<br>- 6 kW inverter<br>- 7 kW Diesel generator<br>- 24x1695 Ah Batteries | Sanitary and drinking water will be provided from an embedded (underground) tank with a pump, dimensioned for monthly needs, and then filled by a cistern.<br>Waste water drainage will be done in waterproof collection ditch of 3,0 $m^3$ minimum capacity. | Fire protection will be done by fire extinguisher for the initial fire extinguishing. The area has no fire protection and hydrant network. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=70.88 $m^3$ |

| | | | | | |
|---|---|---|---|---|---|
| Hvar | The location has access to the ŽC6252 county road. Legally, the access road is registered as general public property. | Variant 3) Off-grid system. Basic loads are powered by electric energy and machinery are powered by diesel fuel.<br>- 13 kWp PV system<br>- 6 kW inverter<br>- 7 kW Diesel generator<br>- 24x1695 Ah Batteries | Sanitary and drinking water will be provided from an embedded (underground) tank with a pump, dimensioned for monthly needs, after which it will have to be filled by a cistern.<br>Waste water drainage will be done in waterproof collection ditch of 3,0 $m^3$ minimum capacity. | Fire protection will be done by fire extinguisher for the initial fire extinguishing. The area has no fire protection and hydrant network. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=49 $m^3$ |
| Vis | The location is part of the Welington landfill restoration project.<br>Only the shape and surface of the plot have been determinate by the conceptual and main design of the landfill restoration process, Phase II, so it is necessary to amend the preliminary design i.e. location permit through which the scope of the project will be defined.<br>The TS will be given a special and new cadastral plot with defined facilities. | Variant 2b)<br>Grid connection with PV system. Only basic loads are powered by electric energy and machinery are powered by diesel fuel.<br><br>- 8 kWp PV system power | Sanitary and drinking water connection will be made to the designed infrastructure network from the landfill restoration project.<br>The waste water drainage will be done in waterproof collection septic tank of 3,0 $m^3$ minimum capacity or with the connection to the sewage network in the landfill restoration project. | There is one aboveground hydrant planned in the landfill restoration project.<br>Besides the hydrants, the fire protection will be done by fire extinguisher for the initial fire extinguishing.<br>The area has no fire protection and hydrant network. | Whole TS platform will be drained by closed water drainage system.<br>Collected water will be treated through separator before discharged to the environment through a well.<br>$V_{well}$=52.54 $m^3$ |

*Note: The Variants are presented and analyzed in the report of alternative solutions for the power transfer stations under the WMC Lećevica, Split, June 2015

More detailed calculations for infrastructure needs will be provided in the technical design study.

## 9.5 PROJECTS CONCEPTUAL SOLUTION

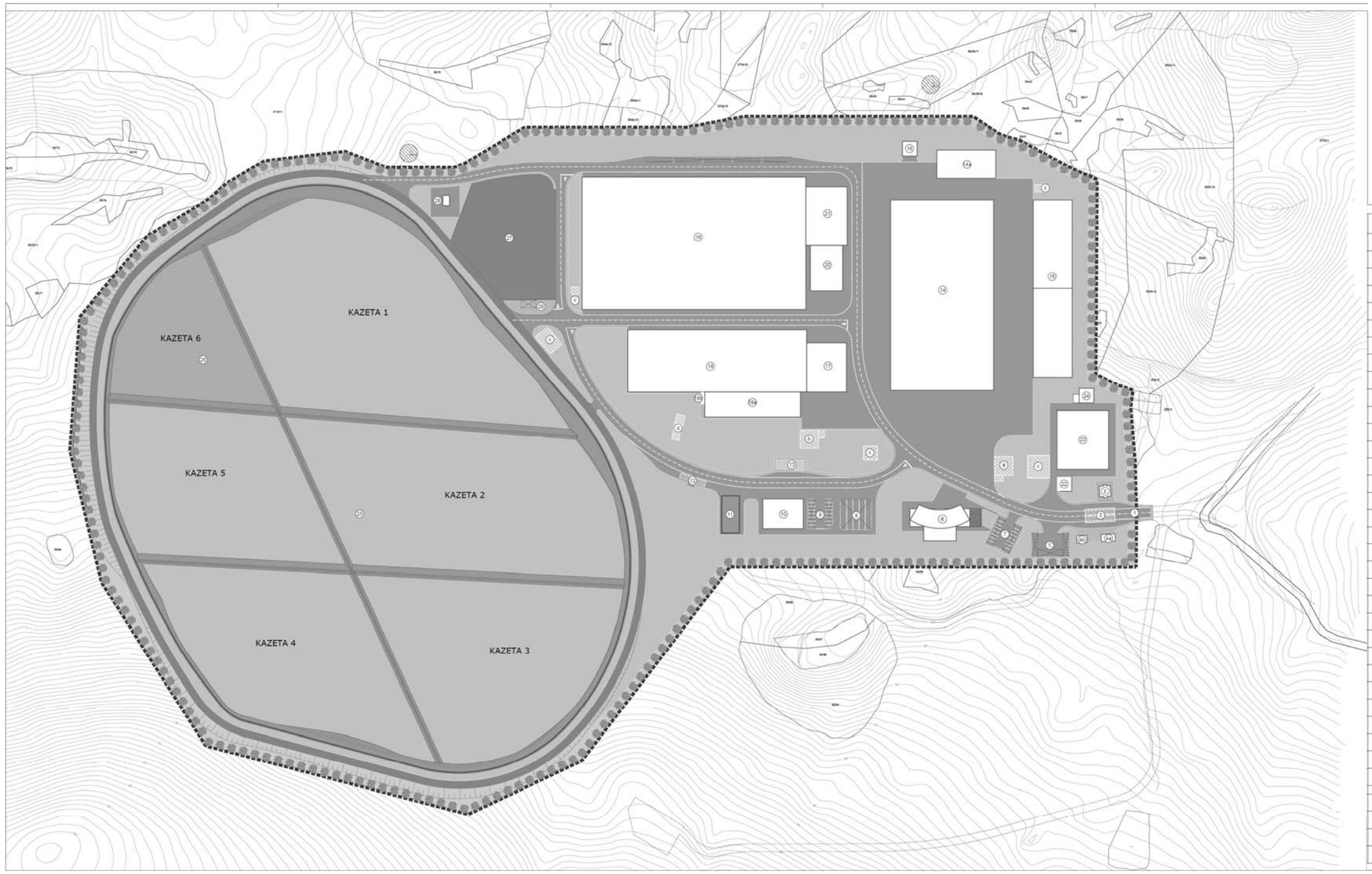
For the sound operation of the County Waste Management Centre in Lecevica, the following main facilities are envisaged:

i) Entrance and control,
ii) Mechanical and Biological Treatment Plant (MBT) with recyclable storage building and biofilter
iii) Cells 1-5 of landfill
iv) Cell 6 of landfill
v) Bulky waste area – Recycling Yard
vi) Buildings area (for the personnel, maintenance and other daily activities),
vii) Internal roads
viii) Waste Water Treatment Plant (WWTP) and
ix) C&D waste area
x) Closed tank for waste water
xi) Closed tank for effluent
xii) Fuel tank, flare, photovoltaics

The entrance of the Facility is located in the south - east side, where the reception, the weighbridge and the transformer station are placed. In the center of the site the landfill cells will be constructed. Incoming trucks are directed to the MBT reception area whereas residues from the MBT process are transferred to the landfill cells. Access to the other works is facilitated via the internal road, i.e. to cell 6 of landfill, WWTP, C&D waste area.

The general layout of the WMC is presented below.

Analytical description of the MBT facilities and landfill sites is given in Annex 9.1 of Chapter 9.




| LEGEND | |
|---|---|
| 1 | ENTRANCE |
| 2 | RECEPTION |
| 3 | WEIGHBRIDGE |
| 4a 4b | TRANSFORMER STATION |
| 5 | RECYCLING YARD |
| 6 | ADMINISTRATIVE BUILDING |
| 7 | PARKING OF ADMINISTRATIVE BUILDING |
| 8 | PARKING FOR TRUCKS |
| 9 | PARKING OF SERVICE BUILDING |
| 10 | SERVICE BUILDING WITH ADDITIONAL ROOMS FOR WORKERS |
| 11 | VEHICLES WASHING FACILITIES |
| 12 | DEVICE FOR WASHING VEHICLES |
| 13 | FUEL STATION |
| 14 | MECHANICAL TREATMENT OF WASTE (SORTING PLANT) |
| 14a | BAG FILTERS FOR DEDUSTING |
| 15 | STORAGE AREA FOR RECYCLABLES AND RDF |
| 16 | PLATEAU FOR DIESEL ENGINES |
| 17 | RECEPTION AREA FOR PRESORTED BIOWASTE |
| 18 | INSTALLATION FOR PHASE 1 OF BIOLOGICAL PROCESS |
| 18a | BIOFILTER |
| 18b | OIL SEPARATOR |
| 19 | COVERED AREA FOR PHASE II OF BIOLOGICAL PROCESS |
| 20 | COMPOST TREATMENT FACILITIES |
| 21 | STORAGE OF THE COMPOST |
| 22 | TANK FOR WASTEWATER |
| 23 | WWTP |
| 24 | EFFLUENT TANK WITH PUMPING STATION |
| 25 | NON HAZARDOUS LANDFILL |
| 26 | INERT LANDFILL |
| 27 | RECYCLING OF C&D WASTE |
| 28 | PLATEAU FOR FLARE UNIT |
| 29 | SERVICE AREA |
| a | TANK OF THE ROOF RAIN WATERS WITH DRAW ( pump ) STATION |
| b | HYDRAULIC WATER SUPPLY WITH DRAW ( pump ) STATION |
| c | INFILTRATION JAMS |
| d | EXISTING FACILITY |

**Figure 9-14: General layout of WMC**

The area allocated for the construction of the various parts is as follows:

**Table 9-8: Area allocated for the WMC facilities (without landfill)**

| WMC FACILITIES | AREA ($m^2$) |
|---|---|
| Power transmission building | 72 |
| Reception building | 62 |
| Administrative building | 790 |
| Parking of administration building | 340 |
| Mechanical Treatment Plant | 9,100 |
| Biofilter for mechanical treatment plant | 780 |
| Storage area for recyclables and RDF | 3,200 |
| Parking for trucks | 420 |
| Parking of service building | 340 |
| Service building with additional rooms for workers | 550 |
| Plateau for washing vehicles | 300 |
| Reception area for presorted biodegradable waste | 904.5 |
| Composting | 5,164 |
| Biofilter of composting area | 1,100 |
| Maturation | 13,725 |
| Refining area | 682 |
| Storage area for clean compost | 1,120 |
| Parking for trucks | 440 |
| Recycling area of C&D waste | 5,186 |
| Plateau of flare unit | 414 |
| Tank for wastewater | 100 |
| Closed Tank for effluent | 100 |
| WWTP | 1,400 |
| **Total area for facilities (without landfill)** | **46,294.5** |

**Table 9-9: Ashpalt surfaces**

| WMC asphalt surfaces | AREA ($m^2$) |
|---|---|
| Plateau of mechanical treatment | 12,815 |
| Plateau for composting | 2,382 |
| Plateau for maturation | 2,153 |
| Plateau for WWTP | 850 |
| Plateau for administrative building | 704 |
| Parking for administrative building | 340 |
| Recycling yard | 412.5 |
| Plateau for flare unit | 414 |
| Roads | 12,663 |
| **Total area** | **34,465.5** |

**Table 9-10: Area of landfill cells**

| Landfill cells | AREA ($m^2$) |
|---|---|
| Landfill cell 1 | 22,528 |
| Landfill cell 2 | 18,982 |
| Landfill cell 3 | 15,495 |
| Landfill cell 4 | 15,073 |
| Landfill cell 5 | 13,039 |
| Landfill cell 6 (Inert waste) | 7,145 |
| **Total landfill area** | **92,262** |

The following tables presents the overall mass balance of the MBT plant and landfill site.

**Table 9-11: Mass Balance of MBT Plant**

| Total Mass Balance for Scenario 1 | Quantities | Percentage |
|---|---|---|
| **Input waste to Mechanical Separation** | **109,973** | **100.0%** |
| Mechacical Separation | 109,973 | 100.0% |
| *Recyclables* | 9,222 | 8.4% |
| *Residues* | 22,543 | 20.5% |
| *RDF* | 31,539 | 28.7% |
| *Special Municipal Waste* | 891 | 0.8% |
| *To Biological Treatment* | 45,778 | 41.6% |
| **Input waste to Aerobic Composting** | **45,778** | **41.6%** |
| Aerobic Composting | 45,778 | |
| *$H_2O$ &$CO_2$ losses* | 18,452 | 40.3% |
| *CLO* | 20,600 | 45.0% |
| *Residues* | 6,725 | 14.7% |
| **Total Residues for landfill** | **49,868** | |

*Note: The quantities that mentioned in the above table correspond to average quantities for period 2023-2047*

**Table 9-12: Expected quantities and recovery rates in Mechanical Treatment**

| Fraction | To treatment with Sc1 | % Recovery | % Final Recovery |
|---|---|---|---|
| **Paper/Cardboard** | 13.92% | 19.7% | 2.75% |
| **Plastic** | 10.53% | 33.8% | 3.56% |
| **Glass** | 3.29% | 20.0% | 0.66% |
| **Metal** | 1.82% | 78.0% | 1.42% |
| **Total** | **29.56%** | | **8.39%** |

**Table 9-13: Total quantities that will be landfilled**

| Total quantities that will be landfilled (Scenario 1) | Quantities (t) | Percentage in total produced MW | Percentage in total produced Construction waste | Percentage in total produced Non hazardous industrial waste |
|---|---|---|---|---|
| **Residues from waste EWC 20 and 15 01** | **54,853** | **24.0%** | | |
| Residues from Mechanical and Biological Treatment of residual waste bin and residues derived from MRF process | 29,268 | 12.8% | | |
| Residues from Treatment of separately collected bio-waste | 2,120 | 0.9% | | |
| Residues from Treatment of hazardous fraction of Municipal Waste | 179 | 0.07% | | |
| Residues from Treatment of Bulky waste | 2,686 | 1.2% | | |
| CLO | 20,600 | 9.0% | | |
| **Residues from Construction waste** | **5,784** | | **7.5%** | |
| **Residues from Industrial Non hazardous waste** | **3,291** | | | **2.0%** |
| **Landfill Cells 1-5 (Scenario 1)** | **58,144** | | | |
| **Landfill Cell 6** | **5,784** | | | |

*Note: The quantities that mentioned in the above table correspond to average quantities*

### 9.5.1 Mechanical treatment

WMC in Lecevica is designed to accept an average of **109,973 t/y** of mixed municipal waste. The dimensioning of the Mechanical Sorting Unit and the overall balance is based on the quantity of mixed waste, whereas calculations are made for the output of recyclable materials, rejects and biodegradable waste entering the Biological Treatment. The selected process is indicative and it is used for the purposes of the feasibility study. The following diagram presents the stages of mechanical treatment process with quantities in t/y (Average 2023-2047).

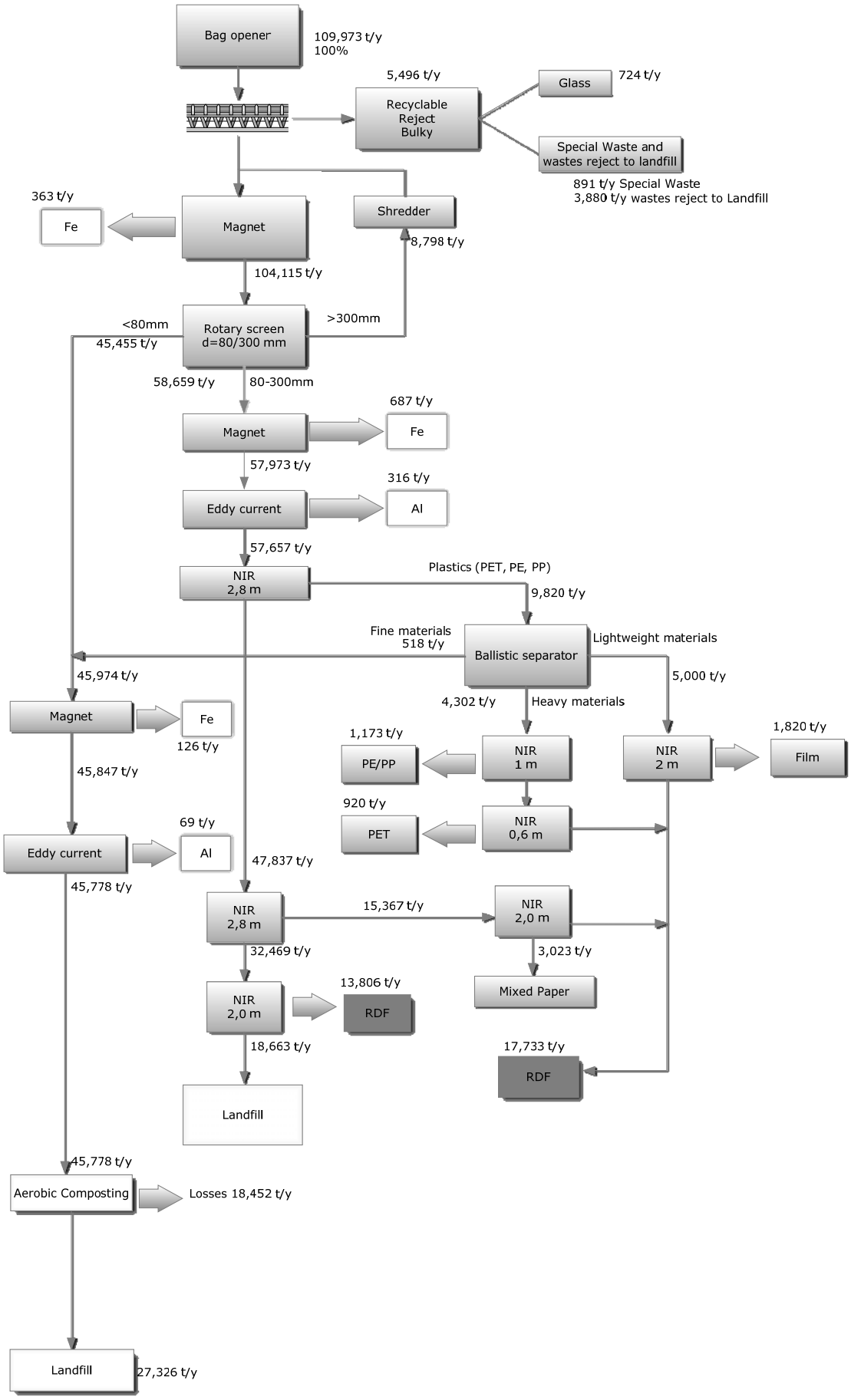



**Figure 9-15: Flow-Diagram of mechanical treatment plant**

Waste collection vehicles will enter from the entrance of the WMC and weighed on weighbridge. Weighting will be carried out in both incoming and outcoming vehicles.

As shown in the above figure, the operational system of MBT is as follows:
When the weighted and recording is completed, waste are transported to the waste reception facility, where it is emptied into the reception bunker that has buffering capacity for five (5) days ' input waste.

The reception area is equipped with one bridge – crane for each processing line (two in total) for the loading of the input waste into the next stage of the treatment process and, also, for the removal of large items. The removal of hazardous / difficult materials ensures minimum interruptions of the plant operation.

Each processing line is equipted with one bag opener. The bag opener units are to be capable of opening and emptying a very high percentage of waste containing plastic bags, and are to be suited to accept a wide range of materials, e.g. packaging materials, biowaste, residuals etc.

Throughout the whole mechanical separation process, the materials are transported from process to process by the use of conveyor systems.

The removal of unwanted and / or bulky materials not removed by the cranes take place within the first 'hand-picking' cabin which is located directly after the bag openers. This initial operation is required so as to avoid overcharging the conveyors, the drum etc with these bulky materials which could result in a blockage of the production line and therefore lead to down time. This hand-sort position also provides the opportunity for the reclamation of glass, these materials often being 'lost' to landfill further down the separation process due to breakage.

The next stage is magnetic ferrous metal extraction by magnet. This is the first extraction face of the process to extract bigger ferrous that harmful for the further process.

The next stage of treatment is the screening. From experience it is also known that in mixed waste, the dry fraction is liable to heavy contamination due to the way waste (mixed) are collected, the manner and time of their transport to the treatment plant. It is therefore a priority to remove this 'organic fraction' from the main waste stream as early on in the processing as possible. This is achieved by the drum screen, which enables the separation of the materials into three fractions by use of two different sized sieving holes, as follow:

- the mainly organic 'small fraction' (< 80mm)
- the 80mm to 300mm material fraction
- the remainder >300mm of the materials which are passed though the end of the sieve drum, where upon they are fed via a conveyor system to the 'pre-shredder'. The use of this 'pre-shredder' is to break down materials over 300mm in dimension which are not able to be easily processed by the optical separators. After being broken down by this shredder these materials are then 'looped back' into the separation process before the drum screen separator by a conveyor system.

The fraction from the drum screen (80-300mm fraction) prior it's transfer to the non ferrous separator is subjected to magnetic separation to reclaim ferrous metals and to avoid damage to

the eddy current separator. Once ferrous materials have been separated from the 80 - 300 mm stream, they are passed on to the 'eddy current' aluminium separator.
The next stage is the Near Infrared Red (NIR) sorting device which recover the plastic materials present in the 80-300mm waste fraction. This sorter precedes the ballistic separator directing mainly plastics there. Removing just the plastic materials, apart from increasing the efficiency of the ballistic separator.

Then the plastics materials is transferred to the ballistic separator, which is used in order to further separate this plastic fraction by weight. The bulky '3D' materials (PET, mixed bottles, other plastics such as PE / PP) though the vibrations of the separator 'roll' toward the lower edge of the inclined sorting surface, while the light '2D' materials (such as plastic films) are moved along and collected at the upper end of the device.

These two fractions of waste are collected by conveyors which lead to sets of optical separators. With the passing though of each NIR separator the different waste streams are further separated into cleaner (higher quality) products (mixed paper, RDF, PP/PE, PET etc.).

The separated recyclables will be compressed and baled into individual parcels through compression provisions. In these devices the following materials will be driven:

- Paper, cardboard and paper categories, i.e. printed paper, packaging etc.
- Metals
- Plastic materials such as PET, plastic sheet and different plastics

The fraction < 80mm from screen is transferred to the biological treatment. Prior to this, they are subjected to magnetic and eddy current separation to reclaim any remaining scrap ferrous and non ferrous metals and to avoid heavy metal contamination during the process of composting. The ferrous metals are removed firstly, this also therefore protecting the eddy current separator from possible damage caused by FE metals. Once ferrous materials have been separated from the <80mm organic stream, they are passed on to the 'eddy current' aluminium separator. Then, the organic fraction is led to biological reception area.

Analytical technical description of Mechanical treatment is given also in Annex 9.1 of the present chapter.

#### 9.5.1.1 Reception Area

As mentioned above, the average daily amount of waste is:

$$Q_{dmean} = 109{,}973 \text{ t/y} / 250 \text{ d/y} = 439.89 \text{ t/d}$$

Considering a safety factor for the daily variation of 10%, the daily input for the Reception Unit is:

$$Q_{des} = 439.89 \text{ t/d} \times 1{,}10 = 483.88 \text{ t/d}$$

To ensure the availability of sufficient temporarily storage space - waiting area for incoming waste collection vehicles, the volume of waste to be treated is calculated at an estimated density of 300 kg/m$^3$. Therefore the minimum volume required for the storage of waste daily is:

$$V_d = 483.88 \text{ t} : 0{,}3 \text{ t} / \text{m}^3 = 1{,}613 \text{ m}^3$$

To ensure sufficient volume for storing the incoming waste prior to treatment over a period of 3 days, the reception unit should have a volume of at least equal to:

$V_d(3days) = 1,613\ m^3 \times 3\ days = 4,839\ m^3$

### 9.5.1.2 Mechanical sorting

The capacity for the waste treatment facility is determined by mass balance and particularly taking into consideration, the amounts resulting from the evolution of the waste for the year 2023-2047, amounts which represent the final capacity of the plant. The following assumptions are made for dimensioning of mechanical sorting unit:

- ⇒ Operation: Five days (5 days) per week
- ⇒ Total operating days per year: 250 days / year
- ⇒ Two (2) operation shifts (with 75% availability): 12 hours / day

Based on the above data – assumptions, the following table presents the dimensioning of the Mechanical Sorting Unit that will ensure the proper functioning of the Unit.

**Table 9-14: Dimensioning of Mechanical Sorting Unit**

| Description | |
|---|---|
| Incoming waste | 109, 973 t/y |
| Days of Operation | 250 days / year |
| Daily Capacity | 439.89 t/d |
| Working hours (75% availability) | 12 hours |
| Hourly capacity | 36.66 t/h |
| Number of lines | **2** |
| Capacity of lines | **18.33/h**<br>**2 lines @ 20t/h each line** |

The mechanical treatment unit will be able to manage the seasonal fluctuations through increasing of working hours of operation.

As it is mentioned in the above table, two lines of 20 t/h gives an annual capacity of 2*20*250*12 t = 120,000 t. This is the minimum quantity that the mechanical treatment unit will be treat. If the working hours of mechanical treatment unit will be increased, for example in 16 hours/day, this means that the unit is capable to treat 2*20*250*16 t = 160,000 t. By this way the mechanical sorting unit will be able to manage the seasonal fluctuations.

### 9.5.1.3 Storage for recyclable materials

The storage building is calculated to accept the total of all recovered materials for a period of 15 production days.

**Table 9-15: Storage Area for Recyclables Products**

| Material | Baler (set output dimensions) | Area per bale ($m^2$) | Specific Weight ($kg/m^3$) | Weight per Bale (tn) | Recovered Materials (t/d) | $N_o$. of bales per day | Floor area for storage of bales for 15 Days Storage ($m^2$) |
|---|---|---|---|---|---|---|---|
| Paper | 1.10mx0.75mx1.10m | 1.21 | 460 | 0.42 | 12.09 | 29 | 132 |
| Plastic | 1.10mx0.75mx1.10m | 1.21 | 350 | 0.32 | 15.65 | 49 | 222 |
| Ferous | 1.10mx0.75mx1.10m | 1.21 | 600 | 0.54 | 4.70 | 9 | 41 |
| Alluminium | 1.10mx0.75mx1.10m | 1.21 | 350 | 0.32 | 1.54 | 5 | 23 |
| RDF | 1.10mx0.75mx1.10m | 1.21 | 400 | 0.36 | 126.16 | 348 | 1,579 |
| | | | | | | **Total** | **1,997** |
| | | | | | | **Total with Safety factor 1,2** | **2,396** |

The glass will be stored in containers with nominal capacity of 30 $m^3$.

**Table 9-16: Storage Area for Glass**

| Description | Quantities |
|---|---|
| Glass quantities | 2.90 t/d |
| Estimated density | 0.27 $t/m^3$ |
| Volumetric Flow | 10.73 $m^3/d$ |
| Nominal Capacity of containers | $30m^3$ |
| Filling Factor | 85% |
| Effective capacity | $25.5m^3$ |
| Containers for 15 days' storage | 7 |
| Area for each container (lxwxh) | 6,2mx2,55mx7m |
| Total area for storage of containers | 111 $m^2$ |
| **TOTAL AREA (safety factor 20%)** | **133 $m^2$** |

The calculations reveal that a storage building **3.200 $m^2$** caters for this 15 days production capacity which also includes extra area enabling ease and safety of movements.

#### 9.5.1.4 Characteristics and classification of produced RDF

The following table presents an estimation of the expected output characteristics of total produced RDF in the plant, based on the process scheme described in the above paragraphs.

**Table 9-17: RDF characteristics**

| Fractions | Wet tonnage (t/a) | Dry tonnage (t/a) | Cl content dry (%) (*) | Moisture content (%) (*) | Dry ash content (%) (*) | Calorific value of wet fractions kj/kg | Calorific value of dry fractions kj/kg |
|---|---|---|---|---|---|---|---|
| TOTAL | 31,539 | 25,307 | 0.56 | 19.13 | 8.95 | 16,189 | 20,602 |

According to these characteristic the produced RDF can be classified as follows:

- In terms of Net Calorific Value, (NCV) in class: 3
- In terms of Clorine content (Cl), in class: 2

It must be noted that the output characteristics of the produced RDF from the Mechanical Sorting Unit, depends directly from the composition, the moisture and other physicochemical characteristics (i.e. Cl content, ash content etc) of the incoming waste, and the applied sorting technology and of course it has to be in line with the requirements and needs of the end user.
Therefore at the current stage of design, the characteristics which are proposed to be set as minimum acceptable requirements for RDF and to be adopted in the next stages of design, are presented in the following table.

**Table 9-18: Proposed RDF minimum requirements**

| CHARACTERISTIC | STATISTICAL MEASURE | UNIT | VALUE | CONTROL STANDARDS |
|---|---|---|---|---|
| Clean calorific value (NCV - Net Calorific Value) | Mean | MJ/kg (ar) | ≥17 | EN 15400:2011 |
| Content of chlorine (Cl) | Mean | % (d) | ≤0.5 | EN 15408:2011 |
| Moisture | - | % w.w | ≤20,0 | CEN/TS 15414:2011 |
| Content of ash | - | %(d) | ≤10,0 | EN 15403:2011 |
| Content of mercury (Hg) | (Median) | mg/MJ (ar) | ≤0,08 | EN 15411:2011 |
| | (80th percentile) | mg/MJ (ar) | ≤0,16 | |

* (d): dry basis
(ar): as received

With these characteristic the produced RDF is proposed to be classified as follows:

- In terms of Net Calorific Value, (NCV) in class: 3
- In terms of Clorine content (Cl), in class: 2
- In terms of Mercury (Hg), in class:3

### 9.5.2 Biological treatment of organic waste derived from MMW

The biological treatment shall be designed to treat the organic fraction 0-80mm, which comes out from the trommel 80-300mm, placed in the Mechanical Seperation building.

The biological process goes through two distinct phases. The 1st phase (active composting) takes places in composting boxes with usefull capacity of 450m$^3$. The composting box's filling is achievied by wheel loader. After a period of 25 days the material is directed via wheel loader to maturation cells. The maturation phases takes place in open, naturally aerated cells. After a period of the 50 days the fresh compost is directed via wheel loader for refining. A drum screen separates

oversized material from fresh compost. The compost product and the residues from refinery are finally led to the landfill, for disposal. The design assumption used in the proposed composting plant are described in the following table.

Analytical technical description of Biological treatment is given in Annex 9.1 of the present chapter.

**Table 9-19: Input design parameters**

| Description | Values |
|---|---|
| Input organic fraction to biological treatment | 45,778 t/year |
| Input organic fraction with safety factor 25% | 57,222 t/year |
| Operation | 250 days/year |
| Material Densities | 0.55 t/m$^3$ |
| Composting Stages | • Material receipt in sheded area<br>• Composting in composting boxes (1$^{st}$ phase)<br>• Maturation (2$^{nd}$ phase) in open, naturally aerated cells |
| Minimum Composting time (1$^{st}$ phase) | 25 days |
| Minimum maturation time (2$^{nd}$ phase) | 50 days |
| Reduction in weight during composting phase | 15% |

According the above data-assumptions the minimum features for each unit of biological treatment are calculated as follows.

**a. <u>Composting phase (1$^{st}$ phase)</u>**

For the purposes of this feasibility study, the composting phase (1$^{st}$ phase) takes place in composting boxes with useful volume of 450m$^3$. The calculation for the number of composting boxes proceeds as follows:

**Table 9-20: Dimensioning of the number of compost boxes**

| Dimensioning of the number of compost boxes | |
|---|---|
| Material to aerobic composting | 45,778 t/y |
| Material to aerobic composting (with safety factor 25%) | 57,222 t/y |
| Specific density | 0.55 t/m$^3$ |
| Volume of material for composting | 104,040 m$^3$/y |
| Retention time | 25 days |
| Annual Working Cycles | 15 cycles |
| Composting Boxes Dimensions | length 30m / width 5m<br>useful height 3 m<br>Useful volume 450 m$^3$ |
| Material per cycle (m$^3$) | 6,936 m$^3$/cycle |
| Proposed number of composting boxes | **16** |

In front of the composting area sufficient space provided for the wheeled loader movements.

**b. Maturation Phase (2nd phase)**

For the purposes of this feasibility study, the maturation phase takes place in open, naturally aerated cells. The number of necessary maturation cells is callulated as follow:

**Table 9-21: Dimensioning of the number of cells in Maturation Unit**

| Dimensioning of the number of cells in Maturation Unit | |
|---|---|
| Material to maturation | 48,639 t/y |
| Specific density | 0.55 t/m$^3$ |
| Volume of material to maturation with safe factor of 15% | 88,434 m$^3$/y |
| Retention time | 50 days |
| Annual Working Cycles | 8 cycles |
| Cells Dimensions | length 80m<br>width 6m<br>height 2,5 m<br>Useful volume 600 m$^3$ |
| Material per cycle (m$^3$) | 11,054 m$^3$/cycle |
| Proposed number of cells | **19** |

Moreover the maturation area should provide sufficient space, in front of cells, for wheel loader movements.

### 9.5.3 Biological treatment of pre-sorted biowaste

The composting plant shall be designed to treat **9,700 tonnes** of pre-sorted biowaste per year. The composting process of pre-sorted biowaste takes place in the same area in which biological treatment of organic waste derived from MMW takes place.The selected composting method will be the same as the composting method of organic waste derived from MMW i.e. will consist of two phases: (1) active composting which takes place in composting boxes and (2) maturation phase which takes place in open, naturally aerated cells.

The minimum features for each unit of biological treatment are calculated as follows.

**a. Reception Area**

The reception area should provide sufficient space for at least 3 days of incoming unshredded waste. For the purposes of this feasibility study the material will be formed having trapezoidal pile shape with 1:4 slopes as the following figure.

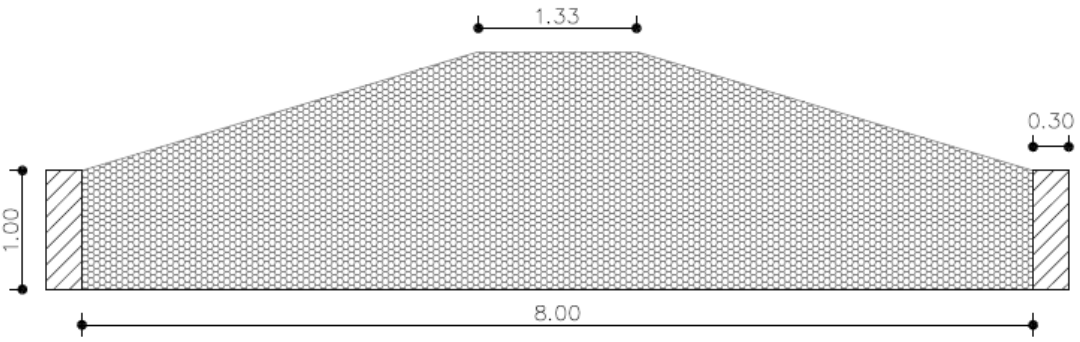



**Figure 9-16: Material pile storage**

The calculation for the reception area proceeds as follow:

**Table 9-22: Dimensioning of Reception Area**

| Dimensioning of Reception Area | |
|---|---|
| Input material | 9.700 t/y |
| Days of operation (days/year) | 250 days/ year |
| Daily capacity | 38,80 t/d |
| Storage time of incoming material | 3 days |
| Specific density of unshreeded material | 0,35 t/m$^3$ |
| Volume of input material for 3 days | 332,57 m$^3$ |
| *Area for storage (3 days) = (8+0,3)*(10+0,3)*3* | 256,47m$^2$ |
| *Total Area with Safety factor (10%)* | *282,12 m$^2$* |
| *Manipulation area for wheel loader movements* | *150,00 m$^2$* |
| *Area for shredder* | *250,00 m$^2$* |
| *Area for placing material after shreeing* | *210,00 m$^2$* |
| **Total reception area** | **892,12 m$^2$ ≅ 905 m$^2$** |

**b. Composting Phase (1st phase)**

For the purposes of this feasibility study, the composting phase (1st phase) takes place in cells/heaps covered with membrane. The calculation for the number of cells /heaps proceeds as follows:

**Table 9-23: Dimensioning of composting area**

| Dimensioning of active composting area | |
|---|---|
| Material to composting | 9,700 t/y |
| Specific density after shreeding | 0.55 t/m$^3$ |
| Volume of material to composting | 17,636 m$^3$/y |
| Retention time = 25 days | 25 days |
| Annual Working Cycles | 15 |
| Cells Dimensions | length 30m<br>width 5m<br>height 3m<br>Useful volume 450 m$^3$ |
| Material per cycle (m$^3$) | 1,176 |
| **Number of Reactors** | **3** |

The composting area should provide sufficient space, in front of cells, for wheel loader movements.

### c. Maturation Area (2nd phase)

For the purposes of this feasibility study, the maturation phase takes place in open, naturally aerated cells. The number of necessary maturation cells is callulated as follow:

**Table 9-24: Dimensioning of the number of cells in Maturation Unit**

| Dimensioning of the number of cells in Maturation Unit | |
|---|---|
| Material to maturation | 8,245 t/y |
| Specific density after composting | 0.55 t/m$^3$ |
| Volume of material to maturation | 14,991 m$^3$/y |
| Retention time = 8 weeks | 50 days |
| Annual Working Cycles | 8 |
| Cells Dimensions | length 80m<br>width 6m<br>height 2,5 m<br>Useful volume 600 m$^3$ |
| Material per cycle | 1,874 m$^3$ |
| **Number of cells** | **3** |

Moreover the maturation area should provide sufficient space, in front of cells, for wheel loader movements.

### d. Storage Area

In regard to the storage area, it should provide sufficient space for at least 2 weeks (14 days). Therefore the storage capacity shall be as follow:

**Table 9-25: Dimensioning of the storage area**

| Dimensioning of the storage area | |
|---|---|
| Material to storage | 4,563 t/y |
| Days of operation | 250 days/year |
| Daily capacity | 18.25 t/d |
| Storage time | 25 days |
| Specific density of compost | 0,55 t/m$^3$ |
| Volume of material in storage (for 35 days) | 829.5 m$^3$/d |
| Total area (includes manipulation area 150 m$^2$) | 979.5 m$^2$ |
| Total Area with Safety factor (10%) | 1,077.5 m$^2$ ≅ 1,100 m$^2$ |

### 9.5.4 Landfill

The total landfill area is divided into 6 cells from which 5 cells (1-5) are aimed for residues and the sixth for inerts. Landfill cells will be separated from each other by embarkments. 5 cells for non hazardous waste will be filled in through five phases of 5 years each, whereas the cell for inert waste wll be filled in through two phases of 12.5 years each. At the end of the planned period, in the year 2047, the total landfill area will occupy approx. 10 ha.

#### 9.5.4.1 Landfill Cells 1-5

##### 9.5.4.1.1 Capacity

In order to plan the cells 1-5 of landfill (residues) the following assumptions have been taken into consideration:

- Density of residues: 0.85 tn/m$^3$
- Cover Material Factor: 10%

The following table presents the required landfill capacity.

**Table 9-26: Landfill Cells 1-5**

| Year | Quantities | Compaction of residues (t/m$^3$) | Cover material factor (%) | Anual capacity (m$^3$) | Total Capacity cumulative year(m$^3$) |
|---|---|---|---|---|---|
| 2023 | 62,607 | 0,85 | 10,00% | 81,020 | 81,020 |
| 2024 | 62,354 | | | 80,694 | 161,714 |
| 2025 | 62,103 | | | 80,368 | 242,082 |
| 2026 | 61,852 | | | 80,044 | 322,126 |
| 2027 | 61,603 | | | 79,722 | 401,848 |
| 2028 | 61,355 | | | 79,401 | 481,249 |
| 2029 | 61,109 | | | 79,082 | 560,331 |
| 2030 | 60,863 | | | 78,764 | 639,095 |
| 2031 | 60,945 | | | 78,870 | 717,964 |
| 2032 | 60,993 | | | 78,933 | 796,897 |
| 2033 | 61,043 | | | 78,996 | 875,893 |
| 2034 | 61,092 | | | 79,060 | 954,954 |
| 2035 | 61,142 | | | 79,125 | 1,034,078 |

| Year | Quantities | Compaction of residues (t/m³) | Cover material factor | Anual capacity | Total Capacity cumulative year(m³) |
|---|---|---|---|---|---|
| 2036 | 61,192 | | | 79,190 | 1,113,268 |
| 2037 | 61,242 | | | 79,255 | 1,192,522 |
| 2038 | 61,293 | | | 79,320 | 1,271,843 |
| 2039 | 61,344 | | | 79,386 | 1,351,229 |
| 2040 | 61,395 | | | 79,453 | 1,430,682 |
| 2041 | 61,447 | | | 79,520 | 1,510,202 |
| 2042 | 61,462 | | | 79,539 | 1,589,741 |
| 2043 | 61,478 | | | 79,559 | 1,669,300 |
| 2044 | 61,494 | | | 79,580 | 1,748,881 |
| 2045 | 61,511 | | | 79,602 | 1,828,483 |
| 2046 | 61,528 | | | 79,624 | 1,908,107 |
| 2047 | 61,546 | | | 79,647 | 1,987,754 |

According to conceptual design solution, the minimum area required for landfilling of 1,987,754 m³ of residues is approximately 85,117 m² while to meet the needs of the first phase of the project, namely the first 5-years approx. amounts to 22,528 m² (exploitable capacity 402,522 m³ ). The life-time, area m² and the capacity in m³ are presented in the table below.

**Table 9-27: Capacity of landfill cells 1-5**

| Landfill cell | Period (y) | Area (m²) | Volume (m³) |
|---|---|---|---|
| Cell 1 | 5 (2023-2027) | 22,528 | 402,522 |
| Cell 2* | 5 (2028-2032) | 18,982 | 449,501 |
| Cell 3* | 5 (2033-2037) | 15,495 | 441,656 |
| Cell 4* | 5 (2038-2042) | 15,073 | 424,336 |
| Cell 5* | 5 (2043-2047) | 13,039 | 312,365 |
| **TOTAL** | **25** | **85,117** | **2,030,380** |

* Cells will be financed in next programming periods

If increasing quantities of residual waste disposed in the landfill, then the life span of the 1st cell would be less that 5 years. In this respect a contingency plan has been developed:

1. The launching of tendering of the next landfill cell can be start earlier. Since all infrastructure will be in place and the design of the whole area has been done the tendering and construction of 2nd landfill cell can be done in a short period (i.e. 9 months).
2. The landfill waste body shall be monitored on a monthly base to provide information for assessing and reporting tha status of the landfill i.e. the total deposited residuals waste and the remaining capacity.

Analytical technical description of Landfill for residues is given in Annex 9.1 of the present chapter.

#### 9.5.4.1.2 Lining

According to the requirements of legislation and EIA Study, the base proofing of the landfill bottom will be carried out as follows (see relative Drawing in Annex 9.6):

- Nature base leveling layer 20-30 cm thick
- Clay layer 50 cm and permeability k ≤ 1.0 x $10^{-9}$ m/s
- GCL (geosynthetic clay liner) with permeability k = 1.0 x $10^{-9}$ m/s
- 2,5 mm HDPE geomembrane
- Geotextile as protecting layer for geomembrane (at least 1,200 g/m2)
- Drainage Layer of gravel (16/32) thickness 0.50m with drainage pipes for leachate
- Separation Geotextile (at least 1,200 g/m2)
- Leak proof system

The lining in the slopes will consist of the same layers as in bottom lining. In case of steep slopes, typically less than 1:2,5, gravel can be substituted with geodrainage material of equivalent permeability.

#### 9.5.4.1.3 Closure-top cover system

The topcover of cells 1-5 will consist of the following layers:

- Support layer, with 0.3m thickness
- Drainage layer, gravel 16/32 mm, with 0.3 m thickness and permeability k≥1X10-3m/s. Alternatively, a drainage layer made of geosynthetic material, having equivalent permeability and drainage coefficient to that of gravel layer with thickness 0.3m and K>1x10-3m/s, could be constructed.
- Separation geotextile weight ≥ 300 g/m²
- clay liner system, with 0.5m thickness, permeability coefficient k = 1X10-9 m/s.
- Geosynthetic Clay Layer (GCL)
- Rainwater Drainage layer, 16/32 mm granulate with 0.5 m thickness and permeability k≥1X10-3m/s.
- Separation geotextile weight ≥ 300 g/m²
- Surface layer (re-cultivation layer), 1.0m, consisting
- Green planting

### 9.5.4.2 Landfill Cell 6 (inert waste)

#### 9.5.4.2.1 Capacity

For sizing of cell 6 of landfill (inerts) the following assumptions have been made:

- Density of residual inerts: 1.4 t/$m^3$

Therefore the required capacity of the Landfill is calculated as follow:

**Table 9-28: Landfill Cell 6 (Inerts)**

| Year | Quantities | Compaction of inerts (t/$m^3$) | Annual capacity ($m^3$) | Total Capacity cumulative ($m^3$) |
|---|---|---|---|---|
| 2023 | 5,399 | 1.4 | 3,856 | 3,856 |
| 2024 | 5,399 | | 3,856 | 7,713 |
| 2025 | 5,399 | | 3,856 | 11,569 |

| Year | Quantities | Compaction of inerts (t/m$^3$) | Annual capacity (m$^3$) | Total Capacity cumulative (m$^3$) |
|---|---|---|---|---|
| 2026 | 5,399 | | 3,856 | 15,426 |
| 2027 | 5,399 | | 3,856 | 19,282 |
| 2028 | 5,399 | | 3,856 | 23,139 |
| 2029 | 5,399 | | 3,856 | 26,995 |
| 2030 | 5,399 | | 3,856 | 30,851 |
| 2031 | 5,399 | | 3,856 | 34,708 |
| 2032 | 5,399 | | 3,856 | 38,564 |
| 2033 | 5,399 | | 3,856 | 42,421 |
| 2034 | 5,399 | | 3,856 | 46,277 |
| 2035 | 5,399 | | 3,856 | 50,134 |
| 2036 | 5,399 | | 3,856 | 53,990 |
| 2037 | 5,399 | | 3,856 | 57,846 |
| 2038 | 5,399 | | 3,856 | 61,703 |
| 2039 | 5,399 | | 3,856 | 65,559 |
| 2040 | 5,399 | | 3,856 | 69,416 |
| 2041 | 5,399 | | 3,856 | 73,272 |
| 2042 | 5,399 | | 3,856 | 77,129 |
| 2043 | 5,399 | | 3,856 | 80,985 |
| 2044 | 5,399 | | 3,856 | 84,841 |
| 2045 | 5,399 | | 3,856 | 88,698 |
| 2046 | 5,399 | | 3,856 | 92,554 |
| 2047 | 5,399 | | 3,856 | **96,411** |

According to conceptual design solution, the minimum area required for landfilling of 96,411m³ of inerts, in order to meet the needs of the total operation phase of the project, namely the 25-years approx. amounts to 7,145 m$^2$ (exploitable capacity 99,618 m³ ).

The life-time, the area m$^2$ and the capacity in m$^3$ are presented in the table below.

**Table 9-29: Capacity of cell 6**

| Landfill cell | | Period (y) | Area, m$^2$ | Volume, m$^3$ |
|---|---|---|---|---|
| Cell 6 of landfill (inert waste) | 6.1 | 12.5 | 3,715 | 99,618 |
| | 6.2 | 12.5 | 3,430 | |

#### 9.5.4.2.2 Lining

The bottom lining system for the cell 6 is the same as for cells 1-5 that described in previous paragraph as one landfill will include cells 1-6 .

#### 9.5.4.2.3 Closure-top cover system

The topcover of cell 6 of landfill will consist of the following layers (according dir. 1999/31/EC):

- Support layer, with 0.2m thickness
- Clay Liner System, with 0.8m thickness, permeability k ≤ 1X10-9 m/s.
- Geosynthetic Clay Layer (GCL)
- Rainwater Drainage layer, 16/32 mm granulate, with 0.5 m thickness and permeability k≥1X10-3m/s.
- Separation geotextile weight ≥ 300 g/m²
- Surface layer (re-cultivation layer), 1.0m, consisting
- Green planting

Analytical technical description of cell 6 of landfill is given in Annex 9.1 of the present chapter.

### 9.5.4.3 Collection system

Primary drainage pipes are made of HDPE or PVC at a nominal (outer) diameter ∅315 mm, are perforated by 2/3 of diameter and have a SN8 or equivalent 10 atm strength. They are placed along the axis of the bottom cell. The pipes are embedded in 0/8 mm sand and surrounded by the 50 cm deep gravel layer.

Secondary drainage pipes are made of HDPE or PVC at a nominal (outer) diameter ∅250 mm in "fishbone" structure (angle of 45°), placed in 20-40m distances. The pipes are also perforated by 2/3 of diameter and have the same strength. They can withstand a load of more than 40 m waste.
From the bottom's lowest point, leachates are directed with gravity outside the landfill via a full DN315 pipe, through the embankment to a collection well and finally towards the treatment plant. The leachate collection well is cylindrical.
Moreover the leak detection system will be constructed in the bottom of the landfill cell.

### 9.5.4.4 Waste Water Treatment Plant

The waste water treatment plant which will be constructed in Split-Dalmatia WMC, will be consisted from the following elements:

- Closed tank for waste water with minimum volume 150 $m^3$ and area 100 $m^2$
- Bioreactor
- Sludge tank
- Pumping station
- Effluent tank

R/O plant can be included also in future if it is needed. Annex 9.1 includes more detail information regarding WWTP.

### 9.5.4.5 Rain water protection works

Rain water protection works are constructed in the site, in order to avoid storm water entering the landfill and mixing with waste and leachates, structural stability of landfill and protect the buildings and the roads from water erosion. Rain water must be drained and diverted outside the landfill. The flood protection works of the site consist of the following:

- Ditches in the perimeter of the landfill cells
- Ditches for the protection of facilities and embankments
- Ditches for the protection of internal road network

- Drainage well of ditches and sewers.

The ditches may have trapezoidal or rectangular shape of suitable section. The ditches are lined with tiles. Rainwater that is collected in the ditch is transported outside the landfill borders via sewers of sufficient diameter.

For the protection of the final relief and the prevention of corrosion after landfill rehabilitation, rainwater draining from the final cover of the landfill will be needed. It can consist of HDPE pipes, directed to the berms of the waste relief.

Rainwater will be collected in an open lagoon covering an area of approximately 100 $m^2$.

#### 9.5.4.6 Gas collection and treatment

In order to calculate the biogas generation from the waste that will be landfilled, LandGEM model has been applied. The total generated landfill gas is presented in the following figure. Analytical calculations and information are presented in Annex 9.1 of the present chapter.

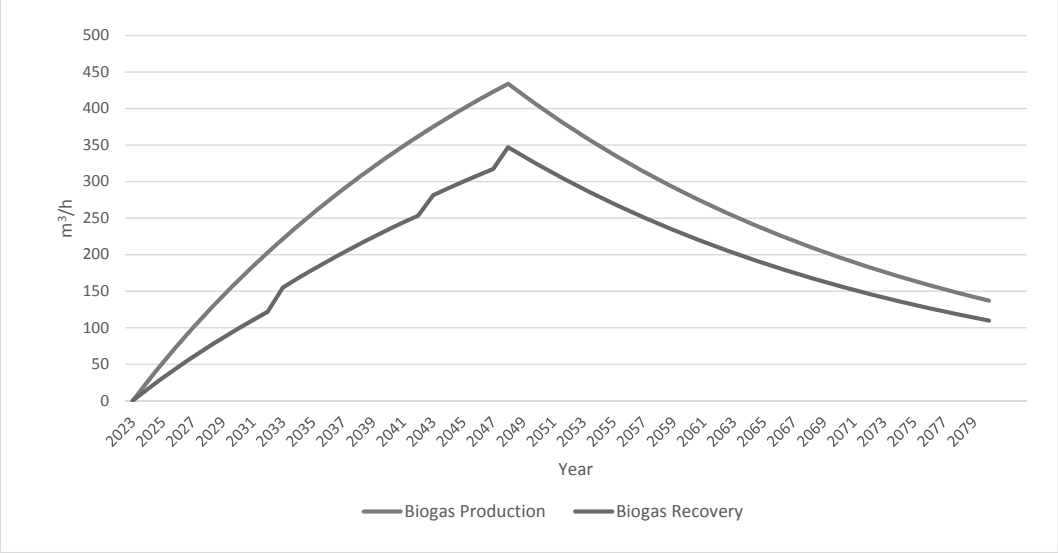



**Figure 9-17: Landfill gas generated/recovered ($m^3$/h)**

### 9.5.5 Infrastructure works

Infrastructure works will consist of the following individual works

- Earthworks (woodcutting, excavations, embankments, cleaning of fire safety zone)
- Buildings and utilities (weighbridge, tire washing system, fencing, entrance, security house, administrative building, maintance building, washing facility, sampling area, energy building, water tank, water supply network, rain water tank, sewage network, fire fighting system, external electrical power supply network, scada, internal infrastructure-networks, fuel tank, appropriate software)
- Construction and Demolition waste area (asphalting for C&D waste area and bulky waste area, crusher for C&D waste)
- Recycling yard (Recylling area, Asphalting, containers)
- Road works
- Others (Green areas, landscaping)

### 9.5.6 Transfer Stations

#### 9.5.6.1 Proposed option for TS

Based on the analytical study for TS provided in Chapter 8, it has been concluded that option 1, which includes the combination of a transfer ramp with a belt conveyor and a semi-trailer with a pressure plate for compacting waste compared to the other two proposed options (no.2. and no.3) is more advantageous and preferable in our case for the following reasons:

- It allows for the greatest rate of unloading waste: this means that the garbage truck unloads waste within 3-5 minutes (as if it unloaded it at a landfill) and does not take part in the unloading process (like in case of other two proposed options) so that it does not hinder it in unloading
- The fastest unloading of 20 t of waste, depending on the number of transfer funnels, one or two: in either case, a total of 50 minutes
- The fastest unloading of 20 t of waste in the WMC: 3 – 5 min
- Lowest construction costs and high flexibility (each container has each own press)
- Spare space for temporary storage of waste: unloading boxes, belt
- The number of unloading points: flexible, determined according to customer's specific needs
- Allows also visual inspection of the composition of the incoming waste and therefore protection of the equipment.

In addition to the transfer ramp, the transfer station standard equipment includes:

- an access road connecting to a public road,
- road infrastructure within the TS,
- a scale,
- checkpoints at the entrances where waste is registered, weighed and paid for,
- a handling area for the transfer equipment and TS vehicles,
- parking lots for TS vehicles,
- a buffer zone, a landscaped area and a fence around the TS area (as well as the foregoing).

#### 9.5.6.2 Waste transfer procedure

Before the transfer starts, the semitrailer with a pressure plate is placed under the loading ramp. After weighing, waste collecting utility vehicles approach the transfer ramp by driving in reverse, where they open their tailgates and unload their municipal waste onto the flat part of the belt conveyor. The belt conveyor transfers the unloaded waste all the way to the loading ramp/transfer funnel, which directs the waste into the upper aperture of the semitrailer. The belt conveyor periodically stops and the pressure plate continuously compacts the waste across the entire length of the semitrailer until it comes in contact with the previously compacted municipal waste. Once the semitrailer is full, the belt conveyor stops. The contaminated water drained from the waste is collected in a special tank (which is an integral part of the belt conveyor). This discharge is transferred from the tank into the semitrailer (waste transport vehicle) by a hydraulic pump through a pressure pipe, this returning to the waste it originated from (this is important for quantity accounting). The tractor is then connected to the semitrailer for further transport to the landfill and another semitrailer is placed under the loading ramp.

All these operations may be performed by a single operator using remote controls and a control board located on the inspection stairs on the side of the belt conveyor, where it is possible to monitor the semitrailer's loading ramp.

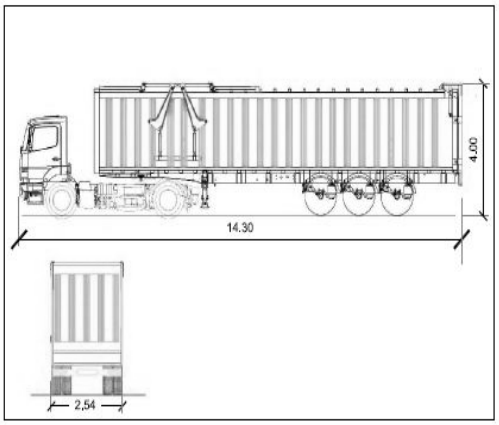
A combination of a conveyor belt, a semitrailer with a 20 t pressure plate and the defined number of transfer funnels results in the following capacity:

| Transfer capacity (rate) t/hrs | |
|---|---|
| Standard device with one transfer funnel and one semi trailer | 20 t/h |

The following table provides a summary of technnical characteristics of the selected type of transport equipment and the technology of TS.

**Table 9-30: Technical characteristics of standard transport equipment / Technical characteristics of proposed type / technology of TS**

| **Standard transport Equipment** | | **Technical characteristics of proposed type of TS** | |
|---|---|---|---|
| **Technical characteristics** | **SEMI-TRAILER WITH A PRESSURE PLATE** | **Technical characteristics** | **BELT CONVEYOR AND WASTE COMPACTIG CONTAINERS** |
| **Payload (tn)** | 20 | **Number of levels for waste loading** | Transfer takes place on one level and does not require costly construction works |
| **Total vehicle length including tractor (m)** | 16.1 | | |
| **Compacted waste** | Yes | **Number of transfer points/transfer ramps** | 1 ramp – several unloading points, the number of unloading points is designed according to the actual needs |
| **Autonomy at TS** | Yes | | |
| **Space for semi-trailer/ container handling** | Full vehicle dimensions | **Rate of transfer/ receiving waste from a waste truck** | 3 – 5 min / waste truck |
| **Waste transfer levels** | 1 | **Time required to transfer 20 t of waste/1 ramp** | Transfer of 20 t of waste with 1 transfer ramp with compacting in the semi-trailer takes up to 50 min |
| **Purpose** | Loading and compacting 20 t of waste (installed press), transport and unloading of waste | | |
| **Waste preparation time for transport from TS (min)** | 50 (20 t) | | |
| **Time of unloading waste at CWMC (min)** | 4 - 6 | **Transfer equipment** | |
| **Towing vehicle** | tractor | **Payload for waste in t** | 20 t of compacted waste |
|  | | **Required area for waste transfer (400 t/8h ) is** | 4.166 m² |
| | | **Required time for transferring 400 t of waste** | 5 hrs (a ramp with 2 transfer funnels) |

| Standard transport Equipment | | Technical characteristics of proposed type of TS | |
|---|---|---|---|
| **Technical characteristics** | **SEMI-TRAILER WITH A PRESSURE PLATE** | **Technical characteristics** | **BELT CONVEYOR AND WASTE COMPACTIG CONTAINERS** |
|  | | **Unloading 20 t of waste, time in minutes** | Pressure plate; 5 min |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### 9.5.6.3 Transfer station parts

Transfer station consists of:

- A ditch for waste acceptance from small waste vehicles with covering
- A transfer ramp
- Road which is connected to the public road
- Internal roads with manipulative surface for transfer equipment, TS vehicles and parking lots
- An aboveground scale
- Contain for operator and control - entrance container
- Equipment container
- A fence

Conveyor belt with engine consisting of:

- flat part (unloading ramp), onto which utility vehicles load their waste
- the slant
- loading ramp – the transfer funnel equipped with rubber curtain for waste directing
- shallow pool equipped with hydraulical pump underneath the slant for waste water collection which is being created by draining the municipal waste during the transfer, which is, after collected, transferred back into the semi trailer
- The drive unit (diesel engine with electro-hydraulic pump as a device driving part with unique keyboard to control the entire belt)

The belt conveyor consists of a flat part (unloading ramp) onto which utility vehicles load their waste, a slant, lifted part, and a loading ramp – the transfer funnel.

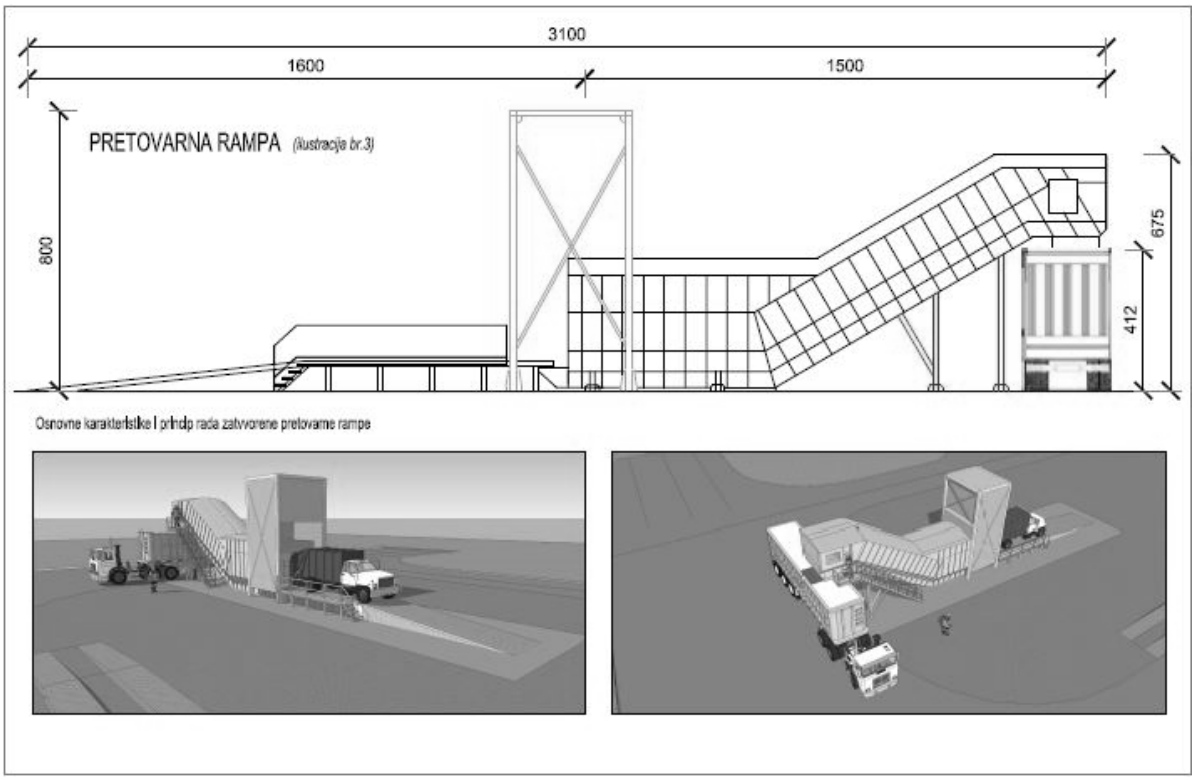



**Figure 9-18: Typical view and cross section of belt conveyor and waste compacting containers**

### 9.5.6.4 Transfer waste amounts thourgh TS

The following table presents the average annual amounts of waste (for 2023-2047 period) transferred to the six proposed TS and the capacity of waste tracks.

**Table 9-31: TS waste amounts transferred**

| | Split TS | Sinj TS | Zagvozd TS | Brac TS | Hvar TS | Vis TS |
|---|---|---|---|---|---|---|
| Waste quantity (t/y) | 49,088 | 12,441 | 10,833 | 3,739 | 4,336 | 1,367 |

### 9.5.7 Collection system

The proposed waste collection system consists of collection with **three waste streams as follows:** Stream 1: separate collection of paper, glass, metal and plastic materials, including packaging waste in different bins, Stream 2: collection of residual municipal waste and Stream 3: separate collection of biodegradable waste. This collection system is currently already in place at project area.

For the development of the separate collection system of the above mentioned streams according to the identified needs, a suitable number of standard bins and transport trucks have been determined.

The relative figures presented in the following Table, where the detailed calculations are presented in Annex 8.1. of chapter 8.

**Table 9-32: Needs of collection equipment for project area**

| | Existing infrastructure | Additional needs |
|---|---|---|
| **Collection Bins 1,1m³** | | |
| Collection Bins for Mixed Waste (1,1m³) | 9,862 | 122 |
| Collection Bins for Paper (1,1m³) | 969 | 3,086 |
| Collection Bins for Glass (1,1m³) | 169 | 663 |
| Collection Bins for Plastic (1,1m³) | 756 | 6,668 |
| Collection Bins for Metal (1,1m³) | 66 | 2,636 |
| Bins for separated Bio-waste | - | 2,139 |
| **Collection trucks** | | |
| Trucks 16m³ for recyclables collection | - | 19 |
| Trucks 12m³ for source separated organic waste | - | 2 |
| Trucks 16m³ for source separated organic waste | - | 5 |

*Note: The calculations for the additional needs in collection bins have been calculated using the formula: Additional needs=Total needs-Existing infrastructure for each town/municipality included in the project area assuming that if a town or municipality has less items in bins than those needed will be necessary to be supplied with extra items and not to be contributed with bins by another town/municipality with surplus.*
*Existing infrastructure includes collection bins with capacity 1.1 m³ and also different capacity bins (i.e. 240 lt, 120 lt) after reduction in capacity 1.1 m³.*

## 9.6 HUMAN RESOURCES AND PROMOTER ORGANIZATION

### 9.6.1 Organizational diagram

Company Regionalni centar čistog okoliša Ltd for waste management (RCČO), based in Split, Domovinskog rata 2, was founded in 2005 by the Split-Dalmatia County, holding a business share in the nominal value of 13.078.000,00 kn, which makes 100 % of the share capital.

The Company is registered at Commercial Court Split, with the company number: 060207999, PIN: 54045399638.

The purpose of establishing the company is defined in Article 1 in conjunction with Article 5 of the Declaration. Statements of Incorporation provide that where the company is established as a profitable economic activity for non-hazardous waste which includes:

- Waste collection for the needs of others
- Transport of waste for the needs of others
- Mediation in organization of use and / or disposal of waste on behalf of others
- Collection, recovery and / or management (treatment, disposal, incineration and other methods of waste disposal), and management of special categories of waste
- Electricity production
- Gas production

In addition to these activities, the Company may perform other activities serving them, if they are on a smaller scale, and usually performed along with the mentioned activities.

The communal infrastructure system for waste management is spread through the Split-Dalmatia County for which reason, SPLIT - DALMATIA COUNTY, with headquarters in Split, Domovinskog rata, being the only founder, is founding the limited liability company.

At the moment of founding the company, the communal infrastructure for waste management including the Waste management centre in Kladnjice, Lećevica Municipality and six transfer stations in Split - Dalmatia County which would be managed by the newly founded company, has not yet been built, however by hiring employees in the first phase and contracting with the consultants and engineers the first precondition for the securement of the project preparation has been met.

### 9.6.2 Personnel requirements

This section presents the indicative personnel requirements for the management and the normal operation of the WMC and TS works. Analytical data regarding each position title, such as job description and required skills are presented in Annex 9.3 of the present chapter.

**Table 9-33: Personnel requirements**

| ***Central Administration – RCCO d.o.o.*** | |
|---|---|
| *Position title* | *Indicative number of personnel* |
| 1. Director | 1 |
| 2. Assistant Director | 1 |
| 3. Project Manager | 1 |
| 4. Head of Engineering projects | 1 |
| 5. Head of Finance and Accounting | 1 |
| 6. Technical Assistance staff for Project Implementation Unit | |
| 7. Public procurement associate | 1 |
| 8. Public relations associate | 1 |
| 9. Chief engineer of construction and infrastructure | 1 |
| 10. Associate for financial management | 1 |
| 11. Public procurement associate | 1 |
| 12. Associate for legal affairs and human resource management | 1 |
| ***Minimum specified requirements for the operation of the MBT facility*** | |
| *Position title* | *Indicative number of personnel* |
| 1. General Manager | 1 |
| 2. MBT operator | 2 |
| 3. Electrical installation technician | 1 |
| 4. Mechanical installation technician | 4 |
| 5. Weighbridge operator | 4 |
| 6. General secretary/administrator | 3 |
| 7. Truck operator-driver | 8 |
| 8. General tasks workers | 15 |
| ***Requirements for landfill operation*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Landfill site supervisor | Common position with MBT operator |
| 2. Waste compactor operator | 1 |
| 3. Bull dozer operator | 1 |

| | |
|---|---|
| 4. Loader operator | 1 |
| 5. Truck driver | Common position with Bull dozer operator |
| 6. General tasks workers | 3 |
| ***WWTP – Landfill gas collection*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Manager | Common position with MBT operator |
| 2. Environmental compliance officer | Common position with MBT operator |
| ***Recycing yard*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Manager | Common position with MBT operator |
| 2. Equipment operator | 1 |
| ***Recylcing yard of Construction waste*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Equipment operator | 1 |
| 2. General tasks worker | Common position with bull dozer operator |
| ***Requirements for technical section of vehicles*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Mechanical engineer | 1 |
| 2. Vehicle mechanic | 2 |
| 3. General tasks worker | 3 |
| ***Guarding, Control and monitoring requirements*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Site quard | 3 |
| ***Transfer Station vehicle drivers*** | |
| *Position title* | *Indicative number of personnel* |
| 1. Truck driver | 24 |

### 9.6.3 Hiring procedures

The hiring procedure of all needed employees is foreseen to be finished three months before the WMC starts to operate, as the latest. The hiring procedure will be performed according to Croatian legislation. All employees necessary for the operation of the WMC will be hired well before the start of the operation in order to get proper training and competence.

### 9.6.4 Annual costs

All data concerning financial aspects of the operation are presented at paragraph 9.9. and at chapters 11 and 12.

### 9.6.5 Training procedures

Under the scope of works of selected contractor for construction of WMC, as well as MBT Plant and supply of equipment the proper training of future working staff and all necessary maintenance manuals shall be included. Every other kind of education and training will be provided before the start of operation, as well as continuously during the operational phase.
The theoretical training of staff should be at least for the following areas:

- General information on waste management
- General description of WMC and TS facilities
- Description of the WMC and TS units
- Description of all plant machinery
- Operation manuals of machinery
- Maintenance Manuals - Parts - Analysis of Faults.
- Health and Safety .

In particular the staff training will be done in modules and by groups of workers. The minimum topics given in the following table:

**Table 9-34: Staff Training**

| N / A | TRAINING MODULE |
|---|---|
| 1 | Legislative framework for waste management |
| 2 | Operating Basics WMC - General education facilities |
| 3 | Detailed presentation of flowchart functions |
| 4 | Internal Processes – Duties List |
| 5 | Hygiene and safety-emergency |
| 6 | Administrative operations, financial management and operational costs |
| 7 | Fundamentals for equipment maintenance, maintenance schedule, maintenance repair operations, parts and service equipment |
| 8 | Environmental monitoring function laboratory measurements-analyzes and processing results, results database, project monitoring reports |
| 9 | Weighing incoming waste and outgoing materials weightings recorded in a database |
| 10 | Techniques and landfill operations, cover material, maximizing available space |
| 11 | Techniques of Leachate treatment unit-Sampling Techniques - Quality Control - Outputs - Disposal |
| 12 | Landfill Equipment - Machinery and Equipment Supporting Equipment- Use of Equipment |
| 13 | Monitoring and Maintenance Project (fences, drainage, street cleaning etc) - Management of Vehicle and Personnel - Transfers |

Finally, it should be noted that there will be the possibility of holding seminars, educational visits / trips and anything else necessary to further educate and train staff on technology, use and operation of equipment or recovery systems.

### 9.6.6 Competence of the promoter – General competence – Project implementation competences

The initial organizational scheme enables accomplishment of the following workings:

**Phase 1: Project Preparation**: investigation work implementation, technical documentation preparation, building acts procurement and securment of co-financing funds according to the proposed financing scheme from EU funds and Republic of Croatia and Split-Dalmatia County.

In this phase, EPEEF in cooperation with JASPERS consultants and MEPN participate in the control of the quality of documentation next to RCCO as the Beneficiary.

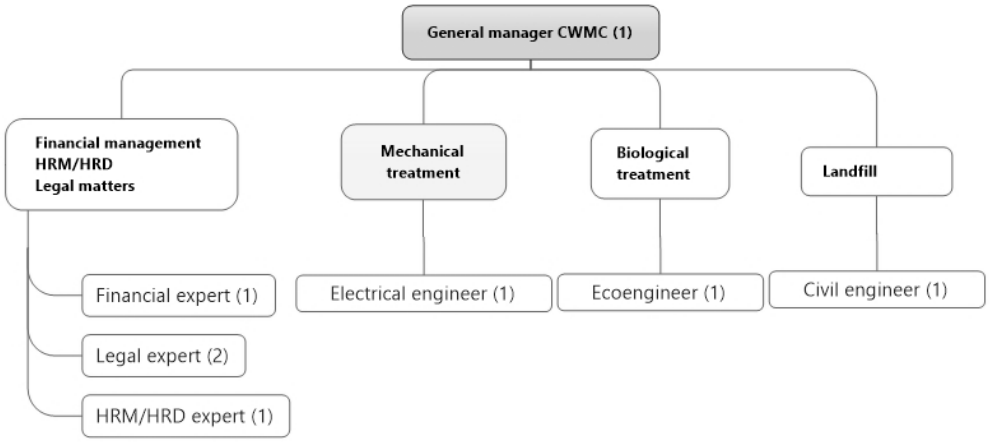



**Figure 9-19: Organizational scheme for project preparation**

**Phase 2**: **Project Implementation**: public procurement - construction and infrastructure equipment contracting - infrastructure building.

According to the *" Regulation on the bodies in the systems of management and control of the usage of European social fund, European regional development fund and Cohesion fund regarding the goal "Investment in growth and workplaces"*[4] (OG 10//14) RCČO as the Beneficiary of the funds, concludes the contract on allocation of the grants with Intermediate body Level 1 and/or Intermediate Body Level 2 according to the General provisions applied to the projects financed from EU structure and investment funds in the financial period 2014 - 2020[5]. Beneficiary is directly responsible for the beginning, management, implementation and results of the project. Project implementation is exclusive responsibility of the Beneficiary.

The development of the organizational structure follows the development of the project so in the Phase 2 the employment of the new employees of required expertise is planned in order to secure legal, management, administrative and financial benefits of the project:

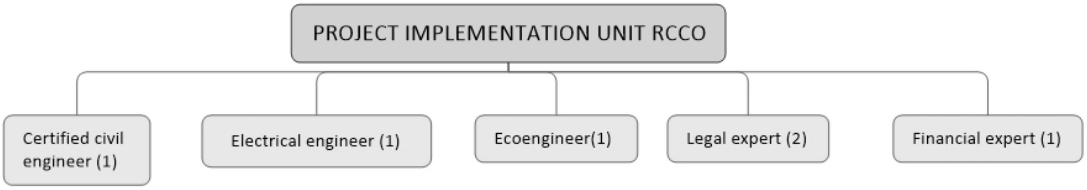



**Figure 9-20: Organizational scheme for project implementation**

[4] Uredba o tijelima u sustavima upravljanja i kontrole korištenja Europskog socijalnog fonda, Europskog fonda za regionalni razvoj i Kohezijskog fonda, u vezi s ciljem „Ulaganje za rast i radna mjesta, slobodan prijevod

[5] Opći uvjeti koji se primjenjuju na projekte finacnirane iz europskih strukturnih i investicijskih fondova u finacnisjkom razdoblju 2014.-2020, Slobodan prijdvod

**Phase 3: Operation And Management Of The Built Infrastructure:** During/at the end of the Phase 2 and before setting in motion of the built infrastructure, it will be necessary to hire all workers necessary to conduct all technological, administrative and management affairs. The workers selection process will be conducted according to the Labor Act and adequate specific education will be performed prior to disposition to the working place. RCČO Framework organizational scheme in the operational phase is given bellow:

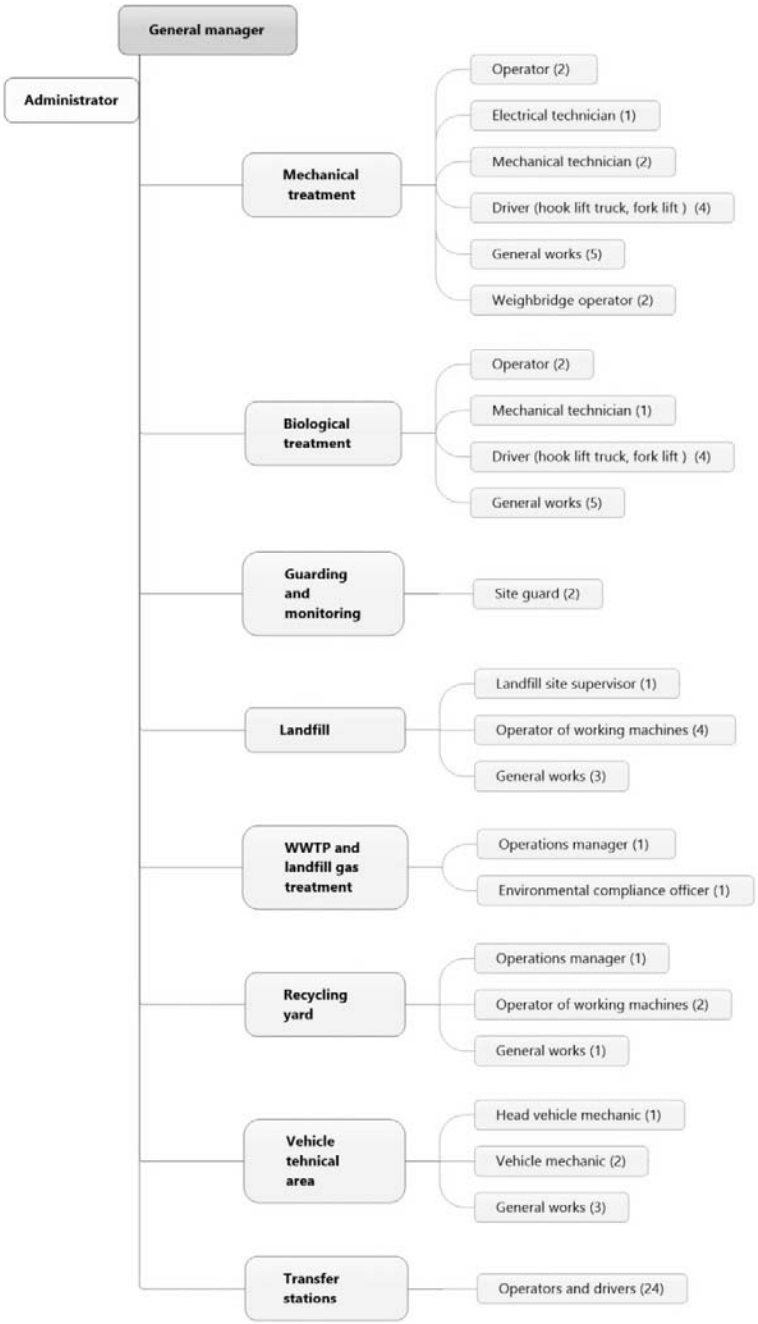



**Figure 9-21: Organizational scheme for project operatio**

## 9.7 FINANCIAL DATA: CAPEX, OPEX AND RE-INVESTMENT COSTS

### 9.7.1 Waste Management Center (WMC)

#### 9.7.1.1 Investment Cost

The cost of waste treatment plant is affected by a number of different parameters as:

- The capacity of the unit
- The type and complexity of technology
- The degree of automation of production process
- The required infrastructure

The table below presents our estimations regarding the investment cost of WMC. The detailed investment cost that is presented in the following table does not include contingencies &VAT.

**Table 9-35: Investment Cost of WMC**

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| **1** | **MECHANICAL SORTING** | | | | | |
| **1.1** | **Mechanical Equipment** | | | | | |
| 1.1.1 | Crane | item | 2 | 300,000 | 600,000 | Eligible |
| 1.1.2 | Bag Opener | item | 2 | 235,000 | 470,000 | Eligible |
| 1.1.3 | Trommel Screen d=80/300mm | item | 2 | 250,000 | 500,000 | Eligible |
| 1.1.4 | Magnet | item | 6 | 45,000 | 270,000 | Eligible |
| 1.1.5 | Shredder | item | 2 | 250,000 | 500,000 | Eligible |
| 1.1.6 | Eddy Current Separator | item | 4 | 85,000 | 340,000 | Eligible |
| 1.1.7 | Balistic Separator | item | 2 | 290,000 | 580,000 | Eligible |
| 1.1.8 | NIR 2,8m | item | 2 | 225,000 | 450,000 | Eligible |
| 1.1.9 | NIR 1m PE/PP | item | 2 | 135,000 | 270,000 | Eligible |
| 1.1.10 | NIR 0,6m PET | item | 2 | 115,000 | 230,000 | Eligible |
| 1.1.11 | NIR 2m film | item | 2 | 220,000.00 | 440,000 | Eligible |
| 1.1.12 | NIR 2,8m paper | item | 2 | 225,000.00 | 450,000 | Eligible |
| 1.1.13 | NIR 2m | item | 4 | 210,000.00 | 840,000 | Eligible |
| 1.1.14 | Baler with PET perforator for paper & plastic | item | 1 | 350,000 | 350,000 | Eligible |
| 1.1.15 | Baler for metals | item | 1 | 350,000 | 350,000 | Eligible |
| 1.1.16 | Shredder for RDF | item | 1 | 250,000 | 250,000 | Eligible |
| 1.1.17 | Baler for RDF | item | 1 | 500,000 | 500,000 | Eligible |
| 1.1.18 | Transportation, collection and acceleration conveyors | item | 1 | 1,400,000 | 1,400,000 | Eligible |
| 1.1.19 | Commisioning (supply, istallation, test) | item | 1 | 200,000 | 200,000 | Eligible |
| 1.1.20 | Hand-picking cabins (including ventilation, air conditioned and | item | 1 | 180,000 | 180,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| | insulated , conveyors etc) | | | | | |
| 1.1.21 | Quality control cabins (including ventilation, air conditioned and insulated , conveyors etc) | item | 1 | 180,000 | 180,000 | Eligible |
| 1.1.22 | RDF wind sifter | item | 1 | 400,000 | 400,000 | Eligible |
| | | | | **Subtotal 1.1: Mechanical Equipment** | **9,750,000** | |
| **1.2** | **Buildings Constructions (Civil works)** | | | | | |
| 1.2.1 | MBT Metallic building | $m^2$ | 9,100 | 550 | 5,005,000 | Eligible |
| 1.2.2 | Storage for recyclables | $m^2$ | 3,200 | 450 | 1,440,000 | Eligible |
| 1.2.3 | Control room (including heating and cooling system) | item | 1 | 80,000 | 80,000 | Eligible |
| | | | | **Subtotal 1.2: Buildings Construction** | **6,525,000** | |
| **1.3** | **Infrastructure** | | | | | |
| 1.3.1 | Electrical and mechanical installation (fire protection, sewage, electrical cables, CCTV etc) | item | | | | |
| *1.3.1.1* | *General electrical / electronic installations* | *item* | *1* | 300,000 | 300,000 | Eligible |
| *1.3.1.2* | *Fire detection and protection installations* | *item* | *1* | 150,000 | 150,000 | Eligible |
| *1.3.1.3* | *Telephone - Data connections* | *item* | *1* | 100,000 | 100,000 | Eligible |
| *1.3.1.4* | *CCTV system installation* | *item* | *1* | 50,000 | 50,000 | Eligible |
| *1.3.1.5* | *Sewage and plumbing installation* | *item* | *1* | 80,000 | 80,000 | Eligible |
| *1.3.1.6* | *Automation System* | *item* | *1* | 300,000 | 300,000 | Eligible |
| *1.3.1.7* | *Others* | *item* | *1* | 40,000 | 40,000 | Eligible |
| *1.3.1.8* | *De-dusting bag filter, fans for air exchange system* | *item* | *1* | 300,000 | 300,000 | Eligible |
| *1.3.1.9* | *Biofilter and auxilliaries* | *$m^2$* | *780* | 450 | 351,000 | Eligible |
| 1.3.2 | Transformer and generator (2 X 800 KVA Transformers) | item | 1 | 220,000 | 220,000 | Eligible |
| | | | | **Subtotal 1.3: Infrastructures** | **1,891,000** | |
| **1.4** | **Mobile Equipment** | | | | | |
| 1.4.1 | Petrol engined fork lift | unit | 2 | 30,000 | 60,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| 1.4.2 | Transport truck with hook lift | unit | 2 | 100,000 | 200,000 | Eligible |
| 1.4.3 | Sweeper | unit | 2 | 50,000 | 100,000 | Eligible |
| 1.4.4 | Container 30m3 for residues | unit | 7 | 11,000 | 77,000 | Eligible |
| 1.4.5 | Container for ferrous, non ferrous products and others | unit | 7 | 1,000 | 7,000 | Eligible |
| 1.4.6 | Containers under hand-picking cabins | unit | 4 | 11,000 | 44,000 | Eligible |
| | | | | **Subtotal 1.4: Mobile Equipment** | **488,000** | |
| **1.5** | **Construction Design, Detailed Design and As-Built Design** | | | | | |
| 1.5.1 | Construction Design, Detailed Design and As-Built Design | unit | 1 | 700,000 | 700,000 | Eligible |
| | | | | **Subtotal 1.5: Construction Design, Detailed Design and As-Built Design** | **700,000** | |
| **1.6** | **Trial Operation** | | | | | |
| 1.6.1 | Trial Operation for 6 months | unit | 1 | 550,000 | 550,000 | Eligible |
| | | | | **Subtotal 1.6: Trial Operation** | **550,000** | |
| | | | | **Subtotal 1: Mechanical Sorting** | **19,904,000** | |
| | | | | | | |
| **2** | **BIOLOGICAL TREATMENT** | | | | | |
| **2.1** | **Biological Treatment** | | | | | |
| **2.1.1** | **Composting** | | | | | |
| *2.1.1.1* | *Construction of concrete for compost boxes* | *$m^3$* | *4,180* | *300* | 1,254,000 | Eligible |
| *2.1.1.2* | *Electrical and mechanical installation (fans, air piping, sewage system, plumbing etc)* | *item* | *16* | *110,000* | 1,760,000 | Eligible |
| *2.1.1.3* | *Building construction for composting (Sheded area)* | *$m^2$* | *1,182* | *400* | 472,926 | Eligible |
| *2.1.1.4* | *Compost testing equipment (thermometer, CO2 meter, pH-Redox test KIT)* | *item* | *1* | *30,000* | 30,000 | Eligible |
| **2.1.2** | **Maturation** | | | | | |
| *2.1.2.1* | *Building construction for maturation (Shed, asphaled area, sewage system etc)* | *$m^2$* | *11,853* | *400* | *4,741,364* | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| *2.1.2.2* | *Compost testing equipment (thermometer, $CO_2$ meter, pH-Redox test KIT)* | *item* | *1* | *10,000* | *10,000* | Eligible |
| **2.1.3** | **Refining** | | | | | |
| *2.1.3.1* | *Building construction for rafinery* | *$m^2$* | *680* | *500* | *340,000* | Eligible |
| *2.1.3.2* | *Trommel screen for refinement (12-25mm)* | *item* | *1* | *190,000* | *190,000* | Eligible |
| *2.1.3.3* | *Transportation & collection conveyors* | *item* | *1* | *250,000* | *250,000* | Eligible |
| *2.1.3.4* | *Container 30$m^3$ for residues* | *item* | *3* | *11,000* | *33,000* | Eligible |
| | | | | **Subtotal 2.1: Biological Treatment** | **9,081,290** | |
| **2.2** | **Infrastructure** | | | | | |
| 2.2.1 | Electrical and mechanical installation (fire protection, sewage, plumbing, electrical cables etc) | | | | | |
| *2.2.1.1* | *General electrical / electronic installations* | *item* | *1* | *200,000* | *200,000* | Eligible |
| *2.2.1.2* | *Fire detection and protection installations* | *item* | *1* | *100,000* | *100,000* | Eligible |
| *2.2.1.3* | *CCTV system installation* | *item* | *1* | *50,000* | *50,000* | Eligible |
| *2.2.1.4* | *Sewage and plumbing installation* | *item* | *1* | *100,000* | *100,000* | Eligible |
| *2.2.1.5* | *Automation System* | *item* | *1* | *250,000* | *250,000* | Eligible |
| *2.2.1.6* | *Others* | *item* | *1* | *10,000* | *10,000* | Eligible |
| 2.2.2 | De-dusting bag filter, fans for air exchange system, Biofilter & Scrubber, and auxilliaries | | | | | Eligible |
| *2.2.2.1* | *De-dusting bag filter, fans for air exchange system* | *item* | *1* | *100,000* | *100,000* | Eligible |
| *2.2.2.2* | *Biofilter & Scrubber, and auxilliaries* | *$m^2$* | *1,105* | *450* | *497,250* | Eligible |
| | | | | **Subtotal 2.2: Infrastructure** | **1,307,250** | |
| **2.3** | **Mobile Equipment** | | | | | |
| 2.3.1 | Wheeled front end loader | unit | 2 | 120,000 | 240,000 | Eligible |
| 2.3.2 | Compost Turner | unit | 1 | 275,000 | 275,000 | Eligible |
| 2.3.3 | Mixer for organic | unit | 1 | 50,000 | 50,000 | Eligible |
| | | | | **Subtotal 2.3: Mobile Equipment** | **565,000** | |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| **2.4** | **Construction Design, Detailed Design and As-Built Design** | | | | | |
| 2.4.1 | Construction Design, Detailed Design and As-Built Design | unit | 1 | 400,000 | 400,000 | Eligible |
| **Subtotal 2.4. Construction Design, Detailed Design and As-Built Design** | | | | | **400,000** | |
| **2.5** | **Trial Operation** | | | | | |
| 2.5.1 | Trial Operation | unit | 1 | 200,000 | 200,000 | Eligible |
| **Subtotal 2.5: Trial Operation** | | | | | **200,000** | |
| **Subtotal 2: Biological Treatment** | | | | | **11,553,540** | |
| | | | | | | |
| **3.** | **LANDFILL** | | | | | |
| **3.1** | **Construction of cell 1** | | | | | |
| **3.1.1** | **Earthworks** | | | | | |
| 3.1.1.1 | Excavations for landfill cell 1 | $m^3$ | 138,676 | 6.8 | 942,997 | Eligible |
| 3.1.1.2 | Backfilling | $m^3$ | 6,578 | 1.7 | 11,183 | Eligible |
| **Subtotal 3.1.1: Earthworks** | | | | | **954,179** | |
| **3.1.2** | **Bottom Lining** | | | | | |
| 3.1.2.1 | Support layer 0.5m | $m^3$ | 11,264 | 1.5 | 16,896 | Eligible |
| 3.1.2.2 | Clay 0,5m | $m^3$ | 11,264 | 4 | 45,056 | Eligible |
| 3.1.2.3 | GCL | $m^2$ | 22,528 | 3 | 67,584 | Eligible |
| 3.1.2.4 | HDPE 2.5mm | $m^2$ | 22,528 | 3 | 67,584 | Eligible |
| 3.1.2.5 | Geotextile 2000g/m2 | $m^2$ | 22,528 | 2.5 | 56,320 | Eligible |
| 3.1.2.6 | Drainage 0.5m | $m^3$ | 11,264 | 11 | 123,904 | Eligible |
| 3.1.2.7 | Leak proof system | $m^2$ | 22,528 | 3 | 67,584 | Eligible |
| **Subtotal 3.1.2: Bottom Lining** | | | | | **444,928** | |
| **3.1.3** | **Leachate management system** | | | | | |
| 3.1.3.1 | Leachate Collection network | item | 1 | 70,000 | 70,000 | Eligible |
| 3.1.3.2 | Leachate Treatment Plant (LTP) | item | 1 | 900,000 | 900,000 | Eligible |
| **Subtotal 3.1.3: Leachate management system** | | | | | **970,000** | |
| **3.1.4** | **Biogas management Works** | | | | | |
| 3.1.4.1 | Biogas Collection network for cell 1 | item | 1 | 50,000 | 50,000 | Eligible |
| 3.1.4.2 | Flare | item | 1 | 100,000 | 100,000 | Eligible |
| **Subtotal 3.1.4: Biogas Management Works** | | | | | **150,000** | |
| **3.1.5** | **Rainwater Works** | | | | | |
| 3.1.5.1 | Rainwater network (perimetric drainage network, shafts, pipes etc) | item | 1 | 350,000 | 350,000 | Eligible |
| 3.1.5.2 | Closed tank for efluent | item | 1 | 20,000 | 20,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| | (8mx8mx5m) | | | | | |
| 3.1.5.3 | Closed tank for waste water (8mx8mx5m) | item | 1 | 20,000 | 20,000 | Eligible |
| 3.1.5.4 | Pumping station, electrical network for hydrant network | item | 1 | 75,000 | 75,000 | Eligible |
| 3.1.5.5 | Pumping station, electrical network for technological water | item | 1 | 75,000 | 75,000 | Eligible |
| | | | | **Subtotal 3.1.5: Rainwater Works** | **540,000** | |
| **3.1.6** | **Monitoring** | | | | | |
| 3.1.6.1 | Monitoring works (monitoring wells, laboratory equipment, etc.) | item | 1 | 150,000 | 150,000 | Eligible |
| 3.1.6.2 | Others | item | 1 | 50,000 | 50,000 | Eligible |
| | | | | **Subtotal 3.1.6: Monitoring** | **200,000** | |
| **3.1.7** | **Mobile Equipment** | | | | | |
| 3.1.7.1 | Bulldozer | item | 1 | 350,000 | 350,000 | Eligible |
| 3.1.7.2 | Compactor | item | 1 | 375,000 | 375,000 | Eligible |
| 3.1.7.3 | Backhoe Loader | item | 1 | 70,000 | 70,000 | Eligible |
| 3.1.7.4 | Tipping truck | item | 2 | 100,000 | 200,000 | Eligible |
| | | | | **Subtotal 3.1.7: Mobile Equipment** | **995,000** | |
| | | | | | | |
| **3.1.8** | **Construction Design, Detailed Design, As-Built Design** | | | | | |
| 3.1.8.1 | Construction Design, Detailed Design, As-Built Design | unit | 1 | 200,000 | 200,000 | Eligible |
| | **Subtotal 3.1.8: Construction Design, Detailed Design, As-Built Design** | | | | **200,000** | |
| **3.1.9** | **Trial Operation** | | | | | |
| 3.1.9.1 | Trial Operation | unit | 1 | 120,000 | 120,000 | Eligible |
| | | | | **Subtotal 3.1.9: Trial Operation** | **120,000** | |
| | | | | **Subtotal 3: Cell 1** | **4,574,107** | |
| | | | | | | |
| **3.2** | **Construction of cell 6** | | | | | |
| **3.2.1** | **Earthworks** | | | | | |
| 3.2.1.1 | Excavations | $m^3$ | 74,671.00 | 6.8 | 507,763 | Eligible |
| 3.2.1.2 | Backfilling | $m^3$ | 3,542.00 | 1.7 | 6,021 | Eligible |
| | | | | **Subtotal 3.2.1: Earthworks** | **513,784** | |
| **3.2.2** | **Bottom Lining** | | | | | |
| 3.2.2.1 | Support layer 0.5m | $m^3$ | 1,786.25 | 1.5 | 2,679 | Eligible |
| 3.2.2.2 | Clay 0.5m | $m^3$ | 1,786.25 | 4 | 7,145 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| 3.2.2.3 | GCL | $m^2$ | 3,572.5 | 3 | 10,718 | Eligible |
| 3.2.2.4 | HDPE 2.5mm | $m^2$ | 3,572.5 | 3 | 10,718 | Eligible |
| 3.2.2.5 | Geotextile 2000g/$m^2$ | $m^2$ | 3,572.5 | 2 | 8,931 | Eligible |
| 3.2.2.6 | Drainage 0.5m | $m^3$ | 1,786.25 | 11 | 19,649 | Eligible |
| 3.2.2.7 | Leak proof system | $m^2$ | 3,572.50 | 3 | 10,718 | Eligible |
| | | | | **Subtotal 3.2.2: Bottom Lining** | **70,557** | |
| **3.2.3** | **Leachate management system** | | | | | |
| 3.2.3.1 | Collection network | item | 1 | 80,000 | 80,000 | Eligible |
| | | | | **Subtotal 3.2.3: Leachate management system** | **80,000** | |
| **3.2.4** | **Rainwater works** | | | | | |
| 3.2.4.1 | Rainwater network | item | 1 | 30,000 | 30,000 | Eligible |
| | | | | **Subtotal 3.2.4: Rainwater works** | **30,000** | |
| **3.2.5** | **Construction Design, Detailed Design, As-Built Design** | | | | | |
| 3.2.5.1 | Construction Design, Detailed Design, As-Built Design | unit | 1 | 15,000 | 15,000 | Eligible |
| | **Subtotal 3.2.5: Construction Design, Detailed Design, As-Built Design** | | | | **15,000** | |
| **3.2.6** | **Trial Operation** | | | | | |
| 3.2.6.1 | Trial Operation | unit | 1 | 10,000 | 10,000 | Eligible |
| | | | | **Subtotal 3.2.6: Trial Operation** | **10,000** | |
| | | | | **Subtotal 3.2: Cell 6** | **719,341** | |
| | | | | | | |
| **4** | **Infrustracture Works** | | | | | |
| **4.1** | **Earthworks** | | | | | |
| 4.1.1 | Removal of bushes and trees up until 10 cm in diamter, loading and unloading at the lanfill site. $m^2$ calculation | $m^2$ | 187,000 | 0.16 | 29,920 | Eligible |
| 4.1.2 | Trees cutting up until 10-30 cm in diamter, log extraction and loading and driving to the landfill site. Calculation per piece | piece | 3,360 | 6 | 20,160 | Eligible |
| 4.1.3 | Trees cutting up until 30-50 cm in diamter, log extraction and loading and driving to the landfill site. Calculation per piece | piece | 1,950 | 11.3 | 22,035 | Eligible |
| 4.1.4 | Trees cutting up until > 50 cm in diamter, log extraction and loading and driving to the landfill site. Calculation per piece. | piece | 280 | 16.6 | 4,648 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| 4.1.5 | General Excavations of soft and hard Soil with machine | $m^3$ | 416,000 | 5 | 2,080,000 | Eligible |
| 4.1.6 | Embankments / compacted soil | $m^3$ | 150,000 | 1.7 | 255,000 | Eligible |
| 4.1.7 | Cleaning of fire safety zone | $m^2$ | 10,680 | 5 | 53,400 | Eligible |
| | | | | **Subtotal 4.1: Earthworks** | **2,465,163** | |
| **4.2** | **Buildings and Utilities** | | | | | |
| 4.2.1 | *Weighbridge* | item | 2 | 30,000 | 60,000 | Eligible |
| 4.2.2 | *Shed for weighbridges* | $m^2$ | 160 | 400 | 64,000 | Eligible |
| 4.2.3 | *Tire washing system* | item | 1 | 25,500 | 25,500 | Eligible |
| 4.2.4 | *Fencing* | m | 2,613 | 40 | 104,520 | Eligible |
| 4.2.5 | *Entrance* | item | 1 | 5,000 | 5,000 | Eligible |
| 4.2.6 | *Security house (40m2)* | item | 40 | 700 | 28,000 | Eligible |
| 4.2.7 | *ADMINISTRATIVE BUILDING* | $m^2$ | 790 | 700 | 553,000 | Eligible |
| 4.2.8 | *MAINTENANCE BUILDING* | $m^2$ | 550 | 475 | 261,250 | Eligible |
| 4.2.9 | *WASHING FACILITY* | $m^2$ | 300 | 400 | 120,000 | Eligible |
| 4.2.10 | *Energy Building - ONE FOR EXTERNAL SUPPLY: 135.000 EUR, ONE FOR Pvs: 162.000, TOTAL:* | item | 1 | 297,000 | 297,000 | Eligible |
| 4.2.11 | *WATER TANK* | $m^2$ | 190 | 200 | 38,000 | Eligible |
| 4.2.12 | *Water supply network* | item | 1 | 75,000 | 75,000 | Eligible |
| 4.2.13 | *Sewage network* | item | 1 | 60,000 | 60,000 | Eligible |
| 4.2.14 | *Fire fighting network* | item | 3 | 40,000 | 120,000 | Eligible |
| 4.2.15 | *External electrical power supply networks* | item | 1 | 400,000 | 400,000 | Eligible |
| 4.2.16 | *Scada* | item | 1 | 250,000 | 250,000 | Eligible |
| 4.2.17 | *External lighting* | item | 1 | 80,000 | 80,000 | Eligible |
| 4.2.18 | *Fuel station* | $m^2$ | 180 | 550 | 99,000 | Eligible |
| 4.2.19 | *Parking (shedded)* | $m^2$ | 1,100 | 450 | 495,000 | Eligible |
| 4.2.20 | *CCTV for fence and infrastructure* | item | 1 | 50,000 | 50,000 | Eligible |
| 4.2.21 | *Detector for radioactive* | item | 1 | 20,000 | 20,000 | Eligible |
| 4.2.22 | *Software* | | | | | |
| 4.2.23 | *Solution for digital Archive and all bussiness proccesses of Archive. Enables the processing oft he documentation boxes. QR barcode lables,* | *item* | 1 | 12,000.00 | 12,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| | *document scaning, search, reports, etc.* | | | | | |
| 4.2.24 | *Software for documentation* | *item* | 1 | 16,000 | 16,000 | Eligible |
| 4.2.25 | *Logistic system* | item | 1 | 25,333 | 25,333 | Eligible |
| 4.2.26 | *Truck controlling system* | item | 1 | 17,869 | 17,869 | Eligible |
| 4.2.27 | Vehicle for internal needs of WMC | item | 1 | 65,000 | 65,000 | Eligible |
| | | | | **Subtotal 4.2: Buildings and Utilities** | **3,341,472** | |
| **4.3** | **Construction and demolition waste (C&D) Area** | | | | | |
| 4.3.1 | Construction and demolition waste (C&D) area | $m^2$ | 4,000 | 3 | 12,000 | Eligible |
| 4.3.2 | C&D mobile unit jaw crusher | item | 1 | 300,000 | 300,000 | Eligible |
| 4.3.3 | Wheeled front end loader | item | 1 | 120,000 | 120,000 | Eligible |
| | | | | **Subtotal 4.3: Recycling of construction and demolition waste (C&D) Area** | **432,000** | |
| **4.4** | **Recycling Yard** | | | | | |
| 4.4.1 | Recycling area (Asphalting) | $m^2$ | 412.5 | 30 | 12,375 | Eligible |
| 4.4.2 | Containers $30m^3$ | item | 4 | 11,000 | 44,000 | Eligible |
| 4.4.3 | Containers $10m^3$ | item | 10 | 5,000 | 50,000 | Eligible |
| | | | | **Subtotal 4.4: Recycling Yard** | **106,375** | |
| **4.5** | **Road Works** | | | | | |
| 4.5.1 | Asphalted roads | $m^2$ | 34,085 | 30 | 1,022,550 | Eligible |
| 4.5.2 | Traffic signalization | m | 1,121 | 40 | 44,840 | Eligible |
| | | | | **Subtotal 4.5: Road Works and asphalted areas** | **1,067,390** | |
| **4.6** | **Photovoltaics** | | | | | |
| 4.6.1 | Photovoltaic system | item | 1 | 696,000 | 696,000 | Non Eligible |
| | | | | **Subtotal 4.6: Photovoltaic system** | **696,000** | |
| **4.7** | **Others (asphalted areas, green areas, irrigation etc)** | | | | | |
| 4.7.1 | Others (green areas) | item | 1 | 20,00 | 20,000 | Eligible |
| 4.7.2 | Cottage restoration | item | 1 | 20,000 | 20,000 | Eligible |
| | | | | **Subtotal 4.7: Others (asphalted areas, green areas, irrigation etc)** | **40,000** | |
| **4.8** | **Construction Design, Detailed Design, As-Built Design** | | | | | |
| 4.8.1 | Construction Design, | unit | 1 | 300,000 | 300,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| | Detailed Design, As-Built Design | | | | | |
| **Subtotal 4.8: Construction Design, Detailed Design, As-Built Design** | | | | | **300,000** | |
| **Subtotal 4: Infrustracture Works** | | | | | **8,448,400** | |
| | | | | | | |
| **5** | **Biological treatment of presorted organic waste** | | | | | |
| **5.1** | **Infrastructure works** | | | | | |
| **5.1.1** | **Composting** | | | | | |
| *5.1.1.1* | *Construction of concrete for compost boxes* | *$m^3$* | *1,310* | *300* | *393,000* | Eligible |
| *5.1.1.2* | *Electrical and mechanical installation (fans, air piping, sewage system, plumbing etc)* | *item* | *3* | *110,000* | *330,000* | Eligible |
| *5.1.1.3* | *Building construction for composting(Sheded area)* | *$m^2$* | *222* | *400* | *88,674* | Eligible |
| *5.1.1.4* | *Compost testing equipment (thermometer, CO2 meter, pH-Redox test KIT)* | *item* | *1* | *10,000* | *10,000* | Eligible |
| 5.1.2 | Reception building of presorted waste | $m^2$ | 945 | 350 | 330,750 | Eligible |
| 5.1.3 | Asphalt area for compost storage | $m^2$ | 350 | 30 | 10,500 | Eligible |
| **5.1.4** | **Maturation** | | | | | |
| *5.1.4.1* | *Building construction for maturation (Shed, asphaled area, sewage system etc)* | *$m^2$* | 1,872 | 400.00 | 748,636 | Eligible |
| *5.1.4.2* | *Compost testing equipment (thermometer, CO2 meter, pH-Redox test KIT)* | *item* | *1* | *10,000* | *10,000* | Eligible |
| **Subtotal 5.1: Infrastructure works** | | | | | **1,921,560** | |
| **5.2** | **Mechanical Equipment** | | | | | |
| 5.2.1 | Shredder | item | 1 | 100,000 | 100,000 | Eligible |
| 5.2.2 | Wastewater network (pumping station, irrigation system etc) | item | 1 | 10,000 | 10,000 | Eligible |
| 5.2.3 | Wheeled front end loader | unit | 1 | 120,000 | 120,000 | Eligible |
| 5.2.4 | Compost Turner | unit | 1 | 70,000 | 70,000 | Eligible |
| 5.2.5 | Mixer | unit | 1 | 50,000 | 50,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| | | | | **Subtotal 5.2: Mechanical Equipment** | **350,000** | |
| **5.3** | **Electrical Equipment** | | | | | |
| 5.3.1 | Electromechanical and other works (lighting, etc) | item | 1 | 45,000 | 45,000 | Eligible |
| | | | | **Subtotal 5.3: Electrical Equipment** | **45,000** | |
| **5.4** | **Construction Design, Detailed Design, As-Built Design** | | | | | |
| 5.4.1 | Construction Design, Detailed Design, As-Built Design | unit | 1 | 50,000 | 50,000 | Eligible |
| | | | | **Subtotal 5.4: Construction Design, Detailed Design, As-Built Design** | **50,000** | |
| **5.5** | **Trial operation** | | | | | |
| 6.5.1 | Trial operation | unit | 1 | 15,000 | 15,000 | Eligible |
| | | | | **Subtotal 5.5: Trial Operation** | **15,000** | |
| | | | | **Subtotal 5: Biological treatment of presorted organic waste** | **2,381,560** | |
| | | | | **TOTAL WMC** | **47,580,948** | |

### 9.7.1.2 Operating Cost

The operating cost has been calculated for each waste treatment component: i.e. mechanical sorting plant, biological plant, Landfill cells 1-5, infrastructure works, Landfill cell 6 (inerts).
Within each element the cost is divided in fixed and variable cost in order to achieve a better projection and differentiation of growth rates.

- **Fixed Cost:** The fixed cost comprises labour (worker skilled/unskilled, driver, engineers/chemists/supervisors), maintenance, administrative cost, insurance, control and monitoring. All elements of the total fixed cost are projected flat.
- **Variable cost:** The variable cost evolves mainly with each tone of waste, e.g. fuel cost and energy. Variable cost is assumed to remain flat.

For the calculation of the operational cost of the various waste management facilities, the following cost categories have been considered:

**Maintenance costs:** The annual maintenance cost for all facilities is calculated based on a certain percentage of the investment cost, which is assumed:

- 4% for mechanical sorting and biological treatment
- 2% for the landfill
- 1% for infrastructure

**Labour cost:** The labour costs have been calculated based on typical salaries for different staff categories, including in the various insurances, taxes, employers' contribution, etc.

**Table 9-36: Assumption for labour cost**

| CATEGORY | Mechanical Treatment | Biological Treatment | Landfill | Infrastructure Works |
|---|---|---|---|---|
| WORKER UNSKILLED | 7 | 6 | 3 | 1 |
| WORKER SKILLED | 14 | 6 | 5 | 2 |
| ENGINEERS/ CHEMISTS/ SUPERVISORS | 2 | 1 | - | - |

**Energy – Fuel:** Electricity and fuel is needed for the operation of the mechanical separation, biological treatment, the landfills, as well as for the infrastructure facilities. The unit consumption factors have been adopted by the Consultant's experience from supervision of similar facilities and projects.

**Table 9-37: Assumption for Fuel & Energy consumptions**

| | Energy (KWh/t) @ 0.12 EUR/KWh | Fuel (l/t) @ (1.2EUR/l) |
|---|---|---|
| Mechanical treatment | 30 | 2 |
| Biological treatment | 30 | 1.1 |
| Landfill | 15 | 5 |
| Infrastructure works | 80,000 kWh/year | 5,000 l/year |

The cost of kWh was taken equal to 0.12 € (Source of data: Eurostat). The cost of diesel fuel was taken equal to 1.2 € per litre (Source of data: Europe Portal Energy https://www.energy.eu/fuelprices/).

**Monitoring:** For the necessary environmental monitoring (noise, dust, odours etc) at work/ perimeter of the site and ensuring product quality are adopted the following annual cost:

**Table 9-38: Monitoring Cost**

| | Monitoring Cost €/year |
|---|---|
| **Mechanical treatment** | 40,000 |
| **Biological treatment** | 50,000 |
| **Cells 1-5 of Landfill** | 80,000 |
| **Cell 6 of Landfill** | 10,000 |

**Aftercare/Insurance:** The aftercare/insurance cost has been calculated as a given percentage of the investment cost, i.e. 0.70% of investment cost.

**Cost for transportation and disposal of RDF:** The cost for transportation and disposal of RDF according to the data provided by the RCCO doo is approx. 30€/t

The average operating cost from operation during the period 2023-2047, is presented in the following table:

**Table 9-39: Average Annual Operating Cost for period 2023-2047**

| OPERATING COST | €/year) (Average 2023-2047) | €/t (Average 2023-2047) |
|---|---|---|
| Mechanical Sorting Plant | 1,916,860 | 17.4 |
| Biological Treatment | 956,635 | 20.9 |
| Landfill Cells 1-5 | 761,628 | 13.1 |
| Landfill Cell 6 | 76,162 | 14.1 |
| Infrastructure works | 198,096 | 1.8 |
| Other operating costs (transportation & disposal cost of RDF) | 956,764 | 30.0 |
| Biological treatment of organic pre-sorted waste | 189,908 | 19.6 |
| **Total Operating Cost, EUR** | **5,056,053** | **46.0** |

The figure shows the estimated operating cost of each unit, in EUR.

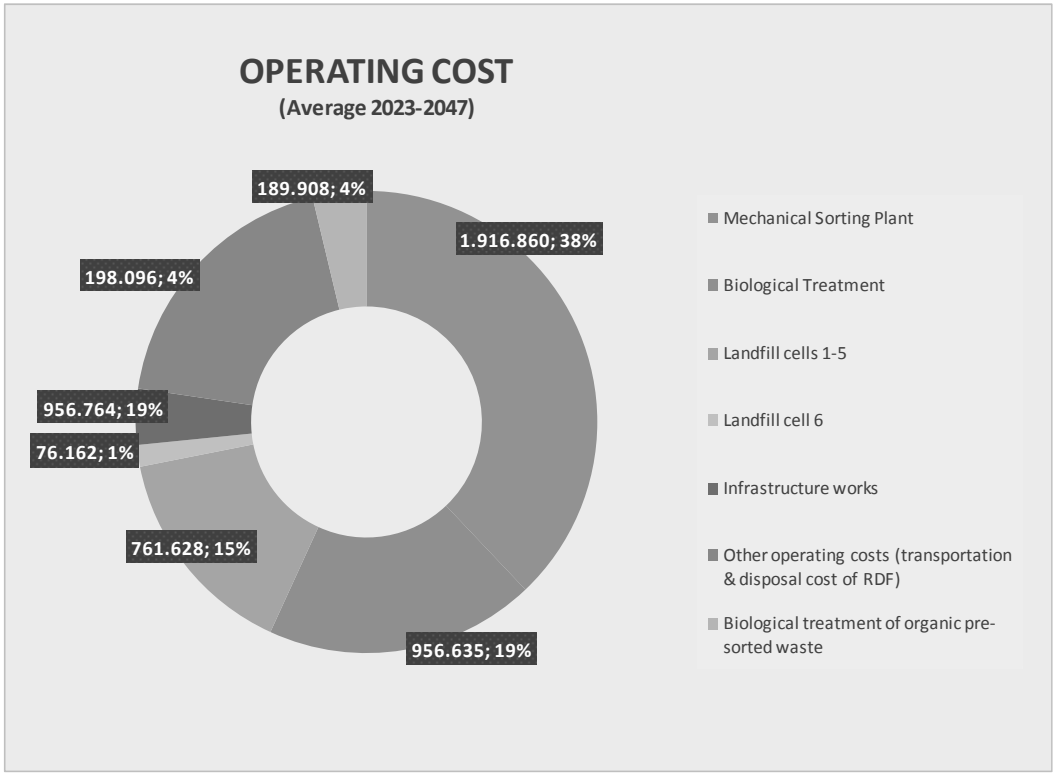



**Figure 9-22: Average Operating Cost of each treatment unit**

### 9.7.1.3 Revenues

Potential revenues from the operation of WMC include i) sale of recyclables & products ii) savings due to own consumption of electricity produced from PVs and iii) revenues from tarrifs.

***Revenues from sales of recyclables and energy***

The unit revenues were taken from current market prices (for example from dedicated websites such as http://www.letsrecycle.com).

**Table 9-40: Market prices of recyclables for the year 2014**

| | MIXED GLASS | | PLASTIC BOTTLES (MIXED) | | MIXED PAPER | | CARDBOARD | | Aluminum | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| £ per tonne | 2 | 15 | 55 | 108 | 56 | 62 | 76 | 81 | 668 | 711 |
| € per tonne | 2,7 | 20 | 73 | 145 | 74 | 83 | 102 | 109 | 894 | 953 |

*(Source: http://www.letsrecycle.com/prices/glass/glass-prices)*

Moreover it has been taken into consideration the cross contaminations of recyclables resulting in lower quality since there are recovered from mixed municipal waste. Thus, the market values of recyclables that they have been used at the following calculations are shown in the following table.

**Table 9-41: Market value of recyclables and energy**

| Sell prices for recyclables and products | |
|---|---|
| **Al** | 600 €/t |
| **Fe** | 140 €/t |
| **Plastics** | 27.5 €/t |
| **Paper/Cardboard** | 15 €/t |
| **Glass** | 2 €/t |
| **Compost** | 5 €/t |

The produced electricity from PVs will cover a part of the energy needs of the plant. The solar power plant will be equipped with smart changers that will have the ability to auto-synchronize with the network and the ability to turn off and turn on the power supply flow to the network within the WMC. Electricity consumption will be monitored within the WMC and make sure that production never exceeds the consumption of electricity so that there will never be electricity replenishment in the power grid.

***Revenues from collection companies***

The estimated revenues from collection companies, year 2013, in SDC are presented in the following table (source: Questionnaires).

**Table 9-42: Revenues from collection companies, year 2013**

| Revenues 2013 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | HH | | | Commercial | | other user | fees | Total | |
| | €/Y | €/t | €/cap | €/Y | €/t | €/Y | €/Y | €/Y | €/t |
| Greben Brela d.o.o. | 101,607 | 92 | 60 | 155,365 | 508 | 45,088 | 0 | 302,060 | 214 |
| TOPANA d.o.o | 297,491 | 71 | 16 | 121,554 | 105 | 2,138 | 0 | 421,182 | 79 |

| Revenues 2013 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | HH | | | Commercial | | other user | fees | Total | |
| PEOVIĆA d.o.o | 637,070 | 87 | 26 | 467,620 | 231 | 62,804 | 0 | 1,167,494 | 125 |
| "Gradina - Baska Voda" d.o.o. | 232,280 | 130 | 84 | 433,171 | 873 | 54,081 | 1,027 | 720,559 | 315 |
| TROGIR HOLDING d.o.o | 239,176 | 37 | 18 | 242,158 | 134 | 15,218 | 0 | 496,551 | 59 |
| MAKARSKI KOMUNALAC d.o.o | 663,717 | 114 | 48 | 555,024 | 345 | 123,914 | 0 | 1,342,656 | 181 |
| JELKOM Ltd. Vrboska | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 323,530 | 109 |
| KOMUNALO "STARI GRAD" d.o.o | 64,908 | 39 | 23 | 94,936 | 206 | 39,207 | 1,836 | 200,886 | 95 |
| PODGORA CISTOCA d.o.o | 191,415 | 129 | 76 | 249,226 | 608 | 100,620 | 95,346 | 636,607 | 337 |
| CISTOCA d.o.o SPLIT | 3,162,480 | 48 | 12 | 3,086,464 | 170 | 1,412,775 | 8,413 | 7,670,133 | 91 |
| Komunalo "Grad" d.o.o | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Communal Hvar d.o.o | 215,531 | 57 | 51 | 442,886 | 423 | 56,316 | 0 | 714,732 | 148 |
| | 5,805,675 | **52** | **17** | **5,848,403** | **191** | **1,912,160** | **106,621** | **13,996,390** | **98** |

***Total Revenues***

The total revenues from operation during the period 2023-2047 is presented in the following table:

**Table 9-43: Annual Revenues for the period 2023-2047**

| Year | Revenues - from tarriffs | Revenues – sale of recyclables & compost | Savings due to own consumption of energy produced from PVs | Total Revenues, (€/y) |
|---|---|---|---|---|
| | (€/y) | (€/y) | (€/y) | (€/y) |
| 2023 | 22,450,148 | 4,768,626 | 69,600 | 27,288,374 |
| 2024 | 22,593,775 | 4,747,120 | 69,600 | 27,410,495 |
| 2025 | 22,739,548 | 4,725,716 | 69,600 | 27,534,864 |
| 2026 | 22,887,488 | 4,704,414 | 69,600 | 27,661,502 |
| 2027 | 23,037,619 | 4,683,211 | 69,600 | 27,790,430 |
| 2028 | 23,189,962 | 4,662,109 | 69,600 | 27,921,670 |
| 2029 | 23,344,540 | 4,641,105 | 69,600 | 28,055,246 |
| 2030 | 23,501,377 | 4,620,201 | 69,600 | 28,191,178 |

| Year | Revenues - from tarriffs | Revenues – sale of recyclables & compost | Savings due to own consumption of energy produced from PVs | Total Revenues, (€/y) |
|---|---|---|---|---|
| | (€/y) | (€/y) | (€/y) | (€/y) |
| 2031 | 23,803,315 | 4,627,158 | 69,600 | 28,500,073 |
| 2032 | 24,095,717 | 4,631,312 | 69,600 | 28,796,629 |
| 2033 | 24,393,061 | 4,635,493 | 69,600 | 29,098,154 |
| 2034 | 24,695,433 | 4,639,702 | 69,600 | 29,404,734 |
| 2035 | 25,002,918 | 4,643,937 | 69,600 | 29,716,455 |
| 2036 | 25,315,605 | 4,648,199 | 69,600 | 30,033,404 |
| 2037 | 25,633,582 | 4,652,489 | 69,600 | 30,355,671 |
| 2038 | 25,956,942 | 4,656,805 | 69,600 | 30,683,347 |
| 2039 | 26,285,775 | 4,661,148 | 69,600 | 31,016,523 |
| 2040 | 26,620,177 | 4,665,518 | 69,600 | 31,355,294 |
| 2041 | 26,960,242 | 4,669,914 | 69,600 | 31,699,756 |
| 2042 | 27,287,742 | 4,671,200 | 69,600 | 32,028,542 |
| 2043 | 29,734,637 | 4,672,531 | 69,600 | 34,476,768 |
| 2044 | 29,743,396 | 4,673,907 | 69,600 | 34,486,903 |
| 2045 | 29,752,440 | 4,675,328 | 69,600 | 34,497,369 |
| 2046 | 29,761,771 | 4,676,795 | 69,600 | 34,508,165 |
| 2047 | 29,771,386 | 4,678,306 | 69,600 | 34,519,291 |

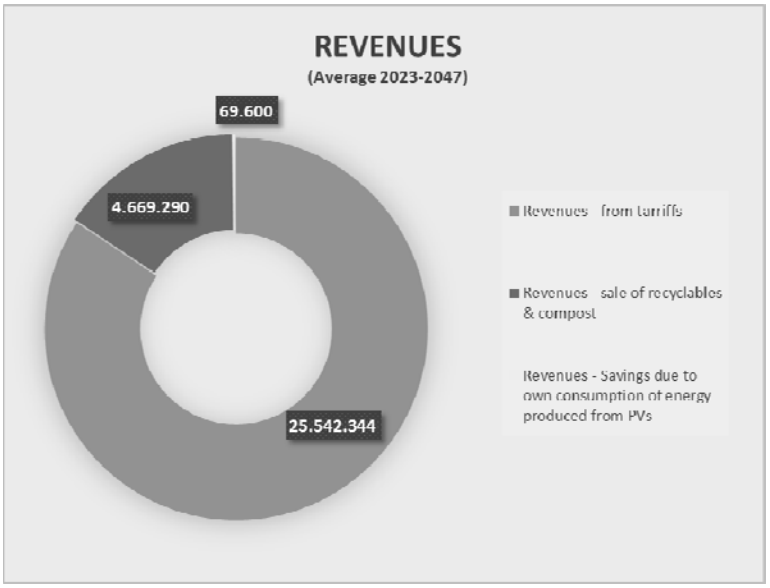



**Figure 9-23: Average Revenues**

### 9.7.2 Transfer Stations

#### 9.7.2.1 Investment Cost of Transfer Stations

The investment cost in terms of both infrastructure and mobile equipment (transfer trucks and containers) are presented in the following Table. The detailed investment cost that is presented in the following table does not include contingencies.

**Table 9-44: CAPEX per TS (€)**

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| **1** | **TS SINJ** | | | | | |
| **1.1** | **Civil works** | | | | | |
| 1.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1 | 292,395 | 292,395 | Eligible |
| 1.1.2 | Container for personnel | item | 1 | 4,000 | 4,000 | Eligible |
| 1.1.3 | Conveyors | item | 1 | 275,000 | 275,000 | Eligible |
| 1.1.4 | Weighbridge | item | 1 | 34,300 | 34,300 | Eligible |
| 1.1.5 | Other (Photovoltaics) | item | 1 | 45,744 | 45,744 | Eligible |
| 1.1.6 | Shed for photovoltaics | item | 1 | 68,092 | 68,092 | Eligible |
| | | | | **Subtotal 1.1: Civil Works** | **719,531** | |
| **1.2** | **Mobile Equipment** | | | | | |
| 1.2.1 | Semitrailers | item | 3 | 100,000 | 300,000 | Non Eligible |
| 1.2.2 | Tractors | item | 2 | 80,000 | 160,000 | Non Eligible |
| 1.2.3 | Truck with trailer | item | 1 | 26,000 | 26,000 | Non Eligible |
| 1.2.4 | Containers 32 m³ | item | 3 | 4,000 | 12,000 | Non Eligible |
| 1.2.5 | Shredder | item | 1 | 75,000 | 75,000 | Non Eligible |
| 1.2.6 | GEODETIC WORKS | item | 1 | 2,444 | 2,444 | Eligible |
| 1.2.7 | Diesel Fuel tank (100l) | item | 1 | 60 | 60 | Eligible |
| | | | | **Subtotal 1.2: Mobile Equipment** | **575,504** | |
| | | | | **Subtotal 1: TS SINJ** | **1,295,035** | |
| **2** | **TS ZAGVOZD** | | | | | |
| **2.1** | **Civil works** | | | | | |
| 2.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1.00 | 315,858 | 315,858 | Eligible |
| 2.1.2 | Container for personnel | item | 1.00 | 4,000 | 4,000 | Eligible |
| 2.1.3 | Conveyors | item | 1.00 | 275,000 | 275,000 | Eligible |
| 2.1.4 | Weighbridge | item | 1.00 | 34,300 | 34,300 | Eligible |
| 2.1.5 | Other (Photovoltaics) | item | 1.00 | 50,760 | 50,760 | Eligible |
| 2.1.6 | Shed for photovoltaics | item | 1.00 | 35,526 | 35,526 | Eligible |
| | | | | **Subtotal 2.1: Civil Works** | **715,444** | |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| **2.2** | **Mobile Equipment** | | | | | |
| 2.2.1 | Semitrailers | item | 5 | 100,000 | 500,000 | Non Eligible |
| 2.2.2 | Tractors | item | 2 | 80,000 | 160,000 | Non Eligible |
| 2.2.3 | Truck with trailer | item | 1 | 26,000 | 26,000 | Non Eligible |
| 2.2.4 | Containers 32 m³ | item | 3 | 4,000 | 12,000 | Non Eligible |
| 2.2.5 | Shredder | item | 1 | 75,000 | 75,000 | Non Eligible |
| 2.2.6 | GEODETIC WORKS | item | 1 | 1,623 | 1,623 | Eligible |
| 2.2.7 | Diesel Fuel tank (100l) | item | 1 | 60 | 60 | Eligible |
| | | | | **Subtotal 2.2: Mobile Equipment** | **774,683** | |
| | | | | **Subtotal 2: TS ZAGVOZD** | **1,490,127** | |
| **3** | **TS BRAC** | | | | | |
| **3.1** | **Civil Works** | | | | | |
| 3.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1 | 323,098 | 323,098 | Eligible |
| 3.1.2 | Container for personnel | item | 1 | 4,000 | 4,000 | Eligible |
| 3.1.3 | Conveyors | item | 1 | 275,000 | 275,000 | Eligible |
| 3.1.4 | Weighbridge | item | 1 | 34,300 | 34,300 | Eligible |
| 3.1.5 | Other (Photovoltaics) | item | 1 | 47,960 | 47,960 | Eligible |
| 3.1.6 | Shed for photovoltaics | item | 1 | 30,789 | 30,789 | Eligible |
| | | | | **Subtotal 3.1: Civil Works** | **715,147** | |
| **3.2** | **Mobile Equipment** | | | | | |
| 3.2.1 | Semitrailers | item | 3 | 100,000 | 300,000 | Non Eligible |
| 3.2.2 | Tractors | item | 1 | 80,000 | 80,000 | Non Eligible |
| 3.2.3 | Truck with trailer | item | 1 | 26,000 | 26,000 | Non Eligible |
| 3.2.4 | Containers 32 m³ | item | 3 | 4,000 | 12,000 | Non Eligible |
| 3.2.5 | Shredder | item | 1 | 150,000 | 150,000 | Non Eligible |
| 3.2.6 | GEODETIC WORKS | item | 1 | 1,863 | 1,863 | Eligible |
| 3.2.7 | Diesel Fuel tank (100l) | item | 1 | 60 | 60 | Eligible |
| | | | | **Subtotal 3.2 Mobile Equipment** | **569,923** | |
| | | | | **Subtotal 3: TS BRAC** | **1,285,070** | |
| **4** | **TS HVAR** | | | | | |
| **4.1** | **Civil Works** | | | | | |
| 4.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1.00 | 346,803 | 346,803 | Eligible |
| 4.1.2 | Container for personnel | item | 1.00 | 4,000 | 4,000 | Eligible |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| 4.1.3 | Conveyors | item | 1.00 | 275,000 | 275,000 | Eligible |
| 4.1.4 | Weighbridge | item | 1.00 | 34,300 | 34,300 | Eligible |
| 4.1.5 | Other (Photovoltaics) | item | 1.00 | 49,360 | 49,360 | Eligible |
| 4.1.6 | Shed for photovoltaics | item | 1.00 | 34,342 | 34,342 | Eligible |
| | | | | **Subtotal 4.1: Civil Works** | **743,805** | |
| **4.2** | **Mobile Equipment** | | | | | |
| 4.2.1 | Semitrailers | item | 3 | 100,000.00 | 300,000.00 | Non Eligible |
| 4.2.2 | Tractors | item | 3 | 100,000 | 300,000 | Non Eligible |
| 4.2.3 | Truck with trailer | item | 1 | 80,000 | 80,000 | Non Eligible |
| 4.2.4 | Containers 32 m³ | item | 1 | 26,000 | 26,000 | Non Eligible |
| 4.2.5 | Shredder | item | 3 | 4,000 | 12,000 | Non Eligible |
| 4.2.6 | GEODETIC WORKS | item | 1 | 150,000 | 150,000 | Eligible |
| 4.2.7 | Diesel Fuel tank (100l) | item | 1 | 1,507 | 1,507 | Eligible |
| | | | | **Subtotal 4.2: Mobile Equipment** | **569,567** | |
| | | | | **Subtotal 4: TS HVAR** | **1,313,372** | |
| **5** | **TS VIS** | | | | | |
| **5.1** | **Civil Works** | | | | | |
| 5.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1 | 238,424 | 238,424 | Eligible |
| 5.1.2 | Container for personnel | item | 1 | 4,000 | 4,000 | Eligible |
| 5.1.3 | Conveyors | item | 1 | 275,000 | 275,000 | Eligible |
| 5.1.4 | Weighbridge | item | 1 | 34,300 | 34,300 | Eligible |
| 5.1.5 | Other (Photovoltaics) | item | 1 | 14,738 | 14,738 | Eligible |
| 5.1.6 | Shed for photovoltaics | item | 1 | 18,947 | 18,947 | Eligible |
| | | | | **Subtotal 5.1: Civil Works** | **585,409** | |
| **5.2** | **Mobile Equipment** | | | | | |
| 5.2.1 | Semitrailers | item | 3 | 100,000 | 300,000 | Non Eligible |
| 5.2.2 | Tractors | item | 1 | 80,000 | 80,000 | Non Eligible |
| 5.2.3 | Truck with trailer | item | 1 | 26,000 | 26,000 | Non Eligible |
| 5.2.4 | Containers 32 m³ | item | 3 | 4,000 | 12,000 | Non Eligible |
| 5.2.5 | Shredder | item | 1 | 150,000 | 150,000 | Non Eligible |
| 5.2.6 | GEODETIC WORKS | item | 1 | 1,623 | 1,623 | Eligible |
| 5.2.7 | Diesel Fuel tank (100l) | item | 1 | 60 | 60 | Eligible |
| | | | | **Subtotal 5.2: Mobile Equipment** | **569,683** | |
| | | | | **Subtotal 5: TS VIS** | **1,155,092** | |

| No | Item | Unit | Quantities | Unit Cost (€) | Cost (€) | Eligible or Non Eligble for funding |
|---|---|---|---|---|---|---|
| **6** | **TS SPLIT** | | | | | |
| **6.1** | **Civil Works** | | | | | |
| 6.1.1 | Site expenditures (excavations, fence, gate, etc.) | item | 1 | 389,054 | 389,054 | Eligible |
| 6.1.2 | Container for personnel | item | 2 | 4,000 | 8,000 | Eligible |
| 6.1.3 | Conveyors | item | 2 | 275,000 | 550,000 | Eligible |
| 6.1.4 | Weighbridge | item | 2 | 34,300 | 68,600 | Eligible |
| 6.1.5 | Water / electricity supply | item | 2 | 17,500 | 35,000 | Eligible |
| 6.1.6 | Other (Photovoltaics) | item | 1 | 134,906 | 134,906 | Eligible |
| 6.1.7 | Shed for photovoltaics | item | 1 | 157,895 | 157,895 | Eligible |
| | | | | **Subtotal 6.1: Civil Works** | **1,343,455** | |
| **6.2** | **Mobile Equipment** | | | | | |
| 6.2.1 | Semitrailers | item | 9 | 100,000 | 900,000 | Non Eligible |
| 6.2.2 | Tractors | item | 9 | 80,000 | 720,000 | Non Eligible |
| 6.2.3 | Truck with trailer | item | 1 | 130,000 | 130,000 | Non Eligible |
| 6.2.4 | Containers 32 m³ | item | 10 | 4,000 | 40,000 | Non Eligible |
| 6.2.5 | Compactor vehicle | item | 1 | 140,000 | 140,000 | Non Eligible |
| 6.2.6 | Shredder | item | 1 | 150,000 | 150,000 | Non Eligible |
| 6.2.7 | GEODETIC WORKS | item | 1 | 2,384 | 2,384 | Eligible |
| 6.2.8 | Diesel Fuel tank (100l) | item | 1 | 60 | 60 | Eligible |
| | | | | **Subtotal 6.2: Mobile Equipment** | **2,082,444** | |
| | | | | **Subtotal 6: TS SPLIT** | **3,425,899** | |
| **7** | **Detailed Design** | | | | | |
| 7.1 | Detailed Design | unit | 1 | 145,000 | 145,000 | Non Eligible |
| 7.2 | Permit fees | unit | 1 | 21,000 | 21,000 | Non Eligible |
| | | | | **Subtotal 7: Detailed Design** | **166,000** | |
| **8** | **Trial Operation** | | | | | |
| 8.1 | Trial Operation | unit | 1 | 106,000 | 106,000 | Non Eligible |
| | | | | **Subtotal 8: Trial Operation** | **106,000** | |
| | | | | **Grand total (1-8)** | **10,236,596** | |

The investment cost for permanent construction works (civil works, plant and machinery) has been set as eligible cost. The cost for mobile equipment (trucks and press containers) which can also been provided from the operator has been set as non eligible.

#### 9.7.2.2 Operating Cost of Transfer Stations

The following table presents the operating cost for the transport of waste from each Transfer Station to WMC and direct transportation cost to WMC. The calculations for this operating cost have been based on the assumptions that transfer takes place 5 days/week or 260 days/year through press containers of 20 t.

**Table 9-45: OPEX per TS (€/t), (t/a, average 2023-2047)**

| Transfer Stations | Transfer to | Waste quantities that must be transferred (t/a) | Unit Cost (€/t) | Total Cost (€/a) |
|---|---|---|---|---|
| TS SPLIT | WMC | 49,088 | 7.3 | 356,282 |
| TS SINJ | WMC | 12,441 | 4.5 | 55,893 |
| TS ZAGVOZD | WMC | 10,833 | 8.3 | 89,629 |
| TS BRAC | WMC | 3,739 | 30.2 | 113,029 |
| TS VIS | WMC | 1,367 | 57.3 | 78,320 |
| TS HVAR | WMC | 4,336 | 39.6 | 171,658 |
| Direct to WMC | WMC | 9,692 | 17.8 | 172,967 |
| **TOTAL** | | **91,495** | **11.3** | **1,037,778** |

### 9.7.3 Collection equipment

#### 9.7.3.1 Investment Cost of Collection equipment

The table below presents the overall investment cost for additional collection equipment required (bins and trucks). The investment cost of collection equipment which presented in the following table is a **non eligible cost**.

**Table 9-46: Investment Cost for collection equipment**

| | Quantities | Unit Cost (€/item) | Total Cost (€) |
|---|---|---|---|
| | (1) | (2) | (3)=(1)*(2) |
| **Collection Bins 1.1m$^3$** | | | |
| Collection Bins for Mixed Waste (1.1m$^3$) | 122 | 220 | 26,840 |
| Collection Bins for Paper (1.1m$^3$) | 3,086 | 220 | 678,920 |
| Collection Bins for Glass (1.1m$^3$) | 663 | 220 | 145,860 |
| Collection Bins for Plastic (1.1m$^3$) | 6,668 | 220 | 1,466,960 |
| Collection Bins for Metal (1.1m$^3$) | 2,636 | 220 | 579,920 |
| Bins for Source Sepatated Biodegradable Waste (1.1 m3) | 688 | 220 | 151,360 |
| **Collection trucks for Recyclables 16m$^3$** | | | |
| Trucks 16 m$^3$ for recyclables collection | 23 | 140,000 | 3,220,000 |
| Trucks 12 m$^3$ for source separated organic waste | 1 | 110,000 | 110,000 |
| Trucks 16 m$^3$ for source separated organic waste | 4 | 140,000 | 560,000 |
| | | | **6,939,860** |

### 9.7.3.2 Operating Cost of collection

In order to calculate the operational collection cost from the collection companies in Split-Dalmatia County for year 2013, information from questionnaires that provided in collection companies from the consultant and data from Croatian Environment Agency were taken.

The following table provides the collection companies which completed questionnaires, the municipalities which served and the total waste that collect for year 2013.

**Table 9-47: Collection companies that completed questionnaires for SDC**

| Authority | Population | Quantities (t) | | | |
|---|---|---|---|---|---|
| | | Total (HH& COMMERCIAL) t/year | HH (76.4%) t/year | Commercial (23.6%) t/year | Other waste t/year |
| Greben Brela d.o.o. | 1,703 | 1,408.82 | 1,103.11 | 305.71 | |
| TOPANA d.o.o | 18,971 | 5,320.00 | 4,165.56 | 1,154.44 | |
| PEOVIĆA d.o.o | 24,270 | 9,312.29 | 7,291.52 | 2,020.77 | |
| "Gradina - Baska Voda" Ltd. | 2,774 | 2,285.28 | 1,789.37 | 495.91 | |
| TROGIR HOLDING d.o.o | 13,189 | 8,322.24 | 6,516.31 | 1,805.93 | 82.42 |
| MAKARSKI KOMUNALAC d.o.o | 13,831 | 7,404.51 | 5,797.73 | 1,606.78 | |
| JELKOM Ltd. Vrboska | 3,581 | 2,963.00 | 2,320.03 | 642.97 | |
| KOMUNALO "STARI GRAD" d.o.o | 2,780 | 2,119.00 | 1,659.18 | 459.82 | |
| PODGORA CISTOCA d.o.o | 2,518 | 1,888.14 | 1,478.41 | 409.73 | |
| CISTOCA d.o.o SPLIT | 258,045 | 83,549.03 | 65,418.89 | 18,130.14 | 1,002.44 |
| Komunalo "Grad" d.o.o | 4,073 | 12,065.28 | 9,447.11 | 2,618.17 | 11.86 |
| Communal Hvar d.o.o | 4,250 | 4829.57 | 3,781.55 | 1,048.02 | |
| **TOTAL** | **349,985** | **141,467** | **110,769** | **30,698** | **1,097** |

*Source: Questionnaires*

The operational collection costs from different companies which were active in Split-Dalmatia County in year 2013 are presented in the following table. More specific this table illustrates:

- Collection cost for Residual waste
- Collection cost for Recyclables
- Total Disposal Cost

**Table 9-48: Operational cost for different companies in SDC**

| Operational cost 2013 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Collection | | Disposal | | Other | Total | |
| | €/t | €/cap | €/Y | €/t | €/Y | €/Y | €/t |
| Greben Brela d.o.o. | 198,081 | 141 | 43,739 | 31 | 18,739 | 260,558 | 185 |
| TOPANA d.o.o | 340,812 | 64 | 77,758 | 15 | 0 | 418,570 | 79 |
| PEOVIĆA d.o.o | 454,681 | 49 | 177,995 | 19 | 0 | 632,676 | 68 |
| "Gradina - Baska Voda" d.o.o. | 484,839 | 212 | 0 | 0 | 30,633 | 515,471 | 226 |
| TROGIR HOLDING d.o.o | 298,042 | 35 | 107,780 | 13 | 0 | 405,822 | 48 |

| Operational cost 2013 | | | | | | | |
|---|---|---|---|---|---|---|---|
| MAKARSKI KOMUNALAC d.o.o | 474,051 | 64 | 155,564 | 21 | 0 | 629,615 | 85 |
| JELKOM Ltd. Vrboska | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| KOMUNALO "STARI GRAD" d.o.o | 0 | 0 | 0 | 0 | 0 | 232,641 | 110 |
| PODGORA CISTOCA d.o.o | 357,984 | 190 | 50,422 | 27 | 0 | 408,406 | 216 |
| CISTOCA d.o.o SPLIT | 2,964,722 | 35 | 2,964,722 | 35 | 0 | 5,929,445 | 70 |
| Komunalo "Grad" d.o.o | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Communal Hvar d.o.o | 653,977 | 135 | 19,427 | | 25,894 | 699,298 | 145 |
| | **6,227,189** | **46** | **3,597,406** | **27** | **75,265** | **10,132,501** | **75** |

#### 9.7.3.3 Operating Cost of direct transportation to WMC

The transportation cost for Towns/Municipalities that will transfer their waste directly to WMC, is 172,967 €/year and is included in the par. 9.7.2.2 - Operating Cost of Transfer Stations.

### 9.7.4 Sorting Plants

The investment cost for the six (6) sorting plants which are under the responsibility of the municipalities estimated approx.. 26.00million EURO.

Regarding the O&M cost (for the 6 MRFs) the following cost categories have been included:

- Labor cost : (175 workers unskilled personnel, 24 skilled workers, 18 engineers / supervisors) 1,413,510 Euros/year;
- Maintenance cost :2,083,507 Euros / Year;
- Monitoring cost :1200,000 Euros / Year;
- Insurance cost :182,307 Euros / Year;
- Administrative cost :424,053 Euros / Year.
- Energy cost :625,052 Euros / year
- Fuel cost :500,042 Euros / year.

In summary the table below illustrates the data mentioned above.

**Table 9-49: Sorting of Recyclables - Operating cost basic assumptions**

| SORTING OF RECYCLABLES (Operating cost for 6 MRFs) | | |
|---|---|---|
| **LABOUR** | | |
| **CATEGORY** | **No** | **EUR/year** |
| WORKER UNSKILLED | 175 | 4.800 |
| DRIVER / HANDLER | 12 | 11.714 |
| WORKER SKILLED | 12 | 11.714 |
| TECHNICIAN | 6 | 16.243 |
| SUPERVISOR | 6 | 16.243 |
| CHIEF ENGINEER | 6 | 16.243 |
| | | |
| **MAINTENANCE** | 2.083.507 | Euro/yr |
| % of investment cost | 8,0% | |
| **ENERGY** | 50 | KWh/t @ 0.12 EUR |
| **INSURANCE** | 182.307 | Euro/yr |
| **FUEL** | 4,0 | l/t @ 1.2 EUR |
| **ADMIN. COST** | 424.053 | Euro/yr |
| ADMIN. COST | 30,0% | |
| **MONITORING** | 120.000 | Euro/yr |

| Calculation of average annual costs | | |
|---|---|---|
| **Cost category (fixed/variable)** | | **EUR/yr** |
| Insurance & Monitoring (fixed) | | 302.307 |
| Labour (fixed) | | 1.413.510 |
| Maintenance (fixed) | | 2.083.507 |
| Energy for … t/year waste (variable) | 104,175 | 625.052 |
| = EUR per t | 3.00 | |
| Fuel for … t/year waste (variable) | 104,175 | 500.042 |
| = EUR per t | 2.40 | |
| Administrative cost (fixed) | | 424.053 |
| **Total EUR** | | **5.348.471** |
| Total Euro | | 5.348.471 |
| **Total EUR/t** | | **51,34** |
| Total Euro/t | | 51,34 |

### 9.7.5 Composting Plants

The investment cost for the composting plants which are under the responsibility of the municipalities estimated approx. 5.00million EURO.

Regarding the O&M cost (for the composting plants) the following cost categories have been included.

- Labor cost :(1 worker unskilled personnel, 2 skilled workers) 94,284 Euros/year;
- Maintenance cost :96,200 Euros / Year;
- Monitoring cost :15,000 Euros / Year;
- Insurance cost :31,835 Euros / Year;
- Administrative cost :5,646 Euros / Year;
- Energy :19,483 Euros / year;
- Fuel :12,989 Euros / year;

In summary the table below illustrates the data mentioned above.

## Table 9-50: Composting Plants - Operating cost basic assumptions

| Composting Plants in LSGU | | |
|---|---|---|
| **LABOUR** | | |
| **CATEGORY** | **No** | **EUR/year** |
| WORKER UNSKILLED | 1 | 4.800 |
| DRIVER / HANDLER | 1 | 11.714 |
| WORKER SKILLED | 1 | 11.714 |
| TECHNICIAN | 0 | 16.243 |
| SUPERVISOR | 0 | 16.243 |
| CHIEF ENGINEER | 0 | 16.243 |
| | | |
| **MAINTENANCE** | 96.200 | Euro/yr |
| % of investment cost | 4,0% | |
| **ENERGY** | 15 | KWh/t @ 0.12 EUR |
| **INSURANCE** | 16.835 | Euro/yr |
| **FUEL** | 1,0 | l/t @ 1.2 EUR |
| **ADMIN. COST** | 18.857 | Euro/yr |
| % of labour cost | 20,0% | |
| **MONITORING** | 15.000 | Euro/yr |

| Calculation of average annual costs | | |
|---|---|---|
| **Cost category (fixed/variable)** | | **EUR/yr** |
| Insurance & Monitoring (fixed) | | 31.835 |
| Labour (fixed) | | 28.228 |
| Maintenance (fixed) | | 96.200 |
| Energy for … t/year composting waste (variable) | 10,824 | 19.483 |
| = EUR per t | 1.80 | |
| Fuel for … t/year composting waste (variable) | 10,824 | 12.989 |
| = EUR per t | 1.20 | |
| Administrative cost (fixed) | | 5.646 |
| **Total EUR** | | **194.380** |
| Total Euro | | 194.380 |
| **Total EUR/t** | | **17,96** |
| **Total Euro/t** | | **17,96** |