European Bank for Reconstruction and Development

KHMELNITSKY SOLID WASTE

Environmental and Social Impact Assessment

70057536\ESIA
FEBRUARY 2020

PUBLIC

European Bank for Reconstruction and Development

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Environmental and Social Impact Assessment

FINAL - PUBLIC

PROJECT NO. 70057536

OUR REF. NO. 70057536\ESIA

DATE: FEBRUARY 2020

WSP

2 London Square
Cross Lanes
Guildford, Surrey
GU1 1UN

Phone: +44 148 352 8400

WSP.com

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Prepared By	Technical Specialists	Technical Specialists	Technical Specialists	
Signature				
Checked By	Jenny Warhurst Matthew Shepherd	Jenny Warhurst	Jenny Warhurst	
Signature				
Authorised By	Rachael Bailey	Rachael Bailey	Rachael Bailey	
Signature				
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INTRODUCTION

1 INTRODUCTION

1.1. THE PROJECT

1.1.1. The European Bank for Reconstruction and Development (herein known as 'the EBRD') is considering providing a senior loan to the communal enterprise Spetskomuntrans (herein known as 'the Company'), a municipal company in the city of Khmelnitsky (herein known as the 'City'). The proposed loan will be used to facilitate the development of an integrated Solid Waste Management (SWM) system by:

- Closing and rehabilitating the existing landfill;
- Constructing a new engineered landfill (the 'proposed landfill'); and
- Construction of a Mechanical Biological Treatment (MBT) Facility.

1.1.2. The development is herein referred to as the 'Project'. The land upon with the Project will be developed is herein referred to as the 'Site'.

1.2 PROJECT NEED

1.1.1. The City's MSW generation was approximately 92,000 tons per annum in 2017 and is anticipated to increase to approximately 107,000 tons per annum within 10 years. Nearly all of this waste generated by the City is landfilled, with no prior treatment at the existing landfill. The existing landfill Site has been in operation since 1956, and is approaching maximum capacity, thus the need for an integrated SWM system is increasingly pressing. There is a lack of operational landfill sites within the vicinity of the City and thus should a replacement landfill not be provided the existing landfill capacity would be exhausted. This would inherently lead to be an increase in illegal waste dumping and fly-tipping.

1.1.2. The existing landfill is not engineered or operated to European Union (EU) Standards and several major fire events have occurred, most recently in April 2018. These events did not result in casualties, but they re-emphasis the need for an integrated SWM system for the City.

1.2. THE PROJECT SETTING

1.2.1. The Project is located to the north of the city of Khmelnitsky, in the Khmelnytsky Oblast in western Ukraine. The existing landfill is located on the northern outskirts of the city, to the north of the Pivdennyi Buh River. The existing landfill lies to the north of Myru Avenue. To the south of Myru Avenue the land slopes downhill towards the Pivdennyi Buh River. The major roads that provide access to the Site are Zakhidna Okruzhna Street and Myru Avenue, which run adjacent to the Site (the south-western edge).

1.2.2. The landfill is located outside the urban area of the city and is bound by agricultural land and/or villages on all sides. The villages surrounding the existing landfill include: Oleshin, Velika Kalinovka, Ivankivtsi, Cherepova and Cherepivka. The villages contain community facilities in the form of schools, an emergency centre, local hospital, dentist and shops. There are residential properties associated with these villages located in the vicinity of the Site, with the closest being located 70m to the south of the existing landfill.

1.2.3. The proposed landfill site will be located directly adjacent to the existing landfill, in the north-east of the site, while the proposed MBT Facility will be located approximately 1km north of the existing landfill site. Figure 1-1 shows the Project location.

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0 1.25 2.5 5 Kilometers

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Key

- Proposed MBT Facility
- Potential Sanitary Protection Zone (MBT)
- Existing Landfill
- Proposed Landfill
- Sanitary Protection Zone
- Potential Sanitary Protection Zone (Landfill)

wsp

Client:

EBRD

Project:

KHMELNITSKY SOLID WASTE PROJECT

Title

Figure 1-1
Project Location Plan

Date: 08/08/2019 Scale: 75,000 @ A4

Drawn: PM Checked: DE Approved: JW

1.3. PROJECT CATEGORISATION

1.3.1. The EBRD Environmental and Social Policy (ESP) categorises projects as A, B, C or FI to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. The categorisation corresponds to the nature, location, sensitivity, scale and likely significance of adverse effects of the project.

1.3.2. The EBRD has assigned the Project a Category A status, as it is a large scale municipal solid waste processing and disposal Project and the potential effects associated with the project cannot be readily identified and assessed. This categorisation means that a comprehensive ESIA must be prepared and a review of associated documents must be carried out, followed by their public disclosure for a minimum period of 120 days.

1.3.3. Category A projects are defined as follows:

"Developments on "greenfield" land, or major extension or transformation-conversion projects, which may give rise to significant or long-term environmental and social risks and impacts".[1]

1.2.1. The Project falls under Annex II of the EIA Directive 2014 as follows:

11 (b) Installation for the disposal of waste (projects not included in Annex I[2]*).*

1.2.2. Annex I of the EIA directive includes waste facilities for irradiated nuclear fuel, hazardous materials and for incineration or chemical treatment.

1.4. EBRD PROJECT REQUIREMENTS

The Project will be structured to comply with EBRD policy such as the EBRD Environmental and Social Policy and Performance Requirements (PRs) 2014. As well as this the project will be structured to ensure compliance with all applicable EU and Ukrainian legislation, inclusive of:

- EU:
  - EU Directive 2014/52/EU – The EIA Directive ;
  - EU Directive 2008/98/EC – The Waste Framework Directive;
  - EU Directive 1999/31/EC – The Landfill Directive;
  - EU Directive 2010/75/EU – The Industrial Emissions Directive; and
  - EU Directive 2006/118/EU – The Groundwater Directive.
- Ukrainian:
  - Law No. 2059-VIII 'On Environmental Impact Assessment'; and
  - Law No. 187/98-VR 'On Waste'.

[1] EBRD (2019). Environmental and Social Policy.

[2] European Parliament (2014). EIA Directive.

1.4.1. Where Ukrainian regulations differ from EU substantive environmental standards, the Project will be expected to meet whichever is the more stringent.

1.4.2. Further details on the legislative and policy requirements are outlined in Chapter 4.

1.5. THE COMPANY

1.5.1. The Company will be the developer for the Project. The company is a communal enterprise in the City, that currently undertakes the collection, treatment and disposal of waste in the City. The Company holds contracts with approximately 92,249 households and approximately 2,891 commercial organisations and collects waste from approximately 1,541 locations throughout the City.

1.5.2. The Company operates a fleet of 29 collection vehicles, that operate seven days a week, for 360 days per year, along 17 collection routes. The collection frequency and timing of collections is variable. The company also operates the existing landfill. It owns one landfill compactor which is 40-years old. This results in waste not being regularly compacted, thereby reducing the efficiency of the existing landfill. Leachate is currently collected and recirculate into the existing landfill.

1.6. FEASIBILITY STUDY

1.6.1. Two feasibility studies have been undertaken in relation to the Project. These were undertaken independently from this ESIA and have been used to inform elements of the ESIA preparation. One feasibility study was prepared in relation to the proposed MBT Facility and the other in relation to the proposed landfill:

- Centre Ltd Eco Consulting – 'Landfill renovation to prevent emergency environmental situation' Feasibility study on the Proposed Landfill, prepared December 2018; and
- R&D Technological Institute of Urban Municipal Economy – 'Feasibility study for solid municipal wastes processing facility construction (wastes sorting line aimed to retrieve raw materials finished products from disposed domestic wastes' Feasibility study on the Proposed MBT Facility, prepared August 2018.

1.7. RESPONSIBLE BODIES

1.7.1. A summary of key organisations and their function in relation to the Project, are presented in Table 1-1 below.

Table 1-1 – Summary of Responsible Bodies

Organisation	Project Function	Reporting Line
City of Khmelnitsky	Local Authority.	Regional Government
Ministry of Ecology and Natural Resources	Project approval.	State / National Government
Bio Gas Energy	Business within the existing landfill.	Spetskomuntrans
Spetskomuntrans	Operator of the Project.	City of Khmelnitsky

Organisation	Project Function	Reporting Line
Waste Segregation Organisations	Business within the existing landfill.	Spetskomuntrans
Local Village Councillors (and head of Village Council)	Representative of local communities.	City of Khmelnitsky
State Ecology Inspection	Reviewed the existing landfill and determined it was a hazard to the region (actions were recommended).	Regional Government
Local Businesses	Both those with the potential to be permanently or temporarily effected as a result of the Project.	City of Khmelnitsky
Smart Lex Group	Preparation of the OVD (national EIA).	WSP
R&D Technological Institute of Urban Municipal Economy	Preparation of the MBT Feasibility Study.	City of Khmelnitsky
Centre Ltd Eco Consulting	Preparation of the Landfill Feasibility Study.	City of Khmelnitsky

1.8. PURPOSE OF THIS REPORT

1.8.1. This ESIA has been prepared in line with EU and Ukrainian environmental standards that are relevant to the Project. This ESIA has been informed by the following reports included in the submission:

- Stakeholder Engagement Plan (SEP);
- Hydrogeological Risk Assessment (HRA);
- Livelihood Restoration Framework (LRF);
- Environmental and Social Management Plan (ESMP);
- Environmental and Social Action Plan (ESAP); and
- Performance Requirements (PR) Compliance Assessment Report.

1.8.2. This ESIA presents the findings of the assessment of the following environmental and social topics, including the potential for significant effects and suitable mitigation measures:

- Consideration of Alternatives (Chapter 3);
- Air Quality (Chapter 6);
- Noise and Vibration (Chapter 7);
- Ecology (Chapter 8);
- Cultural Heritage (Chapter 9);
- Landscape and Visual (Chapter 10);
- Surface Water Environment (Chapter 11);
- Geology and Hydrogeology (Chapter 12);
- Social (Chapter 13);
- Materials and Waste (Chapter 14);

- Climate Change (Chapter 15); and
- Cumulative Effects (Chapter 16).

1.8.3. Chapter 2, Description of the Project, presents an overview of the Project, baseline information and details on construction activities and programme.

1.8.4. Chapter 3, Consideration of Alternatives, provides information on alternative sites and technologies that are being considered for the proposed design.

1.8.5. Chapter 4, EBRD Performance Requirements, EU Standards, Legislative and Policy Context, details the national and international environmental legislation that is of relevance to the Project. It also details EBRD policy and requirements.

1.8.6. Chapter 5, Approach to ESIA, details the ESIA methodology for the environmental assessment and provides a record of the consultation undertaken.

1.8.7. Chapter 17, Summary, presents a summary of the potential impacts and suitable mitigation measures identified in each assessment.

1.8.8. In parallel to the ESIA process Smart Lex Group are preparing the OVD (national Environmental Impact Assessment (EIA)). The OVD for the Project is being developed in accordance with the in accordance with Article 4 of Ukrainian Law No. 2059-VIII 'On Environmental Impact Assessment'. As part of the OVD process a notice was submitted to the Ministry of Ecology and Natural Resources to register the Project in the Unified Register of OVD. The notice was submitted on the 26th November 2019 and the registration number for the Project was 201911224854. The OVD report is due to be submitted in 2020.

2

DESCRIPTION OF THE PROJECT

2 DESCRIPTION OF THE PROJECT

2.1 INTRODUCTION

2.1.1. This chapter provides a description of the Project, including a description of how the Project would be constructed. It also sets out the assumptions used for the assessments, where this information is yet to be confirmed.

2.2 OVERVIEW OF THE PROJECT

2.2.1. The Project will result in the creation of a modern integrated Solid Waste Management (SWM) system for the City. Figure 1-1 shows the Project Boundary, divided into its three primary elements, the phasing of these elements is detailed in 2.2.19. The Project consists of the following elements:

- **Element 1** - The closure, capping and rehabilitation of the existing landfill which will include:
  - The capping of the disposal area, including measures to prevent excessive rainwater input and leachate generation, and to prevent interference with the Landfill Gas (LFG) Collection System;
  - Transfer of the LFG Collection System to a new location; and
  - Reshaping the existing landfill body to stabilise the slope and prevent sliding, including surface water runoff measures and treatment options for the existing leachate pond from which leachate is currently collected for recirculation.
- **Element 2** - Construction of a new engineered landfill cell (total capacity will be between 500,000 to 700,000 tons of MSW), which will include:
  - A natural geological barrier, improved with geosynthetic clay liners and a High-Density Polyethylene (HDPE) lining system;
  - A leachate collection drainage layer and piping system for leachate collection; and
  - A LFG collection layer and system (above the waste layer).
- **Element 3** - Construction of a proposed MBT Facility to the north of the existing landfill. The proposed MBT facility will have a processing capacity of approximately 107,000 tons of MSW per annum (approximately 300 tons per day) and will include:
  - Mechanical processing (sieving) with a material recovery sorting line to extract materials which are suitable for recycling;
  - Refuse Derived Fuel (RDF) fuel production; and
  - Composting of the MSW organic fractions by aeration and stirring enclosed in metal sheets.
- Further elements include:
  - Upgrading equipment with at least one additional bulldozer and a compactor;
  - The provision of road improvements, signage, fencing and fire prevention / fire extinguishing measures; and
  - Overall improvements to the operational procedures.

2.2.2. In total, the Project will cover an area of 20.5 hectares (ha), divided into the following components:

- Closure and rehabilitation of existing landfill – 8.9 ha;
- Proposed Landfill – 6 ha; and
- Proposed MBT Facility – 5.6 ha.

2.2.3. Figure 1-1 show the elements of the Project and includes the physical footprint of the Project.

ELEMENT 1 - CLOSURE AND REHABILITATION OF THE EXISTING LANDFILL

2.2.4. The closure and rehabilitation of the existing landfill will take 3-4 years to complete (the biological rehabilitation taking the longest portion of this period), this is considered completed when it reaches a permeant stable state. The rehabilitation period is divided into two stages; technical and biological.

2.2.5. In accordance with national policy "State Sanitary Rules for Planning and Construction in Urban Areas", the existing landfill has a Sanitary Protect Zone (SPZ) of 500m. In total, approximately 27 houses are located within the SPZ for the existing landfill. Whilst it may be possible to reduce the extent of the SPZ for the existing landfill a specific legislative process would need to be followed.

Technical Stage

2.2.6. The technical stage will consist of the following processes:

- Slope stabilisation;
- Terracing;
- Construction of the de-gassing system; and
- Implementation of re-cultivation multifunctional screen.

2.2.7. Once the backfilling of the existing landfill has been carried out, a slope of 18^{o} will be formed using bulldozers. Once slope stabilisation is complete the multifunctional protective screen will be layered over the existing landfill. The protective screen will consist of six layers, with a total thickness of approximately 0.8m which will be comprise of:

- A levelling layer of loam, sealed;
- Gas drainage system for the collection and discharge of landfill gas;
- A High-Density Polyethene (HDPE) geomembrane to provide waterproofing;
- A drainage layer of sand, to draining surface water;
- A loam reclamation layer; and
- A top layer of soil.

2.2.8. The liquid petroleum gas (LPG) pipeline present beneath the existing landfill will be transferred to a new location. The new location, and the methodology for the transfer, had not been determined at the time of writing. It is understood that the new location and the methodology for the transfer of the LPG pipeline will be determined before the end of 2019.

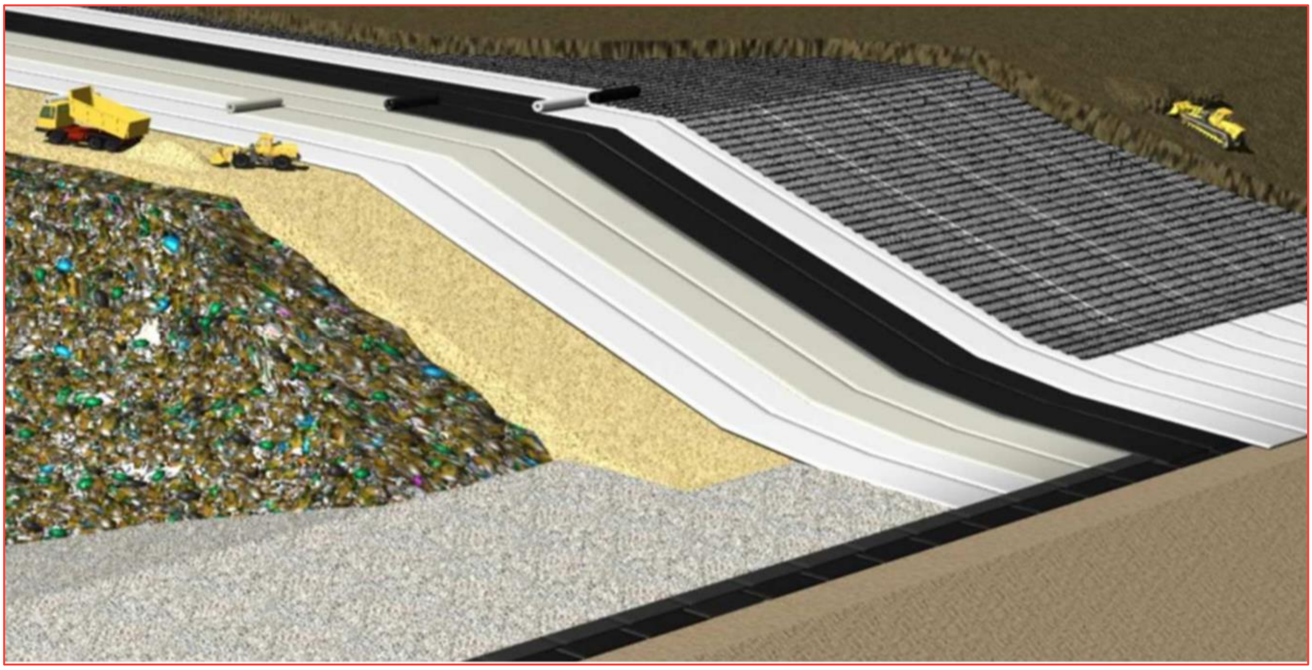

Figure 2-1 – Existing Landfill Capping: Respresentative Image of the Layered Protective Screen[3]

Biological Stage

2.2.9. The biological stage will begin after the technical stage has been completed. It will cover area of approximately 3.8 ha. The area will be terraced and plateaued, and grasses and shrubs will be planted on the slopes of the existing landfill.

2.2.10. The primary purpose of the biological stage is to restore the land.

ELEMENT 2 - CONSTRUCTION OF THE PROPOSED LANDFILL

1.8.9. The proposed landfill will be an engineered landfill with treatment and protection measures incorporated. It will be designed to meet all applicable EU standards.

1.8.10. In accordance with national policy "State Sanitary Rules for Planning and Construction in Urban Areas", the proposed landfill will require an SPZ of approximately 500m. There are currently no permanent houses within the 500m SPZ for the proposed landfill, however, there are some cabins which currently accommodate Roma waste pickers. The size of the SPZ will be confirmed by Spetskomunrans.

1.8.11. The landfill will consist of two sub-cells (2.8ha and 2.3ha with the remaining site area being used for associated infrastructure). The total capacity of the sub-cells will be between 500,000 to 700,000 tons

[3] Source: Centre Ltd Eco Consulting (2018). Landfill Renovation to Prevent Emergency Environmental Situation.

of MSW (non-hazardous waste). The sub-cells will be levelled by bulldozer, with the sub-cell bowls shaped and a covering of geotextile and HDPE geo-membrane. The cell embankment will consist of loamy soils. A drainage system will be installed which will connect to a leachate collection tank.

2.2.11. Fire water reservoirs will be constructed. These will consistent of two ponds which will provide a three-hour supply of water which can be used for fire extinguishing.

2.2.12. The proposed landfill will consist of the following elements:

- The landfill cell;
- Site access station;
- Vehicle washing area;
- Equipment storage and administration facilities;
- Electrical and mechanical workshops;
- Leachate pumping station (to pump leachate to the MBT site for treatment);
- Leachate drainage and collection system;
- Fire water reservoirs;
- Groundwater monitoring wells;
- Transformer sub-station; and
- Access roads.

ELEMENT 3 - CONSTRUCTION OF THE PROPOSED MBT FACILITY

2.2.13. The proposed MBT facility will consist of the following elements:

- Mechanical processing (sieving) with a material recovery sorting line to extract materials which are suitable for recycling;
- Refuse Derived Fuel (RDF) fuel production; and
- Composting of the MSW organic fractions by aeration and stirring enclosed in metal sheets.

2.2.14. In accordance with national policy “State Sanitary Rules for Planning and Construction in Urban Areas”, the proposed MBT facility will require a Sanitary Protect Zone (SPZ) of approximately 500m. Whilst there are no houses within the 500m SPZ there are a small number of gardens, however, provided the development is located away from the northern boundary of the proposed MBT Facility site, the SPZ should not extend into these gardens. The size of the SPZ will be confirmed by Spetskomunrans.

2.2.15. The construction of the proposed MBT facility will be divided into four elements:

- Site clearance;
    - Backfilling with local soil;
    - Waste sorting and processing facility;
    - Waste receiving facility;
    - Ancillary technical premises;
- Leachate collection and treatment system;
    - The external walls and roofing enclosing the facility;
    - Driveways of an appropriate design to be used by waste vehicles and fire-fighting vehicles;
    - Walking passages;
- Earthworks and drainage systems;

- Staff rest area (15m^2) and a staff smoking area (15m^2);
  - Tree planting; and
  - Security systems (fencing, alarms and Closed-Circuit Television (CCTV))

2.2.16. Landscaping measures, such tree planting and reseeding, will be included to improve the aesthetics of the proposed MBT facility.

2.2.17. Site access will be via the existing roads and access points.

CONSTRUCTION PROGRAMME

2.2.18. The Construction Phase is expected to begin in 2021/2022, and last between two and four years, with completion in either 2023/2024 or 2025/2026. The proposed landfill is expected to be constructed first and become operational in 2021. The construction of the proposed MBT facility will follow. The construction activities for the proposed landfill and MBT facility will be completed ahead of the closure, capping and rehabilitation of the existing landfill. A detailed construction programme will be available at the detailed design stage.

PROPOSED KEY CONSTRUCTION ACTIVITIES

2.2.19. At the time of writing the construction activity details were not fully known, so assumptions were made based on other projects of this nature. The assumed likely key construction activities are summarised in the following sections:

- Closure and rehabilitation of the existing landfill and construction of the proposed landfill:
  - Site clearance and preparation works;
  - Wheel washing;
  - Radiation monitoring;
  - Plumbing and Treatment operations (including leachate drainage)
  - Service road construction;
  - Security measures;
  - Operation of plant and construction vehicles;
  - Materials disposal and transport;
  - Capping layer installation;
  - New cell protective layer installation;
  - Auxiliary facilities construction;
  - Earthworks; and
  - Planting of shrubs.
- Construction of the proposed MBT facility:
  - Site clearance and preparation works;
  - Wheel washing;
  - Operation of plant and construction vehicles;
  - Materials disposal and transport;
  - Road construction, surfacing and utilities installation; and
  - Earthworks.

2.3 AIMS OF THE PROJECT

2.3.1. The existing landfill is approaching maximum capacity and the City of Khmelnitsky's MSW waste generation is set to increase in coming years from approximately 94,000 tons per annum (recorded in 2017) to 107,000 tons per annum by 2027. The principal aim of the Project is to provide waste processing capacity within the City of Khmelnitsky. The project also aims to improve the waste management operations and introduce recycling capabilities to the City's waste management infrastructure (in the form of the proposed MBT Facility) and divert waste from landfill. Furthermore, it is anticipated that the Project, once constructed, will be integrated in the regional SWM Plan for the Khmelnitsky Oblast.

2.4 BASELINE: THE EXISTING SITE

SITE LOCATION

2.4.1. The Site is located outside the urban area of the city and is bound by agricultural land and/or villages on all sides. The villages surrounding the Site include: Oleshin, Velika Kalinovka, Ivankivtsi, Cherepova and Cherepivka. The villages contain community facilities in the form of schools, an emergency centre, local hospital, dentist and shops.

Existing and Proposed Landfill

2.4.2. The existing landfill is located to the North of the City of Khmelnitsky (latitude 49o 27' 34'' N; longitude 26o 57' 42'' E (the existing landfill site entrance)) with the nearest settlement being Oleshin village. The closest residential properties are located approximately 70m south of the existing landfill boundary, as shown in Figure 2-2. The existing landfill is located within the City of Khmelnitsky administrative boundary, whilst the proposed landfill is slightly outside of the administrative boundary.

2.4.3. The proposed landfill will be located adjacent to the north of the existing landfill (latitude: 49o 27' 49'' N; longitude 26o 58' 5'' E (the centre of the proposed landfill site)), with a combined site area of 14.9ha (6ha for the proposed landfill).

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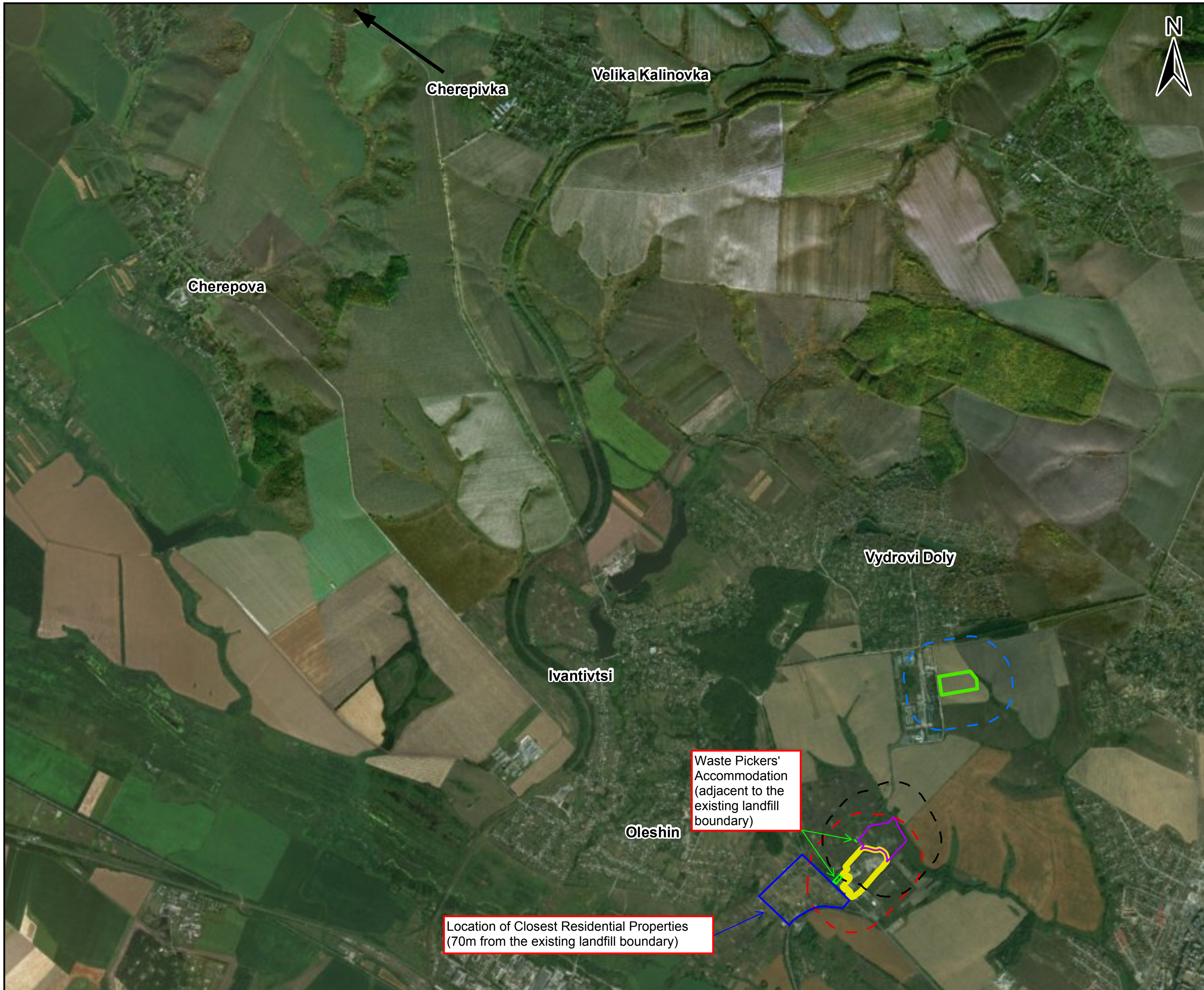


0 1.25 2.5 5 Kilometers

Key

- Proposed MBT Facility
- Potential Sanitary Protection Zone (MBT)
- Existing Landfill
- Proposed Landfill
- Sanitary Protection Zone
- Potential Sanitary Protection Zone (Landfill)

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

wsp

Client:

EBRD

Project:

KHMELNITSKY SOLID WASTE PROJECT

Title

Figure 2-2
Location of Residential Properties

Date: 08/08/2019 Scale: 75,000 @ A4
Drawn: PM Checked: DE Approved: JW

2.4.4. The existing landfill is bounded by:

- Agricultural land to the north, east and west[4];
- Trees and greenhouses to the south-east; and
- Mira Avenue, a boundary of trees and residential dwellings to the south (the closest residential dwelling is located approximately 70m south of the existing landfill boundary).

2.4.5. Approximately 27 of the houses located to the south of Mira Avenue are located within the SPZ for the existing landfill. During discussions with local residents, it was established that many of these residential dwellings are likely to be legal, i.e. where land owners initially built houses on the land designated as 'agricultural use' but then subsequently changed the land use to 'residential use'. Based on the existing legislation and Local Development Plan approved by the village council, the owners of the land plots that surround the Project, can construct summer houses (i.e. not a permanent residential structure) on their land even when it is designated as 'agricultural use'. However, permanent residential structures can only legally be built only on land designated as 'residential use'.

2.4.6. The land on which is the existing landfill is located is designated as 'industrial use'. With regards to the land for the proposed landfill Spetskomuntrans is carrying out a land acquisition programme. Prior to the Project all of the land officially designated as being in 'agricultural use', although in reality the land plots were not used for agricultural activities, due to their proximity to the existing landfill. After the acquisition has been agreed, the land plots ownership rights are being transferred to Spetskomunstrans, and the land use is then changed to 'industrial use'.

2.4.7. Waste pickers work on the existing landfill site and have been observed to reside in cabins within 5-10m from the existing landfill boundary. Eight of these cabins are located to the west of the main entrance to the existing landfill site, with another four being located near the second (gated) entrance to the existing landfill site.

2.4.8. The existing landfill is located on a slight inclined slope (decreasing from south to north). Further out from the existing landfill notable features include:

- The City of Khmelnitsky and the River Pivdennyi Buh to the south and south-west;
- The Mikrorayon Dyvokray urban cluster to the east;
- A former industrial site, containing a mix of disused facilities and new smaller organisations, and the Vydrovi Doly urban cluster to the north; and
- The Oleshin village cluster and woodland to the south, west and north-west.

Proposed MBT Facility

2.4.9. The proposed MBT facility is located to the north west of the City of Khmelnitsky (latitude 49o 28' 31'' N; longitude 26o 58' 35'' E (the centre of the proposed MBT facility site)) with the nearest settlement being Vydrovi Doly, located approximately 650m to the north. However as aforementioned, there are a small number of gardens within the indicative 500m SPZ surrounding the proposed MBT facility, however, provided the development is located away from the northern boundary of the MBT site, the

[4] It should be acknowledged that there is the potential for the land to the west of the existing and proposed landfill to be developed in due course. The owners of the land are entitled to build on their land plots.

SPZ should not extend into these gardens. The proposed MBT Facility is located outside of the administrative boundary of the City of Khmelnitsky. The proposed MBT Facility is adjacent to former industrial site which is occupied by a number of smaller organisations. The total area of the proposed MBT Facility is 5.6 ha. The proposed MBT Facility is not directly accessible from Mira Avenue with the adjacent roads being poorly maintained gravel / dirt tracks. The proposed MBT Facility is bounded by:

- The former industrial facility to the west;
- Agricultural land to the north, east and south; and
- A small area of woodland to the east.

2.4.10. Further out from the proposed MBT Facility notable features include:

- The Vydrovi Doly urban area to the north;
- Agricultural land and the Lisovi Hrynivtsi village to the east;
- Agricultural land and the existing landfill to the south; and
- Agricultural land and woodland to the west.

2.4.11. With regards to the land for the proposed MBT Facility Spetskomuntrans is carrying out a land acquisition programme. Prior to the Project all of the land officially designated as being in 'agricultural use'. After the acquisition has been agreed, the land plots ownership rights are being transferred to Spetskomunstrans, and the land use is then changed to 'industrial use'.

CAPACITY

2.4.12. The existing landfill site receives all of the City of Khmelnitsky's MSW waste arisings (92,000 tons in the year of 2017). The Project will have the following capacities:

- Proposed MBT Facility – approximately 107,000 tons of MSW per annum; and
- Proposed landfill – total capacity between 500,000 to 700,000 tons of MSW (estimated to last for between 5 to 7 years).

EXISTING LANDFILL DESIGN

2.4.13. The existing landfill has been operation since 1956. It has exceeded its lifespan and is now considered an un-designed landfill. None of the original design documentation is available, and as such the structure of the existing landfill is unknown.

EXISTING LANDFILL OPERATIONS

2.4.14. Current operations at the existing landfill consist of the untreated landfilling of waste. The landfill rises approximately 30ms above ground level on the northern side, as shown in Figure 2-3. The existing landfill is not engineered or operated to European standards.

2.4.15. Due to the lack of engineered measures, there have major fires on the site. The most recent major fire occurred in April 2018.

2.4.16. There is a single compactor in operation on Site. Due to the volume of waste arisings and the age of the compactor, the waste compacting process is often not completed, and even when it is the waste is not optimally compacted.

2.4.17. The existing landfill has a SPZ of 500m (as shown in Figure 1-1). The SPZ is established in accordance with legislation and its purpose is to provide a buffer between industrial facilities and nearby residential areas, in order to reduce the potential for the facility to result in adverse human health and environmental effects. The presence of residential areas, recreational zones, schools, hospitals or food production facilities is prohibited within the SPZ of an industrial enterprise. However, this prohibition has not been enforced in relation to the existing landfill and there are several residential dwellings located within the SPZ. Some of these dwelling are constructed on residential land and are therefore 'legal', while others are built on agricultural and are therefore considered 'illegal'.

Figure 2-3 – Existing Landfill (Northern Face)

2.4.18. A privately-owned gas collection firm (Bio Gas Energy) operates a biogas plant on the existing landfill. An image of the Bio Gas Energy Facility is shown in Figure 2-4. In addition, a leachate collection system is in operation.

2.4.19. Leachate ponds, as shown in Figure 2-5, are located to the northern extent of the existing landfill (at the base of the northern face). Leachate is collected from the leachate ponds and deposited on top of the existing landfill as a fire prevention measure. The collection vehicle used for the transfer of the leachate is shown in Figure 2-6.

Figure 2-4 – Bio Gas Energy Facility

Figure 2-5 – Leachate Collection Pond

Figure 2-6 – Leachate Collection Vehicle

2.4.20. A team of 20 to 60 Roma waste pickers work at the existing landfill (numbers vary throughout the year). The waste pickers work in shifts collecting plastics and other materials for re-use from the existing landfill, as shown in Figure 2-7. The waste pickers are employed by two private companies who are subcontracted by Spetskomuntrans.

Figure 2-7 – Waste Pickers at Existing Landfill

2.4.21. Waste collection is carried out by a fleet of 29 waste collection vehicles, one of which is shown in Figure 2-8. The operational periods for collection are 360 days a year (Monday-Sundays), collecting from 1,541 private locations and 233 public locations throughout the City.

Figure 2-8 – Waste Collection Vehicle

3

CONSIDERATION OF ALTERNATIVES

3 CONSIDERATION OF ALTERNATIVES

3.1 INTRODUCTION

3.1.1. This chapter outlines the main alternatives to the Project that have been considered by the Applicant, together with the principal reasons for proceeding with the Project.

3.2 REQUIREMENT FOR THE CONSIDERATION OF ALTERNATIVES

3.2.1. The EIA Directive states that an EIA should include:

"… a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".

3.3 DO-NOTHING SCENARIO

3.3.1. A 'do-nothing' scenario has been considered as an alternative to the Project. The following conditions are likely to remain or occur if the Project does not proceed:

- The City's waste generation would still increase to approximately 107,000 times per annum (within 10 years of 2017) and continue to push the existing landfill beyond its maximum capacity;
- The capacity of the existing landfill would be exhausted and the search for an alternative landfill would need to commence;
- As there is a lack of available operational landfill sites within the vicinity of the City, the cost of waste disposal would increase as waste sites that are further from the City would have to be used. There is also likely to be an increase in illegal waste dumping sites and fly-tipping, which would worsen existing pollution issues and creating new sources of pollution;
- The current leachate treatment system and the associated issues would continue, potentially resulting in water and ground pollution and human health impacts; and
- Without providing an engineered landfill constructed and operated in accordance with EU standards, adverse effects on the surrounding environment, ground conditions and local communities would continue, resulting in adverse effects.

3.3.2. In summary, the existing waste processing and disposal facilities are not sustainable and have reached the limits of capacity. Without implementation of the Project there is likely to be an increase in adverse environmental effects. Therefore, the 'do nothing' scenario is not an acceptable alternative.

3.4 ALTERNATIVE SITES

THE PROPOSED LANDFILL

3.4.1. The feasibility of alternative landfill sites has not been considered as part of this ESIA. The proposed landfill location was considered to be the only practicable location, as it has existing waste operation systems, and it provides a valuable opportunity to reduce adverse effects associated with the existing landfill, while providing new additional waste management capacity.

THE PROPOSED MBT FACILITY

3.4.2. Three prospective locations were considered for the proposed MBT Facility, and Location 1 was selected. the three locations are summarised below. The approximate locations are shown on Figure 3-1.

Location 1

3.4.3. Location 1 is located 1.5km to the north of the existing landfill site, adjacent to a former industrial site and is 5.6ha in size. At the time of writing the land was privately owned and being used as agricultural land. Access to the site is via a poorly maintained gravel / dirt track, which connects to the existing road network in the area of the existing landfill. The nearest residential facilitates are 500m from the location in Vydrovi Doly and the surroundings areas is made up of the former industrial site, to the west, which contains a mix of disused facilities and small businesses, and agricultural land to the north, east and south.

3.4.4. Location 1 has been chosen as it is a shorter distance to the City compared to Locations 2 and 3. This location is also expected to have lower transportation and materials costs than the other locations, during both construction and operation.

Location 2

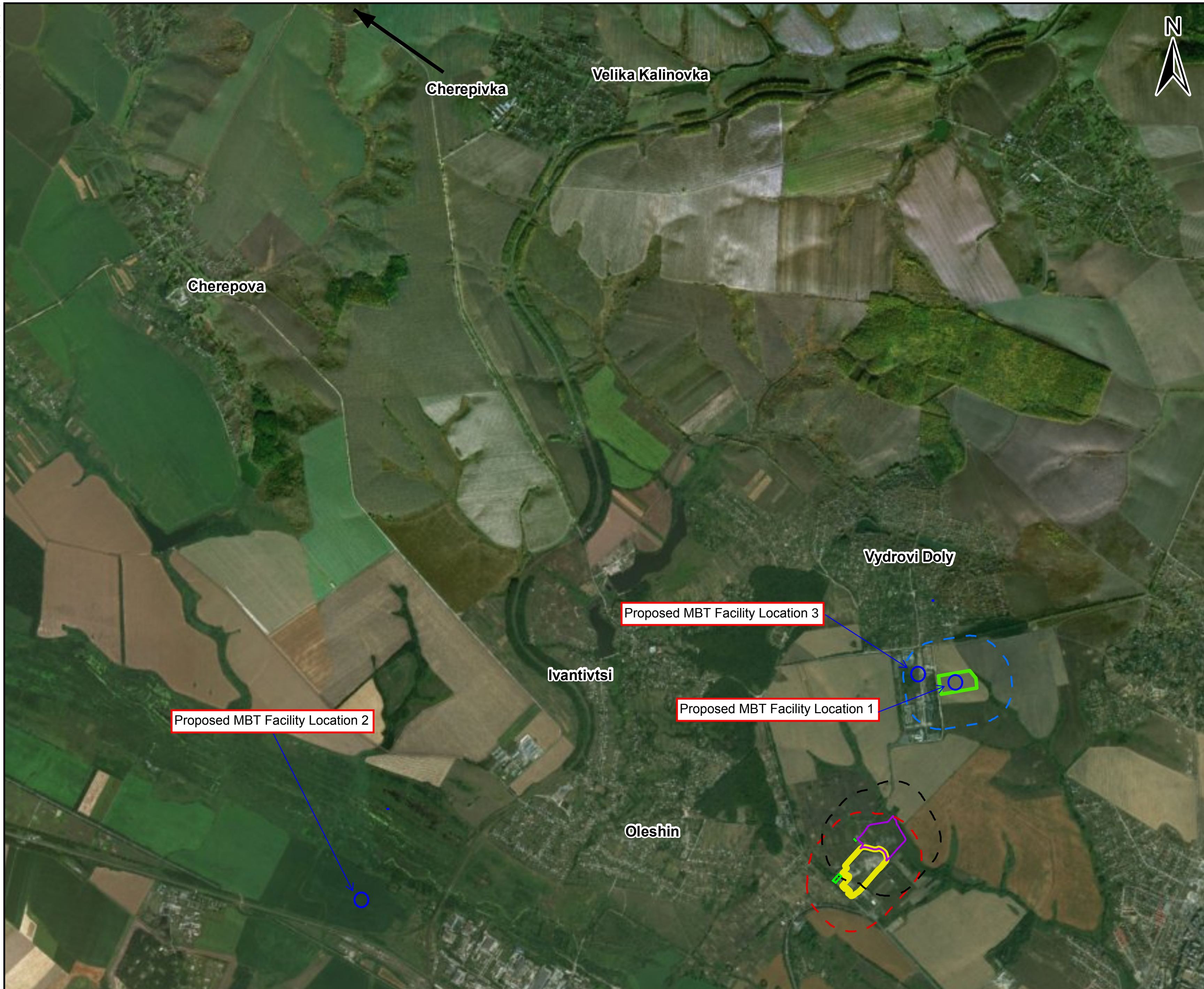
3.4.5. Location 2 is located to the west of Oleshin village and is bounded by the railway line. The distance from the centre of the City of Khmelnitsky is approximately 9km. Location 2 is bound by the railway line to the south, open field, agricultural land and forest to the north, east and west. The site is privately owned and is currently unproductive land not being used for any commercial operation.

3.4.6. Location 2 was not chosen as the Proposed MBT facility location, as it is further from the proposed landfill and the City than Location 1.

Location 3

3.4.7. Location 3 is located 1.5km to the north of the existing landfill, within the former industrial site. Acquisition of an area within the industrial facility was considered. However, this was determined to be not be feasible due to the financial costs of the remediation works, and because it would displace the organisations operating within the industrial facility.

Date Saved: 08/08/2019



0 1.25 2.5 5 Kilometers

Key

- Proposed MBT Facility
- Potential Sanitary Protection Zone (MBT)
- Existing Landfill
- Proposed Landfill
- Sanitary Protection Zone
- Potential Sanitary Protection Zone (Landfill)

wsp

Client:

EBRD

Project:

KHMELNITSKY SOLID WASTE PROJECT

Title

Figure 3-1
Approximate Location of Alternative Sites

Date:	30/10/2019			Scale:	75,000 @ A4
Drawn:	PM	Checked:	DE	Approved:	JW

3.5 TECHNOLOGY ALTERNATIVES

THE PROPOSED LANDFILL

3.5.1. Alternative technologies to the proposed landfill have not been considered in this assessment, as regardless of the technologies used in the proposed MBT Facility, there will inevitably be a portion of MSW arisings that require landfill disposal. In the absence of a MBT facility the operational lifespan of the proposed landfill would be reduced from between 7 and 10 years to between 5 and 7 years.

THE PROPOSED MBT FACILITY

3.5.2. Different MBT Facility processes have been considered in both this assessment and the MBT Facility Feasibility Study (2018) produced by the R&D Technological Institute of Urban Municipal Economy. A range of biological, thermal, chemical, mechanical processing facilities were appraised at as part of the MBT Facility Feasibility Study (2018). As part of the MBT Facility Feasibility Study (2018) each of these processing facilities were considered relative to the composition of MSW received at the existing landfill. The results of the compositional analysis are available in the MBT Facility Feasibility Study (2018). Table 3-1 depicts the average composition of waste received at the existing landfill over a year. Three different MBT facility options were considered further, the main difference between each MBT facility option being the proposed composting system, as follows:

Table 3-1 – MSW Composition Summary

Type	Percentage Composition (by weight)
Cardboard and Paper	9.64
Glass and Ceramics	14.24
Metals	23.88
Plastics	10.35
Electrical and Electronic Equipment	0.32
Organic	45.05
Construction	11.47
Hazardous	1.35
Bulky	0.27
Other	6.09
Total	**100**

Facility Option 1

3.5.3. Option 1 would contain the following elements:

- Mechanical processing with material recovery;
- Refuse Derived Fuel (RDF) fuel production; and
- Composting of the MSW organic fractions by aeration and stirring enclosed in metal sheets.

3.5.4. The composting system would consist of forced aeration and stirring of biodegradable fractions in rows covered in metal sheets. The process accelerates the compost production and takes an average of 30 days to complete.

3.5.5. Option 1 was recommended as the preferred option in the MBT Facility Feasibility Study (2018). The option requires less construction of major infrastructure, has simple and easy to install equipment and has a simple maintenance regime. At the time of writing this remains the recommended option and as such has been assessed as part of this ESIA.

Facility Option 2

3.5.6. Option 2 would contain the following elements:

- Mechanical processing with material recovery;
- RDF fuel production; and
- Composting of the MSW organic fractions by aeration and stirring in aerobic stabilisation tunnels.

3.5.7. This system includes a screening system to remove inorganic elements. As with Option 1, the process accelerates compost production and takes and average of 30 days to complete.

Facility Option 3

3.5.8. Option 3 would contain the following elements:

- Mechanical processing with material recovery;
- Bio drying systems for composting of MSW organic fractions, including stirring;
- RDF fuel production; and
- Biomass fuel production (heating).

3.5.9. The composting would be conducted in a non-isolated environment (open-air). This option is the least resource intensive method. The composting process takes an average of 42 days.

4

EBRD PERFORMANCE REQUIREMENTS, EU STANDARDS, LEGISLATIVE AND POLICY CONTEXT

4 EBRD PERFORMANCE REQUIREMENTS, EU STANDARDS, LEGISLATIVE AND POLICY CONTEXT

4.1 EBRD PERFORMANCE REQUIREMENTS

4.1.1. The EBRD's project requirements are as follows:

- The Project will be structured to be complaint with all applicable national legislation, applicable national waste management strategies and relevant EU environmental standards, including (but not limited to) the pertinent requirements of:
  - The EIA Directive 2014 (2014/52/EU)), the Waste Framework Directive (2008/98/EC), the Landfill Directive (1991/31/EC), the Industrial Emissions Directive (2010/75/EU) and the Groundwater Directive (2006/118/EC). If and when the host country (Ukraine) regulations differ from EU substantive environmental standards, the Project will be expected to meet the most stringent of these;
  - EBRD's Environmental and Social Policy (ESP) and PRs 2014;
  - Requirements of International Financial Institutions (IFIs), where there are not discrepancies with EBRD's ESP and PRs; and
  - Relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation.
- Public consultation and stakeholder engagement will be tailored for the Project, be meaningful and allow for disclosure of information and public participation in decision-making (in accordance with PR10);
- Disclosure of the ESIA in accordance with EBRD's Public Information Policy (PIP);
- The Project shall include reasonable measures to minimise or mitigate any adverse change in environmental and social effects and impacts on public health and safety, especially with respect to any disproportionate effects as a result of the Project on any group of people as a result of their gender, age, disability, socio-economic status and/or other characteristics.

4.1.2. The Project will be required to comply with the following requirements:

- PR1: Environmental and social appraisal and management;
- PR2: Labour and working conditions;
- PR3: Pollution prevention and abatement;
- PR4: Community health, safety and security;
- PR5: Land acquisition, involuntary resettlement and economic displacement;
- PR6: Biodiversity conservation and sustainable management of living natural resources;
- PR7: Indigenous people (not applicable to this Project);
- PR8: Cultural heritage;
- PR9: Financial intermediaries (not applicable to this Project); and
- PR10: Information disclosure and stakeholder engagement.

4.2 INTERNATIONAL CONVENTIONS

4.2.1. Ukraine has ratified several international environmental conventions and protocols that are of relevance to the Project, as set out in the table below.

Table 4-1 – Ukrainian Ratified International Environmental Conventions

Convention	Date of Ratification	Applicable
United Nations Framework Convention on Climate Change 1992	October 1996	Yes, climate change effects are considered in Chapter 15 of the ESIA
Kyoto Protocol 1997	April 2004	Yes, climate change effects are considered in Chapter 15 of the ESIA
Paris Agreement 2015	September 2016	Yes, climate change effects are considered in Chapter 15 of the ESIA
Convention on Biological Diversity 1992	February 1995	Yes, ecology effects are considered in Chapter 8 of this ESIA.
Convention Concerning the Protection of the World Cultural and Natural Heritage 1972	October 1988	Yes, ecology effects are considered in Chapter 8 and Cultural Heritage is considered in Chapter 9 of this ESIA.
Convention on the Conservation of Migratory Species of Wild Animals 1979	November 1999	Yes, ecology effects are considered in Chapter 8 of this ESIA.
Convention on the Conservation of European Wildlife and Natural Habitats 1979	January 1999	Yes, ecology effects are considered in Chapter 8 of this ESIA.
Agreement on the Conservation of Populations of European Bats	September 1999	Yes, ecology effects are considered in Chapter 8 of this ESIA.
Protocol on Water and Health 1999	June 1999	Yes, water environment effects are considered in Chapter 11 of this ESIA.
The Vienna Convention for the Protection for the Ozone Layer 1989	July 1999	Yes, air quality effects are considered in Chapter 6 of this ESIA.
Global Forest Resources Assessment	Participation since 2007	Yes, ecology effects are considered in Chapter 8 of this ESIA.

4.3 EU ENVIRONMENTAL STANDARDS

EU EIA DIRECTIVE

4.3.1. A review against the EU EIA Directive's (2014/52/EU) requirements has been undertaken, to assess whether the Project activities are listed in Annex I or II of the EIA Directive. EU EIA Annex I project require a full EIA, Annex II projects require a project by project assessment, using national law to undergo a 'screening process' to determine if EIA is required.

4.3.2. The following is of relevance for the Project:

- Annex II, projects referred to in Article 4(2) – Projects to be determined if they require an EIA include: Installations for the disposal of waste.

EU WASTE FRAMEWORK DIRECTIVE

4.3.3. The objective of the Directive (2008/98/EC) is to prevent or reduce adverse environmental effects associated with the generation and management of waste, in order to reduce the overall effects of resource use and improve the efficiency of said use thereby protecting the environment and human health.

4.3.4. The Directive sets the basic concepts and definitions in relations to waste management, such as defining waste itself and different waste criteria, and establishes the Waste Hierarchy. The following articles within the directive are of relevance to the Project:

- The Directive defines the elements of the waste hierarchy and requirements in relation to these components of the waste hierarchy (waste prevention, re-use, recycling, recovery and disposal);
- Article 15 – Responsibility for Waste Management: Details responsibilities for the waste transfer process such as the need to ensure professional waste collection and transport results in delivery to appropriate treatment installations;
- Article 17 – Control of Hazardous Waste: Outlines the need to ensure the production, collection, transportation, storage and treatment of hazardous waste is carried out in conditions protecting the environment and human health;
- Article 18 – Ban on the mixing of hazardous waste: Outlines that hazardous waste must not be mixed with non-hazardous waste, with exceptions that if Best Available Techniques (BAT) is applied at permitted facilities then mixing is allowed;
- Article 22 – Bio-waste: Encourages the treatment of bio-waste in a way that fulfils a high level of environmental protection;
- Article 23 – Issue of Permits: Requires the implementation of a permitting system for establishments carrying out waste treatment. Article 27 details the minimum standards required for treatment activities requiring permits; and
- Article 28 – Waste Management Plans: Outlines the requirements for competent authorities to establish Waste Management Plans (WMPs) and details the required contents of these WMPs.

EU LANDFILL DIRECTIVE

4.3.5. The objective of the Landfill Directive (1999/31/EC) is to reduce as far as possible, negative effects on the environment, in particular on surface water, groundwater, soil, air, and on human health from the landfilling of waste, by introducing stringent technical requirements for waste in landfills.

4.3.6. The Landfill Directive defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land. Landfills are divided into three classes:

- Landfills for hazardous waste;
- Landfills for non-hazardous waste; and
- Landfills for inert waste.

4.3.7. The Directive includes three Annexes:

- Annex I – General Requirements for all Classes of Landfills: Details required measures for all landfills to implement such as stability of the mass of waste and measures to control water and leachate;
- Annex II – Waste Acceptance Criteria and Procedures: Provides general principles of the acceptance of waste at various classes of landfill and guidelines on preliminary waste acceptance procedures; and
- Annex III – Control and Monitoring Procedures in Operation and after-care Phases: Provides the minimum procedures for monitoring to be carried out in relation to waste acceptance, landfill processes, environmental protection systems and permitting conditions.

4.3.8. A standard procedure for acceptance of waste in a landfill is laid down, so as to avoid any risks, including:

- Waste must be treated before being landfilled;
- Hazardous waste within the meaning of the Directive must be assigned to a hazardous waste landfill;
- Landfills for non-hazardous waste must be used for municipal waste and for other non-hazardous waste;
- Landfill sites for inert waste must be used only for inert waste; and
- Criteria for the acceptance of waste at each landfill class must be adopted in accordance with the general principles of Annex II of the Directive.

4.3.9. The following wastes may not be accepted in a landfill:

- Liquid waste;
- Flammable waste;
- Explosive or oxidising waste;
- Hospital and other clinical waste which is infectious;
- Used tyres (with certain exceptions); and
- Any other type of waste which does not meet the acceptance criteria laid down in Annex II.

4.3.10. The Directive sets up a system of operating permits for landfill sites. Applications for permits must contain the following information:

- The identity of the applicant and, in some cases, of the operator;
- A description of the types and total quantity of waste to be deposited;
- The capacity of the disposal site;
- A description of the site;
- The proposed methods for pollution and abatement;
- The proposed operation, monitoring and control plan;
- The plan for closure and aftercare procedures;
- The applicant's financial security; and
- An impact assessment study on the effects of certain public and private projects on the environment, where required under the EIA directive.

EU INDUSTRIAL EMISSIONS DIRECTIVE

4.3.11. The Directive (2010/75/EU) aims to achieve a high level of protection of human health and the environment by reducing industrial emissions through the applications of BAT. The facilities that are required to operate in accordance with the Directive are identified in Annex I, which includes Waste Management Facilities.

4.3.12. The facilities require a permit, which sets out the conditions said that the facility must operate under, emissions limits and techniques to apply.

4.3.13. Article 11, Article 14 and Article 15 are of relevance to the Project. These articles detail principles and measures that facilitates must be operated in accordance with such as ensuring no significant pollution is caused and appropriate measures are taken to prevent accidents.

EU GROUNDWATER DIRECTIVE

4.3.14. The purpose of the Directive (2006/118/EC) is to prevent and control groundwater pollution, it also aims to support groundwater components of Directive 2000/60/EC.

4.3.15. The Directive includes 10 Annexes:

- Annex I – Categories of Activities referred to in Article 10;
- Annex II – List of Polluting Substances;
- Annex III - Criteria for determining Best Available Techniques;
- Annex IV – Public Participation in Decision-making;
- Annex V – Technical Provisions relating to Combustion Plants;
- Annex VI – Technical Provisions relating to Waste Incineration Plants and Waste co-incineration Plants;
- Annex VII – Technical Provisions relating to installations and activities using Organic Solvents;
- Annex VIII – Technical Provisions relating to installation producing Titanium Dioxide;
- Annex IX – Repealed directives, their amendments and time limits for transposition into national law; and
- Annex X – Correlation Table.

4.3.16. The following articles are of relevance to the Project:

- Article 3 – Outlines the criteria to use when assessing groundwater chemical status, including the determination of threshold values. Annex II of the Directive contains guidelines for the establishment of threshold values, as well as pollutants to assign threshold values for;
- Article 4 – Outlines the procedure to use when assessing groundwater chemical status; and
- Article 6 – Details measures to prevent or limit inputs of pollutants of inputs into groundwater.

4.4 APPROPRIATE ASSESSMENT

4.4.1. Appropriate Assessment is required by Article 6(3) of EU Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora (the 'Habitats Directive'). Appropriate Assessment tests whether a plan or a project is likely to have significant adverse impacts on a European Sites such as the following:

- Special Protected Area (SPA) – Designated to protect birds;
- Special Area of Conservation (SAC) – Designated to protect habitats; and
- Ramsar Site – Designated to protect wetlands.

4.4.2. Appropriate Assessment is not required for this ESIA as the Project has scoped out European Designated Sites from further assessment (due to their distance from the Project). The closest European Designated Site is the Pivdennyi Bug, an Important Bird Area which is 10km east of the Site.

4.5 UKRAINIAN ENVIRONMENTAL STANDARDS

4.5.1. This section summaries the key legislation that applies to this ESIA. Further, topic specific legislation is included in the relevant Chapters in this ESIA.

ADMINISTRATIVE BODIES IN THE UKRAINIAN ENVIRONMENT SECTOR

4.5.2. The main administrative bodies which are involved in the environmental sector are:

- The Ministry of Ecology and Natural Resources (formerly the Ministry of Environmental Protection and the Ministry of Environmental Protection and Nuclear Safety) is responsible for ecological monitoring and development throughout the country. They must be notified about planned activities that are subject to an EIA. The ministry contains the following environmental departments:
  - Department of State Ecological Policy and International Actions;
  - Department of Ecological;
  - Department of Conservation Affairs;
  - Department in Security of Natural Resources and Eco-Network;
- State Agency of Geology and Resources;
- State Agency of Water Resources;
- State Agency of Ecological Investments; and
- State Agency of Ecological Inspection.

UKRAINIAN EIA LEGISLATION

4.5.3. Law No. 2059-VIII 'On Environmental Impact Assessment' came into effect in December 2017 (herein referred to as the 'EIA Law'). The EIA Law implements the principles of Directive 2011/92/EU (which preceded the current EU EIA Directive 2014)). The EIA Law divides projects into two categories (1st and 2nd Categories) and consists of 17 articles.

4.5.4. The EIA Law outlines a five-step process, containing the following steps:

- Preparation of the EIA report by the company;
- Public consultation on the project;
- Assessment of the EIA report and public consultation results by the relevant state agency;
- Issue of the EIA conclusion by the state agency; and
- Consideration of the EIA conclusion prior to the company receiving a permit for the planned activity.

4.5.5. In December 2017, the Ukrainian Government also adopted the following secondary legislation required for implementation of the EIA law:

- Regulation No. 1010 'On Criteria for Determining Planned Activity, its Expansion and Change which are not Subject to the EIA'.;
- Regulation No. 989 'On Procedure for Conducting Public Discussion while Preparing the EIA';
- Regulation No. 1026 'On Procedure for the Transfer of Documentation to Provide the EIA Conclusion and the EIA Funding and on Procedure for Maintaining the Unified Register on the EIA'.

4.5.6. Article 3, Section 2 of the EIA Law states:

"The first category [Category 1] of types of planned activities and facilities that may have a significant impact on the environment and are subject to environmental impact assessment include:

(8) Waste Management:

- Hazardous waste management operations (storage, processing, recycling and disposal); and
- Household and other waste management operations (processing, utilisation, disposal and burial) of 100 tons of waste per day or more.”

4.5.7. As the Project is set to process approximately 300 tons of waste per day, it is classified as a Category 1(8) development, and a national EIA is required.

UKRAINIAN WASTE LEGISLATION

4.5.8. The Ukrainian waste management legislation, as set out in Law No. 187/98-VR ‘On Waste’ (updated in January 2018) is the main relevant national legislation on management of MSW areas. The law establishes the requirement for a radial SPZ, 500m from the boundary of a waste treatment / disposal site.

4.5.9. Law No. 808, ‘On the approval of list of activities and objects of high environmental hazard’ (2013) mandates the monitoring of MSW landfills. This monitoring is to be done in accordance with Law No. 295 ‘On approval of methodological recommendations on introduction of monitoring system in the sphere of solid household waste management’.

STATE SANITARY RULES FOR PLANNING AND CONSTRUCTION IN URBAN AREAS

4.5.10. In accordance with national policy, industrial facilities are required to establish a SPZ to provide a buffer between industrial facilities and nearby residential areas, in order to reduce the potential for the facility to result in adverse human health and environmental effects. SPZs for waste facilities are nominally of a 500m radius (as explained in Section 4.6). The presence of residential areas, recreational zones, schools, hospitals or food production facilities is prohibited within the SPZ of an industrial facility.

4.5.11. The SPZ prohibition has not been enforced for the existing landfill and there are currently residential properties within the SPZ. Whilst it may be possible to reduce the extent of the SPZ for the existing landfill a specific legislative process would need to be followed.

4.5.12. The proposed landfill and the proposed MBT Facility will be required to establish SPZs. There are currently no permanent properties within the indicative SPZ for the proposed landfill extension, there are some cabins that are used to accommodate Roma, but the LRF includes measures to provide them with access to better accommodation. There are also no permanent properties within the indicative SPZ for the proposed MBT, but it does extend into some gardens, so Spetskomuntrans will need to design the facility to be located away from the northern boundary of the site to avoid impacts on these gardens. Once the proposed landfill and the proposed MBT SPZs has been established, the construction of new residential houses within these SPZs will not be permitted.

4.6 UKRAINIAN NATIONAL WASTE MANAGEMENT STRATEGY UNTIL 2030

4.6.1. Prior to the implementation of the Ukrainian National Waste Management Strategy[5], Ukraine experienced high levels of waste generation and low rates of recovery and re-use of secondary raw

[5] Ukrainian National Waste Management Strategy Until 2030 (2017).

materials. The aim of the National Waste Management Strategy is to establish regional waste disposal centres and introduce circular economy principles that accord with the highest tiers of the Waste Hierarchy.

4.6.2. The National Waste Management Strategy provides short, mid and long-term targets for addressing the challenges for all main waste sectors (e.g. industrial waste, construction and demolition waste, hazardous waste, agro-industrial waste and specific waste streams) as well as the fulfilment of obligations of Ukraine according to international agreements.

4.6.3. The Strategy is considered one of the main drivers of waste management market development, compliant with the EU requirements and close to the innovative integrated concept[6].

4.6.4. The Project will support the implementation of the Strategy, though the closure of the existing landfill, the construction of a modern landfill and the MBT facility.

[6] Ministerie van Lnadbouw, Natuur en Voedselkwaliteit (2019). Study on Waste Management in Ukraine.

5

APPROACH TO ESIA

5 APPROACH TO ESIA

5.1 INTRODUCTION

5.1.1. This chapter outlines the approach to the ESIA, in particular the objectives and overall strategy for the ESIA. Scoping has been an ongoing process, which is documented within this chapter. The chapter sets out the evidence base associated with the topics and elements of topics that have been scoped out of the assessment. The approach to the ESIA has been undertaken in accordance with the EIA Directive (detailed in Section 4.3) and the approach outlined in the Scoping Report.

5.1.2. The approach to consultation is also outlined, together with the approach to proportionate assessment, including the assessment criteria and the methodology for assessing cumulative effects.

5.1.3. A nation EIA (OVD) that is compliant with national EIA requirements and processes, is being prepared in parallel to this ESIA, using all relevant data and studies.

5.2 OBJECTIVES OF THE ESIA

5.2.1. The key objectives of the ESIA are as follows:

- Set the legal framework;
- Document the consultation process;
- Consider the alternatives to the Project;
- Establish baseline environmental conditions at the Project Site and within the surrounding area;
- Identify likely significant effects during the design process so that some effects can be avoided, prevented, reduced or, if possible, offset prior to the assessments within the ESIA;
- Identify, predict and assess the environmental effects associated with the Project: beneficial and adverse; permanent and temporary; direct and indirect and short / medium / long term; significant or not significant;
- Identify, predict and qualitatively assess the cumulative effects of the Project including those associated with the other developments; and
- Identify suitable mitigation measures to prevent, reduce or, if possible, offset likely significant adverse effects on the environment and identify the likely significant residual effects following the implementation of these measures; and
- Identify monitoring measures where likely significant residual effects are identified.

5.3 SCOPING

SCOPING REPORT

5.3.1. An ESIA Scoping Report was prepared by WSP and submitted to EBRD in June 2019. The report outlined the proposed methodology for the ESIA and identified likely significant effects for key environmental topics. The Scoping Report has been used to inform the completion of this ESIA.

5.3.2. During the preparation of the ESIA Scoping Report the following topics were scoped into the ESIA:

- Consideration of Alternatives (Chapter 3);
- Air Quality (Chapter 6);
- Noise and Vibration (Chapter 7);
- Ecology (Chapter 8);
- Cultural Heritage (Chapter 9);

- Landscape and Visual (Chapter 10);
- Surface Water Environment (Chapter 11);
- Geology and Hydrogeology (Chapter 12);
- Social (Chapter 13);
- Materials and Waste (Chapter 14);
- Climate Change (Chapter 15); and
- Cumulative Effects (Chapter 16).

5.3.3. The following topics were scoped out of the ESIA during the preparation of the ESIA Scoping Report:

- Major Accidents and Disasters;
- Heat and Radiation; and
- Climate Change Resilience.

5.4 APPROACH TO THE ASSESSMENT OF THE PROJECT

5.4.1. This section outlines the phases of the Project that have been assessed, together with the approach to the baseline conditions, future baseline conditions, cumulative effects and design tolerances. It also sets out the overarching approach to the ESIA, together with project specific requirements for the assessment of effects.

5.4.2. The maximum extent of the Project boundary and building footprint / height has been assessed to allow for a worst-case scenario analysis of effects. There is therefore some degree of flexibility to allow the Project to evolve (i.e. reduce in size) if necessary.

5.4.3. In order to avoid duplication of assessment, assumptions have been made in relation to measures to be implemented under existing or pending consents.

BASELINE SCENARIO

5.4.4. Baseline information (environmental characteristics and conditions) has been collated, based upon site visits undertaken and desk-based information available at the time of the assessment. Technical chapters 6 – 15 provide details of the baseline information and a summary is provided in Chapter 2: Description of the Project. The methodology used in the baseline's assessment, any consultation undertaken, the temporal and spatial extent and any limitations establishing the baseline are described in Technical chapters 6 – 15.

5.4.5. The baseline conditions for the purpose of the ESIA is defined below. If baseline years vary across the ESIA the justification is provided in Chapters 6-16.

5.4.6. The dates of sites and the dates when data sources have been accessed are provided within Technical chapters 6 – 15.

FUTURE BASELINE

5.4.7. The assessment has also taken into consideration how the current baseline conditions may change going forward without the presence of the Project, known as the future baseline. The future baseline scenario is summarised in Technical chapters 6 – 15.

5.4.8. Due to the limitations, necessary assumptions and lack of evidence associated with the future baseline (i.e. it cannot be accurately measured), a detailed consideration of the effects of the Project against the future baseline would generally not result in a robust assessment. However, consideration has been given, in descriptive terms, within each topic chapter to likely significant effects arising in relation to the future baseline.

TEMPORAL SCOPE

5.4.9. This ESIA has addressed effects that are anticipated to arise during the construction of the Project (the construction phase) and following its completion (commonly referred to as the 'operational phase'). The construction period is assumed to last to 2025/2026 and includes the construction of the proposed landfill and the proposed MBT facility and the rehabilitation of the existing landfill. These effects can broadly be summarised as follows:

- Any effects during the construction period that may arise as a result of construction activities such as demolition / rehabilitation, temporary use of land (such as for site compounds), construction of new buildings, changes in traffic movements and temporary closures or diversions to roads; and
- Any effects during the operational period that may arise as a result of operational activities such as vehicle movements to and from the Project Site or emission associated with waste treatment and landfilling activities.

5.4.10. Consideration has been given to impacts (changes in the environment) associated with the Project in comparison to the baseline conditions identified in the baseline assessments (conditions that would exist without the presence of the Project).

5.4.11. For the purpose of the assessment the following baseline years are used:

- Construction Phase – 2021/2022; and
- Operation Phase – 2025/2026.

5.4.12. At the time of writing an assessment of the effects of decommissioning has not been considered appropriate for the whole Project. Any decommissioning work would be likely not result in effects exceeding the level of effects arising during the construction phase. It should be noted that the first element of the project is the rehabilitation and closure of the existing landfill.

SPATIAL SCOPE OF THE ESIA

5.4.13. The spatial scope of the ESIA varies in accordance to the assessment requirements for individual ESIA topics. This study areas for each topic are outlined in Chapters 6 to 17.

5.4.14. In the interests of clarity, the areas covered by the existing landfill, the proposed landfill and the proposed MBT facility are referred to as the Project Site throughout the ESIA.

ASSESSMENT CRITERIA

5.4.15. The classification of each effect identified has been assessed based on the magnitude of change (or impact) due to the Project and the sensitivity/value of the affected receptor to change, as well as other factors that are outlined in more detail below. The classification of residual effects has been assessed taking into consideration the extent to which additional mitigation measures will prevent, reduce or, if possible, offset adverse effects or enhance beneficial effects.

5.4.16. The assessment of likely effects for each of the technical topics are presented in technical chapters 6 - 15 and have taken into account criteria to determine whether or not the likely effects have the potential to be significant. Where it was possible and appropriate, the effects have been assessed quantitatively. The following criteria were taken into account when classifying the likely effects:

- Relevant legislation and planning policy;

- International, national, regional and local standards;
- Likelihood of occurrence of the effect;
- Geographical extent of effect;
- Sensitivity and/or value of the receptor;
- Magnitude and complexity of effect;
- Whether the effect is temporary or permanent;
- Duration (short, medium or long-term), frequency and reversibility of effect;
- Whether the effect is direct or indirect, secondary or transboundary;
- Inter-relationship between different effects (both cumulatively and in terms of likely effect interactions); and
- The consultation outcomes.

MAGNITUDE OF IMPACT

5.4.17. The magnitude of impact for each identified receptor is predicted as a deviation from the established baseline conditions, as a result of the Project. The magnitude of these impacts is also defined within technical chapters 6 - 15 and has been determined where available and appropriate by quantifiable data, available appropriate national and international standards or limits (World Health Organisation (WHO) Limits, EU Quality Standards, etc.) and professional judgement. The scale used is defined in Table 5-1 below.

Table 5-1 – Description of the Magnitude of an Impact

Magnitude of an Impact	Adverse / Beneficial	Criteria
Very Large	Adverse	Loss of resource and / or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute.
Large	Adverse	Loss of resource, but not negatively affecting the integrity; partial loss of / damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Moderate	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one or more key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one or more key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of an adverse impact occurring.
Slight	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No Change	n/a	No loss of alteration of characteristics, features or elements.

5.4.18. The magnitude of change identified is based on the peak potential magnitude of change, i.e. the greatest likely magnitude of change that may be experienced by a sensitive / valuable receptor (existing or proposed).

SENSITIVITY / VALUE OF RECEPTORS

5.4.19. The sensitive / valuable receptors considered within the ESIA are identified within Technical chapters 6 – 15. The sensitivity of these receptors to change is also defined within Technical chapters 6 – 15 and has been determined where available and appropriate by quantifiable data, the consideration of existing designations and professional judgement. The categories used (very high, high, medium, low, and negligible), unless otherwise stated, are shown in Table 5-2. Where topic specific methodology deviates from this approach, for example as a result of using topic specific guidance, this is set out in the assessment methodology section of the technical chapter.

5.4.20. Table 5-2 below defines the level of sensitivity of receptors.

Table 5-2 – Description of the Sensitivity / Value of a Receptor

Sensitivity	Criteria
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, very local scale.

5.5 CLASSIFICATION OF EFFECTS

5.5.1. Determining the classification of effects has been undertaken using professional judgements (assumptions and value systems) that underpin the attribution of significance. Each effect has been assessed against the change of magnitude and the sensitivity / value of the receptor as shown in Table 5-3.

Table 5-3 – Matrix for Classifying Effects

		Magnitude of Impact				
		No Change	**Slight**	**Moderate**	**Large**	**Very Large**
Environmental Sensitivity	**Very High**	Neutral	Minor	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Minor	Minor or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Minor	Minor	Moderate	Moderate or Large
	Low	Neutral	Neutral or Minor	Neutral or Minor	Minor	Minor or Moderate
	Negligible	Neutral	Neutral	Neutral or Minor	Neutral or Minor	Minor

5.5.2. The terms as used within Table 5-3 have been defined below, applying to both beneficial and adverse effects:

- Very Large effect: Only adverse effects are normally assigned this level of significance. They represent key factors in the assessment process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category;
- Large effect: These effects are considered to be very important considerations and are likely to be material in the decision-making process;
- Moderate effect: Effects that may be important but are not likely to be key in the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor;
- Minor effect: These effects may be raised as local factors and are unlikely to be critical in the decision-making process. They are important in enhancing the subsequent design of the Project; and
- Neutral: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.5.3. Unless otherwise stated in the relevant chapter of this ESIA, effects that are classified as moderate, large or very large are considered to be significant effects. Effects classified as minor or below are considered to be not significant.

5.5.4. Where topic specific methodology deviates from this approach, for example as a result of following topic specific guidance, this is set out in the methodology section of the technical chapter. Tables summarising the likely significant effects associated with each technical topic area, required mitigation measures and residual effects are provided at the end of each technical chapter. The tables provide a clear distinction of the type of effect:

- Beneficial or adverse;
- Permanent or temporary;
- Direct or indirect;
- Very short, short, medium or long-term;
- Reversible or irreversible; and
- Significant or not significant.

5.5.5. With regards to the frequency and duration of an effect, the ESIA has considered whether the effect will be continual or intermittent over the identified time period. The duration of effect will be defined as:

- Very short term: Less than 2 years;
- Short term: 2 to 5 years;
- Medium term: 5 to 10 years;
- Long term: 10 to 15 years; and
- Very long term: More than 15 years.

5.5.6. Effects will be described as either temporary or permanent, according to whether the effect is expected to last indefinitely.

5.5.7. Direct effects arise as a direct consequence of the Project, for example a building demolition or an increase in construction traffic. Indirect effects are those which are not a direct result of the Project but occur away from the original effect.

5.5.8. Any variation to these definitions arising for example from differences in topic methodology or guidance is explained in Technical chapters 6 – 15.

ADDITIONAL MITIGATION AND MONITORING

5.5.9. Additional mitigation describes actions that will require further activity in order to achieve the anticipated outcome. Examples include additional design measures, for example to comply with proposed lighting limits or developing a travel plan for the Project.

5.5.10. Where the potential for likely significant adverse effects have been identified in the assessment, measures to prevent or reduce and, if possible, offset likely significant adverse effects on the environment are described. Monitoring is typically required where there are significant adverse residual effects. In some cases, for instance where there is uncertainty of residual effects remain, it may also be appropriate to implement monitoring.

5.5.11. Effects have been assessed following the inclusion of mitigation measures. If any significant effects remain after implementation of mitigation measures, this is recorded within the ESIA.

5.5.12. Proposed additional mitigation and monitoring measures are set out within Technical Chapters where necessary. As well as additional mitigation, the embedded mitigation measures within the Project are also recorded.

CUMULATIVE EFFECTS

As per the EIA Directive, Annex I(C), Paragraph 5, the ESIA has assessed the cumulative effects of the Project. Cumulative effects are categorised as follows:

- In-combination Effects: Those arising from the Project in-combination with other projects; and
- Effect Interactions: Those arising from inter-relationships within the Project.

5.5.13. There is no widely accepted methodology or best practice for assessing cumulative effects although various guidance documents exist. The approach used has been adopted based on: previous experience, the types of receptors being assessed, the nature of the Project, the other developments under consideration and the information available to inform the assessment. The approach was outlined in the EIA Scoping Report. The assessment of cumulative effects is presented in Chapter 17: Cumulative Effects.

5.5.14. Further details regarding the scope and methodology of the assessment of cumulative effects, the identification of relevant committed developments and a description of those included within the assessment are provided in Chapter 17: Cumulative Effects.

5.6 CONSULTATION AND STAKEHOLDER ENGAGEMENT

5.6.1. An SEP has been developed for the Project, as required under PR 1 and PR 10. It will be publicly disclosed and available for questions, comments and suggestions together with this ESIA, after which it will be regularly updated throughout the life of the Project.

CONSULTATION UNDERTAKEN DURING SITE VISITS

5.6.1. As part of undertaking the ESIA for the Project, the following consultations have been undertaken up to date:

- **4th – 6th June 2019** - during the initial stage the core environment team undertook a site visit, to refine their understanding of the Project, collect baseline environmental and social data and consulted with interested parties; and
- **1st – 5th July 2019** - a second site visit was undertaken by the core environment team and technical specialists to collect further baseline data, undertake environmental and social surveys and undertake scoping consultation activities.

5.6.2. A summary of the two site visits are provided below.

Table 5-4 – Meetings and Site Visit Summary – June 2019

Meeting / Site Visit	Date	Attendees	Summary
Site visit	5th June 2019	▪ Project Director, WSP ▪ Assistant Project Manager, WSP ▪ Local Consultant, WSP ▪ Representatives, City of Khmelnitsky ▪ Deputy Major, ▪ Landfill Operator, Spetskomuntrans	▪ General tour of the existing landfill, the proposed landfill site and the proposed MBT site to gain some initial baseline information and an understanding of the key constraints. ▪ Visit to the nearest residential villages in Vydrovi Doly (north), Ivankivtsi (north west) and Oleshin (west). ▪ Visit to the Bio Gas Energy Facility located on the southern side of the existing landfill site. ▪ Visit to Spetskomuntrans vehicle storage and maintenance area in Khmelnitsky. ▪ Tour of waste collection facilities within the City of Khmelnitsky.
Meeting with Head of Village Council and the City of Khmelnitsky	6thJune 2019	▪ Project Director, WSP ▪ Assistant Project Manager, WSP ▪ Local Consultant, WSP ▪ City of Khmelnitsky, economy department ▪ Deputy Mayor ▪ Representative, City of Khmelnitsky ▪ Head of Village Council for Oleshin Village, Velika Kalinovka, Ivankivtsy, Cherepova, and Cherepivka.	▪ Meeting with the Head of the Village Council to discuss their general understanding of the Project and to hear their general views with regards to key issues, ESIA focus and experiences with the existing landfill, and any community feedback on the proposed Project and the land acquisition process. ▪ Visit to see the closet residential receptors (located adjacent to the road on the southern side of the existing landfill). ▪ Visit to one of the City of Khmelnitsky's offices to discuss outstanding queries, questions raised during the site visit and the next steps.

Table 5-5 – Meetings and Site Visit Summary – July 2019

Meeting / Site Visit	Date	Attendees	Summary
Proposed Landfill Preliminary Design Meeting	2nd July 2019	▪ WSP Project Manager, ▪ WSP and IDOM team, and ▪ Local Consultant, WSP	▪ Meeting to discuss the baseline Project information gathered as part of the design activities and the design of the proposed landfill.
Site Visit	2nd July 2019	▪ WSP Assistant Project Manager, ▪ WSP and IDOM team, and ▪ Representative, City of Khmelnitsky	▪ General tour of the existing landfill, the proposed landfill and the proposed MBT Facility to gain further baseline information and to further understand the key constraints.
Environmental and Social Surveys	2nd July – 3rd July 2019	▪ WSP Project Manager, ▪ WSP Assistant Project Manager ▪ WSP team ▪ Representative, City of Khmelnitsky	▪ Morning and afternoon noise / air quality / odour surveys at representative receptors. ▪ Observations of the waste picking activities. ▪ Visual water surveys of wells and the stream in close proximity to the existing landfill. ▪ Meetings with residents to discuss their experience of the land acquisition process and the proposed Project.
Waste Pickers Focus Group	2nd July 2019	▪ WSP team ▪ Representative, City of Khmelnitsky	▪ Focus Group meeting with the waste pickers to discuss their types of work, working conditions, average wage and their general understanding of the Project.
Group of local landowners	2nd July 2019	▪ WSP team ▪ Representative, City of Khmelnitsky	▪ Meeting to understand the local land owners' view on the land acquisition process undertaken to date
Legal Team / Land Acquisition Meeting	2nd July 2019	▪ WSP team ▪ Land Acquisition Officer from the City of Khmelnitsky ▪ Land Acquisition Officer from Spetskomuntrans	▪ Meeting to understand the land acquisition process undertaken to date and the land acquisition process moving forwards with the Project.
Village Councils Meeting	3rd July 2019	▪ WSP Project Manager ▪ WSP and IDOM team ▪ Local Consultant, WSP ▪ National EIA Team	▪ Meeting with the Head of the Village Council (Oleshin) and four other heads from the surrounding villages to hear their views with regards to key issues and to answer topic specific questions posed by the specialists.
Bio Gas Energy Facility Meeting	3rd July 2019	▪ WSP and IDOM team	▪ Meeting with Bio Gas Energy Facility operator to discuss operating regimes and plant specifications.

Meeting / Site Visit	Date	Attendees	Summary
City of Khmelnitsky and Spetskomuntrans Meeting	3rd July 2019	▪ WSP and IDOM team ▪ Local Consultant, WSP ▪ National EIA Team ▪ Representatives from the City of Khmelnitsky and Spetskomuntrans	▪ Representatives from the City of Khmelnitsky and Spetskomuntrans to discuss: ▪ Organisational arrangements and policies; ▪ Health and safety (H&S) procedures; ▪ National / regional waste management legislation / policy; and ▪ Existing and Projected waste collection procedures / vehicles / system and source segregation processes.
Scoping / ESIA Methodology Presentation	4th July 2019	▪ WSP team ▪ Representatives from the City of Khmelnitsky ▪ Representatives from Oleshin (including the Head of the Village Council).	▪ Presentation to summarise the Project and the scoping / ESIA methodology for the Project. All residents were invited to attend via the City of Khmelnitsky's website, the City also agreed to notify the heads of the surrounding villages.

5.6.3. During the Scoping / ESIA Methodology Presentation (4th July), a WSP ESIA Specialist in collaboration with Spetskomuntrans provided a presentation about the Project to local representatives. The meeting was advertised on the City's website (http://khm.gov.ua/) a week prior to the presentation. The meeting was undertaken in one of the City's meeting rooms. Key attendees in this meeting included the local village council lawyer, a resident who lived near to the landfill site and is the Head of the Village Council, and representatives from the City of Khmelnitsky. The meeting provided a useful platform to further develop the attendees understanding of the Project, which it was understood would be distributed to the heads of the surrounding villages through their community meetings. The Head of the Village Council was also able to provide feedback on the local community's key concerns and issues which had been obtained since the first site visit.

5.6.4. The meeting that was held in Oleshin Village Hall the previous day (3rd July), and was attended by the head of the Village Council (Oleshin) and four other village heads from the surrounding villages, also provided further information on the concerns and aspirations expressed by residents near to the landfill, and this information is included here for completeness.

5.6.5. Key concerns and issues raised during the presentation included:

- Potential obstruction of local community access rights particularly during the construction;
- Previous concerns expressed with regards to Roma waste pickers chopping local woodlands during winter;
- Potential concerns as to how the Project would affect the surrounding villages masterplan which included for the provision of potential new housing adjacent to the existing and proposed landfills – no timing for the housing are known; and
- Lack of awareness and information about the Project in particular the process of closing and rehabilitating the existing landfill.

5.6.6. Apart from the issues and concerns aforementioned, the attendees were generally positive about the Project.

Figure 5-1 – Presentation to Explain the Scoping / ESIA Methodology

FURTHER MEETINGS AND CONSULTATIONS

5.6.7. During the development of the ESIA and the national EIA, additional meetings / consultations will take place. The consultation activities are summarised in the table below.

Table 5-6 – Further Meetings / Consultations

Consultations on the ESIA:

- According to the EBRD PR 10, for Category A Projects, a public hearing will be conducted at the Village Hall in Oleshin (or equivalent) and the ESIA will be disclosed for a period of 120 days. The ESIA, Non-Technical Summary and LRF will be made available at the City Council Office, in the Mayor's Office in Khmelnitsky and in the schools (or equivalent) in all adjacent villages. The addresses of the schools (or equivalent) are:
  - Oleshyn School – 13a Shkilna Street, Village of Oleshyn, 31312
  - Ivankivtsi Lyceum – 2 Shkilna Street, Village of Ivankivtsi, 31314
  - Cherepova School – 2 Centralna Street, Village of Cherepova, 31316
  - Cherepivka School – 25 Trublaini Street, Village of Cherepivka, 31305

Consultations on the national EIA:

- Consultations with the public, providing sufficient time and opportunities to review EIA materials and participate in the decision-making process according to the detailed procedures outlined in the applicable Ukrainian Law (25-35 business days);
- Review of the EIA by the 'Authorised Body' (i.e. the Ministry of Ecology and Natural Resources), considering public opinion and an analysis of the information gathered by business entities during the public debate; and
- The Ministry of Ecology and Natural Resources shall also establish the Unified EIA Registry (to be available online, with a free access for public).

6

AIR QUALITY

6 AIR QUALITY

6.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

6.1.1. Legislation, policy and guidance considered as part of the assessment are identified below, this includes applicable EU legislation.

AIR QUALITY DIRECTIVE (2008/50/EC)

6.1.2. The Air Quality Directive 2008/50/EC[7] sets limit values for the concentration of pollutants in air for the protection of human health, vegetation and ecosystems in the European Union (EU). Compliance with the limit values for pollutants is mandatory in EU member states that have ratified the Directive and incorporated it into their national legislation. Failure to comply would result in infraction proceedings with potentially a substantial financial penalty. In the case of human exposure, the limit values apply everywhere in the external environment.

6.1.3. In September 2014, Ukraine ratified the signature of the EU-Ukraine Association Agreement. Under this Agreement, Ukraine will cooperate with the EU on environmental issues; however, the requirements of Air Quality Directive are yet to be adapted into Ukrainian legislation.

LANDFILL DIRECTIVE (1999/31/EC)

6.1.4. The Landfill Directive 1999/31/EC[8] regulates waste management of landfills, defined as waste disposal sites for the deposit of waste onto or into land, in the EU. According to the waste management hierarchy, landfilling is the least preferable option and should be limited to the necessary minimum. Where waste needs to be landfilled, it must be sent to landfills which comply with the requirements of the Directive.

6.1.5. The objective of the Directive is to prevent, or reduce as far as possible, negative effects on the environment, including on the effects on surface water, groundwater, soil, air, and on human health from the landfilling of waste.

INDUSTRIAL EMISSIONS DIRECTIVE

6.1.6. The Industrial Emissions Directive (IED) 2010/75/EU[9] is the main EU instrument regulating pollutant emissions from industrial installations. The IED aims to achieve a high level of protection of human health and the environment by reducing harmful industrial emissions across the EU, through application of BAT.

[7] The European Parliament and the Council of the European Union (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe.

[8] The European Parliament and the Council of the European Union (1999). Directive 1999/31/EC of the European Parliament and of the Council of 26 April 1999 on Landfill of Waste.

[9] The European Parliament and the Council of the European Union (2010). Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control).

6.1.7. Installations undertaking industrial activities listed in Annex I of the IED must operate in accordance with a permit granted by the appropriate regulatory authorities in Member States. The permit contains conditions set in accordance with the principles and provisions of the IED.

ON ATMOSPHERIC AIR PROTECTION

6.1.8. Since Ukraine gained its independence, environmental regulations and standards have been based on the use of Maximum Permissible Concentrations (MPC), which were considered for the permitting system[10].

6.1.9. In 2001, new changes were introduced to the Law 'On Atmospheric Air Protection' taking into account air pollutants' emissions from existing and new installations. Ukraine started on the path towards implementation and adoption of the EU Integrated Pollution Prevention and Control (IPPC) Directive and use of the principle of BAT.

WORLD HEALTH ORGANISATION AIR QUALITY GUIDELINES FOR PARTICULATE MATTER, OZONE, NITROGEN DIOXIDE AND SULPHUR DIOXIDE

6.1.10. The World Health Organisation (WHO) air quality guidelines, revised in 2005[11], are designed to offer guidance in reducing the health impacts of air pollution and are based on expert evaluation of current scientific evidence relating to the health impacts of air pollution. The guidelines are intended to inform policy-makers and to provide appropriate targets for a broad range of policy options for air quality management in different parts of the world.

GUIDANCE ON THE ASSESSMENT OF DUST FROM DEMOLITION AND CONSTRUCTION

6.1.11. The UK's Institute of Air Quality Management (IAQM) published guidance[12] for developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified

GUIDANCE ON THE ASSESSMENT OF ODOUR FOR PLANNING

6.1.12. The IAQM Odour Guidance[13] provides guidance for assessing odour impacts for planning purposes. The guidance presents a range of methodologies, including sniff tests, that can be adopted for an odour assessment and highlights that some degree of professional judgement is required throughout the assessment.

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[10] The International Bank for Reconstruction and Development / The World Bank (2016). Ukraine Country Environmental Analysis.

[11] World Health Organisation (2006). WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide - Global Update for 2005.

[12] Institute of Air Quality Management (2016). Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1).

[13] Institute of Air Quality Management (2018). Guidance on the Assessment of Odour for Planning (Version 1.1).

ASSESSMENT OF BIOAEROSOLS

6.1.13. In the absence of national guidance for the exposure and assessment of bioaerosols, the UK Health and Safety Executive (HSE) research[14] has been applied. The 'risk zone' proximity model has been utilised within the assessment.

HIGHWAYS ENGLAND DESIGN MANUAL FOR ROADS AND BRIDGES SECTION 3 PART 1 (HA207/07)

6.1.14. Highways England (formerly the Highways Agency) Design Manual for Roads and Bridges[15] gives guidance on the assessment of the impacts that major road projects may have on local air quality including emissions of 'climate change' pollutants such as carbon dioxide (CO_2). The pollutants of most concern near roads are nitrogen dioxide (NO_2) and particles (PM_{10}) in relation to human health and oxides of nitrogen (NO_x) in relation to vegetation and ecosystems.

AIR QUALITY STANDARDS

6.1.15. Air quality is assessed nationally against Ukrainian Air Quality standards which are given in Table 6-1 for NO_2, sulphur dioxide (SO_2) and Total Suspended Matter; however, there are no Ukrainian standards for particulate matter (PM_{10} and $PM_{2.5}$). The WHO guidelines and EU limit values for PM_{10} and $PM_{2.5}$ have been provided in Table 6-1.

[14] Health and Safety Laboratory for the Health and Safety Executive (2010). Section 3.3 – Bioaerosol emissions from waste composting and the potential for workers' exposure. Available at: http://www.hse.gov.uk/research/rrpdf/rr786.pdf (Accessed 23/08/2019).

[15] Highways England (2007). Design Manual for Roads and Bridges Section 3 Part 1 (HA207/07).

Table 6-1 – Comparison of Ukrainian, WHO and EU Air Quality Standards (μg/m³)

Concentration (μg/m³)											
Ukrainian Limit Value				**WHO Guideline**				**EU Limit Value**			
Short-term		**Long-term**		**Short-term**		**Long-term**		**Short-term**		**Long-term**	
Nitrogen Dioxide (NO_2)											
200	Hourly (1-hour) mean	40	Annual mean	200	Hourly (1-hour) mean	40	Annual mean	200	Hourly (1-hour) mean, not to be exceeded more than 18 times a calendar year	40	Annual mean
Sulphur Dioxide (SO_2)											
500	Hourly (1-hour) mean	50	Daily (24-hour) mean	500	10-min mean	20	Daily (24-hour) mean	350	Hourly (1-hour) mean, not to be exceeded more than 24 times a calendar year	125	Daily (24-hour) mean, not to be exceeded more than 3 times a calendar year
Total Suspended Matter											
500	Hourly (1-hour) mean	150	Daily (24-hour) mean	None				None			
Particulates less than 10 micrometres in diameter (PM_{10})											
None				50	Daily (24-hour) mean	20	Annual mean	50	Daily (24-hour) mean, not to be exceeded more than 35 times a calendar year	40	Annual mean
Particulates less than 2.5 micrometres in diameter ($PM_{2.5}$)											
None				25	Daily (24-hour) mean	10	Annual mean	None		25	Annual mean

6.2 ASSESSMENT METHODOLOGY

SCOPE

6.2.1. This assessment uses the scope, methodology and significance criteria outlined in Chapter 5: Approach to ESIA. The scope has been determined through:

- A desk study to confirm the locations of nearby existing human receptors that may be sensitive to changes in local air quality, and a review of the masterplan for the Project to establish the location of new sensitive receptors, which were subsequently verified during the site visits undertaken by the Project Team;
- A review of traffic data to determine the number of heavy-duty vehicle[16] (HDV) movements associated with the construction and operational stages of the Project; and
- A review of the estimated volumes of waste, including putrescible material[17], to be accepted by the Project to establish the potential for odour and bioaerosols[18] which may give rise to nuisance complaints.

6.2.2. The potential for impacts was considered both with, and without, the implementation of appropriate industry 'best practice' mitigation measures. Appropriate mitigation has been recommended for the Project and specifically where effects have been identified due to dust-generating activities which may lead to health effects and a loss of amenity.

LIKELY SIGNIFICANT EFFECTS

6.2.3. The scope of the assessment considers the likely significant effects on local air quality due to:

- Dust and particulate matter generated by on-site activities during both the construction and operational stages of the Project;
- Changes in NO_2 and PM_{10} concentrations resulting from road vehicle exhaust emissions arising from construction traffic and plant (referred to as 'Non-Road Mobile Machinery', NRMM);
- Changes in pollutant concentrations resulting from HDV vehicle exhaust emissions accessing the Project once operational; and
- Odour and bioaerosols generated by waste management activities conducted on-site during the operational stage.

EXTENT OF THE STUDY AREA

6.2.4. The full extent of the study area is given in Figure 6-1, Figure 6-2 and Figure 6-3. It includes the area immediately surrounding the Project together with the location of 'high' sensitivity dust receptors, which may be affected by construction dust impacts (as shown in Figure 6-2); the roads affected by its operation (as shown in Figure 6-2); and the area immediately surrounding the Project which may

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[16] Lorries, buses and coaches >3.5 tonnes.

[17] Material liable to decay.

[18] An aerosol containing biologically active bacteria, spores, viruses, toxins, and other similar material.

be affected by operational dust impacts, odour and bioaerosols (as shown in Figure 6-3), including the location of high sensitivity receptors.

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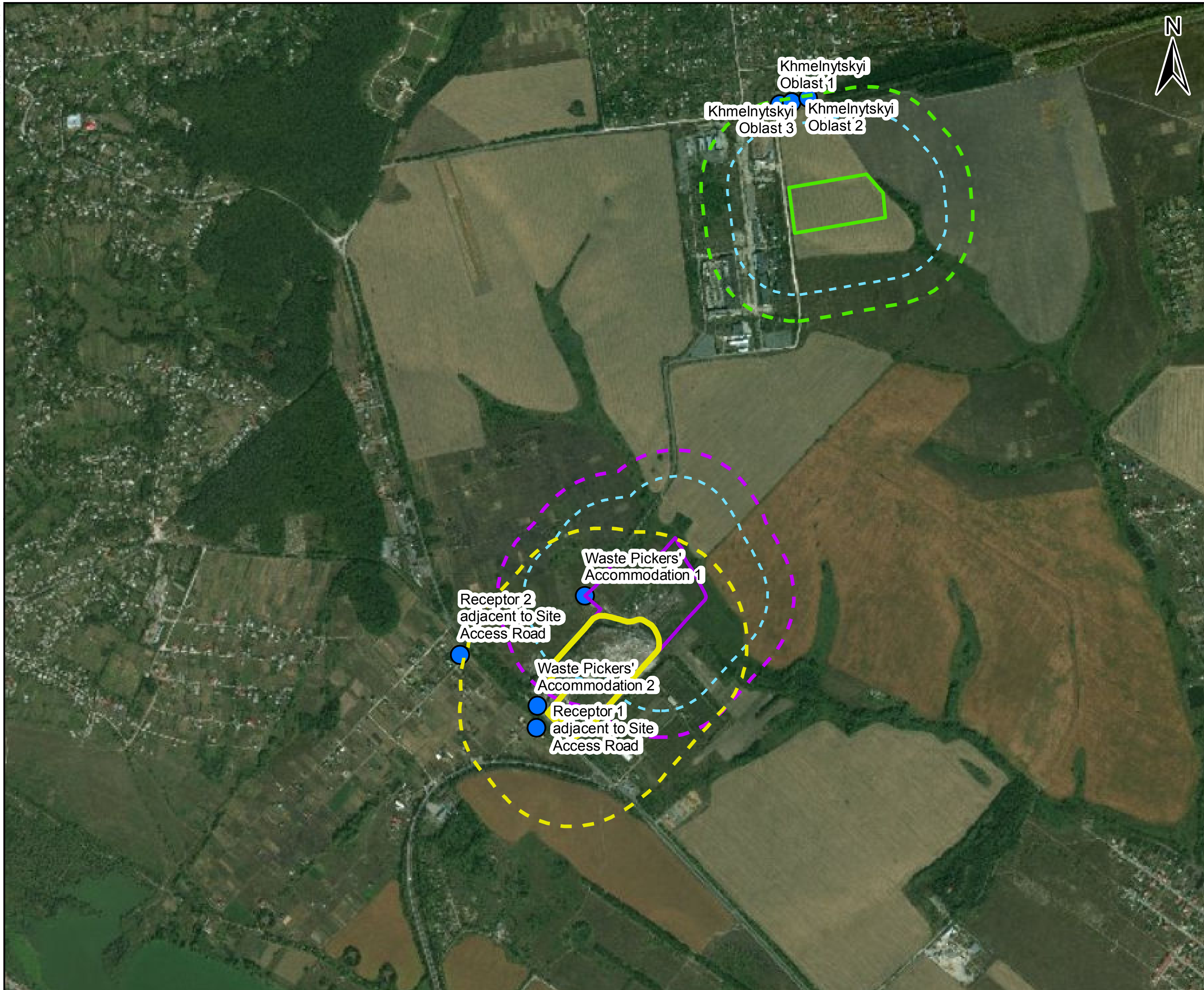

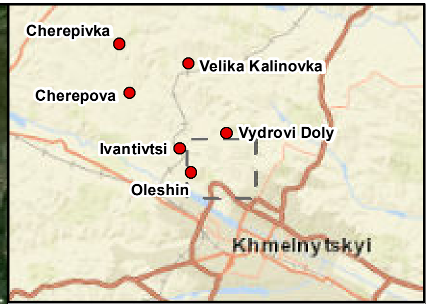

Key

- Existing Landfill
- Existing Landfill - Indicative 500m Sanitary Protection Zone (SPZ)
- Proposed Landfill
- Proposed Landfill Site - Indicative 500m Sanitary Protection Zone (SPZ)
- Proposed MBT Facility
- Proposed MBT Facility - Indicative 500m Sanitary Protection Zone (SPZ)
- 350m Dust Study Area
- Existing High Sensitivity Receptor

wsp

Client:

EBRD

Project:

KHMELNITSKY SOLID WASTE PROJECT

Title

Figure 6-1
Construction Dust Assessment

Date: 24/10/2019		Scale: 30,000 @ A4
Drawn: PH	Checked: DE	Approved: JW

0 0.5 1 2 Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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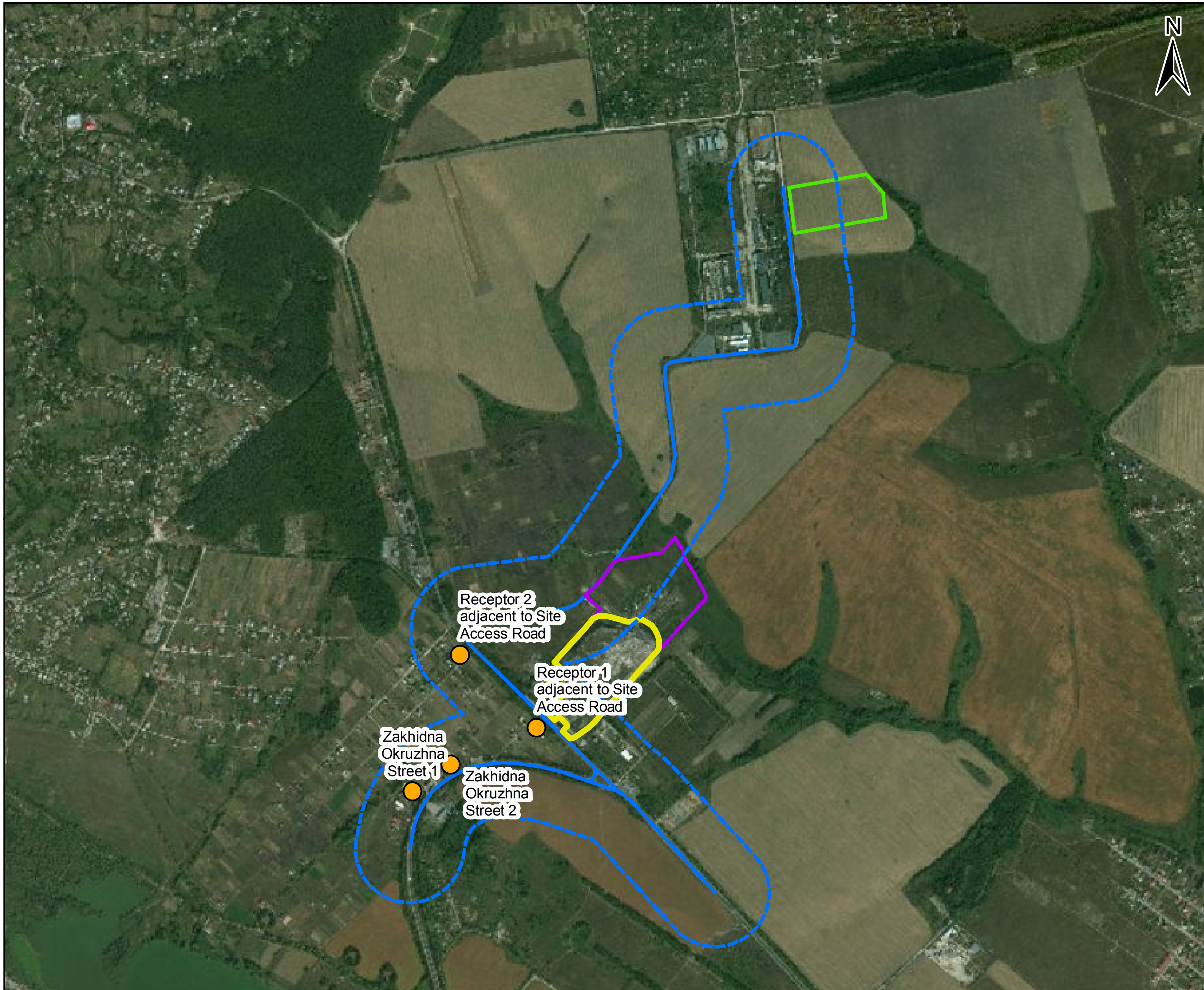
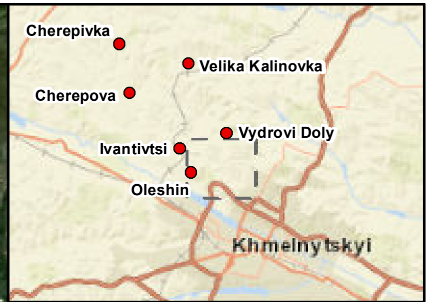




Key

- Existing Landfill
- Proposed Landfill
- Proposed MBT Facility
- Affected Road Network
- Affected Road Network - 200m Study Area
- High Sensitivity Roadside Receptor

0 0.5 1 2 Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

wsp

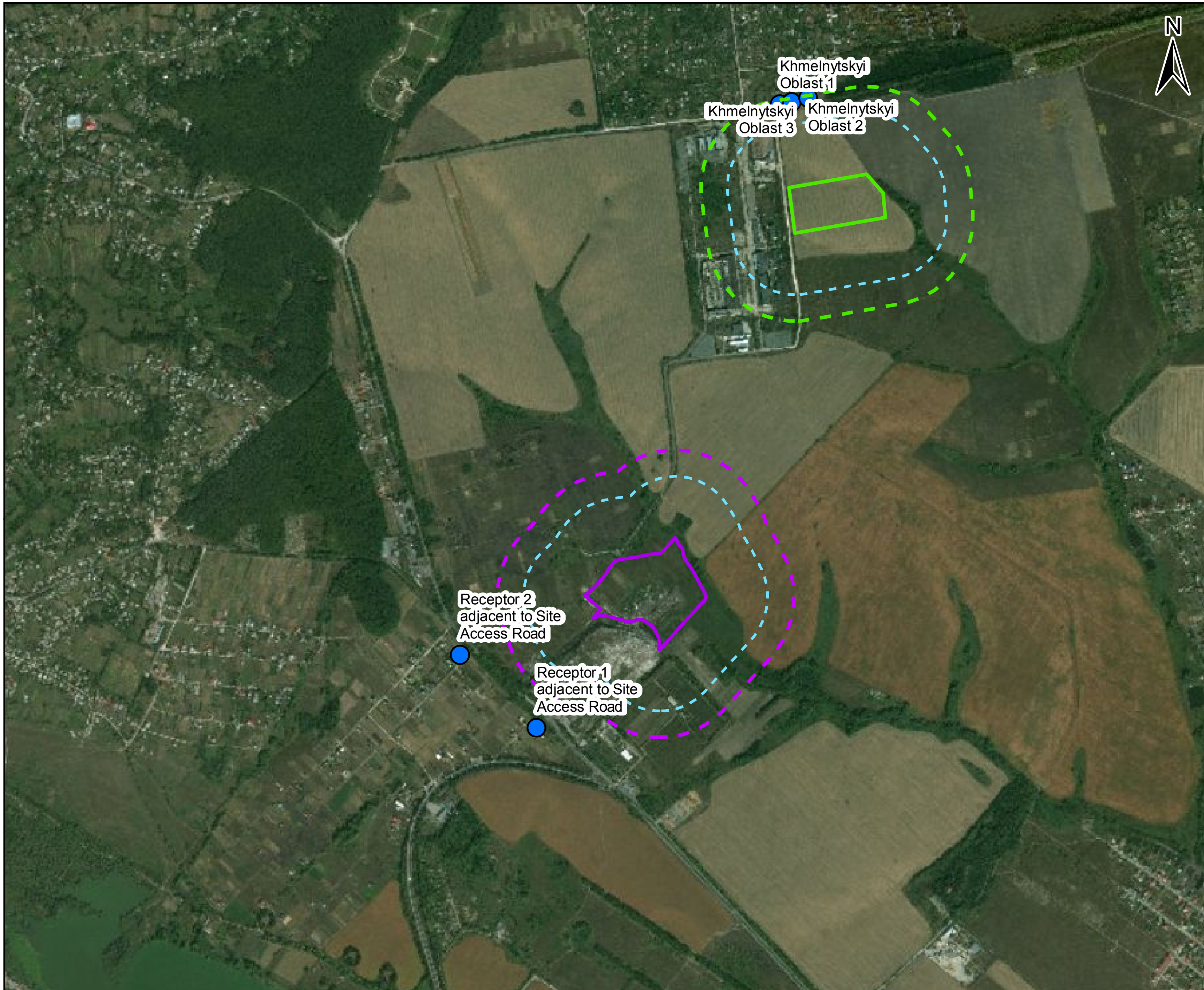
Client:
EBRD

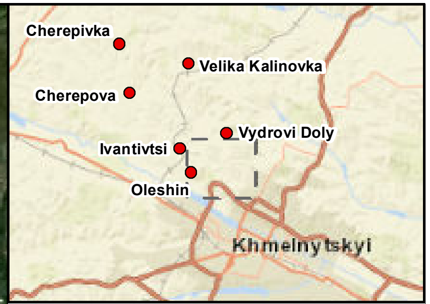
Project:
KHMELNITSKY SOLID WASTE PROJECT

Title
Figure 6-2
Operational Phase Assessment - Affected Roads Network

Date: 24/10/2019		Scale: 30,000 @ A4	
Drawn: PH	Checked: DE	Approved: JW	

Date Saved: 24/10/2019





Key

- Proposed Landfill
- Proposed Landfill Site - Indicative 500m Sanitary Protection Zone (SPZ)
- Proposed MBT Facility
- Proposed MBT Facility - Indicative 500m Sanitary Protection Zone (SPZ)
- 350m Dust Study Area
- High Sensitivity Receptor

0 0.5 1 2 Kilometers

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

wsp

Client:

EBRD

Project:

KHMELNITSKY SOLID WASTE PROJECT

Title

Figure 6-3
Operational Phase Assessment - Dust, Odour and Bioaerosols

Date:	24/10/2019			Scale:	30,000 @ A4
Drawn:	PH	Checked:	DE	Approved:	JW

Construction Stage

6.2.5. IAQM guidance[19] has been followed in defining the study area for construction stage impacts. This requires consideration of 'human receptors' within 350m of the Project, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance. There are no sensitive ecological sites in the area that would be affected.

6.2.6. Earthworks and civil works are not among the activities considered likely to generate significant odour and bioaerosol emissions. It is considered unlikely that activities associated with the construction phase would result in the generation of odours other than odours from vehicles and construction machinery / equipment exhausts.

Operational Stage

6.2.7. The impacts of dust and particulate matter arising from the operation of the Project have been assessed against the IAQM guidance criteria given above.

6.2.8. In addition to the area which includes the SPZ, to determine emission of dust from the landfill operation, the study area for operational stage assessment will also include receptors within 200m of the roads shown in Figure 6-3.

6.2.9. During the operational phase, the likelihood of odours from the proposed landfill and the proposed MBT facility causing a nuisance depends on: the frequency, intensity, duration, unpleasantness of odours and the location of human receptors in relation to these. This can be judged by considering the location of the source relative to sensitive receptors (distance and direction), and the effectiveness of dispersion / dilution. Meteorological conditions influence whether offensive odour will be experienced (wind direction and speed being particularly important), and available local meteorological data have therefore been considered (see Appendix 6-2).

6.2.10. Substantial quantities of micro-organisms (bioaerosols) are known to be emitted to air during landfilling and composting processes, as microbiological activity is fundamental to the composting process. Residents near waste composting sites (sensitive receptors) may be exposed to these bioaerosols.

METHODOLOGY

Construction Stage

6.2.11. Dust comprises particles typically in the size range 1-75 micrometres (μm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited near the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

[19] IAQM (2016). Guidance on the Assessment of Dust from Demolition and Construction.

6.2.12. The smaller particles of dust (less than 10µm in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5µm). As these particles are at the smaller end of the size range of dust particles, they remain suspended in the atmosphere for a longer period than the larger dust particles and can therefore be transported by wind over a wider area. PM_{10} and $PM_{2.5}$ are small enough to be drawn into the lungs during breathing, which could have a potential impact on the health of sensitive members of the public.

6.2.13. An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for this phase of the Project provided by the Client and Project Team; and professional judgement.

6.2.14. The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition; earthworks; general construction activities and movement of vehicles out of the site (referred to as 'track-out'). The assessment has accounted for the nature and scale of the activities and the sensitivities of the surrounding areas to increased dust and PM_{10} levels. Risks have been assigned as 'low', 'medium' or 'high'. Site specific mitigation has been assigned according to the level of risk, and the significance of residual effects determined. A summary of the IAQM assessment methodology is provided in Appendix 6-2.

6.2.15. In addition to dust impacts, exhaust emissions from construction vehicles and NRMM are likely to impact on local air quality along roads used by construction traffic and in the area surrounding the Project Site. As detailed information on construction traffic and NRMM operations is not available at this stage, a commentary has been provided on the potential impacts.

Operational Stage

6.2.16. A qualitative assessment of the impacts (i.e. changes) due to the operation of the Project has been undertaken for NO_2, PM_{10}, $PM_{2.5}$, odour and bio-aerosols.

Dust and Particulate Matter

6.2.17. The methodology used to assess the impacts of dust and particulate matter arising from the operation of the Project is the same used to assess the Construction Stage impacts (given above).

Road Traffic Emissions

6.2.18. The change in air pollutant concentrations (NO_2 and PM_{10}) due to the operation of the Project have been predicted using the 'DMRB Screening Tool'. This is a spreadsheet-based screening method devised by Highways England, UK, which predicts air pollutant concentrations based on Annual Average Daily Traffic (AADT) flows, vehicle speeds (km/h) and the percentage of HDVs (%HDV).

6.2.19. Two scenarios have been considered:

- Baseline; and
- Baseline with the Project.

Odour

6.2.20. The methodology used to assess odour impacts follows, where possible, the IAQM guidance[20], drawing upon the simple qualitative representation of the Source-Pathway-Receptor (S-P-R) concept.

Bioaerosols

6.2.21. The methodology used to assess exposure risk from bioaerosols follows the 'risk zone' proximity model proposed by the HSE[21].

SENSITIVE RECEPTORS

6.2.22. Sensitive locations are places where the public may be exposed to pollutants resulting from activities associated with the Project. These will include locations sensitive to:

- Increased dust deposition and PM_{10} exposure due to on-site construction and operational activities;
- Exposure to gaseous pollutants (NO_2 and PM_{10}) emitted from road vehicle exhaust emissions accessing the Project once operational; and
- Odour and bioaerosols generated by waste management activities conducted on-site during the operational stage.

6.2.23. The locations of sensitive receptors considered are given in Table 6-2 and shown in Figure 6-1 to 6-3. The table below also indicates which component of the assessment the receptor is relevant to.

6.2.24. The location of the waste pickers' accommodation is not given in the table below as they are not considered as part of the construction and operational phase assessments, as they will have access to better accommodation as part of implementation of the LRF. However, they have been shown in Figure 6-1 as they form part of the assessment of dust sensitivity.

Table 6-2 - Locations of Sensitive Receptors Used in the Assessment

Receptor Description	Longitude (°N)	Latitude (°W)	Construction Phase	Operational Phase	
			Receptors susceptible to Dust impacts (Figure 6-1)	Receptors adjacent to scheme roads (Figure 6-2)	Receptors susceptible to Dust, Odour and Bioaerosol impacts (Figure 6-3)
Khmelnytskyi Oblast 1	26.974	49.480	●		●
Khmelnytskyi Oblast 2	26.974	49.480	●		●

[20] Bull et al (2014). IAQM Guidance on the assessment of odour for planning, Institute of Air Quality Management, London.

[21] Health and Safety Laboratory for the Health and Safety Executive (2010). Section 3.3 – Bioaerosol Emissions from Waste Composting and the Potential for Workers' Exposure.

Receptor Description	Longitude (°N)	Latitude (°W)	Construction Phase	Operational Phase	
			Receptors susceptible to Dust impacts (Figure 6-1)	Receptors adjacent to scheme roads (Figure 6-2)	Receptors susceptible to Dust, Odour and Bioaerosol impacts (Figure 6-3)
Khmelnytskyi Oblast 3	26.975	49.480	●		●
Receptor 1 adjacent to Site Access Road	26.961	49.459		●	
Receptor 2 adjacent to Site Access Road	26.957	49.462		●	
Zakhidna Okruzhna Street 1	26.955	49.457		●	
Zakhidna Okruzhna Street 2	26.957	49.458		●	

SIGNIFICANCE CRITERIA

Construction Phase

6.2.25. The IAQM assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity, with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors, therefore the residual effect will normally be negligible.

Operational Phase

Road Traffic Emissions

6.2.26. Air quality effects have been classified in accordance with ESIA methodology detailed in Chapter 5: Approach to ESIA, using the descriptors in and below Table 5-3. Pollutant concentrations have been compared to EU limit values and WHO guidelines. This approach has been followed to determine whether local air quality impacts are likely to give rise to a significant effect, which may be adverse or beneficial.

6.2.27. In determining whether an effect is significant the following have been considered:

- The magnitude of each change in ambient pollutant concentration at each receptor (i.e. the impact as given by the impact descriptors);
- The existing and future air quality in the absence of Project; and
- The extent of current and future population exposure to the impacts.

Odour Emissions

6.2.28. The potential odour effects have been classified in accordance with ESIA methodology detailed in Chapter 5: Approach to ESIA, using the descriptors in and below Table 5-3. The risk of odour nuisance has been applied using a relative risk descriptor of negligible, low, medium or high-risk impact. This approach has been followed to determine whether odour impacts are likely to give rise to a significant effect, which may be adverse or beneficial.

6.2.29. In determining whether not an effect is significant the following have been considered:

- The magnitude of risk of odour nuisance at the closest receptor;
- The existing and future risk of odour nuisance in the absence of the proposed landfill site; and
- The extent of current and future population exposure to the impacts.

Bioaerosols

6.2.30. Risk of Bioaerosol effects have been classified in accordance with ESIA methodology detailed in Chapter 5: Approach to ESIA using the descriptors in and below Table 5-3. Risk of bioaerosol effects have applied the proximity model threshold of 50m, 100m and > 250m representing high risk, medium risk and low risk impacts, respectively. This approach has been followed to determine whether bioaerosol impacts are likely to give rise to a significant effect, which may be adverse or beneficial.

LIMITATIONS AND ASSUMPTIONS

6.2.31. Where data is unavailable, professional judgement has been used.

6.2.32. The routes to be used by construction vehicles are currently unknown. It is assumed that all vehicles accessing the proposed landfill site during the operational phase will approach and leave the site via Zakhidna Okruzhna Street. It is also assumed that during the operational phase vehicles will use the route shown in Figure 6-2 to travel between the proposed landfill and the proposed MBT facility.

6.2.33. It is assumed that the only change in road traffic (AADT and %HDV) is due to the operation of the Project, and it will lead to a doubling of the number of HDV vehicle trips.

6.2.34. To provide a conservative estimate of the change in air pollutant concentrations associated with the operational stage road traffic of the Project, Pre-Euro (1996) UK vehicle emission factors have been used in the DMRB Screening Tool.

6.2.35. In the absence of site-specific baseline, emissions, or detailed waste arising data, both the odour and bioaerosol assessments have been undertaken as qualitative assessments in accordance with IAQM odour guidance and the HSE bioaerosol methodology.

6.2.36. The odour assessment has been undertaken on the basis that odour complaints arising from the existing landfill site are frequent, and that no systematic waste segregation is in place.

6.2.37. Bioaerosol assessment has been undertaken on the basis that no systematic waste segregation is in place.

6.3 BASELINE CONDITIONS

AIR QUALITY

6.3.1. There is currently no air quality data available for the Site or the region to inform the baseline conditions, however, air quality is likely to be impacted by the presence and operation of the existing landfill. The world bank provides a world map showing annual mean $PM_{2.5}$ concentrations (in $\mu g/m^3$)

for 2017[22]. The estimated annual mean $PM_{2.5}$ concentration for the Ukraine is 20.3µg/m^3. Research indicates that concentrations of PM_{10} is generally composed of approximately 70% $PM_{2.5}$[23]. On this basis, average annual mean PM_{10} concentrations are likely to be approximately 30µg/m^3.

6.3.2. The existing landfill is a windblown site of 8.9ha in size, with no systematic waste segregation and minimal material control. It has the potential to be a continuous significant dust risk to human health, as there are sensitive residential receptors located approximately 70m from the boundary of the existing landfill, within the 500m Sanitary Protection Zone for the landfill. The proposed remediation and capping of the existing landfill site will reduce the dust risk to human health.

ODOUR

6.3.3. The existing landfill site accepts mixed household waste, with no segregation of putrescible waste from non-putrescible waste. The absence of a functional waste management procedure at the existing landfill site has generated conditions which are liable to produce uncontrolled odours. This has been confirmed from reports of repeated odour nuisance complaints at residential receptor location close to the existing landfill.

BIOAEROSOLS

6.3.4. Wind-blown dust release from the existing landfill may occur due to minimal material control. Due to the presence of putrescible waste, a proportion of this wind-blown dust will contain micro-organisms. Waste-pickers are at greatest risk of suffering ill-effects from exposure to bio-aerosols releases from the landfill site, due to their continued presence at the landfill and close proximity to its releases. Such effects are likely to be expressed in the waste-pickers health as: poor respiratory health, throat and eye infections, as well as chronic demagogical infections.

6.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

6.4.1. Construction activities that have the potential to generate and / or re-suspend dust and PM_{10} include:

- Site clearance and preparation;
- Preparation of temporary access/egress to the Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Site;
- Use of crushing and screening equipment/plant;
- Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;

---

[22] World Bank (2017). $PM_{2.5}$ Air Pollution, Mean Annual Exposure (micrograms per cubic meter) 2017. Available at: https://data.worldbank.org/share/widget?indicators=EN.ATM.PM25.MC.M3&view=map (Accessed 23/08/2019).

[23] Defra (2012). Air Quality Expert Group, Fine Particulate Matter ($PM_{2.5}$) in the United Kingdom. Available at: https://uk-air.defra.gov.uk/assets/documents/reports/aqeg/pb13837-aqeg-fine-particle-matter-20121220.pdf (Accessed 23/08/2019).

- Construction of buildings, the landfill cell, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing; and
- Site landscaping after completion.

6.4.2. The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from substantial earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Assessment of Potential Dust Emission Magnitude

6.4.3. The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition; earthworks; construction; and, trackout. The findings of the assessment are presented below.

Demolition

6.4.4. Demolition activities will not be undertaken and therefore consideration of the impact of this source on dust soiling and ambient PM_{10} is not required.

Earthworks

6.4.5. The total area of the existing landfill, proposed landfill and the proposed MBT facility is 20.5ha comprising: 8.9ha of existing landfill, 6ha of proposed landfill and 5.6ha associated with proposed MBT facility. The underlying soil type is predominantly loamy in texture and therefore has the potential for moderate dust release when dry. Due to the scale of the Project large amounts of material will be moved as part of the construction phase, with excavated material temporarily stockpiled within the Site. It is also estimated that more than 10 heavy earth moving vehicles will be active at any one time. Construction of the Project is anticipated to begin in 2021/2022 and last between two and four years. Therefore, the potential magnitude of dust emission is considered to be large for earthwork activities.

Construction

6.4.6. Based on information from the Design Team the total volume of buildings to be constructed as part of the proposed MBT facility will be more than 100,000m^3 using some potentially dust generating construction material, such as concrete. Additionally, material with a low potential for releasing dust (e.g. metal cladding) will also be utilised. It has been assumed that concrete batching will be undertaken on Site and it is deemed unlikely that solid hoarding will be erected during construction. Therefore, the potential magnitude of dust emission is considered medium for construction activities.

Trackout

6.4.7. Information on the number of HDVs associated with this phase of the Project is not available and therefore professional judgement has been used. It has been assumed that given the size of the development area there are likely to be >50 HDV outward movements in any one day, travelling over moderately dusty surface material. As the unpaved road length in the Site is likely to be >100m, it is considered that the potential magnitude of dust emission is large for trackout.

6.4.8. Table 6-3 provides a summary of the potential dust emission magnitude determined for each construction activity considered.

6.4.9.

Table 6-3 – Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Not Applicable
Earthworks	Large
Construction Activities	Medium
Trackout	Large

Assessment of the Sensitivity of the Study Area

6.4.10. The sensitivity of the study area has been assessed by considering the prevailing meteorology and the location of dust sensitive receptors to the Project during the construction and operational phases.

6.4.11. A wind rose generated using 2014-2018 meteorological data from the Khmelnitsky Meteorological station is shown below in Figure 6-4. It shows that the prevailing wind direction is from the south east and north west, with the highest wind speeds occurring from the north west. Therefore, receptors located to south east and north west of the Site are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction and operational phases.

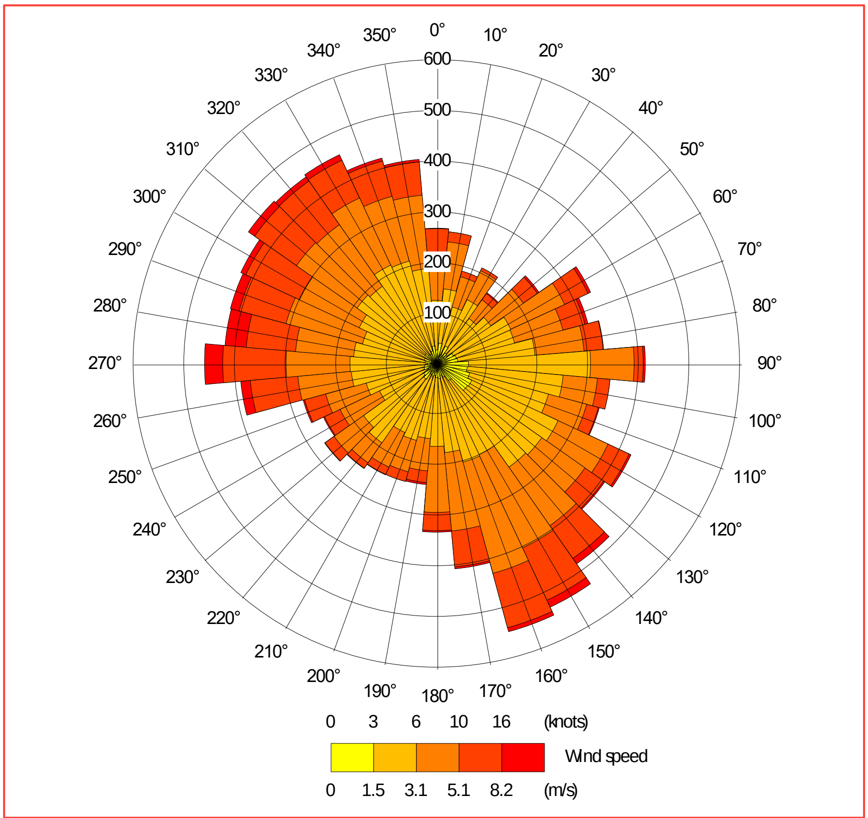


Figure 6-4 – Wind Rose 2014 – 2018

6.4.12. Rainfall is also an influential climatological parameter in the generation of dust. Rainfall greater than 0.2mm per day[24] is sufficient to suppress dust emissions at the source and eliminating the pathway to the receptor.

6.4.13. Whilst precipitation is highest during the summer months, showers and thunderstorms are frequent during the winter. The annual rainfall in the study area is between 530 to 670mm. Additionally, snow cover is formed from mid-December until the beginning of March and is approximately 10-15cm in thickness.

6.4.14. When there are low wind speed conditions and during dry conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. The surrounding area is predominantly characterised by agricultural land, with the closest means of accommodation to the existing are the cabins which currently accommodate Roma waste pickers, these are located immediately west and south-west of the existing landfill (waste pickers' accommodation 1 and 2). The closest residential properties are located approximately 70m south of the existing landfill boundary. The established villages of Oleshin, Velika Kalinovka, Ivankivtsi, Cherepova and Cherepivka are located further afield.

[24] Arup & Ove Arup Environmental (1995). Environment Effects of Surface Mineral Workings.

6.4.15. There is a former industrial site, situated approximately 100m to the west of the proposed MBT facility, which is occupied by a number of small businesses. Commercial buildings and offices are situated approximately 200m and 475m north west, respectively. The closest residential dwellings are situated approximately 460m north of the proposed MBT facility and within 50m of a possible construction route. As such, these sensitive receptors have the potential to be subject to adverse effects due to trackout emissions. It is estimated there are between 1 to 10 residential receptors (in accordance with the IAQM guidance) within 20m and 50m of the road edge, when considering possible construction routes up to 500m from the entrance of the proposed MBT facility.

6.4.16. From reviewing the area around the Project, it is estimated that there are currently between 1 and 10 medium sensitivity receptors (industrial and commercial units) and 1 high sensitivity receptor (the waste pickers' accommodation) located within a 350m radial study area surrounding the Site. Moreover, there are between 1-10 residential dwellings within 50m of the road edge of access roads up to 500m from each of the likely access points of the proposed landfill and proposed MBT facility.

6.4.17. There is no background PM_{10} monitoring data for the area around the Project at the time of writing. Although the background PM_{10} concentrations are likely to be influenced by the road surface composition and presence of agricultural activity surrounding the Site, the current concentrations are anticipated to be below the PM_{10} EU limit value, with exception of the sensitive residential receptors located approximately 70m from the existing landfill. On the basis of the limited evidence currently available, the area is likely to be of low sensitivity to dust soiling and of low sensitivity to human health effects to due increases in ambient PM_{10} concentration.

6.4.18. There are no ecological designated sites located within the vicinity of the Site (the nearest is approximately 10km away). Therefore, there is no requirement to consider ecological receptors in the assessment.

6.4.19. Taking the above into account and following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in Table 6-4.

Table 6-4 – Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Medium	Medium	Medium
Human Health (PM_{10})	N/A	High	High	High

Risk of Impacts

6.4.20. The LRF for this Project commits the Developer to increase the waste pickers' salary so they can afford off-site accommodation. This mitigation measure will be implemented prior to the construction of the Project and subsequently removes the high sensitivity receptors (the waste pickers' accommodation) located within the 350m radial study area surrounding the Site.

6.4.21. Taking this mitigation measure into account, the predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of dust impacts during the construction phase, prior to mitigation. Table 6-5 provides a summary of the risk of dust impacts for the Project. The risk category identified for each construction activity has been used to determine the level of mitigation required.

6.4.22. The predicted risk to human health due to earthworks and trackout would be high if the LRF for the Project was not implemented; however, taking this measure into account reduces the risk to low for all activities at both the proposed landfill and the proposed MBT facility.

Table 6-5 – Summary Dust Risk Table to Define Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Low Risk	Low Risk	Low Risk
Human Health (PM_{10})	N/A	Low Risk	Low Risk	Low Risk

Construction Vehicles and Plant

6.4.23. The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access. Construction traffic routing is unknown; therefore, it has been assumed construction traffic could approach the proposed landfill site and the proposed MBT facility from either the north or south. Review of aerial imagery suggests the closest industrial units to the proposed MBT facility operate LGVs and HGVs on the immediate road network. However, it is unknown how the construction traffic will compare to existing flows on the immediate road network at the proposed landfill and the proposed MBT facility.

6.4.24. Final details of the exact plant and equipment likely during the construction phase will be determined by the appointed contractor, it is considered likely to comprise waste trucks, tracked excavators and diesel generators. In addition, asphalt spreaders, rollers, compressors and trucks will likely be utilised on both proposed landfill and the proposed MBT facility. The number of plant and their location within the Site are likely to be variable over the construction period.

Summary

6.4.25. Based on the current local air quality in the area, the proximity and number of sensitive receptors to the roads likely to be used by construction vehicles, the likely numbers of construction vehicles and plant that will be used, and the implementation measures outlined in the ESMP and Air Quality Management Plan (AQMP), the effects are considered to be **neutral / minor (not significant)**.

OPERATIONAL PHASE

Road Traffic Emissions

6.4.26. The roads affected by the Project's operation, and the location of high sensitivity receptors, are shown in Figure 6-2. The change in air pollutant concentrations (NO_2 and PM_{10}) due to its operation have been predicted using the 'DMRB Screening Tool'.

6.4.27. The changes in annual mean NO_2 concentrations resulting from road vehicle emissions due to the operation of the project range from 0.06-0.39µg/m^3. This indicates a change in concentration relative to the Ukraine objective (40µg/m^3) between 0.15-0.98% The impact at existing receptor locations during the operational phase will be long term and permanent.

6.4.28. The changes in annual mean PM_{10} concentrations resulting from road vehicle emissions due to the operation of the project range from 0.02-1.21µg/m^3. This indicates a change in concentration relative to the EU Limit value (40µg/m^3) between 0.05-3.03%. Assuming a PM_{10} background concentration of 30µg/m^3, the maximum predicted increase of 1.21µg/m^3 would yield a total PM_{10} concentration (31.21µg/m^3) below the EU limit value of 40µg/m^3. The impact at existing receptor locations during the operational phase will be long term and permanent.

6.4.29. The potential effects are considered to be **minor (not significant)**.

Dust

6.4.30. Due to the operational site activities associated with the Project, there is the potential that dust will be generated. The area immediately surrounding the Project which may be affected by operational dust is shown in Figure 6-3 and includes the location of high sensitivity dust receptors.

Proposed Landfill

6.4.31. The proposed landfill, consisting of two sub-cells, will be infilled with MSW from the City of Khmelnitsky. The likely sources of dust during the operation of the landfill are anticipated to include:

- Movements on internal haul roads;
- Material handling and infilling;
- Exposed surfaces/ stockpiles; and
- Off-site transportation.

6.4.32. From the above, the principal sources of dust will likely arise from movements on internal haul roads. It is understood the internal haul roads will be made up of a combination of sand, gravel, crushed stone and road slabs, therefore dust may be generated during dry conditions.

6.4.33. The proposed landfill will be infilled in phases one sub-cell at a time which reduces the extent of exposed surfaces. Due to the proposed implementation of a wheel wash, dust emissions associated with off-site transportation will be significantly reduced. Moreover, the proposed landfill will be operated to EU standards, therefore it is assumed that best practice measures will be implemented.

Proposed MBT Facility

6.4.34. The proposed MBT facility has the potential to release dust emissions due to the type of material being handled and the processes being undertaken at the plant. The processing capacity of the facility will be 107,000 tonnes per annum.

6.4.35. When determining the impacts of dust, it is valuable to consider the: Source, Receptor and Pathway[25]. The following Site activities are considered to be potential sources of dust:

[25] IAQM (2016). Guidance on the Assessment of Mineral Dust Impacts for Planning.

- Transportation of waste on / off site;
- Handling of waste material;
- Unloading / loading HGVs;
- Internal movements / transportation of waste;
- Processing of waste, including crushing, separating, shredding; and
- Storage of waste.

6.4.36. The potential magnitude of dust generation is dependent on the waste type, the metrological conditions and the difference processes within the plant. Whilst waste processing and treatment have the potential to release dust, they will be undertaken within an enclosed building, which will limit emissions to air. The waste will likely be stored within the enclosed building and therefore the majority of dust generating activity will remain contained within the proposed MBT facility. It is also understood that abatement technologies will be installed which will capture and store dust created within the plant.

6.4.37. Based on the above, the predominant source of dust during the operation of the proposed MBT facility will be the transportation of waste on/off site. It has been assumed that 70% of vehicles visiting the proposed MBT facility will return to the new landfill, located to the south, to deposit waste. Vehicles entering and leaving the Site will be sheeted. Due to the road composition the potential magnitude of dust emission is considered to be medium from trackout.

6.4.38. As outlined in section 6.4.15above, the closest high sensitivity (residential) receptors are located approximately 460m north from the proposed MBT facility, and therefore the potential impact of dust emissions originating from within the site boundary at sensitive receptors is deemed negligible. Dust deposition rates decline after 300m from source, with the highest concentrations deposited within 100m[26].

6.4.39. Sensitive receptors could be affected by dust generated through trackout. One of the predominant wind directions is from the south east, which increases the potential for dust emissions at receptors located to the north west of the traffic routes. However, there are only a few residential dwellings within 50m of the edge of the access road and within 500m of the proposed MBT facility's entrance.

Summary

6.4.40. Dust generation associated with the proposed landfill is likely to primarily arise from truck movements on the internal haul roads. The haul roads will be constructed from potentially dust generating material and therefore may release dust when dry. In the wider vicinity, there are 10 residential dwellings within 300m of the current landfill entrances.

6.4.41. Based on the limited information provided, operational dust associated with the proposed MBT facility is anticipated to be generated primarily from the off-site transportation of waste to the landfill site. Due to the prevailing wind direction there is potential for dust to be deposited at high sensitivity receptors. However, the number of dwellings likely to be affected is low, as there are less than 10 residential receptors within 50m of the edge of the access road and within 500m of the proposed MBT facility's entrance.

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[26] IAQM (2016). Guidance on the Assessment of Mineral Dust Impacts for Planning.

6.4.42. With the implementation of mitigation measures outlined in the ESMP and Air Quality Management Plan (AQMP) the potential operational effects associated with dust deposition and PM_{10} are considered to be **neutral / minor (not significant)**.

Odour

6.4.43. The area immediately surrounding the Project which may be affected by operational odour is shown in Figure 6-3, which includes the location of high sensitivity receptors.

6.4.44. Once operational, the proposed new landfill site and MBT have substantial potential to generate odours. The probability that odours will be generated by the site and cause a nuisance to nearby receptors is influenced by several variables including: the frequency; intensity; duration; unpleasantness of odours; the proximity of sensitive receptors to the new landfill site; and their location with respect to prevailing winds direction.

6.4.45. Meteorological conditions play an important part in whether or not an odour experienced at a sensitive receptor location is considered offensive, as the of dispersion / dilution can reduce an offensive odour. Therefore, local meteorological data has been considered, where both wind direction and wind speed are critical in determining whether effective dispersion is likely to routinely occur.

6.4.46. As the proposed landfill and proposed MBT facility will be operational throughout the year, there is, therefore, a risk that odours could be generated at all times. Odours are likely to be generated during the warmer spring and summer months and may be less apparent during colder winter months. The wind rose indicates that the predominant wind direction in the area is south-south-eastern sector, and then the west through to the north-western sector. Therefore, for the majority of the time, the greatest potential for any odours generated to be detected will be either at the receptors located to the north-north west and to the east through to the south-eastern sector. As outlined in section 6.5.14 above, the nearest high sensitivity receptors are located at a sufficient distance from the Site (over 630m) to permit the dispersion of any unpleasant odours.

6.4.47. The perceived offensiveness of an odour is subjective and varies from person to person. Odours associated with anaerobic decomposition of waste are generally considered to be highly unpleasant, whilst odours from the proposed MBT facility composting are considered as moderately unpleasant. Odour emissions from anaerobic decomposition of waste from the proposed landfill site and MBT facility would be indication of poor management practices, as the generation of odours can be controlled through regular turning of composting matter.

6.4.48. There is a low risk that odour complaints will arise from residents in the area, as a consequence of the proposed landfill and the proposed MBT facility operations, based on the distance between the potentially odorous activities and the sensitive receptors, there is the opportunity for significant dispersion and dilution by the wind,

6.4.49. The proposed landfill and the proposed MBT facility operations are anticipated to result in a significant improvement in odour amenity, as a result of improved waste management, waste segregation, and increased distance between sensitive receptors and the proposed landfill. Adverse impacts of odour from the proposed MBT facility upon residential receptors will be avoided through proactive and effective waste management, reducing the risk of being malodours being released. The impact at existing receptor locations during the operational phase will be long term and permanent. The potential effects are considered to be **neutral / minor beneficial (not significant)**.

6.4.50. Odorous emissions from vehicles transporting waste and/or waste products could also occur. However, whilst the routes used could have nearby residential properties, exposure to such emissions would be highly limited and intermittent. The potential effects are considered to be **neutral (not significant)**.

Bioaerosols

6.4.51. The area immediately surrounding the Project which may be affected by bioaerosols generated during the operational phase is shown in Figure 6-3, which includes the location of high sensitivity receptors.

6.4.52. The proposed landfill will have a far lower potential for wind-blown bioaerosol releases than the current landfill, due to its cellular structure and management of surface waste. In addition, the segregation and treatment of putrescible waste at the proposed MBT facility will reduce the regeneration of waste derived containing micro-organisms at the proposed landfill.

6.4.53. The bioaerosol, exposure risk impact of the new landfill site operation at existing receptor locations during the operational phase will be long term and permanent. The potential effects are considered to be **neutral / minor (not significant)**.

6.5 MITIGATION AND ENHANCEMENT MEASURES

6.5.1. The mitigation and enhancement measures presented with the following sections are also reflected within the ESMP.

CONSTRUCTION PHASE

6.5.2. Based on the assessment results above, a number of dust mitigation measures are proposed for the construction phase of the Project and are provided in the ESMP. General measures, such as site management, communication and operation have been provided, in addition to specific measures applicable to earthworks, construction and trackout. Specific management plans will be developed as part of the ESMP, including a Road Maintenance and Restoration Plan.

6.5.3. Detailed mitigation measures to control construction traffic should be discussed with the Company to establish the most suitable access and haul routes for the site traffic.

OPERATIONAL PHASE

6.5.4. Based on the assessment, a number of dust mitigation measures are proposed for the operational phase, which are outlined in the ESMP. The measures are applicable to specific site activities, such as dust generating activities, equipment and vehicles, vehicle movements and management and soil, overburden and materials handling. General mitigation measures have also been provided to be applied as part of good practice. Specific management plans will be developed as part of the ESMP, including an Odour Management Plan and any complaints received in relation to dust, air quality and odour will be recorded into a Complaints Log.

6.6 RESIDUAL EFFECTS

Phase Construction Phase

6.6.1. The residual effects of dust and PM_{10} generated by construction activities following the application of the mitigation measures set out in the ESMP and good site practice is considered to be **negligible (not significant)**.

6.6.2. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **negligible (not significant)**.

Operational Phase

6.6.3. The residual effects of the operational phase of the Project on air quality, following the implementation of the Operational Air Quality Management Plan, is considered to be **negligible (not significant)** for NO_2, PM_{10}, odour and bioaerosols.

6.7 SUMMARY

Table 6-6 – Summary of Potential Impacts, Effects and Mitigation (Air Quality)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Dust and Particulates	Assumed to be good.	Construction	Generation of dust / re-suspend dust and PM_{10}.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to dust nuisance and harmful PM_{10} concentrations.	See ESMP for further detail	Negligible (not significant)
		Operation	Generation of dust / re-suspend dust and PM_{10}.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to dust nuisance and harmful PM_{10} concentrations.	See ESMP for further detail	Negligible (not significant)
Road Traffic Emissions	Assumed to be good.	Construction	Potential emissions of NO_2 to air.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to harmful NO_2 concentrations.	See ESMP for further detail	Negligible (not significant)
		Operation	Potential emissions of NO_2 to air.	**Minor Adverse (not significant)** Sensitive receptor exposure to	See ESMP for further detail	Negligible (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
				harmful NO_2 concentrations.		
Odour and Bioaerosols	Poor baseline conditions, odour complaints and high risk of exposure to bioaerosols.	Construction	N/A	N/A	N/A	Negligible (not significant)
		Operation	Potential odour and bioaerosol emissions.	**Minor Adverse to Minor Beneficial (not significant)** Sensitive receptor exposure to odour nuisance and health impacts from bioaerosols.	See ESMP for further detail	Negligible (not significant)

7

NOISE AND VIBRATION

7 NOISE AND VIBRATION

7.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

Directive 2002/49/EC[27]

7.1.1. The Environmental Noise Directive (END) is the main instrument to identify noise pollution levels and to identify actions for Member States. The aims of the END focus on:

- The determination of exposure to environmental noise;
- Ensuring that information on environmental noise and its effects is made available to the public; and
- Preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

ISO 1996-2:2017[28]

7.1.2. ISO 1996-2:2007 'Description, measurement and assessment of environmental noise' defines and prescribes best practice during recording and reporting of environmental noise. It advises that the information to be reported should include measurement technique (including type of instrumentation, measurement procedure and position of measurements), prevailing conditions during the measurements and any relevant qualitative data such as the nature of the sound source.

Worldbank / IFC Environmental, Health and Safety Guidelines (2007)[29]

7.1.3. The Environmental, Health and Safety (EHS) Guidelines, titled 'Noise Management' provides noise level guidelines which are normally used to assess the potential noise impact arising from a noise source of an industrial nature. It states that the noise impact should not exceed the levels presented in Table 7-1 or result in a maximum increase in background levels of 3 dB at the nearest receptor.

Table 7-1 – Worldbank / IFC Noise Level Guidelines

Receptor	Criteria $L_{Aeq,1hr}$
Residential, Institutional, Educational	55 dB daytime (07:00 – 22:00); 45 dB night-time (22:00 – 07:00)
Industrial, Commercial	70 dB daytime (07:00 – 22:00); 70 dB night-time (22:00 – 07:00)

BS5228:2009 and A1:2014[30]

7.1.4. BS5228, titled 'Noise and Vibration Control on Construction and Open Sites' has a methodology for predicting noise levels from construction sites, and assessing its effects on those exposed to it.

[27] European Parliament and Council (2002). 2002/49/EC, relating to the assessment and management of environmental noise

[28] ISO 1996-2 (2017). Description, Measurement and assessment of Environmental Noise.

[29] International Finance Corporation, Worldbank Group (2007). Environmental, Health and Safety Guidelines.

[30] BSI (2009 + 2014). BS5228 Noise and vibration control on construction and open sites.

BS5228 is the industry approved code of practice in the United Kingdom, and it complies with EU requirements for assessing noise from construction sites.

BS8233:2014[31]

7.1.5. BS8233:2014 'Guidance on sound insulation and noise reduction for buildings' outlines suggestions for criteria for many common situations, such as suitable sleeping / resting conditions and proposes noise levels that normally satisfy these criteria for most people. This is intended to guide the design of new or refurbished buildings rather than the assessment of changes to external noise sources.

7.1.6. Acceptable noise criteria for bedrooms are generally used to provide conservative criteria for internal levels. Table 7-2 reproduces Table 4 from BS8233:2014 and outlines the internal ambient noise limits appropriate for residential dwellings.

Table 7-2 – Indoor Ambient Noise Levels for Residential Dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room / area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

7.1.7. Criteria for external amenity space such as gardens and patios is outlined in BS8233 as 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$. These values are derived from guidance produced by the World Health Organisation within 'Guidelines for Community Noise' and are outlined as a lower and upper limit, which would be acceptable in noisier environments.

ISO 9613:1996[32]

7.1.8. ISO 9613, titled Part 2 'Acoustics – Attenuation of sound during propagation outdoors' specifies an engineering method to calculate the attenuation of noise propagating outdoors under meteorological conditions favourable for propagation.

7.1.9. The conditions for propagation are downwind, or equivalent, propagation under a moderate ground-based temperature inversion, such as that encountered at night.

7.1.10. The method consists of octave band algorithms to calculate the propagation originated from a point source, or several sources, taking into account the following physical effects:

- Geometrical divergence;
- Atmospheric absorption;

[31] BSI (2014). BS8233 Guideline on sound insulation and noise reduction for buildings.

[32] ISO (1996). ISO9613-2 Acoustics – attenuation of sound during propagation outdoors.

- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles.

7.2 ASSESSMENT METHODOLOGY

BASELINE NOISE SURVEY

7.2.1. A baseline noise survey was undertaken in accordance with ISO 1996-2 between 2nd and 3rd July 2019. The purpose of the noise monitoring survey was to establish the existing noise climate at noise sensitive receptors near the existing landfill, the proposed landfill and the proposed MBT facility. Measurements were also taken at the existing landfill to characterise the typical noise sources associated with its operation.

7.2.2. Noise measurements were undertaken using a Class 1 Sound Level Meter, in free field conditions, more than 3.5m away from any reflective surface other than the ground. The noise descriptors recorded included L_{Aeq}, L_{A90}, L_{A10} and L_{Amax}. Noise frequency data was also recorded in 1/3 octave bands for the measurements on the existing landfill. Calibration checks were performed before and after undertaking the noise measurements with no significant change noted. Table 7-3 presents a summary of the equipment used in the survey. Appendix 7-2 contains the associated calibration certificates.

7.2.3. Weather conditions were generally sunny, calm and dry, and therefore conducive for noise monitoring. Wind speed measurements were taken with a hand-held anemometer.

Table 7-3 – Noise Survey Equipment

Sound Level Meter	Pre-amplifier	Microphone	Calibrator
RION NL-52 Serial Number 1021290	RION NH-25 Serial Number 21332	RION UC-59 Serial Number 04346	RION NC-74 Serial Number 01020510

7.2.4. A description of the baseline noise survey locations outside the boundary of the existing landfill is presented in Table 7-4. Satellite photos indicating the locations of the readings are shown in Figure 7-1, Figure 7-2 and Figure 7-3.

Figure 7-1 – Noise Survey Locations (1 – 4)

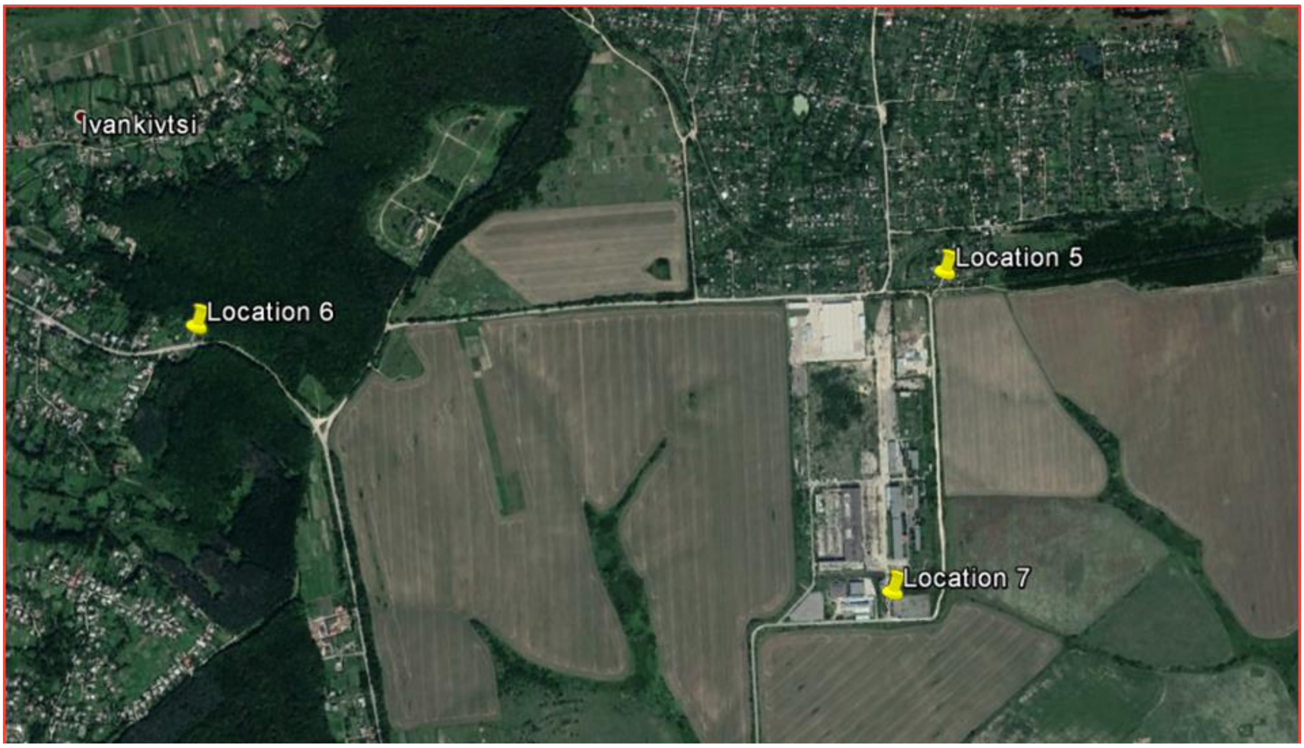

Figure 7-2 – Noise Survey Locations (5 – 7)

Figure 7-3 – Noise Survey Locations (8 – 12)

7.2.5. Please refer to Figure 1-1 for the boundaries of the existing landfill, the proposed landfill and the proposed MBT facility. Table 7-4 and Table 7-5 depict the coordinates for each of the survey locations.

Table 7-4 – Off-site Noise Survey Locations

Location	Latitude	Longitude	Description
1	49°27'34.3"N	26°57'41"E	Approximately 29m south of the existing landfill boundary, 4m from the road
2	49°27'33.7"N	26°57'38"E	Approximately 80m south of the existing landfill boundary, residential
3	49°27'32.9"N	26°57'36.3"E	Approximately 130m south of the existing landfill boundary, residential
4	49°27'48.7"N	26°57'48.2"E	Adjacent to secondary access to the existing landfill, informal residential

Location	Latitude	Longitude	Description
5	49°28'47.6"N	26°58'24.5"E	Southern edge of Vydrovi Doly, 2km from the existing landfill, residential
6	49°28'37.8"N	26°56'45"E	Ivankivtsi, over 2km from the existing landfill, residential
7	49°28'19.5"N	26°58'20.9"E	Former industrial site, small organisations (e.g. offices)

Table 7-5 – On-site Noise Survey Locations

Location	Latitude	Longitude	Description
8	49°27'32.9"N	26°57'48"E	Existing landfill entrance / haul road, 4m from source
9	49°27'42.01"N	26°57'57.52"E	Existing landfill tipping area, 4m from source
10	49°27'42.01"N	26°57'57.52"E	Existing landfill tipping area, 4m from source
11	49°27'42.56"N	26°57'54.77"E	Existing landfill tipping area, 40m from source
12	49°27'35.94"N	26°57'45.61"E	Biogas, 5m from the source

ASSESSMENT METHODOLOGY

Construction Phase

7.2.6. Construction activities inevitably lead to some degree of noise disturbance at locations near the activity. It is however a temporary source of noise. The noise levels generated by construction have the potential to impact upon nearby noise sensitive receptors. Noise levels at any one location will vary as different combinations of plant machinery are used and throughout construction activities and the specific locations of these activities will also change.

7.2.7. A qualitative assessment has been undertaken to provide an indication of risks during the construction phase. It is anticipated that the construction phase will begin in 2021/2022 and it will last between two to four years (completing between 2023/2024 and 2025/2026).

7.2.8. Mitigation measures, including noise limits, have been recommended. It is also recommended that a further assessment is undertaken once a detailed construction programme and full list of construction plant is available at the detailed design stage.

Operational Phase

7.2.9. A noise model using CadnaA was prepared to determine the likely noise impact arising from the operation of the proposed landfill and the proposed MBT facility. Calculations in the model were undertaken following the methodology in ISO 9613, Part 2 for the site activities, and Calculation of Road Traffic Noise (CRTN) for the traffic on the local roads using results of the noise survey. It should be noted that ISO 9613 Part 2 assumes propagation from source to receptor in downwind conditions, as a worst-case scenario.

7.2.10. The noise data collected during the baseline noise survey at the existing landfill has been used to characterise the noise sources associated with the operation at the proposed landfill and vehicle movements to the proposed MBT facility. Table 7-7 presents the noise frequency spectrum used for the movement of waste trucks and the tipping activities.

7.2.11. The following noise modelling scenarios have been prepared:

- Baseline day and night-time: existing local road network and existing landfill activities; and
- Proposed scheme day and night: existing local road network, proposed landfill activities, proposed vehicle movements on local road network and proposed MBT facility operation.

Limitations and Assumptions

7.2.12. The Project is at an early stage of the design process, therefore for the purposes of this assessment, the following assumptions have been made.

7.2.13. The number of heavy vehicles currently accessing the existing landfill is assumed not to exceed 17 trucks per hour during the daytime and nine trucks per hour during night-time. This is based on the vehicle log for the period 1st to 5th July 2019 provided by the landfill operator (Spetskomuntrans);

7.2.14. Waste is currently compacted on the existing landfill using a bulldozer/ compactor. It is assumed that this will be the same for the operation of the proposed landfill. Likely variations in compaction due to better operational procedures are expected, however, this is unlikely to affect the conclusions of this assessment.

7.2.15. The proposed building dimensions for the proposed MBT facility will be a maximum of 150m in length by 30m wide X 10m in height. The internal noise level within the proposed MBT facility will not exceed $L_{Aeq,1hr}$ 80 dB. The envelope of the building will provide a noise reduction of at least 15 dB. Please note that this assumes that the acoustic performance of the cladding, doors, and any ventilation openings will provide 15 dB attenuation. The noise emission from the building has been assumed to be constant during both daytime and night-time.

7.2.16. Noise measurements were not taken during the night-time period. It has been assumed that the noise levels would drop by approximately 10 dB compared to the levels measured in the daytime, as the dominant noise source is road traffic noise from the local road network.

7.2.17. There is no information on the likely additional generation of heavy vehicle movements on the road network due to the operation of the proposed landfill and proposed MBT facility. It is understood that a proportion of the material processed in the proposed MBT facility will be taken to the proposed landfill and that a proportion will be distributed for recycling. The number of vehicles on the road adjacent to the proposed MBT has been estimated to be 34 per hour during the daytime and 18 per hour during night-time. It should be noted that this is intended to provide a conservative assessment for a worst-case hour during the daytime and night-time.

7.3 BASELINE CONDITIONS

7.3.1. Appendix 7-3 presents the noise monitoring forms, which show description of the locations and noise levels measured in each of the readings. The photos illustrate the surrounding environment. Table 7-6 shows a summary of the noise levels recorded outside the boundary of the existing landfill. Observations during the survey were made and it is confirmed that most off-site noise survey locations are quiet and rural / semi-rural in nature. Local road traffic noise is noticeable and generally constant during the daytime at locations 1, 2 and 3. Other off-site locations are quiet with infrequent road traffic noise.

Table 7-6 – Noise Survey Results (Off-site)

Location	Start Time (hh:mm)	$L_{Aeq,T}$ (dB)	$L_{Amax,T}$ (dB)
1	10:47	67	68
2	11:13	59	75
3	11:20	49	60
4	11:48	61	79
5	12:16	48	68
6	12:45	57	70
7	13:13	52	68

7.3.2. Table 7-7 shows the noise measurement results for the on-site readings in octave band (linear).

Table 7-7 – Noise Survey Results (On-site) (L_{eq} dB)

Source	31.5Hz	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz
Waste Truck Pass by 4m	72	72	65	56	56	54	52	46	31
Tipping 40m	67	57	55	46	48	45	46	41	38
Bio Gas Energy Facility 5m	57	64	54	50	52	48	46	37	28

7.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

7.4.1. There is no off-site construction planned as part of the Project. It is anticipated that large amounts of material will be moved as part of the construction phase, due to the scale of the Project. At this stage it is considered likely that there will be a temporary increase of the ambient noise levels at the residential dwellings (within close proximity to the road and the proposed MBT facility) with potential for **moderate adverse (significant)** effects). It has been assumed that informal cabins, used as accommodation by the Roma waste pickers (adjacent to the existing landfill boundary) would be vacant during construction. There is also potential for vibration impact if pilling methods are required for the construction works.

7.4.2. Locations which may be particularly affected during the construction phase are likely to be those locations in Vydrovi Doly, which overlook the site for the proposed MBT facility, and any potential developments on the land to the west of the existing and proposed landfill.

OPERATIONAL PHASE

7.4.3. The potential noise impacts arising from the operational phase are likely to arise from the following activities:

- Noise arising from the machinery once the proposed MBT facility is open. The noise sources are likely to include: vehicle movements, mechanical processing such as waste preparation, shredders, screens, trommels[33], air classification, air extraction fans, etc.;
- Compaction machinery at the proposed landfill; and
- Road traffic noise associate with vehicles accessing the proposed landfill and proposed MBT facility.

7.4.4. A noise model was prepared to assess the likely impacts arising from the Project. The effects are assessed against the World Bank noise limit guidelines provided in Table 7-1. For the purposes of this assessment, the effect is considered significant if the guidelines are exceeded. The magnitude of impact has considered to be minor if predicted noise levels are 1dB higher than guidelines, moderate between 1 and 3dB higher than guidelines and major for predicted levels at least 3dB higher than guidelines. Context is provided in relation to BS8233 indoor noise levels for dwellings provided in Table 7-2, where applicable.Table 7-8 and Table 7-9 present the results of the noise model predictions compared against the baseline data and IFC Guidelines for daytime and night-time, respectively. The tables show the predicted noise levels during baseline and operation of the Project at the 1st floor level of the nearest sensitive receptor. Sensitive receptors in the table refers to the same locations as the baseline noise survey.

Table 7-8 – Operational Noise Impact (Daytime)

Sensitive Receptor	Baseline noise level $L_{Aeq,1hr}$ dB	Predicted noise level $L_{Aeq,1hr}$ dB	Criteria dB	Significance
2 (residential)	59	59	55 or 3 dB > baseline	Not Significant
3 (residential)	52	53	55 or 3 dB > baseline	Not Significant
4 (residential)*	58	60	55 or 3 dB > baseline	Not Significant

[33] A mechanical screening machine used to separate materials.

Sensitive Receptor	Baseline noise level $L_{Aeq,1hr}$ dB	Predicted noise level $L_{Aeq,1hr}$ dB	Criteria dB	Significance
5 (residential)	49	51	55 or 3 dB > baseline	Not Significant
6 (residential)	54	54	55 or 3 dB > baseline	Not Significant
7 (commercial)	52	55	70 or 3 dB > baseline	Not Significant

*Potential developments on the land to the west of the existing and proposed landfill – therefore a residential sensitive receptor has been located 15m away from the in close proximity to this area of land.

7.4.5. The daytime assessment results indicate that the predicted noise level would not exceed the baseline noise level by more than 3 dB, therefore, effects are anticipated to be **minor adverse (not significant)**.

Table 7-9 – Operational Noise Impact – Night-time

Sensitive Receptor	Assumed Baseline noise level $L_{Aeq,1hr}$ dB	Predicted noise level $L_{Aeq,1hr}$ dB	Criteria dB	Significance
2 (residential)	49	51	45 or 3 dB > baseline	Not Significant
3 (residential)	43	43	45 or 3 dB > baseline	Not Significant
4 (residential)	49	54	45 or 3 dB > baseline	Significant
5 (residential)	39	41	45 or 3 dB > baseline	Not Significant
6 (residential)	44	44	45 or 3 dB > baseline	Not Significant
7 (commercial)	Not Applicable	Not Applicable	Not Applicable	Not Applicable

7.4.6. The night-time assessment results indicate that the predicted noise level would not exceed the baseline noise level by more than 3 dB in most of receptor areas, therefore, effects are anticipated to be **minor adverse (not significant)**. Dwellings at Receptor 4 are likely to experience **moderate**

adverse (significant) effects, due to the additional heavy vehicle movements during the night. However, with a typical double-glazed window, the internal noise levels within bedrooms are likely to be within the indoor ambient levels recommend by BS8233. It should be noted that the assumptions have been made for a worst-case hour of vehicle movements during the night-time.

7.5 MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

7.5.1. Best Practice Means should be adopted in the construction activities associated with the proposed MBT facility and local access road improvement as outlined in the ESMP. The mitigation measures to be adopted during the construction phase will be included in a Noise and Vibration Management Plan.

7.5.2. It is also recommended that a further assessment should be undertaken once a detailed construction programme and full list of construction plant is available at the detailed design stage.

OPERATIONAL PHASE

7.5.3. No mitigation measures are required for the operation of the landfill if the noise levels presented in this chapter are not exceeded. The ESMP set out the requirements for operational noise monitoring and measures to rectify any potential exceedance.

7.6 RESIDUAL EFFECTS

7.6.1. The residual effects, once the mitigation measures are taken into account, are expected to be **minor adverse (not significant)** during the construction and operational phases.

7.7 SUMMARY

Table 7-10 – Summary of Potential Impacts, Effects and Mitigation (Noise and Vibration)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Noise and Vibration	Semi-rural locations between L_{Aeq} 40 – 60 dB	Construction	Construction activities and truck movements.	Moderate adverse (significant)	Best Practice Means Noise and Vibration Management Plan	Minor adverse (not significant)
		Operation	Waste truck movements and machinery in the proposed MBT facility.	Daytime - minor adverse (not significant) Night-time - moderate adverse (significant)	Operational Noise Monitoring	Minor adverse (not significant)

8

ECOLOGY

8 ECOLOGY

8.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

8.1.1. The overall strategy with regards nature conservation in the Ukraine is documented within 'Strategy for National Environmental Policy in Ukraine to 2020' (signed by the President of Ukraine in 2010). Relevant legislation and polices underpinning this strategy are as follows:

- Law of Ukraine 'On the Environmental Network of Ukraine' (No. 1864-IV. 2004);
- Law on the Protection of the Natural Environment (No. 1264-XII. 1991);
- Law on Nature Conservation Fund of Ukraine (No. 2456. 1992);
- Statute on the Red Data Book of Ukraine (No. 3055-III. 2002);
- Law of Ukraine 'On the Fauna' (No. 2894-III. 2001);
- Law of Ukraine 'On the Flora' (No. 591-XIV. 1999);
- The Land Code (No. 2768-III. 1992);
- Forest Code (No. 3852-XII. 1994);
- Water Code (No. 213/95-VR. 1995); and
- Law on Ecological Examination (Impact Assessment) (No. 2059-VIII. 1995)

8.1.2. In addition to the above, Ukraine has ratified or signed the following relevant major environmental agreements related to natural resources, including:

- Convention on Biological Diversity (1992) – Ratified;
- Convention on Wetlands on International Importance as Waterfowl Habitat (Ramsar) – Ratified;
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn) – Ratified;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern) – Ratified;
- Convention on International Trade in Endangered Species (CITES) – Acceded, not Ratified; and
- Agreement on the Preservation of Bats in Europe – Ratified.

8.1.3. Additional international / European legislation / agreements are also relevant to the Project due to the requirements of PR6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources'. These include, but are not limited to, the following:

- Directive 2009/147/EC of the European Parliament and of the Council on the Conservation of Wild Birds (herein referred to as the EU Birds Directive) – this gives provision for the protection of all wild birds, their nests, and eggs, within the European Community.
- Council Directive 92/43/EEC of the European Parliament and of the Council on the Conservation of Natural Habitats and of Wild Fauna and Flora (herein referred to as the EU Habitats Directive) – this provides a framework for the strict protection of animal and plant species listed under Annex IV of the Directive; and
- Ramsar List of Wetlands of International Importance.

8.1.4. Further detail on the application of PR6 is documented within the associated Guidance Note[34].

[34] EBRD. (2014). EBRD Guidance Note. Biodiversity Conservation and Sustainable Management of Living Natural Resources.

8.2 ASSESSMENT METHODOLOGY

8.2.1. This ecological impact assessment follows international guidance (as well as relevant documents referenced within Chapter 5):

- EBRD (2014). Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; and
- The World Bank (2000). Biodiversity and Environmental Assessment Toolkit.

8.2.2. In addition, the ecological assessment is underpinned by the methodology outlined by the Chartered Institute of Ecology and Environmental Management (CIEEM)[35].

RECEPTOR EVALUATION

8.2.3. The sensitivity of ecological resources has been valued by taking into account those that have been designated for their nature conservation interest, and the uses of professional judgement to determine biodiversity values, including any social, community and economic values of ecological resources. The valuation has made use of available guidance and information and considered the distribution or status of the species or features. Where uncertainty exists, or where features cannot be valued with confidence due to lack of survey, an 'up to' valuation has been applied as a precautionary approach, using professional judgement based on available information. The conservation categories of value in Table 8-1 have been used.

Table 8-1 – Evaluation Categories

[35] CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition.

Value / Sensitivity	Criteria	Examples
Very High	High importance and rarity, international scale and limited potential for substitution.	Internationally designated sites, such as Ramsar Sites.
High	High importance and rarity, international, national or regional scale with limited potential for substitution.	■ Ramsar, Biosphere Reserves, National Nature Parks; ■ Critical Habitats (as per PR6); and ■ Critically Endangered or Endangered Species (as per IUCN[36]).
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution.	■ Local Zakazniks[37] with potential for substitution; and ■ Species with locally restricted distribution.
Low	Low or medium importance and rarity, local scale.	Non-designated sites / areas of some local biodiversity.
Negligible	Very low importance and rarity, local scale.	Other sites with little or no local biodiversity.

8.2.4. The assessment has initially considered the effects in the absence of mitigation. This gives an indication of the need for additional mitigation to be implemented. The likely effectiveness of that mitigation is considered, and a residual effect is stated.

8.2.5. The assessment of significance of effects takes into account the following:

- The size, value and sensitivity of the receptor;
- The duration, magnitude and extent of the impacts;
- The timing and frequency of the impacts;
- The ability of the affected receptor to recover from temporary impacts and timescale of recovery;
- The potential for implementation of, and effectiveness of, additional mitigation or enhancement measures; and
- The level of confidence in these predictions.

8.2.6. Impact assessment definitions in the following tables (Table 8.2 and Table 8.3) describe criteria used for assessing impact magnitude, confidence levels and the overall appraisal categories used in the assessment.

[36] ICUN (2019). The IUCN Red List of Threatened Species. Available at: https://www.iucnredlist.org/ (Accessed 23/08/2019).

[37] Projected area in former Soviet Union countries that meet the World Conservation Union's criteria.

Table 8-2 – Magnitude of Impact

Magnitude	Criteria
Major	Major effect on the nature conservation status of the Site, habitats or species, likely to threaten the long-term integrity of the system.
Moderate	Moderate effect on the nature conservation status of the Site, habitats or species, but would not threaten the long-term integrity of the system.
Minor	Noticeable effects, but either of sufficiently small scale or short duration to cause no harm to the conservation status of the Site, habitats or species.
Negligible	Not expected to affect the conservation status of the Site, habitats or species under consideration in any way, therefore no noticeable effects on the ecological resource.

Table 8-3 – Confidence in Predictions

Confidence Level	Description
Certain	Probability estimated at 95% chance or higher.
Probable	Probability estimated above 50% and below 95%.
Unlikely	Probability estimated above 5% but less than 50%.
Extremely Unlikely	Probability estimated at less than 5%.

8.2.7. The final stage of the assessment used the values as obtained with reference to the above tables in order to provide a qualitative assessment of the resulting effects.

ASSUMPTIONS AND LIMITATIONS

8.2.8. The biodiversity baseline information for the Project has been obtained from a review of existing information, site walkover observations and anecdotal information obtained during the two site visits. These sources are limited in their extent. Given the level of degradation already present at the site, and the lack of features of increased biodiversity interest, this limitation is not considered to represent a constraint to the integrity of the assessment.

8.3 BASELINE CONDITIONS

PROTECTED / DESIGNATED AREAS

8.3.1. The Project site is not located within any area designated for its importance to biodiversity. The nearest designated areas are listed within Table 8-4 below.

Table 8-4 – Protected Areas Summary

Site Name	Designation (and IUCN category)	Approximate Distance from Project site (and direction)	Site Summary
Pivdennyj Bug River Valley	Important Bird Area (IV)	10km (E)	An area designated for its importance to passage greylag goose *Anser anser* and lesser white-fronted goose *Anser erythropus.* Potential for these birds to forage outside the site across agricultural fields in the wider area.
Verkhnie Pobozhzhia	Emerald (IV)	20km (NE)	A mosaic of aquatic and woodland habitats; no connectivity to the Project Site.
Ostashki	Regional Park (IV)	4km (W)	Unclear. Upstream of the Project Site; no obvious connectivity.
Gruzevits'kiy	Regional Park (IV)	6km (W)	Unclear. Potentially riparian woodland/scrub. Upstream of the Project Site; no obvious connectivity.
Davidkovets'kiy	Regional Park (IV)	10km (E)	Unclear. Likely woodland / scrub habitat. No connectivity with the Project Site.
Molomolinets'kiy	Regional Park (IV)	13km (NE)	Unclear. Potentially riparian habitats. No connectivity with the Project Site.

8.3.30. The Pivdennyj Bug River Valley IBA will be further considered within this assessment, as there is some potential for connectivity with the Project. There will be no further consideration given to the other areas listed above, as they are unlikely to have any connectivity with the Site.

HABITATS

8.3.31. The Project Site comprises areas that have been heavily modified as result of the existing landfill operations, and other land uses. As would be expected, the existing landfill is occupied by active landfill operations, while the proposed landfill has been subject to illegal dumping as a result of the existing landfill spreading in to surrounding areas. The proposed landfill extends across an area that appears to be dominated by ruderal vegetation and a mix of grasses and herbs.

8.3.32. The wider area is dominated by open agricultural fields, interspersed with treelines (especially alongside the access roads).

8.3.33. Scattered waterbodies have been identified from aerial imagery of the Project Site and verified on the site visits, including the leachate ponds at the base of the existing landfill.

8.3.34. The proposed MBT facility is located within an area dominated by arable agriculture land use. The only slight variation to this comprises the marginal semi-natural ruderals and scattered scrub at the field edges.

FLORA AND FAUNA

8.3.35. The Project Site is not considered to support any plant species of increased conservation value (i.e. those included within the Red Book of Ukraine, etc.). The heavily modified nature of the habitats across the Project Site means that it is extremely unlikely that any remnant flora of interest persists; it is also likely that the current virulent invasive species growth across the Project site is further reducing the likelihood of such flora being present. Invasive species are discussed in greater detail below.

8.3.36. The Project Site is not considered to support any important populations of animal species of increased conservation value (i.e. those included within the Red Data Book of Ukraine (1992), etc.)

8.3.37. The existing landfill is known to support an assemblage of common scavenging fauna; white stork Ciconia ciconia were observed on the existing landfill, along with gulls. Rodents such as mice Apodemus spp. and voles Microtus spp. are likely to forage across the existing landfill, and in turn will attract predators such as foxes Vulpes Vulpes, feral cats and dogs.

8.3.38. Animals may make use of the existing landfill for sheltering purposes, but this is likely to be limited nesting birds and infrequent bat roosts (where suitable structures exist, and where the baseline of disturbance does not prevent roosting). Figure 8-1 below illustrates a building with bat roost potential; such structures may also support nesting birds, in particular hirundines (e.g. barn swallow Hirundo rustica).

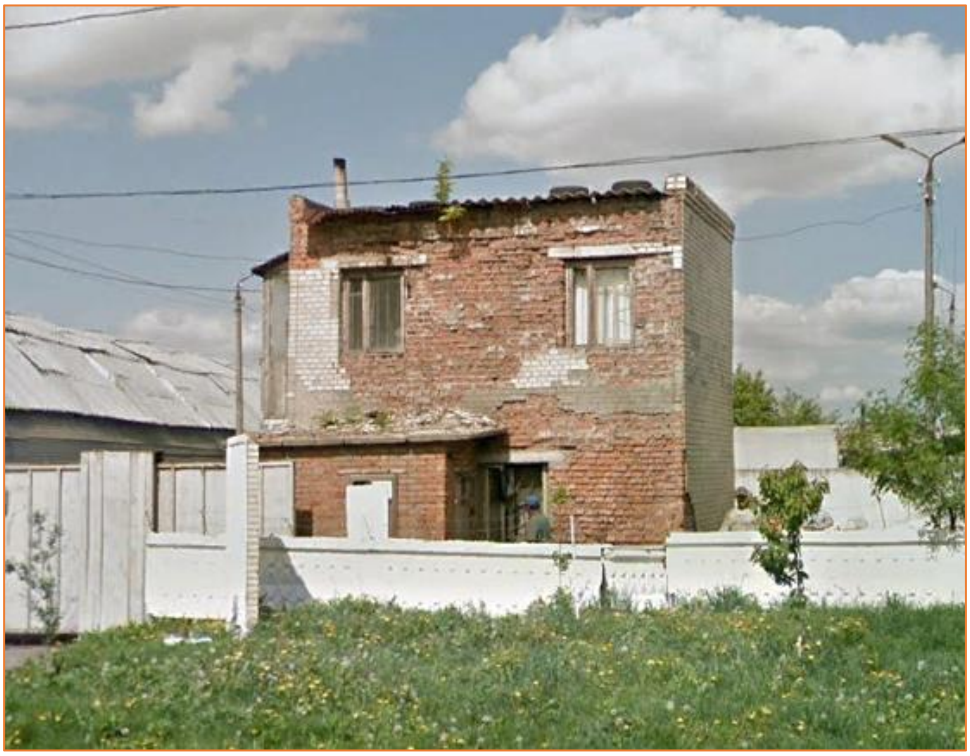

Figure 8-1 – Existing Landfill Building with Bat Roosting Potential

8.3.39. The location of the proposed landfill is likely to support a greater number of nesting birds due to the undisturbed nature of the vegetation and the presence of areas of scrub. Furthermore, the likelihood nesting birds will enhance with increasing distance from the existing landfill.

8.3.40. The Project Site is likely to support several invasive species. Invasive species were confirmed as being present on, and around, the existing landfill, including hogweed: either Sosnowsky's hogweed

Heracleum sosnowskyi or giant hogweed Heracleum mantegazzianum), both of which are alien species that pose a health and safety risk to the public and construction workers, due to toxins contained within the plant sap.

8.4 POTENTIAL IMPACTS AND EFFECTS

8.4.1. This section comprises a precautionary assessment of the impacts upon receptors of ecological importance in relation to the Project. The receptors to be considered within this assessment are as follows:

- Pivdennyj Bug river valley Important Bird Area (IBA);
- Birds and bats; and
- Invasive species.

CONSTRUCTION PHASE

Existing Landfill

8.4.2. The mature trees on / flanking the existing landfill site and built structures which remain may provide the potential for bats which are listed under Annex IV of the EU Habitats Directive, especially those of stone / brick-built structure (e.g. see Figure 8-1). While the baseline of disturbance is likely to have prevented any locally important roosts from becoming established, there could feasibly be less affected features where bat roosts persist. On a precautionary basis, it is assumed that bats would represent a receptor of low sensitivity (as per Table 8-1).

8.4.3. The number of features that are potentially suitable for bats across the existing landfill appears limited, and similar suitable features (especially mature trees) have been identified across the surrounding areas, especially mature trees and isolated buildings.

8.4.4. The magnitude of the loss of suitable bat roosting features across the existing landfill has the potential to be of major magnitude at the Project level, but is not considered to be an impact that will significantly affect the integrity of the local bat population, mainly due to the prevalence of more suitable (and abundant) roosting features across the surrounding area. The overall effect is therefore considered to be **Minor (not significant)**.

8.4.5. Vegetation and built structures on site may support breeding birds, and it is considered likely that such an assemblage will comprise common bird species. The clearance of vegetation represents an impact that is likely to be major in terms of its magnitude. Given the inherent mobility of this animal group and the likely presence of suitable similar habitat in the surrounding area, together with the negligible sensitivity/value of this receptor group, any effects are considered to be **Negligible (not significant)**.

8.4.6. Construction activities have the potential to facilitate the spread of invasive species across the wider area. Given the inherent ease and speed with which such plant species spread, the potential magnitude of this impact is major, with a legitimate risk of alien species colonising ‘new’ areas across the local area and displacing native species in the process. Despite the generally limited sensitivity/value of habitats out with the site (i.e. a heavily modified landscape), the overall effect is precautionarily considered to be **Moderate (significant)**.

Proposed Landfill

8.4.7. The construction of the proposed landfill will result in the loss of nesting bird habitat as remnant areas of rank vegetation and scrub will be cleared to make way for the new landfill cell. This represents an impact of major magnitude (assuming all relevant habitat/features will be lost). Given the abundance of similar (and superior) nesting habitat in the wider area, together with the negligible sensitivity / value of the receptor, any effects are considered to be **Negligible (not significant)**.

Proposed MBT Facility

8.4.8. The proposed MBT facility will be located within arable field(s). There is a slight possibility that these fields will be of use to foraging geese associated with the IBA and are therefore have the potential to be of high sensitivity. No evidence of such usage was identified during site visits, and on review of potentially available similar habitat across a 20km radius from the IBA, the site earmarked for the proposed MBT facility represents less than 1% of available habitat, should it be used by foraging IBA birds. Therefore, the impact is considered to be negligible, with any effects upon the IBA as a result of construction of the proposed MBT facility considered to be **Negligible (not significant)**.

OPERATIONAL PHASE

8.4.9. The potential effects upon fauna and flora are considered to be **Negligible (not significant)**, due to the existing baseline of operational disturbance to both the existing landfill and the proposed landfill. It is likely that the expansion of landfill activities will increase the numbers of scavenging faunal species, but this would not increase the number to the extent that any additional assessment is required, especially when considering the net scale of landfill operations will decrease from 8.9ha (current position) to 6ha upon project completion. The exception to this is in relation to invasive species, which are discussed below.

8.4.10. Operational activities have the potential to further facilitate the spread of invasive plant species across the Project and the wider area (i.e. through vehicle movements in/out of the proposed MBT facility and proposed landfill). The potential magnitude of this impact is major, with a legitimate risk of alien species colonising ‘new’ areas across the local area and displacing native species in the process. Despite the generally limited sensitivity/value of habitats within the site (i.e. a heavily modified landscape), the overall effect is precautionarily considered to be **Moderate (significant)**.

8.5 MITIGATION AND ENHANCEMENT MEASURES

8.5.1. Although the loss of the habitat within the proposed MBT facility site is not considered to be significant in terms of the overall foraging resource available to geese associated with the IBA, a walkover should be completed prior to construction commencing during the winter (i.e. between December and February) to confirm this field is not being used by foraging geese. The walkover should be completed by a suitably qualified ecologist. Should evidence of usage by geese be recorded then the recommended measures to reduce any impact further should be documented within the ESMP for the Project. Mitigation may include: timing of works to avoid disturbance during the months that foraging is occurring, and engagement with local landowners to ensure long-term reliability of the remaining foraging resource.

8.5.2. All buildings and mature trees on the Project Site should be retained where possible. If any rehabilitation / felling works are required for these buildings or trees, then bat surveys are required prior to the start of any works in order to identify roosts which should subsequently be retained (where possible), or their loss mitigated through the provision of artificial roost sites in close proximity. These checks should be undertaken at least one month prior to construction activities (ideally further in advance if possible). The residual effect is not considered to be significant, following the incorporation of this mitigation.

8.5.3. All breeding birds are protected under the provision of the EU Birds Directive. The removal of vegetation has the potential to impact upon breeding birds through the destruction of nests or eggs. Vegetation clearance works shall be timed to take place outside of the breeding bird season, thus preventing any potential direct impacts to nesting birds. The provision of landscape planting, as referenced in Chapter 2, will mitigate the loss of this resource.

8.5.4. An Invasive Species Management Plan will be produced, to reduce the effects of invasive species spread across the Project Site. This will detail measures to be adopted during construction and operation to reduce the risk of the spread of invasive species to an acceptable level. Such measures should inclusive of, but are not limited to:

- Accurate mapping of current extent of invasive plant species across the Project Site;
- Adequate disposal of invasive plant species required to be removed as part of the Project construction activities (i.e. by a suitably qualified contractor);
- Chemical treatment of invasive plant species remaining on the Project Site;
- Wheel-washing facilities for vehicles; and
- Toolbox talk / awareness-raising exercise for Project personnel to provide information on invasive plant species and the risks associated with their spread.

8.5.5. These mitigation and enhancement measures are also reflected within the ESMP.

8.6 RESIDUAL EFFECTS

8.6.1. On the assumption that baseline conditions are corroborated during pre-construction walkovers, it is considered that the Project will not result in significant residual effects upon sensitive ecological receptors across the Project Site (**not significant**).

8.7 SUMMARY

Table 8-5 – Summary of Potential Impacts, Effects and Mitigation (Ecology)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Ecology	Limited biodiversity interest. Potential connectivity with nearby IBA; some roosting/nesting habitat for birds and bats; and invasive species across the Project site.	Construction	Loss of foraging habitat associated with IBA trigger species	Negligible (Not significant)	Pre-works check of proposed MBT facility location; liaison with local landowners if required.	Not significant
			Loss of bat roosting habitat	Minor Adverse (Not significant)	Pre-works surveys of any mature trees/buildings to be affected by the Project. Retention of roosts, and/or	Not significant

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					provision of artificial roost features where appropriate.	
			Loss of bird nesting habitat	Negligible (Not significant)	Timing of works to avoid nesting period (March to August inclusive). Provision of landscape planting to provide additional suitable nesting resource.	Not significant
			Spread of invasive species	Moderate Adverse (Significant)	Prevention of invasive species spread through provision of suitable procedures within the Invasive Species Management Plan for the Project.	Not significant
		Operation	Spread of invasive species	Moderate Adverse (Significant)	Prevention of invasive species spread through provision of suitable procedures within the Invasive Species Management Plan for the Project.	Not significant

9

CULTURAL HERITAGE

PUBLIC

9 CULTURAL HERITAGE

9.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

9.1.1. The following legislation has been reviewed for this chapter:

- The Law of Ukraine on the Protection of Cultural Heritage[38];
- The Law of Ukraine on Protection of Archaeological Heritage[39]; and
- EBRD PR8[40].

9.1.2. In addition, the 'Historical-Architectural Reference Plan'[41] for the City has been reviewed as key piece of policy.

9.2 ASSESSMENT METHODOLOGY

9.2.1. The assessment was undertaken using available online resources and from information provided by the Project Team. Some documents were translated through software applications and therefore there may be minor discrepancies. Cultural heritage data has been interrogated and reviewed to provide a clear assessment of the potential effects of the Project on cultural heritage assets within the study area.

9.2.2. A 10km study area was adopted to consider vehicle routes and more sensitive cultural heritage assets, such as the graves of the victims of the Nazi regime. Cultural heritage assets of local significance within the study area have been assessed based on information provided by the Project Team. There are no cultural heritage assets of national or international significance within the 10km study area.

9.3 BASELINE CONDITIONS

9.3.1. The following documents have been used as sources of information, they were sourced via the Project Team or through desk-based research. The documents are:

- Detailed plan of solid water landfill territory at the address of Khmelnitsky City[42];
- UNESCO Ukraine World Heritage Site List[43];
- Ministry of Culture of Ukraine, Public register of immoveable monuments of Ukraine, Interactive Map[44]; and

[38] The Law of Ukraine on the Protection of Cultural Heritage (2000).

[39] The Law of Ukraine on the Protection of Cultural Heritage (2004).

[40] EBRD (2014). Environmental and Social Policy.

[41] Order of the Ministry, Culture of Ukraine (2016). Historical-Architectural Reference Plan: Khmelnitsky with Determination of Boundaries and Regimes of use of Zone of Monuments and Historical Areas: TOM I: Explanatory Note.

[42] Center LTD Eco Consulting (2018). Detailed plan of solid water landfill territory at the address of Khmelnitsky City.

[43] United Nations (2019). World Heritage List. Available at: https://whc.unesco.org/en/list/ (Accessed: 26/08/2019).

[44] Міністерство культури України, Інститут географії НАНУ (2019). Публічна частина Державного реєстру нерухомих пам'яток України. Available at:

- Ministry of Culture of Ukraine, State Register of Immovable Monuments of Ukraine[45].

9.3.2. There is some evidence of the region of Khmelnitsky being occupied in Prehistoric times, and there are mounds, thought to date to the Prehistoric periods within the region. There were Iron Age settlements within the city borders of Khmelnitsky, including Str. Bandera and the Micro-district of Zarichchia. Prehistoric archaeology is believed to be present to the north of the city boundary in the form of mound 169, which is just over 1km from the site.

9.3.3. Khmelnitsky originates from the small settlement of Ploskiriv (or Ploskirivka), which was known in 1431 where it is first mentioned within written sources. In the 17th century the settlement was subjected to destruction, with very few structures surviving, due to the war of Ukrainian liberation led by Bohdan Khmelnitsky. Khmelnitsky liberated Ukraine from the Polish crown and gave freedom to the nation. Throughout the 18th century the settlement was rebuilt before being destroyed by fire in 1822. The rebuilding of the settlement saw the development of the region, particularly the grain and salt industries. There are several buildings from the 19th century when the region was rebuilt, these buildings are largely within the confines of the old city walls.

9.3.4. During the second World War the region was occupied by the Axis Powers where the Nazi Regime was implemented. It is known that the area contained a Prisoner of War camp in the Rakovo suburb. Ukraine had a prominent Jewish community with Khmelnitsky being a Jewish dominant region, therefore those who lived here were killed. The region contained 49 known killing sites, but only 37 memorials. Within the City of Khmelnitsky there are three known mass graves with 22,000 alleged victims in total. There are also military cemeteries throughout the city commemorating those who died during the War. The city was rebuilt in the 1950s and in 1954 the city was renamed Khmelnitsky in honour of Hetman Bohdan Khmelnitsky who led the liberation war of the Ukrainian people.

9.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

9.4.1. During the construction phase there is potential for impacts to below-ground heritage assets within the vicinity of the proposed landfill and the proposed MBT Facility. Machinery, vibrations from soil removal and a change in water levels can impact the below-ground archaeological resource. Removal of heritage assets is final and impacts this finite resource. It is unknown whether there are below-ground heritage assets, and if there are, the importance of them is unknown.

9.4.2. As a result of the data gathered from the public register of immoveable monuments of the Ukraine and the State Register of Immovable Monuments of Ukraine the potential for remains from the archaeological periods can be identified. There is medium potential for archaeological deposits relating to the Prehistoric period to be present. Effects to below-ground heritage assets during construction would be **large adverse (significant)** prior to mitigation.

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http://publicregistry.heritage.in.ua/#!&card2=a2:type,maps|id,800|zoom,false|centerLat,false|centerLng,false|controlsLegend,false|controlsDescription,false|controlsBaseMaps,false|controlsOverlay,false|controlsTable,false|overLayers,undefined (Accessed: 27/08/2019).

[45] Міністерство культури України, Інститут географії НАНУ (2019). ДЕРЖАВНИЙ РЕЄСТР НЕРУХОМИХ ПАМ'ЯТОК УКРАЇНИ. Available at: http://mincult.kmu.gov.ua/control/uk/publish/officialcategory?cat_id=244910406 (Accessed 29/08/2019).

OPERATIONAL PHASE

9.4.3. During the operational phase there is potential to impact on archaeological priority zones surrounding heritage assets, such as mound 169. This could change the overall experience of the heritage asset. The operational phase will result in movement of waste collection and transportation vehicles throughout the City, including near to above-ground and below-ground heritage assets. However, as there are already these routes throughout the City due to the Existing Landfill, these effects are expected to be **neutral (not significant).**

9.5 MITIGATION AND ENHANCEMENT MEASURES

PRE-CONSTRUCTION MITIGATION

9.5.1. The ESMP includes a Cultural Heritage Management Plan (CHMP), as recommended in PR8, which will cover the pre-construction and construction phases. The CHMP identifies a series of steps required to be undertaken, by the Contactor's environmental specialist, who will have heritage expertise. This will include a pre-construction site walkover. If further mitigation is required following the site walkover, this should be included in the CHMP, and be in accordance with Ukrainian law and recommendations provided in PR8.

CONSTRUCTION PHASE

Chance Find Procedure

9.5.2. A Chance Find procedure as specified in ERBD PR8[46] should be set up to mitigate for potential chance finds during the construction phase. If a chance find is discovered it is recommended that the contractor stops work, notifies the local authority and put a cordon around the chance find. The contractor will not disturb any find until a designated and qualified heritage specialist has been contacted who can identify the find, record it and identify the importance. This full procedure should be documented prior to construction in the CHMP in the ESMP.

Cultural Heritage Management Plan

9.5.3. A CHMP is recommended in PR8 and is used to inform all the requirements, procedures, resources and skills and timeline needed to minimise impacts on cultural heritage assets. The overall objective of the CHMP is to preserve and protect cultural heritage sites or artefacts from adverse impacts associated with project activities. A CHMP aims to minimise the chance of damage to any archaeological or culturally significant sites during construction and to present a methodology and procedure for adequately mitigating for "chance finds" should they be discovered. The plan outlines the cultural heritage management principles and procedures to be followed during construction and operations in accordance with the Project's policies and national legal requirements.

9.5.4. Mitigation Measure for the Construction Period are as follows:

- Ensure that all construction staff and stakeholders activities take into account the potential for identifying cultural remains as defined in the CHMP;

[46] EBRD (2014). Guidance Note: EBRD Performance Requirement 8.

- Code of conduct, awareness raising, and training for workers and personnel involved during the construction phase; and
- Implement monitoring and reporting requirements that must be adhered to during the construction phases.

OPERATIONAL PHASE

9.5.5. No mitigation measures are recommended for the operational phase due to the anticipated **neutral (not significant)** effects. The CHMP would not be required during the operational phase.

9.6 RESIDUAL EFFECTS

9.6.1. On the assumption that baseline conditions are corroborated during pre-construction walkovers, it is considered that the Project will not result in significant residual effects upon the above ground heritage assets. There is potential for up to **moderate adverse (significant)** residual effects upon potential below-ground heritage resources (if uncovered during works) until the below-ground construction works are completed.

9.6.2. Given that the effects associated with the operational phase are considered to be neutral (not significant), the residual effects will remain unchanged from that reported above.

9.7 SUMMARY

Table 9-1 – Summary of Potential Impacts, Effects and Mitigation (Cultural Heritage)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Cultural Heritage	There is potential for below-ground heritage assets to be impacted during the construction period.	Construction	Below-Ground Heritage Assets	Large Adverse (significant)	Chance Finds Procedure in the Cultural Heritage Management Plan	Up to Moderate adverse (up to significant) – if any below ground heritage is found.
	There is potential for the above ground heritage assets to be impacts although this is unlikely.	Operation	Above Ground Heritage Assets	Neutral (not significant)	Not Applicable	Neutral (not significant)

10

LANDSCAPE AND VISUAL

10 LANDSCAPE AND VISUAL

10.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

10.1.1. Ukraine prepared its National Environment Strategy 2020, which was adopted in 2010. It includes the requirements for EIAs but does not contain specific requirements for Landscape and Visual Impact Assessments (LVIA).

10.1.2. Further legislative considerations and guidance for this assessment includes:

- Environmental Impact Assessment Directive 2014 (2014/52/EU); and
- EBRD PR6 Guidance Note[47].

10.1.3. As there is currently no guidance available relating to LVIA in Ukraine, this appraisal of landscape and visual impacts has been undertaken broadly in accordance with the following good practice guidelines, which are the industry accepted best practice guidance in the UK, and are in accordance with EU requirements:

- 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA), third edition, 2013, published by the Landscape Institute and Institute of Environmental Management and Assessment; and
- 'An Approach to Landscape Character Assessment' 2014 published by Natural England.

10.2 ASSESSMENT METHODOLOGY

SCOPE OF THE APPRAISAL

10.2.1. The methods for assessing effects upon landscape and visual receptors as a result of the Project broadly follow guidance outlined above. This methodology is summarised as follows:

- A brief desk-based review of the relevant guidance and planning policy context (where possible);
- A brief description of existing land use within the site and its immediate surroundings;
- A high-level review of local landscape character, including the existing site and features on the site;
- A high-level review of surrounding potential visual receptors;
- Identification of potential landscape and visual receptors and the potential effects of the Project upon them; and
- Identification of potential opportunities for mitigation and enhancement.

METHOD OF BASELINE DATA COLLECTION

10.2.2. A desk-based review was undertaken in order to determine existing landscape features, landscape character, and potential visual receptors. The baseline data has been obtained through a combination of the site visits, and desk-based review of third party / consultation information. The desk-based review has been informed by the following resources:

[47] EBRD (2014). Guidance Note: EBRD Performance Requirement 6.

- Aerial imagery[48];
- Site photography (taken by environmental experts during the two site visits); and
- Desk-based review of existing publicly available on-line information.

STUDY AREA

10.2.3. The Study Area for the landscape and visual assessment is typically defined by the extent to which the Project may be visible. Visual effects can only occur where at least some part of the Project is visible. The Study Area for the landscape assessment is informed by the visibility study and covers both the site itself and the full extent of the wider landscape around it which the Project may influence in a significant manner.

10.2.4. A Study Area of 2km from the Project Site has been used for this assessment. This is based on professional judgement and experience of similar projects; whereby significant effects typically decrease with distance from the Project. Review of topographical mapping and site visits have confirmed that a 2km study area is suitable for the purposes of this assessment.

TEMPORAL SCOPE

10.2.5. The temporal scope for this Chapter is medium term duration for construction activities (i.e. between two and four years in duration) and long-term for operational effects of the Project (i.e. greater than ten years duration).

RECEPTOR SENSITIVITY

10.2.6. Following the review of baseline information, landscape and visual receptors were identified and allocated an indicative value, based on the criteria outlined in Table 10.1 (and broadly in accordance with GLVIA, 3rd Edition).

Table 10-1 - Indicative Receptor Sensitivity

Sensitivity	Visual Receptors	Landscape Receptors
	Context of View / Number of Potential Viewers / Susceptibility to Change	**Context, Value, Quality**
Very High	High concentrations of static receptors such as large residential estates. Large residential areas; high quality public open space; visitors / users of recreational, historical or cultural sites where landscape is an integral part of its enjoyment (such as users of National Parks, World Heritage Sites). Very high susceptibility to any change.	Typically, strong landscape with many features worthy of conservation; infrequent detracting features. Typically, of international recognition such as World Heritage Sites.
High	Many viewers including static viewpoint such as residential property.	Good quality, high value and often designated landscape.

[48] As obtained via Google Earth Pro.

Sensitivity	Visual Receptors	Landscape Receptors
	Context of View / Number of Potential Viewers / Susceptibility to Change	**Context, Value, Quality**
	Residential areas; public open space; visitors / users of recreational, historical or cultural sites where landscape is a significant factor in its enjoyment (such as users of long-distance trails). High susceptibility to change.	High importance.
Medium	Several viewers, longer transient views such as from public open space and recreational areas. Retail areas, offices, formal sports facilities where the landscape is secondary to enjoyment of the sport; outdoor work spaces; users of scenic roads, railways or waterways; users of tourist routes, schools and other institutional buildings and their outdoor areas. Moderate susceptibility to change.	A reasonably attractive landscape with a mix of attractive features and intrusive elements. Pleasant but unremarkable. Moderate importance.
Low	Several viewers, longer transient views such as from public open space and recreational areas. Indoor workers in medium quality landscape; passengers in public transport on main arterial routes; users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities). Limited susceptibility to change.	Typically, a poor-quality landscape of low importance, with detracting features and intrusive features but with occasional attractive features and elements.
Negligible	Very few viewers; fast, transient views such as from vehicles along a national road. Industrial area, land awaiting development; indoor workers in poor quality landscape; users of large main roads (e.g. motorways and national roads). Very limited susceptibility to change.	A degraded or disturbed landscape, typically awaiting development. Many unattractive and intrusive features, litter and dirt. Poor quality landscape. Very low importance.

DESCRIPTION OF IMPACT MAGNITUDE

10.2.7. The nature of the potential impacts was described within the context of the landscape and visual receptors identified, both in terms of temporal and spatial scope, considering the geographical extent of the area influenced, the duration of the impact and its reversibility. Criteria for assessing magnitude of impact is outlined in Chapter 5.

EFFECT SIGNIFICANCE

10.2.8. The objective of the assessment process is to identify and qualitatively define the likely significant effects arising from the Project. The effects of the Project upon the existing (baseline) landscape and visual environment have been identified and assessed at two points in time:

- Construction Phase: During construction; and
- Operational Phase: On completion and occupation.

10.2.9. Whilst there is a large degree of professional judgement involved in determining the significance of effects, they can broadly be determined by the interaction of the sensitivity of the receptor and magnitude of change. Criteria for assessing magnitude of impact is outlined in Chapter 4.

DESCRIPTION OF REQUIRED MITIGATION MEASURES

10.2.10. Where potentially significant effects are identified, mitigation measures are described that could potentially reduce adverse significant effects. Additionally, general mitigation is included for the purposes of reducing non-significant effects.

SUMMARY OF RESIDUAL EFFECTS

10.2.11. The final stage of assessment is a summary of residual effects. These take into account mitigation measures and change over time. Given the relatively high-level nature of baseline data collection, the subsequent assessment has adopted a precautionary approach.

ASSUMPTIONS AND LIMITATIONS

10.2.12. The following assumptions and limitations have been made in relation to this chapter:

- The landscape and visual assessment has been informed by site photographs, and some surrounding photographs, along with a desk-based review of aerial photographs, maps and (highly limited) publicly available on-line data;
- No digital mapping or modelling has been undertaken in relation to visibility and therefore conclusions are based on desk-based review and limited site visits;
- There was limited on-line information available in English relating to: designations or landscape / visual related legislation, public access rights of way, or cultural areas, therefore these sections are limited in extent;
- No consultation relating specifically to landscape or visual issues was undertaken, although local residents raised concerns over the visual impacts of the existing landfill, and were interested in the measures that were being proposed to decommission it; and
- This Chapter does not constitute a full Landscape and Visual Impact Assessment in terms of GLVIA. Instead, it broadly follows the GLVIA stages to provide a high-level qualitative appraisal of potential impacts of the Project on landscape and visual receptors.

10.3 BASELINE CONDITIONS

LANDSCAPE DESIGNATIONS AND FEATURES

10.3.1. The closest National Parks to the Site are as follows:

- Upper Pobozhia National Nature Park – approximately 32km east of the Project Site.
- Podilsji Tovtry National Park – approximately 54km south west of the Site: and
- Lower Polissia National Park – approximately 78km north of the Site.

10.3.2. All of these parks are too distant to be impacted by the proposed development and will not be considered further.

10.3.3. A desktop analysis of the area surrounding the site identified the following features:

- An area of mature (possibly ancient) woodland 750m to the west of the site, that provides a dense visual barrier between the site and the northerly extents of the village of Oleshin beyond;
- The Pivdennyi Buh river runs approximately 1.4km to the south of the site. The river has been dammed at Kam'yanets'ka Street, creating a substantial lake which is crossed by a road bridge carrying Zakhidna Okruzhna Street north towards the Project Site. The lake has a small heavily wooded island (Shrobtak Island) which appears to be a nature reserve, and there are two parks,

one of which is located at the eastern end and the other at the south of the lake, both of which include leisure facilities; and

- There no public paths or trails located with the study area.

LOCAL LANDSCAPE CHARACTER

10.3.4. To help understand the local landscape character of the area, the study area has been divided into five distinct character areas which are outlined below.

- Character Area 1: River and riverine terraces

10.3.5. This area is characterised by the riparian landscape associated with the River Pivdennyi Buh and reservoir. The area is fertile and heavily vegetated with a mixture of woodland, scrub, wetland and grassland.

- Character Area 2: Industrial/Former Industrial Site

10.3.6. These areas are characterised by a generally poor-quality landscape with little vegetation of note. Some areas are still in active use, however there are also areas that are no longer used and have fallen into dereliction. In these areas, some pioneer species are beginning to colonise.

- Character Area 3: Large Scale Agricultural Farmland

10.3.7. This area is characterised by larger-scale commercial agricultural fields. Few buildings are present other than agricultural structures and access is largely via unmade roads and tracks. The fields are typically large and open in nature and predominantly arable, although there are some areas of pasture. A network of irrigation ditches distributes water through the area from the higher ground to the west.

- Character Area 4: Residential Settlements/Small Scale Agricultural Land

10.3.8. These areas are characterised by residential properties with adjoining smallholdings and small scale agricultural farmsteads. On the lower slopes where the gradient is shallower, the ratio of buildings to agricultural land is lower, and a range of crops are grown in strips. Further to the west the development becomes slightly denser and more residential in nature, however small-scale farming appears to be a feature of most of the properties in this area and is likely to be a characteristic of the wider landscape of the Ukraine.

- Character Area 5: Mature Woodland

10.3.9. This area is characterised by a mixture of mature deciduous woodland on the southerly and easterly slopes, and with coniferous agro-forestry further to the west.

ARTIFICIAL LIGHTING

10.3.10. There is existing street lighting along Myru Avenue, and sporadic street lighting along Zakhidna Okruzhna Street. Within the existing landfill, there are several street lights on the access roads towards the south of the existing landfill, and near the existing processing facilities and buildings. The northern parts of the existing landfill are largely taken up by the waste mound / tipping area and appear to be unlit. Vehicles accessing the tipping area would clearly need to use lights at times of low lighting, and it is likely that these would on occasion be visible due to the elevated nature of the landform. Limited lighting is present within the residential area of Oleshin to the west but given its proximity to the existing landfill it is unlikely that there will be significant light spill from the into the residential areas.

VISUAL RECEPTORS

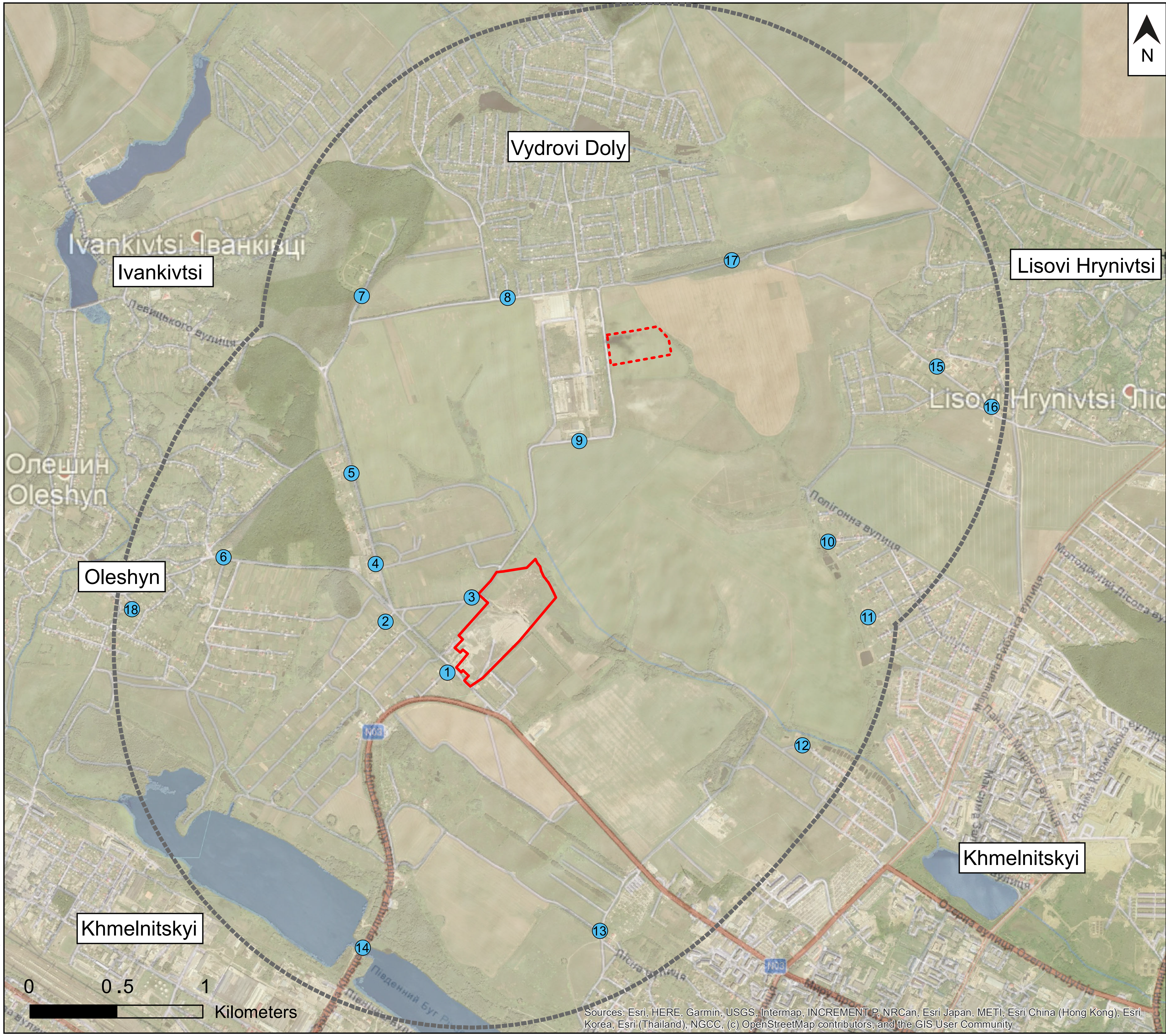
10.3.11. Visual receptors within the study area have generally short-distance views of the Site, from surrounding residences, local businesses, users of surrounding access tracks and highways, and from surrounding fields. There are some receptors that may have mid to long range views of the Project, including a sports pitch in Oleshin and a number of residential receptors towards the outer extents of the study area.

10.3.12. Housing in the area typically comprise two storey detached dwellings with outbuildings and small-scale agricultural land and adjoining smallholdings. The housing tends to become denser in more urban locations, with multi-occupancy buildings and high-rise blocks more commonplace.

10.3.13. The existing landfill generally has very limited visual screening. The southern boundary fronting Myru Avenue has a modular concrete fence, approximately 2.5m in height, with some roadside buildings and a small number of mature trees which, coupled with the nature of the landform falling away to the north, screen much of the site from the road. The remainder of the site boundaries have little or no visual screening; this is clearly illustrated when viewed from the un-named road to the west, where clear views of the existing waste mound are available. Similarly, the site is clearly visible from the north, and there are several possible residential and business receptors in this vicinity that may be affected.

10.3.14. The residential properties directly to the south of the site on the southerly side of Myru Avenue, and those on an unnamed road to the north west of the site to the north of the fire station, are of particular note due to proximity to the Project. Whilst they are visually screened when vegetation is in full leaf, their proximity will still result in some potential intervisibility of the construction activities, noise and lighting through the vegetation.

10.3.15. Figures 10-1 to 10-4 identify the landform, key land uses, landscape features and topography to illustrate the study area context. Figure 10-5 provides a series of viewpoint photographs from some of the key visual receptors that may be impacted by the Project.



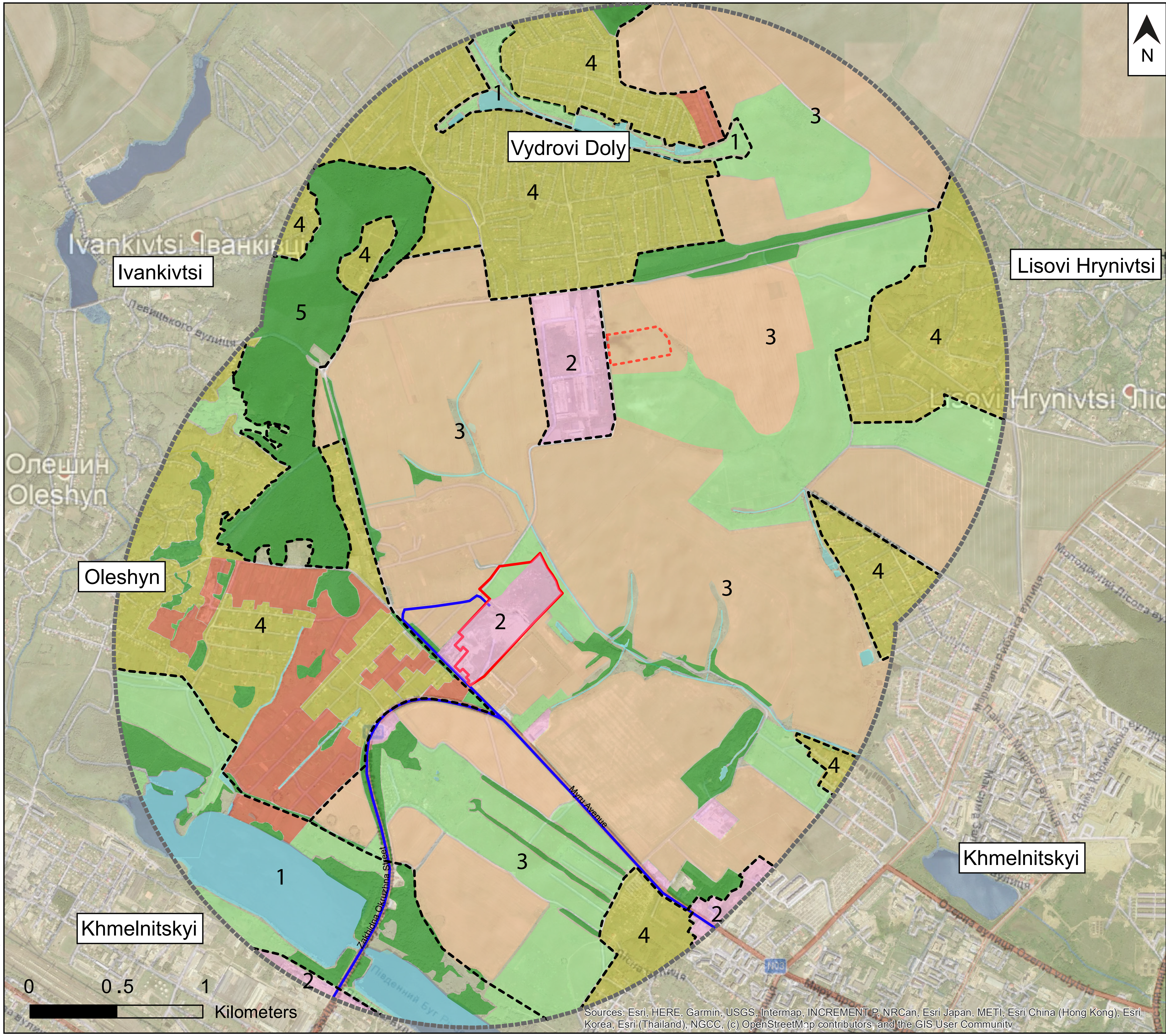
Key
- Site Boundary - Landfill Site
- Site Boundary - MBT Site
- 2km Study Area
- 16 Viewpoint Location

Client:
European Bank for Reconstruction and Development

Project:
Khmelnitskyi Solid Waste Project

Title
FIGURE 10-1:
Site Location and Viewpoint Location Plan

Drawing No:	70057536-01	Drawn:	DW
Date:	09/08/2019	Checked:	KM
Scale:	33,000 @ A3	Approved:	MH



Key

- Site Boundary - Landfill Site
- Site Boundary - MBT Site
- 2km Study Area
- Key access route
- Landscape character type boundary

Local landscape character type

1. River and riverine terrraces
2. Industrial/former industrial land
3. Large scale agricultural land
4. Residential settlements/small scale agricultural land
5. Mature woodland

Land use

- Arable farmland
- Mixed grassland/scrub
- Residential settlements / smallholdings
- Small scale agricultural farmsteads
- Woodland/significant belt of vegetation
- Water body/water course
- Industrial

wsp

Client:

European Bank for Reconstruction and Development

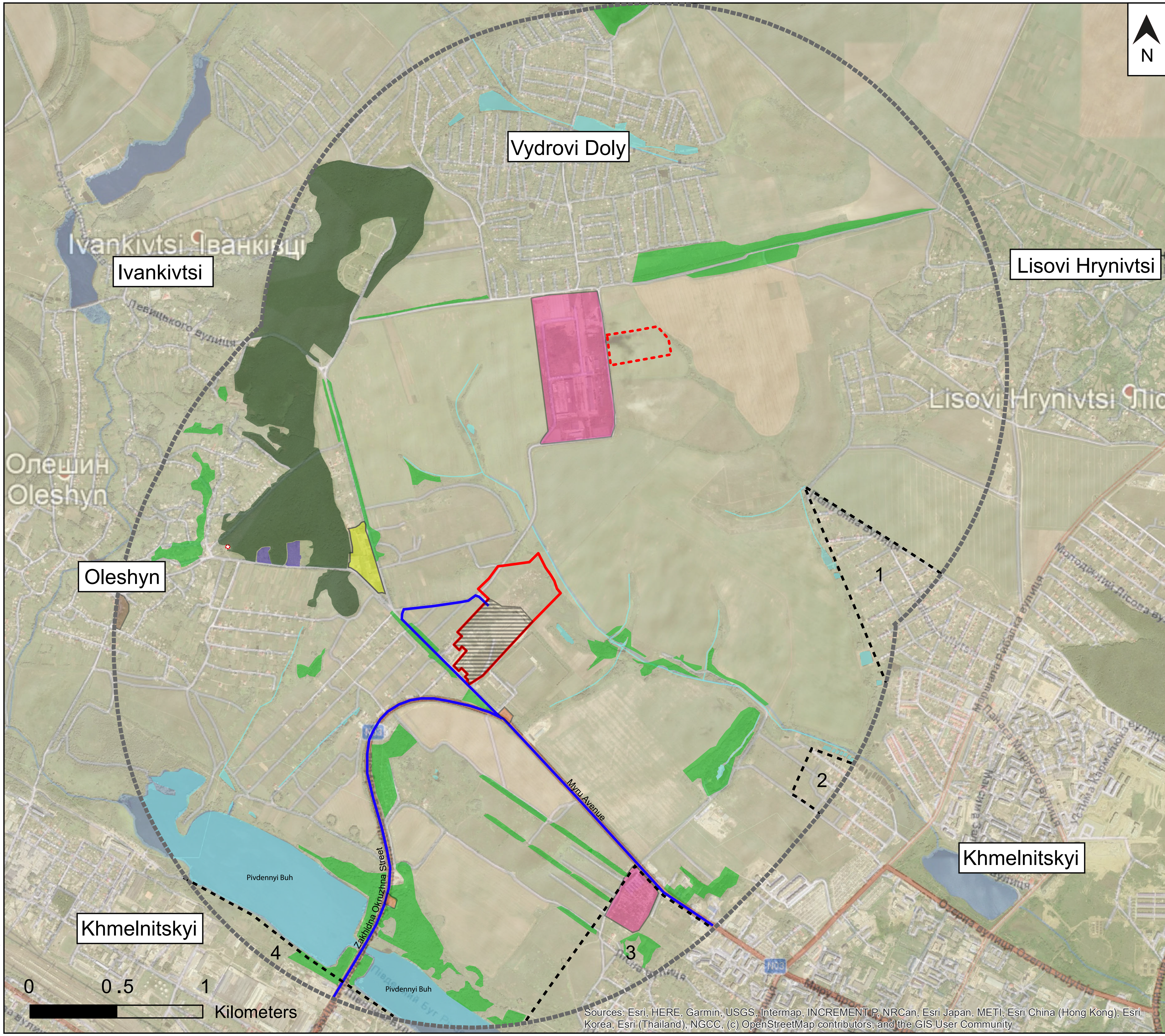
Project:

Khmelnitskyi Solid Waste Project

Title

FIGURE 10-2:
Local Landscape Character

Drawing No:	70057536-02	Drawn:	DW
Date:	09/08/2019	Checked:	KM
Scale:	33,000 @ A3	Approved:	MH



Key
- Site Boundary - Landfill Site
- Site Boundary - MBT Site
- 2km Study Area
- Key access route
- Khmelnitskyi microdistrict boundary
  1. Dyvokray District
  2. Otradne District
  3. Zarichchya District
  4. Hrechany District

Local landscape features
- Water body / watercourse
- Church (Temple of the DNC)
- Possible ancient woodland
- Significant vegetation
- Derelict site
- Cemetary
- Fire Station
- Fuel station
- Sports fields
- Sports fields

wsp

Client:
European Bank for Reconstruction and Development

Project:
Khmelnitskyi Solid Waste Project

Title
FIGURE 10-3:
Local Landscape Features

Drawing No:	70057536-03	Drawn:	DW
Date:	09/08/2019	Checked:	KM
Scale:	33,000 @ A3	Approved:	MH

Document Path: \\uk.wspgroup.com\central data\Projects\700575xx\70057536 - Khmelnitsky Solid Waste ESIA\03 WIP\03 - Landscape\GIS\Base mapping revised.mxd User Name: UKDRW003 Date Saved: 05/08/2019 15:31:54

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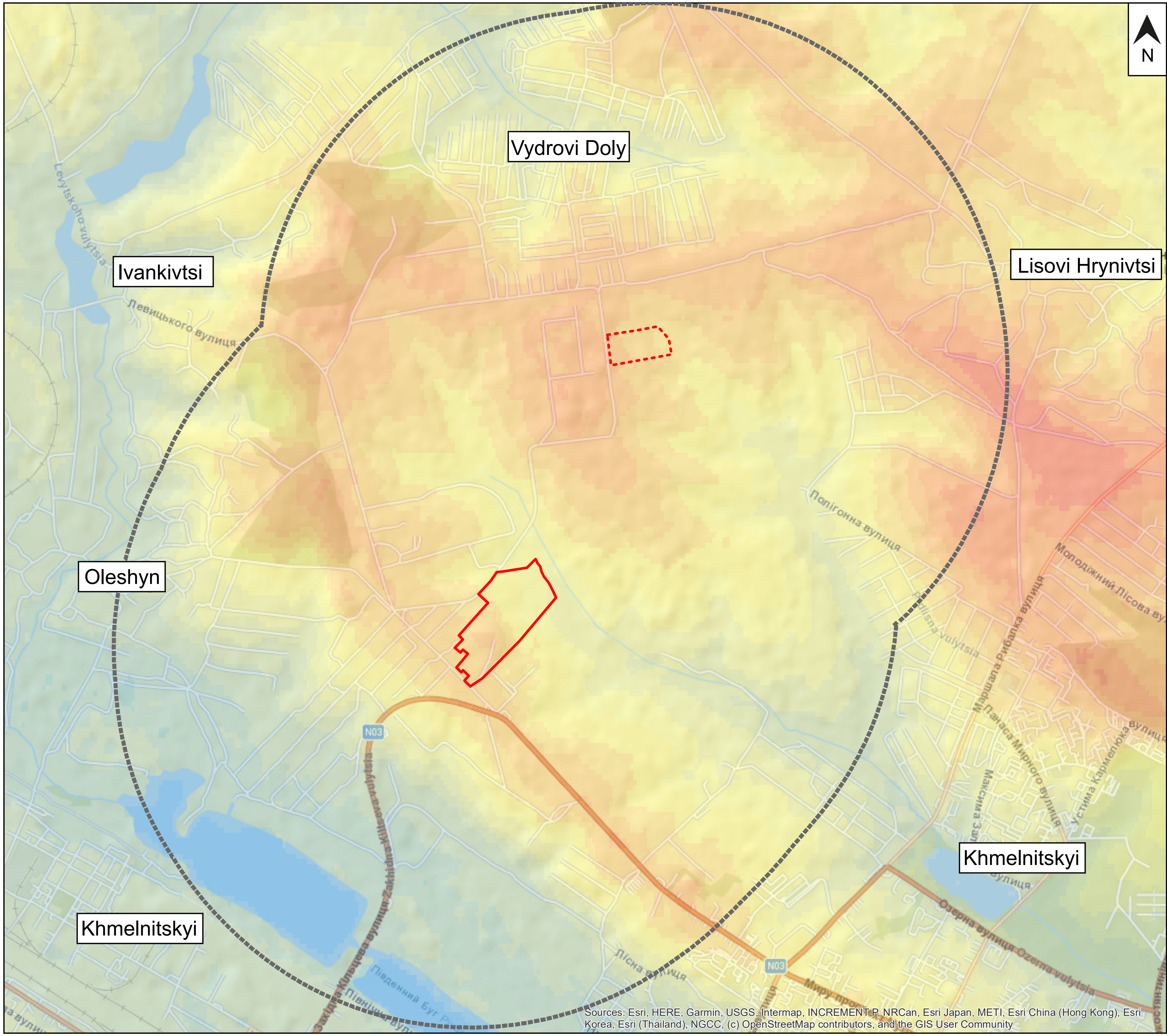


Key

- Site Boundary
- Site Boundary - MBT Site
- 2km Study Area

Topography (m)

- 267 - 275
- 275 - 285
- 285 - 295
- 295 - 305
- 305 - 315
- 315 - 325
- 325 - 335
- 335 - 345
- 345 - 355
- 355 - 365
- 365 - 375
- 375 - 385
- 385 - 395
- 395+

Client:

European Bank for Reconstruction and Development

Project:

Khmelnitskyi Solid Waste Project

Title

FIGURE 10-4
Topography

Drawing No:	70057536-04	Drawn:	DW
Date:	09/08/2019	Checked:	KM
Scale:	33,000 @ A3	Approved:	MH

View 01: Dwellings off Myru Avenue adjacent to southern site boundary

Viewpoint Location (Northings/Eastings): 49°27'34.97"N 26°57'40.20"E

Viewpoint Elevation (AOD): 358m

Distance to the Site Boundary:

View 02: Looking east towards the site from local un-named residential street.

Viewpoint Location (Northings/Eastings): 49°27'43.15"N 26°57'20.31"E

Viewpoint Elevation (AOD): 352m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Document Date: 18/07/19

Sheet 01

Project Number: 70057536

Sheet Size: A3

Photography Date & Time: Varies

View 03: Looking east towards the northern face of existing landfill and proposed MDT site from un-named access road.

Viewpoint Location (Northings/Eastings): 49°27'44.0"N 26°59'42.5"E

Viewpoint Elevation (AOD): 345m

Distance to the Site Boundary:

View 04: Looking east towards the proposed development from the Fire Station

Viewpoint Location (Northings/Eastings): 49°27'52.58"N 26°57'20.14"E

Viewpoint Elevation (AOD): 361m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Document Date: 18/07/19

Project Number: 70057536

Sheet Size: A3

Photography Date & Time: Varies

Sheet 02

View 05a : Un-named road between Oleshyn and Khmelnitskyi looking north

View 05b : Un-named road between Oleshyn and Khmelnitskyi looking south towards the Fire Station

Viewpoint Location (Northings/Eastings): 49°28'08.89"N 26°57'13.90"E

Viewpoint Elevation (AOD): 359m

Distance to the Site Boundary:

View 06a: Monument to the Dead in Oleshyn with Temple of the DNC behind. Looking east.

View 06b: Looking North towards the Temple of the DNC in Oleshyn

Viewpoint Location (Northings/Eastings): 49°27'56.65"N 26°56'30.86E

Viewpoint Elevation (AOD): 335m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Sheet 03

Project Number: 70057536 **Sheet Size:** A3 **Photography Date & Time:** Varies **Document Date:** 18/07/19

View 07: From un-named road at the entrance to secluded residential development looking south towards the Landfill Site (not visible)

Viewpoint Location (Northings/Eastings): 49°47'91.23"N 26°95'37.68"E

Viewpoint Elevation (AOD): 368m

Distance to the Site Boundary:

View 08: Looking south towards the existing landfill site from un-named road to the south of Vydrovi Doly

Viewpoint Location (Northings/Eastings): 49°28'44.94"N 26°57'57.10"E

Viewpoint Elevation (AOD): 365m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

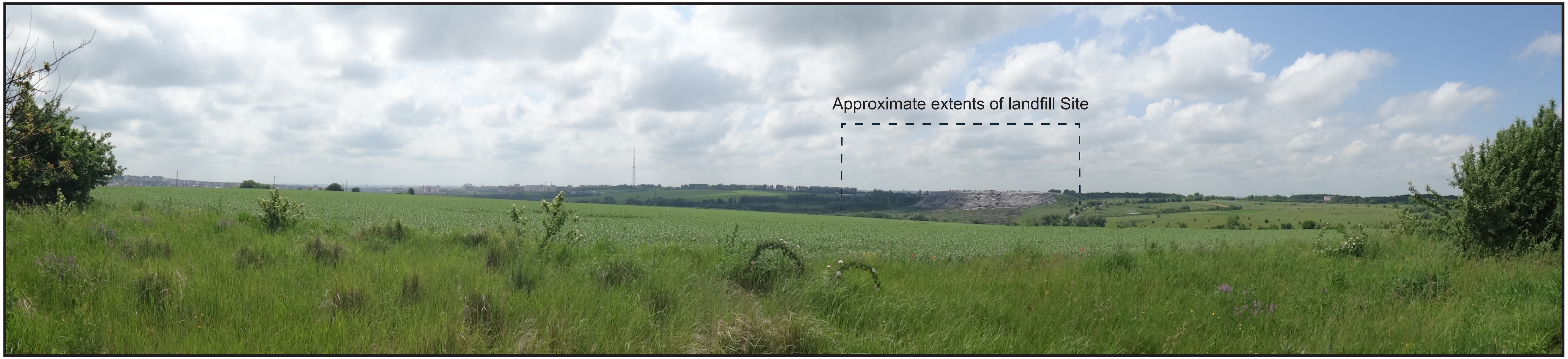
Sheet 04

Project Number: 70057536

Sheet Size: A3

Photography Date & Time: Varies

Document Date: 18/07/19

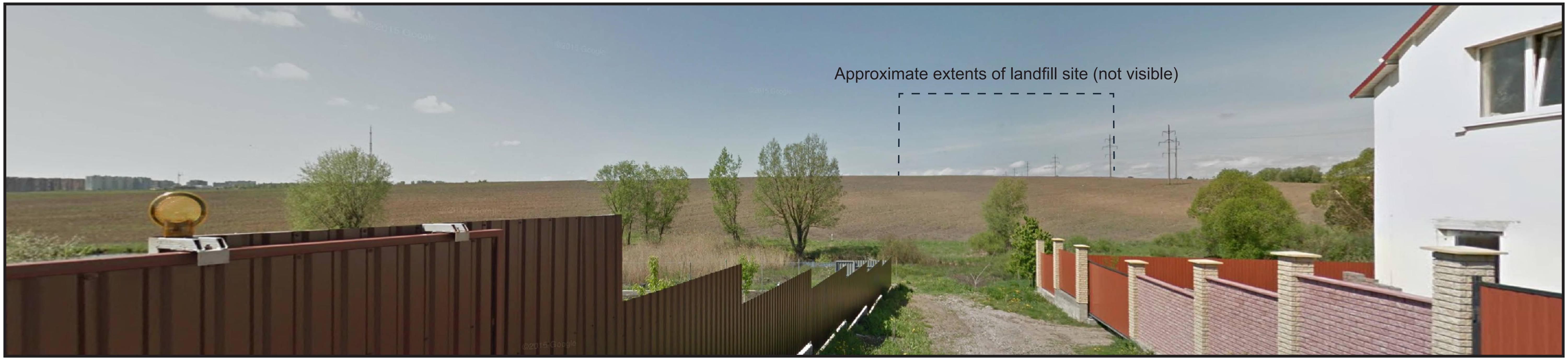


View 09: Looking south towards the existing landfill site from the entrance to the industrial complex to the north.

Viewpoint Location (Northings/Eastings): 49°28'18.16"N 26°58'19.16"E

Viewpoint Elevation (AOD): 367m

Distance to the Site Boundary:



View 10: Looking west towards the proposed development from Vulytsya Verkhnya in Miokrorayon Otradne

Viewpoint Location (Northings/Eastings): 49°27'58.93"N 26°59'29.96"E

Viewpoint Elevation (AOD): 322m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

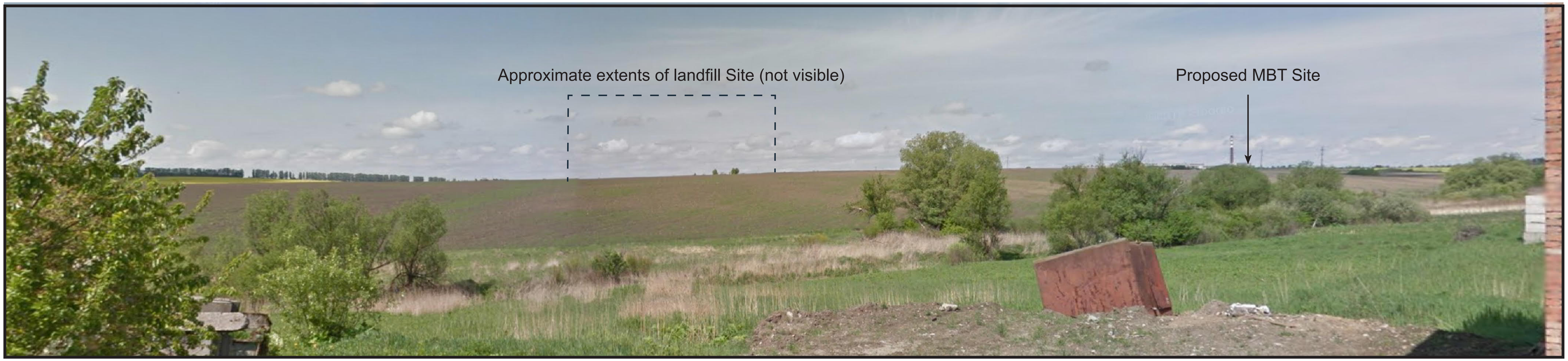
Document Date: 18/07/19

Sheet 05

Project Number: 70057536

Sheet Size: A3

Photography Date & Time: Varies



View 11: Looking west towards the proposed development from Vulytsya L. Lupana in Mikrorayon Otradne

Viewpoint Location (Northings/Eastings): 49°27'44.0"N 26°59'42.5"E

Viewpoint Elevation (AOD): 318m

Distance to the Site Boundary:

View 12: Looking west towards the proposed development from un-namned road in Mikrorayon Otradne

Viewpoint Location (Northings/Eastings): 49°27'17.26"N 26°59'30.30"E

Viewpoint Elevation (AOD): 309m

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Sheet 06

Project Number: 70057536 **Sheet Size:** A3 **Photography Date & Time:** Varies **Document Date:** 18/07/19

View 13: Looking north-west toward the proposed development (not visible) from boundary of residential property on un-named road adjoining Lisova Street

Viewpoint Location (Northings/Eastings): **49°26'44.84"N 26°58'24.44"E**

Viewpoint Elevation (AOD): **312m**

Distance to the Site Boundary:

View 14: Looking north towards the proposed development (not visible) from Zakhidna Okruzhna St on bridge over Pivdennyi Buh River

Viewpoint Location (Northings/Eastings): **49°26'41.63"N 26°57'14.70"E**

Viewpoint Elevation (AOD): **280m**

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Document Date: 18/07/19

Sheet 07

Project Number: 70057536

Sheet Size: A3

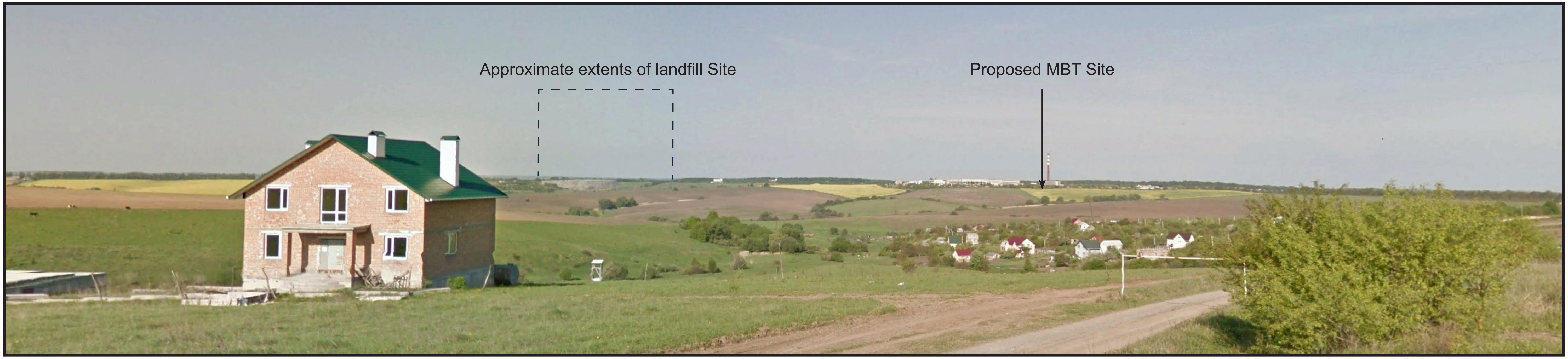
Photography Date & Time: Varies

View 15: Looking west towards proposed development from boundary of residential property on un-named road adjoining Vulytsya Haydara in Lisovi Hrynivtsi

Viewpoint Location (Northings/Eastings): 49°26'44.84"N 26°58'24.44"E

Viewpoint Elevation (AOD): **312m**

Distance to the Site Boundary:



View 16: Looking west towards proposed development from boundary of residential property on un-named road in Lisovi Hrynivtsi

Viewpoint Location (Northings/Eastings): 49°26'41.63"N 26°57'14.70"E

Viewpoint Elevation (AOD): **280m**

Distance to the Site Boundary:

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

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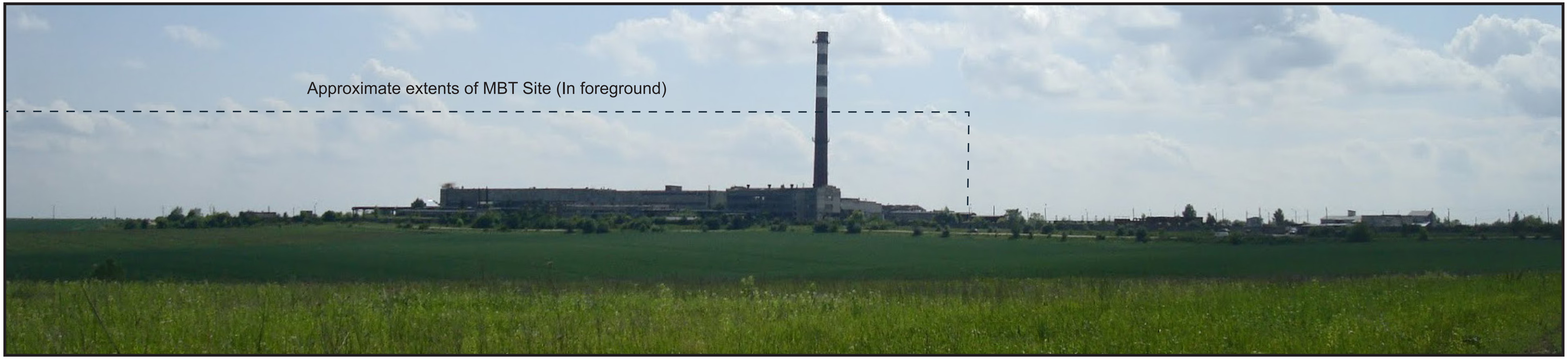
Sheet 08

Project Number: 70057536

Sheet Size: A3

Photography Date & Time: Varies



View 17: Looking south-west towards the proposed MBT Site from un-named road to the soth of Vydrovi Doly

Viewpoint Location (Northings/Eastings): 49°28'49.99"N 26°59'12.33"E

Viewpoint Elevation (AOD): 361m

Distance to the Site Boundary:

View 18: Sports and Social Club in Oleshyn

Viewpoint Location (Northings/Eastings): 49°27'49.04"N 26°56'00.83"E

Viewpoint Elevation (AOD): 294m

Distance to the Site Boundary:

Figure 12-5
Photograph Sheets

Sheet 09

Project: Khmelnitsky Solid Waste Project

Client: European Bank For Reconstruction and Development

Project Number: 70057536 | **Sheet Size:** A3 | **Photography Date & Time:** Varies | **Document Date:** 18/07/19

10.4 POTENTIAL IMPACTS AND EFFECTS

PROJECT OVERVIEW

10.4.1. With regards to the proposed landfill whilst the operational practices will be designed to EU standards, many of the elements will be visually similar in character to the elements of the existing landfill, for example lighting and vehicle movements. The exiting landfill will be re-graded and capped, which will improve its appearance. The proposed landfill will have improved operational practices and will be regularly covered to minimise dust and unsightly appearances. The proposed MBT facility will be located on an agricultural field adjacent to the former industrial site (with the chimney). The proposed MBT facility will include built form up to approximately 10m in height. Existing infrastructure will be used to access the Project.

10.4.2. The Project is located within a relatively flat, open landscape, although variations in local topography and the presence of woodland blocks and existing built form helps to limit visibility. There will be no tree felling required, although existing agricultural land will be replaced within the proposed landfill and proposed MBT facility areas of the Project.

10.4.3. During construction, the existing landfill will be re-graded and capped, allowing it to integrate better into the existing landform, and result in slightly less visual intrusion. The multifunctional protective screen which will be layered over the existing landfill will be topped with a layer of soil and planted with grasses / shrubs. Some artificial lighting may also be required during construction of the proposed MBT facility.

10.4.4. At operation, regular passage of vehicles to both sites will be required, along existing roads. There is the potential for material to escape from waste trucks or be blown from the proposed landfill, impacting on the local landscape character and on visual amenity within the nearby villages (particularly Vydrovi Doly (north), Ivankivtsi (north west) and Oleshin (west) as well as residential receptors located approximately 70m south of the existing landfill. Waste trucks will be covered to prevent wind-blown material and the proposed landfill areas will be regularly covered to minimise dust and wind blown material.

RECEPTOR EVALUATION

10.4.5. The information collected to inform this assessment has been summarised in the following tables. They identify the key landscape and visual receptors that may be affected by the Project, and their potential sensitivity to it.

Table 10-2 – Indicative Sensitivity of Landscape Receptors

Receptor / Resource	Sensitivity	Justification
Site vegetation	Low	Vegetation within the Project site is agricultural (arable) fields. Field boundaries are largely open or edged with scrub/intermittent hedgerow or access roads. There is limited vegetation within the existing landfill site, and it is of limited aesthetic value. Agricultural land is commonplace in the local landscape.
Character Area 1: River and riverine terraces	High	Fertile, heavily vegetated landscape with a mixture of woodland, scrub, wetland and grassland as well as an island nature

Receptor / Resource	Sensitivity	Justification
		reserve, generally in good condition and of good quality and with a sense of place.
Character Area 2: Industrial/ former industrial land	Low	Poor-quality, degraded landscape with little vegetation of note. Some areas functioning as active industrial units and of functional rather than aesthetic quality.
Character Area 3: Large scale agricultural farmland	Medium	Larger-scale agricultural fields typically rectilinear in shape and used for mainly arable production. Large areas are often bounded by trees or dirt tracks with a strong network of irrigation ditches. Few buildings are present other than agricultural structures. A pleasant landscape, albeit unremarkable and partially substitutable.
Character Area 4: Residential settlements/ small scale agricultural land	Medium	Residential properties, typically single or 2-storey detached dwellings, with adjoining smallholdings and small scale agricultural farmsteads. Density of built form increases further west away from the lower slopes.
Character Area 5: Mature Woodland	Medium	A mixture of mature deciduous woodland on the southerly and easterly slopes, and coniferous agro-forestry further to the west. This character area is partially substitutable, but with some areas of higher quality.

Table 10-3 – Indicative Sensitivity of Visual Receptors

Receptor / Resource	Sensitivity	Justification
Residential properties along Myru Avenue to the south	High	Static views in very close proximity to the site., although partially screened by vegetation and built form. Represented by viewpoint 01.
Residential properties along unnamed roads to the north-west	High	Static views in close proximity to the site, although partially screened by vegetation Represented by viewpoint 04, 05 and 07.
Residences and businesses on the edge of Ivankivtsi, Oleshin, and Lisovi Hrynivtsi settlements to the west and east of the Site.	High	Views are from a static location in close proximity to the site although partially screened by vegetation Represented by viewpoint 02, 06, 15, 16 and 18.
Users of Oleshin sports pitch	Medium	Users of indoor and outdoor recreational facilities Represented by viewpoint 18.
Residences and businesses on the edges of Khmelnitsky to the south and east	High	Views are from a static location in close proximity to the site, although partially screened by vegetation and built form Represented by viewpoints 10 – 13.
Residences and businesses on the	High	Views are from a static location in close proximity to the site although partially screened by vegetation

Receptor / Resource	Sensitivity	Justification
edges of Vydrovi Doly to the north		Represented by viewpoint 08.
Workers within adjacent industrial units	Low	Indoor workers but in close proximity to the site. Represented by viewpoint 03 and 09.
Users of surrounding agricultural land and un-surfaced paths and tracks	Medium	Views are relatively transient but in close proximity to the Site.
Users of surrounding main highways	Low	Views are transient and typically from faster moving vehicles and public transport. Represented by viewpoint 03, 09, 14 and 17.

10.4.6. Potential impacts of the Project on the above landscape and visual receptors are described for both the construction and the operational phases below.

CONSTRUCTION PHASE

10.4.7. The use of construction machinery and construction works will create increases in noise, dust and activity, along with potential traffic management requirements on surrounding highways. The capping and covering of the existing landfill will result in some potential improvement of local landscape character and visual amenity by visually covering landfill material with a less visually intrusive capping layer.

10.4.8. A summary of the potential effects on landscape and visual receptors at construction, prior to mitigation, is outlined in Section 10.6 below.

OPERATIONAL PHASE

10.4.9. The Project will result in increased traffic volumes along the highway, and increased activity within the Project site itself. As such, there is the potential for a greater awareness of activity on surrounding roads as well as noise, activity and visual intrusion from new buildings and/or extended site operations. Whilst the measures to cover the existing landfill site will be of benefit, there will be an overall extended area of new built form, vehicular activity and visible operational area within the landscape.

10.4.10. A summary of the potential effects on landscape and visual receptors at operation, prior to mitigation, is outlined in Section 10.6 below.

10.5 MITIGATION AND ENHANCEMENT MEASURES

10.5.1. These mitigation and enhancement measures are also reflected within the ESMP.

CONSTRUCTION PHASE

10.5.2. The following mitigation measures will reduce adverse effects of the Project on surrounding landscape character and visual amenity during the construction phase:

- Removal / loss of natural and semi-natural habitat should be minimised throughout;
- Minimise the use of artificial lighting on the site and where needed, use directional lighting;

- Regrade, cap and cover existing landfill site to contours that appear natural and as sympathetic to the existing landform as possible;
- Covered sections to be planted up with suitable planting of grasses, wildflowers and / or shrubs; and
- New tree and hedge / shrub planting to be planted around the Project boundaries. Plants to include low, medium and tall-growing species and planted into a suitable depth of appropriate topsoil to aid establishment and provide some screening of the Project.

OPERATIONAL PHASE

10.5.3. The following mitigation measures will reduce adverse effects of the Project on surrounding landscape character and visual amenity during the operational phase:

- Plant any completed landfill sub-cells with suitable planting of grass / wildflower / shrubs as soon as the cell becomes filled and non-operational;
- Ensure suitable establishment of tree / scrub / hedgerow / vegetation planting to maximise screening properties; and
- Ensure regular covering of landfill cells to minimise wind-blown litter and dust and reduce visual intrusiveness of landfill operations.

10.6 RESIDUAL EFFECTS

10.6.1. A summary of the potential residual effects on landscape and visual receptors at operation, prior to mitigation, is outlined in Section 10.7 below.

10.7 SUMMARY

Table 10-4 – Summary of Potential Impacts, Effects and Mitigation (Landscape and Visual)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Landscape and Visual	Visual barrier in form of mature woodland exists 750m west of site. Local landscape character areas include those described in Section 10.3. Visual receptors are generally short-distance visual	Construction	Effects to Landscape Character Areas	**Minor adverse (not significant) with one instance of moderate adverse** for Character Area 3: Large scale agricultural farmland.	Mitigation measures are detailed in the ESMP.	**Minor adverse (not significant).**
			Effects to visual receptors	Ranging from minor adverse (not significant) to large adverse (significant).	Mitigation measures are detailed in the ESMP.	Ranging from **minor adverse (not significant) to large adverse (significant).**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
	receptors from surrounding residences, local businesses, users of surrounding access tracks and highways, and the surrounding fields.	Operation	Effects to Landscape Character Areas	Range from **minor adverse (not significant) to minor beneficial (not significant).**	Mitigation measures are detailed in the ESMP.	**Range from minor adverse (not significant) to minor beneficial (not significant).**
			Effects to visual receptors	Range from **minor adverse (not significant) to moderate adverse (significant).**	Mitigation measures are detailed in the ESMP.	Range from **minor adverse (not significant) to medium adverse (significant).**

11

SURFACE WATER ENVIRONMENT

11 SURFACE WATER ENVIRONMENT

11.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

11.1.1. The assessment has been undertaken in line with international best practice. The following EU directives have been considered during the completion of this assessment, where appropriate when considering the surface water environment:

- The Landfill Directive (EEC/1999/31/EC); and
- The Water Framework Directive (2000/60/EC).

11.1.2. The following National legislation has been considered during completion of this assessment:

- Law of Ukraine on the Environmental Protection (No. 1264 (1991));
- Law of Ukraine on Drinking Water and Drinking Water Supply (No. 2918 (2002));
- Protection of Surface Waters Against Pollution (SanPiN 4630-88);
- Hygienic Drinking Water Regulations Intended for Human Consumption ((GSanPiN) 2.2.4-171-10);
- Water Code of Ukraine (No. 213 (1995));
- National Standard of Ukraine on “Fresh Water” for Water Quality Monitoring Methods and Requirements (7525:2014); and
- UN Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Ratified by Ukraine in 2003. Plan of implementation № 46963.

11.1.3. In addition, where deemed appropriate, the UK Landfill Guidance has been considered within this assessment. This guidance is in accordance with EU Legislation.

11.2 ASSESSMENT METHODOLOGY

11.2.1. This Chapter qualitatively assesses the potential effects of the Project on the surrounding surface water features during both construction and operation.

11.2.2. Where appropriate it also identifies proposed mitigation measures to minimise or control likely adverse effects on surface water receptors arising from the Project. This Chapter should be read in conjunction with the introductory chapters (Chapter 1: Introduction to Chapter 5: Approach to ESIA) and Chapter 12: Geology and Soils (and the Hydrogeological Risk Assessment (HRA)).

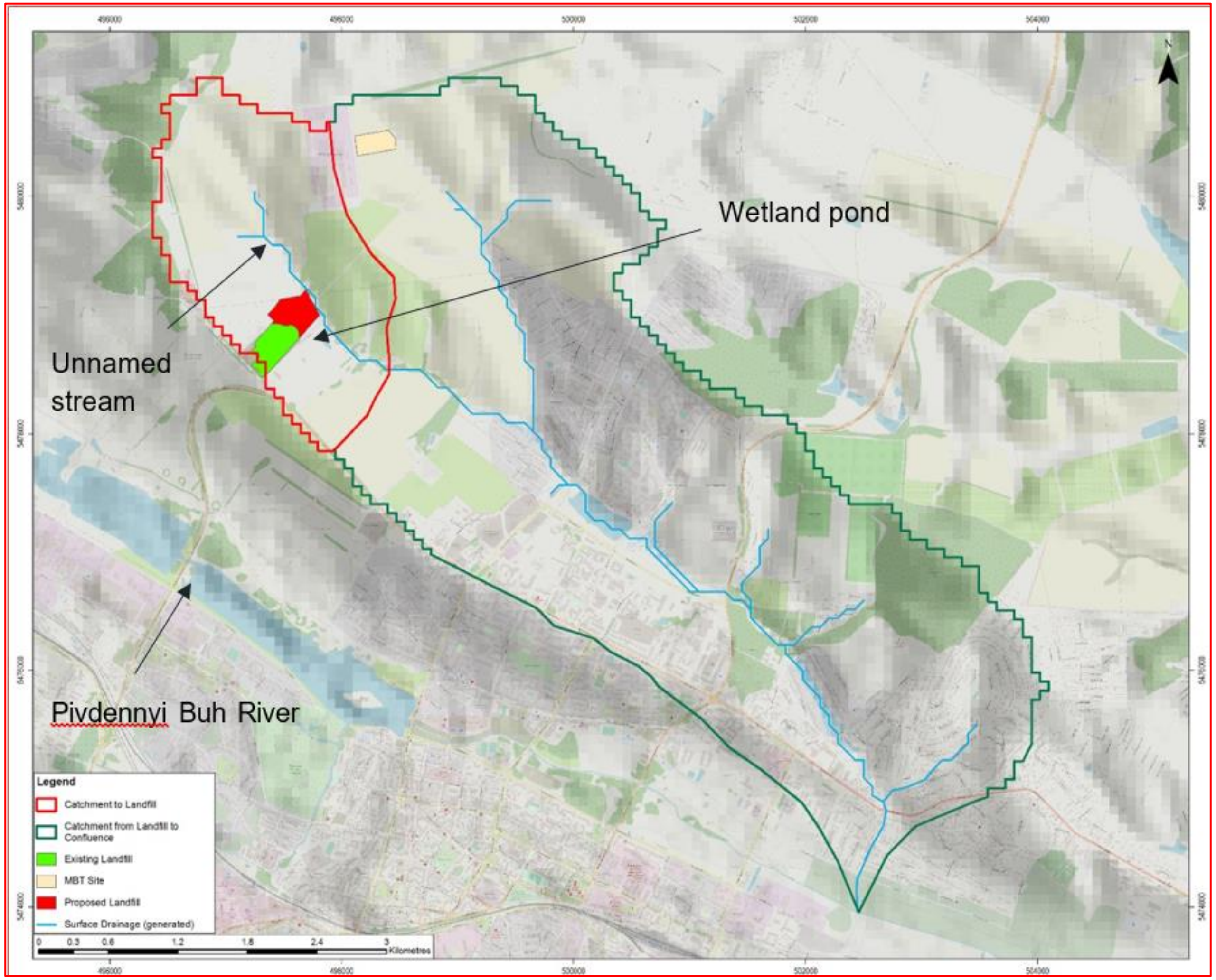
11.2.3. The assessment of the Project has been undertaken primarily through a desk-based study using available information relating to existing water quality, contamination, overland flow routes and flood risk in combination with the observations made during the two site visits (31 May and 3 July 2019).

STUDY AREA

11.2.4. The Study Area for surface water characterisation and assessment is defined according to potential surface water receptors (described in greater detail in paragraph 11.2.4)and the surface water catchment within which the Project is located (Figure 11-1). The Study Area is therefore defined as follows:

- To the north and east – a wetland pond and an unnamed watercourse that are located approximately 150m to the north-east of the existing landfill at their closest points;

- To the east – a line 2km down gradient of the existing landfill, which corresponds approximately with the western boundary of the Otradne Micro-district and encompasses the confluence of the local water course and a tributary that joins from the north;
- To the south – the Pivdennyi Buh River; and
- To the west and north west - the margin of the watershed of the unnamed stream, i.e. the red-line catchment boundary to the west and northwest (Figure 11-1), or 2km from the existing landfill, whichever is less.



Note: The red-line boundary indicates the catchment of the unnamed stream including the Project. The green-line boundary indicates the entire catchment of the unnamed stream

Figure 11-1 – Surface Water Catchment and Surface Water Receptors

11.3 BASELINE CONDITIONS

SURFACE WATER

11.3.1. The baseline data has been obtained through a combination of the two site visits observations, water quality sampling and the desk-based review of third party and consultation information.

11.3.2. The Project is located at an elevation of approximately 330m to 360m above mean sea level (AMSL) on the northern side of a ridge approximately 1.5km north of the of City of Khmelnitsky. The ridge separates a valley occupied by an unnamed local watercourse and which contains the Micro-districts of Otradne and Dyvokray which are part of the main City of Khmelnitsky conurbation, and the Pivdennyi Buh River which flows through the centre of Khmelnitsky, at an elevation of approximately 276m AMSL at its nearest point.

11.3.3. The Study Area has several surface water features. The closest of these are the wetland pond approximately 150m east of the north-eastern corner of the existing landfill and an unnamed stream that is 225m to the east/northeast at its closest point. The stream is ephemeral and dries out during the summer months. It is not known whether the wetland pond is a natural or anthropogenic feature or whether it dries out. The wetland pond freezes over in winter. Neither are utilised by local villagers for water supply. The unnamed stream has a catchment area of approximately 3.9km^2 above the landfill and 18.6km^2 below the landfill, (i.e. approximately 22.5km^2 in total). At the northern edge of the existing landfill, there are leachate ponds as shown in Figure 11-2 and Figure 11-3.

Figure 11-2 – View of Northern Edge of the Existing Landfill and Leachate Ponds (photograph taken looking east – the wetland pond is in front of the trees in the distance, the unnamed stream is located to the left-hand-side of the photograph between the landfill and the arable fields)

Figure 11-3 – View of Leachate Ponds at the Northern Edge of the Existing Landfill

11.3.4. The unnamed stream and wetland pond features are located down-gradient of the existing landfill as shown in Figure 11-2. The wetland pond is located within the Project Site. The unnamed stream drains south-east and joins the Pivdennyi Buh River approximately 8km downstream of the Project.

11.3.5. The Pivdennyi Buh River is a major river that traverses the country and ends in the Black Sea. The Pivdennyi Buh River is a source of water for the City of Khmelnitsky and is located 1.5km to the south-west from the Project at its closest point. The catchment area of the Pivdennyi Buh River at its confluence with the unnamed stream is approximately 637.7km^2. The existing and proposed landfill are separated topographically from the City and the Pivdennyi Buh River by the ridgeline immediately south of the existing landfill. Rainfall interacting with the Project will drain indirectly to the Pivdennyi Buh River via the unnamed stream and potentially via groundwater pathways.

11.3.6. The Pivdennyi Buh River is dammed in the City of Khmelnitsky to create two reservoirs for water supply and amenity value. To the north-west of the Project is another reservoir, located west of Ibahkibu and to the north and east of the Project are a series of surface water ponds in urban settings.

WATER QUALITY ASSESSMENT

11.3.7. Two samples were collected in May 2018 from the wetland pond and unnamed stream located to the east of the existing landfill respectively (see Figure 11-3), (the precise location of the stream sample is not known). In addition, second and third rounds of sampling were undertaken in April and December 2019. Sampling in April 2019 included leachate from the leachate pond immediately north of the existing landfill (Figure 11-2) and surface water samples collected from the unnamed streams 500m upgradient and 500m downgradient of the existing landfill. The wetland pond and two leachate ponds were also sampled in December 2019. Table 11-1 presents a summary of the analytical results compared to the surface water standards for the Ukraine. Any exceedances are formatted in bold.

Table 11-1 – Surface Water Quality Assessment

Determinand	Leachate small / large pond December 2019 (April 2019)	Unnamed Stream (500m upgradient of the existing landfill)	Unnamed Stream (500m down gradient of the existing landfill)	Wetland Pond December 2019 (May 2018)	Unnamed Stream (adjacent to the northeast of the proposed landfill)	Surface Water Standard[49]
pH	**8.80** / **8.85** (**8.71**)	7.24	7.65	(7.17) 7.4	7.29	6.5-8.5
Electrical conductivity (µS/cm)	**4,262** / **3,896** (-)	-	-	(-) **1,415**	-	1,000
Dissolved oxygen (mg/l)	9.2 / 8.6 (-)	-	-	(6.4) 14.7	5.8	>4
Ammonia (mg/l)	**120** / **116** (**1,636**)	0.23	0.29	(0.31) 1.6	0.29	2.6
Chloride (mg/l)	**640** / **578** (**4,013**)	49.6	64.2	**(547) 584**	64.9	350
Biological Oxygen Demand (BOD) (mgO/l)	**125** / **112** (**9,433**)	5.1	5.6	(3.5) 1.43	3.8	6
Chemical Oxygen Demand (COD) (mgO/l)	**4,300** / **3,600** (**16,262**)	28.1	29.8	**(43.3) 46.0**	**34.6**	30
Total Dissolved Solids (TDS) (mg/l)	**5,623** / **4,532** (**15,844**)	360.1	501.1	**(1,109) 1,421**	506.0	1,000
Total alkalinity (mmol/l)	**35.2** / **36.0** (-)	-	-	(3.8) 6.4	**6.6**	6.5
Iron (mg/l)	**13.5** / **13.8** (**1.31**)	0.27	0.028	(0.31) **1.1**	**2.5**	0.3
Manganese (mg/l)	**0.6** / **0.56** (-)	-	-	**(0.29) 0.11**	**0.39**	0.1
Magnesium (mg/l)	**87.5** / **84.1** (-)	-	-	(21.6) 5.4	8.2	80
Calcium (mg/l)	**179.4** / **186.0** (-)	-	-	(**212**) 48.7	125.8	130
Sodium (mg/l)	**572.5** / **492.6** (-)	-	-	(-) **256.4**	-	200

[49] Protection of Surface Waters Against Pollution (SanPiN 4630-88).

Determinand	Leachate small / large pond December 2019 (April 2019)	Unnamed Stream (500m upgradient of the existing landfill)	Unnamed Stream (500m down gradient of the existing landfill)	Wetland Pond December 2019 (May 2018)	Unnamed Stream (adjacent to the northeast of the proposed landfill)	Surface Water Standard[49]
Potassium (mg/l)	**151.9** / **157.3** (-)	-	-	(-) **84.2**	-	20
Chromium (mg/l)	**0.10** / **0.07** (-)	-	-	**(<0.05) 0.052**	<0.05	0.05
Nickel (mg/l)	**0.38** / **0.40** (0.097)	<0.01	<0.01	(<0.01) 0.02	<0.01	0.02
Lead (mg/l)	**0.05** / **0.04** (-)	-	-	(<0.01) **0.02**	<0.01	0.01
Arsenic (mg/l)	0.002 / <0.001 (-)	-	-	0.01 (-)	-	0.01
Barium (mg/l)	<0.01 / <0.01 (-)	-	-	<0.01 (-)	-	0.13
Cadmium (mg/l)	**0.01** / **0.01** (-)	-	-	<0.001 (<0.01)	<0.01	0.001
Cobalt (mg/l)	**0.175** / **0.18** (-)	-	-	<0.01 (0.01)	<0.01	0.10
Copper (mg/l)	- / - (0.063)	0.005	0.005	- (<0.005)	<0.005	1.0
Zinc (mg/l)	**1.7** / **1.6** (0.103)	0.007	0.009	(0.017) 0.06	0.01	1.0
Nitrate (mg/l)	**121** / **160** (**237**)	5.19	6.52	(6.18) **61.0**	5.42	45
Nitrite (mg/l)	2.4 / 2.0 (**100**)	0.016	0.017	(0.009) 0.8	0.016	3.3
Phosphate (mg/l)	- / - (**1,798**)	1.29	1.71	(1.82)	1.68	3.5
Sulphate (mg/l)	483 / 450 (**12,149**)	44.1	47.14	(37.3) 63	48.6	500
Petroleum Products (mg/l)	**0.61** / **0.70** (**9.26**)	<0.01	<0.01	(<0.3) 0.02	<0.3	0.3
Organochloride pesticides (mg/l)	0.0002 / <0.0001 (-)	-	-	<0.0001	-	0.0005

11.3.8. The data in Table 11-1 show that the Ukrainian surface water standards for chloride, COD, TDS, nitrate, manganese, iron, calcium, sodium, potassium, lead, and chromium were exceeded in samples from the wetland pond. Levels of COD, iron, total alkalinity and manganese sampled from the unnamed stream nearest the landfill also exceeded the Ukrainian surface water standards.

FUTURE BASELINE

11.3.9. The future baseline would be characterised by the ongoing and uncontrolled release of leachate into the neighbouring environment. Depending on their intensity, rainfall events will flood the un-engineered leachate ponds and mobilise leachate and contaminated soils. The unnamed stream and wetland pond immediately downslope of the landfill would likely deteriorate in quality over time.

RECEPTORS

11.3.10. The surface water receptors are indicated in Figure 11-1. They are described in more detail and assigned a sensitivity below:

- The nearby unnamed stream 225m to the east/northeast of the existing landfill and the wetland pond 150m east of the existing landfill and within the Project area are referred to collectively as 'local surface water receptors. These may be impacted by a combination of overland flow and groundwater discharge. The stream is unnamed and locally ephemeral, drying out in the driest of summers. It is unknown whether the wetland pond is a natural or anthropogenic feature, nor whether it dries out or not, it is known to freeze over in winter. The unnamed stream is canalised in its lower reaches proving little amenity value and no resource value, the wetland pond has no known designation and no known amenity or resource value. The local surface water receptors are considered low sensitivity.
- The Pivdennyi Buh River approximately 1.5km south of the existing landfill may be impacted indirectly via groundwater discharge. The Pivdennyi Buh River is dammed in the centre of Khmelnitsky to form a reservoir for the town with significant local amenity and resource value. The receptor is considered high sensitivity.

11.4 POTENTIAL IMPACTS AND EFFECTS

11.4.1. Although there are no records of such activity, anecdotal reports indicate hazardous waste (inclusive of radioactive materials) may have been deposited in the existing landfill. Ukraine generates large volumes of hazardous waste and has few sites that are equipped to dispose of it[50]. Humans may be affected by radioactivity via several potential pathways during construction such as: direct contact during reprofiling of the landfill; contact with or ingestion of leachate; contact with or ingestion of contaminated soils.

CONSTRUCTION PHASE

11.4.2. As the dilution of contaminants and suspended materials will increase with increasing distance downstream of the Project, the magnitude of change at the Pivdennyi Buh River receptor is anticipated to be neutral.

11.4.3. The construction required for the proposed landfill and the MBT Facility will include soil excavation, and the creation of surplus material that will require management. The excavated material will be temporarily stockpiled and has the potential to erode and migrate to local surface water receptors

[50] Netherlands Enterprise Agency (2018) Waste Management in Ukraine Opportunities for Dutch Companies

downstream of the Project. Stockpiled materials have the potential to mobilise sediment and previously contaminated soils. The sensitivity of the local surface water receptors is low and the magnitude of change, prior to mitigation, is small. There is likely to be a direct, temporary, short term **minor adverse (not significant)** effects on the quality of surface waters at and downstream of the Project. Due to the distance from the Project and considerable buffering effects of additional dilution of contaminants, it is considered that there will be **neutral (not significant)** effects on the Pivdennyi Buh River.

11.4.4. Leachate is continuously draining (breaking out) from the existing landfill. Soil excavation and reprofiling of the existing landfill may have potential adverse impact on soil due to the existing landfill material being brought to the surface and / or the mobilisation of leachate containing materials towards the unnamed stream and wetland area. Construction activity around the existing landfill will require the excavation of waste materials deposited on the shallow embankment within the footprint of the proposed landfill. This has the potential to erode and release contaminants to surface water downstream of the Project, which will be reduced though the best practice measures outlined in the construction method statement in the ESMP. The sensitivity of the local surface water receptors is low, and the magnitude of change is small. Therefore, the overall effects are anticipated to be **minor adverse (not significant)**. Due to the distance from the Project and considerable buffering effects of additional dilution of contaminants, it is considered that there will be **neutral (not significant)** effects on the Pivdennyi Buh River.

11.4.5. There is potential for previously contaminated soils to be mobilised towards the unnamed stream and wetland area due to flooding of the temporary leachate storage ponds during the construction phase. The sensitivity of these receptors is low, and the magnitude of change is small. Therefore, the overall effects on the unnamed stream and wetland area are anticipated to be **neutral (not significant)**. Due to the distance from the Project and considerable buffering effects of additional dilution of contaminants, it is considered that there will be **neutral (not significant)** effects on the Pivdennyi Buh River, due to the mobilisation of previously contaminated soils.

11.4.6. The movement of vehicles coming in and out of the existing landfill during construction can lead to the superficial spread of soils and materials outside of the Project, which can potentially cause contamination of surface water downstream of the Project. The sensitivity of surface water runoff water is low and the magnitude of change, prior to mitigation, is small. There is likely to be a direct, temporary, short term **minor adverse (not significant)** effects on the quality of surface water runoff and subsequently on the quality of the unnamed stream and wetland area. Due to the distance from the Project and considerable buffering effects related to dilution in a much larger catchment, it is considered that there will be **neutral (not significant)** effects on the Pivdennyi Buh River.

11.4.7. There is a risk of oil and / or petroleum leaks / spills from machinery and vehicles used during the construction phase, which could result in surface water contamination, which will be reduced though the best practice measures outlined in the ESMP. The sensitivity of the local surface water receptors is low, and the magnitude of change is small. There is likely to be a, temporary **minor adverse (not significant)** effects on the quality of the unnamed stream and wetland area. Due to the distance from the Project and considerable buffering effects related to dilution in a much larger catchment, it is considered that there will be **neutral (not significant)** effects on the Pivdennyi Buh River.

OPERATIONAL PHASE

11.4.8. The operation and management of the proposed landfill and the closure of the existing landfill (capping and removal of the leachate storage ponds), will lead to a reduction in the flux of contaminated groundwater towards the unnamed stream and wetland area north of the existing and proposed landfills. The sensitivity of the local surface water receptors is low, and the magnitude of change will be small. This will result in a **minor beneficial (not significant)** effects on water quality of the local surface water features, although it may take several years for that benefit to be realised and become measurable at the local surface water receptors. Due to the distance from the Project and considerable buffering effects of additional dilution of contaminants, it is considered that there will be **neutral (not significant)** effects to the Pivdennyi Buh River.

11.4.9. The closure of the existing landfill will include the re-engineering of the northern slope and the installation of a perimeter leachate drainage system that will limit leachate heads (i.e. the height of fluid above the base of the cell liner), prevent the risk of uncontrolled breakouts in the future, and reduce the mobilisation of leachate and contaminated soils from the existing landfill towards the unnamed stream and wetland pond. The sensitivity of the local surface water receptors is low, and the magnitude of change will be small. The closure of the existing landfill and operation of the leachate management system will result in a **minor beneficial (not significant)** effects on water quality in the stream. There will be **neutral (not significant)** effects to the Pivdennyi Buh River, due to its distance from the Project and the buffering effects of the additional dilution.

11.4.10. A leachate treatment plant will be installed to manage leachate from the existing and proposed landfill. The leachate treatment plant (and the Project) will discharge water that is treated to national standards. The discharge will be transferred via a closed pipe to the sewer system, where it will be directed to the City's sewage treatment plant. The sensitivity of the local surface water receptors is low, and the magnitude of change will be medium. The consequence of the operation of the leachate management will be a near complete reduction in uncontrolled release of leachate to local surface water receptors and **moderate beneficial (significant)** effect on the unnamed stream and wetland pond. There will be **neutral (not significant)** effects to the Pivdennyi Buh River, due to the distance from the Project and buffering effects of additional dilution.

11.4.11. During operation of the proposed landfill the accumulation of waste will produce leachate. Residual leachate accumulating in the base of the proposed landfill has the potential to move through the base of the landfill into groundwater and potentially to the unnamed stream and wetland area. Leachate heads will be managed to limit the flux of contaminants. It is anticipated that control measures implemented during operation will limit the impact on the water environment to acceptable levels, although some changes to water quality may be perceptible in the long-term. The sensitivity of the local surface water receptors is low, and the magnitude of change would be neutral. There is potential for indirect long-term **neutral (not significant)** effects on the quality of surface waters downstream of the Project. Due to the distance from the Project and buffering effects of additional dilution, it is considered that there will be **neutral (not significant)** effects to the Pivdennyi Buh River.

11.4.12. The movement of vehicles coming in and out of the proposed landfill can lead to the superficial spread of soils and materials outside of the Project, which can potentially cause contamination of local surface waters downstream of the Project. The sensitivity of local surface water receptors is low and the magnitude of change, prior to mitigation, would be small. There potential for a **minor adverse (not significant)** effects on the quality of surface waters, prior to the implementation of mitigation measures. Due to the distance from the Project and buffering effects of additional dilution, it is considered that there will be **neutral (not significant)** effects to the Pivdennyi Buh River.

11.4.13. There is a risk of oil and/or petroleum leaks / spills from machinery and vehicles used during the operational phase, which could result in surface water contamination, although it will be managed though the implementation of good practice measures. The sensitivity of the local receptors is low, and the magnitude of change is small. There is likely to be a temporary **minor adverse (not significant)** effects on the quality of surface waters downstream of the Project, prior to the implementation of mitigation measures. Due to the distance from the Project and buffering effects of additional dilution, it is considered that there will be **neutral (not significant)** effects to the Pivdennyi Buh River.

11.5 MITIGATION AND ENHANCEMENT MEASURES

11.5.1. These mitigation and enhancement measures are also reflected within the ESMP.

CONSTRUCTION PHASE

11.5.2. The mitigation and enhancement measures proposed for the construction phase of the Project are outlined in Table 11-2.

Table 11-2 – Surface Water Mitigation Measures (Construction)

Effect	Mitigation Measure
Runoff and overland flow from stockpiles to the unnamed stream and wetland.	▪ Testing and removal of contaminated soils. ▪ Implementation of sediment and erosion control measures. ▪ Use of clean material for the proposed engineered lining system.
Flooding of temporary leachate ponds.	▪ Careful consideration of how surface water and leachate will be managed during construction. Additional measures likely to include: • Temporary ponds to include perimeter bunds to prevent flooding; • Standby pumps; and, • Provision of off-site tankering for emergency pumping of leachate.
Exposure of waste and leachate breakout during reprofiling of the existing landfill.	▪ Careful consideration should be given to leachate management during construction. ▪ Leachate levels in existing landfill will need to be below the top of excavated surface to prevent breakout during construction. ▪ Testing and removal of contaminated material arising from the existing landfill.
Vehicle movements and mobilisation of contaminated soils.	▪ Tyre washing before exit from the construction site. ▪ Collection and safe discharging of contaminated wash-water.

Oil and / or petroleum leaks from machinery – impact to surface waters.	▪ Provision of spill kits to contain oil / petroleum leaks or spills. ▪ Program to ensure good driver behaviour / maintenance of vehicles.

OPERATIONAL PHASE

11.5.3. The mitigation and enhancement measures proposed for the operational phase of the Project are outlined in Table 11-3.

Table 11-3 – Surface Water Mitigation Measures (Operation)

Effect	Mitigation Measure
Leachate accumulation in proposed landfill.	▪ Completion of a detailed quantitative Hydrogeological Risk Assessment (HRA) to determine acceptable leachate levels. ▪ Development and implementation of leachate extraction management system and treatment plant (Preparation and implementation of a Leachate Management Plan). ▪ Annual monitoring report to confirm leachate heads, surface water and groundwater conditions during operations.
Vehicle movements and mobilisation of contaminated soils.	▪ Tyre washing before exit from the construction site. ▪ Collection and safe discharging of contaminated wash-water. ▪ Provision of suitable haulage access roads.
Oil and / or petroleum leaks from machinery – impact to surface waters.	▪ Provision of spill kits to contain oil / petroleum leaks or spills. ▪ Program to ensure good driver behaviour / maintenance of vehicles.

11.6 RESIDUAL EFFECTS

11.6.1. While the closure of the existing landfill and the construction and operation of the proposed landfill and the proposed MBT Facility will result in environmental improvements, a legacy due to poor environmental management in the past, will potentially persist for many years to come. Leachate has contaminated local water features, although the baseline information is limited, the effect is most notable on the wetland pond, and the legacy effects due to the previous operation of the landfill are expected to continue, albeit at a reduced level, during the operation phase of the Project.

11.6.2. Detailed environmental monitoring will be undertaken during pre-construction, construction and operations to help manage the legacy risk to the environment.

11.6.3. With the mitigation measures in place, it is anticipated that effects to surface water as a result of the Project will be **neutral (not significant)** during construction and **neutral (not significant)** during operation.

11.7 SUMMARY

Table 11-4 – Summary of Potential Impacts, Effects and Mitigation (Surface Water Environment)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Surface Water Environment	The Project lies on northern ridge of a sub- catchment divide. Project drains to an unnamed stream to the north-east which discharges to the Pivdennyi Buh River in the City. Evidence of contamination from existing landfill at wetland pond and unnamed stream, which are collectively referred to as 'local surface water features'.	Construction	Stockpiling of soils and potentially contaminated materials. Runoff and overland flow from stockpiles to the un-named stream and wetland.	Minor adverse (not significant) contamination of wetland and unnamed stream from sediment and/or contaminated materials.	Implementation of sediment and erosion control measures. Segregation of clean and contaminated materials.	Neutral (not significant).
		Construction	Excavation of soils and potentially contaminated materials and re-profiling of existing landfill waste. This could lead to the uncontrolled release of leachate, impacts on local surface water features and human health.	Minor adverse (not significant) contamination of surface water receptors. Human exposure of waste and leachate breakout.	Management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Testing and removal of contaminated material arising from the existing landfill. Protective clothing and personal equipment.	Neutral adverse (not significant). Note, the assessment refers to change caused by project. There will be continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill in concentrations of potential significance during construction.
		Construction	Flooding of temporary leachate ponds, migration of leachate to the local surface water receptors.	Neutral (not significant) deterioration in quality of surface water receptors.	Specific / additional engineering measures including the design of temporary ponds with	Neutral (not significant).

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					perimeter bunds to prevent flooding. Standby pumps and provision of off-site tankering for emergency pumping of leachate.	
		Construction	Vehicle movements and mobilisation of contaminated soils.	Minor adverse (not significant) contamination of local surface water features and/or contaminated materials.	Tyre washing before exit from the construction site Collection and safe discharging of contaminated wash-water.	Neutral (not significant).
		Construction	Oil and / or petroleum leaks from machinery.	Minor adverse (not significant) contamination of local surface water features.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	Neutral (not significant).
		Operation	Contaminant migration to groundwater from the existing landfill.	Minor beneficial (not significant) reduction in contamination of the local surface water features and neutral (not significant) reduction in	There are unlikely to be any practical measures in addition to the proposed capping, re-profiling and leachate management that will	Minor beneficial (not significant) reduction in contamination of the local surface water features and neutral (not significant) reduction in contamination of the Pivdennyi Buh River.

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
				contamination of the Pivdennyi Buh River.	reduce the risk to groundwater.	
		Operation	Excessive accumulation of leachate leading to significant contaminant migration through the liner of the proposed landfill to groundwater.	Indirect minor (not significant) contamination of local surface water features and neutral (not significant) contamination of the Pivdennyi Buh River	Landfill to be constructed to EU standards and leachate to be managed in accordance with findings of detailed quantitative hydrogeological risk assessment	Neutral (not significant) contamination of local surface water features and neutral (not significant) contamination of the Pivdennyi Buh River
		Operation	Excessive leachate accumulation leading to break-outs from proposed and / or existing landfill	Indirect minor (not significant) contamination of local surface water features and neutral (not significant) contamination of the Pivdennyi Buh River.	Landfill to be constructed to EU standards and leachate to be managed in accordance with findings of detailed quantitative hydrogeological risk assessment Provision of leachate extraction management system and treatment plant.	Neutral (not significant). Note, the assessment refers to change caused by project. There will be continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill in concentrations of potential significance during operation.
		Operation	Vehicle movements and mobilisation of contaminated soils.	Minor adverse (not significant) contamination of wetland and unnamed stream from sediment	Tyre washing before exit from the construction site.	Neutral (not significant).

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
				and/or contaminated materials.		
		Operation	Oil and / or petroleum leaks from machinery	Minor adverse (not significant) contamination of surface water receptors.	Collection and safe discharging of contaminated wash-water.	Neutral (not significant).

12

GEOLOGY AND HYDROGEOLOGY

12 GEOLOGY AND HYDROGEOLOGY

12.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

12.1.1. The assessment has been undertaken in line with international best practice. Where appropriate when considering geology and soils and the groundwater environment, the following EU legislation has been considered during the completion of this assessment:

- The Landfill Directive (EEC/1999/31/EC);
- Groundwater Directive (2006/118/EC); and
- The Water Framework Directive (2000/60/EC).

12.1.2. The following National legislation has been considered during completion of this assessment:

- Law of Ukraine on the Environmental Protection (No. 1264 (1991));
- Law of Ukraine on Drinking Water and Drinking Water Supply (No. 2918 (2002));
- Protection of Surface Waters Against Pollution (SanPiN 4630-88);
- Hygienic Drinking Water Regulations Intended for Human Consumption ((GSanPiN) 2.2.4-171-10); Water Code of Ukraine (No. 213 (1995));
- National Standard of Ukraine on "Fresh Water" for Water Quality Monitoring Methods and Requirements (7525:2014); and
- UN Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Ratified by Ukraine in 2003. Plan of implementation № 46963.

12.1.3. The key international guidelines for the protection of drinking water quality are the World Health Organisation's (WHO) 'Guidelines for Drinking-water Quality' (2011)[51].

12.1.4. In addition, where deemed appropriate, the UK Landfill Guidance has been considered within this assessment, which is in accordance with EU Legislation.

12.2 ASSESSMENT METHODOLOGY

12.2.1. This Chapter qualitatively assesses the potential effects of the Project on the surrounding area in terms of geology, soils and groundwater during both construction and operation.

12.2.2. Where appropriate it also identifies proposed mitigation measures to minimise or control likely adverse effects on geology, soils and groundwater arising from the Project. This Chapter should be read in conjunction with the introductory chapters (Chapter 1: Introduction to Chapter 5: Approach to ESIA) and Chapter 11: Surface Water Environment and the HRA.

12.2.3. The assessment of the Project has been undertaken primarily through a desk-based study using available information relating to geology, soils and groundwater in combination with the observations made during the two site visits (31 May and 3 July 2019).

[51] WHO (2011). Guidelines for Drinking-Water Quality, Fourth Edition.

STUDY AREA

12.2.4. The Study Area for geology, soils and groundwater is defined according to potential groundwater flow paths that might extend away from the Site towards surface water receptors and the surface water catchment within which the existing landfill is located. The Study Area is therefore defined by:

- To the north and east - the unnamed watercourse that is located approximately 225m to the northeast of the existing landfill at its closest point;
- To the east – an arbitrary line 2km down gradient of the existing landfill, which corresponds approximately with the western margin of the Otradne Micro-district and encompasses the confluence of the local watercourse and a tributary that joins from the north;
- To the south – the Pivdennyi Buh River; and
- To the west and north west - the margin of the watershed of the unnamed stream, i.e. the red-line catchment boundary to the west and northwest (refer to Figure 11-1), or 2km from the existing landfill, whichever is less.

12.3 BASELINE CONDITIONS

12.3.1. The baseline data has been obtained through a combination of observations during two site visits, and the desk-based review of third party and consultation information.

GEOLOGY

12.3.2. Superficial (Quaternary) deposits have formed by weathering of the underlying strata. The residual sands and clays vary between zero and approximately 20m thick depending on elevation. The greatest thickness occurs in valley bottoms. Locally alluvium is associated with surface drainage. Sands and clays deposited by streams and rivers vary from less than one metre thick adjacent to small streams, such as that immediately north and east of the Project, to a thickness of 10m to 15m adjacent to the Pivdennyi Buh River. The sequence of superficial deposits at the existing landfill and proposed MBT site are understood to be similar.

12.3.3. The existing landfill and proposed MBT site are situated in an area that is underlain by clastic sediments, primarily clays, sands and sandstones with subordinate limestone (Neogene to Cretaceous in age). These sedimentary strata overlie Precambrian deposits, which are encountered between 50m and 100m below ground level (bgl) and which in turn overlie Proterozoic crystalline basement approximately 250m bgl.

12.3.4. The existing landfill is located within a disused clay pit, (clays of Neogene in age), it is unlined and has no engineered containment. The depth of the clay pit and the elevation of the base of the existing landfill were investigated in a ground investigation undertaken in November 2019 and reported by Eco Consulting Center Ltd[52], the findings are summarised as follows:

- A total of 17 ground investigation boreholes were drilled;

[52] Eco Consulting's Center Ltd (2019). Engineering and geological exploration at the site: Reconstruction of the landfill solid waste to prevent the occurrence of an emergency of the environmental situation at Khmelnytskyi str. Prospect Mira, 7.

- 6 boreholes (referenced 1 to 6) were advanced through the main body of the landfill in order to determine the thickness of the waste and characterise the underlying geology.
- 8 boreholes (referenced 1a to 8a) were drilled adjacent to the landfill in order to characterise the superficial Quaternary deposits.
- 3 boreholes (referenced 37.1, 37.2 & 37.3) were drilled and completed as groundwater monitoring installations.

- Landfill waste was encountered in borehole 1 to 6 and monitoring well 37.3 and is described as solid household waste with construction debris such as brick, rubble, concrete and plastics with 15-20% of dark grey and black soil matter. The thickness of the main landfill body was proven to be between 23 and 28m thick at elevations of 343 to 345m amsl (m above mean sea level). Waste was encountered around 300m to the northwest of the main landfill body at a depth of 4.0m bgl (m below ground level) adjacent to the wetland pond. It is likely that the waste is present as a relatively thin veneer on the shallow embankment from the main landfill body to the edge of the unnamed stream.
- The succession of shallow Quaternary deposits is described as follows:
  - Vegetation soil layer (IV) – recorded as a low strength loam, semi-solid, slightly humus, brownish-yellow in colour with plant roots and sandy lenses. Encountered from ground surface and is between 1.2 and 2.5m thick, it is notably absent from beneath the main landfill body.
  - Plastic or semi-solid sandy loam (III) – Thixotropical, yellow-grey in colour with inclusions of semi-solid clay layers. Present across the study area overlying the clay deposits, found to be between 0.5 and 3.0m in thickness.
  - Firm to stiff clay (II) – greyish green or brownish grey in colour, firm to stiff clay with occasional bands of soft sandy loam. The base of clay not encountered in ground investigation. A clay thickness of 11.8m is proven beneath landfill waste.

12.3.5. The upper surface of clay (II) deposits broadly follow topography and is highest in the southwest (350m amsl) reducing in elevation towards the unnamed stream in the northeast (324m amsl).

12.3.6. A ground investigation undertaken in 2018, which was summarised in a 2018 feasibility study[53], comprised the drilling of a series of thirteen boreholes to characterise the near surface geology. The base (thickness) of the Quaternary deposits are understood to be up to 10m bgl within the Study Area. The Quaternary deposits overlying the confirmed the same geological units (IV and III) described in paragraph 12.3.4 but did not encounter the deeper clay unit (II).

12.3.7. In May 2018, soil sample data was obtained from within the area of the proposed landfill, which is located to the north east of the existing landfill. A total of five samples were obtained from the upper 30cm within the footprint of the proposed landfill. Data received from Spetkomuntrans are presented in Table 12-1. The soil quality data compared with standards set in Finnish legislation. The Finnish standards are recommended by Toth et al. (2016)[54] in their review of heavy metals in agricultural soils of the European Union. The data show low concentrations of toxic metals in all samples and no

[53] Centre Ltd Eco Consulting (2018). Landfill renovation to prevent emergency environmental situation' Feasibility study on the Proposed Landfill.

exceedances of the threshold value (for remediation). Elevated levels of iron were measured in all samples; these are in excess of 9,800 mg/kg.

Table 12-1 – Soil Quality Summary

Determinand	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Threshold value[54]
Organic content (%)	11.3	6.02	6.09	12.8	13.6	-
Moisture content (%)	1.32	1.25	1.24	1.84	2.06	-
pH (water extract)	8.07	7.69	7.94	7.96	8	-
pH (salt extract)	7.67	6.87	7.12	7.32	7.4	-
Iron (mg/kg)	9,875	10,250	12,500	10,600	10,000	-
Cadmium (mg/kg)	0.6	0.56	0.56	0.58	0.6	1.0
Cobalt (mg/kg)	3.62	3.75	3.44	3.75	4.06	20.0
Manganese (mg/kg)	432	392	400	396	388	-
Copper (mg/kg)	14.2	13.3	12.5	13.8	14.6	100.0
Nickel (mg/kg)	12.5	12.2	12.6	12.7	12.8	50.0
Lead (mg/kg)	9.17	7.5	8.33	8.64	9.67	60.0
Zinc (mg/kg)	53.3	24.6	26.7	44.6	40.8	200.0
Chromium (mg/kg)	15	12.5	12.5	14.2	15	100.0

HYDROGEOLOGY

12.3.8. There are multiple aquifers in the area surrounding the existing landfill. Certain villages, i.e. Oleshyn draw water from shallow aquifers (Quaternary and/or Neogene). The City draws water from deeper aquifers, e.g. the Cretaceous for public supply. The aquifers, which are described in the feasibility study and relate to the regional understanding of geology and hydrogeology, are summarised as follows:

- Quaternary alluvial aquifers associated with main rivers. The water table is shallow, typically 1 to 6m bgl, fluctuating in response to precipitation and snow melt. Water is exploited using shallow wells. Yields are typically less than 0.8 litres per second (L/s). The water is fresh (i.e. not saline or brackish) but it will be susceptible to contamination from surface activities. The groundwater levels

[54] G.Toth, T.Hermann, M,R, Da Silva and L.Montanarella (2016). Heavy metals in agricultural soils of the European Union with implications for food safety.

are reported to be between 2.4 and 7.0m bgl, in the thirteen boreholes drilled in the Study Area, as indicated in the 2018 ground investigation (summarised in the Feasibility Report).

- Neogene aquifers are widespread and comprise layered fine-grained sands, sandstones and limestones (potentially karstic). Water is typically encountered between 1m and 15m bgl. Borehole and well yields range from 0.3 to 1.0 L/s. Water is fresh.
- Eocene deposits, comprise glauconitic sands up to 16m thick contain water close to ground surface where present. Borehole and well yields range from 0.2 to 0.5 L/s. Water is fresh.
- Cretaceous sands are typically 13.5m to 16m thick and encountered at depths of 10m to 15m below river valleys and 40m to 80m below watersheds. Borehole yields range from 4 to 34 L/s. The aquifer provides one of the main sources of water for the City, where it is assumed to be within 10-15m of ground surface. The Cretaceous aquifer is unconfined and tends to be in hydraulic connectivity with overlying aquifers.
- Upper Proterozoic fractured aquifers are up to 100m thick and typically in hydraulic connection with the overlying younger aquifer systems. Borehole yields are variable between 0.8 and 15.0 L/s depending on the setting and the number of fractures intercepted.

12.3.9. Groundwater levels measured in the November 2019[55] ground investigation can be described as follows:

- Groundwater strikes are typically recorded in the loam (III) deposits at or just above the interface between the loam (III) and the underlying clay (II) at depths ranging from 2.2 to 3.5mbgl.
- Groundwater levels indicate there is a shallow perched aquifer overlying the clay deposits in the loam. The underlying clay behaves as an aquitard by inhibiting the vertical downward movement of groundwater.
- Groundwater levels are considered to be representative of the shallow Quaternary aquifer system.
- Groundwater elevations measured across the site correlate with topography and indicate a hydraulic gradient from southwest to northeast towards the unnamed stream.

WATER QUALITY ASSESSMENT

12.3.10. Groundwater quality data for the Project Site and the Project Sanitary Protection Zone (SPZ) was collected in December 2019 by a local consultant under direction from WSP. The results are presented in Table 12-2; results which exceed the water quality standard are formatted in bold.

[55] Eco Consulting's Center Ltd (2019). Engineering and geological exploration at the site: Reconstruction of the landfill solid waste to prevent the occurrence of an emergency of the environmental situation at Khmelnytskyi str. Prospect Mira, 7.

Table 12-2 – Groundwater Quality Results from Landfill and SPZ

Determinand	Unit	Khmelnitsky landfill observation borehole 37.2	Drinking water well in SPZ 150m southwest of landfill (duplicate result value)	Water quality standard[56]
Temperature	°C	9.2	8.5	<3
pH	pH	**8.63**	8.07	6.5-8.5
Electrical conductivity	µS/cm	601	645.8 (647.5)	1000
Dissolved oxygen	mg/l	14.6	14.7 (13.6)	>4.0
Turbidity	mg/l	0.3	0.3 (0.3)	1.0
Dry residue (TDS)	mg/l	614.2	658 (665.5)	1000
Ammoniacal nitrogen	mg/l	0.8	0.04 (0.05)	2.0
Nitrite	mg/l	0.6	0.1 (0.1)	3.3
Nitrate	mg/l	**51.3**	**47.3 (48.6)**	45
Oxidation reduction potential (ORP)	mV	32.6	35.7 (33.8)	60
BOD	mg O/l	1.43	1.8 (1.5)	6.0
COD	mg O/l	24	24.6 (24.4)	30
Total alkalinity	mmol/l	5.2	4.48 (4.5)	6.5
Calcium	mg/l	48.7	41.8 (40.6)	130
Magnesium	mg/l	10.4	17.3 (18.0)	80
Sodium	mg/l	86	186 (182.4)	200
Potassium	mg/l	19.3	16.4 (17.3)	20
Sulphate	mg/l	31.5	54.8 (55.6)	500
Chloride	mg/l	94	35.7 (35.1)	350
Iron	mg/l	**0.38**	0.12 (0.13)	0.30
Manganese	mg/l	**0.11**	0.02 (0.02)	0.05
Cadmium	mg/l	<0.001	<0.001 (<0.001)	0.001
Chromium	mg/l	<0.01	0.03 (0.03)	0.05
Cobalt	mg/l	<0.01	0.013 (<0.01)	0.10
Nickel	mg/l	0.02	0.02 (<0.01)	0.02

[56] SanPiN No. 4630-88 Protection of surface waters from pollution.

Determinand	Unit	Khmelnitsky landfill observation borehole 37.2	Drinking water well in SPZ 150m southwest of landfill (duplicate result value)	Water quality standard[56]
Lead	mg/l	**0.02**	**0.02** (<0.01)	0.01
Zinc	mg/l	0.06	0.05 (0.04)	1.0
Arsenic	mg/l	<0.01	<0.01 (<0.01)	0.01
Barium	mg/l	<0.01	<0.01 (0.02)	0.13
Orthophosphate	mg/l	1.4	0.91 (1.03)	3.0
Petroleum products	mg/l	0.01	0.02 (0.01)	0.30
Organochloride pesticides	mg/l	<0.0001	0.0002 (<0.0001)	0.0005

12.3.11. The results in Table 12-2 are summarised as follows:

- Landfill borehole 37.2 is located down hydraulic gradient 300m northeast of the main landfill body and has a response zone between 5 and 7 mbgl that spans the loam (III) and clay (II). Water quality data indicate that shallow groundwater at this location has elevated pH, nitrate, iron, manganese and lead that exceed the limits of the water quality standard. It is considered likely that concentrations are lower at this location compared to groundwater closer to the landfill due to the effect of dilution and natural attenuation processes reducing concentrations of contaminants in groundwater as it flows away from the landfill.
- A drinking water well located 150m southwest of the landfill is understood to take water from the shallow Quaternary aquifer from an unknown depth. As the well is located in a different catchment, it is considered that the source of groundwater is different to that of borehole 37.2. This is supported by the contrasting water quality in the SPZ well which is characterised by low chloride and lower pH, and, slightly elevated sodium and sulphate relative to borehole 37.2. The well has slightly elevated nitrate and lead with respect to the threshold limits in the standard, this accords with other local well water quality in the area which is presented in Table 12-3. Overall groundwater quality suggests little/no impact from the landfill however it should be stated that SPZ groundwater quality south of the landfill is based on samples from a single source (well).

12.3.12. Groundwater quality data obtained from Oleshin village wells and boreholes in December 2019 is presented in Table 12-3; results which exceed the water quality standard are formatted in bold.

Table 12-3 – Oleshin Village Groundwater Quality

Determinand	Unit	Oleshin village well 1	Oleshin village well 2	Oleshin village well 3	Oleshin village borehole 1	Oleshin village borehole 2	Water quality standard
Temperature	°C	8.5	9.8	7.9	14.8	21.1	<3
pH	pH	7.96	7.97	7.86	7.96	7.67	6.5-8.5
Electrical conductivity	μS/cm	801	806.1	836.4	990.7	1119	1000
Dissolved oxygen	mg/l	12.8	14.2	10.3	12.2	13.6	>4.0

Determinand	Unit	Oleshin village well 1	Oleshin village well 2	Oleshin village well 3	Oleshin village borehole 1	Oleshin village borehole 2	Water quality standard
Turbidity	mg/l?	0.3	0.3	0.3	0.4	0.5	1
Dry residue (TDS)	mg/l	834.6	851	844.3	954	**1124.4**	1000
Ammoniacal nitrogen	mg/l	0.42	0.43	0.46	0.032	0.043	2
Nitrite	mg/l	0.7	0.9	0.8	0.85	0.98	3.3
Nitrate	mg/l	**49.8**	38.6	**58.4**	44.1	**51.3**	45
Oxidation reduction potential (ORP)	mV	41.6	25.9	41.2	34.1	42.4	60
BOD	mg O/l	1.56	1.8	1.36	1.6	1.8	6
COD	mg O/l	27.2	21.6	26.7	26	26	30
Total alkalinity	mmol/l	4.8	5.2	5.76	**6.8**	**7.4**	6.5
Calcium	mg/l	51.3	41.3	32.1	16	12.8	130
Magnesium	mg/l	15.4	13.4	12.4	3.5	3.1	80
Sodium	mg/l	**233.7**	**256.7**	**254**	**309.3**	**347**	200
Potassium	mg/l	12.6	16.9	17.0	**126.1**	**154**	20
Sulphate	mg/l	96.4	54.7	66	65	47	500
Chloride	mg/l	79	73.6	67	24.6	20	350
Iron	mg/l	**0.04**	0.029	**0.034**	0.15	0.14	0.3
Manganese	mg/l	0.02	0.04	<0.01	**0.05**	**0.06**	0.05
Cadmium	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Chromium	mg/l	0.02	0.03	0.02	<0.01	0.012	0.05
Cobalt	mg/l	<0.01	<0.01	<0.01	<0.01	0.014	0.1
Nickel	mg/l	0.02	<0.01	0.02	0.02	0.02	0.02
Lead	mg/l	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	0.01
Zinc	mg/l	0.51	0.39	0.47	0.03	0.04	1
Arsenic	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Barium	mg/l	<0.01	<0.01	<0.01	0.02	<0.01	0.13
Orthophosphate	mg/l	1.9	1.46	1.8	1.46	1.2	3
Petroleum products	mg/l	0.15	0.18	0.2	0.01	0.01	0.3
Organochloride pesticides	mg/l	**0.002**	**0.002**	0.0003	<0.0001	0.00013	0.0005

12.3.13. Groundwater quality in Table 12-3 is summarised as follows:

- Village wells 1, 2 and 3 are located between 1.6 and 1.8km west of the landfill in the village of Oleshin. The wells are shallow (<10mbgl) and are thought to abstract groundwater from the Quaternary aquifer loam (III) and/or clay (II). Shallow groundwater quality is characterised by elevated nitrate, sodium, iron and, in wells 1 and 2 elevated organochloride pesticides relative to threshold limits in the water standard.
- Boreholes 1 and 2 are located 1km west of the landfill and are drilled much deeper than the shallow wells. They are understood to be abstracting groundwater from a deeper aquifer (Neogene to Cretaceous in age) at around 50 to 60 mbgl. Groundwater quality is distinctly different from the shallow Quaternary groundwater sampled from the wells. Groundwater from the deeper aquifer is characterised by elevated dissolved solids, alkalinity, potassium, sodium, iron and low chloride relative to shallow groundwater.
- Slightly elevated nitrates and lead relative to the water quality standard are ubiquitous in both the shallow wells and deep boreholes. Groundwater quality in the shallow and deeper aquifer is considered to influenced by localised conditions and diffuse pollution from agricultural activities unrelated to the landfill.

12.3.14. The properties located within the SPZ, and other properties to the south of the site, predominantly use mains water from the system that supplies the Municipality of Khmelnitsky. It is reasonably assumed that this municipal water supply meets the required water quality standards. However, local wells and boreholes are known to be used either as the primary source of water or as an ancillary source if the mains supply fails.

12.3.15. There closest receptors that uses private groundwater from wells for domestic use are in the SPZ in the east of the village of Oleshin, located 150m to the southwest of the site (at its closest point). The residents of Oleshin have raised concerns that the landfill may have been polluting the groundwater. However, these boreholes/wells are not in the same surface water catchment as the Project site, and therefore are very unlikely to be located in the same groundwater catchments as the landfill, and there is data to indicate that other factors are reducing the quality of the groundwater in these wells. A summary of water quality from local wells supplied by Khmelnitsky City Council is presented in Table 12-4. The data is presented for wells located in and around the village of Oleshin, however the results have not been validated. The prevalence of elevated nitrates suggests impacts from diffuse pollution relating to agricultural activities and conforms with recent sampling (Table 12-3). The detection of E-Coli bacteria suggests some local wells are impacted by poor hygiene practices at surface near those wells.

Table 12-4 – Local Well Water Quality Summary

Year	No. Wells Tested	E-Coli Detected / No. Tests	Elevated Nitrate & Hardness Detected / No. Tests
2017	84	6 / 15	4 / 10
2018	202	24 / 31	28 / 31
2019	30	8 / 30	24 / 30

TOPOGRAPHY

12.3.16. The existing landfill is located at an elevation of approximately 330m to 360m above mean sea level (AMSL) on the northern side of a ridge approximately 1.5km north of City of Khmelnitsky. The ridge separates a valley occupied by: an unidentified local watercourse; the micro-districts of Otradne and Dyvokray from the main City of Khmelnitsky conurbation; and the Pivdennyi Buh River, which flows through the centre of the City, the ridge is at an elevation of approximately 276m AMSL at its nearest point. The MBT is located on agricultural land approximately 1km to the north of the existing landfill, occupying a similar elevation and relief as the existing landfill.

FUTURE BASELINE

12.3.17. The future baseline would be characterised by the ongoing migration of leachate and mobilisation leakage of leachate into soil and groundwater directly through the base of the existing landfill, and indirectly via the side wall and leachate ponds. There would be no capping of the existing landfill, no improvements of the side wall and no treatment applied to the leachate ponds or contaminated soil. The quality of soil and groundwater immediately adjacent to, and below, the existing landfill would likely continue to deteriorate with time.

RECEPTORS

12.3.18. The identified receptors and their assigned sensitivity are outlined as follows:

- Community groundwater supplies (boreholes and wells). The local population south and west of the landfill are dependent on private groundwater supplies drawn from shallow wells and deeper boreholes. Local groundwater supplies are considered to be of medium sensitivity. However, topographical analysis and definition of catchment areas (Chapter 11) indicates that these private supplies are in a different surface water catchment and, therefore, very unlikely to be hydraulically connected to the landfill site. Analysis of groundwater sampled from local wells and boreholes, (Tables 2 and 3), indicate that there is no contamination of these water sources from the landfill.
- Superficial (Quaternary) aquifer. At the project site, this aquifer fills with water during and following the spring snow-melt. Groundwater in the Quaternary aquifer flows northeast down hydraulic gradient towards the local watercourse. The Quaternary aquifers may sustain flows to the local watercourse after the snow-melt and following rainfall. The superficial aquifers are considered to be of low sensitivity.
- Neogene and Eocene aquifers. These aquifers are combined because they are likely to be in hydraulic connectivity to some extent. They are relatively shallow, variable aquifers containing water at depth, the clay deposits act as an aquitard between the overlying Quaternary aquifer and the Neogene/Eocene aquifers. The aquifers are likely to contribute baseflow to the Pivdennyi Buh River, helping maintain flows year-round. The Neogene and Eocene aquifers are considered to be of medium sensitivity.
- Cretaceous aquifer. This aquifer can sustain large abstractions. It is understood that the City of Khmelnitsky abstracts groundwater for public supply from the Cretaceous aquifer and some local boreholes may also utilise the aquifer via abstraction boreholes. The aquifer is widespread and will provide an important source of water to the Pivdennyi Buh River. The Cretaceous aquifer is considered to be of high sensitivity.
- Soil and superficial geology proximal to the landfill site and proposed MBT. Soil and geology within the footprint of the existing landfill operation is of little or no social, economic or environmental value

and is considered to be of negligible sensitivity. The sensitivity of the soil and geology adjacent to the existing landfill and proposed MBT is low.

- Agricultural soil outside of the footprint of the landfill and proposed MBT is of notable value to local farmers and is of medium sensitivity.
- Human receptors working on the landfill during the construction are considered as potential receptors, due to the possibility that they may come into contact with contaminated (or radioactive materials) and are of high sensitivity.

12.3.19. For the purposes of this assessment groundwater is considered as a single receptor/entity. Ground investigations undertaken in November 2019 prove greater than 10m of clay below the landfill and Quaternary aquifer isolating them from deeper aquifers (within the Project Site). Combining groundwater (and all aquifers) in a single receptor is, therefore, a conservative approach. Groundwater is considered to have a medium sensitivity overall.

12.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

12.4.1. The construction required for the proposed landfill and the MBT Facility will include soil excavation and the creation of surplus material that will require management. These are assessed separately due to the differing potential effects.

12.4.2. Due to the low sensitivity of the shallow geology within the Project, effects during the construction phase are expected to be **neutral (not significant)**.

12.4.3. Due to the negligible sensitivity the soils within the Project effects during construction are expected to be **neutral (not significant)** compared to the baseline conditions.

12.4.4. There is a possibility that hazardous (inclusive of radioactive) waste may have been deposited in the landfill. The sensitivity of the human receptor to radionuclides is high, the potential magnitude of change to human health (from ingestion) is large. Therefore, the potential effects on construction workers are considered **large adverse (significant)** and will need to be managed to an acceptable level through the measures in the ESMP.

12.4.5. Continuous and uncontrolled leachate breakout occurs from the existing landfill, particularly at the down-slope, northern wall. Reprofiling of the existing landfill may potentially adversely impact soil, due to the existing landfill material being brought to the surface and / or the unintentional mobilisation of leachate containing materials. There is potential for increased leachate breakouts and mobilisation of previously contained contaminants:

- Directly into groundwater. The sensitivity of groundwater is medium. The magnitude of change is slight compared to the similar pre-operational conditions. The potential effects are considered to be **minor adverse (not significant)**;
- Directly to adjacent agricultural soils. The sensitivity of the agricultural soil is medium. The magnitude of change is slight. The potential effects are considered to be **minor adverse (not significant)**; and
- Indirectly into surface water (Chapter 11: Surface Water Environment) and the air (Chapter 6: Air Quality).

12.4.6. A soil excavated during construction of the Project is potentially contaminated by leachate or by particulate matter originating from the existing landfill. Excavated soil material will be managed and handled according to best practice and the process of removal, and disposal in an EU Directive compliant landfill, will provide **minor beneficial (significant)** effects.

12.4.7. As aforementioned, a large proportion of the soil excavated during construction of the Project is likely to be contaminated by leachate or by particulate matter, originating from the existing landfill. Excavated soil material will be managed and handled according to best practice. The sensitivity of groundwater is medium, and the process of removal will provide **minor beneficial (not significant)** effects to groundwater downgradient of and within the Project, through the removal of a potential source of contamination.

12.4.8. The excavated material that will be temporarily stockpiled may contain contaminants that could migrate to shallow groundwater and adjacent soils. The secondary effects of stockpiling of materials is the potential mobilisation to surface water (assessed in Chapter 11: Surface Water Environment) and into the air (assessed in Chapter 6: Air Quality). The infiltration of potentially hazardous contaminants that may be present in the stockpiles are expected to be **neutral (not significant)** compared to the baseline conditions where leachate is infiltrating through the base of the landfill and the leachate ponds, and the risk of this will be further reduced by the implementation of good practice measures in the ESMP.

12.4.9. The existing landfill will be closed and capped as part of the Project, vastly reducing infiltration and leachate generation. The Project does not include plans to retro-engineer a basal liner for the existing landfill, due to the associated construction risks and pre-closure contamination that is already in the subsurface. Pollutants from the existing landfill will continue to migrate away from the landfill through the base and sidewall of the existing landfill to groundwater, albeit at a lower rate and volume. The magnitude of change is likely to be slight and the overall effects are considered to be **minor beneficial (not significant)** compared to the current situation.

12.4.10. Furthermore, the existing landfill will be capped, and leachate collector drains will be installed along the northern wall to drain leachate and reduce leachate levels. The leachate will no longer be recirculated or stored in the unlined ponds to the north of the landfill, further reducing the infiltration of leachate. The result will be a reduction in leachate migration from the site, resulting in a slight improvement, and the overall effects are considered to be minor beneficial (not significant) compared to the current baseline.

12.4.11. During construction, the possibility of flooding of the temporary leachate storage ponds during construction could give rise to the uncontrolled mobilisation of leachate and / or waste (leachate containing materials) within the Project Site and to surrounding land:

- Directly to adjacent agricultural soils. The sensitivity of the agricultural soil is medium. The magnitude of change is slight. There therefore is the potential for temporary **minor adverse (not significant)** effects;
- Directly into groundwater. The sensitivity of groundwater is medium. The magnitude of change is slight compared to the similar pre-operational conditions. There therefore is the potential for **minor adverse (not significant)** effects; and
- Indirectly into surface water (Chapter 11: Surface Water Environment).

12.4.12. The movement of vehicles coming in and out of the construction site can lead to the superficial spread of soils and materials outside of the Project, which can potentially cause contamination of agricultural soils adjacent to the Project. The sensitivity of the receptor is medium, and the magnitude of change is slight, as construction vehicles will have their wheels washed before leaving the site. There is therefore likely to be **minor adverse (not significant)** effects on the quality of adjacent agricultural soils.

12.4.13. There is a risk of oil and / or petroleum leaks / spills from machinery and vehicles used during the construction phase, which could result in soil contamination, although this risk will be managed though best practice construction measures as set out in the ESMP. The sensitivity of the soils adjacent to the existing landfill is low, and the construction risk management measures will ensure there is no change compared to the pre-existing conditions, and the overall effects are expected to be **neutral (not significant)**.

OPERATIONAL PHASE

12.4.14. As for the Construction Phase, groundwater is considered as a single receptor/entity, although it is recognised that distinct groundwater bodies are likely to be present in discrete aquifer units in the Project area. Groundwater is considered to have an overall medium sensitivity. The new landfill will have to operate to EU standards and will be operated according to management plans as outlined in the ESMP.

12.4.15. Due to the low sensitivity of the shallow geology within the Project area, the operational effects on geology are expected to be **neutral (not significant)** compared to the baseline conditions (in the absence of mitigation).

12.4.16. Due to the negligible sensitivity the soils within the Project area, the operational soil effects are expected to be **neutral (not significant)** compared to the baseline conditions (in the absence of mitigation).

12.4.17. During operation of the proposed landfill the accumulation of waste will produce leachate. Residual leachate accumulating in pools in the base of the proposed landfill has the potential to move by advection or diffusion through the landfill liner into groundwater. Leachate heads (i.e. the height of fluid above the base of the cell liner) will be managed to limit the flux of contaminants through the liner. The implementation of control measures during operation are anticipated to limit the impact on the water environment to acceptable levels or undetectable. The sensitivity of the groundwater receptor is medium, and there would be no magnitude of change because the Project will include measures to contain or treat all leachate generated. There is, therefore, potential for a **neutral (not significant)** long-term effects on the quality of groundwater beneath the proposed landfill.

12.4.18. The movement of vehicles coming in and out of the proposed landfill can lead to the superficial spread of soils and materials outside of the Project area, which can potentially cause contamination of agricultural soils adjacent to the Project. The sensitivity of this receptor is medium, and the magnitude of change is anticipated to be slight, as a wheel washing facility is included in the design and will be used to manage this risk. There is therefore likely to be **minor adverse (not significant)** effects on the quality of adjacent agricultural soils.

12.4.19. There is a risk of oil and / or petroleum leaks / spills from machinery and vehicles used during the operational phase, which could result in soil and groundwater contamination, although this will be managed through good practice measures. The sensitivity of the soils adjacent to the existing landfill is low. There is likely to be no magnitude of change compared to the pre-existing conditions and the overall effects are considered to be **neutral (not significant).** The sensitivity of groundwater is medium. There is likely to be no magnitude of change compared to the similar pre-operational conditions. The magnitude of change is, therefore, considered **neutral (not significant).**

12.5 MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

12.5.1. The mitigation and enhancement measures proposed for the construction phase of the Project are outlined in the table below.

Table 12-5 – Soil, Geology and Groundwater Mitigation Measures (Construction)

Effect	Mitigation measure
Mobilisation of leachate to agricultural soil during reprofiling of the existing landfill.	Consideration and management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Engineering and design of temporary ponds to include perimeter bunds and prevent flooding. Provision of standby pumps and tanker for emergency pumping of leachate. Careful construction and thorough quality control during construction around the existing landfill. Testing and removal of contaminated material arising from the existing landfill.
Mobilisation of leachate into groundwater during reprofiling of the existing landfill.	Consideration and management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Engineering and design of temporary ponds to include perimeter bunds and prevent flooding. Provision of standby pumps and tanker for emergency pumping of leachate. Careful construction and thorough quality control during construction around the existing landfill. Testing and removal of contaminated material arising from the existing landfill.
Human contact with contaminated materials.	Avoid direct contact with waste, leachate and soil. Specific measures during ground investigations such as full body suits to prevent contact while drilling debris.
Human contact with radionuclides.	Avoid direct contact with waste, leachate and soil. Routine monitoring of radioactivity during construction. The use of personal radiation detectors. Specific measures during ground investigations such as full body suits to prevent contact will drilling debris.
Oil and / or petroleum leaks from machinery – impact to soil.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles.

OPERATIONAL PHASE

12.5.2. The mitigation and enhancement measures proposed for the operational phase of the Project are outlined in the table below.

Table 12-6 – Soil, Geology and Groundwater Mitigation Measures (Operation)

Effect	Mitigation measure
Vehicle movements and mobilisation of contaminated soils.	▪ Tyre washing before exit from the construction site. ▪ Collection and safe discharging of contaminated wash-water. ▪ Provision of suitable haulage access roads.
Oil and / or petroleum leaks from machinery – impact to groundwater.	▪ Provision of spill kits to contain oil / petroleum leaks or spills. ▪ Program to ensure good driver behaviour / maintenance of vehicles.

12.6 RESIDUAL EFFECTS

12.6.1. The closure of the existing landfill and the construction and operation of the proposed landfill will result in significant environmental improvements. The legacy of poor environmental management due to the existing landfill will potentially persist for many years to come, however, the Project provides a valuable opportunity to reduce the legacy effects through:

- Capping of the existing landfill, including measures to prevent excessive rainfall input and leachate generation;
- Reshaping of the existing landfill waste mass to stabilise the slope and prevent sliding, including surface water runoff measures (Chapter 11); and
- Treatment options for leachate.

12.6.2. Leachate is highly likely to have contaminated local soil, water features (most notably the wetland pond) and the underlying groundwater, although there are no site-specific data to confirm the contamination of groundwater.

12.6.3. Detailed environmental monitoring will be undertaken during pre-construction, construction and operation to help manage the legacy risk to the environment and human health.

12.6.4. With the mitigation measures in place, it is anticipated that effects to soils, geology and groundwater as a result of the Project will be **moderate adverse (significant)** during construction and **minor adverse (not significant)** during operation.

12.7 SUMMARY

12.7.1. A summary of the identified construction and operational phase impacts on the geology, soils and groundwater, proposed mitigation measures and residual effects after mitigation is presented in Table 12-7.

Table 12-7 – Summary of Potential Impacts, Effects and Mitigation (Geology, Soils and Groundwater)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Geology, Soils and Groundwater Environment	Project area is underlain by clastic sediments (clays and sands) of no economic potential. Project surrounded by agricultural land. Existing landfill possesses no engineered containment. Excavated into disused clay pit, may penetrate through base of the clay that was excavated historically. Layered multi-aquifer system at Project location. Neocene/Eocene & Cretaceous aquifers used for groundwater supply. Evidence of contamination from agriculture and poor sanitation in local water supply wells.	Construction	Excavation/ exposure of radioactive and/or contaminated materials	Large adverse (significant). Human contact with radioactive and/or contaminated materials.	Avoid direct contact with waste, leachate and soil. Routine monitoring of radioactivity during construction. The use of personal radiation detectors. Specific measures during ground investigations such as full body suits to prevent contact will drilling debris.	Moderate Adverse (significant). Possible and potential for temporary cessation of works.
		Construction	Excavation of soils and potentially contaminated materials. Re-profiling of existing landfill waste.	Minor adverse (not significant). Exposure of waste and mobilisation (breakout) of leachate. Contamination of groundwater and agricultural soils.	Management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Careful construction and thorough quality control during construction around the existing landfill.	Minor adverse (not significant) due to continued migration of leachate to groundwater from existing landfill.

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					Testing and removal of contaminated material arising from the existing landfill.	
		Construction	Excavation/ removal of soils and potentially contaminated materials.	Minor beneficial (not significant). Removal of source of contamination to soil and groundwater.	N/A	Minor beneficial (not significant).
		Construction	Stockpiling of soils and potentially contaminated materials. Infiltration and runoff from stockpiles to groundwater and agricultural soils.	Neutral (not significant). Continued contamination of groundwater and agricultural soils from sediment and/or contaminated materials.	Implementation of sediment and erosion control measures. Segregation of clean and contaminated materials.	Neutral (not significant)
		Construction	Flooding of temporary leachate ponds	Minor adverse (not significant) to moderately adverse (significant). Rapid mobilisation of contaminants to groundwater and agricultural soils.	Engineering and design of temporary ponds to include perimeter bunds to prevent flooding. Standby pumps and provision of off-site tankering for emergency pumping of leachate.	Neutral (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
		Construction	Vehicle movements and mobilisation of contaminated soils.	Minor adverse (not significant). Contamination of groundwater and agricultural soils from sediment and/or contaminated materials.	Tyre washing before exit from the construction site. Collection and safe discharging of contaminated wash-water. Provision of suitable haulage access roads.	Neutral (not significant)
		Construction	Oil and/or petroleum leaks from machinery.	Neutral (not significant). Contamination of groundwater and agricultural soils.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	Neutral (not significant)
		Operation	Leachate accumulation in existing landfill.	Minor beneficial (not significant) due to reduction of but continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill.	Continued use and maintenance of leachate drainage infrastructure to maintain leachate heads at low levels. Continued use and maintenance of leachate extraction	Minor beneficial (not significant).

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					management system and treatment plant	
		Operation	Waste storage volume in proposed landfill	Neutral (not significant). Leachate generating materials contaminating groundwater and agricultural soils.	Construction of perimeter embankment and northern wall around proposed landfill to EU Landfill Directive standards. Continued use and maintenance of leachate extraction management system. Installation of a new leachate treatment plant, and high-quality leachate containment a treatment system in the proposed landfill. Daily cover to reduce rainfall infiltration and reduce aerial waste deposition.	Neutral (not significant)
		Operation	Storage and transportation of waste at MBT	Minor adverse (not significant).	Waste to be stored on hard-standing in bunded areas.	Neutral (not significant)
		Operation	Vehicle movements and mobilisation of contaminated soils.	Minor adverse (not significant).	Tyre washing before exit from the construction site.	Neutral (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
				Contamination of agricultural soils.	Collection and safe discharging of contaminated wash-water. Provision of suitable internal access roads.	
		Operation	Oil and/or petroleum leaks from machinery	Neutral (not significant) to Minor adverse (not significant). Contamination of groundwater and soil receptors.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	Neutral (not significant)

13

SOCIAL

13 SOCIAL

13.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

13.1.1. Applicable social laws and guidance are outlined in the table below. Key legislation in relation to land and livelihood has been described in the developed LRF.

Table 13-1 – Social Legislation, Policy and Guidance

Key Related Regulations		Applicability to Project
National Legislation		
Anti-discrimination	Ukraine's anti-discrimination legislation. Art. 1 (1) (2) of the Law of Ukraine "On the Principles of Prevention and Counteracting Discrimination in Ukraine" № 5207-VI of 06 September 2012.	Roma constitute one of ethnic minorities in Ukraine. As Roma are employed as waste pickers at the existing landfill site, this legislation is directly relevant to the Project activities. Attempts should be made to ensure the protection and integration of the Roma waste pickers.
Labour rights including child and forced labour	Ukrainian Labour Code 1972 as amended.	The Project should align with the Ukrainian Labour code. This includes implementation of a minimum wage (UAH 4173/month) and a minimum working age. Ukrainian law distinguishes between an employment agreement (used to formalise employment relations in most cases) and an employment contract (a more flexible employment agreement that can be used only in situations expressly provided by law).
Gender Equality	Law on ensuring Equal Rights and Opportunities of Women and Men (2005, amended 2014). In 2017 Ukraine revised its legislation on preventing domestic violence, criminalising it in order to implement the provisions of the Council of Europe Convention on Preventing and Combating Violence against Women and Domestic Violence (Istanbul Convention), which has not been ratified yet.	The objective of the 2005 Law is to achieve the equality of women and men in all spheres of social life by legally ensuring equal rights and opportunities of women and men.
International Legislation		
EBRD – Gender	The EBRD Strategy for the Promotion of Gender Equality – 2016 – 2020.	The overall objective of this Strategy is to increase women's economic empowerment and equality of opportunities in the EBRD Countries of Operation. In relation to the Project, this strategy should be implemented in conjunction with the national Law on ensuring Equal Rights and Opportunities of Women and Men (2005, amended 2014).

Key Related Regulations		Applicability to Project
		The application in relation to the Project is detailed above.
EBRD PR2 Requirements	The EBRD PR2 relate to labour and working conditions. EBRD requires for its clients to have good human resources management and a sound worker-management relationship based on respect for workers' rights, including freedom of association and right to collective bargaining, which are key to the sustainability of enterprises.	The EBRD PR2 is applicable to the Project. The objective of PR2 is to: ▪ Respect and protect the fundamental principles and rights of workers; ▪ Promote the decent work agenda, including fair treatment, non-discrimination and equal opportunities of workers; ▪ Establish, maintain and improve a sound worker-management relationship; ▪ Promote compliance with any collective agreements to which the client is a party, national labour and employment laws; ▪ Protect and promote the safety and health of workers, especially by promoting safe and healthy working conditions; and ▪ Prevent the use of forced labour and child labour as it relates to project activities.
International Labour Organisation (ILO) Conventions	Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87). Right to Organise and Collective Bargaining Convention, 1949 (No. 98). Forced Labour Convention, 1930 (No. 29) (and its 2014 Protocol). Abolition of Forced Labour Convention, 1957 (No. 105). Minimum Age Convention, 1973 (No. 138). Worst Forms of Child Labour Convention, 1999 (No. 182). Equal Remuneration Convention, 1951 (No. 100). Discrimination (Employment and Occupation) Convention, 1958 (No. 111).	The key ILO conventions set strict requirements on minimum age for employment, elimination of any cases of forced labour and child labour.

13.2 ASSESSMENT METHODOLOGY

13.2.1. The social impact assessment methodology for this Project is based on the following:

- WSP site visit observations and field interviews/meetings conducted in 1-4 July 2019 with a wide range of key stakeholders including affected groups:
  - A site walk-over of the existing landfill site and its surrounding areas, including locations where houses are present within the SPZ;
  - A site walk-over of the potential proposed MBT site and the surrounding areas;

- A focus group with potentially affected waste pickers, and a site walk over to view their accommodation adjacent to the existing landfill site;
- A scoping meeting with a head of village council and deputy villagers;
- Household meetings with three private land owners, who sold their land plots to the City Council (as part of the completed Land Acquisition Phase I and II for the proposed landfill); and
- Meetings with key responsible parties at the City of Khmelnitsky (land acquisition department, grievance department, and The Company (see stakeholder consultation section for full details)).

- Desk top study to obtain socio-economic baseline data (disaggregated information by age and gender on population, education, employment, etc) for the region and local area; and
- Evaluation of significance of effects based on 'Sensitivity/Importance of a receptor vs Magnitude of an Impact' based on international best practice using knowledge, expertise and professional judgement.

13.2.2. Appendix 13-1 explains the sensitivity and magnitude criteria used in this assessment.

13.3 BASELINE CONDITIONS

ADMINISTRATIVE STRUCTURE

13.3.1. The Project is located in western Ukraine in the city of Khmelnitsky, which is the administrative centre of the Khmelnitsky Oblast. The existing site is located on the northern outskirts of the City, north of Pivdennyi Buh River. The major roads providing access to the Site are Zakhidna Okruzhna Street and Myru Avenue.

13.3.2. At the next administrative level down, local settlements within the Project area include; Oleshin (head of village cluster), Velika Kalinovka, Ivankivtsy, Cherepov, Cherepivka.

POPULATION CHARACTERISTICS

13.3.3. The total population of Ukraine is 44.83 million people (2017 data[57] women made up more than half of the population (53.7%)). For the last 8 years, there has been a minor and consistent decrease in population year on year (totalling (0.2%)), partly because deaths have outnumbered births over recent years (Table 13-3 in Appendix 13-1). The average household size in Ukraine was 2.58 people in 2017, this figure has remained static since 2012[58].

[57] World Bank Database.

[58] State Statistics Service of Ukraine (2018). Household Characteristics (excluding a part of temporarily occupied territory of the Donetck and Luhansk regions). Available at: https://ukrstat.org/en/operativ/operativ2007/gdvdg_rik/dvdg_e/har2010_e.htm (Accessed 29/08/2019).

13.3.4. Khmelnitsky region comprises: 20 districts, 13 cities, 24 urban settlements and 1414 villages[59]. Khmelnitsky Oblast's population decreased from 1,282,000 people in 2016 to 1,261,500 people in 2018 (-2.3%).

13.3.5. Khmelnitsky City has a population of 265,583 (January 2018), comprising 46.1% males and 53.9%females. Net outward migration from the region has declined from 2800 in 2017, to 700 people in 2018[60].

13.3.6. The highest proportion of the population are in 0-19 age group (Table 13-4 – in Appendix 13-1).

Local Settlements

13.3.7. Oleshin Village has a population of 2,728 people. The remaining villages are substantially smaller with between 400 and 860 inhabitants each (Table 13-5 in Appendix 13-1).

Ethnicity and Languages

13.3.8. The population within Khmelnitsky region is made up of the following ethnicities; Ukrainian (93.9%), Russian (3.6%), Polish (1.6%) and others (0.9%)[60].

13.3.9. Data from the 2001 census shows that the major language at the time was Ukrainian, spoken by 68% of the population, while the second most common language was Russian, spoken by 30% of the total population, although most Ukrainians are bilingual.

EMPLOYMENT AND ECONOMY

13.3.10. The national unemployment rate is 9.1% of the working age population. This figure has remained relatively static since 2010 when the figure was 8.9%[61]. No sex disaggregated data is available. The approximate number of unemployed people (of working age) in Khmelnitsky region in quarter one 2019 was 55,800.[62] Using Khmelnitsky region's 2018 population for comparison (1,261,500 people), this equates to an unemployment rate of approximately 4.42%.

[59] Khmelnytsky Regional State Administration (2018). Information about the region. Available at: https://www.adm-km.gov.ua/?page_id=1501 (Accessed 29/08/2019).

[60] Khmelnitsky Regional State Administration (2018). Information about the region. Available at: https://www.adm-km.gov.ua/?page_id=1501 (Accessed 29/08/2019).

[61] State Statistics Service of Ukraine (2018). Basic indicators on labour market in 201-2018 (annual data). Available at: https://ukrstat.org/en/operativ/operativ2007/rp/ean/ean_e/arh_osp_rik_e.htm (Accessed 29/08/2019).

[62] State Statistics Service of Ukraine (2019). ILO unemployment by region. Available at: https://ukrstat.org/en/operativ/operativ2019/rp/rp_reg/reg_e/bn_2019_e.xls (Accessed 29/08/2019).

13.3.11. In 2018, 1.3% of Ukraine's population were living below the poverty line, with a total income less than the legally established minimum[63]. The 2019 rate of inflation[64] in Ukraine was 8%, a reduction from 2018 where the rate was 10.9%[65].

13.3.12. In quarter one of 2019, 61.1% of the population (aged 15-70) of Khmelnitsky region participated in the labour force, in comparison to 62.8% nationally[66]. National statistics for 2017 highlight that the main three sources of employment in Khmelnitsky region mirror those at national level; agriculture, fishing and forestry (27.9%); wholesale and retail trade, repair of motor vehicles and motorcycles (22%); and industry (12.2%)[67] (Table 13-6– in Appendix 13-1).

13.3.13. The average net salaries per month in the Khmelnitsky Region, without taxes and contributions are; Khmelnitsky City - 7,323 UAH, Khmelnitsky region/oblast - 7,345 UAH[68]. These figures are substantially below the national average of 9,904 UAH. The national minimum salary in Ukraine UAH 4173/month UAH per month[69].

City Council

13.3.14. The City council employs 580 people, with 111 male and 469 female employees. The Company is part of the City Council, with a team of approximately ten people.

LABOUR AND WORKING CONDITIONS

Child Labour, Forced Labour and Employment Conditions

13.3.15. In Ukraine, the minimum age for work is 16. However, the Labour Code allows children to be employed at age 15 with parental consent. In secondary or vocational schools, students may perform light work at age 14 with parental consent, provided that the work does not interfere with their education and is not harmful to their health. Children in vocational training programs for hazardous occupations are permitted to perform hazardous work, beginning at age 14, but it must be for less than 4 hours a day and occupational health and safety standards must be met.[70] There is a lack of inspection of child

[63] State Statistics Service of Ukraine (2018). Differentiation of household living standards. Available at: https://ukrstat.org/en/operativ/operativ2007/gdvdg_rik/dvdg_e/duf2010_e.htm (Accessed 29/08/2019).

[64] The average consumer price index (CPI) is a measure of a country's average level of prices based on the cost of a typical basket of consumer goods and services in a given period. The rate of inflation is the percent change in the average CPI. Source: World Economic Outlook (2019).

[65] International Monetary Fund (2019). Inflation rate, average consumer prices - Ukraine. Available at: https://www.imf.org/external/datamapper/PCPIPCH@WEO/OEMDC/ADVEC/WEOWORLD/UKR (Accessed 29/08/2019).

[66] State Statistics Service of Ukraine (2019). Participation rate of the population in labour force in 2019, by region. Available at: https://ukrstat.org/en/operativ/operativ2019/rp/rp_reg/reg_e/rean_2019_e.xls (Accessed 29/08/2019).

[67] State Statistics Service of Ukraine (2017). Employed population by economic activities and regions in 2017. Available at: https://ukrstat.org/en/operativ/operativ2013/rp/zn_ed_reg/zn_ed_reg_e/zn_ed_reg_2017k_e.htm (Accessed 29/08/2019).

[68] Source: SU Statistics.

[69] Wage Indicator (2019). Minimum wage – Ukraine. Available at: https://wageindicator.org/salary/minimum-wage/ukraine (Accessed 29/08/2019).

[70] Bureau of International Labour Affairs (2019). 2015 Findings of the Worst Forms of Child Labour. Available at: https://www.justice.gov/eoir/page/file/909771/download (Accessed 29/08/2019).

labour issues in the country. According to various reports, children in Ukraine are at high risk of illegal trafficking and criminal laws are weak in terms of investigating these issues.

13.3.16. The Company has a human resources policy and complies with both national and EBRD PR2 requirements.

Supply Chain

13.3.17. Two private companies provide manual waste picking services to Spetskomuntrans by separating and recycling waste at the existing landfill facilities. These Contractors include an individual entrepreneur and LLC "Recycling Podillya". Both parties provide services to the Company for collection of plastic bottles and other materials for sale to the recycling markets. The Company has contracts with these two companies which have been provided. The contract with Podillya expires 1st of July 2019, but it is likely that it will be renewed. Each of these two contractors employ between 10-30 workers. More are employed in the summer and less in the winter. In total up to 60 people are employed throughout the year. The Company's contract with the individual entrepreneur is maintained on a month-to-month basis.

13.3.18. The agreements between The Company and these contractors (Podillya and the individual entrepreneur) state that employees receive UAH 0.5 per 1 kg, including tax 18% and a military fee of 1.5%.

13.3.19. The City Council/The Company does not monitor the labour and working condition of the contractors' employees and currently does not have any supply chain management policies.

13.3.20. Based on the internet research conducted on Recycling Podillya, it is understood that there is an established registered office for this Company. However, no information was found on the entrepreneur employed by Spetskomuntrans and his company. The Company does not currently appear to have any procedures to screening its suppliers. Therefore, it is anticipated that there could be potential social risks (i.e. child labour and forced labour) within supply chain due to lack of monitoring and screening of the existing suppliers.

Occupational Health and Safety

13.3.21. The operation of the landfill presents several risks to the health and safety of workers, contractors and others present at the site. A summary of the key risks and the current management of these is as follows:

- **Fire & explosion –** the degradation of waste materials under anaerobic conditions produces landfill gas, which has a high content of methane and toxic and flammable gases and can result in fires. If allowed to accumulate in a restricted space and ignited, this may result in an explosion. Over the past three years, eight fires have been reported at the landfill site and residents also raised concerns about the fire incidents related to the landfill during the site visits. The incidence of fires has decreased since the installation of the biogas plant. Fire risks may also be generated by the presence of flammable materials or mixing of incompatible wastes. There are currently limited waste inspection processes at the landfill to prevent receipt of unacceptable materials. There is no notable fuel storage at the site, and machinery is fuelled with diesel manually from drums.

  A fire safety instruction has been developed for the site. Basic fire response actions comprise recirculation of leachate from the leachate pond to the operational area of the landfill, but this has limited effectiveness. No formal firefighting provisions are currently in use at the site, and staff have not been trained in fire response. Response actions is currently devolved to the emergency services.

- **Health Risk & Disease, including Pests –** the decomposition of wastes and the potential presence of medical and sanitary wastes means that biohazards are present on landfill sites. This includes disease causing viruses and bacteria such as hepatitis. Disease vectors such as insects, birds, rodents and dogs are also present. Many dogs were observed at the facility. Site management reported that an annual rodent control service is engaged from a contractor, and that cats and dogs found on site are sterilised to prevent population growth. No other pest control measures are currently operated.

  Limited sanitary facilities are currently present at the landfill site, with one toilet having been recently installed. Rest areas are provided but offer limited hygiene provisions. There are no effective controls on hygiene for eating, drinking or smoking. Some use of gloves and masks by waste pickers and site operators was observed, but this was not universal. Protective footwear guarding against potential puncture injuries (including needle puncture injuries) was not observed.

- **Plant and Equipment –** Waste trucks and bulldozers operate on the landfill body. Waste pickers were observed immediately adjacent to trucks while waste was being offloaded, with the remuneration being based on weight of material, encouraging risk taking behaviours to gain early access to loads. No adequate separation of vehicles and pedestrians is enforced at the site. Other small items of fixed plant are also present. No preventative maintenance is currently undertaken on plant at the site, with only reactive maintenance to address faults and breakdowns.
- **Hazardous Materials –** The facility is nominally limited to domestic waste on the main landfill body and construction waste in the adjacent area. Hazardous wastes are not permitted at the facility. However, formal inspections of wastes arriving at the site are not conducted, so hazardous materials may be present in loads deposited on site. Additionally, public access to the construction waste area is possible, and the implementation of waste acceptance criteria is particularly weak in this area. Cement sheet, potentially containing asbestos, was observed in the construction waste area. Anecdotally, there is potential that radioactive wastes may have been historically deposited at the facility.
- **High Risk Activities –** No formal controls are in place for high risks work, such as entry into confined spaces, work at heights, excavation below ground level or isolation of sources of energy during maintenance.
- **Work near Water –** The leachate ponds at the base of the landfill are unfenced and access is largely uncontrolled. Escape provisions such as life vests and life rings are not provided to allow rescue in the event of a fall.

13.3.22. The Company has a Work Safety Policy. However, observations on site indicate that these policies are not implemented robustly. Records of accidents and injuries indicate that, in the last 3 years, there have been 5 production-related accidents that required a hospital stay. No data is maintained for injuries to contractors working at the site.

Education

13.3.23. Ukraine has one of the highest rates of public spending on education in the world, spending nearly 6% of GDP on education in 2017. Despite the high rate of spending on education, Ukrainian schools often lack adequate facilities, equipment and textbooks. 94.5% of women and 95.6% of men in Ukraine (aged 25 or over) had undertaken at least some secondary education between 2010 and 2017[71]. There is no information available at a regional level.

HEALTH

13.3.24. The number of health care or medical institutions in Ukraine nationally, has halved from 1990 (3900) to 2017 (1700) (although the 2017 figure excludes the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions)[72]. The most common diseases in Ukraine (as seen in Table 13-7 in Appendix 13-1) are respiratory diseases with 12 million new cases in 2017, making up 45% of the total 26.6 million newly registered diseases. The next most common diseases are blood circulation diseases (1800 new cases in 2017) and disease of the urogenital system (1700 new cases in 2017). The number of newly registered diseases has decreased between 1990 and 2017 by 5500 (Table 13-7 in Appendix 13.1)

13.3.25. Outbreaks of measles have been reported recently in Ukraine with approximately 37,000 cases, including 14 deaths, between 1st January and 4th April 2019. Khmelnitsky region was one of four regions where outbreaks were reported[73].

13.3.26. Ukraine has the second highest HIV infection populations in Eastern Europe and Central Asia. It is estimated that 240,000 people are living with HIV in 2018, which includes 140,0000 officially registered cases[74]. Significant growth rates of registered cases of HIV were registered in Khmelnitsky region, among others.[75] Statistics from the Ukrainian Centre for Monitoring and Evaluation of HIV/Aids Programs estimate that 3,500 people in the Khmelnitsky region were living with HIV in 2017[76], from a total population of 1.271 million (approximately 3% of the region's population).

CRIME

13.3.27. The number of offences recorded has increased substantially between 1990 and 2017, from 369,809 to 523,911, an increase of 41.7%. Although the number of crimes detected increased, the number of convictions decreased in the same period from 104,199 to 76,804 (-35.7%)[77].

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[71] United Nations (2018). Human Development Reports. Available at: http://hdr.undp.org/en/composite/GII (Accessed 29/08/2019).

[72] State Statistics Service of Ukraine (2018). Health care establishments. Available at: https://ukrstat.org/en/operativ/operativ2007/oz_rik/oz_e/zakladu_06_e.html (Accessed 29/08/2019).

[73] European Centre for Disease Prevention and Control (2019). Communicable Diseases Threats Report. Available at: https://ecdc.europa.eu/sites/portal/files/documents/communicable-disease-threats-report-13-april-2019.pdf (Accessed 29/08/2019).

[74] Health Europa (2018). HIV epidemic in Ukraine. Available at: https://www.healtheuropa.eu/hiv-epidemic-ukraine/83554/ (Accessed 29/08/2019).

[75] Aids-Institute (2018). Terrible Statistics from the Center for Public Health. Available at: http://www.aids-institute.org/en/news/220-terrible-statistics-from-the-center-for-public-health.html (Accessed 29/08/2019).

[76]Ukrainian Centre for Monitoring and Evaluation of HIV/Aids Programs (2017). Dashboard. Available at: http://hiv.phc.org.ua/dashboardRespond/?locale=en (Accessed 28/08/2019).

[77] State Statistics Service of Ukraine (2019). Justice and Crimes. Available at: https://ukrstat.org/en/operativ/operativ2005/pp_rik/pp_e/2002_e.html (Accessed 29/08/2019).

13.3.28. Corruption is one of the biggest issues in Ukraine, with Ukraine only second to Russia as the most corrupt county in Europe with a global corruption score of 120 out of 180 countries worldwide[78].

13.3.29. No information was available on crime at the Oblast and City level. However, interviews with a few local villagers raised concerns associated with alcoholism and gender violence in Khmelnitsky city and surrounding villages. These issues have mainly been raised by women.

13.3.30. Spetskomuntrans has developed and implemented a Bribery Prevention Policy.

COMMUNITY INFRASTRUCTURE

Hospitals and Clinics

13.3.31. In 2013, the routine monitoring of facilities by the Ministry of Health found that 37% of primary care facilities required renovation or rebuilding of which – 23% in rural areas and 46% in urban areas. Unsatisfactory sanitary conditions are most often found in rural health care facilities. The Ukrainian health system has also consistently encountered severe difficulties with the supply and maintenance of existing technological equipment[79.]

13.3.32. There are 17 hospitals and out-patient medical institutions in and around Khmelnitsky City (these include a children's hospital, infectious diseases hospital, anti-tuberculosis centre and a regional psychiatric hospital).[80] There are no hospitals in the local villages. However, there are small health clinics which are used by locals. The main hospital in Khmelnitsky city is used by workers at the landfill site and is planned to be used by the Project construction workers and employees.

Schools

13.3.33. There are 39 educational institutions in Khmelnitsky Oblast.81 Oleshin Village (approximately 1.1km west from the site) has two schools in the village, whilst Ivankivsky (1.9km west of the site) has one.

Recreation and Culture

13.3.34. There are seven cinemas or theatres in or around Khmelnitsky city, and ten museums or monuments in both the Oblast and city. There are no cinemas, theatres or museums at settlement or village level. There is a local sport stadium in Oleshin village.

[78]Corruption Perceptions Index (2018). Global Index for 2018. Available at: https://www.transparency.org/cpi2018 (Accessed 29/08/2019).

[79] Health System in Transition (2015). Ukraine. Available at: http://www.euro.who.int/__data/assets/pdf_file/0018/280701/UkraineHiT.pdf (Accessed 26/08/2019).

[80] Khmelnitsky City Council, health Dept (2018). Medical and Preventative Institutions of Khmelnitsky. Available at: http://uoz.khm.gov.ua/hospitals (Accessed 29/08/2019).

[81] City of Khmelnitsky (2019). Educational Institutions. Available at: http://education.km.ua/?dep=page&dep_up=0&dep_cur=3# (Accessed 29/08/2019).

Access to Other Facilities (Internet, Water, Electricity)

13.3.35. In Khmelnitsky region, the number of internet subscribers was 76,000 in 2018[82]. From a regional population of 1,261,500, this equates to around 6% of the population of Khmelnitsky with an internet subscription.

13.3.36. A United Nations Food and Agricultural Organization report from 2015 highlights that drinking water quality is a health problem, both in urban and rural areas. In towns, water quality is low and the supply is limited. Whereas in rural areas, where wells are more prominent, issues include shortages and chemical contamination (e.g. manganese, iron, hydrogen sulphide and nitrates)[83].

13.3.37. At 1 January 2019, 84% of the population of Khmelnitsky City were connected to a public water supply system (i.e. receiving water through public water supply pipes, not private wells). However, most houses within the Project area, mainly in local villages, do not have access to piped water and have wells to use for both drinking and sanitary water as identified during the site visit. All the local villages have access to electricity.

AFFECTED PEOPLE

Roma Waste Pickers

13.3.38. A team of 20 to 60 Roma waste pickers work at the existing landfill (numbers vary throughout the year). The waste pickers work in shifts collecting plastics and other materials for re-use from the existing landfill.

13.3.39. The waste pickers have been observed to reside in cabins within 5-10m from the existing landfill boundary. Eight of these cabins are located to the west of the main entrance to the existing landfill site, with another four being located near the second (gated) entrance to the existing landfill site.

13.3.40. These waste pickers are employed by two local Contractors (Recycling Podillya and the individual entrepreneur), who in turn have a contract to provide waste picking services to Spetskomuntrans. The waste pickers came from the Zakarpattia Oblast (Ukraine) and currently work at the landfill facilities. A summary of the waste pickers' labour and working conditions is provided as follows:

- Poor occupational health and safety including lack of all protecting equipment (no head protection, no face-masks to protect against dust, bioaerosols and odour on the site, no cap-steel boots, no gloves, etc).
- The waste pickers' working accommodation (within 50m from the landfill site) is in a very poor state. The cabins are equipped with chimneys and some were confirmed to be occupied throughout the winter period as well as through warmer months, i.e. permanently.
- Women (about five) were observed and some of them did not have proper suitable HSE clothing while working on the site.

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[82] State Statistics Service of Ukraine (2019). Number of internet subscribers, 1 April 2019. Available at: https://ukrstat.org/en/operativ/operativ2019/zv/zv_reg/kal_reg/kal_reg0119_e.htm (Accessed 27/08/2019).

[83] FAO (2015). Ukraine, Environment and health. Available at: http://www.fao.org/nr/water/aquastat/countries_regions/UKR/index.stm (Accessed 27/08/2019).

- It was confirmed that some waste pickers finish their work at the landfill facilities around October and then come back around April, while other Roma waste pickers stay in the cabins and containers throughout the year.

13.3.41. The field interviews conducted with male waste pickers indicate that the male waste pickers could possibly have low literacy level.

13.3.42. During the landfill observations two adolescent males were spotted near the waste pickers' cabins (potentially 13-14 years old). It is assumed that these two children assist their parents with waste sorting. This is compliant with the above-mentioned national provisions that children from 14 years old can perform light work with parental consent for less than 4h per day. However, this needs to be confirmed during socio-economic surveys to be carried out by Spetskomuntrans, as part of the Livelihood Restoration Plan (LRP) preparation (see Livelihood Restoration Framework).

13.3.43. A brief media search has been conducted on Roma communities in the country:

> In recent years there have been violent attacks on Roma communities by right wing groups in Ukraine.[84] In 2013, the Ukrainian Government adopted a Strategy for the "Protection and Integration of the Roma Ethnic Minority in Ukraine" which runs up to 2020. The Strategy has been criticised for not being implemented and lacking in budget. To date, government assistance has been provided with regard to employment and land which has been allocated to Roma.[85]
>
> Though the Roma population is diverse and living conditions vary significantly between different communities and regions, they nevertheless are disproportionately marginalised in almost every area of their lives, from education and health care to housing and employment. While poverty, isolation and high levels of illiteracy contribute to their destitution, discrimination against Roma at every level of society, including among police, prosecutors and officials, also plays an important part in perpetuating their secondary status[86].
>
> The last Ukrainian census in 2001 estimated the Roma population to be around 40,000, although rights groups say the figure could be as high as 260,000. The Roma face discrimination in many countries, with the UN describing them as being "among Europe's most excluded groups"[87].

13.3.44. Waste pickers therefore are considered to be vulnerable. Further information about the waste pickers is provided in the LRF.

Houses Located within the SPZ

13.3.45. In the 1990s the village council authorities implemented a programme of selling land plots to individuals, including land plots within the SPZ for the existing landfill, even though the SPZ restrictions

[84] Minority Rights (2019). Ukraine. Available at: https://minorityrights.org/wp-content/uploads/2019/05/MRG_Rep_Ukraine_EN_Apr19.pdf (Accessed 27/08/2019).

[85] UK Government (2019). Ukraine Minority Groups. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812080/Ukraine_-_Minority_Groups_-_CPIN_-_v2.0__June_2019_.pdf (Accessed 26/08/2019).

[86] Minority Rights Group Europe (2019). Roma in Ukraine – A Time for Action: Priorities and Pathways for an Effective Integration Policy. Available at: https://minorityrights.org/wp-content/uploads/2019/05/MRG_Rep_Ukraine_EN_Apr19.pdf (Accessed 27/08/2019).

[87] BBC News (2018). Europe. Available at: https://www.bbc.co.uk/news/world-europe-44593995 (Accessed 26/08/2019).

were present and the site was operational at that time. The land plots were intended to be use for recreational gardening and were designated as an “agricultural” land use. Several of these land owners have subsequently built houses on their land plots, and then changed the land use from “agricultural” to “residential”, thus legalising their houses.

13.3.46. At the same time, other land owners have built houses on their land plots (see Figure 13-1 below) but have not yet applied for change of land use, thus the houses with unchanged/agricultural land use that are used as permanent residential dwelling are illegal. National land use legislation makes it illegal to build permanent residential properties on the land plots which have agricultural land use.

13.3.47. Since the Ukraine’s independence referendum in 1991, the country has embarked on reviewing and amending its national legislation, as well as its legislation on SPZs and their size. There is a specific legislative process that must be followed to secure a reduction in the extent of the SPZ for existing landfills, and any application for a reduction must be supported by the required monitoring data. Based on the latest amendments, the law states that where developers consider the construction (or reconstruction) which could be hazardous (i.e. could cause negative impacts on the environment and population’s health), the size of SPZ should be considered separately in each individual case taking into account monitoring data with regards to negative exposure to the environment in the proximity to the said facilities and beyond its boundary[88].

13.3.48. Although the SPZ around the existing landfill site is 500m, some houses are located approximately 70m from the existing landfill boundary. The WSP team identified 27 houses which are currently within the SPZ for the existing landfill.

13.3.49. Based on discussions with local residents, it was established that in the 1990s when these land plots were sold to individuals, they originally had an “agricultural land use” designation. With time, people built houses on their land plots and subsequently and successfully applied for land use change. Some of these SPZ houses currently and legally have a “residential” land use designation, which is registered in the National Cadastre database. Other land owners have simply built houses on their land plots but have not yet applied for the land use change. The number of land plots and houses that have the revised “residential” designation and original “agricultural” designation is unknown and will be determined by Spetskomuntrans during the preparation of the Livelihood Restoration Plan.

13.3.50. For clarity, all SPZ houses which currently have the “residential” land use designation, will be referred to as “legal houses”. Those houses located within the SPZ of the existing landfill, which were built on an agricultural land plot and where land use has not been changed, are referred to as “illegal”, as national legislation does not allow residential dwellings to be built on an agricultural land plot.

13.3.51. It was confirmed that although some of the houses are clearly used only during the summer period, approximately half of the houses are permanently occupied (throughout the year).

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[88] 1996 Law on Approval of State Sanitary Rules for Planning and Development of Residential Areas/Settlements, as amended in 2007, 2008 and 2018.

13.3.52. The breach of the SPZ for the existing landfill is historic. The legislative process to reduce the extent of the SPZ for the existing landfill has not been undertaken.

13.3.53. Almost all of the houses located within the SPZ of the existing landfill have fruit and vegetable gardens which are well maintained. The Project could result in the potential loss of crops and trees located on local residents' private land plots, i.e. back gardens and around the houses as a result of accidental damage by contractors and their staff, or, if the construction works are not sufficiently contained within the land either currently owned, or purchased for, the Project.

Figure 13-1 – Houses Located with the SPZ of the Existing Landfill (approximately 70m from the existing landfill boundary)

Vulnerable Groups

13.3.54. In Ukraine, vulnerable groups legislation states "socially vulnerable groups are individuals or social groups that are more likely to suffer social damage from the impact of economic, environmental, industrial and other factors of modern life." Categories in need of urgent assistance from the state include: pensioners, invalids, families with children, orphans, youth, unemployed, victims of the Chernobyl accident, low income people, marginalised populations (homeless people dependent on alcohol, drugs, offenders) and others.[89] The Ukrainian definition of vulnerable groups covers a number of different groups (including those specific to the country – i.e. those who suffered in Chernobyl) and is aligned with the EBRD requirements related to vulnerable groups. Within the context of the Project and according to the EBRD PR1, some individuals or groups are more vulnerable than the majority of

[89] Agency for legislative initiatives (2015). Monetization of benefits: experience of other countries and conclusions for Ukraine (Policy Paper). Available at: https://parlament.org.ua/2015/11/23/monetyzatsiya-pilg-dosvid-inshyh-krayin-ta-vysnovky-dlya-ukrayiny-policy-paper/ (Accessed 27/08/2019).

the affected population and, if affected by the Project, will thus require the implementation of special livelihood restoration and/or assistance measures. Such groups are expected to include:

- Roma waste pickers (men and women) who work at the current landfill;
- Owners of structures (built without necessary permits), with no other property or place of residence;
- Persons who depend on the affected land for incomes/livelihoods and it is the only land they own or use;
- Elderly and women single headed households, single parent households, households with multiple members, or those living below the poverty line or affected by war;
- Persons who could be affected by economic displacement,
- Persons whose socio-economic status is low, for example beneficiaries of social welfare; and
- People with low-literacy levels who may have difficulties accessing information about the Project and their livelihood restoration entitlements or understanding contracts and other important documents, etc.

13.3.55. Vulnerability will be further assessed and confirmed based on the results of socio-economic and census and asset inventory surveys (as part of the Livelihood Restoration Plan preparation) and regular stakeholder consultations.

GENDER

13.3.56. In 2018 women made up more than half of the population in Ukraine (53.7%). According to the UNDP 2017, female labour force participation is 46.9%% compared to 63% for males90. On average, women's monthly wages are approximately 25% lower than men's[91]. 87% of adult women enrolled for secondary education in comparison to 86% of males[92].

13.3.57. In 2017, Ukraine ranked 61[93] of 160 countries in the Gender Inequality Index (GII)[94]. This rate highlights an inferior situation for women in Ukraine in comparison to most of its neighbouring countries. Violence against women is common with 1 in 5 women aged 15-49 experiencing physical violence since they turned 15 years old, 5% of which were incidents of violence by a non-related perpetrator[95].

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[90] UNDP (2017). Gender Inequality Index, Ukraine. Available at: http://hdr.undp.org/en/composite/GII (Accessed 27/08/2019).

[91] State Statistics Service of Ukraine (2019) Average monthly wages by sex and type of economic activity in industry over the quarter in 2019. Available at: https://ukrstat.org/en/operativ/operativ2019/gdn/smzp_zs/smzp_zs_prom/smzp_zs_prom_e_19.xlsx (Accessed 26/08/2019). Data excludes the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and a part of temporarily occupied territories in the Donetsk and Luhansk regions.

[92] Word Bank (2014). Education Statistics, Country at a glance – Ukraine. Available at: http://datatopics.worldbank.org/education/country/ukraine (Accessed 26/08/2019).

[93] UNDP (2017) Gender Inequality Index, Ukraine. Available at: http://hdr.undp.org/en/composite/GII (Accessed 27/08/2019).

[94] The GII is an inequality index. It measures gender inequalities in three important aspects of human development—reproductive health, measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and economic status, expressed as labour market participation and measured by labour force participation rate of female and male populations aged 15 years and older (UNDP, 2017).

[95] Research Department of GfK Ukraine (2014). The Prevalence of Violence Against Women and Girls.

13.3.58. In 2005 Ukraine introduced a Law on Ensuring Equal Rights and Opportunities of Women and Men. Ukraine has also adopted international commitments on gender equality. The country adopted the Sustainable Development Goals (SDGs), joined the Beijing Declaration and the Platform for Action (BPfA) of the 4th World Conference for Women (1995) and ratified key human rights treaties, including Convention on the Elimination of All Forms of Discrimination against Women (CEDAW, 1980) and its Optional Protocol.

13.3.59. Despite the implementation of measures to increase gender equality, Ukrainian women still face challenges due to patriarchal attitudes, stereotypes, weak implementation of laws and a lack of political support. Women are less likely to be employed in formal jobs dealing with waste collection and management than men. Within the city council, 469 of the 580 employees are women (80.8%). In relation to informal waste picking, only five women out of 35 to 36 waste pickers (approximately 14%) were observed at the existing landfill dump site and none participated in the focus group discussion.

13.3.60. Women waste pickers may be more vulnerable than men, where for example they are able to collect less waste and earn less money, or if they are single mothers or have caregiving responsibilities in their households, or if their safety at the landfill/waste accommodation area is jeopardised, etc. It is essential that the working conditions of the affected women waste pickers to be improved as some of them have children and their 'temporary living area' is in a very poor condition. The Company does not have a gender equality policy.

LAND ACQUISITION

13.3.61. Spetskomunstans is carrying out its land acquisition programme in three Phases, where 17,357 Hectares (rounded number, ha) spread between 14 land plots were acquired during Phase I. Another 2,238ha (rounded) spread between 20 land plots were acquired during Phase II. As such, the land acquisition programme for Phase I and II (the proposed landfill) has been completed. Phase III land plots are marked for the future development by Spetskomuntrans and are outside of this Project. See Figure 13-2 for details.

13.3.62. The land plots required for the proposed MBT facility are not part of the Phase I to III land acquisition programme. The land plots are currently designated as "agricultural use". After the sale if this land is agreed, the land plots ownership rights will be transferred to Spetskomunstrans, and the land use will be changed to "industrial".

13.3.63. The plots acquired during Phase I and II (the proposed landfill) were all officially designated for "agricultural use", although in reality the land plots were not used for agricultural activities due to their proximity to the landfill. After each sale was agreed, the land plots ownership rights were transferred to Spetskomunstrans, and the land use was changed to "industrial".

13.3.64. The Company or KCA (Khmelnitsky City Administration) is responsible for the land acquisition process and cannot follow a compulsory land expropriation process, because based on Ukrainian Law, the land can be expropriated only for "public interest" purposes, which are specified as: (i) the need to build a road across the country, (ii) a railway, or (iii) another large infrastructure development of national importance. As further development of the existing landfill facilities does not fall under any of these categories, the Company buys land on a "willing buyer - willing seller" basis and follows principles of Ukrainian land law on land acquisition process.

13.3.65. All land acquisition activities will continue to comply with the applicable national regulations. The company will also review its land acquisition process to align with the Entitlement Matrix (see LRF, Section 6.2).

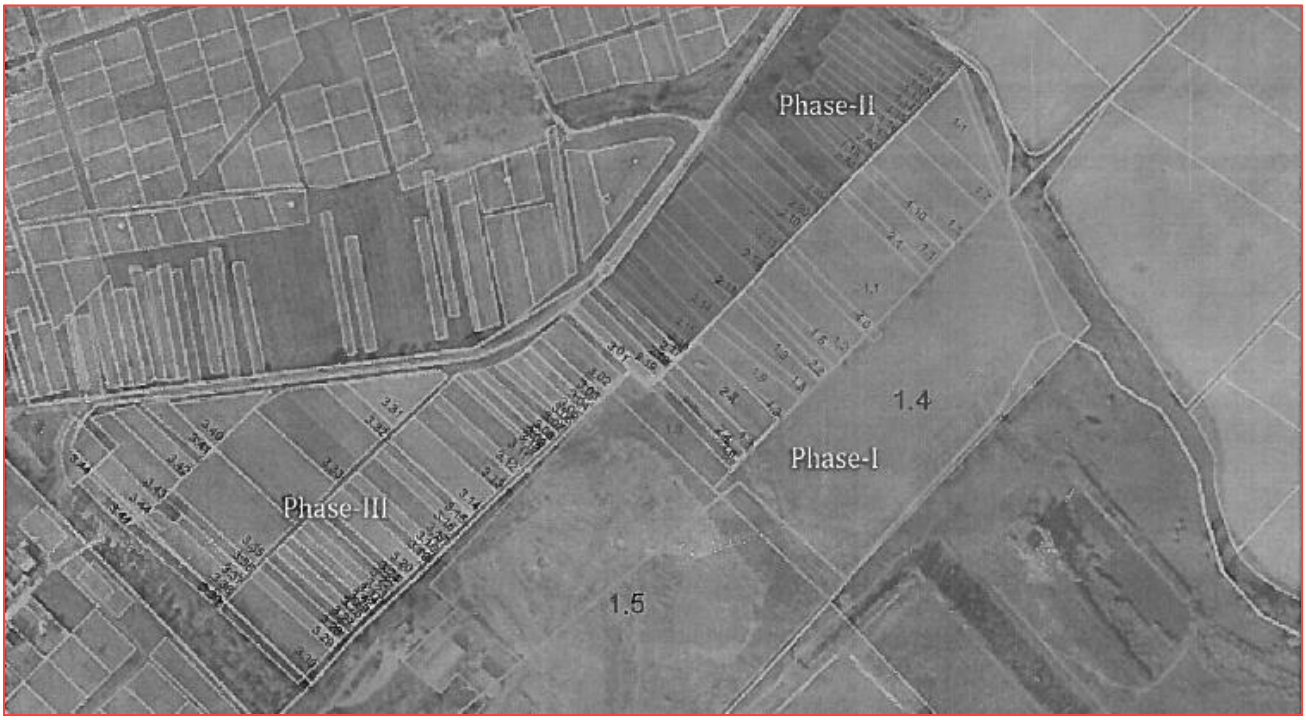

Figure 13-2 – Spetskomuntrans' Phased Land Acquisition Programme

13.3.66. However, there are some gaps between the Ukrainian legislation and the EBRD PR5 requirements, so a LRF was prepared to address these gaps. The legislative requirements gap analysis can be found in the LRF (Section 4).

13.3.67. No information is yet available on the Project requirement for temporary land use for construction workers' accommodation, storage areas etc.

CURRENT LAND ACQUISITION PROCESS FOLLOWED BY SPETSKOMUNTRANS

13.3.68. The WSP team met with both the Spetskomuntrans land acquisition officer, and a land acquisition officer from the Khmelnitsky City Administration (KCA). They described how they follow the Ukrainian Legislation process described above, and the specific process they use when buying land from the land-owners in the Project area:

- **Step 1** – as part of the Khmelnitsky City Administration (KCA) system of providing municipal services to the local population, the KCA first needs to identify and confirm its land acquisition needs to be able to grow their municipal services offering and provide municipal services to the local population. Once its land acquisition needs are confirmed, the KCA makes a decision, which is then formally registered in the minutes of its meetings. Such a decision is typically supported by a budget allocated by the City Administration for the land acquisition.
- **Step 2** – the decision is announced in a publication notice in local newspapers, and information is sent to local land owner associations (Zemlyanoe Tovarischestvo in Ukrainian) to reach those landowners who have an interest in selling the land.

- **Step 3** - Once a land-owner expressed his/her interest to sell a plot of land in the area where KCA is interested in purchasing the land, the land-owner typically arranges for a certified land valuator to visit the land plot in question and prepare a land valuation report. The value is derived and estimated based on a market valuation and the latest land plot sales in the area. Spetskomuntrans makes the point that land valuation is best arranged and paid for by land owners themselves, as this gives the land owners more control over the valuation process. The responsibility for transaction costs and relevant professional fees currently falls on the seller. The land owner sends a copy of the Land Valuation Report to the Land Acquisition department of Spetskomuntrans.
- **Step 4** – Then discussions start between the land owner and Spetskomuntrans in relation to the final price. The land owner has a choice of either accepting the maximum price now (based on the valuation report) or waiting for the next year (all asset valuations must be updated annually), hoping that the next valuation report will deliver an increased land valuation (which is not guaranteed).
- **Step 5** – Once an agreement between a land owner and Spetskomuntrans is reached, a local notary office will get involved, acting as an intermediary, assisting with the process and holding the land ownership documentation until the payment is transferred by Spetskomuntrans (who by that time would have received KCA approval for the transaction). Once the agreed amount of money is transferred to the land owners' bank account, the notary finalises and registers the sale, and the land is then registered in Spetskomuntrans' name.
- **Step 6** – The sale is then registered by the Notary with the City Administration and Land Registry/Cadastre.
- **Step 7** – Spetskomuntrans then applies for the land plot land use designation to change from agricultural usage to industrial.

13.3.69. Spetskomuntrans or KCA cannot follow a compulsory land expropriation process, because based on Ukrainian Law, land can only be expropriated when it is for "public interest" purposes, which are specified as: (i) the need to build a road across the country, (ii) a railway, or (iii) another large infrastructure development of national importance. This project does not fall under any of these categories. It is thus concluded that Spetskomuntrans will be required to buy the land on a "willing buyer - willing seller" basis as described above, and the land acquisition process will be voluntary.

13.3.70. The WSP team met with the land acquisition officer in Spetskomuntrans and also with a land acquisition officer from the Khmelnitsky City Administration (KCA). They described how they follow the Ukrainian Legislation process described above. The details are included in the Livelihood Restoration Framework.

GRIEVANCE MECHANISM

13.3.71. The City has a grievance department which is responsible for Citizens Appeals. During the WSP site visit, a meeting was conducted with the deputy head of the department. The City follows the Law of Ukraine On Appeals of Citizens (1996, amended 2016). According to this law, citizens can appeal either via personal appointment, hot line number or a written letter. Under Article 20 of this law, appeals are considered and resolved no later than one month from the date of its receipt, and immediately for enquiries that do not need further investigation although not later than 15 days of the date of its receipt.

If issues raised in the appeal cannot be resolved within a month, then the recipient will be informed about the further timeline needed to resolve the issue[96].

13.3.72. The department register letters and electronic emails in a database. Citizens also have access to the hotline number as provided on the City website: http://khm.gov.ua/uk/content/zvernennya-gromadyan. In the first half of the year in 2019, about 32,000 queries were raised and the majority of them were resolved positively. Queries are mainly related to obtaining free land plots and financial assistance for the disabled people and people in need of medical help. The majority of grievances were raised by women and covered the following issues:

- Creating better system for waste management;
- Community health and safety in relation to the fire accidents that happened at the landfill, which led to smoke, and emissions and houses had to be evacuated;
- Waste pickers who reside close to the landfill site and cause pollution of their living areas and surroundings; and
- Odour associated with the landfill which predominantly felt by communities during windy periods.

13.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

Land Acquisition / use and Livelihood Restoration

Land Acquisition and Land Use

13.4.1. The land acquisition of land plots for the proposed MBT site is not expected to cause physical displacement of any individuals with legal or customary rights to lands. Spetskomuntrans acquires land on a ‘willing seller - willing buyer’ basis (see above) and during the WSP field visit and meetings with local land owners it was confirmed that the land plots are not being used for farming activities due to their proximity to the landfill site. The land owners interviewed during the WSP visit did not express any concerns about the land acquisition process. In the future, the land acquisition process implemented by Spetskomuntrans will follow the LRF.

13.4.2. Individuals who own land and property that is located within the SPZ for the existing landfill, and those who own land within the new SPZs for the proposed landfill extension and MBT, may experience a reduction in the value of their land and structures due to the Project. Any land, or property, that may in the future be located within the new SPZs for the Landfill extension or MBT would be subject to restrictions on the construction of residential properties, in accordance with the SPZ legislation, which could reduce the value of the land or property. These restrictions would need to be enforced by local planning authorities to ensure compliance with national legislation and prevent future breaches of the SPZ and will need to be monitored by Spetskomuntrans.

13.4.3. The proposed new waste management facilities will enhance solid waste collection and management in the Khmelnitsky City and its suburbs, where the proposed MBT site was selected on the basis of

[96] Security Services of Ukraine (2019). FAQ of filing citizen’s appeals. Available at: https://ssu.gov.ua/en/pages/145 (Accessed 28/08/19).

its proximity to the existing landfill, to reduce the potential for significant effects on settlements, and to utilise a site next to an existing landfill, thus minimising visual and land use impacts.

13.4.4. Potential impacts on the land owners and house owners in the SPZ include restrictions on further construction of residential properties on all land plots within the SPZ area (applicable to the existing landfill, the proposed landfill and the proposed MBT Facility.

13.4.5. Based on the current Project footprint, the Project is not expected to cause any physical displacement of any individuals with legal or customary rights to lands, this was also confirmed by The Company.

13.4.6. To this effect, the impacts associated with land acquisition are considered as 'Minor adverse' given the medium sensitivity of the receptor and moderate magnitude of the impact.

Land for Workers' Accommodation and Storage Areas

13.4.7. Any land that might be required for the Project workers' accommodation or storage areas is expected to be acquired on a 'willing seller - willing buyer' basis in accordance with the National regulations, and this will be aligned with the entitlement matrix developed as part of the LRF. It is highly unlikely that any temporary use of land would cause any significant potential physical displacement or economic displacement as there are lands surrounding the local villages which seem to be left unused.

13.4.8. At this stage, the effect is considered to be 'Moderate adverse' due to its dependence on finding suitable sites (see the section on Labour Influx).

Waste Pickers

13.4.9. The Roma waste pickers' current accommodation arrangements (the cabins located within 50m from the existing landfill site boundary) and their working conditions were discussed with them during July 2019 site visit and later confirmed by Spetskomuntrans and their sub-contractors employing the waste pickers. It was confirmed that all of the Roma waste pickers reside in the cabins/shipping containers and none of them rent properties elsewhere.

13.4.10. The 'Smart Environment Khmelnitsky' Employment Policy (dated February 2019) refers to the currently employed waste pickers and confirms that The Khmelnitsky City Administration and Spetskomuntrans are committed to continue to employ these waste pickers at the new facilities, where appropriate. As the waste pickers accommodation is provided by Spetskomuntrans' subcontractor (although no renting agreement exists – as confirmed) and is linked to their employment, the working condition and accommodation of the waste pickers are addressed on the basis of the PR2 requirements– "Labour and Working Conditions".

13.4.11. The "Smart Environment Khmelnitsky" Employment Policy stated that a priority will be given to the waste pickers for employment in the new sorting facilities at the proposed MBT facility. Some obstruction to work of the waste pickers and contractors may be expected during the construction through the closure of the existing landfill site. The closure of the existing landfill site will happen for a period when construction activities for the landfill rehabilitation will occur. During the closure/construction period, the waste pickers will lose access to the landfill waste dump/collection area and their waste picking activities may become suspended. However, this will be temporary, and it is highly likely that the waste pickers would continue working/assisting with alternative labour work during the construction and closure of the landfill stage. Any potential impact associated with economic displacement during the closure/rehabilitation of the landfill will be managed through implementation of the LRF.

13.4.12. In the absence of mitigation, the effects associated with the temporary economic displacement affecting waste pickers are anticipated to be ‘Moderate adverse’. Mitigation is therefore required and is outlined in Section 13.5.

EMPLOYMENT AND ECONOMY

13.4.13. At this stage, there is no detailed information on the number of jobs and workers required to carry out the construction work. However, based on the field observations and review of the feasibility study, the landfill needs a major rehabilitation work including: excavations, pipe work, building changing rooms and proper sanitary facilities, new cells, waste compactors and others. The process of the rehabilitation will be very labour-intensive, and it is envisaged that the estimated construction workforce would be approximately between 400-450 people at its peak level.

13.4.14. It is understood that there is a significant shortage of skilled and unskilled workforce (particularly manual labour) in Ukraine as more and more local workers move to other European countries such as Germany in search of higher salaries[97]. The shortage of local workforce and complexity of the landfill rehabilitation work could result in employment of foreign contractor(s). At this stage, it is not known how many foreign or national contractors will be employed for this project. In the case of employment of foreign contractor(s), potential impacts associated with labour influx would be anticipated.

Potential Impacts Associated with Labour Influx and Workers’ Accommodation Location

13.4.15. If the location of the Workers’ accommodation is not carefully selected and agreed through consultations with the local communities, there may be the potential for adverse social and environmental impacts on local communities, particularly if the communities are rural, remote or small, such as the Project area. Generally, these impacts are dependent on a variety of factors such as the size of the project, location of workers’ accommodation, current local employment situation and duration of the project. At this stage, the details about the construction workers’ accommodation are not yet known. Depending on the potential location of the Project workers’ accommodation, the nature and level of impacts associated with labour influx could be varied and perceived differently by local community. As a worst-case scenario and due to the above reasons, the following labour influx related impacts could be anticipated on the Project:

- If the majority of non-Ukrainian workers are likely not to speak Ukrainian, they might find it harder to fit into the local community which could cause potential local conflict;
- Long term duration of construction activities (approximately four years as currently planned) could exacerbate the related impacts of labour influx;
- Influx of migrant workers into adjacent villages with their small population could put a strain on the existing infrastructure; and
- The proximity of the workers’ accomodation to local residential households could further contribute to strained relationships between the workers and local residents (see Table 13-2 below).

[97] Talant, Bermet (2018). ‘Ukrainian industry looks for ways to keep its workers’, KyivPost, 9 July. 2018. Available at: https://www.kyivpost.com/business/ukrainian-industry-looks-for-ways-to-keep-its-workers.html?cn-reloaded=1 (Accessed 27/08/19).

13.4.16. The following impacts could be anticipated as a worst-case scenario:

- Increased conflict with residents through movement of workers in and out of the residential areas threatening the peace and quiet of the villages (particularly if there are non-Ukrainian workers are not familiar with local culture and language);
- Increased anti-social behaviour resulting from recreational alcohol or drug use by the workers which is likely to cause potential nuisance, disturbance of local women and reduced local security;
- Nuisance and disturbance of local women (or any potential gender-based violence which could be triggered assuming a worst-case scenario); and
- Impact on usage of facilities and infrastructure if the Project does not accommodate sufficient facilities for workers (i.e. access roads, water and electricity supply, transport etc).

13.4.17. The presence of large number of workers, mainly young males, could contribute to an increased risk of communicable diseases such as HIV. Ukraine has the second biggest HIV epidemic in Eastern Europe and Central Asia (Section 13.3) with Khmelnitsky region having a significant growth in the rate of registered cases of HIV in. The influx of migrant workforce to the area, particularly young, male workers could lead to an increase in community disturbance (e.g. decrease in community cohesion, increase in crime and instability, incidences of gender-based violence) and an increase in the spread of infectious (communicable) diseases from the interaction of migrant workers with the residents of local communities (particularly women).

13.4.18. A brief risk assessment conducted to provide assumptions on the level of impacts pertinent to potential location of the Project workers' accommodation and preferred option.

Table 13-2 – A Workers' Accommodation Site Selection

Options for Site location	Key Impacts	Potential Impact and Recommendations
Close to the SPZ area or within 500m distance from local residential areas	Congestion and inconvenience may be experience by road users, due to increase in traffic resulting from movement of vehicles and site personnel to and from the accommodation Migration of workers in to the area may cause cultural conflicts between the site workers and the local communities. In particular, women may feel unsafe around the male workers. Workers are likely to use recreational facilities in the local area, and therefore recreational activities in the adjacent villages and settlements, particularly at night could exacerbate issues such as alcoholism, crime and anti-social behaviour. Potential strain on local facilities, such as hospitals, if workers accommodation/ facilities does not	The receptor sensitivity being high and the magnitude of the impacts being large (construction of a major infrastructure for 4 years); the effects would be considered as potentially 'Large adverse'. This is pre-mitigation and mainly due to potential proximity of the workers' accomodation to local residents which could be perceived as unacceptable by local communities. This option is not recommended due to its' associated impacts.

Options for Site location	Key Impacts	Potential Impact and Recommendations
	have in-house medical facilities or a medical professional. Increased risk of transmission of diseases such as HIV.	
A workers' accommodation is located in a rural and remote area (further away from local residential areas)	The accommodation that is located away from local residential area is less likely to cause significant issues associated with local access rights, due to certain distance from nearest villages and settlements. Such solution will contribute to fewer interactions between the locals and construction workers. Where workers' accommodation is located away from residential areas, the contractor is obliged to provide complementary transport to and from the site and due to its remote location, is typically expected to provide accommodation with medical and recreational facilities.	If this option is chosen, the magnitude of the impact is reduced and therefore the potential effects with this impact are expected to be 'Moderate adverse'. This is mainly due to the workers' accommodation being further away from the local residential areas. This option is considered as 'Preferred'.

Employment Opportunities and Improved Local Economy

13.4.19. The Project could potentially create opportunities for direct employment of local engineers, graduates, site managers and workers. In addition to direct employment opportunities, there will be opportunities for indirect employment through the procurement of goods and services from local companies, which will further increase jobs in the domestic market. Indirect employment will be created for local businesses such catering facilities, cleaning services and procurement of goods through local contracts. Induced employment is also expected as a result of increased expenditure associated with construction workers spending their salaries and contributing to local economy.

13.4.20. The effects associated with local employment and improved local economy are considered to be 'Minor beneficial'.

Labour and Working Conditions

Child Labour, Forced Labour and Employment Relations

13.4.21. Key labour risks associated with the construction stage could be associated with the following:

- Lack of formal contracts and agreements with construction workers leading to child labour, forced labour, debt bondage, illegal trafficking and sexual abuse;
- Discrimination against workers due to lack of implementation of human resources policy and equality policy; and
- Lack of strict labour monitoring procedures and inspection on the site, leading to some workers (below minimum age) getting involved in hazardous work and also involved in accidents.

13.4.22. National legislation does not require the Company to inspect and carry out regular audits of their contractors, or their contractors existing practices, labour accommodation or employment relationship.

Such audits are carried out by the “Inspektsiya” authorities who are an independent body and thus act independently of the Company. In addition, the Podillya’s contracts with waste pickers do not include any specific statements about forced and/or child labour, or working hours, or annual leave entitlements, or health and safety practice/policies.

13.4.23. In the absence of mitigation and taking into consideration the “High” sensitivity and “Moderate” magnitude of potential impacts (as the number of waste pickers is believed to not exceed 60 people in total during peak/summer time), the effects are considered as ‘Moderate adverse’. Mitigation is therefore required and is set out in Section 13.5.

Supply Chain Monitoring

13.4.24. The salary and accommodation condition of the contract workers are also not monitored strictly by the Company and they have indicated that these issues are out of their control. As such, contractors could breach the national labour law and/or source some construction workers illegally or provide them with unsuitable accommodation. The Company’s inadequate regime for monitoring and inspecting their contractors’ activities, could create potentially significant risks associated with supply chain management in general, and workers accommodation in particular.

13.4.25. In the absence of mitigation and given the high sensitivity of the receptor and large magnitude of the impact, the effects are considered as ‘Large adverse’ considering the estimated number of construction workers (approximately 300-400 at its peak level). Mitigation is therefore required and is set out in Section 13.5.

Occupational Health and Safety

13.4.26. The current state of the cabins and living conditions of the waste pickers do not comply with the EBRD PR2, particularly the requirements pertaining to workers’ accommodation. Moreover, the cabins are even closer to the existing landfill (up to 50m) than some houses located within SPZ (the closest are located approximately 70m from the existing landfill boundary). As such, the current living conditions of waste pickers’ accommodation is a major HSE risk and the waste pickers could be exposed to exacerbated health and safety conditions during the construction stage. In the absence of mitigation, the effects associated with the poor labour and working conditions that will be experience by the waste pickers are considered as ‘Large’ given the high sensitivity of the receptor and large magnitude of the impact. Mitigation is therefore required and is set out in Section 13.5.

13.4.27. Due to uncertainty with regards to national contractors’ HSE practices during the construction stage, based on a worst-case scenario, the effects associated with the construction workers’ occupational Health and Safety are considered as ‘Large adverse’ given the high sensitivity of the receptor and large magnitude of the impact. Mitigation is therefore required and is set out in Section 13.5.

13.4.28. Key impacts and effects related to occupational health and safety during the construction phase include the following:

- **Traffic & Plant**- Increased traffic movements (both on-site and off-site), particularly by heavy vehicles, are anticipated during the construction phase. There is increased potential for accidents involving pedestrians, stock and other vehicles, and potential for damage to roads, decreasing their safety.
- **Release / Mobilisation of Hazardous Substances and Pathogen -** excavation of wastes and disturbance of the landfill body may mobilise hazardous substances which are currently effectively enclosed in the landfill mass, including land fill gas, other hazardous decomposition products and

asbestos. Although excavation would not generate additional biological hazards, it may mobilise any pathogens present into the atmosphere and create increased potential for intake into the body. Anecdotally, there may have been historical disposal of radioactive materials at the facility and, if this is the case, there is potential for increased emissions if materials are disturbed.

- **Ground Excavation**s - A gas pipeline runs below the existing and proposed landfill areas. Damage to this pipeline by direct impact during excavations, or by weakening of the surrounding soils, could cause high volume gas release and fires / explosion. Additionally, other buried services may be present in the land to be used for the proposed landfill. Damage to these could cause lesser, but potentially still significant safety impacts.
- **Stability Impacts -** excavation of the landfill body and adjacent areas, and draining of adjacent wet ground, could impact the stability of the landfill body and lead to slope failure and other instability effects.
- **Fuels & Chemicals -** Diesel, oil and other chemicals may be stored on site. The precise nature and quantities are not known at this time, but they may present a range of health and safety risks due to their physical and chemical properties.
- **Harmful Plants** – A number of invasive species have been seen on site including; hogweed: (either Sosnowsky's hogweed Heracleum sosnowskyi or giant hogweed Heracleum mantegazzianum). Both of which are alien species that pose a health and safety risk to construction workers
- **Other Construction Risks - c**onstruction sites present a high risk of accidents and injuries, due to the complex nature of the activities, operation of high risk activities such as work at height, excavation, concrete pumping, work in trenches and confined spaces, etc. the constantly change site layout and work environment, and a changing workforce, often including the activities of multiple sub-contractors.

Community Health, Safety and Security

Houses within the SPZ

13.4.29. As described above, a number of residential and temporary summer houses (the latter called dachas) were built in the SPZ, where some of these house owners have converted their land into "residential" thus legalising their houses, and some are yet to do so.

13.4.30. As the Project includes the closure and rehabilitation of the existing landfill, any impact that the existing landfill is currently having on residential properties located within it's SPZ is expected to be reduced.

13.4.31. There are currently no permanent properties within the indicative 500m SPZ for the proposed landfill extension, however, there are some cabins which currently accommodate Roma waste pickers. There are a small number of gardens within the indicative 500m SPZ surrounding the MBT site, however, provided the development is located away from the northern boundary of the MBT site, the SPZ should not extend into these gardens and properties. Spetskomuntrans need to ensure that the SPZ for the MBT does not extend as far as these gardens, to minimise potential impacts on local residents' assets and their health and safety.

13.4.32. The Project will be developed based on EU and EBRD standards, and thus the overall environment in the Project area will improve with time. The effects are considered as 'Moderate adverse'.

Increase in Exposure to Air, Noise and Odour emissions

13.4.33. The detailed impacts on the population and construction workers associated with air, noise and odour and groundwater are addressed in Chapter 6, 7 and 12.

Increase in Rates of Vector-Borne and Zoonotic Diseases

13.4.34. There will be risks associated with development of vector-borne or zoonotic diseases affecting houses within the SPZ area. As it is common with landfills, stray dogs could be attracted to the waste dump sites. A few dogs were observed at the site during the WSP field visit and the dogs appeared to be owned by the waste pickers. However, no information is available on whether the dogs have had all the necessary vaccinations, and therefore there are risks associated with development and increase of zoonotic diseases (e.g. rabies).

13.4.35. Rodents and pests can easily access the houses within the SPZ. Other local villages, which are further away from the landfill site, are not expected to be affected. Overall, this impact will be temporary and could be remediated within a short period of time. In the absence of mitigation, given the moderate magnitude of the impact and high sensitivity of the receptor, the effects associated with this impact are considered as 'Moderate adverse'. Mitigation is therefore required and is set out in Section 13.5.

Increase in Injury, Mortality Rates cause by Accidents due to Increased Project-Related Road Transportation

13.4.36. During the construction of the Project, there is an increased risk of traffic collisions due to the construction traffic operating on the road network around the site. In the absence of mitigation, this effect could be 'Moderate adverse' due to the moderate magnitude of impact and medium sensitivity of the receptor.

Reduced Local Security

13.4.37. The impact associated with any reduced local security is covered under labour influx.

Community Infrastructure (including community access rights)

13.4.38. There are major concerns among the local villagers about the deterioration of the quality of roads during the construction and operation stages, as the roads connect villagers with the City. The Company will build temporary access roads to the construction sites to address these concerns and ensure that the existing roads and community Right of Way will not be affected.

13.4.39. The Project construction workers' accommodation (presence of workers) could put a strain on local infrastructure such as electricity, water supply and the City hospital facilities. It is anticipated that the Project will have its own water storage tank for sanitary and construction activities and water pipes and drainage will be built in-house; and medical first aid facilities and a trained first aid employee will also be available on site. In total, there are 17 medical centres, private clinics and hospitals (in and around the City) which could be used by workers. However, the quality of health care facilities for specialist complex cases may not be suitable and patients may be referred to other hospitals outside Khmelnitsky. It is not anticipated that workers' commute to the Project area will affect the capacity of the schools, as the majority of workers are expected to be men with no families (or their families living in different regions/areas).

13.4.40. Due to the temporary nature of this impact and establishment of the Project access roads and expected presence of sufficient facilities at the Project accommodation and construction sites, the effects are considered as 'Moderate adverse' given the high sensitivity of the receptor and moderate magnitude of the impact. Mitigation is therefore required and is set out in Section 13.5.

Community Cohesion and Wellbeing

13.4.41. The presence of construction workers from different backgrounds (Ukrainian or from other countries) and entrance of potential opportunists to the Project area in search of jobs may cause fractions in the local community's interactions and unity, hence affecting social cohesion. The reason for such impact could be due to:

- Increased frustration among the locals due to the newcomers' having a different lifestyle, and potentially culture, language or ethnicity;
- Potential rivalry between the locals and new comers competing for jobs at the proposed landfill and MBT site;
- Workers and construction vehicles movements in and out of the Project area causing disturbance to local residents; and
- Lack of full awareness about the Project construction activities and uncertainty about the accommodation of construction workers are likely to create negative emotions towards, or concerns about workers (similarly to the local residents' current concern about the Roma waste pickers' who obtain wood for common woodlands during the winter period) and therefore could reduce local community's trust in key stakeholders and their ability to deliver a successful Project outcome

13.4.42. Due to the reasons listed above, the effects associated with reduced community cohesion are considered as 'Large adverse' mainly attributed to potential labour influx, potential lack of understanding of the locals about the Project situation and uncertainty about the accommodation and the living conditions of the future workers. Mitigation is therefore required and is set out in Section 13.5.

VULNERABLE GROUPS INCLUDING WOMEN

13.4.43. Overall, the Project is likely to impact on a number of vulnerable groups including women. The significance of these effect could be disproportionately felt by these people through the nature of their vulnerability. Due to potential labour influx, the key risks potentially affecting this group would be associated with the following:

Roma Waste Pickers

- Potential low literacy levels amongst the existing waste pickers could lead to the situation where they do not fully understand their contracts and their related legal rights with regards to the working hours, annual leave entitlement and their job safety.
- Additionally, the cabins' current proximity to the landfill (up to 50m) is likely to be resulting in an increased health and HSE risk to the waste pickers.
- Potential conflict between the waste pickers and the local residents due to uncertainty and concerns about their living conditions.
- Potential lack of the waste pickers' participation in the Project decision-making process.

Gender / Women

- Potential violence towards women is common in Ukraine and was raised during the field interviews.
- Potential discrimination against women, particularly from minority background (Roma).
- Dust and emissions affecting local women and children, particularly those with chronic respiratory illnesses.
- Lack of participation of local women (particularly in traditional male-dominated households) in the Project consultation activities, and their inability to raise their grievances or concerns.

- Local disturbance to local women due to construction workers moving in and out of the local area.
- Lack of job opportunities for women in waste management sector due to social stigma surrounding women working in industrial sector.

13.4.44. A stand-alone brief gender assessment included as Appendix 13.2 provides further details.

13.4.45. In addition to the sections above, people who might have not completed 10 years of schooling, people living on social benefits, and land owners/users with no alternative income, could be affected as a result of the Project construction activities.

13.4.46. Given the 'very high' sensitivity of the receptor and 'large' magnitude of the impact, the effects of the Project on vulnerable groups are considered as 'Large adverse'. Mitigation is therefore required and is set out in Section 13.5.

OPERATIONAL PHASE

PHYSICAL DISPLACEMENT AND ECONOMIC DISPLACEMENT

13.4.47. There are no impacts associated with physical displacement in relation to the operation stage as the land acquisition process (both for the proposed landfill and the proposed MBT facility) will be completed prior to the construction stage in 2021.

13.4.48. However, the need to comply with the national SPZ regulations in the project area, would result in the imposition of restrictions on the construction of permanently occupied residential properties (which is illegal) in the SPZ and thus is addressed in the LRF. Land plots owners within the SPZ area can continue with the construction of dachas, i.e. summer houses, which are typically used by their owners during the summer period,

EMPLOYMENT AND ECONOMY

13.4.49. There will be local employment opportunities and it is anticipated that the following direct jobs will be created:

- The facility, largely a manual dry fraction sorting line, is expected to create 100-200 positions within a year during the operation stage;
- Administration and management jobs as part of the implementation of working group;
- Landfill manager, Landfill master, Operations manager, about three bulldozer operators, housekeeper, guard, welder, truck drivers and maintenance workers; and
- Technical engineering roles will be created for operation of the MBT site and thus waste management engineers are likely to be employed from outside of the Khmelnitsky City, due to potential shortage of such skills in the area. The number of jobs to be created during the operation stage will be less than the construction stage.

13.4.50. The local economy would temporarily experience a reduction in employment opportunities, one the construction stage is completed, and many workers and contractors will leave the Project area. However, operational job opportunities and the new MBT still requires local contractors and the improved facility could result in new expertise moving into the area.

13.4.51. The effects on employment and economy are considered as 'Minor beneficial' due to the number of jobs that will be created as part of the Project.

LABOUR AND WORKING CONDITION

Child Labour and Forced Labour

13.4.52. The operational risk associated with child labour and forced labour is anticipated to be similar to the construction stage. However, the magnitude of this impact could be expected to be smaller due to anticipated lower number of workers (approximately 100-200 mainly local) and limited contract work compared to the construction stage.

13.4.53. The effects are considered as 'Moderate adverse' given the high sensitivity of the receptor and moderate magnitude of the impact. Mitigation is therefore required and is set out in Section 13.5.

Supply Chain Monitoring

13.4.54. The operational risk in relation to supply chain is anticipated to be similar to the construction stage. However, the magnitude of the impact is anticipated to be lower (Moderate) as there will be fewer suppliers required during this stage. The sensitivity of the receptor however is considered as 'High' due to potential breach of national and international labour regulations and potential occurrence of any forced labour, child labour and debt bondage affecting suppliers' workforces.

13.4.55. In the absence of mitigation, the effects are considered as 'Moderate adverse' given the high sensitivity of the receptor and moderate magnitude of impact. Mitigation is therefore required and is set out in Section 13.5.

Occupational Health and Safety

13.4.56. As mentioned in the earlier Community Health, safety and Security sub-section, the Project includes the closure and rehabilitation of the existing landfill, and thus any impact that the existing landfill is currently having on local community and also workers' health and safety, is expected to be reduced. As such, the type of risks to worker health and safety from operation of the upgraded and operated to the EU standards landfill are anticipated to be significantly lower than those at the current facility.

13.4.57. The proposed MBT facility is still at early concept stage and the nature and specification of the facility has yet to be developed.

13.4.58. However, the anticipated impacts and effects for both the proposed MBT facility and the proposed landfill are also summarised below.

- **Fire and Explosion**
  - The nature of the wastes will remain unchanged, so potential for gas generation is similar to the current facility. However, improved landfill gas collection and management is likely to reduce the potential for fires, although a risk will still exist. The designers indicated that the proposed landfill will incorporate a fire-fighting system comprising a pipe with hydrants around the perimeter of the site and a fire-water tank and a pumping station, supplemented by a liquid supply from treated leachate. This improved fire-fighting capacity will reduce the risks of fires becoming serious.
  - Fire risks associated with the proposed landfill and the proposed MBT facility may include generation of flammable / toxic gases, although this is significantly lower risk than for landfills due to the lower residence time of the wastes, and therefore lower potential for build-up of gases. However, this may still be a risk in buildings and enclosed spaces. If fuels (diesel, LPG, etc.) are present at the facility, these also present a risk of fire if ignition sources are introduced, and a fuel which may exacerbate fires started other means.

- **Health Risk and Disease –** The nature of the wastes will remain unchanged, so potential for pathogens is similar to the current facility. Biological and health risks associated with the MBT and the proposed landfill are also similar.
- **Hazardous Materials –** The nature of the wastes will remain unchanged, so potential for exposure to hazardous substances is similar to the current facility. Risks associated with the MBT and the proposed landfill are also similar. However, improved waste receipt and inspection processes will reduce the potential for exposure of workers.
- **Plant and Equipment –** Plant and equipment at the landfill will be similar to that currently present. However, removal of the waste sorting operations to the MBT will reduce the risk of workers from mobile plant at the landfill site. It is anticipated that fixed plant, potentially including conveyors, compactors, balers, etc. will be present at the MBT, introducing potential impacts to worker safety related to crushing, entangling, etc.
- **High Risk Activities –** The presence of fixed plant at the MBT and installation of water treatment plant at the landfill will increase potential impacts associated with work in confined spaces, and energy sources during maintenance.
- **Work near Water –** The leachate ponds will be replaced with enclosed reservoirs, restricting access to water bodies, so potential for impacts will be significantly reduced. Additionally, potential for public access to the site will be significantly reduced, as it is proposed to fence the whole facility.

13.4.59. In the absence of mitigation, the effects associated with Occupational Health and Safety are considered as 'Moderate adverse' considering the high sensitivity of the receptor and moderate magnitude of the impact. Mitigation is therefore required as outlined in Section 13.5.

Community Health, Safety and Security

Residential Households Within the SPZ Area

13.4.60. The impacts associated with the SPZ-related restrictions on the construction of the new permanently occupied residential properties on agricultural land plots in the project area are addressed in the LRF.

Increase in Exposure to Air, Noise, Odour and Impact on Ground Water

13.4.61. The detailed impacts associated with air, noise, odour and groundwater are addressed in Chapter 6, 7 and 12.

Increase in Rates of Vector-Borne and Zoonotic Diseases

13.4.62. The adoption of high standards for the proposed landfill site will limit the potential for the development and spread of resident populations of vermin and pests onsite. The effects are considered as 'Minor adverse' given the high sensitivity of the receptor and moderate magnitude of the impact.

Increase in Injury and Mortality Rates cause by Accidents due to Increased Project-Related Road Transportation

13.4.63. Although the number of vehicles used in the operation of the Project are not currently known, it is anticipated that there will be an increase in the total numbers and the routes of operation will likely change. The change from the existing routine and increase in vehicle numbers has the potential to increase the chance of traffic accidents. In the absence of mitigation, there is the potential for a 'Moderate adverse' effect to occur due to the moderate magnitude of impact and the medium sensitivity of the receptor.

Community Infrastructure

13.4.64. No restrictions to community access rights are anticipated during the operation stage. By the time operations commence, all the construction workers would have left the Project area and any pressure on the existing community infrastructure would be significantly reduced.

13.4.65. In the absence of mitigation. the effects associated with impact on community infrastructure are considered as ‘Minor adverse’.

Community Cohesion and Benefits

13.4.66. It is planned that as part of the establishment of Project Implementation Unit (PIU), community initiatives and waste management awareness programmes will be implemented. The Khmelnitsky City Council has on-going community initiatives such as The Young Entrepreneur School Project, Project “Buy Khmelnitsky” etc. As part of this Project, The Company intend to collaborate with local schools to provide education on waste recycling activities and environmental programmes, as mentioned by a member of the Working Group.

13.4.67. The completion of the rehabilitation process and establishment of the proposed landfill will improve the waste management infrastructure and will also improve the visual view of the site. As part of the Project, there is a plan for upgrading the existing road adjacent to the MBT site. Therefore, the positive impacts associated with the Project considering creation of jobs, improved infrastructure and community initiatives to raise local environmental awareness could cumulatively contribute to a better environment for maximising community cohesion.

13.4.68. Based on the above, the effects associated with community cohesion are considered as ‘Positive beneficial’.

Vulnerable Groups (including women)

13.4.69. The nature of the risks of the Project activities on this group remain similar to the construction stage, and as listed in Section 13.4.43. However, it is anticipated that the magnitude of the impact would be much lower mainly due to the following:

- There will be no labour influx, as the construction workers would leave the Project area once the construction is completed, and thus no related impacts are anticipated (such as disturbance and potential harassment of local women);
- There will be fewer vehicles compared to the construction stage; and
- The waste pickers will be transferred to the proposed landfill site with improved and safe working and living conditions.

13.4.70. In the absence of mitigation, the effects of the Project impact on vulnerable groups are considered as ‘Moderate adverse’ given the high sensitivity of the receptor and moderate magnitude. Mitigation is therefore required as per Section 13.5.

13.5 MITIGATION AND ENHANCEMENT MEASURES

13.5.1. To mitigate the impacts and enhance opportunities, a series of measures have been set out in the ESMP, a summary is provided below.

CONSTRUCTION STAGE

Permanent and Temporary Land Acquisition

- Implement the LRF, and based on the LRF - develop and implement a LRP.

Employment and Economy

13.5.2. The Company will develop and implement an Employment Management Plan covering construction stage.

13.5.3. The following measures are recommended to reduce risks associated with potential labour influx:

- The Company will develop and implement a Construction Accommodation Management Plan, and a Security Management Plan; and
- The location for Project Workers' accommodation will be carefully selected and will meet the requirements of IFC and EBRD Guidance Document[98].

13.5.4. The Company will avoid potential impacts associated with labour migration by implementing the following measures:

- Ensure that the workers' accommodation will not be located nearby local residential areas;
- Ensure that training will be provided to migrant contractors and workers on local culture and traditions;
- Ensure that transport, welfare and medical facilities will be provided for workers in-situ to avoid putting a strain on local infrastructure; and
- Ensure that the workers' accommodation will meet best international practice (IFC and EBRD) requirements.

Labour and Working Condition

Child Labour, Forced Labour and Employment Relations

- Conduct a Labour Risk Assessment and regular audits during the construction stage.

Supply Chain

- The Company will develop and implement a Supply Chain Policy; and
- The Company will develop and implement a Procurement Management Plan to reduce social risks associated with supply chain.

Occupational Health and Safety

- The Company will develop an Occupational Health and Safety Plan; and
- As per the measures suggested in the LRF (LRF, Section 6.2), any potential impacts on the waste pickers' health and safety through their contractual usage of the provided containers that currently serves as their accommodation, Spetskomuntrans will ensure that their renegotiated

[98] IFC/EBRD (2009), Workers' Accommodation: Process and Standards. Available: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_workersaccommodation

contracts/salary is sufficient to allow them to rent local accommodation of adequate standard, away from the site. As their new accommodation will be away from the construction site, with this mitigation measure implement, the residual impact is considered to be 'Minor adverse'. Spetskomuntrans will provide transport for waste pickers or require all contractors to provide accommodation in compliance with EBRD PR2 requirements.

13.5.5. Additionally, as per EBRD PR2, the Company to ensure the following:

- Construction workers' accommodation shall be appropriate for its location and be clean, safe and, at a minimum, meet the basic needs of workers. In particular, the provision of accommodation shall meet national legislation and international good practice in relation, but not restricted, to the following: the practice for charging for accommodation; Workers freedom of movement to and from the employer-provided accommodation shall not be unduly restricted.

Community, Health, Safety and Security

- In accordance with the EBRD PR4, the Company will implement a Community Health, Safety and Security Plan (see ESMP).
- Reduce local security risks by implementing security measures as described above.

Impact on the Properties within the SPZ Area

13.5.6. The Company will:

- Enforce the relevant SPZ regulations to prevent future and illegal construction of permanently occupied residential houses within the SPZ area;
- Provide regular information to local residents (and well in advance) with regards to any notable works and activities that could generate local nuisance or disturbance; and
- Consult with affected people in the SPZ area and provide livelihood restoration assistance such as opportunities for work at the proposed MBT facility. See the LRF entitlement matrix for more details.

Impacts Associated with Air, Noise, Odour and Groundwater Quality Affecting Local Community

13.5.7. Implement air quality control, noise and odour and groundwater mitigation measures as specified in Chapter 6, 7 and 12 (reference to Appendix 13.3 and Appendix 13.4).

Vector-borne or Zoonotic Diseases

13.5.8. Ensure regular monitoring of housekeeping within the construction sites to avoid any spread of rodents and pests. Implement measures outlined in the ESMP.

Increase in Injury, Mortality Rates Caused by Accidents due to Increased Project-Related Road Transportation

13.5.9. During the construction phase a Transport Management Plan will be implemented. This will ensure that transport operations are undertaken safely and that all drivers are adequately trained. A Community Health and Safety Plan will also be implemented as per the ESMP which will put measures in place to ensure signage and safety measures are put in place.

Community Infrastructure

- Ensure establishment and development of temporary access roads as per preliminary design and consult with local communities on the exact location of the proposed access roads;
- Ensure access is maintained throughout construction phase; and

- Ensure a self-sufficient Project in terms of resources (water, electricity, gas) to reduce any impact on local infrastructure and medical facilities.

Community Cohesion and Benefits

13.5.10. To reduce impacts on community cohesion and enhancement of community benefits, the following are recommended:

- Conduct community awareness workshops and consultations with locals on activities associated with construction activities (including potential labour influx);
- Provide training to construction workers on local culture and social;
- Involve local residents in the Project decision-making process through gatherings at community hall or village council office;
- Establish social initiatives where people can interact with each other;
- Collaborate with local NGOs, Khmelnitsky University and schools on establishment of environmental education programmes; and
- Implement a grievance mechanism to record and address community concerns during construction stage (see SEP).

Vulnerable Groups (including women)

Waste Pickers

- As mentioned in the LRF and as part of the LRP preparation, conduct a census and asset inventory and a socio-economic survey to identify all vulnerable individuals who could be affected by the Project, and confirm the assistance that they might require;
- Make sure that the salary of waste pickers allows them to rent locally and privately, away from the site,
- As part of the Supply Chain management (see below), Spetskomuntrans will monitor third parties' compliance with national regulations and all applicable EBRD;
- Include all waste pickers in the Project decision-making process (through separate focus groups discussions with men and women); and
- Build trust and collaborate with head of Roma representatives on issues and concerns resulting from the Project and any temporary loss of jobs.
- Follow the LRF principles throughout the lifecycle of the Project and prepare and implement an LRP.

13.5.11. Implement mitigation measures on incorporation of gender aspects into the Project construction stage as described in further detail in Gender Matrix (Appendix 13.2). In addition, conduct regular consultations with other vulnerable groups to ensure their concerns are addressed.

OPERATION STAGE

Employment and Economy

13.5.12. All the measures specified during the construction stage are also applicable to this stage. Local economy and livelihood of local people will be enhanced through promotion of community initiatives and increased local content through creating and contracting local Small Medium Enterprises.

Labour and Working Condition

Child Labour and Forced Labour

13.5.13. In addition to the measures specified for the construction stage:

- Ensure continuous monitoring of labour and working conditions; and
- Continue to conduct on-site inspections for any sign of children below age of 14 getting involved in any type of jobs.

Supply Chain Management

13.5.14. In addition to the measures specified for the construction stage:

- Ensure continuous monitoring of suppliers' performance and conduct risk assessments to ensure that third parties' performance follows national labour and occupational health and safety legislations, and complies with the EBRD PR02 requirements; and
- Regularly carry out on the spot and on-site inspection of contractors' labour and working conditions and include the details in their reporting to EBRD.

Occupational Health and Safety

- The Company will develop and implement a Solid Waste Management Plan and Material Use Management Plan (See section on Waste and Material Use in ESMP);
- The Company will develop and implement Operational Environmental, Health, Safety Management Plan (See ESMP); and
- The new facilities will be designed in line with EU regulations and BAT (see Appendix 13-3 and Appendix 13-4).

Community, Health, Safety and Security

Properties within the SPZ Area

- Conduct monitoring of the SPZ area regularly to inspect any changes within the living conditions and environmental situation of the area.

Impacts Associated with Air, Noise, Odour and Groundwater Quality Affecting Local Community

13.5.15. Implement air quality control, noise and odour and groundwater mitigation measures as specified in Chapter 6, 7 and 12.

Vector-borne or Zoonotic Diseases

13.5.16. Regularly monitor housekeeping within the sites to avoid any spread of rodents and pests:

- Ensure the appointed CLO conduct regular consultation with local residents to identify any illnesses or health issues which could be associated with the operational phase of the Project.

Increase in Injury, Mortality Rates Caused by Accidents due to Increased Project-Related Road Transportation

13.5.17. As with the construction phase, a Transport Management Plan will be put in place during the operation of the Project. This will ensure a safe way of working is implemented. An operational health and safety plan will also set out measures to apply during operation to ensure safety measures are put in place.

Reduced Local Security

- Collaborate with local policy on any anti-social behaviour or any potential conflict between the Company employees/workers and locals.

Community Infrastructure

13.5.18. The measures are similar to the Construction Stage. In addition, conduct post-monitoring of community infrastructure to ensure quality of roads and other infrastructure is restored to pre-project level. Access must be maintained at all times.

Community Cohesion and Benefits

- Continue with community awareness workshops and consultations with locals following the construction stage and ensure regularity in the consultations;
- Ensure the dedicated Project focal point and CLO would continue with local capacity building and implementation of social initiatives;
- Host events and local gatherings at the village council office; and
- Involve locals in enhancing stakeholder relationships and building trust through a wide range of community workshops.

Vulnerable Groups (including women)

13.5.19. As part of the LRP implementation, conduct post-monitoring of vulnerable groups to ensure their livelihood is restored to pre-project level.

13.6 RESIDUAL EFFECTS

13.6.1. On the assumption that key mitigation measures listed above will be implemented during both construction and operation stage, it is not expected that there will be any significant residual effects as part of this Project.

13.7 SUMMARY

Table 13-3 – Summary of Potential Social Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Land Acquisition and Livelihood Restoration	Land acquisition (for all Phases) is voluntary and is being carried out on the. 'willing buyer-willing seller' basis. Based on the documentation presented by the two companies employing waste pickers, up to 60 waste pickers work at the current landfill site (during pick/summer time). It is expected that waste pickers will be transferred to the proposed MBT facility.	Closure of the existing landfill	Economic displacement and temporary suspension of jobs.	Moderate adverse (significant)	Implement the LRF, and on its basis, develop and implement an LRP. Ensure that the affected waste pickers and other site workers will be given alternative jobs during the closure period.	Minor adverse (not significant)
		Construction	No physical displacement is anticipated. Likely delays or extensions within the construction programme activities and also closure of the landfill will have a consequential impact on the waste pickers' employment.	Minor adverse for land acquisition (not significant) Moderate adverse for economic displacement (significant)	Implement the LRF, and on its basis, develop and implement an LRP. Ensure that all project related impacts are mitigated, and the affected parties are assisted on the basis of their entitlements outlined in the Entitlement Matrix (see the LRF), Section 6.2.	Minor adverse (not significant)
		Operation	Based on Ukrainian SPZ regulations, restrictions on future development of permanently occupied residential houses ion the agricultural land in the SPZ area.	Minor adverse (not significant). The construction of residential houses on the agricultural land is illegal based on national SPZ regulations. However, the construction of summer houses/dachas is legal, and the land owners are within their rights to do so.	Assistance with preferential job offering at the new facilities will be provided to this group of people, if they wish so and have relevant skills.	Neutral (not significant)
Employment and Economy	Unemployment rate is below average national. Regional positive trade.	Closure of the existing landfill	Economic displacement and temporary suspension of jobs.	Moderate adverse (significant)	Implement the LRF, and on its basis, develop and implement an LRP. Ensure that the affected waste pickers and other site workers will be given alternative jobs during the closure period.	Minor adverse (not significant)
		Construction	Employment opportunities and / improved local economy.	Minor beneficial (not significant)	Develop and implement an Employment Management Plan. Promote local investments through assistance to businesses. Collaborate with local NGOs and recycling organisations.	Minor beneficial (not significant)
			Potential impacts associated with labour influx and the presence of the large number of non-local workers in the Project area.	Large adverse (depending on the location of the potential accommodation) (significant)	Carefully select location for a Construction Workers Accommodation, develop and implement: Construction Worker's Accommodation Management Plan (if applicable), Grievance Register, Security Management Plan. Provide training to all workers on community HSE aspects and local customs. Avoid selection of sites in the	Minor adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					proximity to the SPZ area for the Project construction workers' accommodation.	
		Operation	No labour influx but still potential for creation of jobs and attracting talents.	N/A	No impact expected as there will be no labour influx at operational stage, as by that time the construction will be completed, and all non-local workers will be expected to move on.	N/A
Labour and Working Conditions	Risk of children working at site, two young teenagers were observed near the site. Lack of the monitoring of supply chain with regard to labour and working conditions and health and safety issues. Poor occupational health and safety (OHS) at the current landfill site	Construction and Closure (the impact applies to the both stage)	Potential risk associated with child labour, forced labour. Poor accommodation conditions provided to Roma waste pickers as part of their employment package, unless changes are introduced in their contracts.	Moderate adverse (significant)	Implement a Labour Risk Assessment and Audit. As part of their supply chain management, Spetskomuntrans will ensure that their contractors comply with the EBRD PR2 requirements. Regularly Inspect and monitor labour performance / PR2 compliance. Implement grievance mechanism and register. Eradicate any potential acts of discrimination.	Minor adverse (not significant)
			Lack of monitoring of supply chain on health, safety and social issues. Risk of OHS hazards involving workers on site.	Large adverse (significant)	Implement Procurement Plan. Implement Occupational Health and Safety Plan Implement Accidental Management Plan. Implement Emergency Preparedness and Response Plan.	Minor adverse (not significant)
		Operation	Child and forced labour risks anticipated to be similar to construction stage although less likelihood of occurrence due to reduced number of workforce. Supply chain Monitoring, similar to construction stage but with reduced number of suppliers. OHS risks, similar to those at the current facility.	Moderate adverse (significant)	Implement a Supply Chain Policy. Ensure continuous monitoring of labour and working conditions and compliance with EBRD PR2. Continue to conduct on-site inspections for any sign of children below the legal age. Ensure continuous monitoring of suppliers' performance. On-site inspection of contractors' labour and working conditions. Develop detailed operational procedures.	Minor adverse (not significant)
Community Health, Safety and Security	The houses within the SPZ area could be at risk of health, safety and security issues resulting from the Project.	Construction and Closure (covers rehabilitation activities, waste suppressing etc and therefore similar impacts apply)	Community impacts: noise, emissions, groundwater pollution and increased traffic are addressed in Chapter 6,7,12 and 16. Increase in rates of vector-borne and zoonotic diseases.	Large adverse (significant)	Implementation of ESMP. Provide regular information to local residents about the anticipated Project works and potential impacts. Monitoring of housekeeping and employee and community health (via CLO) in relation to vector born or zoonotic diseases. Immediate isolation of waste dumps through temporary cover and reduce waste	Minor adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
			Increase in Injury, Mortality Rates/ Accidents due to Increased Project-Related Road Transportation	Moderate adverse (significant)	footprint. Transport Management Plan and Community Health and Safety Plan.	Minor adverse (not significant)
		Operation	Similar effects on local communities are anticipated during the operation stage.	Large adverse (significant)	Impose SPZ restrictions on construction of new permanently occupied residential houses on agricultural land in the project area (as per Ukrainian regulations) as such construction is illegal in the SPZ.	Minor adverse (not significant)
			Vector-borne and zoonotic diseases, the proposed landfill site will be much improved therefore risks will be reduced; reduction in vehicles expected during the operation stage.	Moderate adverse (not significant)	As part of regular engagement with local communities and during project area walk-overs, monitor the SPZ area regularly to inspect any changes within the living condition and environmental situation of the area, as well as the number and nature of new developments.	Minor adverse (not significant)
			Increase in Injury, Mortality Rates cause by Accidents due to Increased Project-Related Road Transportation.	Moderate adverse (not significant)	Regularly monitor housekeeping within the sites. Regular health check-up of employees to ensure they are healthy and immunised from any infectious diseases. Ensure the appointed CLO conduct regular consultation with local residents to spot any illnesses or health issues. Transport Management Plan and Community Health and Safety Plan.	Minor adverse (not significant)
Community infrastructure	There are 17 hospitals and out-patient medical institutions in and around Khmelnitsky. There are 39 educational institutions in Khmelnitsky Oblast, Oleshin Village has two schools and Ivankivsky has one. The majority of houses within the Project area do not have access to piped water and have wells to use for both drinking and sanitary water.	Construction and closure (similar impacts)	Potential deterioration of road quality during construction and restricted access rights. The project workers' accommodation could put a strain on local infrastructure.	Moderate adverse (significant)	Ensure establishment and development of temporary access roads. Ensure a self-sufficient Project in terms of resources (water, electricity, gas) to reduce any impact on local infrastructure. Ensure that workers' accommodation is equipped with welfare, and medical facilities and that local transport is provided for workers.	Minor adverse (not significant)
		Operation	Reduced impact on community infrastructure as by the time of the operation construction workers left the Project area.	Minor adverse (significant)	The measures are similar to the Construction Stage as specified in Section 13.5.1.5. Conduct post-monitoring of community infrastructure to ensure quality of roads and other infrastructure is restored to pre-project level.	Neutral (not significant)
Community cohesion and benefits	See community health, safety and security and community infrastructure.	Construction	Construction workers from different backgrounds may cause resentment among local residents.	Large adverse (significant)	Ongoing consultation and awareness of grievance process. Training for construction workers on local culture and social norms.	Minor adverse (not significant)
		Operation	Waste management awareness programmes will be implemented.	Minor beneficial (not significant)	Ongoing consultation. Dedicated Project focal point and CLO for local capacity building and implementation of social initiatives, including hosting events and local gatherings at the village council office.	Minor beneficial (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Vulnerable groups including women	Some individuals or groups are more vulnerable than others, and if affected by the Project, will require the implementation of special livelihood restoration and/or assistance measures.	Construction	Key risks potentially affecting vulnerable groups.	Large adverse (significant)	Implement mitigation measures to incorporate gender aspects into the Project construction stage. as described in Gender Matrix (Appendix 13-2). Compliance with the LRF principles throughout the lifecycle of the Project. Implement LRP. Include the Roma waste pickers in the Project decision making. Build trust and collaborate with head of Roma waste pickers on issues and concerns associated with the affected waste pickers.	Minor adverse (not significant)
		Operation	Risks similar to construction stage but with a lower magnitude of impact.	Moderate adverse (significant)	Conduct post-monitoring of affected vulnerable groups through focus group discussions (including women focus group) to ensure their livelihood is restored to pre-project level and provide training for the current employees/waste pickers to develop alternative skills.	Minor adverse (not significant)

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MATERIALS AND WASTE

14 MATERIALS AND WASTE

14.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

INTERNATIONAL

EIA Directive (2014/52/EU)

14.1.1. The EIA Directive[99] provides the overarching legislative framework for assessing the significance of impacts and effects from projects on the environment.

14.1.2. The Directive requires that environmental assessment takes a full account of the "*nature and quantity of materials" used on a project, to ensure that "resource efficiency (is) increased".* The Directive also requires a description of the "*material assets*" which will be significantly affected by a project, as well as a description of the "*quantities and types of waste produced during the construction and operation phases".*

Directive 1999/31/EC on the Landfill of Waste

14.1.3. The Directive on the landfill of waste[100] aims to prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from the landfilling of waste, during the lifecycle of the landfill.

Waste Framework Directive (2008/98/EC)

14.1.4. The Waste Framework Directive[101] sets the basic concepts and definitions related to waste management and lays down waste management approaches such as the 'polluter pays principle'.

14.1.5. It provides a comprehensive foundation for the management of waste across the European Community and provides a common definition of waste which defines waste as:

"…*any substance or object that the holder discards or intends to, is required to discard*"

14.1.6. The Waste Framework Directive also sets out the Waste Hierarchy (Figure 14-1) against which action to reduce the production and disposal of waste shall be taken.

[99] European Commission (EC) (2014). The Environmental Impact Assessment Directive (2014/52/EU).

[100] EC (1999). Directive 1999/31/EC on the Landfill of Waste.

[101] EC (2008). The Waste Framework Directive (2008/98/EC).

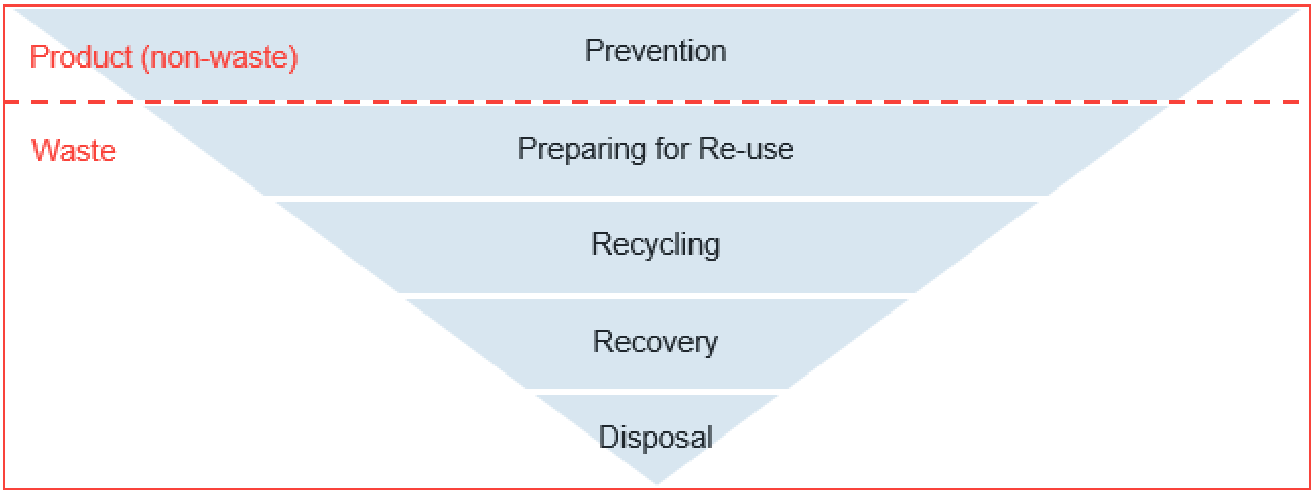

Figure 14-1 – Waste Hierarchy

14.1.7. The main principles of the Waste Hierarchy are:

- Prevention - using less material in design and manufacture; keeping products for longer; re use; using less hazardous materials;
- Preparing for reuse - checking, cleaning, repairing, refurbishing, whole items or spare parts;
- Recycling - turning waste into a new substance or product; includes composting if it meets quality protocols;
- Recovery - anaerobic digestion; incineration with energy recovery; gasification and pyrolysis which produce energy (fuels, heat and power); recovering materials from waste; some backfilling; and
- Disposal - landfill and incineration without energy recovery.

NATIONAL

Ukrainian National Waste Management Strategy until 2030

14.1.8. Prior to the implementation of the Ukrainian National Waste Management Strategy[102], Ukraine experienced high levels of waste generation and low rates of recovery and re-use of secondary raw materials. The aim of the National Waste Management Strategy is to establish regional waste disposal centres and introduce circular economy principles that accord with the highest tiers of the Waste Hierarchy.

14.1.9. The National Waste Management Strategy provides short, mid and long-term targets for addressing the challenges for all main waste sectors (e.g. industrial waste, construction and demolition waste, hazardous waste, agro-industrial waste and specific waste streams) as well as the fulfilment of obligations of Ukraine according to international agreements.

[102] Ukrainian National Waste Management Strategy until 2030 (2017).

14.1.10. The Strategy is considered one of the main drivers of waste management market development, compliant with the EU requirements and close to the innovative integrated concept[103].

14.1.11. The short-term targets in the Strategy (adopted between 2017 and 2018), focused on institutional improvements and implementation processes, such as the establishment of:

- Waste management government bodies;
- Waste legislation and technical regulations (for example, tax incentives, reform of tariffs, and the introduction of Extended Producer Responsibility, EPR); and
- Educational plans for re-using natural resources, waste, recycling and disposal.

The Strategy's medium-term targets (2019 – 2023) focus on the development of standards, regulatory and methodological documents for waste management, and measures related to information systems and educational programmes e.g. population awareness, transformational behaviour change and research and development. Long-term targets (2024-2030) relate to the modernisation and assurance of waste management business entities (including investment in equipment, technology and infrastructure development) and the digitalisation of waste management industries.

14.1.12. The overarching goals of the Strategy, which are to be achieved by 2030, are to[104]:

- Increase the percentage of MSW recycling to 20% (in 2017 MSW recycling was at 3%);
- Reduce the percentage of waste that is sent for disposal to landfills to 35% (in 2017 waste to landfill was at 50%); and
- Increase the percentage of waste subject to thermal disposal to 10% (in 2017 thermal disposal was at 2%).

14.1.13. Key targets in relation to the management of household and hazardous waste are:

- Organisation of separate waste collection in 5,000 settlements;
- Construction of 240 waste reception centres;
- Construction of 735 waste recycling facilities;
- Construction of 19 plants for thermal waste disposal;
- Construction of 50 modern MSW landfills; and
- Closing and reclamation of the 5,700 existing MSW landfills.

14.1.14. The Project will support the implementation of this Strategy, though the closure of the existing landfill, construction of a modern SW landfill and a MBT facility.

NATIONAL LEGISLATION

14.1.15. The Project is required to comply with all applicable Ukrainian legislation. The key legislation for waste management is as follows:

[103] Ministerie van Lnadbouw, Natuur en Voedselkwaliteit (2019). Study on Waste Management in Ukraine.

[104] Waste Management 2019: Market Background and Law Changes.

- Law No. 187/98-VR 'On Waste' (updated in January 2018) [105]. The law prohibits the disposal of non-recycled waste to landfill.
- Law No. 3073-III 'Amendment to Legislative Acts of Ukraine on Waste'. [106]

EBRD Requirements

14.1.16. The EBRD's project requirements[107] as relevant to this chapter, are as follows:

- The Project shall be structured to be compliant with applicable legislation, strategies and standards;
- Reasonable measures shall be included to avoid, minimise or mitigation any adverse change in environmental and social conditions and impacts; and
- Compliance with the following requirements:
  - PR1: Environmental and social appraisal and management establishes the importance of integrated assessment to identify the environmental and social impacts and issues associated with projects, and the client's management of environmental and social performance throughout the life of the project; and
  - PR3: Resource Efficiency and Pollution Prevention and Control recognises that increased economic activity and urbanisation can generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels.

14.2 ASSESSMENT METHODOLOGY

SENSITIVITY, MAGNITUDE AND SIGNIFICANCE

14.2.1. This assessment considers the sensitivity of materials and waste receptors, the magnitude of impact on those receptors during the lifetime of the Project, and whether (in combination) that has the potential to result in significant adverse environmental effects.

14.2.2. The sensitive receptors that have been incorporated in this assessment are:

- The availability (stocks, production and/or sales) of materials regionally and within Ukraine; and
- Landfill void capacity of regional and national infrastructure, to the first year of operation of the scheme.

14.2.3. The magnitude of impacts from the Project that have been considered in this assessment include anticipated reductions:

- In availability (stocks, production and/or sales) of materials regionally and within Ukraine; and
- In the landfill void capacity of regional and national infrastructure.

[105] Laws of Ukraine (March 1998). Law 'On Waste' No. 187/98-VR.

[106] Laws of Ukraine (March 2002). Amendment to Legislative Acts of Ukraine on Waste, No. 3073-III.

[107] EBRD (2019). Performance Requirements and Guidance. Available at: https://www.ebrd.com/who-we-are/our-values/environmental-and-social-policy/performance-requirements.html (Accessed 28/08/19).

14.2.4. The significance of environmental effect for materials, and waste, has been determined by comparing the sensitivity of receptors with the expected magnitude of impact from the Project. Impacts have been assessed using professional judgement and experience in line with relevant legislation, policies and guidance.

14.2.5. In summary, the assessment aims to identify whether impacts occur during construction and operation and are adverse or beneficial, short-term or long-term and direct or indirect, and whether resultant effects are significant or not.

ASSESSMENT NOTES

14.2.6. The likely types and estimated quantities of material resources required (including site arisings generated) for the Project have been assessed. Impacts and effects have been evaluated against data for the regional and national materials markets, where such information is available.

14.2.7. The likely types and estimated quantities of waste have been considered for the Project. Impacts are evaluated against the capacity of regional (or if appropriate, national) waste management infrastructure.

14.2.8. It should be noted that there are potential impacts and effects associated with waste that cannot be predicted with accuracy, as they would only occur from the result of unplanned, accidental occurrences (such as spillages) or as a result of failure by a contractor or sub-contractor to follow procedures. Often these risks can be reduced or eliminated through well planned and controlled construction site management. For all impacts falling into this category, professional judgement about the extent of impact have been influenced by the likelihood that an impact would actually occur. This took into account the nature, frequency and duration of the activity and the waste concerned, its location in relation to relevant receptors, and any control measures that will be committed to by the contractor, as set out in the ESMP.

14.2.9. Opportunities to eliminate, reduce, reuse, recycle or recover material resources, site arisings and (potential) waste, were identified through a review of the Project (including proposed building materials, construction methods and design, where available) and in accordance with industry best practice.

14.2.10. The regional and national capacity of infrastructure designed to process and divert arisings and waste from landfill (for example, Materials Recycling Facilities) are not, as beneficiaries of surplus resources, considered sensitive receptors in the context of this chapter. Instead, where any arisings can be managed through such infrastructure (rather than being disposed of), it will reduce the magnitude of impact of landfill void capacity.

SCOPE OF THE ASSESSMENT

14.2.11. The following topics have been assessed in this Chapter:

- The consumption of material resources (from primary, recycled or secondary, and renewable sources, and including products offering sustainability benefits) including the generation and use of arisings recovered from the Project;
- The generation of waste from the construction of the Project; and
- The generation of waste from treatment processes and employees during the operational phase of the Project.

METHODOLOGY

14.2.12. The assessment process aims to:

- Take into account the results of any consultation;
- Identify materials (primary, secondary, recycled, excavated for reuse, manufactured) required for the project and the associated quantities;
- Establish the anticipated waste and recoverable arisings from the Project, by quantity and type;
- Evaluate the impacts from material consumption and waste generation and disposal, to determine whether they are adverse/beneficial, permanent/temporary, and direct/indirect; and
- Determine the significance of effects that will arise from in scope elements in relation to materials and waste.

14.2.13. The main outputs of this assessment are:

- Identification of environmental impacts and effects associated with material resources (including site arisings) and waste; and
- Potential measures that could be implemented to eliminate or mitigate impacts, and to fulfil resource efficiency and circular economy[108] opportunities.

Method of Baseline Data Collection

14.2.14. The baseline data collected and presented in this chapter were obtained by desk study.

14.2.15. Currently the following development data (Table 14-1, as provided by the client through confidential financial data) is available regarding the volumes of construction materials to be consumed. No information on their source or recycled content, or the volumes of construction waste anticipated (or their management / disposal method) are available.

Table 14-1 – Available Materials and Waste Data for the Project

Design Feature	Material	Quantity (m^2)	Weight (m^3)	Assumptions
Surfaces	Asphalt	15,000	2,550	Surfaces assumed to be asphalt; layers reported to be laid at a depth of 100mm.
Concrete pads	Concrete	3,300	1,118	Depth of concrete pads is assumed to be 150mm.

[108] The Circular Economy is a concept that seeks to eliminate waste from each stage of a project, product or material lifecycle, and the continual use of resources in their highest possible value application

14.2.16. The impacts and effects have been assessed using professional judgement, based on knowledge of developments that are similar in scale and nature, due to limitations in the extent of available data and the certainty with which it can be relied upon (the Project is at an early stage of development).

Materials

14.2.17. The assessment of the impacts of consuming materials required during construction (anticipated to begin in 2021/22 and last between two and four years) and operation, was undertaken by considering the likely origins and sources of materials, including their general availability (production, stock, sales) and the proportion of recovered (reused or recycled) materials they contain.

14.2.18. The potential to reuse excavated materials and other arisings has been evaluated as part of the assessment of materials, to determine whether adverse effects associated with the consumption of primary resources can be reduced.

14.2.19. The assessment takes into account the sensitivity of receptors and magnitude of impacts (adverse/beneficial, permanent/temporary, direct/indirect) from materials, and uses professional judgement to determine overall the significance of effect(s).

Landfill Capacity

14.2.20. An assessment of the remaining landfill capacity in Ukraine has been used to provide a baseline, against which the impacts and effects of waste generated during construction and operation of the Project can be compared.

14.2.21. The assessment considers the volumes of waste anticipated to be generated by the Project and determines the potential impact on the remaining landfill capacity in the region. Where waste has the potential to be recovered (diverted from landfill), this has been considered in the assessment of impacts and resultant effects.

14.2.22. The assessment has taken into account the nature of impacts (adverse / beneficial, permanent / temporary, direct / indirect) from waste generated, and disposed of, and has used professional judgement to determine the significance of effect.

14.3 BASELINE CONDITIONS

14.3.1. This section provides an overview of baseline material consumption, and waste generation and disposal information, in the context of which the assessment is undertaken.

14.3.2. The availability of data for material resource trends, landfill capacity and waste recovery is limited in the Ukraine. The most up-to-date sources of available information at the time of writing have been used and referenced accordingly.

MATERIALS

Materials Currently Required

14.3.3. The site is currently an operational landfill. As such, it is expected that there are limited requirements for the consumption of construction or other materials.

Material Availability

14.3.4. Figures 14-2 and 14-3 provide an overview of the availability - in the Ukraine - of the main materials that would (based on experience of developments of a similar scale and nature from the UK) typically be required for the construction of solid waste infrastructure projects. They provide the context in which the assessment of impacts and effects from the Project can be based.

14.3.5. After a steep decline in 2008, the availability of building bricks and cement increased in line with the recovery of the construction sector in the Ukraine (Figure 14-2).

14.3.6. In the Ukraine, steel production also suffered a steep decline around 2008 (Figure 14-3). However, the level of production increased and stabilised during 2008-2014. There was another steep decline in 2014, although between 2014 and 2019, steel production has stabilised, though at a low level (comparable to 1995-2000).

14.3.7. It is understood that a geotextile membrane will be one of the resources used to close the existing landfill. Whilst no data is available on the national production, availability or stocks of this product type in the Ukraine, it would – by volume – be expected to comprise a relatively small proportion of the overall resources consumed on the Project. Baseline data on this product has therefore not been included in this chapter.

14.3.8. Non-structural soil will also be used in the landfill closure, as part of the surface capping layer. It is expected that this resource can be found abundantly in-country, and – hence – no further baseline data for soil has been sought for this chapter.

Figure 14-2 – Construction Materials Market Trends[109]

[109] InvestUkraine and Deloitte (2012). Industry Overview: Construction and building materials market in Ukraine.

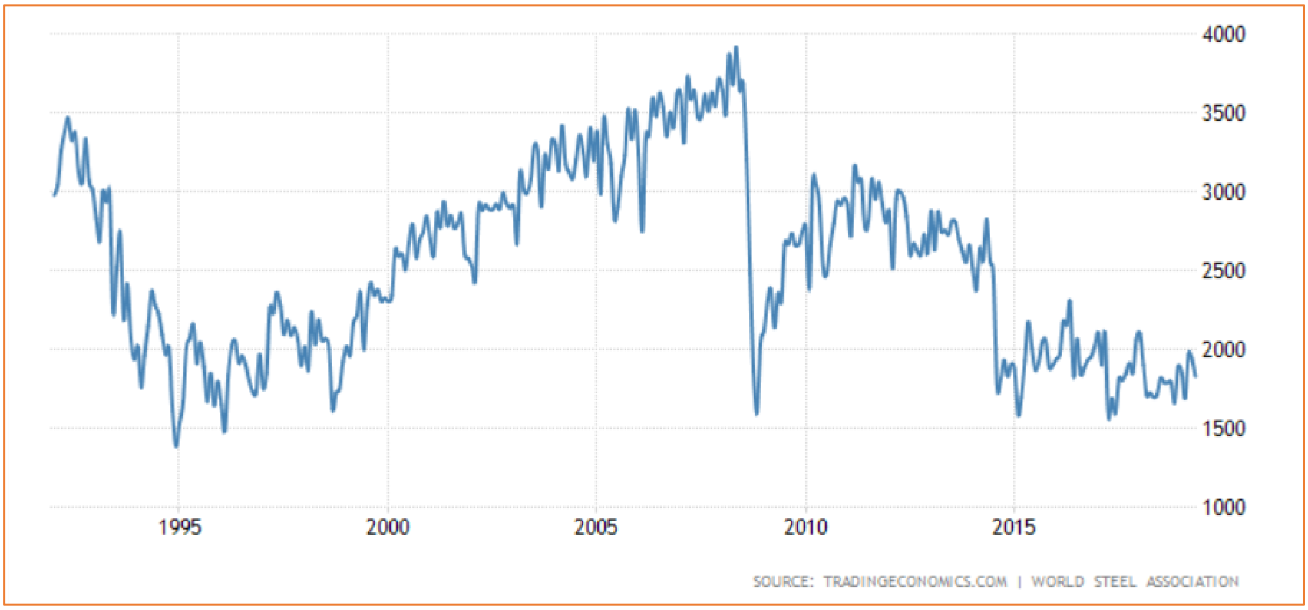

Figure 14-3 – Steel Production Trends (1,000 tonnes)[110]

14.3.9. This information indicates that the main materials (by volume) that are typically required to deliver construction projects of this nature, are readily available in Ukraine. Due to lack of data on materials required by the Project, a working assumption has been established in that no issues of availability will manifest themselves, though Figure 14-2 and 14-3 do indicate that market strength (and hence supply chain security) are prone to suffer steep declines.

14.3.10. At this time, information on construction materials comprising re-used/recycled content in Ukraine is not available for inclusion in this chapter.

14.3.11. The Project will require the consumption of materials during construction. However, during operation there will be very limited requirements for material consumption (outside normal maintenance and operational activities).

14.3.12. The proposed MBT Facility will help to recover recyclable materials from Municipal Solid Waste (MSW)[111] only. Therefore, the MBT facility will minimise impacts on landfill from MSW, rather than enhance the availability and consumption of construction materials.

SITE ARISINGS

Site Arisings Currently Generated

14.3.13. As the site is an operational landfill, there is currently limited generation of site arisings.

14.3.14. A team of 20 to 60 Roma waste pickers work at the existing landfill (numbers vary throughout the year). The waste pickers work in shifts collecting plastics and other materials for re-use from the

[110] Trading Economics (2019). Ukraine Steel Production: Ukraine.

[111] Comprises household waste collected by local authorities and some commercial and industrial wastes.

existing landfill. The waste pickers are employed by two private companies who are subcontracted by Spetskomuntrans. The plastics and other materials are then baled (Figure 14-4) for onwards recycling / re-use. No data on the quantities of plastic and other material picked and removed from landfill, were available at the time of writing.

Figure 14-4 – Plastic Picked and Baled for Onwards Recycling / Reuse

Transfer, Recovery / Recycling Rates and Capacity

14.3.15. The current transfer, recovery and recycling rates and capacity in Ukraine are very low. In 2011, the State Agency for Investment and National Projects of Ukraine (Invest Ukraine) stated waste processing levels were between 5-8%, with only 15 waste separation lines, two incineration plants, and no waste processing plants in the country.[112]

14.3.16. In Ukraine in 2016, only 5.8% of household waste was recycled; 2.71% was incinerated, 3.09% was sent to other recycling stations and 0.003% was composted. The vast majority (approximately 94%) was sent to landfill and other disposal sites.[113] This information indicates that the availability of transfer, recovery and recycling infrastructure in Ukraine is currently very low. Most arisings across all industries are not recovered and are (as a result) sent to landfill.

14.3.17. Within the City of Khmelnitsky, municipal wastes are disposed of at the existing landfill[114]. With the exception of the two organisations operating waste picking activities at existing landfill no other transfer, recovery or recycling of waste is known to occur.

[112] Global Recycling Magazine (2017). Ukraine Waste Management: Yet Dependent on Investments.

[113] Ministry of Foreign Affairs (2018). Waste Management in Ukraine: Opportunities for Dutch Companies.

[114] R&D Technological Institute of Urban Municipal Economy (2018). Feasibility study for solid municipal wastes processing facility construction (wastes sorting line) aimed to retrieve raw materials finished products from disposed domestic wastes.

14.3.18. Accordingly, it is expected that any arisings that the Project generate during construction, and which cannot be used on-site in landscaping and other similar capacities, will be sent to landfill.

14.3.19. During operation, the Project is expected to improve the transfer, recovery and recycling capacity of municipal waste in Ukraine and the City of Khmelnitsky, therefore, would positively reduce in country disposal rates and work towards achieving the objectives of the National Waste Management Strategy which aligns with the circular economy principles and the waste hierarchy.

14.3.20. The feasibility study[114] expects that during the operation of the Project, recovery rates of 60-95% could be achieved for paper and cardboard; 70-95% for glass; 80-95% for plastic and aluminium; and 90-95% for ferrous metal.

WASTE

Waste Currently Generated

14.3.21. As the site is an operational landfill, there is very limited waste currently generated; any minor quantities of waste produced would likely be disposed of on the landfill itself.

14.3.22. The site has accepted untreated solid household waste since 1956 and is reaching maximum capacity. The quantity of waste sent for disposal at Khmelnitsky between 2015 and 2017 is reducing (from 171,000 tonnes to 105,000 tonnes). [114]

14.3.23. A study on the morphology of the waste[114] currently received at Khmelnitsky indicates some seasonal fluctuation. However, the majority of received waste is consistently organic (44 - 46%), with glass and ceramics comprising 11 - 18%, construction and repair waste 7 - 16%, plastics 9 - 11% and cardboard and paper 7 - 12%. The remainder of the waste volume comprises metals, hazardous wastes, electrical waste and other unsorted residues.

Remaining Landfill Capacity

14.3.24. In 2017, Khmelnitsky generated approximately 92,000 tonnes of MSW per annum; this is anticipated to increase to approximately 107,000 tonnes per annum by 2027. Nearly all of the MSW is landfilled, with no prior treatment, at the existing landfill.

14.3.25. The average annual waste generation rate in Ukraine is 250-300kg per person, and this rate is increasing over time.

14.3.26. The current landfill at Khmelnitsky, which the Project aims to close, has been in operation since 1956. As stated, it is currently approaching its maximum capacity, and the need to develop an integrated SWM system is urgent.

14.3.27. According to the official data on the (approximate) 5,500 landfills and other disposal sites in Ukraine, in 2016 almost 6% were over capacity and 30% did not meet national environmental safety standards. Due to the insufficiency of control and the lack of proper waste management systems, over 27,000 unauthorised disposal sites are formed each year and require closure. It is estimated that 2,000 ha (20 km^2) of additional land will be required for new landfills in Ukraine in the future.[115]

14.3.28. Based on this information, it is reasonable to assert that there is very limited landfill capacity remaining in Ukraine.

14.3.29. Within the City of Khmelnitsky, it is forecast that the annual generation of MSW will increase from 84,000 tonnes to 91,000 tonnes by 2028[114].

14.3.30. The Project will generate waste through construction which is likely to be landfilled at the Site. This will negatively impact the total landfill capacity in the country. During operation, the Project is expected to reduce adverse impacts on landfill capacity through the provision of the proposed MBT facility which will help recover valuable recyclable materials, and generate compostable materials, supporting the aims of the National Waste Management Strategy.

14.4 POTENTIAL IMPACTS AND EFFECTS

14.4.1. The table below summarises potential impacts associated with material consumption, and waste generation and disposal.

14.4.2. The associated potential environmental impacts (both direct and indirect) would occur principally during construction. The magnitude of the impacts is considered to be negligible during operation.

Table 14-2 – Environmental Impacts

Element	Direct Impacts	Indirect Impacts
Materials	Consumption of natural and non-renewable resources	▪ Release of greenhouse gas emissions ▪ Water consumption and scarcity ▪ Nuisance to communities (visual, noise) ▪ Impacts on health and wellbeing
Waste	Reduction in landfill capacity	▪ Release of greenhouse gas emissions ▪ Nuisance to communities (visual, noise) ▪ Impacts on health and wellbeing

CONSTRUCTION PHASE

14.4.3. Construction of the Project will require the procurement, transport and use of the following materials:

- Bulk materials for earthworks, including soil for use in capping the existing landfill;
- Primary aggregate, recycled and secondary aggregate;
- Steel e.g. for structures, sheet piling and fencing;
- Precast or prefabricated concrete;
- Road paving materials, including sub-base and bituminous materials;
- Drainage and other pipework e.g. for the proposed gas collection system;

[115] Ministry of Foreign Affairs (2018). Waste Management in Ukraine: Opportunities for Dutch Companies.

- Timber for use in the temporary works (e.g. shuttering) or in the permanent works (e.g. fencing);
- Technology and plant specific for the MBT facility; and
- Other general construction materials, including geotextile membranes

14.4.4. The construction phase will also result in the production of wastes, including:

- Surplus topsoil or subsoil materials arising from earthworks;
- Timber, steel, concrete, bricks, and aggregate waste;
- Any hazardous or contaminated material found or generated on-site;
- Vegetation and other above-ground materials produced by site clearance, including notifiable or injurious weeds; and
- General construction waste, e.g. packaging, ducting and pipework, plasticised products, damaged goods.

14.4.5. The consumption of primary and secondary materials would be required for the construction of the Project and any associated civil infrastructure. Primary materials are a finite resource and whilst some will be available through regional supply, national or wider sourcing is also likely to be required. Whilst it is anticipated that efforts will be made to maximise the specification and use of materials with known sustainability credentials (use of recycled content, for example), impacts from consuming primary resources would still arise. Impacts would be adverse, direct and permanent, and would result in the (effect of) depleting natural resources, and regional or national resource stocks, and the degradation of the natural environment.

14.4.6. Site preparation and remediation (incorporating ground works, excavation and site clearance) will produce construction arisings (top soil, vegetation and other earthworks). It is expected that most of this material will be recovered for reuse on site, and only be disposed of in the landfill as a last option. Based on professional judgement there is likely to be some potential to recover resources during site preparation and remediation.

14.4.7. Using professional judgement and based on the scale and nature of the construction plans for the Project, and the maturity of regional and national infrastructure to minimise disposal to landfill, it is assessed the effects of both material consumption, and the disposal of waste, would, before mitigation, be **moderate adverse** (**significant)**.

OPERATIONAL PHASE

14.4.8. The operational phase of the Project may require the consumption of materials and generate waste that needs to be disposed of to landfill, as part of the ongoing maintenance requirements (including repair work) for the proposed landfill and the proposed MBT Facility.

14.4.9. The quantity of materials required, and waste generated from maintenance, repair and operational site activities (office / administration waste, for example) is, however, forecast to be minimal and therefore effects are considered (using professional judgement) to be **minor adverse (not significant)**.

14.4.10. It should be noted that the primary purpose of the Project is to improve waste disposal capacity through the provision of the proposed landfill and the proposed MBT Facility, specifically designed to help recover and recycle valuable materials from MSW, before disposing of the remainder in the landfill.

14.4.11. The proposed landfill would be designed and constructed on the available land plot of 6 hectares (60,000 m^2). The landfill size could be increased to 10 hectares (100,000 m^2) as part of a separate project at an appropriate time. The estimated capacity of the proposed landfill is 500,000 to 700,000 tons of MSW.

14.4.12. On balance during the operational phase effects are considered to be **minor beneficial (not significant)** as the new landfill and the MBT Facility will positively influence waste management practice and (simultaneously) reduce MSW disposal rates in Ukraine.

14.5 MITIGATION AND ENHANCEMENT MEASURES

14.5.1. These mitigation and enhancement measures are also reflected within the ESMP.

CONSTRUCTION

14.5.2. **Design measures,** and circular economy opportunities to avoid and mitigate adverse impacts from material resources consumption and site arisings, and the generation and disposal of waste, shall include:

- Design for resource optimisation: simplifying layout and form, using standard sizes, balancing cut and fill, maximising the use of renewable material resources, and materials with recycled or secondary content, and setting net importation as a scheme goal;
- Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction;
- Design for recovery and reuse: identifying, securing and using material resources at their highest value, whether they already exist on site, or are sourced from other schemes; and
- Design for the future: considering how material resources can be designed to be more easily adapted over an asset lifetime, and how deconstructability and demountability of elements can be maximised at end-of-first-life;

14.5.3. **Measures to be adopted during construction** to avoid and mitigate adverse impacts from material resources consumption and site arisings, and the generation and disposal of waste, shall include:

- Implementation of a Construction Environmental and Social Management Plan (CESMP), incorporating a Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) to effectively identify, monitor and manage materials, arisings and waste on site. For example, these documents will set on-site waste practices and targets for the Project, incorporating a suitable programme of regular monitoring to focus upon:
  - Quantification of waste by type, volume and destination;
  - Methods by which the waste streams are being handled and stored at site;
  - Available management routes used e.g. recovery, transfer, disposal; and
  - The success of waste management initiatives employed.
- Recovery of resources from site preparation / excavation for re-use in the construction (and/or recycle / stockpile them for future use on other development schemes).
- Treatment of earthworks and topsoil material classified as unacceptable for reuse, to divert these arisings from landfill, where the cost-benefit of such action is proven beneficial.
- Provision of temporary site waste segregation areas to ensure that construction waste materials are securely stored prior to reuse, recycling or disposal.
- Placing haul and construction access roads in the same locations as the final highway layout to minimise the consumption of materials and potential for waste to landfill.

- Ensuring, through contract, that suppliers of raw materials and products are committed to reducing surplus packaging. This includes the reduction and take-back of plastics (i.e. shrink wrap and bubble wrap), cardboard and wooden pallets.

OPERATION

14.5.4. As no adverse impacts or significant effects from the operation of the Project are expected, no mitigation measures are required.

14.5.5. However, the following actions would be expected to be implemented, to ensure that consideration of the prevention and minimisation of waste meets good practice requirements.

14.5.6. Implementation of an Operational Environmental and Social Management Plan (OESMP), The development and implementation of an Operational Waste Management Plan (OWMP) for the Project, to include:

- Methods used for the prevention of operational waste (examples could include):
  - Creating a paperless office environment – discourage unnecessary printing;
  - Sourcing and purchasing products with less or no packaging - evaluate the packaging used and eliminate single-use containers;
  - Hiring or leasing (rather than purchasing) electrical and electronic equipment, or furniture;
  - Donating unwanted but reusable / repairable items to local charities;
  - Requesting that vendors take back their packaging;
  - Supplying reusable plates, mugs and cutlery and remove all disposable catering items; and
  - Investing in better quality equipment to reduce the number of times it needs to be maintained, repaired or replaced.
- Establishment of the types and quantities of waste expected to be generated during the operation of the Project (excluding MSW received by the landfill and/or MBT facility):
  - Waste generated from maintenance and repair activities;
  - Waste generated by administration / office facilities; and
  - Waste generated from employees / canteen.
- Segregation and storage of recyclables from residual / general waste.

14.6 RESIDUAL EFFECTS

CONSTRUCTION PHASE

Materials

14.6.1. Although the market for construction materials has fluctuated in Ukraine in the past decade, the trends suggest that the availability is increasing in line with a resurgence in the industry.

14.6.2. The Project will require the consumption of materials in construction, with minimal (negligible) volumes required during operation for on-going maintenance and repair. Therefore, there will be adverse, permeant and direct impacts and effects through the consumption of natural and non-renewable resources associated with the construction phase of Project only.

14.6.3. In the absence of data and information, it is reasonable to assert that subject to the successful implementation of all mitigation and enhancement measures listed in Section 14.5, the impacts from material consumption would be reduced, and the residual construction phase effects, are considered **slight adverse (not significant).**

Waste

14.6.4. Landfill capacity in Ukraine is known to be very limited. The Project will generate waste for landfill disposal during construction. During operation there will be minimal (negligible) volumes of waste, associated with ongoing maintenance and repair activities. During construction, adverse and direct impacts on landfill capacity from the Project are forecast.

14.6.5. It is reasonable to assume that subject to the successful implementation of all mitigation and enhancement measures listed in Section 14.5, the impacts from waste on landfill would be reduced, and the residual construction effects are considered **slight adverse (not significant).**

OPERATIONAL

14.6.6. The operational phases effects are not considered to be significant, so the residual effects will remain unchanged from those from the residual effects reported above.

14.7 SUMMARY

Table 14-3 – Summary of Potential Impacts, Effects and Mitigation (Materials and Waste)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Materials	As the site is an operational landfill, there are currently limited requirements for construction materials. The national availability of construction materials is currently felt to be sufficient to accommodate the project, with a possible need to source resources internationally.	Construction	Will require the consumption of materials and generate waste through construction.	**Significant adverse effect** on depletion of natural resources and materials stocks and supplies.	A range of resource efficiency measures and circular economy opportunities should be adopted in design and construction. A CESMP, incorporating a SWMP and MMP should be part of the mitigation approach.	Reduced impacts and effects on natural resources and the availability of construction materials nationally. **Impacts would be adverse and permanent, but effects would not be significant.**
		Operation	May require the consumption of negligible quantities of materials	**Not significant**	Good practice actions, including the development and implementation	**Not significant** Beneficial effects through the

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
			through on-going maintenance and repair work.		of an OESMP, incorporating a OWMP.	MBT facility improving materials recovery rates.
Waste		Construction		**Significant adverse effect** on landfill capacity.	A range of resource efficiency measures and circular economy opportunities should be adopted in design and construction. A CESMP, incorporating a SWMP and MMP should be part of the mitigation approach.	Reduced impacts and effects on landfill capacity. **Impacts would be adverse and permanent, but effects would not be significant**.
		Operation	May produce negligible quantities of waste for disposal, through on-going maintenance and repair work.	**Not significant**	Good practice actions, including the development and implementation of an OESMP, incorporating an OWMP.	**Not significant** Beneficial effects through the MBT facility helping to extend the lifespan of the new landfill.

15

CLIMATE CHANGE

PUBLIC

15 CLIMATE CHANGE

15.1 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

15.1.1. International legislation related to climate change has been agreed under the United Nations Framework Convention on Climate Change (UNFCCC). The following agreements are the most important in terms of international action to address climate change:

- Kyoto Protocol (1997)[116];
- Doha amendment to the Kyoto Protocol (2013)[117]; and
- The Paris Agreement (2015) – As part of this agreement, countries are required to outline and communicate their post-2020 climate actions. Ukraine's Intended National Determined Contributions states that it will not exceed 60% of 1990 Greenhouse Gas (GHG) emissions level in 2030.

EUROPEAN UNION LEGISLATION

15.1.2. Since it's amendment in 2014 the EU EIA Directive[118] contains a requirement to consider climate change. This requires "… a description of the likely significant effects of the Proposed Scheme on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the Proposed Scheme to climate change". As such this chapter assesses the GHG emissions as a result of the Project.

GUIDANCE

15.1.3. The following guidance documents have been used during the preparation of this Chapter:

- EBRD Protocol for Assessment of Greenhouse Gas Emissions (2017)[119;]
- IEMA EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2017) [120];
- Whole Life Carbon Assessment for the Built Environment (2017) [121;]
- Guidelines for National Greenhouse Gas Inventories (2006)[122;] and
- PAS 2080: Carbon Management in Infrastructure (2016)[123.]

[116] UNFCCC (1997). Kyoto Protocol.

[117] UNFCCC (2013). Doha Amendment to the Kyoto Protocol.

[118] European Parliament and Council (2014). Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment Text with EEA relevance.

[119] European Bank for Reconstruction and Development (2017). EBRD Protocol for Assessment of Greenhouse Gas Emissions.

[120] IEMA (2017). Assessing Greenhouse Gas Emissions and Evaluating their Significance.

[121] RICS (2017). Whole Life Carbon Assessment for the Built Environment.

[122] IPCC (2006). IPCC Guidelines for National Greenhouse Gas Inventories. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).

[123] BSI (2016). PAS 2080: Carbon Management in Infrastructure.

EBRD REQUIREMENTS

15.1.4. The project must follow EBRD PR3, which aims to promote the reduction of Project related greenhouse gas emissions. The GHG section of the requirements states that:

- The ESIA will consider alternatives and implement technically and financially feasible and cost-effective options to avoid or minimise Project related GHG emissions during the design and operation of the Scheme.
- For Projects that currently produce, or are expected to produce post-investment, more than 25,000 tonnes of CO_2e[124] annually, the client will quantify these emissions in accordance with EBRD Methodology for Assessment of Greenhouse Gas Emissions. The scope of GHG assessment shall include all direct emissions from the facilities, activities and operations that are part of the Scheme or system, as well as indirect emissions associated with the production of energy used by the Scheme. Quantification of GHG emissions will be conducted by the client annually and reported to the EBRD.

15.2 ASSESSMENT METHODOLOGY

15.2.1. GHGs are natural and man-made gases occurring in the atmosphere which absorb and emit infrared radiation thereby maintaining the Sun's energy within the Earth's atmosphere. There is an overwhelming scientific consensus that the major increase in the concentration of GHGs from man-made sources is contributing to global warming and climate change.

15.2.2. The assessment approach considers the likely magnitude of GHG emissions (or avoided emissions) of the Project in comparison to the baseline scenario with no scheme and the continued use of the existing operational landfill.

15.2.3. The scope considers emissions without the scheme (existing landfill) and with the proposed MBT facility and landfill throughout the life cycle including:

- Embodied emissions associated with construction materials for the Project (A1-3)[125],
- Transportation of construction materials to the Project Site (A-4)[65];
- Operational energy use at the proposed MBT Facility and the proposed landfill (B-6)[65];
- Emissions from the composting of waste at the MBT Facility (B-8)[65,]
- Transportation of waste to and from the proposed MBT Facility and the proposed landfill (B-1)[65]; and
- Emissions (or avoided emissions) from the proposed landfill (B-8)[65].

15.2.4. For all life cycle stages, available data / information on the scale of GHG emitting activities (e.g. tonnes concrete, litres of fuel, kWh electricity) for the baseline scenario and for the Project was collected.

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[124] The seven main GHGs defined by the Kyoto Protocol are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. In combination, these GHG emissions are expressed in terms of carbon dioxide equivalents (CO2e) according to their relative global warming potential.

[125] PAS2080 Life Cycle Reference Codes: A1-3 Product Stage; A-4 Transport to Works Site; B-6 Operational energy use; B-1 Use; B-8 Other Operational Processes.

15.2.5. The data in Table 15-1, Table 15-2, Table 15-3 and Table 15-4 was gathered from project information and used as the basis for the assessment.

Table 15-1 – Construction – Materials Data (Project Site)

Material	Quantity (tonnes)	Assumed distance for transport of material (km) [9]
Asphalt	2550	50
Concrete	1188	50

Table 15-2 – Operational – Waste Data (Proposed Landfill and MBT Facility)

Total waste collected per year (t)	Total waste transported to landfill (t)	Recyclable waste (t)	Fuel for district heating (t)	Maturation losses (t)
108,000	71,000	15,000	15,000	7,000

Table 15-3 – Operational – Transport Data (Proposed Landfill and MBT Facility)

Transport distance from landfill to MBT facility (km)	Assumed distance for transport of recycled material (km)	Assumed distance for transport of fuel for district heating (km) [9]
1	50	50

Table 15-4 – Operational – Yearly Fuel and Energy Use (Proposed Landfill and MBT Facility)

Plant Diesel Use (l)	Total Power use (kWh/year)
204,984	5,813,366

15.2.15. Embodied emissions associated with materials and the emissions from the transportation of these materials for the construction phase have been calculated by multiplying provided emissions activity (e.g. quantities of material consumed, transport distances (Table 15-1)) by the relevant emissions factors expressed in carbon dioxide equivalents sourced from the ICE database[126]. Assumptions were made about the materials required and the volume of materials, as well as the distance travelled and type of vehicle. More information on this can be found in the Assumptions and Limitations Section.

[126] Circular Ecology (2019). Inventory of Carbon and Energy.

15.2.16. Emissions calculations for the operational transport phase has been completed by multiplying provided transport distances, shown in Table 15-3, and waste tonnages, shown in Table 15-2, by the emissions factors sourced from the GHG Protocol[127].

15.2.17. For the operational plant and power use calculations, litres of fuel per year and kWh per year, were multiplied by relevant emissions factors from the GHG Protocol[128] and the Department for Business, Energy and Industrial Strategy (BEIS) Greenhouse Gas Reporting – Conversion Factors[128] to produce tonnes of CO_2e. It has been assumed that all power is from the grid, and no power generated onsite is used.

15.2.18. The IPCC Waste Guidelines (2006)[129] were then used to calculate the amount of CO_2e produced by the aerobic composting plant by multiplying the tonnes of waste by an appropriate emissions factor and then by converting tonnes of CH_4 to CO_2e, in order to represent a worst-case scenario it has been assumed that no efforts are made to capture the escaping gas.

15.2.19. The IPCC Waste Guidelines (2006)[129] was then used to model the baseline 'do nothing' existing landfill scenario and the expected scenario with the Project. This required data on the composition and amount of waste added to the landfill over a ten-year period until the landfill is expected to be full, and then the calculation of decomposition over a fifty-year period (a typical assessment period for decomposition). With the Project, the quantity of CH_4 captured due to the project was not included as it was assumed that these emissions are combusted to CO_2 and are biogenic.

15.2.20. The assessment of the Project has been undertaken in line with best practice GHG methods and has assessed the Project in line with the principles of PAS 2080[130]. The assessment approach has considered the likely magnitude of GHG emissions (or avoided emissions) in comparison to the baseline scenario.

LIMITATIONS AND ASSUMPTIONS

15.2.21. This ESIA has been completed based on the currently available information and data. Types and quantities of material provided at this stage and are indicative and limited due to the constraints of working with preliminary designs and preliminary design descriptions. Where data has been unavailable, assumptions have been used to fill gaps.

15.2.22. Key construction materials have been based on the information available at the time of writing. No data was available for buildings, roads, utilities, etc and so these were not included in the assessment.

15.2.23. Professional judgement has been used when completing the IPCC 2006 Waste Model[129] and interpreting the data provided for input into the tool. This was based upon knowledge of similar schemes.

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[127] GHG Protocol (2019). Calculation Tools.

[128] BEIS (2016). Greenhouse Gas Reporting – Conversion Factors.

[129] IPCC (2006). Guidelines for National Greenhouse Gas Inventories.

[130] BSI (2016). PAS 2080: Carbon Management in Infrastructure.

15.2.24. Extremely limited construction data has been provided, only concrete and surfaces (assumed to be asphalt) have been included, not buildings required for this project.

15.2.25. It has been assumed that the surface material will be asphalt, with a 7% binder content as this is the most conservative, and a depth of 100mm.

15.2.26. It has been assumed that the concrete pads will have a depth of 150mm and a general emissions factor was used.

15.2.27. The transportation of materials and waste to and from Site (i.e. the source of materials and destination of waste) has been taken from RICS[121] transportation scenarios in the absence of location specific data.

15.2.28. There is currently no specific guidance on carbon emissions thresholds, which, if exceeded, are considered significant. Therefore, professional judgement and current guidance have been used to determine significance.

15.2.29. It has been assumed that all trucks used for the transportation of materials and waste to and from the Proposed MBT facility will be the same.

15.2.30. It has been assumed that plant use during operation will require diesel fuel as no information is given about the type of fuel used.

15.2.31. The forecast data for the Project are predictions, and as such are associated with a high degree of uncertainty.

15.2.32. It has been assumed that all power used at the proposed MBT Facility has been sourced from the Ukrainian grid.'

SIGNIFICANCE CRITERIA

15.2.33. The magnitude of change in GHG emissions is considered as part of the significance criteria.

15.2.34. The sensitivity / value of different human and natural receptors is not considered in this assessment as the effects of GHG emissions relate to their contribution to global warming and climate change. These effects are global and cumulative in nature, with every tonne of GHG emissions contributing to impacts on natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur, and as such, it is not possible to link a specific project to a specific environmental effect.

15.2.35. Therefore, the significance of effects associated with GHG emissions is assigned with reference to the magnitude of emissions, their context, guidance from IEMA[120], and the use of professional judgement. There are currently no agreed thresholds in published guidance for what level of GHG emissions are considered to be significant in an EIA.

STUDY AREA

15.2.36. The GHG assessment is not restricted by geographical area, but instead includes any increase or decrease in GHG emissions as a result of the Project, regardless of location. This includes construction GHG emissions in the vicinity of the Project, but also related to the transport of materials to and from the site, their extraction, manufacture and disposal, for example GHG emissions for the manufacture of concrete.

15.3 BASELINE CONDITIONS

15.3.1. In the baseline scenario, GHG emissions occur constantly and widely because of human and natural activity including energy consumption (fuel and power), industrial processes and land use change. The GHG assessment only considers where the Project will result in additional or avoided emissions in comparison to the baseline scenario and it's assumed evolution. The baseline conditions therefore focus on those emissions sources subject to change between the baseline scenario and the Project.

CONSTRUCTION

15.3.2. In the baseline scenario for construction, there would be no construction materials used and no construction activity, resulting in no emissions.

OPERATION

15.3.3. In the baseline scenario, waste disposal trucks are driven straight to the existing landfill. Whereas, with the Project, the distance travelled is further (as explained in Chapter 7: Noise and Vibration). Therefore, the emissions from the transport of waste to the existing landfill are considered to be zero, as only additional emissions from the additional distance travelled with the Project in place are quantified.

15.3.4. In the baseline scenario the Project would not exist, and therefore, operational plant and equipment emissions are also zero.

15.3.5. Without the Project, MSW will still be produced in the City, and this is expected to be 108,000 tonnes per year by 2027. However, all this waste will be disposed of at the existing landfill which is already approaching maximum capacity. As such, in the future baseline emissions of 1,296,724 tonnes of CO_2e over in total are expected to be produced by the decomposition of waste at the existing landfill.

15.4 POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

15.4.1. The Project has the potential to result in increases in greenhouse gas emissions associated with construction activities (such as manufacturing of materials and construction processes). During construction phase, notable sources of emissions include 'embedded carbon' emissions generated during the extraction and manufacturing of key construction materials.

15.4.2. Due to limited data at this stage of the Project only emissions from paving and the concrete pads were included in the assessment[131].

15.4.3. The total construction related GHG emissions arising from, the product stage (A1-313), and the transportation of materials to site; has been calculated to be 309 tonnes of CO_2e; 271 tCO_2e for product stage as embodied carbon, and 38 tCO_2 from the transportation of these materials to the Project Site, as presented in Table 15-5 and Table 15-6.

[131] Data on buildings, roads and utilities was not provided at the time of writing and so has not been included in the assessment.

Table 15-5 – Construction Emissions – Materials

Material	Quantity (t)	Emissions factor (tCO_2e/kg)	tCO_2e
Asphalt	2,550	0.0584	149
Concrete	1,188	0.103	122
Total CO_2e (t)			271

Table 15-6 – Construction Emissions – Transportation

Material	Quantity (t)	Distance (km)	Emissions factor ($kgCO_2$/short ton.mile)	tCO_2
Asphalt	2,550	50	0.297	26
Concrete	1,188	50	0.297	12
Total CO_2 (t)				38

15.4.4. The majority of emissions (approximately 87%) of GHG emissions from the construction phase are associated with the materials stage (product stage 'cradle to gate' or 'embodied' GHG emissions), with approximately 13% of GHG emissions from transportation.

15.4.5. In line with the methodology for assessing significance of effects and in the absence of agreed thresholds for what level of GHG emissions is considered significant in an ESIA, IEMA Guidance[120] and professional judgement including previous experience of road infrastructure schemes has been used to assess the significance of effects based on schemes of a similar size and nature.

15.4.6. The magnitude of change in GHG emissions during construction is predicted to be negligible, and therefore the Project is expected to result in a neutral effect during construction. IEMA guidance suggests that all GHG emissions are significant in the absence of any significance criteria or defined threshold. However, given the magnitude of GHG emissions and the context of the Scheme, using professional judgement it is considered that the neutral effect of this Scheme will not be significant.

OPERATIONAL PHASE

15.4.7. Throughout its operational life, the Proposed MBT Facility will generate emissions from the transport of waste to and from the facility, the use of fuel and power at the plant and the expected waste decomposition at the proposed landfill. There will also be a reduction in GHG emissions from the closure of the existing landfill, improvements to the biogas collection system as part of the closure of the existing landfill, and a biogas collection system for the proposed landfill.

15.4.8. GHG emissions per year arising from: the transportation of waste, and on-site power and plant use; has been calculated to be 6,062 tCO_2e; 340 tCO_2 from transportation of waste, 548 tCO_2 from plant use, 414 tCO_2 from power use and 4760 tCO_2e from emissions from the composting process, as presented in Table 15-7, Table 15-8, Table 15-9 and Table 15-10.

Table 15-7 – Operation Emissions – Transportation of Waste

Waste (t)	Destination	Distance (km)	Emissions factor ($kgCO_2$/short ton.mile)	tCO2
108,000	MBT Facility	1	0.297	22
71,000	Landfill	1	0.297	14
15,000	Recycled[132]	50	0.297	152
15,000	Fuel	50	0.297	152
Total CO_2 per annum (t)				340

Table 15-8 – Operation Emissions – Plant Use

Vehicle Type	Fuel Use (l/year)	Emissions factor ($kgCO_2$/US gallon)	tCO2
Front End Loader	87,600	10.131	234
Work Trucks	73,584	10.131	197
Forklift	43,800	10.131	117
Total CO2 per annum (t)			548

Table 15-9 – Operation Emissions – Power Use

Power	Use (kWh/year)	Emissions factor (kg/kWh)	tCO2
MBT facility	2,807,587	0.07122	200
Biological consumption	3,005,779	0.07122	214
Total CO_2 per annum (t)			414

[132] Onward transfer of recycled materials. Unknown destination - assumed they will be used locally.

Table 15-10 – Operation Emissions – Composting

Amount of waste (t)	Emissions factor (g CH_4/kg waste treated)	tCH_4	tCO_2e
35,000	4	140	4,760

15.4.9. However, as shown in Table 15-11, the expected decrease in waste sent to landfill, and the change in landfill type is predicted to save -1,009,040 tCO_2e from waste decomposition over a 50-year period compared to the existing landfill. This is calculated based on a baseline scenario, which has includes emissions from the existing non-engineered deep landfill. The result is a saving due to the Project replacing an unmanaged landfill with a managed landfill, inclusive of improvements to the existing biogas collection system, and a biogas collection system for the proposed landfill.

Table 15-11 – Operation Emissions – Waste Decomposition

Landfill type	Emissions over a 50-year period (tCO_2e)	Emissions Captured (tCO_2e)	Total Emissions (tCO_2e)
Unmanaged deep (baseline)	1,296,724	0	1,296,724
Managed	650,387	367,703	287,684
Total CO_2e saved (t)			-1,009,040

15.4.10. Table 15-12 shows the operational savings expected from the implementation of the Project. The waste decomposition process has been calculated over a 50-year period. However, as the landfill was operational on a ten-year basis, the average savings have been calculated over a 10-year lifetime. Overall, once the savings are averaged over the ten-year period, an operational saving can be calculated as -94,032 tCO_2e per year, 0.03% of Ukraine's total emissions in 2017, excluding the sector Land Use, Land Use Change and Forestry[133].

Table 15-12 – Operational Savings

Total savings over a 50-year period (tCO_2e)	Average saving per year over the 10-year period (tCO_2e)	Average operational emissions per year (tCO_2e)	Net saving per year (tCO_2e)	Ukraine's total emissions in 2017 ($MtCO_2e$)	Percentage of net saving per year
-1,009,040	-100,094	6,062	-94,032	320.63	0.03%

[133] UNFCCC (2019). National Inventory Submissions.

15.4.11. The magnitude of change in GHG emissions during operation predicted to be moderate beneficial as a reduction has been calculated. Total GHG emissions during the operation of the Scheme are predicted to reduce in comparison to the 'do nothing' scenario, as such, the Project is anticipated to have **a moderate beneficial (significant) effect.**

15.5 MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

15.5.1. It is recommended that the following mitigation measures are put in place to further reduce the effects associated with the construction phase of the Project:

- Design optimisation to reflect the carbon reduction hierarchy[134]:
  - Reduce the materials required for the construction phase of the Project e.g. through efficient design, minimisation of waste etc.;
  - Reduce the requirement for construction materials;
  - Substitute construction elements for lower-carbon alternatives (e.g. using low temperature asphalt); and
  - Use efficient construction processes, such as design for manufacture and assembly.
- Select and engage with material suppliers and construction contractors considering their policies and commitments to reduction of GHG emissions, including embodied emission in materials;
- Minimise energy consumption including fuel usage by, for example, reducing the requirement for earth movements to / from and within the Project Site;
- Source materials locally to minimise transport distances; and
- Use efficiency plant and equipment and minimise idling.

OPERATIONAL PHASE

15.5.2. It is recommended that the following mitigation measures are put in place both in order to further enhance the beneficial effects associated with the operational phase of the Project:

- Designing, specifying and constructing the Project with a view to maximising the operational lifespan and minimising the need for maintenance and refurbishment (and all associated emissions);
- Designing, specifying and constructing the Project with a view to maximising the potential for reuse and recycling of materials/elements at the end-of-life stage;
- Specifying high efficiency mechanical and electrical equipment such as lighting (LED lights) and telecommunications;
- Operating, maintaining and refurbishing the Project using best-practice efficient approaches and efficient plant and equipment; and

[134] The carbon reduction hierarchy is detailed 6.1.4 of 'BEIS (2016). PAS:2080 Carbon Management in Infrastructure'.

- When the proposed landfill becomes full and the MBT Facility is required to supply a different landfill, ensure subsequent sites are within close proximity to minimise distance required to transport waste.

15.6 RESIDUAL EFFECTS

15.6.1. The construction phase effects are not considered to be significant, so the residual effect will remain unchanged from those reported above.

15.6.2. The operation phase effects are considered beneficial (and significant), the residual effect will also remain unchanged from that reported above.

15.7 SUMMARY

Table 15-13 – Summary of Potential Impacts, Effects and Mitigation (Climate Change)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Climate Change	The baseline scenario includes the continued use of the existing landfill and no construction activities.	Construction	Climate change – release of GHG emissions.	**Neutral (not significant)**	▪ Design optimisation to reflect the carbon reduction hierarchy ▪ Engage with materials suppliers ▪ Minimise energy consumption ▪ Source materials locally ▪ Use efficiency plant and equipment	**Neutral (not significant)**
		Operation	Climate change – release of GHG emissions.	**Moderate Beneficial (significant)**	▪ Maximise operational lifespan ▪ Maximise potential for reuse/recycling of materials at end of life stage ▪ Specify high efficiency mechanical and electrical equipment	**Moderate Beneficial (significant)**

16

CUMULATIVE EFFECTS

PUBLIC

16 CUMULATIVE EFFECTS

16.1 INTRODUCTION

16.1.1. This chapter reports the likely significant cumulative environmental effects (both effect interactions and in-combination effects) associated with the Project.

16.2 SCOPE AND METHODOLOGY FOR ASSESSMENT

16.2.1. This section should be read in conjunction with the cumulative effects section of Chapter 5: Approach to EIA.

16.2.2. At present, there is no widely accepted or best practice methodology for the assessment of cumulative effects although there are several guidance documents available. The following approach is based on previous experience and professional judgement, the types of receptors being assessed, the nature of the Project and the environmental and social information available to inform the assessment.

16.2.3. The EU EIA Directive requires an assessment of:

"Direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project".

16.2.4. Two types of cumulative effects have been considered within this assessment:

- Effect Interactions – cumulative impacts from the Project; and
- In-combination effects – cumulative impacts from different Projects (in combination with the project being assessed).

16.2.5. In addition, and further to each of the Technical Chapters the potential for transboundary effects has been considered relative to the location of the Project, its characteristics, and the environmental importance of the receiving environment. It is considered that the Project is unlikely to have significant effects either alone or cumulatively on the environment in either an adjacent of close by country.

EFFECT INTERACTIONS

16.2.6. The approach to the assessment of effect interactions considers effects arising from the combined action of a number of different environmental / social topic specific effects upon a common receptor due to the Project.

16.2.7. The assessment is based upon significant residual effects (moderate or greater) of the common receptors (identified in Section 16.4). The study area for the assessment is informed by the study areas for the individual topic assessments as set out in technical chapters 6 – 15.

IN-COMBINATION EFFECTS

16.2.8. The approach to the assessment of in-combination effects considers effects arisings from the combined action of a number of different projects ('committed developments'), in combination with this Project, on a single receptor.

16.2.9. The assessment is based upon significant residual effects (moderate or greater) of the common receptors that have been identified in Technical chapters 6 – 15 as well as available environmental information for the applicable 'committed developments'.

16.2.10. For the purposes of this assessment, 'committed developments' are defined as those projects meeting one or more of the following criteria:

- The committed development has been identified by stakeholder and / or consultees; and
- The committed development is within a relevant geographical boundary with common sensitive receptors.

16.3 DETERMINING SIGNIFICANT EFFECTS

16.3.1. There is no formal guidance on the criteria for determining significance of cumulative effects. The following principles have been considered when assessing the significance of cumulative effects in relation to both effect interactions and in-combination effects:

- The nature of the receptors affected;
- How the effects identified combine to affect the condition of the receptor;
- The probabilities of the effects occurring in relation to each other in such as way so as to produce cumulative effects; and
- The ability of the receptor to absorb further effects.

16.3.2. The resulting determination of significance based on this is therefore an illustration of how multiple effects may lead to an increased residual effect compared to viewing the effects in isolation. For example, nearby residential receptors may see a moderate adverse effect from air quality and a minor adverse effect from ground conditions as a result of the Project. In this case it may be determined that these two effects, when combined and acting on the same receptor, may degrade the ability of the receptor to absorb further effects than if the effects were in isolation. The effect interaction determination in this case may be concluded to be minor adverse as a result. There is a measurable heightened effect to be recorded, but in this case, it may be determined that this effect is not in fact significant.

16.3.3. The determination of significance for the purposes of this assessment is therefore made on a receptor basis, taking account of the assessments in Technical chapters 6 – 15, available environmental and social information, professional judgement and experience. Levels of significance have been made in accordance with the definitions set out in Chapter 5: Approach to ESIA.

16.4 ASSESSMENT OF CUMULATIVE EFFECTS

COMMON RECEPTORS

16.4.1. The common receptors and their corresponding environmental topics are displayed in Table 16-1 below.

Table 16-1 – Common Receptors

Phase	Receptor	Environmental Topics
Construction	Construction Workers	▪ Air Quality; and ▪ Geology and Hydrogeology.
Construction / Operation	Local Communities Residential Dwellings	▪ Air Quality; ▪ Noise and Vibration; ▪ Landscape and Visual; ▪ Geology and Hydrogeology; and

Phase	Receptor	Environmental Topics
		▪ Social.
Construction / Operation	Commercial Properties	▪ Noise and Vibration; and ▪ Landscape and Visual.
Construction / Operation	Agricultural Land / Soil	▪ Geology and Hydrogeology; and ▪ Landscape and Visual.
Construction / Operation	Surface Water Bodies	▪ Surface Water Environment; and ▪ Geology and Hydrogeology.

CONSTRCUTION

16.4.2. Table 16-2 comprises a summary matrix for the construction phase of the Project showing the residual effect interactions between environmental / social topics, following the implementation of the required mitigation measures set out in Technical chapters 6 – 15. This enables a qualitative assessment of the interactions of residual effects outlining the overall significance to the identified common receptor.

16.4.3. Any residual effects identified in Technical chapters 6 – 15, that do not affect the common receptors identified, have not been presented below, as no effects interactions are anticipated. Furthermore, negligible residual effects have not been considered during the assessment of interactions but are included in Table 16-2 for completeness.

Table 16-2 – Matrix of Effect Interactions (Construction)

Technical Topic / Effect	Common Sensitive Receptors				
	Construction Workers	Local Communities Residential Dwellings	Commercial Properties	Agricultural Land and Soil	Surface Water Bodies
Air Quality	**Neutral (not significant)**	**Neutral (not significant)**	n/a	n/a	n/a
Noise and Vibration	n/a	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	n/a	n/a
Ecology	n/a	n/a	n/a	n/a	n/a
Cultural Heritage	n/a	n/a	n/a	n/a	n/a
Landscape and Visual	n/a	**Minor Adverse (not significant) to Large Adverse (significant)**	**Minor Adverse (not significant) to Large Adverse (significant)**	**Moderate Adverse (significant)**	n/a
Surface Water Environment	n/a	n/a	n/a	n/a	**Neutral (not significant) to Minor Adverse (not significant)**
Geology and Hydrogeology	**Minor Adverse (not significant) to Moderate Adverse (significant)**	**Minor Beneficial (not significant) to Moderate Adverse (significant)**	n/a	**Neutral (not significant) to Minor Adverse (not significant)**	**Neutral (not significant) to Minor Adverse (not significant)**
Social	n/a	**Minor Adverse (not significant)**	n/a	n/a	n/a
Materials and Waste	n/a	n/a	n/a	n/a	n/a
Climate Change	n/a	n/a	n/a	n/a	n/a
Overall Effect Interactions	**Neutral (not significant)**	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	**Neutral (not significant)**

16.4.4. The assessment of effect interactions in the construction phase, has determined that there will be no significant interaction effects due to the Project. There will be **Minor Adverse (not significant)** effect interactions on residential, commercial and agricultural common receptors, but no additional mitigation measures are recommended or required.

OPERATION

16.4.5. Table 16-3 comprises a summary matrix for the operation phase of the Project showing the residual effect interactions between environmental / social topics, following the implementation of the required mitigation measures set out in Technical chapters 6 – 15. This enables a qualitative assessment of the interactions of residual effects outlining the overall significance to the identified common receptors.

16.4.6. Residual effects that have been identified in Technical chapters 6 – 15 that do not affect the common receptors identified have not been presented below, as no effects interactions are anticipated. Furthermore, negligible residual effects have not been considered during the assessment of interactions but are included in Table 16-3 for completeness.

Table 16-3 – Matrix of Effect Interactions (Operation)

Technical Topic / Effect	Common Sensitive Receptors			
	Local Communities Residential Dwellings	Commercial Properties	Agricultural Land and Soil	Surface Water Bodies
Air Quality	**Neutral (not significant)**	n/a	n/a	n/a
Noise and Vibration	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	n/a	n/a
Ecology	n/a	n/a	n/a	n/a
Cultural Heritage	n/a	n/a	n/a	n/a
Landscape and Visual	**Minor Adverse (not significant) to Moderate Adverse (significant)**	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	n/a
Surface Water Environment	n/a	n/a	n/a	**Neutral (not significant) to Minor Adverse (not significant)**
Geology and Hydrogeology	**Neutral (not significant)**	n/a	**Neutral (not significant)**	**Minor Beneficial (not significant) to Neutral (not significant)**
Social	**Minor Beneficial (not significant) to Minor Adverse (not significant)**	n/a	n/a	n/a
Materials and Waste	n/a	n/a	n/a	n/a
Climate Change	n/a	n/a	n/a	n/a
Overall Effect Interactions	**Minor Adverse (not significant)**	**Minor Adverse (not significant)**	**Neutral (not significant)**	**Neutral (not significant)**

16.4.7. The assessment of effect interactions in the operational phase determined that there will be no significant effect interactions due to the Project. There is the potential for **Minor Adverse (not significant)** effect interactions are anticipated on residential and commercial receptors, but no additional mitigation measures are recommended or required.

16.5 ASSESSMENT OF IN-COMBINATION EFFECTS

16.5.1. An overview of the committed development(s) and supporting environmental documentation used for the assessment of in-combination effects is presented in Table 16.4. The discussion of in-combination effects has been approached on a topic by topic basis, dependent upon the availability of relevant information. Where environmental / social information is not presented within the available documents relating to the committed development(s), a high-level appraisal using publicly available sources has been undertaken to supplement the available information to enable a qualitative assessment of in-combination effects. If insufficient information in the public domain has been identified, this is clearly outlined.

Table 16-4 – Summary of Committed Development(s)

Reference	Name of Committed Development	Status	Distance from Project
1	Private land allocated for residential development (various owners).	Currently designated as both residential and agricultural land. The area is allocated for residential development in Villages Local Plan. In order to assess the worst-case, it is assumed that there is the potential for the land classification to be changed from agricultural to residential in a future scenario with the purpose of facilitating development.	Less than 100m from the boundary of the existing and proposed landfill. **Figure 16-1 – The Site and Committed Developments** 

16.5.2. For the purposes of this assessment, as information relating to the timeframes for the committed development were unknown at the time of writing, so it has been assumed that the construction and operational phases could overlap with the Project.

16.5.3. Table 16-5 presents the findings of the assessment of the potential in-combination effects. The assessment considers the residual effects that have been identified as moderate or greater in

Technical chapters 6 – 15, as no in-combination effects are anticipated where there are not likely to be significant residual effects as a result of the Project. Therefore, negligible residual effects have not been considered within the assessment of in-combination effects.

Table 16-5 – In Combination Effects (Land Allocated for Residential Development)

Technical Topic	Potential In-combination Effects
Air Quality	During the construction phase there is likely to be a heightened level of localised air quality effects in the form of pollutant and dust emissions associated with the operation of construction plant. Any air quality effects during the operation phase are not anticipated to be beyond neutral when compared to the Project in isolation. As the residual effects for Air Quality are all **neutral (not significant)** for the Project, it is considered that there would be a **neutral (not significant)** in-combination effect.
Noise and Vibration	During the construction phase there are potential in-combination effects in relation to increased noise levels as a result of construction activities and truck movements. Potential operational in-combination effects relate to increased vehicle movements and machinery operation. The increased footprint of construction activities, and subsequent noise levels, that would result from concurrent construction periods is anticipated to result in a **minor adverse (not significant)** in combination effect. The operational in-combination effect is anticipated to be **neutral (not significant)** due to the lack of change in effect compared to the Project in isolation.
Ecology	During the construction phase there is the increased potential for adverse interactions with roosting / nesting habitats for birds and bats as a result of construction activities and the combined construction footprint of the committed development and the Project. During the operation phase, there is the potential for an increased spread of invasive species throughout the region. As the residual construction and operation effects for the project are all **neutral (not significant),** it is considered that there would be a **neutral (not significant)** in-combination effect.
Cultural Heritage	During the construction phase there is the potential for adverse effects to below ground heritage assets (the status of these assets in the area is unknown) of prehistoric origin. These effects would result from machinery operation (and subsequent vibration), soil removal and change in water level. During the operation phase there is the potential for increased pressure to be placed on above ground assets as a result of vehicle movements. The combined construction footprint of the committed development and the Project would result in a **moderate adverse (significant)** in-combination effect due to the substantial increase in total potential area of destroyed heritage assets when compared to the Project in isolation. During the operation phase all residual effects as a result of the project are neutral (not significant), it is considered that there would be a **neutral (not significant)** in-combination effect.
Landscape and Visual	Construction landscape effects as a result of the Project relate to vegetation change and changes to a series of character areas such as the former industrial site and agricultural farmland. These effects are all adverse. Construction visual effects relate to views from nearby residential properties, businesses, recreational users, industrial workers, agricultural land and road users. Again, these effects are all adverse. During the operation phase landscape and visual effects relate to

Technical Topic	Potential In-combination Effects
	effects on certain character areas due to the increased footprint of the landfill as a result of the Project, and additional operational activities. Due to the location of the committed development there are unlikely to be in-combination effects with some of the character areas affected by the Project, namely Character Area 2 and Character Area 3. As the most adversely affected character area by the project is Character Area 3, the resultant in-combination construction landscape effects are **minor adverse (not significant)**. The construction of the committed development alongside the Project is unlikely to result in significant adverse effects on receptors compared to the Project in isolation. The exceptions to this are users of the surrounding highways network, users of agricultural land and workers within adjacent industrial units. These receptors are anticipated to see a **minor adverse (not significant)** in-combination effect. The operational landscape effects would result in a minor adverse (not significant) in-combination effect in relation to Character Area 2. All other effects would result in a **neutral (not significant)** in-combination effect. The operational visual effects are anticipated to be **neutral (not significant)** in relation to the committed development in comparison to the Project in isolation.
Surface and Water Environment	During the construction phase there is the potential for in-combination effects on run-off from stockpiled materials, excavation and exposure of existing landfill waste and / or contaminated soil and leaks and spills from machinery and / or plant. During operation, no in-combination effects are anticipated. Construction residual effects as a result of the Project are all **neutral (not significant)** with the exception of excavation of contaminated material / soil. Due to the location of the committed development there is not anticipated to be an increased risk of contamination as the site does not have a history of waste disposal or leachate deposition.
Geology and Hydrogeology	During the construction phase, potential in-combination effects may occur in the form of excavation / exposure of radioactive and / or contaminated materials and excavation and / or exposure of contaminated soils and / or materials. During the operation phase no in-combination effects are anticipated to occur. The construction in-combination effects are anticipated to be **neutral (not significant)** due to the location of the committed development it is not anticipated that sources of contamination in the area of the committed development, particularly if hazardous (inclusive of radioactive contaminants) are uncovered.
Social	During the construction phase, potential in-combination effects may occur in the form of temporary land acquisitions, employment (economic), H&S and community effects (H&S, infrastructure, wellbeing and connectivity). During the operation phase in-combination effects are may occur in the form of community effects (H&S, infrastructure and connectivity). It is anticipated that during the construction phase **minor adverse (not significant)** in-combination effects may occur. This is due to the community effects in the form of H&S risks, infrastructure pressure and severance due to the construction footprints. The adverse effects are slightly offset by the beneficial economic effects that would result from the Project and committed development. During the operation phase a **minor adverse (not significant)** in-combination effect would occur. This is due to the committed development being located within

Technical Topic	Potential In-combination Effects
	the Project SPZ, placing H&S risks on the new residents who would reside inside this zone.
Materials and Waste	In-combination effects in the construction and operation phases relate to the procurement of materials and the generation of waste requiring disposal to landfill. The in-combination effects for both construction and operation are anticipated to be **neutral (not significant)** in relation to both materials and waste. This is due to the nature and relatively small scale of the works anticipated on the committed development, and the subsequent lack of change in significance when compared to the Project in isolation.
Climate Change	The in-combination effects as a result of the release of greenhouse gas emissions is the only potential in-combination effect assessed in this chapter. The in-combination effects in relation to the committed development are assessed to be **neutral (not significant)** during construction and operation due to the scale and nature of the committed development in comparison to the Project in isolation.

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SUMMARY

17 SUMMARY

Table 17-1 – Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Air Quality						
Dust and Particulates	Assumed to be good.	Construction	Generation of dust / re-suspend dust and PM_{10}.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to dust nuisance and harmful PM_{10} concentrations.	See ESMP for further detail.	**Negligible (not significant)**
		Operation	Generation of dust / re-suspend dust and PM_{10}.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to dust nuisance and harmful PM_{10} concentrations.	See ESMP for further detail.	**Negligible (not significant)**
Road Traffic Emissions	Assumed to be good.	Construction	Potential emissions of NO_2 to air.	**Neutral to Minor Adverse (not significant)** Sensitive receptor exposure to harmful NO_2 concentrations.	See ESMP for further detail.	**Negligible (not significant)**
		Operation	Potential emissions of NO_2 to air.	**Minor Adverse (not significant)** Sensitive receptor exposure to harmful NO_2 concentrations.	See ESMP for further detail.	**Negligible (not significant)**
Odour and Bioaerosols	Poor baseline conditions, odour complaints and high risk of exposure to bioaerosols.	Construction	N/A	N/A	N/A	**Negligible (not significant)**
		Operation	Potential odour and bioaerosol emissions.	**Minor Adverse to Minor Beneficial (not significant)** Sensitive receptor exposure to odour nuisance and health impacts from bioaerosols.	See ESMP for further detail.	**Negligible (not significant)**
Noise and Vibration						
Noise levels	Semi-rural locations between L_{Aeq} 40 – 60 dB	Construction	Construction activities and truck movements.	**Moderate Adverse (significant)**	Measures as outlined in the ESMP. – NV1	**Minor Adverse (not significant)**
		Operation	Waste truck movements and machinery in the proposed MBT Facility.	**Daytime - Minor Adverse (not significant)** **Night-time - Moderate Adverse (significant)**	Measures as outlined in the ESMP. – NV2	**Minor Adverse (not significant)**
Ecology						
Ecology	Limited biodiversity interest. Potential connectivity with nearby IBA; some roosting/nesting habitat for birds and bats; and invasive species across the Project site.	Construction	Loss of Foraging Habitat Associated with IBA Trigger Species Loss of Bat Roosting Habitat	**Negligible (Not significant)** **Minor Adverse (Not significant)**	Pre-works check of proposed MBT facility location; liaison with local landowners if required. Pre-works surveys of any mature trees/buildings to be affected by the Project. Retention of roosts, and/or provision of artificial roost features where appropriate.	**Not Significant** **Not Significant**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
			Loss of Bird Nesting Habitat	**Negligible (Not significant)**	Timing of works to avoid nesting period (March to August inclusive). Provision of landscape planting to provide additional suitable nesting resource.	
			Spread of Invasive Species	**Moderate Adverse (Significant)**	Prevention of invasive species spread through provision of suitable invasive species management procedures within the Invasive Species Management Plan for the Project.	**Not Significant** **Not Significant**
		Operation	Spread of Invasive Species	**Moderate Adverse (Significant)**	Prevention of invasive species spread through provision of suitable invasive species management procedures within the Invasive Species Management Plan for the Project.	**Not Significant**
Cultural Heritage						
Above and below ground heritage assets	There is potential for below-ground heritage assets to be impacted during the construction period.	Construction	Below-Ground Heritage Assets	**Large Adverse (significant)**	Chance Finds Procedure and Cultural Heritage Management Plan	**Up to Moderate adverse (up to significant)**, if any below ground heritage is found.
	There is potential for the above ground heritage assets to be impacts although this is unlikely.	Operation	Above Ground Heritage Assets	**Neutral (not significant)**	N/A	**Neutral (not significant)**
Landscape and Visual						
Landscape and Visual	Visual barrier in form of mature woodland exists 750m west of site. Local landscape character areas include those described in Section 12.3. Visual receptors are generally short-distance visual receptors from surrounding residences, local businesses, users of surrounding access tracks and highways, and the surrounding fields.	Construction	Effects to Landscape Character Areas	**Minor Adverse (not significant) with one instance of Moderate Adverse** (Character Area 3: Large scale agricultural farmland)	Mitigation measures are detailed in the ESMP.	**Minor Adverse (not significant)**
			Effects to visual receptors	**Minor Adverse (not significant) to Large Adverse (significant)**	Mitigation measures are detailed in the ESMP.	**Minor Adverse (not significant) to Large Adverse (significant)**
		Operation	Effects to Landscape Character Areas	**Minor Adverse (not significant)** to **Minor Beneficial (not significant)**	Mitigation measures are detailed in the ESMP.	**Minor Adverse (not significant) to Minor Beneficial (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
			Effects to Visual Receptors	**Minor Adverse (not significant)** to **Moderate Adverse (significant)**	Mitigation measures are detailed in the ESMP.	Minor Adverse (not significant) to Moderate Adverse (significant)
Surface Water Environment						
Surface Water Environment	The Project lies on northern ridge of a sub-catchment divide. Project drains to an unnamed stream to the north-east which discharges to the Pivdennyi Buh River in the City. Evidence of contamination from existing landfill at wetland pond and unnamed stream, which are collectively referred to as ‘local surface water features’.	Construction	Stockpiling of soils and potentially contaminated materials. Runoff and overland flow from stockpiles to the un-named stream and wetland.	**Minor Adverse (not significant)** contamination of wetland and unnamed stream from sediment and/or contaminated materials.	Implementation of sediment and erosion control measures. Segregation of clean and contaminated materials.	**Neutral (not significant)**
		Construction	Excavation of soils and potentially contaminated materials and re-profiling of existing landfill waste. This could lead to the uncontrolled release of leachate, impacts on local surface water features and human health.	**Minor Adverse (not significant)** contamination of surface water receptors. Human exposure of waste and leachate breakout.	Management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Testing and removal of contaminated material arising from the existing landfill. Protective clothing and personal equipment.	**Neutral Adverse (not significant)** Note, the assessment refers to change caused by Project. There will be continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill in concentrations of potential significance during construction.
		Construction	Flooding of temporary leachate ponds, migration of leachate to the local surface water receptors.	**Neutral (not significant)** deterioration in quality of surface water receptors.	Specific / additional engineering measures including the design of temporary ponds with perimeter bunds to prevent flooding. Standby pumps and provision of off-site tankering for emergency pumping of leachate.	**Neutral (not significant)**
		Construction	Vehicle movements and mobilisation of contaminated soils.	**Minor Adverse (not significant)** contamination of local surface water features and/or contaminated materials.	Tyre washing before exit from the construction site Collection and safe discharging of contaminated wash-water.	**Neutral (not significant)**
		Construction	Oil and / or petroleum leaks from machinery.	**Minor Adverse (not significant)** contamination of local surface water features.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	**Neutral (not significant)**
		Operation	Contaminant migration to groundwater from the existing landfill.	**Minor Beneficial (not significant)** reduction in contamination of the local surface water features and neutral (not significant) reduction in contamination of the Pivdennyi Buh River.	There are unlikely to be any practical measures in addition to the proposed capping, re-profiling and leachate management that will reduce the risk to groundwater.	**Minor Beneficial (not significant)** reduction in contamination of the local surface water features and neutral (not significant) reduction in contamination of the Pivdennyi Buh River.

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
		Operation	Excessive accumulation of leachate leading to significant contaminant migration through the liner of the proposed landfill to groundwater.	**Minor Adverse (not significant)** contamination of local surface water features and contamination of the Pivdennyi Buh River.	Landfill to be constructed to EU standards and leachate to be managed in accordance with findings of detailed quantitative HRA.	**Neutral (not significant)** contamination of local surface water features and neutral (not significant) contamination of the Pivdennyi Buh River.
		Operation	Excessive leachate accumulation leading to break-outs from proposed and / or existing landfill.	**Minor Adverse (not significant)** contamination of local surface water features and neutral (not significant) contamination of the Pivdennyi Buh River.	Landfill to be constructed to EU standards and leachate to be managed in accordance with findings of detailed quantitative HRA. Provision of leachate extraction management system and treatment plant.	**Neutral (not significant)** Note, the assessment refers to change caused by project. There will be continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill in concentrations of potential significance during operation.
		Operation	Vehicle movements and mobilisation of contaminated soils.	**Minor Adverse (not significant)** contamination of wetland and unnamed stream from sediment and/or contaminated materials.	Tyre washing before exit from the construction site.	**Neutral (not significant)**
		Operation	Oil and / or petroleum leaks from machinery	**Minor Adverse (not significant)** contamination of surface water receptors.	Collection and safe discharging of contaminated wash-water.	**Neutral (not significant)**
Geology, Soils and Groundwater Environment						
Geology, Soils and Groundwater Environment	Project area is underlain by clastic sediments (clays and sands) of no economic potential. Project surrounded by agricultural land. Existing landfill possesses no engineered containment. Excavated into disused clay pit, may penetrate through base of the clay that was excavated historically. Layered multi-aquifer system at Project location. Neocene/Eocene & Cretaceous aquifers used for groundwater supply. Evidence of contamination from agriculture and poor sanitation in local water supply wells.	Construction	Excavation / exposure of radioactive and / or contaminated materials	**Large Adverse (significant)**, human contact with radioactive and / or contaminated materials.	Avoid direct contact with waste, leachate and soil. Routine monitoring of radioactivity during construction. The use of personal radiation detectors. Specific measures during ground investigations such as full body suits to prevent contact will drilling debris.	**Moderate Adverse (significant)** Possible and potential for temporary cessation of works.
		Construction	Excavation of soils and potentially contaminated materials. Re-profiling of existing landfill waste.	**Minor Adverse (not significant)**, exposure of waste and mobilisation (breakout) of leachate. Contamination of groundwater and agricultural soils.	Management of leachate levels in existing landfill to reduce levels to below top of excavated surface and prevent breakout. Careful construction and thorough quality control during construction around the existing landfill. Testing and removal of contaminated material arising from the existing landfill.	**Minor Adverse (not significant)** due to continued migration of leachate to groundwater from existing landfill.
		Construction	Excavation / removal of soils and potentially contaminated materials.	**Minor Beneficial (not significant)**, removal of source of contamination to soil and groundwater.	N/A	**Minor Beneficial (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
		Construction	Stockpiling of soils and potentially contaminated materials. Infiltration and runoff from stockpiles to groundwater and agricultural soils.	**Neutral (not significant)**, continued contamination of groundwater and agricultural soils from sediment and/or contaminated materials.	Implementation of sediment and erosion control measures. Segregation of clean and contaminated materials.	**Neutral (not significant)**
		Construction	Flooding of temporary leachate ponds	**Minor Adverse (not significant) to moderately Adverse (significant)**, rapid mobilisation of contaminants to groundwater and agricultural soils.	Engineering and design of temporary ponds to include perimeter bunds to prevent flooding. Standby pumps and provision of off-site tankering for emergency pumping of leachate.	**Neutral (not significant)**
		Construction	Vehicle movements and mobilisation of contaminated soils.	**Minor Adverse (not significant)**, contamination of groundwater and agricultural soils from sediment and/or contaminated materials.	Tyre washing before exit from the construction site. Collection and safe discharging of contaminated wash-water. Provision of suitable haulage access roads.	**Neutral (not significant)**
		Construction	Oil and / or petroleum leaks from machinery.	**Neutral (not significant)**, **c**ontamination of groundwater and agricultural soils.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	**Neutral (not significant)**
		Operation	Leachate accumulation in existing landfill.	**Minor Beneficial (not significant)**, due to reduction of but continued migration of leachate and contaminated groundwater to surface water bodies from existing landfill.	Continued use and maintenance of leachate drainage infrastructure to maintain leachate heads at low levels. Continued use and maintenance of leachate extraction management system and treatment plant	**Minor Beneficial (not significant)**
		Operation	Waste storage volume in proposed landfill.	**Neutral (not significant)**, leachate generating materials contaminating groundwater and agricultural soils.	Construction of perimeter embankment and northern wall around proposed landfill to EU Landfill Directive standards. Continued use and maintenance of leachate extraction management system. Installation of a new leachate treatment plant, and high-quality leachate containment an treatment system in the proposed landfill. Daily cover to reduce rainfall infiltration and reduce aerial waste deposition.	**Neutral (not significant)**
		Operation	Storage and transportation of waste at MBT.	**Minor Adverse (not significant)**	Waste to be stored on hard-standing in bunded areas.	**Neutral (not significant)**
		Operation	Vehicle movements and mobilisation of contaminated soils.	**Minor Adverse (not significant)**, contamination of agricultural soils.	Tyre washing before exit from the construction site. Collection and safe discharging of contaminated wash-water.	**Neutral (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					Provision of suitable internal access roads.	
		Operation	Oil and / or petroleum leaks from machinery.	**Neutral (not significant) to Minor Adverse (not significant)**, contamination of groundwater and soil receptors.	Provision of spill kits to contain oil / petroleum leaks or spills. Program to ensure good driver behaviour / maintenance of vehicles	**Neutral (not significant)**
Social						
Land Acquisition and Livelihood Restoration	Land acquisition (for all Phases) is voluntary, i.e. 'willing buyer-willing seller'. Based on the documentation presented by the two companies employing waste pickers, up to 60 waste pickers work at the existing landfill (during pick/summer time).	Closure of the Existing Landfill	Economic displacement and temporary suspension of waste picker employment.	**Moderate Adverse (significant)**	Implement the LRF, and on its basis, develop and implement an LRP. Waste pickers will be provided with alternative employment opportunities. Such employment opportunities will either include a renumeration package which enables the waste pickers to rent suitable accommodation or include accommodation as part of the renumeration package.	**Minor Adverse (not significant)**
		Construction	Physical displacement of the waste pickers. Loss of waste picker employment and accommodation.	**Moderate Adverse (not significant)**	Implement the LRF, and on its basis develop and implement a LRP. Ensure that all project affected parties are compensated and assisted on the basis of their entitlements outlined in the Entitlement Matrix (see the LRF), section 6.2.	**Minor Adverse (not significant)**
		Operation	Based on Ukrainian SPZ regulations, restrictions on future development of permanently occupied residential houses ion the agricultural land in the SPZ area.	**Minor Adverse (not significant)** The construction of residential houses on the agricultural land is illegal based on national SPZ regulations. However, the construction of summer houses/dachas is legal, and the land owners are within their rights to do so	Assistance with preferential job offering at the new facilities will be provided to this group of people, if they wish so and have relevant skills.	**Neutral (not significant)**
Employment and Economy	Unemployment rate is below average national. Regional positive trade.	Closure of the Existing Landfill	As per economic displacement.	**Moderate Adverse (significant)**	As per economic displacement.	**Minor Adverse (not significant)**
		Construction	Employment opportunities and / improved local economy.	**Minor Beneficial (not significant)**	Develop and implement an Employment Management Plan, Recruitment Plan. Promote local investments through assistance to businesses. Collaborate with local NGOs and recycling organisations	**Minor Beneficial (not significant)**
			Whilst unlikely, potential impacts associated with any labour influx and the presence of the large number of non-local workers in the Project area.	**Large Adverse (significant)** (depending on the provision of workers' accommodation, if any)	Carefully select location of any workers' accommodation, develop and implement: Construction Camp Management Plan (if applicable), Grievance Register, Security Management Plan. Provide training to all workers on community HSE aspects and	**Minor Adverse (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					local customs. Avoid selection of sites in the proximity to the SPZ area for the workers' accommodation (if applicable).	
		Operation	No labour influx but still potential for creation of jobs and attracting talents.	**N/A**	No impact expected as a result of labour influx at operational stage. In relation to employment and economy, the measures specified during the construction stage will be applicable to this stage.	**N/A**
Labour and Working Conditions	Risk of children working at site, two teenage waste pickers were observed near the existing landfill site. Lack of the monitoring of supply chain with regard to labour and working condition and health and safety issues. Poor occupational health and safety (OHS) at the existing landfill site.	Closure and Construction	Potential risk associated with child labour, forced labour.	**Moderate Adverse (significant)**	Implement a Labour Risk Assessment and Audit. As part of their supply chain management, Spetskomuntrans will ensure that their contractors comply with the EBRD PR2 requirements. Regularly inspect and monitor labour performance / PR2 compliance. Implement grievance mechanism and register. Eradicate any potential act of discrimination.	**Minor Adverse (not significant)**
			Lack of monitoring of supply chain on health, safety and social issues. Risk of OHS hazards involving workers.	**Large Adverse (significant)**	Implement Procurement Plan. Implement Occupational Health and Safety Plan. Implement Accidental Management Plan. Implement Emergency Preparedness and Response Plan.	**Minor Adverse (not significant)**
		Operation	Child and forced labour risks anticipated to be similar to construction stage although there is less likelihood of occurrence due to reduced numbers of workforce. Supply chain Monitoring, similar to construction stage but with reduced number of suppliers. OHS risks, similar to those at the existing landfill.	**Moderate Adverse (significant)**	Implement a Supply Chain Policy. Ensure continuous monitoring of labour and working conditions and compliance with EBRD PR2. Continue to conduct on-site inspections for any sign of children below the legal age. Ensure continuous monitoring of suppliers' performance. On-site inspection of contractors' labour and working condition. Develop detailed operational procedures.	**Minor Adverse (not significant)**
Community Health, Safety and Security	The houses within the SPZ area could be at risk of health, safety and security issues resulting from the Project.	Closure and Construction (covers rehabilitation activities, waste suppressing etc. and therefore similar impacts apply)	Community impact as a result of noise, emissions, groundwater pollution and increased traffic is addressed in Chapter 6,7,12 and 16.	**Large Adverse (significant)**	Implementation of ESMP. Provide regular information to local residents about anticipate Project works and potential impacts.	**Minor Adverse (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
			Increase in rates of vector-borne and zoonotic diseases;	**Moderate Adverse (significant)**	Monitoring of housekeeping and employee and community health (via CLO) in relation to vector born or zoonotic diseases. Immediate isolation of waste dumps through temporary cover and reduce waste footprint.	**Minor Adverse (not significant)**
			Increase in Injury, Mortality Rates cause by Accidents due to Increased Project-Related Road Transportation	**Moderate Adverse (significant)**	Transport Management Plan and Community Health and Safety Plan.	**Minor Adverse (not significant)**
		Operation	Similar effects on local communities are anticipated during the operation stage.	**Large Adverse (significant)**	Impose SPZ restrictions on construction of new permanently occupied residential houses on agricultural land in the project area (as per Ukrainian regulations) as such construction is illegal in the SPZ.	**Minor Adverse (not significant)**
			Vector-borne and zoonotic diseases, the proposed landfill site will be much improved therefore risks will be reduced; reduction in vehicles expected during the operation stage.	**Moderate Adverse (significant)**	As part of regular engagement with local communities and during project area walk-overs, monitor the SPZ area regularly to inspect any changes within the living condition and environmental situation of the area, as well as the number and nature of new developments.	**Minor Adverse (not significant)**
			Increase in Injury, Mortality Rates cause by Accidents due to Increased Project-Related Road Transportation	**Moderate Adverse (significant)**	Regularly monitor housekeeping within the sites. Regular health check-up of employees to ensure they are healthy and immunised from any infectious diseases. Ensure the appointed CLO conduct regular consultation with local residents to spot any illnesses or health issues. Transport Management Plan and Community Health and Safety Plan	**Minor Adverse (not significant)**
Community Infrastructure	There are 17 hospitals and out-patient medical institutions in and around Khmelnitsky. There are 39 educational institutions in Khmelnitsky Oblast, Oleshin Village has two schools and Ivankivsky has one. The majority of houses within the Project area do not have access to piped water and have wells to use for both drinking and sanitary water.	Construction and Closure	Potential deterioration of road quality during construction and restricted access rights. Depending on the provision of workers' accommodation, is any, there could be a strain placed on local infrastructure.	**Moderate Adverse (significant)**	Ensure establishment and development of temporary access roads Ensure a self-sufficient Project in terms of resources (water, electricity, gas) to reduce any impact on local infrastructure. Ensure that workers' accommodation (if any) is equipped with welfare, and medical facilities and that local transport is provided for workers	**Minor Adverse (not significant)**
		Operation	Reduced impact on community infrastructure as by the time of the operation construction workers left the Project area.	**Minor Adverse (not significant)**	The measures are similar to the Construction Stage as specified in Section 13.5.1.5. Conduct post-monitoring of community infrastructure to ensure quality of roads and other infrastructure is restored to pre-project level.	**Neutral (not significant)**

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Community cohesion and benefits	See community health, safety and security and community infrastructure.	Construction	Construction workers from different backgrounds may cause resentment among local residents (13.4.1.6).	**Large Adverse (significant)**	Ongoing consultation and awareness of grievance process. Training for construction workers on local culture and social norms.	**Minor Adverse (not significant)**
		Operation	Waste management awareness programmes will be implemented.	**Minor Beneficial**	Ongoing consultation. Dedicated Project focal point and CLO for local capacity building and implementation of social initiatives, including hosting events and local gatherings at the village council office.	**Minor Beneficial (not significant)**
Vulnerable Groups Including Women	Some individuals or groups are more vulnerable than others, and if affected by the Project, will require the implementation of special livelihood restoration and/or assistance measures.	Construction	Key risks potentially affecting vulnerable groups.	**Large Adverse (significant)**	Implement mitigation measures to incorporate gender aspects into the Project construction stage as described in Gender Matrix (Appendix 13-3). Compliance with the LRF principles throughout the lifecycle of the project. Implement LRP. Include the waste pickers in the Project decision making. Build trust and collaborate with head of Roma on issues and concerns associated with the affected waste pickers.	**Minor Adverse (not significant)**
		Operation	Risks similar to construction stage but with a lower magnitude of impact.	**Moderate Adverse (significant)**	Conduct post-monitoring of affected vulnerable groups (including women focus groups) to ensure their livelihood is restored to pre-project level and provide training for the former employees / waste pickers to develop alternative skills.	**Minor Adverse (not significant)**
Materials and Waste						
Materials	As the site is an operational landfill, there are currently limited requirements for construction materials. The national availability of construction materials is currently felt to be sufficient to accommodate the project, with a possible need to source resources internationally.	Construction	Will require the consumption of materials and generate waste through construction.	**Moderate Adverse (significant)** effect on depletion of natural resources and materials stocks and supplies.	A range of resource efficiency measures and circular economy opportunities should be adopted in design and construction. A CESMP, incorporating a SWMP and MMP should be part of the mitigation approach.	**Minor Adverse (not significant)** Reduced impacts and effects on natural resources and the availability of construction materials nationally.
		Operation	May require the consumption of negligible quantities of materials through on-going maintenance and repair work.	**Minor Adverse (not significant)**	Good practice actions, including the development and implementation of an OESMP, incorporating an OWMP.	**Minor Adverse (not significant)** Beneficial effects through the MBT facility improving materials recovery rates.
Waste		Construction		**Moderate Adverse (significant)** effect on landfill capacity.	A range of resource efficiency measures and circular economy opportunities should be adopted in design and construction. A CESMP, incorporating a SWMP and MMP should be part of the mitigation approach.	**Minor Adverse (not significant)** Reduced impacts and effects on landfill capacity.

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
		Operation	May produce negligible quantities of waste for disposal, through on-going maintenance and repair work.	**Minor Adverse (not significant)**	Good practice actions, including the development and implementation of an OESMP, incorporating an OWMP.	**Minor Adverse (not significant)** Beneficial effects through the MBT facility helping to extend the lifespan of the new landfill.
Climate Change						
Greenhouse Gases	The baseline scenario includes the continued use of the existing landfill and no construction activities.	Construction	Climate change – release of GHG emissions.	**Neutral (not significant)**	Design optimisation to reflect the carbon reduction hierarchy. Engage with materials suppliers. Minimise energy consumption. Source materials locally. Use efficiency plant and equipment.	**Neutral (not significant)**
		Operation	Climate change – release of GHG emissions.	**Moderate Beneficial (significant)**	Maximise operational lifespan. Maximise potential for reuse / recycling of materials at end of life stage, Specify high efficiency mechanical and electrical equipment.	**Moderate Beneficial (significant)**

Appendix 6

AIR QUALITY

PUBLIC

Appendix 6.1

GLOSSARY

Term	Definition
$\mu g/m^3$	Micrograms per cubic metre. A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
AADT Annual Average Daily Traffic	A daily total traffic flow (24 hours), expressed as a mean daily flow across all 365 days of the year.
Accuracy	A measure of how well a set of data fits the true value.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model.
Ambient air	Outdoor air in the troposphere excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
BAT	Best Available Technology
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
Dust	Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials.
Emission Rate	The quantity of a pollutant released from a source over a given time period.
EU	European Union
Exceedance	Time period where pollutant concentration is greater than the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle (>3.5 tonnes)
Highways England	Highways England operates, maintains and improves England's motorways and major A roads and works with the UK's Department for Transport.
IAQM	Institute of Air Quality Management, the UK's the professional body for air quality practitioners.
IED	Industrial Emissions Directive
LRF	Livelihood Restoration Framework

Term	Definition
MBT	Mechanical Biological Treatment
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NRMM	Non-Road Mobile Machinery
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.
WHO	World Health Organisation

Appendix 6.2

IAQM CONSTRUCTION ASSESSMENT METHODOLOGY

STEP 1 - SCREENING THE NEED FOR A DETAILED ASSESSMENT

An assessment will normally be required where there are:

- 'Human receptors' within 350m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- 'Ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

STEP 2A – DEFINE THE POTENTIAL DUST EMISSION MAGNITUDE

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment.

Examples of Human Receptor Sensitivity to Construction Phase Impacts

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000m^3 building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty surface material (e.g. clay), >100m unpaved roads
Medium	**Demolition** 20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks 2,500-10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously,

Dust Emission Magnitude	Activity
	4-8m high bunds, 20,000-100,000 tonnes material moved
	Construction 25,000-100,000m^3 building volume, dusty material e.g. concrete, on site concrete batching
	Trackout 10-50 HDVs out / day, moderately dusty surface material (e.g. clay), 50 -100m unpaved roads
Small	**Demolition** <20,000m^3 building demolished, non-dusty material (e.g metal cladding), <10m above ground level, work during wetter months
	Earthworks <2,500m^2 site area, soil with large grain size (e.g. sand), <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved, earthworks during wetter months
	Construction <25,000m^3, non-dusty material (e.g. metal cladding or timber)
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

STEP 2B – DEFINE THE SENSITIVITY OF THE AREA

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Sensitivity of the Area to Human Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
Low	-	>1	Low	Low	Low	Low	Low

Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from The Sources (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

STEP 2C – DEFINE THE RISK OF IMPACTS

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is ‘negligible’ no mitigation measures beyond those required by legislation will be required.

Risk of Dust Impacts

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Low	Low Risk	Low Risk	Negligible

STEP 3 – APPLICATION SITE SPECIFIC MITIGATION

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high-risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

STEP 4 – DETERMINE SIGNIFICANT EFFECTS

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

Appendix 7

NOISE AND VIBRATION

Appendix 7.1

GLOSSARY

Glossary of Acoustics Terminology

Glossary of Acoustics Terminology

Decibel (dB)	The decibel scale is used in relation to sound because it is a logarithmic rather than a linear scale. The decibel scale compares the level of a sound relative to another. The human ear can detect a wide range of sound pressures, typically between 2×10^{-5} and 200 Pa, so the logarithmic scale is used to quantify these levels using a more manageable range of values.
Sound Pressure Level (SPL)	The Sound Pressure Level has units of decibels, and compares the level of a sound to the smallest sound pressure generally perceptible by the human ear, or the reference pressure. It is defined as follows: SPL (dB) = $20 \, Log_{10}(P/P_{ref})$ where P = Sound Pressure (in Pa) P_{ref} = Reference Pressure 2×10^{-5} Pa An SPL of 0dB suggests the Sound Pressure is equal to the reference pressure. This is known as the *threshold of hearing*. An SPL of 140dB represents the *threshold of pain*.
A-Weighting	The human ear can detect a wide range of frequencies, from 20Hz to 20kHz, but it is more sensitive to some frequencies than others. Generally, the ear is most sensitive to frequencies in the range 1 to 4 kHz. The A-weighting is a filter that can be applied to measured results at varying frequencies, to mimic the frequency response of the human ear, and therefore better represent the likely perceived loudness of the sound. SPL readings with the A-weighting applied are represented in dB(A).
L_{10} or L_{A10} and other percentile measures	This represents the SPL which is exceeded 10% of the time, expressed in dB or dB(A). L_{A10} is used to quantify road noise levels. Other percentiles exist and are used for various types of noise assessment. These include L_{01}, L_{50}, L_{90}, L_{99}.
Noise	A noise can be described as an unwanted sound. Noise can cause nuisance.
Noise Sensitive Receptors (NSR's)	Any identified receptor likely to be affected by noise. These are generally human receptors, which may include residential dwellings, work places, schools, hospitals, and recreational spaces.

Appendix 7.2

CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

MEASUREMENT SYSTEMS

UKAS CALIBRATION
0653

Date of Issue: 17 June 2019

Certificate Number: UCRT19/1696

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	WSP UK Limited Kings Orchard 1 Queen Street Bristol BS2 0HQ

Order No. 20093915

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NL-52	01021290
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	21332
Rion	Microphone	UC-59	04346
Rion	Calibrator	NC-74	01020510
	Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 YES Approval Number 21.21 / 13.02

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received 14 June 2019 ANV Job No. UKAS19/06401

Date Calibrated 17 June 2019

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	14 June 2017	UCRT17/1490	0653

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	17 June 2019		
Calibrator cert. number	UCRT19/1695		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.01	dB	Calibration reference sound pressure level
Calibrator frequency	1001.13	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Wind Shield WS-10

Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	±	
Temperature	22.32	23.21	± 0.30	°C
Humidity	49.0	48.9	± 3.00	%RH
Ambient Pressure	100.69	100.68	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise	This test is currently not performed by this Lab.		
Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.8	dB	UR	16.5	dB	UR	21.8	dB	UR

Uncertainty of the electrical self generated noise ±	0.12	dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k*=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: A Patel

Additional Comments

None

Appendix 7.3

NOISE MONITORING FORMS

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 1	Project No: 70057536 Engineer: Esteban Olmos
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB	General Weather Description: Overcast, dry

Additional Comments: 4m from the road, approximately 29m to the existing landfill site boundary

Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 10:47	15.00	<5	20-25	66.3	80.5	67.6	49.6	Road traffic from local road , bird songs, dogs barking (64 vehicles)
02/07/2019 14:03	15.00	<5	20-25	68.0	80.5	67.9	49.3	Road traffic from local road , bird songs, dogs barking

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA
Location 2

Project No: 70057536
Engineer: Esteban Olmos

Equipment: RION NL-52
Pre-Calibration Level: 94.0 dB
Post-Calibration Level: 94.0 dB

General Weather Description:
Overcast, dry

Additional Comments: 9m to façade of nearest house, 80m from the site

Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 11:13	2.00	1.5 - 2.5	20-25	61.5	75.2	65.3	48.7	Constant distant road traffic, dogs barking
02/07/2019 14:58	10.00	1.5 - 2.5	20-25	51.3	61.5	52.8	46.1	Constant distant road traffic, dogs barking

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 3	Project No: 70057536 Engineer: Esteban Olmos
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB	General Weather Description: Overcast, dry
Additional Comments:	Approximately 130m from the site boundary

Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 11:20	15.00	1.5 - 2.5	20-25	49.7	59.8	51.1	46.5	Constant distant road traffic noise from Zakhidna Okruzhna Street (255 vehicles)
02/07/2019 15:12	15.00	1.5 - 2.5	20-25	47.6	56.4	49.3	44.1	Constant distant road traffic noise from Zakhidna Okruzhna Street (205 vehicles)

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 4	Project No: 70057536 Engineer: Esteban Olmos
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB	General Weather Description: Overcast, dry

Additional Comments: 4m from road, adjacent to construction waste access to the existing landfill, approximately 12m from informal residential accommodation

Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 11:48	10.00	1.1	20-25	53.4	65.9	46.5	34.2	ocassional traffic on local road and trucks to the landfill
02/07/2019 15:41	12.00	1.1	20-25	63.4	78.6	61.8	42.1	ocassional traffic on local road and trucks to the landfill

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 5	Project No: 70057536 Engineer: Esteban Olmos
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB	General Weather Description: Overcast, dry

Additional Comments: Rural location, approximately 2km to the existing existing landfill

Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 12:16	15.00	<2	20-25	50.5	68.2	42.9	31.6	rural, 4 cars, distant industrial noise
02/07/2019 16:36	15.00	<2	20-25	41.1	50.9	43.1	34.4	rural, 4 cars, distant industrial noise

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 6				Project No: 70057536 Engineer: Esteban Olmos				
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB				General Weather Description: Overcast, dry				
Additional Comments:		Rural location, approximately 2.1km to the existing landfill, 6m from the road						
Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 12:45	15.00	<2	20-25	58.2	70.1	48.5	35.1	Local sporadic traffic, 11 vehicles.
02/07/2019 17:01	15.00	<2	20-25	53.6	68.7	49.5	37.3	Local sporadic traffic, 14 vehicles.

Noise Monitoring Form

Project Name: Khmelnitsky Solid Waste Project ESIA Location 7	Project No: 70057536 Engineer: Esteban Olmos
Equipment: RION NL-52 Pre-Calibration Level: 94.0 dB Post-Calibration Level: 94.0 dB	General Weather Description: Overcast, dry

Additional Comments: Approximately 80 from existing offices in industrial state, 1.1km from existing landfill

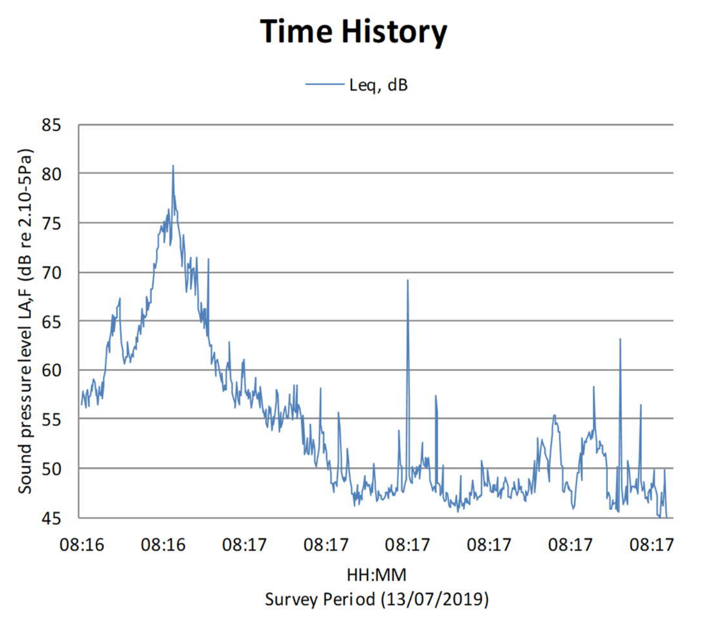
Measurement Period		Weather		Statistical Noise Levels / dB				Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
02/07/2019 13:13	15.00	1.0	20-25	54.3	67.8	44.7	35.8	Ocassional traffic, 3 cars
02/07/2019 16:04	15.00	3.0	20-25	48.5	65.2	43.9	32.0	Ocassional traffic, 2 cars

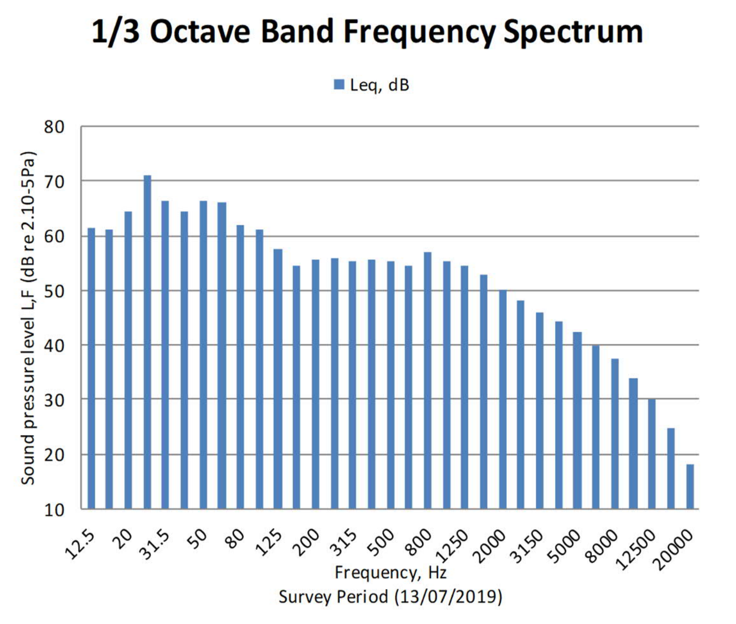


Noise Monitoring Form

Project:	Khmelnitsky Solid Waste ESIA	**Job Number:**	70057536
Location:	Location 8		
Equipment:	RION NL-52	**Engineer:**	Esteban Olmos
Pre-Calibration Level:	94.0 dB	**General Weather Description:**	sunnry,dry, wind speed 1-2 m/s
Post-Calibration Level:	94.0 dB		
Additional Comments:	40m from the existing landfill entrance towards the tipping point, 4m from truck		

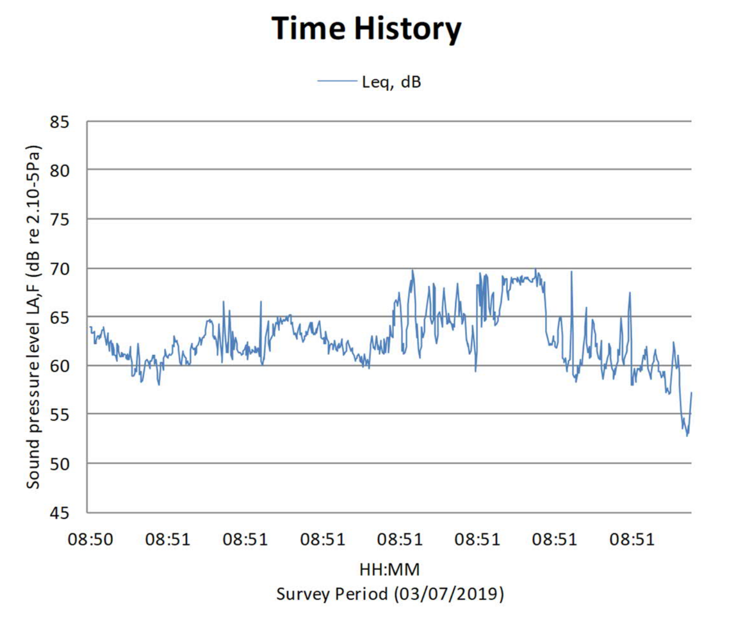
Measurement Period			**Statistical Noise Levels / dB**					**Description of Audible Noise**
Date	**Start / Stop Time**	**Measurement Periods**	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
03/07/2019	08:16	1 min	63.7	79.2	45.7	66.6	47.3	Waste collection truck arriving to the existing landfill

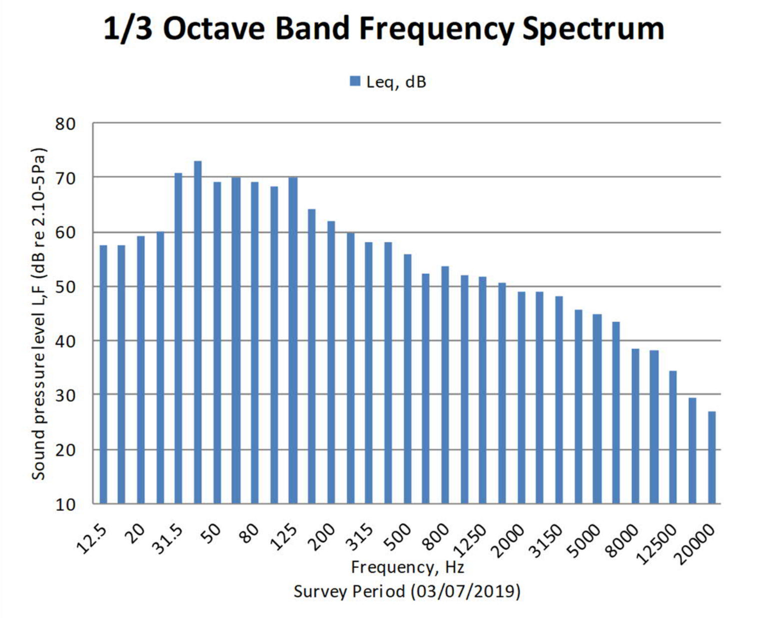




Noise Monitoring Form			
Project:	Khmelnitsky Solid Waste ESIA	**Job Number:**	70057536
Location:	Location 9		
Equipment:	RION NL-52	**Engineer:**	Esteban Olmos
Pre-Calibration Level:	94.0 dB	**General Weather Description:**	sunnry,dry, wind speed 1-2 m/s
Post-Calibration Level:	94.0 dB		
Additional Comments:	Tripping point of the existing landfill, waste collection trucks passing by 4m		

Measurement Period			**Statistical Noise Levels / dB**					**Description of Audible Noise**
Date	**Start / Stop Time**	**Measurement Periods**	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	Waste collection truck passing by on tipping area
03/07/2019	08:50	1 min	64.0	81.8	58.0	67.6	60.4	

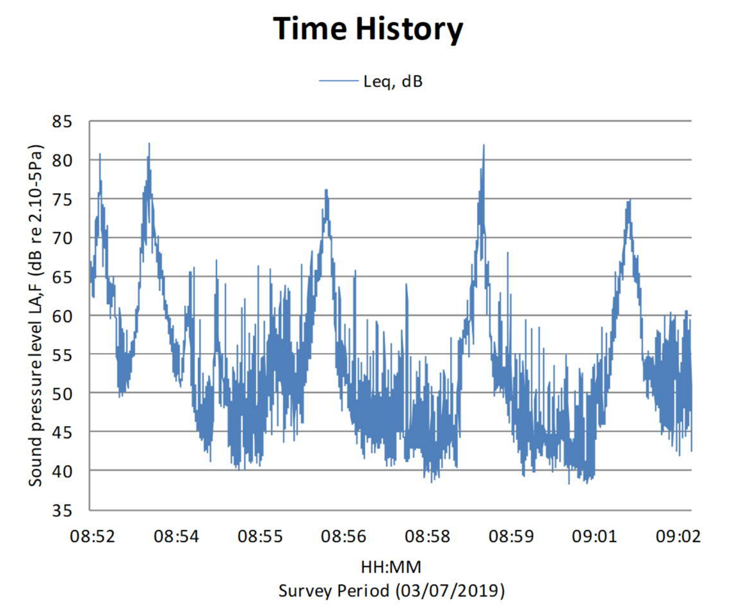


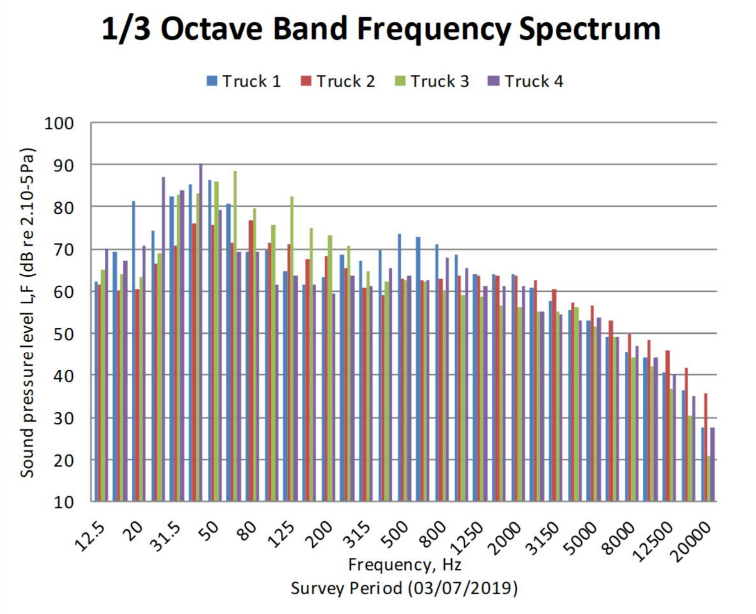


Noise Monitoring Form

Project:	Khmelnitsky Solid Waste ESIA	**Job Number:**	70057536
Location:	Location 10		
Equipment:	RION NL-52	**Engineer:**	Esteban Olmos
Pre-Calibration Level:	94.0 dB	**General Weather Description:**	sunnry,dry, wind speed 1-2 m/s
Post-Calibration Level:	94.0 dB		
Additional Comments:	Tripping point of the existing landfill, waste collection trucks tipping, reversing and passing by		

Measurement Period			**Statistical Noise Levels / dB**					**Description of Audible Noise**
Date	**Start / Stop Time**	**Measurement Periods**	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	Waste collection truck passing and tipping on tipping area
03/07/2019	08:52	10 min	64.2	76.5	44.2	63.7	45.7	

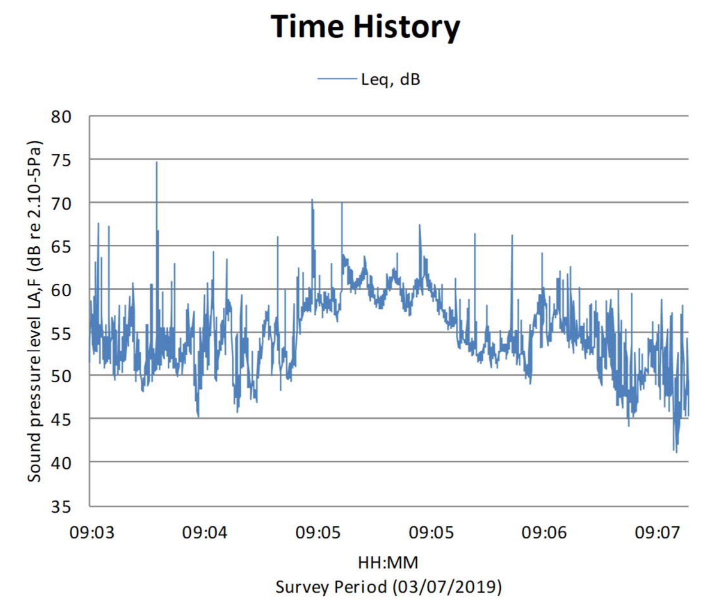


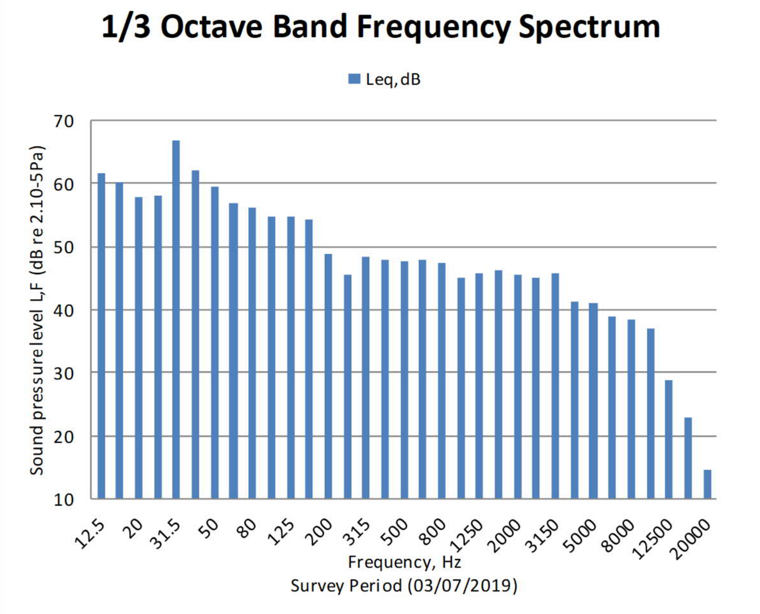


Noise Monitoring Form

Project:	Khmelnitsky Solid Waste ESIA	**Job Number:**	70057536
Location:	Location 11		
Equipment:	RION NL-52	**Engineer:**	Esteban Olmos
Pre-Calibration Level:	94.0 dB	**General Weather Description:**	sunnry,dry, wind speed 1-3 m/s
Post-Calibration Level:	94.0 dB		
Additional Comments:	Tripping point of the existing landfill, waste collection trucks tipping and dozer		

Measurement Period			Statistical Noise Levels / dB					Description of Audible Noise
Date	Start / Stop Time	Measurement Periods	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
03/07/2019	09:03	3 min	57.0	70.3	47.1	59.1	50.2	Waste truck tipping and dozer compacting material at approximately 30-40m

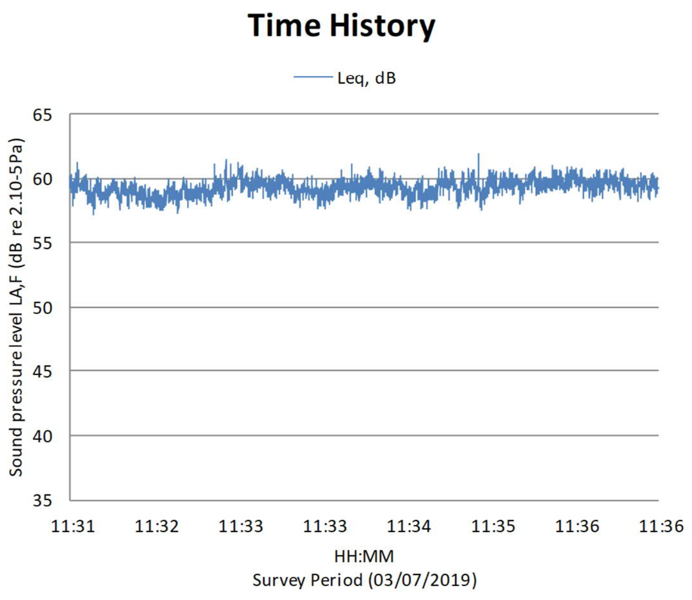


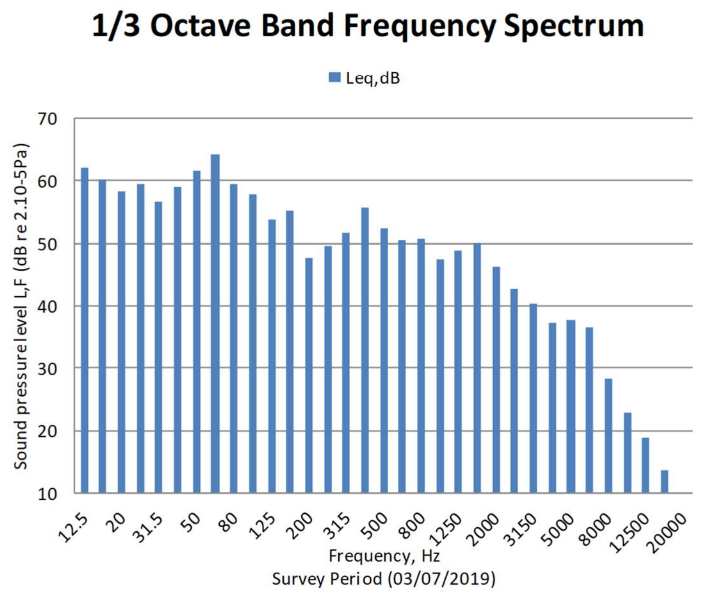


Noise Monitoring Form

Project:	Khmelnitsky Solid Waste ESIA	**Job Number:**	70057536
Location:	Location 12		
Equipment:	RION NL-52	**Engineer:**	Esteban Olmos
Pre-Calibration Level:	94.0 dB	**General Weather Description:**	sunnry,dry, wind speed 1-2 m/s
Post-Calibration Level:	94.0 dB		
Additional Comments:	5m from Biogas plant on site		

Measurement Period			Statistical Noise Levels / dB					Description of Audible Noise
Date	Start / Stop Time	Measurement Periods	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	Biogas plant
03/07/2019	11:31	5 mins	59.3	61.0	57.9	59.9	58.7	





Appendix 7.4

TRAFFIC DATA

SCENARIO 1: BASELINE

Receptor	Speed (km/h)	AADT (vehicles/day)	% HDV
Waste Pickers' Accommodation 1	10	1,120	57
Waste Pickers' Accommodation 2	40	4,608	19
Site Access Road 1			
Site Access Road 2			
Zakhidna Okruzhna Street 1	60	15,424	15
Zakhidna Okruzhna Street 2			

SCENARIO 2: BASELINE WITH THE PROJECT

Receptor	Speed (km/h)	AADT (vehicles/day)	% HDV
Waste Pickers' Accommodation 1	10	1,376	65
Waste Pickers' Accommodation 2	40	4,864	23
Site Access Road 1			
Site Access Road 2			
Zakhidna Okruzhna Street 1	60	15,680	16
Zakhidna Okruzhna Street 2			

Appendix 13

SOCIAL

PUBLIC

Appendix 13.1

ADDITIONAL TABLES AND FIGURES

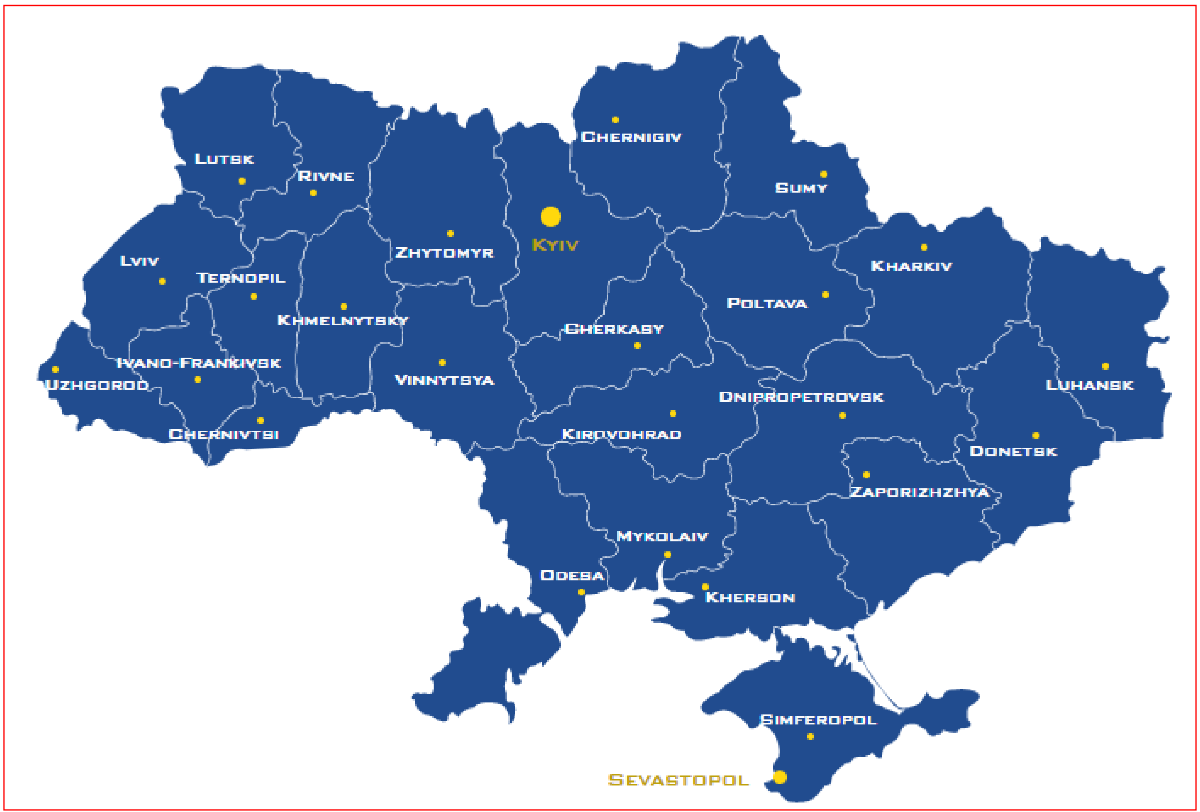


Figure A13-1 - Regions of Ukraine[135]

Sensitivity Criteria

Receptor Sensitivity	Definition as pertinent to the Project context
Very High	Many communities depend on the affected resource (s) and there are no nearby alternatives Many households and business owners/operators perceive that the change will affect them significantly and they may need to leave the area/community An extremely high level of concern was expressed about the impact by NGOs and a range of stakeholders in all Project Affected Communities (PACs) Extremely significant permanent and unrecoverable social impacts affecting the project area and the region (e.g. groundwater contamination leading to major human illnesses/deaths as evident by health department)

[135] The Ministry of Foreign Affairs of Ukraine (2019). Regions. Available at: https://mfa.gov.ua/en/about-ukraine/info/regions (Accessed 27/08/19).

Receptor Sensitivity	Definition as pertinent to the Project context
	Breach of international legal limits on both environmental and social issues (child labour, forced labour) leading to major human rights issues Extreme shortage of labour pool Extremely unacceptable level of Project risk affecting minority groups
High	A community depends on the affected resource(s) and there are no nearby alternatives; Total permanent loss of access to landfill site for waste pickers and any minority groups (i.e.Roma) which will affect local livelihood and income to an unacceptable extent (permanent loss of jobs and income with no alternative resources/income); Involuntary resettlement/relocation of PACs (Project Affected Community) (more than one PAC) due to land acquisition Significant permanent and unrecoverable environmental, health and safety and social impacts affecting the project area and wider region (e.g. groundwater contamination leading to major human illnesses/deaths as evident by health department) Many households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life to an unacceptable extent; and A high level of concern was expressed about the impact by many stakeholders in most of the affected areas /communities receiving national rganisations' (including international NGOs) attention Breach of national environmental limits, legal established sanitary boundaries where impacts would be felt much higher by vulnerable groups including people with health issues, the disadvantaged and elderly High shortage of labour pool
Medium	A community depends on the affected resource, however there are nearby alternatives; Partial loss of access to landfill site for waste pickers, which will temporarily result in loss local income or livelihood; Some households and business owners/operators perceive that a change will affect their ability to maintain their livelihood, store of resources or quality for a period (>1 year) Intermediate risks to health and well-being and local nuisance posed by Project-induced changes (increased traffic, trenches, noise, air and groundwater, access rights limitation, odour) understood by all adults, but recoverable within a period
Low	Individuals or households (HH) or communities that use affected resource(s) have access to nearby alternatives, the use of which may cause limited adverse indirect impacts; Low level risks to health and well-being and local nuisance which are felt during certain periods and will be recovered in a short period of time (1 year) Few stakeholders expressed concern about the impact in affected communities.
Negligible	No direct and indirect changes to local livelihood, and no harm associated with; and No stakeholders expressed concern about the impact in the affected communities.

Magnitude Criteria

Magnitude	Definition as pertinent to the Project context
Very Large	Permanent reduction in the ability of land owners and users to exploit their land, such that economic displacement (as defined in EBRD PR 5) affects a very large percentage of the population in PACs Households/individuals in a PAC may be able to adapt, but the transition period will be difficult for most individuals / households to an extremely unacceptable level Physical displacement of a large percentage of the population in PACs (more than a PAC). Influx of thousands of workers Spread of infectious disease affecting many PACs
Large	Permanent reduction in the ability of land owners and users to exploit their land, such that economic displacement (as defined in EBRD PR 5) affects a large percentage of individuals or households in a PAC (more than 20) Households/individuals in a PAC may be able to adapt, but the transition period will be difficult for most individuals / households to an unacceptable level Physical displacement of a large percentage of the population in a PAC Influx of hundreds of workers
Moderate	Permanent reduction in the ability of land owners and users to exploit their land, such that economic displacement (as defined in IFC P-S 5) affects a few households (up to 5) Households and individuals in a PAC may be able to adapt to the loss or change of use of land, but the transition period will be difficult for some households/individuals (up to 5) Limited number of workers (100-200 mainly local)
Minor	Temporary (<1 year) or intermittent negative changes to some aspects of the ability of land owners and users/PAPs to exploit their land or other resources that do affect the livelihoods, economic opportunities or options for improvement of the standard of living, but to which most individuals/households are expected to be able to adapt relatively easily Limited workers' contracts and labours (mainly local)
No Change/ Beneficial	No change to the current socio-economic environment associated with the Project (no change) Employment opportunities for both men and women (beneficial) Improvement in social infrastructure and improved access (beneficial)

Ukraine Population Statistics, 2011 to 2018 (as of 1 January, '000s)[136]

Statistic	2011	2012	2013	2014	2015	2016	2017	2018
Total Resident Population	45598.2	45453.3	45372.7	45245.9	42759.7	42590.9	42414.9	42216.8
Women within Population	24565.6	24476.6	24410.0	24327.6	22971.9	22873.0	22770.3	22658.6
Birth Rate	502.6	520.7	503.7	465.9	411.8	397.0	364.0	335.9
Mortality Rate	664.6	663.1	662.4	632.3	594.8	583.6	574.1	-
Natural Increase / Decrease (-) Population	-162.0	-142.4	-158.7	-166.4	-183.0	-186.6	-210.1	-
Population Migration between Ukraine and Other Counties Increase / Decrease (-) in population	17.1	61.8	31.9	22.6	14.2	10.6	12.0	-

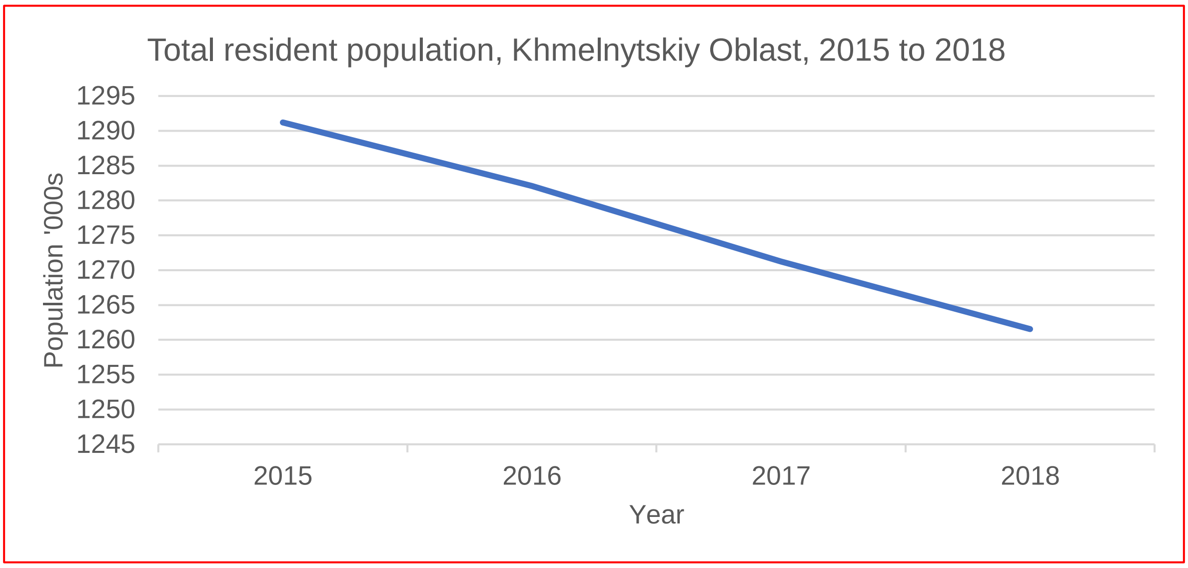


Figure A13-2 - Total resident population of Khmelnytskiy Oblast from 2015 to 2018 ('000s)[137]

[136] Ukrstat (2018). State Statistics Service of Ukraine documents publishing. Available at: https://ukrstat.org/en/operativ/operativ2007/ds/nas_rik/nas_e/nas_rik_e.html (Accessed 27/08/19). Data for the years 2015 to 2018 excludes the temporarily occupied territories of the Autonomous Republic of Crimea, and the city of Sevastopol.

[137] Khmelnitsky Regional State Administration.

Khmelnitsky City by Age Group at 1 January 2018, Number of People and %[138]

Age group (years)	Number of People	Percentage
0-19	55,862	21%
20-29	33,907	12.8%
30-39	50,433	19%
40-49	38,352	14.4%
50-59	36,649	13.8%
60 and over	50,380	19%
Total	265,583	100%

Local Settlements' Population[139]

Village Name	Population
Oleshin	2,728
Vydrovi Doly	400
Ivankivtsy	860
Cherepova	410
Cherepivka	523
Velyka Kalynivka	410

[138] SU Statistics.

[139] Khmelnitsky City Council (2019). Khmelnitsky City Council – Official Site. Available at: http://khm.gov.ua/ (Accessed 28/08/19).

National Versus Regional Comparison of Source of Employment (%)[140]

Top 3 Sources of Employment	2017 (%)	
	National level	Regional level
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles Industry	21.8%	22%
Agriculture, Fishing and Forestry	17.7%	27.9%
Industry	15.1%	12.2%

Morbidity of Population 1990 and 2017 (000s)[141]

Morbidity Factor	Number of newly registered cases by Year (000s)	
Year	**1990**	**2017**
Newly registered	32,188	26,615
Neo-plasms	310	366
Diseases of the nervous system	2,640	636
Diseases of blood circulation system	1,149	1,781
Diseases of respiratory organs	17,021	12,037
Diseases of skin and hypodermic cellular tissue	1,799	1,564
Disease of bony and muscle systems and connective tissue	1,374	1,218
Diseases of urogenital system	1,224	1,724
Congenital anomalies (defects of development), deformation and chromosome disorders	41	47
Traumas, poisoning and some other consequences of external affects	2,866	1,697

[140] State Statistics Service of Ukraine (2017). Employed population by economic activities and regions in 2017. Available at: https://ukrstat.org/en/operativ/operativ2013/rp/zn_ed_reg/zn_ed_reg_e/zn_ed_reg_2017k_e.htm (Accessed 26/08/19).

[141] Ukrstat (2018). State Statistics Service of Ukraine documents publishing. Available at: https://ukrstat.org/en/operativ/operativ2007/oz_rik/oz_e/zahvor_06_e.html (Accessed 26/08/19). Data from 2017 excludes the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and temporarily occupied territories in the Donetsk and Luhansk regions.

Appendix 13.2

GENDER IMPACT MATRIX

Women are identified as a vulnerable group for this project. A brief gender assessment has been conducted to evaluate the impacts of the proposed project work on local women. The EBRD Gender Toolkit: Matrix 2 has been used as a reference[142].

Area	**Key Gender issues and baseline**	**Mitigation Measures**
PR1: Environmental and Social Management	Any different priorities and needs of men and women with respect to the services in question should be taken into account based on the type of service, and in the assessment of disruptions caused by the construction/modernisation works.	Conduct regular monitoring of the social performance to measure the benefit potentially delivered by the Project for men and women (i.e. KPIs such as number of new jobs created for men and women, number of complaints submitted by men and women).
PR2: Labour and Working Conditions	The project should provide equal employment opportunities for local women. Opportunities should be made available for women. With regards to gender equality and non-discrimination, patriarchal attitudes and gender stereotypes still exist in Ukraine[143]. No gender equality policy exists at Spetskomuntrans.	▪ Where possible and as part of the Project, make the following employment positions available to both male and female candidates provided it does not contradict the current national HSE requirements: • Landfill manager • Landfill master • Operations manager (dispatcher) • Bulldozer operators • Excavator operator • Cesspool emptier (KO-503B-13) driver • Housekeeper • Guard • Welder • Timber cutting machine operator ▪ Spetskomuntrans already has equal opportunities policy which has been implemented. Regularly review and update the equal opportunities policy. ▪ Via the existing Grievance Mechanism, request Human Resources to record and monitor any complains by women related to discrimination against them, and report on resolution of such type of complaints.

[142] EBRD (2019). Gender Toolkit: Matrix 2. Issues relevant to Sector. Available at: https://www.ebrd.com/downloads/sector/gender/Gender_toolkit_matrix2.pdf (Accessed 27/08/19).

[143] UN Ukraine (2019). Gender equality. Available at: http://www.un.org.ua/en/resident-coordinator-system/gender-equality (Accessed 27/08/19).

Area	Key Gender issues and baseline	Mitigation Measures
		▪ Improve employment opportunities for new female graduates by interacting with the University of Khmelnitsky. ▪ Provide internship programmes for female high school graduates particularly on waste management related work such as technical jobs, community awareness on waste management etc.
	In relation to the gender pay gap, at a national level the gender pay gap in Ukraine was 21% in 2017 reaching 40% in some economic activities.	▪ Development of a gender pay gap policy with the Human Resources procedures. ▪ Promote women leadership through development of a 'Women Thought Leaders' programme. ▪
PR3: Pollution Prevention and Abatement	Within the Project area, local women are the main household carers and spend longer hours at home compared to men and they are also responsible in gardening activities particularly in the SPZ area. Therefore, women will be more exposed directly to the Project impacts such as dust, odour and any water quality contamination.	▪ As part of the SEP implementation and through ongoing consultations with local residents, consult with local women through focal groups to understand if they have any concerns or experienced any changes in emissions or other aspects associated with the construction and operation of the facilities.
PR4: Community Health, Safety and Security	Works in this sector can impact on use of public streets, causing temporary or permanent disruption, consideration should be given to safety concerns in relation to women and children, taking account, for example of baby carriages and shopping loads. As part of the Project, between 100 and 300 construction workers are anticipated. It is likely that there will be labour influx. Violence against women is common with 1 in 5 women aged 15-49 experiencing physical violence since they turned 15 years old, 5% of which were violence from a non-related perpetrator.	▪ Provide sufficient lighting surrounding the access roads and community right of way so women feel comfortable in these areas during the evening/night time. ▪ Consult with local women on potential location of the Project workers' accommodation. ▪ During focus group discussions and as part of keeping local residents updated on the project progress, make sure that sufficient information is provided to local women about the Project and ask female deputy villagers to participate in women focus groups. ▪ If there are any grievances related to women's safety and security issues associated with the Project, coordinate such issues with local police.
PR 5: Land Acquisition,	Where waste picking on landfill sites is a means of income for some men and	▪ Ensure that all relevant compensation measures outlined in the

Area	Key Gender issues and baseline	Mitigation Measures
Involuntary Resettlement and Economic Displacement	women, they should be considered entitled to compensation for economic displacement. Women waste pickers may be at risk of sexual abuse and gender violence as they may not have legal identification documents and could be target of traffickers.	LRF/Entitlement Matrix are equally provided to both men and women. ▪ As per the measures outlined in the LRF, provide assistance to currently employed affected women-waste pickers in terms of finding alternative jobs at the Project if their hours are reduced or the construction activities temporarily affect the working hours/shifts they prefer.
	Elderly and particularly illiterate women may not be able to understand the legal land acquisition process and could be misled or miscommunicated on the process.	▪ KCA to assist illiterate and elderly women (particularly with no family members) in terms of communicating the land acquisition process, their rights to compensation and livelihood restoration in accordance with the measures defined in the LRF/ Entitlement Matrix.
PR10: Information Disclosure and Stakeholder Engagement	Lack of women's awareness about the project risks and benefits could cause local grievances among women. Women may feel isolated and may not be able to participate in the project decision-making process. Therefore, it is important that the project disseminate relevant information. Women are considered vulnerable for the purposes of this Project.	▪ Facilitate a women's focus group prior to the start of the project and if required, provide transportation particularly for elderly women to attend consultation meetings (i.e. local EIA (OVD) public hearing(s)). ▪ As part of the SEP implementation, Spetskomuntrans to hold regular quarterly meetings with local women to ensure their concerns and comments about the project are addressed. ▪ Continue with consultations with local female residents throughout the implementation of the project to ensure stakeholders remain fully engaged, and ensure support is maintained. ▪ As part of monitoring the Livelihood Restoration Plan implementation and as part of reporting to the Bank on social aspects of the Project, monitor how local households and particularly(vulnerable) households led by women, benefitted from the Project activities.

Appendix 13.3

BAT - EXISTING AND PROPOSED LANDFILL

LFD REQUIREMENT	ARRANGEMENTS IN PLACE		BAT?
	Existing Landfill Operation	Proposed Landfill Operation	
OPERATION			
Security Recommendations			
Provide perimeter fencing and gates to prevent unauthorised access as far as practicable (including preventing free access to animals and wildlife, as required by the Animal By-products Regulations).	The main access to the landfill is fenced with a concrete wall and a vehicle gate. However, the rear of the landfill body, the leachate ponds and the informal construction waste area(s) are not securely fenced. Some fencing is present in this area but it is not complete and the fencing that is present is in poor condition. The City indicated that the landfill is controlled and monitored 24 hours per day, 7 days a week, by security personnel, in order to prevent non-authorised dumping of waste. However, this could not be verified during the site visit.	The Feasibility Study for the proposed landfill indicates that it will have a mesh fence of galvanized wire on columnar foundations including 4.5m wide entrance gates, to be connected to the existing concrete fence. The length of designed fence will be 1,525 m. Landfill operating procedures should include procedures for site security and maintenance of fencing and security infrastructure.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Security fencing may be appropriate for vulnerable locations. The recommend minimum height for security fencing is 2m with cranked top and barbed wire strands.			
Ensure perimeter fencing is inspected regularly by a nominated person.			
Maintain perimeter fencing in good repair at all times.			
You should consider using the following measures to prevent free access to the site: • Security cameras; • Security guard; and • Intruder alarms, lighting, shutters and bars on accommodation.			
Recommendations for Accident Management Plan			
Particular areas of accidents to be considered at landfills may include, but should not be limited to, the following: • Uncontrolled migration of landfill gas; • Explosion; • Waste slippage; • Failure of a basal or side wall liner; • Incompatible wastes coming into contact; • Release of leachate to an uncontained area; • Overfilling of tanks/lagoons; • Emission of a treated leachate before adequately checking its composition; • Vandalism; and • Hazardous wastes to be deposited.	No emergency response plans for other types of incident are in place, and the site does not have an Accident Management Plan (AMP).	The Feasibility Study for the proposed landfill makes reference to the need for developing emergency response plans, but no additional detail is included. Landfill operating procedures (to be developed) should include formal emergency response plans covering all potential emergency scenarios.	**Current** No **Proposed** Operational aspects are not assessable at this stage.
Recommendations for Preventing Fires			
You should take the following measures to minimise the risk of fires: • Site security to prevent unauthorised access; • Prompt emplacement, compaction and covering of wastes in well-defined cells;	Access is controlled, although fencing is not complete (see Security section above). Wastes are emplaced in four sectors, with one sector active at any time, and with covering of active areas monthly.	Improved fencing and security is proposed (see Security section above). Daily covering of wastes is proposed, using materials excavated adjacent to the site.	**Current** Partial **Proposed**

• Prompt capping of completed areas; and • Prevention of air ingress in to the waste and gas extraction and collection systems.	A gas collection system has recently been installed and site management reported that the number of fire outbreaks has decreased significantly following installation of the biogas plant.	An upgraded gas collection system is proposed, although treatment options have not yet been fully assessed.	Partial (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Your waste acceptance procedures should preclude the acceptance of hot or reactive wastes.	All vehicles entering the existing landfill are weighed, but, there are no further checks, and no specific checks for hot or reactive wastes. There are currently no formal operational procedures for operation of the existing landfill.	Landfill operating procedures (to be developed) should include procedures for prohibition of hot and reactive wastes.	**Current** No **Proposed** Not assessable at this stage
You should extinguish fires as soon as possible and report fires to the Environmental Regulator.	Site management reported that several fires have occurred at the existing landfill in recent years. Basic fire response actions comprise recirculation of leachate from the leachate pond to the operational area of the existing landfill, but this has limited effectiveness. The Feasibility Study indicates that the following measures with a bearing on fire-prevention / suppression have recently been implemented at the existing landfill: • Water reservoirs of 80 m^3 have been installed as a backup fire-water supply, and a fire-water supply piping system has been constructed and put into operation. • Road access to the leachate collection point and disposal areas has been improved, facilitating better access for firefighting. • External lighting has been repaired. • Firefighting equipment has been purchased. No other formal firefighting provisions are currently in use, and staff have not been trained in fire response. Response actions would be devolved to the emergency services. Additionally, site management reported that the number of fire outbreaks has decreased significantly following installation of the biogas plant. An LPG pipe runs under part of the existing landfill (western side).	The design team indicated that the new landfill will incorporate a fire-fighting system comprising: • A pipe with hydrants around the perimeter of the site; and • A fire-water tank and a pumping station, supplemented by a liquid supply from treated leachate. Additional details were not provided, but it was reported that the system would be designed in accordance with the applicable Ukrainian regulations for fire-fighting systems. An LPG pipe runs below the proposed landfill site and this may present an elevated fire hazard. A plan for relocation and/or management of this hazard will be required.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Recommendations for Stability			
You should assess the stability of your landfill. Your assessment should include: ▪ Settlement or slippage within the foundation (subgrade) beneath the landfill base or sides; ▪ Slippage within the liner system; ▪ Slippage at the waste / liner interface; ▪ Rotational failure within the waste, or through the whole cross-section ▪ Slippage failure of the cap or of its components; ▪ Effects of settlement on the landfill cap and restoration; and ▪ Effects of settlement on environmental management infrastructure	No stability assessment is known to have been conducted. No monitoring for stability and settlement is currently undertaken in the existing landfill. The landfill body has very steep slopes – up to 40º in some location – with the steepest slopes in the northern side of the existing landfill. This has led to instability and slopes failures and an urgent need to reprofile these slopes has been identified, to prevent further slippage. The instability is compounded by the presence of ponds at the base of the existing landfill body, reducing ground integrity.	On development of the new cell, the landfill body will be reshaped to have a maximum angle of 18º. No stability assessment is known to have been conducted during design. Additionally, waterlogged land in the vicinity will be dried out to provide additional stability. However, details of how ongoing drainage of this land will be achieved were not available. Landfill operating procedures (to be developed) should include procedures for monitoring of stability and settlement.	**Current** No **Proposed** No, as no stability assessment is known to have been conducted. Note: Operational aspects are not assessable at this stage.

Your assessment should take account of the presence and movement of waste and leachate.			
You should not analyse waste stability by ascribing to it conventional geotechnical parameters, unless the waste is homogeneous, and its geotechnical properties known. This is because waste is generally a heterogeneous material subject to decomposition, consolidation, and considerable variation, both spatially and with time. You should justify any assumptions and should undertake sensitivity analysis.			
For household waste and similar industrial and commercial waste, convenient rules of thumb you may consider are: ▪ A maximum finished slope of 1 in 4 will generally provide an acceptable factor of safety; and ▪ For temporary slopes between phases of a landfill, 1 in 2 to 1 in 3 has been found to be satisfactory. However, as the biodegradable component of landfilled municipal solid waste declines and pre-treatment of waste increases in response to the Landfill Directive, such rules of thumb will require re-evaluation.			
You should monitor stability and settlement in the construction, operational and aftercare phases.			
Stability can be a problem at the interfaces between geosynthetics and mineral layers. When building liner systems, it is necessary to construct layers of different materials, either for separate or synergistic purposes. You should consider all potential interactions between layers, both in use and under construction. You should assess the interface friction between each layer under all conditions of use, both static and dynamic, temporary or permanent.			
Recommendations for Site Investigation			
Your site investigation should comprise both a desk study and field investigations, where necessary. The scale and extent of the investigations should relate to the nature of the proposed landfill (types of waste), the complexity and sensitivity of the geological and hydrogeological environment, and the proximity of potential receptors which may be affected. Investigations should be phased and should have clear identifiable objectives for each phase.	No site investigations are known to have been conducted prior to the 2018 hydrogeological study (see right).	A hydrogeological study is understood to have been conducted in 2018 in the area affected by the landfill. The data was not available for review.	**Current** No **Proposed** Assumed no, due to lack of access to data.
A quality approach for all site investigation activities should be adopted, as part of the overall quality approach to landfill design, construction and operation.			
Investigations should include both the site and surrounding areas that will be influenced by the landfill.			

Investigations should include initial design of the monitoring programme, and installation of groundwater and soil gas monitoring points to allow collection of background/base readings over the maximum practicable period of time. Seasonal fluctuations (i.e. in groundwater levels) should be taken into account.			
An accurate topographic survey should be undertaken for site design purposes and calculating void space. All borehole positions and other site features should be surveyed. Ideally, the data will be in electronic format. Consider using aerial photographs to communicate the context of the site and record development throughout its life.	No topographic survey is known to have been conducted for design of the existing landfill.	Topographic and geodetic survey works were performed for the proposed landfill in September 2018.	**Current** No **Proposed** Yes
Recommendations for Construction Quality Assurance (CQA)			
CQA plans should be submitted in advance of programmed work to allow for consideration of proposals. A submission programme with the Environmental Regulator should be agreed and all CQA plans approved.	Not completed for the existing landfill.	Not conducted at this stage, as the construction contractor has not yet been appointed. The competency requirements listed should be applied during selection processes. A validation report should be developed following completion to demonstrate construction as per the design specifications.	**Current** No **Proposed** Not assessable at this stage.
CVs of all CQA personnel involved in the works should be provided prior to works commencing. Roles and responsibilities for each member of the CQA team should be outlined. This should be approved by the Environmental Regulator.			
A validation report should be submitted.			
Recommendations for Rain Water, Surface Water and Groundwater Management			
Water management at the site must be planned to take into account weather, hydrology and hydrogeology. A final plan for the water control infrastructure as an integral part of the engineering design and this should be linked to the site restoration plan.	Limited leachate collection infrastructure is present (see below) but no separate collection or management of other water streams is known. Routing of domestic wastewater (small volumes) is not known.	The Design Team indicated that three separate water streams will be generated at the proposed landfill, and will be managed and treated independently: ▪ Domestic / household sanitary waste water: This will be treated on site in a plant with five m^3/day capacity, and the following stages ○ Mechanical treatment (first stage): primary settlement tank, intended to guarantee the sedimentation of coarse mineral impurities and suspended matter, with a retention time of approximately 30 minutes. ○ Biological treatment – aero tank mixer (second stage): aerobic oxidation of dissolved and colloidal organic substances through compressor equipment. ○ Secondary sedimentation tank (third stage): a mixture of excess active sludge and purified sewage water is conducted into the secondary sedimentation tank. Active sludge particles are aggregated and deposited in the bottom, and sludge mix is constantly recirculated to the aerobic oxidation stage. The purified sewage water will be discharged through the outlet. ▪ Rainwater from potentially contaminated areas: ○ Potentially contaminated runoff from operational areas of the site (away from the landfill body) will be treated in an oil separator to remove petroleum products and suspended matter.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.

		○ Uncontaminated rainwater will be separately routed. ▪ Leachate – this will include both the leachate generated in the new landfill and the leachate continuing to flow from the old landfill. This will be managed in an on-site treatment facility with the following characteristics: ○ Physical-chemical treatment: Two flotation units installed in a row. ○ Biological treatment: Five-day retention aerobic oxidation, with a 150 m^3/day capacity; and ○ Desalination and disinfestation tertiary treatment: foam polystyrene and sand filters including a reverse osmosis unit and a disinfection block (hypochlorite sodium addition).	
Water balance calculations based on accurate data should be undertaken relevant to specific site locations. Consider seasonal variations.	Not done for the existing operations. However, leachate generation from the existing landfill body is incorporated into calculations for the proposed landfill, as both streams will be treated in the new leachate treatment plant.	The Feasibility Study for the proposed landfill indicates that water flows have been calculated in accordance with Ukrainian state norms DBN b.2.5-64:2012 Internal Water Supply & Sewerage and DBN V.2.5-75: 2013 Sewerage: Designing External Networks & Structures. It indicates the following annual flows: • Treated household water: 1,633m^3; • Contaminated rainwater 2,500m^3; and • Treated leachate: 19,000m^3. Additionally, 14,410m^3 of surface water from uncontaminated areas and not requiring treatment is calculated. These streams (calculated total 37,543m^3) will be directed to collection vessels, water reservoirs and holding tanks, and mostly used for moistening of the MSW landfill and as fire water supply, with excess capacity discharged to the municipal sewerage system. The design consultants stated that the capacity and capability of the municipal WWTP to treat this effluent has been confirmed, but this was not verified. A permit will be required for these discharges.	**Current** No (although included in mass balance for new facility) **Proposed** Yes
Rainwater running off areas outside the landfill should be intercepted and channelled away from construction, operational and post-closure phases. Rainwater encountering waste and / or leachate should be managed as leachate. It should be treated to remove suspended solids prior to use or discharge.	No infrastructure is installed – leachate ponds only.	Separate networks and treatment for stormwater originating outside the landfill body are proposed (see above). Leachate treatment collection and treatment is proposed (see previous sections of this table).	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Temporary caps should be installed on non-operational areas and completed areas should be capped and restored as soon as practicable.	No temporary capping or restoration is known to have been undertaken.	Landfill operating procedures (to be developed) should include procedures for temporary capping and restoration of non-operational areas.	**Current** No **Proposed** Operational aspects are not assessable at this stage.

The surface water drainage system should be designed to cope with storm events.	No surface water infrastructure is installed – leachate ponds only.	Excess capacity would be transferred to the municipal sewerage system. It should be confirmed that storm events have been factored into the assessment of the system capacity.	**Current** No **Proposed** Not assessable.
Groundwater should be prevented from entering the landfill as far as is necessary to ensure there is no unacceptable risk to the stability or effectiveness of engineering controls, other environmental protection measures and the environment. Risk assessments which satisfy requirements of the Groundwater Directive should be undertaken to determine what constitutes acceptable risk. Where possible, long term control of groundwater by passive means such as barriers or gravity drainage should be implemented.	No control measures for groundwater are currently in place. A groundwater risk assessment has not been undertaken for the existing site and groundwater monitoring is not undertaken on a regular basis.	The cells will be lined, which will limit potential for groundwater ingress to the proposed landfill. No groundwater risk assessment is known to have been conducted for the proposed landfill. During construction GW controls will comprise management of leachate levels in the existing landfill to prevent breakout / migration to groundwater during reprofiling, use of standby pumps for emergency leachate pumping if leachate is mobilised at surface, and engineering / design of temporary ponds to prevent flooding / seepage to ground. Additionally, waterlogged land in the vicinity will be dried out to provide additional stability. However, details of how ongoing drainage of this land will be achieved were not available. Landfill operating procedures (to be developed) should include procedures for groundwater management and monitoring.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
The risk of direct discharge of listed substances to groundwater in the long-term should be addressed.			
You should design groundwater management systems to: ▪ Accommodate calculated flows ▪ Avoid clogging of drainage layers ▪ Accommodate discrete spring flows ▪ Accommodate anticipated settlement and overburden ▪ Allow CCTV inspection, jetting and maintenance			
Recommendations for Leachate Management			
A water balance calculation should be used to predict the volume of leachate produced with time.	Not done for the existing operations. However, leachate generation from the existing landfill body is incorporated into calculations for the proposed landfill, as both streams will be treated in the new leachate treatment plant.	As discussed above, the Feasibility Study for the proposed landfill indicates that water flows have been calculated, with annual flows of treated leachate of 19,000m^3. Additionally, 14,410m^3 of surface water from uncontaminated areas and not requiring treatment is calculated.	**Current** No (although included in mass balance for new facility) **Proposed** Yes
The Environmental Regulator will set a limit or limits for leachate depth. You should develop site-specific action levels below the specified compliance limits. This should be contained within your environmental management system and be designed to instigate the pumping of leachate to ensure compliance limits are not breached.	No action levels are known to have been developed.	No action levels are known to have been developed.	**Current** No **Proposed** No
The drainage layer should be used along the entire base of the cell. The side slope drainage should be subject to risk based design and may not necessarily be the same design as the basal drainage layer.	Leachate is currently drained to leachate ponds at the foot of the landfill by means of perforated perimeter pipes and perimeter drains. From this pond, leachate is regularly recirculated into the existing landfill using trucks. Currently, leachate is not treated. Once remediation and closure of the existing landfill has been completed, collection of leachate will take place through a	The Feasibility Study for the proposed landfill includes details of a proposed new leachate collection system comprising: ▪ Leachate outlet manifold K-1 in north-west and northern part of the MSW landfill (total drainage length; 824m); ▪ Leachate outlet manifold K-2 in southeast and east part of the MSW landfill (total drainage length; 767m); and ▪ Leachate outlet manifold K-3 at the foot of north-east part of existing MSW landfill (total drainage length; 2,712m).	**Current** No **Proposed** The proposed treatment system appears to be generally aligned with BAT, although the Feasibility Study makes no reference to some specific aspects covered by the guidance. These should
Use of an aggregate drainage blanket with hydraulic conductivity. This is related to the grading of the material used. Recommended grading of aggregate for use in a drainage layer is BS 13242:2002 20/40 aggregate.			

A finer graded 10/20 aggregate in combination with a filter geotextile on top of the leachate drainage blanket can be used if site specific issues.	purpose designed drainage system which will conduct the leachate stream to the new Leachate Treatment Plant. The specifically designed leachate collection drainage will consist of a perforated perimeter pipe capturing the leachate coming from the existing landfill (pond areas) and conducting it to the proposed new treatment plant, which has been designed with capacity for the new and existing cells.	The (closed) leachate drainage system will be installed with the following sequence (from bottom to top): ▪ Ditch excavation: 0.8m wide, with a 1:1.5 slope inclination; ▪ Anti-infiltration screen installation: hydro insulating geo-synthetic clay barrier around the ditch perimeter; ▪ HDPE 1.5 mm membrane; ▪ Filtration layer of thermally fixed geo-textile. ▪ Sand bed, 0.1m thick; ▪ Perforated (360º perforation) reinforced double wall drainage pipe (300mm diameter), wrapped up with a geotextile layer; ▪ Drainage crushed stone coverage layer (20-40mm diameter); and ▪ Ballast and protective layer of compressed soil. In the north-east part of the active landfill a well will be constructed, made of prefabricated reinforced concrete rings (diameter 2.0m) with internal insulation to collect the infiltrated waters from the cell. This will be fitted with a submersible pump unit with a level triggered automatic switching system which will pump leachate into the leachate reservoir. Two holding tanks, each of 100m^3 will be constructed for collection of effluent prior to treatment. One tank will serve as a sedimentation reservoir, and the other one will be used for the filtration of impurities. Treated effluent from the Leachate Treatment Plant (and also other treated wastewater streams – see above) will be either recirculated to the landfill for irrigation, stored for fire-water supply, or (mainly in winter) piped to the municipal sewerage system for additional treatment by the City. Effluent pumped to the city network will have to comply with the specific standards (acceptance values) stablished by the City and will require a permit. The Feasibility Study for the proposed landfill specifies that leachate will be re-used in the summer period (April – October), for watering of the new landfill cells while they are active.	be incorporated into the designs where feasible.
Any drainage aggregate should have a minimum soaked 10% fines values of 100 kN. Other drainage media are acceptable providing the following issues are assessed: ▪ Chemical resistance / compatibility; ▪ Strength and physical characteristics; ▪ Long term hydraulic performance; ▪ Permeability; ▪ Transmissivity; ▪ Stability; ▪ Redundancy; ▪ Liner protection; ▪ Fires (tyres); and ▪ Compacted thickness (tyres).			
Pipes should be bedded on suitable material and covered with drainage material. All sections of pipe should be firmly fixed together using butt fusion or electro-fusion welding. Pipe diameter should be a minimum of 120mm for branches and 160 mm for main runs. Pipe spacing should be a maximum of 30 metres or calculated using Rowe Section 2.4[144] (			
Leachate should be drained to collection sumps at low points where it can be removed. Leachate should be removed from the drainage collection system by: ▪ Vertical wells; ▪ Side slope risers located on site perimeter; and ▪ Gravity drains.			
Your design of leachate extraction wells should meet the following: ▪ Minimum internal diameter 600mm; ▪ Walls with slots for leachate ingress only within permitted leachate level; ▪ Air tight sealing at top of well; ▪ Sealing between the well and waste;			

[144] Rowe RK, Quigley RM, Brachman RWI, and Booker JR (2004). Barrier Systems for Waste Disposal Facilities.

▪ Appropriate strength and protection; ▪ Provision for CCTV access and jetting of leachate collection pipework; ▪ Heavy, lockable, gas tight covers; ▪ Appropriate written safety procedures for entry; ▪ Designed to accommodate settlement of the waste around the extraction well; and ▪ Designed so as not to damage the liner below.			
Leachate collection and monitoring wells should avoid locations that are difficult to access for monitoring and abstraction purposes.			
Side slope risers permit access for CCTV or jetting and for inspection. Side slope risers should also be sealed near the surface to prevent air ingress into the landfill.			
Measures required to treat contaminated water and leachate to appropriate standards prior to discharge should be considered. Contingency plans for leachate management in the event of a breakdown of components should be included.			
For biodegradable waste landfill, leachate recirculation into the waste mass as part of the leachate management system could be considered if certain requirements are met.	Leachate is recirculated, but the current landfill setup does not meet the relevant criteria in the guidance.	Recirculation of treated leachate is proposed. The leachate treatment system, if installed as designed appears to permit recirculation under the criteria in the guidance.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Recommendations for Geological Barriers			
A geological barrier must be in place which provides a barrier to contaminant movement, that is, it must possess purifying powers. The geological barrier must extend along the base and all the way up the sides of the landfill site.	The Design Team reported that the existing landfill is located in an area which was historically a clay quarry, and that the underlying clay has a coefficient of permeability below 10^{-9}. The clay layer is understood to extend beyond the boundaries of the historical quarry, and to the surrounding areas. This means that, even though no specific geological barrier has been installed, the facility is situated on a substrate comprised of low permeability clay. However, as the existing landfill is now substantially above the level of the original quarry, this protection is only provided at the base of the existing landfill body and does not extend all the way up the sides. A risk assessment has not been undertaken for the current site to demonstrate the performance of the in-situ clay in meeting the requirements of the Groundwater Regulations.	It is proposed to level the site with a bulldozer. Then, the bottom of the landfill body and the slopes of the enclosing dam will be covered with a 0.5m thick layer of loamy soil excavated during the pit construction. This enclosing dam will have a total height of 2ms. The total volume of soil required will total approximately 45,500m³. Then, an artificial sealing liner will be placed over the geological barrier. An anchor trench will be excavated around the perimeter of the cell and further to be filled after protective film was laid down. A hydrogeological Risk Assessment (HRA) has been conducted as part of this ESIA. The construction of the artificial geological barrier should follow relevant guidance on the construction of compacted clay liners, bentonite enhanced soils, or other appropriate guidance.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
The geological barrier must provide sufficient attenuation to prevent risks to soil and groundwater. Your risk assessment must demonstrate the performance of the barrier against requirements of the Groundwater Regulations, that is, there must be no discharge to groundwater of List I substances and no pollution of groundwater by List II substances at any stage of the site life cycle.			
Your risk assessment should consider: ▪ Operational and post-closure phases; ▪ Failure and degradation of other controls; ▪ Likely variation of leachate concentration with time;			

▪ Stability and settlement; ▪ The role of the barrier in controlling landfill gas. If the geological barrier does not provide sufficient environmental protection naturally, this can be artificially enhanced. Artificial barriers must be at least 0.5 m thick.			
Recommendations for Artificial Sealing Liner			
The leachate collection system must include an artificial sealing liner. This should be selected on the basis that risk assessment of the overall design demonstrates there is no likelihood of unacceptable discharges from the landfill. Appropriate guidance should be used depending on the liner type. A stability assessment should take into account the interactions between the multiple layers present in the lining system. The liner system should be very low in terms of permeability, be stable and robust, durable and resistant to chemical attack and puncture. Chemical compatibility of the liner materials should be assessed with the probable waste, leachate and gas composition and temperature. The effects of potential weaknesses or imperfections in the liner materials on short and medium term performance of the liner should be considered.	The existing landfill does not have any type of artificial sealing liner.	The proposed landfill will be equipped with an artificial sealing liner comprising a geotextile (presenting a 300g/m^2 density) plus a HDPE (High Density Polyethylene) geomembrane layer 1.5mm thick. An anchor trench will be excavated around the perimeter of the cell to be filled after the protective film is installed. The construction of the artificial geological barrier should follow relevant guidance on the construction of compacted clay liners, bentonite enhanced soils, or other appropriate guidance. Before finalising the design and installation of the liner, the chemical compatibility of the liner materials (and, if used, any artificial support structures) should be assessed in the context of the likely waste, leachate and gas composition and temperature that will exist in the landfill. The stability assessment of the new landfill cells should take into account the interactions between the multiple layers present in the lining system.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Recommendations for Artificial Sealing Liner Protection			
You should select a suitable material to provide appropriate protection. A range of materials including geotextiles and mineral materials can provide this appropriate protection.	The existing landfill does not have a liner.	See comments on geotextile in “Recommendations for Artificial Sealing Liner” section.	**Current** N/A **Proposed** Yes (subject to installation as designed)
Recommendations for Leak Detection			
You should monitor the performance of the liner system in order to verify design assumptions and inform the design of future phases. This may require the installation of permanent or semi-permanent monitoring systems. You should use geophysical leak detection on all cells where the artificial sealing liner is a geomembrane to check for defects. Your risk assessment may indicate the need for a leakage interception layer within the lining system. The system should be divided into compartments to assist in locating any significant leakage, and possibly in its remediation.	The existing landfill does not have an artificial sealing liner and therefore no leak detection provisions are in place.	A risk assessment should be conducted to identify optimal leak protection provisions and the proposed landfill operating procedures (to be developed) should include procedures for monitoring of leak detection measures if the risk assessment identifies that this is necessary.	**Current** No **Proposed** No

Any leak interception system should be monitored, and results interpreted. You should consider whether land should be reserved adjacent to the landfill as a contingency against unanticipated seepage.			
Recommendations for Settlement			
Stability and settlement of the waste, the constructed landform, its foundation, environmental management infrastructure and the interactions between them must be assessed. You must demonstrate that environmental management infrastructure will not be compromised and there will be no risk to safety or detriment to the landform over the entire lifecycle.	No stability assessment is known to have been conducted	No stability assessment is known to have been conducted	**Current** No **Proposed** No
Recommendations for Capping			
Your capping system should contain a sealing layer, and a surface water drainage system. Cover soils to protect the sealing layer and drainage system. Appropriate sealing layers should be determined on the basis of the hydrogeological and landfill gas risk assessments. You should consider interactions between all elements in the capping systems in a stability risk assessment. Consideration should be applied as to whether a gas drainage layer is included in the capping design. These may have a greater role for inorganic landfills, in particular, landfills for hazardous waste.	The Feasibility Study for the proposed landfill includes proposals for capping of the existing landfill. These include installation of the following: ▪ A levelling layer of loam 0.2m thick with a seal; ▪ Gas drainage for collection and discharge of landfill gas; ▪ 1.5mm HDPE geomembrane with welding of joints for waterproofing; ▪ A drainage layer of sand of 0.2m which serves as the drainage of surface water; ▪ A reclamation layer of loam 0.10m thick; ▪ Arranges a layer of fertile soil with a thickness of 0.3m. Thus, the overall thickness of the screen is 0.83m. The risk assessment process used to develop this proposal is not known.	It is not clear if the same design as for the existing landfill will be used for capping of the proposed landfill when it is closed.	**Current** Yes (subject to installation as designed) **Proposed** Not assessable at this stage.
Recommendations for Landfill Gas Management			
You should undertake a landfill gas risk assessment.	No risk assessment is known to have been conducted for the existing landfill, although it is anticipated that a design study would have been conducted prior to installation of the current collection system.	A calculation of anticipated biogas generation rates and composition has been conducted and is summarised in the Feasibility Study for the proposed landfill. However, no information was available to confirm whether a wider risk assessment has been conducted. The Feasibility Study for the proposed landfill has estimated the quantity and quality of the landfill gas that is expected to be produced during the operating and post closure phases of the proposed new cells, according to the following assumptions / considerations: ▪ Biogas generation (flowrate) has been calculated using a model / formula based on the following parameters: biomass temperature (º C), substrate moisture content (%), ash content of the dry organic matter (%), landfill daily disposal factor (kg/m^3 per day), concentration of organic matter in the dumped material (kg/m^3), fermentation period (days), volumetric density of waste (kg/m^3) and fermentation process temperature (º C).;	**Current** No **Proposed** Partial

		▪ Even if the anaerobic decomposition of organic matter in the body of the landfill lasts for several decades, the process intensity reaches its maximum output approximately one year after the landfill cover with an insulating layer of soil has taken place and stays practically almost at the same level for five to six years, proceeding then gradually to decline. Hence, from a practical point of view (in order to carry out the required calculations) it has been assumed that 42.5% of biogas shall be extracted during the first six years and another 57.5% over the next 15 years; ▪ Municipal Solid Waste will have a moisture content between 40 and 60%; ▪ Of all the total amount of waste expected to be deposited in the landfill, 28 to 45% will correspond to food waste; ▪ Of all the total amount of waste expected to be deposited in the landfill, 70 to 80% will be available for biological degradation under aerobic and anaerobic conditions; ▪ Body temperature of the landfill between 28 and 32 º C; ▪ Biogas generation potential of 120 m^3/t and 60% of methane; and ▪ Total generation of methane in the range of 27,103,010 m^3.	
You should develop a landfill gas management plan. This, and the above risk assessment, should be reviewed on at least an annual basis. It should be reviewed more frequently if there are changes in the landfill gas (i.e. odour issues, quantity) If the risk assessment identifies landfill gas will be generated; this must be managed through containment, collection or utilisation, flaring and treatment. Gas extraction systems should be designed to maximise the quantity of landfill gas collected. Pumping trials could be undertaken to provide information on how much gas can be extracted from the waste. You should design and operate cells to minimise the period before you can install active gas extraction.	There are 60 wells across the existing landfill for the recovery of landfill gas. There are two gas collection stations available in the site; one approximately at the centre of the disposal area, and another one on the south-western part of the existing landfill. Biogas flows from each vertical extraction well to the nearest gas collection station. However, according to the information available the gas collection approach / system is only 50% efficient (only half of the existing vertical extraction wells are in use at the moment); this lack of efficiency is attributed to the fact that there is a biogas / leachate contact in the extraction wells due to the recirculation of the leachate from its accumulation pond to the upper part (active area) of the existing landfill. Leachate and condensate are accumulated in the wells, blocking screen openings and reducing gas flow. The biogas utilisation system / equipment (operated by a private company, named Bio Gas Energy) is located in the south-eastern corner of the existing landfill site, including a grid connection. Landfill gas collected through the vertical wells and directed to the gas collection stations, is transferred to and burnt in a 659 kW Jenbacher engine (LFG utilisation plant). It is a closed system, the only forced air being the stream required for the condensing unit / cold filter implemented immediately before the engine. The offtake line from the engine is circa 10 kV with a step-up transformer within the facility to connect it to the grid.	A biogas collection system will be included as part of the proposed landfill. The Feasibility Study for the proposed landfill specifies that biogas will be extracted from the proposed landfill through a system of collection wells connected to gas manifolds comprising 250mm diameter perforated pipes placed beneath a geomembrane and above a layer of slaked lime. The outlet section of the pipe will be located above the ground, at a height of approximately 2m above ground. Pipe outlet aperture sections will be closed by means of a louvered grate. The Design Team indicated that, although installation of a proper biogas plant has been envisaged as essential, it has not been fully specified as yet, and detailed proposals have not been developed. It has not been confirmed if the collected landfill gas will be utilised in the current electricity production facility (on-site), if and additional / modified production facility will be installed, or if it will be flared. Landfill operating procedures (to be developed) should include procedures for management of landfill gas and leachate.	**Current** Partial **Proposed** Not assessable at this stage as system design has not been completed.

	According to the operator of Bio Gas Energy interviewed at the landfill on the 3rd of July 2019: ▪ Since its start-up the engine has been working on a continuous regime; ▪ Average methane content in the biogas stream ranges between 40 and 50% approximately; ▪ Biogas flowrate reaching the engine of approximately 300 m^3/h; and ▪ The biogas utilisation system / engine holds Environmental Permit for its emissions. When the operation regime of the engine began (by July 2019 it has been operative for 21 months), the exhaust gases of the combustion were monitored, and it was verified that those emissions complied with the limit values. No further monitoring has been carried out.		
Leachate recirculation can increase landfill gas production rates and must take place as part of a controlled landfill gas and leachate management strategy.	Leachate is recirculated however no procedures to manage this are in place at the existing landfill.	Landfill operating procedures (to be developed) should include procedures for management of landfill gas and leachate.	**Current** No **Proposed** Not assessable at this stage.
Landfill gas collection pipework and extraction systems should be designed to adequately deal with predicted volume and flow rates of landfill gas produced.	No risk assessment is known to have been conducted for the existing landfill, although it is anticipated that a design study would have been conducted prior to installation of the current collection system.	Designs have yet to be finalised, so assessment is not possible at this stage.	**Current** No **Proposed** Not assessable at this stage.
The capacity of the treatment system should be sufficient to deal with the volume of gas generated at the landfill.	No risk assessment is known to have been conducted for the existing landfill, although it is anticipated that a design study would have been conducted prior to installation of the current collection system.	Designs have yet to be finalised, so assessment is not possible at this stage.	**Current** No **Proposed** Not assessable at this stage.
Open flares should not be used except for emergency or test purposes.	There is no flaring in the existing landfill; and no emergency flare is installed for use in case the biogas utilisation engine is not working.	The design for the biogas treatment system for the new facility has not been completed and it had not been confirmed whether a flare will be installed. However, discussions with the design consultants indicate that installation of an emergency flare is likely. This would comprise an enclosed flare.	**Current** No **Proposed** Not assessable at this stage.
Your design of the landfill gas collection infrastructure should take account of potential air ingress and a programme of inspection and maintenance of the infrastructure should form part of your landfill gas management plan.	A landfill gas management plan is not available for the existing landfill and there are no procedures for inspection and maintenance of the landfill gas infrastructure.	The design for the landfill gas collection system for the new facility has not been completed. Landfill gas management procedures for the proposed landfill have not been developed.	**Current** No **Proposed** Not assessable at this stage.
Fire prevention measures and early detection measures should be considered. Routine monitoring of carbon monoxide should be undertaken to monitor possible hot spot development. Monitoring for carbon monoxide should be undertaken, using handheld instrumentation, during balancing of the gas extraction system. Frequency and assessment levels for carbon monoxide monitoring should be included in the landfill gas management plan.	No carbon monoxide monitoring is known to be conducted.	Monitoring procedures for the proposed landfill have not been developed.	**Current** No **Proposed** Not assessable at this stage.

Landfill gas poses a risk of fire and / or explosion if not managed correctly. A risk assessment to identify hazardous zones should be undertaken and control measures applied to minimise the risks within these zones.	No risk assessment is known to have been conducted.	A risk assessment should be conducted once the proposed landfill is constructed and operational.	**Current** No **Proposed** Not assessable at this stage.
Recommendations for Waste Inspection			
You must undertake a visual inspection at the landfill entrance unless it is not practicable to see the waste due to the vehicle or container in which the waste is delivered. Visual inspection is not usually practicable where the waste is delivered in: ▪ A front end loader; ▪ A rear end loader; ▪ Compaction container; ▪ Road sweeper collector; ▪ A sheeted container; and ▪ Any other enclosed vehicle where there is no access for inspecting the waste without unloading the vehicle In these circumstances you should check the delivery vehicle is consistent with vehicle type normally used for the waste described in the documentation. If for whatever reason you are concerned or suspicious about the nature of the waste, you should make a particular effort to complete a visual inspection at the landfill entrance. Where the waste is not consistent with the description provided, you should quarantine the load while you carry out further checks, or alternatively refuse the load.	Trucks are weighed on arrival, but no other formal waste acceptance procedures are in place. The waste area at the base of the existing landfill, primarily used for construction waste, adjacent to the leachate ponds was publicly accessible during the site visits (the gate was not closed or controlled), therefore limited control of waste types is possible. Some asbestos sheeting was observed. There are no formal operational procedures for waste receipt and inspection at the existing landfill.	Trucks will be weighed on arrival and departure. No hazardous wastes will be accepted for their disposal in the proposed landfill, but processes for this have not yet been developed. A weighbridge and security hut will be installed at the entrance of the proposed landfill. Landfill operating procedures (to be developed) should include formal procedures for waste inspection and acceptance, and for management and disposal of non-acceptable waste, including asbestos.	**Current** No **Proposed** Operational aspects are not assessable at this stage.
You should visually inspect all waste at the point of deposit using staff who are: ▪ Aware of the waste description for each load they are inspecting; and ▪ Familiar with the wastes permitted for disposal at the landfill You should have procedures in place to allow the staff inspecting the loads to make detailed queries about the wastes that are permitted at the landfill including information on basic characterisation and compliance testing. Where the visual inspection of the waste identifies the waste is not consistent with the description provided for the waste or is otherwise not permitted at the landfill, you should ensure the load of waste is: ▪ Reloaded on to the delivery vehicle; and ▪ Removed to a designated quarantine area The waste should not be accepted for disposal at your landfill. Where you refuse wastes for disposal at you landfill, they should be removed by the delivery vehicle and you should make a record of this. Where it is not possible for the waste to be removed by the delivery vehicle, you should store the wastes in a quarantine area and remove them as soon as possible.	Trucks are weighed on arrival, but no other formal waste acceptance procedures are in place. Wastes are observed during offloading at the allocated tipping area. Site management reported that wastes such as ash, chemicals, etc are prohibited, and that if identified in wastes deposited, they would be retained and the person who delivered them would be recalled removing them. However, this is an informal process. No other waste inspections are conducted in the main landfill area. The waste area at the base of the existing landfill, primarily used for construction waste, adjacent to the leachate ponds was publicly accessible during the site visits (the gate was not closed or controlled), therefore limited control of waste types is possible. Some asbestos sheeting was observed. The existing landfill does not have procedures for the management of difficult wastes. There are no formal operational procedures for waste receipt and inspection at the existing landfill.	Trucks will be weighed on arrival and departure at the proposed landfill. No hazardous wastes will be accepted for their disposal, but processes for this have not yet been developed. A weighbridge and security hut will be installed at the entrance of the proposed landfill. Landfill operating procedures (to be developed) should include formal procedures for waste inspection and acceptance, and for management and disposal of non-acceptable waste, including asbestos.	**Current** Partial **Proposed** Operational aspects are not assessable at this stage.

Recommendations for Waste Handling			
Ensure every load is visually inspected by personnel trained to recognise waste that requires special handling.	Refer to arrangements relating to 'Recommendations' for Waste Inspection.	Refer to arrangements relating to 'Recommendations for Waste Inspection'.	**Current** Partial **Proposed** Operational aspects are not assessable at this stage.
You should design the size of the working area to minimise the potential for fugitive releases. You should level and compact waste as soon as it is discharged at the working area. You should ensure waste is covered as soon as practicable. Guidance on using daily cover is given in separate Environment Agency guidance. Any cover materials you use should meet the objectives of landfill cover set out in the guidance.	Wastes are emplaced in four sectors, with one sector active at any time, and with covering of active areas monthly. Extensive areas of uncovered waste away from the operational area were observed. There are no formal operational procedures for waste compaction at the landfill.	Landfill operating procedures (to be developed) should include formal procedures for management of working area size and prompt compacting and covering of wastes.	**Current** Partial **Proposed** Operational aspects are not assessable at this stage.
Difficult wastes - Your risk assessment should identify any wastes with characteristics requiring a particular method of handling at the site which is not part of normal day to day procedures. Typical examples are: ▪ Fine particulate material; ▪ Empty containers; ▪ Very large objects; ▪ Sludges; ▪ Very light materials, for example, expanded polystyrene; and ▪ Odorous wastes. You should consider a pre-treatment method to reduce the handling difficulties posed by such wastes.	The existing landfill only officially accepts municipal type wastes. However, other waste streams are contained in loads, and there is the potential for such difficult wastes to be present within the municipal waste. There are no formal operational procedures for the management of difficult wastes, such as specific handling measures which may be required to accommodate them. The waste area at the base of the existing landfill was publicly accessible during the site visits (the gate was not closed or controlled), therefore limited control of waste types is possible.	Landfill operating procedures (to be developed) should include formal procedures for waste inspection and acceptance, and for management and disposal of difficult and non-acceptable wastes.	**Current** No **Proposed** Operational aspects are not assessable at this stage.
A site closure plan should be implemented which includes: ▪ Removing or flushing out pipelines and vessels; ▪ Plans of all underground pipes and vessels; ▪ Method and resources necessary for clearing of lagoons; ▪ Removal of asbestos or other potentially harmful materials; and ▪ Testing of soil to ascertain the degree of any pollution caused. The site closure plan should be reviewed at least once every four years, or if significant changes occur. Annual reviews should consider progress made towards criteria for permit surrender. You should review the criteria for surrender of the permit at least once every four years.	The Feasibility Study for the proposed landfill includes proposals for capping of the existing landfill (See comments on capping in "Recommendations for Capping" section.). However, no detailed closure plan meeting the requirements of the Directive was identified.	No detailed closure plan meeting the requirements of the LFD was identified. A Closure Plan should be developed and maintained.	**Current** No **Proposed** No
Recommendations for Particulate Matter Control – Dust and Aerosols			
You should have procedures in place to deal with particulate matter arising from: ▪ The placement of wastes; ▪ Traffic on site roads during periods of dry weather;	Although some control measures are in place (see subsequent sections) no formal procedures are currently in place for management and abatement of dust and aerosols.	Landfill operating procedures (to be developed) should include formal procedures for control of dust and aerosols.	**Current** Partial **Proposed**

▪ Site preparation and restoration activities; ▪ Surface emissions; and ▪ Carriage of dust/mud onto the highway. Your abatement procedures should take into account the following issues: ▪ Abatement of particulate matter at the source of generation is likely to be more effective than suppression of particulate matter once they have become airborne; ▪ Particle size is very important - coarse particles have much greater settling rates than finer particles: coarse particles will settle out as deposited dust quite close to the source; whereas fine particulate matter may remain airborne for longer periods and travel much greater distances. These are implicated more in health exposure impacts. There is no sharp dividing line between the sizes of suspended particulate matter and deposited particulate matter, although particles with diameters >50 mm tend to be deposited quickly and particles of diameter <10 mm have an extremely low deposition rate in comparison; and ▪ Many dust-suppression techniques are ineffective for the finer particles biological activity - Much particulate matter (solid or liquid droplets) from some landfills is biologically active. Biological aerosols (bioaerosols) consist of finely divided biological organisms suspended in air. These aerosols can vary in size from 0.5 to >100µm and can occur as aggregates, as droplets or attached to inert dust particles. Bioaerosols are complex in nature, and may include: viruses, bacteria, actinomycetes, fungi, enzymes, endotoxins, mycotoxins and glucans. They can affect organisms by infection, allergy, toxicity, pharmacological and other processes. Bioaerosols are most likely to be formed when degrading waste is disturbed.			Operational aspects are not assessable at this stage.
Your site design should minimise the area left unrestored. Restoration should take place as soon as possible following the end of waste disposal in a cell or phase.	Although some intermediate covering is done, most of the existing landfill body is not capped or covered. The Feasibility Study for the proposed landfill includes proposals for capping of the existing landfill (See comments on capping in "Recommendations for Capping" section.).	Landfill operating procedures (to be developed) should include formal procedures for capping and restoration.	**Current** Partial **Proposed** Operational aspects are not assessable at this stage.
You should extend surfaced site roads as far as possible to the tipping face and should make them available for as long as possible. You should maintain surfaced site roads and keep them in a clean condition.	Site roads are gravelled and need some repair.	New access roads have been proposed in the Feasibility Study for the proposed landfill. Cross-sections of the proposed roads are available. The Feasibility Study for the proposed landfill specifies that internal site roads will be surfaced with crushed stone. Design for the north-west road: ▪ Sand 100 mm' ▪ Gravel 150 mm; ▪ Crushed stone 200 mm (100 mm fraction 20/40; 100 mm fraction 10/20); and	**<u>Current</u>** No **<u>Proposed</u>** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.

		▪ Road slabs 3,000 x 2,000 x 180. Design for the east-south road: ▪ Sand 100 mm; ▪ Crushed stone 250 mm 40/70; and ▪ Crushed stone for wedging 70 mm fraction 0/40. The Feasibility Study for the proposed landfill states that roads will be designed to meet standard requirements for heavy vehicles, including firefighting trucks. Landfill operating procedures (to be developed) should include measures for maintenance of roads.	
You should control the movements of site traffic including restrictions on routes and speeds.	Waste delivery vehicles entering the site are directed to the active tipping area by operators. No formal traffic management rules are in place. There is a risk of vehicle overturning. Waste pickers were observed immediately adjacent to vehicles during tipping, assumed with the intention of accessing wastes before other waste pickers.	The Feasibility Study for the proposed landfill states that traffic signs will be installed, speed limits applied, barriers installed, and pedestrians segregated from vehicles. Landfill operating procedures (to be developed) should include measures for traffic management.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
You should locate wheel washers far enough from the site entrance to allow any residual debris to be deposited within the site.	A water pit is installed at the site entrance and functions as a wheel wash for trucks leaving the site. The location of the current wheel-wash is considered to meet this requirement.	The Feasibility Study for the proposed landfill indicates that a disinfection unit will be installed at the site exit, comprising a concrete reservoir (8m x 3.5m x 0.3m) for disinfection of the wastes truck wheels. The reservoir will be filled with a disinfection solution (3% Lysol water solution and sawdust). Landfill operating procedures (to be developed) should include measures for management of this unit, and for prevention and management of debris on roads.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Your management system should include the following measures to prevent mud escaping from the site, to prevent potential accident hazards, dust and other amenity issues. ▪ Effective wheel and body cleaners to remove mud and debris from vehicles prior to them leaving the site; ▪ Maintenance (for example, regular water changes for wet systems) of wheel-wash equipment; ▪ Supervision of the use of wheel-wash to ensure that vehicles use the equipment correctly; ▪ Main site roads maintained in a mud free condition by employing a mechanical sweeper/washer; ▪ Sufficient distance on surfaced site roads between haul roads and any wheel wash facilities; ▪ Monitoring of site road between final wheel wash and public highway; and ▪ Monitoring of public highway.	The wheel wash unit is emptied every two weeks and the effluent is tankered to the municipal waste water treatment plant. No monitoring of roads is known to be conducted.	A disinfection unit is proposed (see above). Landfill operating procedures (to be developed) should include measures for management of mud and debris from vehicles, and maintenance of equipment.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
You should provide dust suppression including the availability of 'bowsers' and water supplies. You should not use leachate for dust suppression.	Untreated leachate is currently used for wetting of the existing landfill body and roads. No other dust suppression processes are in place.	Landfill operating procedures (to be developed) should include formal procedures for management of dust.	**Current** No **Proposed** Not assessable at this stage.

You should develop particulate monitoring programmes for the categories of particulate matter identified in M17[145]. The waste streams and substances identified in the selection of appropriate Environmental Assessment Levels (EALs) would form the basis for the monitoring of hazardous substances. The monitoring programmes should be reviewed until the appropriate frequencies and parameters can be determined on a site-specific basis.	No dust monitoring is currently conducted.	Landfill operating procedures (to be developed) should include formal procedures for monitoring, including dust in air emissions.	**Current** No **Proposed** Not assessable at this stage.
Recommendations for Litter Control			
You should manage accumulations of litter within the site and prevent litter escaping from the site.	There are no effective processes in place for control of litter. Loose waste was observed on the access road and fences around the existing landfill.	Landfill operating procedures (to be developed) should include formal procedures for management of litter.	**Current** No **Proposed** Not assessable at this stage.
You should manage litter generation through the following measures: ▪ Instructions to ensure incoming waste remains sheeted for as long as possible prior to emplacement; ▪ Provision of an emergency tipping area to allow discharge of light waste within a secure litter enclosure during adverse weather; this may be a permanent fixture or mobile; ▪ Adequate compaction during waste emplacement; ▪ Adequate covering of wastes following emplacement; ▪ Minimising the extent of the active tipping area; ▪ Adequate plant on active phase for placement, compaction and covering of waste; ▪ Ensuring the adequate supply of daily and intermediate cover material; ▪ Daily meteorological monitoring, as part of the daily and weekly operations; ▪ Instructions to ensure the full discharge of a vehicle discharging waste at the site, to prevent any waste retained in the vehicle after tipping being subsequently released; and ▪ Closure of the site to specific or all waste types during adverse weather conditions, for example high winds.	Wastes are emplaced in four sectors, with one sector active at any time, and with covering of active areas monthly. No more frequent covering is done.	Landfill operating procedures (to be developed) should include formal procedures for management of litter, including consideration of the management methods listed.	**Current** No **Proposed** Not assessable at this stage.
You should prevent litter escaping the site through the following measures: ▪ Considering prevailing wind direction and strength and the proximity of receptors when designing the filling development and sequence, this may require a risk assessment approach;	There are no effective processes in place for control of litter. Loose waste was observed on the access road and fences around the existing landfill.	Landfill operating procedures (to be developed) should include formal procedures for management of litter.	**Current** No **Proposed** Not assessable at this stage.

[145] Environment Agency (2013). TGN M17 – Monitoring of Particulate Matter in Ambient Air Around Waste Facilities..

▪ Installing permanent and mobile litter fences around the active area; ▪ Installing temporary bunds immediately adjacent to the tipping area; ▪ Regular inspections and collection of litter around the site boundary and beyond; specifically, ditches, haul roads, water courses; and ▪ Deploying additional temporary personnel to collect litter, as deemed necessary from inspections and monitoring.			
Recommendations for Preventing Mud on the Road			
Your management system should include the following measures to prevent mud escaping from the site, to prevent potential accident hazards, dust and other amenity issues. ▪ Effective wheel and body cleaners to remove mud and debris from vehicles prior to them leaving the site; ▪ Maintenance (for example, regular water changes for wet systems) of wheel-wash equipment; ▪ Supervision of the use of wheel-wash to ensure that vehicles use the equipment correctly; ▪ Main site roads maintained in a mud free condition by employing a mechanical sweeper/washer; ▪ Sufficient distance on surfaced site roads between haul roads and any wheel wash facilities; ▪ Monitoring of site road between final wheel wash and public highway; and ▪ Monitoring of public highway. In the event that mud or other debris is carried onto the public highway, you should erect warning signs on the highway to inform users of the potential hazard following approval by the highway authority. You should employ road sweepers immediately to clean the affected area.	A water pit is installed at the site entrance and functions as a wheel wash for trucks leaving the existing landfill. The unit is emptied every two weeks and the effluent is tankered to the municipal waste water treatment plant. No monitoring of roads is known to be conducted.	The Feasibility Study for the proposed landfill indicates that a disinfection unit will be installed at the site exit, comprising a concrete reservoir (8m x 3.5 m x 0.3 m) for disinfection of the wastes truck wheels. The reservoir will be filled with a disinfection solution (3% Lysol water solution and sawdust). Landfill operating procedures (to be developed) should include measures for management of this unit, and for prevention and management of mud on roads.	**Current** Partial **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Recommendations for Odour Control			
You should have procedures to deal with: ▪ Waste materials, such as wastes from transfer stations, which have started to decompose prior to landfilling; ▪ Old waste disturbed by digging; ▪ Malodorous wastes; ▪ Agricultural and sewage treatment residues; ▪ Leachate and leachate treatment systems; and ▪ Landfill gas.	No formal procedures are currently in place for management and abatement of odours.	Landfill operating procedures (to be developed) should include formal procedures for control of odour. Daily covering of wastes is proposed, using excavated materials. Theoretically, the proposed landfill will receive the residue coming from the proposed MBT Facility, reducing the organic content of the wastes to a minimum and, therefore, reducing potential for odour. The installation of an effective leachate and wastewater treatment plant, and proper collection and management of landfill gas will also help minimise odour emissions.	**Current** No **Proposed** Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.

You should have procedures in place to maintain a description of the types of odorous substances deposited and generated (intentional and unintentional). This should include: ▪ The treatment applied before landfill, which should limit wastes which are inherently odorous; and ▪ The distinction between wastes which are inherently odorous where the impact is likely to be more immediate and those wastes which may give rise to odour because of microbiological action in the landfill (organic or inorganic)	The existing landfill only officially accepts municipal waste and, therefore, it does not receive other particularly odorous waste streams, e.g. from agriculture or specific industrial processes. However, other waste streams are contained in loads, and there is the potential for odorous wastes to be present within the municipal waste. No waste treatment is currently provided prior to landfilling. There are no formal operational procedures for the management of odorous wastes.	Landfill operating procedures (to be developed) should include formal procedures for management of odorous wastes.	**Current** Partial **Proposed** Not assessable at this stage.
You should undertake a regular odour impact assessment. The impact assessment should cover a range of reasonably foreseeable odour generation and receptor exposure scenarios and the effect of different mitigation options. Your assessment should include point sources (such as flares) as well as linear or area sources (tipping faces, cracks in the cap).	An odour impact assessment has not been undertaken for the existing landfill. Observations during the site visit indicated little odour in the administrative area. However, strong odour was noted near the leachate ponds and, anecdotally, during the humid summer months; odour is reported to be detectable 1km away from the landfill site.	Landfill operating procedures (to be developed) should include formal procedures for control of odour (Odour Management Plan), and risk assessment for odour (sources-pathways-receptors) which should consider the potential for odours during activities, such as the installation of gas wells should be used during development of this.	**Current** Partial **Proposed** Not assessable at this stage.
You should ensure: ▪ Sulphate wastes are disposed of in cells in which biodegradable waste is not accepted; ▪ There is co-ordination between the gatehouse staff and staff at the tipping face where known odorous wastes are being accepted; and ▪ The potential for odours during the excavation of waste or removal of cover, (for example, during the installation of gas wells, or for other operational needs) is assessed.	As detailed above, there are no formal operational procedures for operation of the landfill and the only checks are visual observation during tipping There are no specific checks or restrictions on sulphate containing or odorous wastes. There are no formal processes for assessment of potential for odour during excavation works. This should be considered during design and installation of the new leachate treatment and landfill gas management systems.	Landfill operating procedures (to be developed) should include formal procedures for waste inspection and acceptance, and for management of sulphate containing and odorous wastes.	**Current** No **Proposed** Not assessable at this stage.
You should: ▪ Keep tipping areas as small as possible; ▪ Cover waste as soon as possible; and ▪ Design, construct and maintain intermediate capping to prevent the possible release of odours.	Wastes are emplaced in four sectors, with one sector active at any time, and with covering of active areas monthly. No more frequent covering is done.	Daily covering of wastes is proposed, using excavated materials . Landfill operating procedures (to be developed) should include formal procedures for management of working area size, covering and capping.	**Current** Partial **Proposed** Not assessable at this stage.
You should: ▪ Implement an effective landfill gas management plan in conjunction with good operational practice (such as not leaving odorous waste uncovered) to prevent such releases; ▪ Ensure full containment of the waste, including temporary and/or phased capping of the site; ▪ Ensure landfill gas control systems are well constructed, operated and maintained; ▪ Consider point source emissions such as those from landfill gas flares in selecting and assessing the control system; and ▪ Install active landfill gas extraction as soon as possible to minimise the release of uncontrolled landfill gas emissions.	A existing landfill gas collection system and Bio Gas Energy Facility are installed. However, these were retrofitted and performance is suboptimal. Temporary capping is not conducted.	A biogas collection system is included for the proposed landfill. However, detailed proposals have not been developed.	**Current** Partial **Proposed** Not assessable at this stage.
You should: ▪ Use an enclosed leachate treatment operation where the proximity of the operation to a receptor is likely to cause an odour problem;	The leachate ponds are uncovered and no odour control measures are in place.	The Feasibility Study for the proposed landfill indicates that the leachate collection and treatment system will be enclosed and drawings indicate that the reservoirs will also be enclosed.	**Current** No **Proposed**

▪ Provide enclosed leachate storage where the proximity of the storage to a receptor is likely to cause an odour problem; and ▪ Effectively seal leachate sumps/wells/side wall drainage systems (retaining any necessary access for monitoring and maintenance).			Yes (subject to installation as designed) Note: Operational aspects are not assessable at this stage.
Recommendations for Noise and Vibration Control			
You should ensure regular maintenance of the access roads to repair 'pot-holes'; this serves to significantly reduce noise generated by empty vehicles.	There is potential for noise and vibration nuisance impact from haulage vehicles passing through residential areas. Roads were generally observed to be in poor repair. No preventative maintenance programme is in place for plant and equipment. No flare is currently operational. No formal controls on noise and vibration are currently in place.	The Feasibility Study for the proposed landfill does not contain any specific reference to noise and vibration management. Landfill operating procedures (to be developed) should include measures for noise and vibration management.	**Current** Partial **Proposed** Not assessable at this stage.
Your design criteria of enclosed landfill gas flares should include noise reduction.			
Recommendations for Pest Control			
You should have procedures to deal with the presence of scavenging birds which should consider: ▪ The deposit of excrement and scraps of food on mobile plant and vehicles on-site, reducing driver's visibility and damaging nearby property; ▪ Bird-strike damage to aircraft; ▪ The introduction of pathogens to nearby water bodies, crops and animals; and ▪ The introduction of alien species to sensitive local habitats.	Bird populations were observed during the site visit. Waste covering is undertaken, but not on a frequent basis. No other formal processes for bird control were identified.	The Feasibility Study / for the proposed landfill does not contain any reference to pest management. No specific measures have been identified for management of the potential presence of bird populations, stray dogs and insects. Landfill operating procedures (to be developed) should include measures for pest control, including management of birds.	**Current** No **Proposed** Not assessable at this stage.
The measures you use to mitigate bird nuisance should include the employment of good landfill practice, with prompt disposal and compaction, working in small active areas with progressive covering of waste, and netting, together with the use of bird scaring techniques. These measures include: ▪ Flying birds of prey over the site; ▪ Bird kites mimicking birds of prey; ▪ Shell crackers - containing flare and bangers; ▪ Rope bangers; ▪ Gas cannons; ▪ Scarecrows - fixed or mobile; ▪ Amplified recordings of bird distress calls (species specific); ▪ Electronic sounds imitating calls of distress; and ▪ Bird corpses or dummies. Note: Measures involving explosions or distress calls may have an adverse environmental impact in terms of noise and may scare desirable species living in the vicinity of the site.			
You should maintain a log of techniques employed to demonstrate compliance with requirements and as part of your			

performance monitoring system. The log will also assist you in assessing the effectiveness of the different methods. There are advantages and disadvantages to all of the methods and the degree of effectiveness of any method may deteriorate with time and may need to be changed regularly. You should periodically review the measures you use.			
You should take into account the aviation safety standards introduced by the International Civil Aviation Organisation in 2003. One of these standards relates to bird hazard reduction at, or in the vicinity of aerodromes, particularly large numbers of flocking birds feeding at landfill sites.	No airports are present in the vicinity of the existing landfill.	No airports are present in the vicinity of the proposed landfill.	N/A
You should use the following measures to deal with pest infestation: ▪ Effective site management involving prompt emplacement, compaction and covering of wastes in well-defined cells, intermediate capping and prompt capping of completed areas; ▪ Ensuring previously employed waste is not disturbed, exposed or moved; ▪ Regular visits by pest control contractors or fully trained operatives; and ▪ Inspection and treatment of areas where rats live, for example sewers, culverts and drains. Fly infestations commonly arise from waste which has been awaiting collection for some time. You should have procedures in place to prevent or limit the acceptance of such wastes. You should reduce the risk of infestation by prompt burial of such wastes in order to interrupt the reproductive cycle of the fly. You should consider the potential for fly infestation to develop if engineering works require waste to be excavated.	Wastes are emplaced in four sectors, with one sector active at any time, and with covering of active areas monthly. No more frequent covering is done. Bird populations were observed during the site visit. Dogs were present on the existing landfill, although it is unclear if these are feral or associated with the waste pickers. No evidence of significant insect populations was noted. Site management reported that an annual rodent control service is engaged from a contractor, and that cats and dogs found on site are sterilised to prevent population growth. No other pest control measures are currently operated.	The Feasibility Study for the proposed landfill does not contain any reference to pest management. No specific measures have been identified for management of the potential presence of bird populations, stray dogs and insects. Landfill operating procedures (to be developed) should include measures for pest control.	**Current** Partial **Proposed** Not assessable at this stage.
Recommendations for Monitoring			
You should design your monitoring for a specific purpose and it must be fit for that purpose. For example, combined gas and groundwater monitoring boreholes are not recommended due to conflicts between the objectives of the monitoring (for example, depths of screened portions of the borehole) You should review the position and construction of monitoring points during the design of the main (and any supplementary) site investigations and later during the regular review of monitoring data. If necessary, you should upgrade the monitoring points to reflect the design proposals. You should use the monitoring data gathered during your operation of the site to review the validity of your conceptual model and the design assumptions you made during the planning and development processes. You should undertake this	The following observations were noted with regards to environmental monitoring at the existing landfill: ▪ No air monitoring has been undertaken at the site, either to characterise the baseline; environment nor during the construction or operational phases of the landfill; ▪ No regular monitoring of stack emissions from the biogas plant is conducted; ▪ Surface water monitoring is not undertaken on a regular basis; ▪ Groundwater monitoring is not undertaken and no wells are installed; and ▪ No detailed site investigations are known to have been conducted.	The Feasibility Study describes proposed groundwater monitoring at the proposed landfill, including installation of three wells of average depth 10 m. Water monitoring in the wells will be carried out on an annual basis, with analysis for the following parameters: pH, Ca, Mg, (Na + K), SI, SO_4, HCOs, hardness, dry residue as well as Fe, Mn, Sr, H2S, O_2. In addition, three samples will be taken (annually, is understood) to detect heavy metals: Ag, Al, As, Ve, Co, Cr, Cu, F, Fe, Mn, Mo, Ni, Pb, Se, Sr, Zn. No information on proposed monitoring for other environmental media was available. A monitoring programme for all environmental media (groundwater, leachate, wastewater discharges, point source and	**Current** No **Proposed** Not assessable at this stage.

interpretation of monitoring data on at least an annual basis, and should revise your conceptual model and monitoring plan accordingly.		diffuse air emissions, noise, etc.) should be developed and implemented.	
Assessment levels and compliance limits form the basis of emission control and assessment at landfill sites. You should have procedures in place with regard to the following: ▪ Assessment levels are criteria relating to specific parameters we use to determine whether a landfill and its pollution control systems are performing as designed. They are levels intended to help identify the development of adverse, or unexpected trends in emissions. Such trends may results from failure of site engineering or management, or from variations between actual conditions and those assumed within the conceptual model ▪ Assessment levels for groundwater are called 'control levels' in the Landfill Directive ▪ Assessment levels should be treated as an early warning system to enable you to implement appropriate investigative or corrective measures, particularly where there is potential for a compliance limit to be breached ▪ Compliance limits are limits given in a permit for specific parameters. These are concentrations at which significant adverse environmental effects and/or breaches of legislation have occurred ▪ Compliance limits for groundwater are called 'trigger levels' in the LFD.			
You may need to undertake environmental monitoring, for example, when: ▪ There are vulnerable receptors; ▪ The emissions are a significant contributor to an Environmental Quality Standard (EQS) that may be at risk; and ▪ You are looking for departures from standards based on lack of effect on the environment ▪ To validate modelling work.			
Where you do need to undertake environmental monitoring, you should consider the following in drawing up proposals: ▪ Determinants to be monitored, standard reference methods, sampling protocols ▪ Monitoring strategy, selection of monitoring points, optimisation of monitoring approach ▪ determining background levels contributed by other sources ▪ Uncertainty for the employed methodologies and the resultant overall uncertainty of measurement ▪ Quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail.			

▪ Reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information			
You should establish and maintain a network of stable, permanent survey control stations to control all survey work around the site. You should undertake topographical surveys. The plan produced by the topographical survey should: ▪ be of an appropriate scale adequate to show the surveyed features of the landfill; ▪ be of a scale of at least 1:1250; ▪ include 1m contours; ▪ include the landform or an indication of the landform immediately adjacent to the landfill; ▪ include all roads, structures, boundaries, monitoring points, extraction points and all other relevant site features in the permitted installation; ▪ include the positions of ground features to within 1m; ▪ where there are significant landform changes since the previous survey, include spot levels to 0.01m at intervals of no greater than 50 metres in open areas of even gradient and spot levels to 0.01m at intervals of less than 50m when indicating embankments, stockpiles and other such features. You should ensure that there is an accurate record of the locations of engineering structures and their level referenced to OD.	No topographic survey is known to have been conducted for design of the existing landfill.	Topographic and geodetic survey works were performed for the proposed landfill in September 2018.	**Current** No **Proposed** Yes
Recommendations for Record Keeping			
The LFD requires you to keep a register of the quantities and characteristics of the wastes deposited at your site (Article 11). This register should include: ▪ quantity of waste deposited. This may be recorded either in tonnage or volume; ▪ waste characteristics. This information can be extracted from the basic characterisation information associated with the waste being sent to landfill, such as its List of Wastes code, the SIC code and appearance of the waste; ▪ waste origin. Where practical the source of the waste should be recorded. However, sometimes waste will be delivered to a landfill within a multi-collection vehicle (from numerous origins). In these circumstances the name of the waste collector in combination with a designation of 'multi-collection vehicle' would be sufficient; ▪ the delivery date; ▪ the identity of the producer, or in the case of the municipal waste, the collector. The waste producer is the person best placed to provide information on waste characterisation; and ▪ within a cell. One option is for you to 'grid' an individual landfill cell into a number of zones using a hand held global	All vehicles entering the existing landfill are weighed prior to gaining access to the tipping area. Other information recorded includes vehicle registration, nature of the waste (domestic / commercial / construction). Vehicles are only weighed on arrival to the existing landfill and do not get weighed when they are empty.	Landfill operating procedures (to be developed) should include formal procedures for recording waste quantities and types deposited at the landfills.	**Current** Partial **Proposed** Not assessable at this stage.

positioning system and assign individual deposits to a particular zone and a specific waste lift/depth. For hazardous waste monocells (for example asbestos) individual deposits need only be assigned to a specific landfill cell.			

Appendix 13.4

BAT - PROPOSED MBT FACILITY

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
Overall Environmental Performance		
In order to improve the overall environmental performance, BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates all of the following features: ▪ commitment of the management, including senior management; ▪ definition of an environmental policy that includes the continuous improvement for the installation by the management; ▪ planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; ▪ implementation of procedures, paying particular attention to: ○ structure and responsibility; ○ recruitment, training, awareness and competence; ○ communication; ○ employee involvement; ○ documentation; ○ effective process control; ○ maintenance programmes; ○ emergency preparedness and response; and ○ safeguarding compliance with environmental legislation. ▪ checking performance and taking corrective action, paying particular attention to ○ monitoring and measurement; ○ corrective and preventive action; ○ maintenance of records; and ○ independent (where practicable) internal auditing or external auditing. ▪ Review of the EMS and its continuing suitability, adequacy and effectiveness by senior management; ▪ Following the development of cleaner technologies; ▪ Consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life including application of sectoral benchmarking on a regular basis; ▪ Waste stream management; ▪ An inventory of waste water and waste gas streams; ▪ Residues management plan; ▪ Accident management plan; ▪ Odour management plan; and ▪ Noise and vibration management plan.	No formal EMS or controls for the items listed in the BAT summary are in place at the City or the proposed operators, Spetskomuntrans.	No
In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given below: ▪ To implement waste characterisation and pre-acceptance procedures; ▪ To implement waste acceptance procedures; ▪ To implement a waste tracking system and inventory; ▪ To implement an output quality management system; ▪ To ensure waste segregation; ▪ To assess waste compatibility; and ▪ To sort incoming waste.	No assessment possible at this stage. Site-specific operating procedures should be developed and should include formal procedures for waste acceptance.	Too early in development to assess.
In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system, that incorporates all of the following features: ▪ Information about the characteristics of the waste to be treated and the waste treatment processes;	No assessment possible at this stage.	Too early in development to assess.

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
■ Information about the characteristics of the waste water streams; and ■ Information about the characteristics of the waste gas streams.	Site-specific operating procedures should be developed and should include monitoring programmes.	
In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given below: ■ Optimised storage location; ■ Adequate storage capacity – measures are taken to avoid accumulation of waste, such as: ○ Safe storage operation; and ○ Separate area for storage and handling of packaged hazardous waste.	No assessment possible at this stage. Site-specific operating procedures should be developed and should include formal procedures for waste acceptance. BAT guidance should be considered during design and development of the proposed MBT Facility.	Too early in development to assess.
In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures, including the following elements: ■ Handling and transfer of waste are carried out by competent staff; ■ Handling and transfer of waste are duly documented, validated prior to execution and verified after execution; ■ Measures are taken to prevent, detect and mitigate spills; and ■ Operation and design precautions are taken when mixing or blending wastes (e.g. vacuuming dusty/powdery wastes).	No assessment possible at this stage. As part of the site-specific operating procedures (to be developed) documented procedures should be developed to ensure that handling of waste is only carried out by qualified and trained staff and that measures are taken to minimise environmental risk.	Too early in development to assess.
Monitoring		
For relevant emissions to water as identified by the inventory of waste water streams, BAT is to monitor key process parameters (e.g. waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g. at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation). BAT is to monitor emissions to water with at least the frequency indicated in the BREF Note, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality. BAT item 7 of the BREF specifies different parameters and frequencies to be monitored depending on the waste treatment activities being undertaken.	No assessment possible at this stage. Site-specific operating procedures should be developed and should include monitoring programmes.	Too early in development to assess.
BAT is to monitor emissions to air with at least the frequency indicated in the BREF Note, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	No assessment possible at this stage. If point source emissions to air are generated, monitoring programmes for these should be developed as part of the site-specific operations plan.	Too early in development to assess.
BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given below: ■ Measurement; ■ Emission factors; and/or ■ Solvent mass balance.	No solvent processing is anticipated.	N/A
BAT is to periodically monitor odour emissions. Odour emissions can be monitored using: ■ EN standards (e.g. dynamic olfactometry according to EN 13725:2003 in order to determine the odour concentration or EN 16841-1 or -2: 2016 in order to determine the odour exposure); and	No assessment possible at this stage. Odour monitoring procedures, such as periodic ‘sniff’ testing at MBT Facility boundaries is recommended as part of the site-specific operations plan (to be developed).	Too early in development to assess.

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
▪ when applying alternative methods for which no EN standards are available (e.g. estimation of odour impact), ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.		
BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.	No assessment possible at this stage. Documented procedures covering the monitoring of water, energy, waste etc. should be developed as part of the environmental management system (to be developed).	Too early in development to assess.
Emissions to Air		
In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system, that includes all of the following elements: ▪ A protocol containing actions and timelines; ▪ A protocol for conducting odour monitoring as set out in BAT 10 of the BREF; ▪ A protocol for response to identified odour incidents, e.g. complaints; and ▪ An odour prevention and reduction programme designed to identify the source(s), to characterise the contributions of the sources; and to implement prevention and / or reduction measures.	No assessment possible at this stage. Odour management procedures should be included as part of the site-specific operations plan (to be developed).	Too early in development to assess.
In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given below: ▪ Minimise residence times; ▪ Chemical treatment; and / or ▪ Optimise aerobic treatment.	No assessment possible at this stage. As part of the site-specific operating procedures (to be developed) documented procedures should be developed to ensure that relevant controls are implemented to minimise odour.	Too early in development to assess.
In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below: ▪ Minimise the number of potential diffuse emissions sources; ▪ Select and use high integrity equipment; ▪ Corrosion prevention; ▪ Ensure containment, collection and treatment of diffuse emissions; ▪ Dampening; ▪ Maintenance; ▪ Cleaning; and / or ▪ Set up and implement a Leak Detection System and Repair (LDAR) programme.	No assessment possible at this stage. As part of the site-specific operating procedures (to be developed) documented procedures should be developed to ensure that relevant controls are implemented to minimise dust. Dust control measures (e.g. paving of surfaces and roads, selection of equipment, etc.) should be factored into proposed MBT Facility design.	Too early in development to assess.
BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns) by using both of the techniques given below: ▪ Correct plant design; and ▪ Plant management.	No flare is anticipated. However, if the design includes plant of this type, appropriate design and management controls should be implemented.	N/A
In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given below: ▪ Correct design of flaring devices; and ▪ Monitoring and recording as part of flare management.	No flare is anticipated. However, if the design includes plant of this type, appropriate design and management controls should be implemented.	N/A

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
Noise and Vibration		
In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system, that includes all of the following elements: ▪ I. a protocol containing appropriate actions and timelines; ▪ II. a protocol for conducting noise and vibration monitoring; ▪ III. a protocol for response to identified noise and vibration events, e.g. complaints; and ▪ IV. a noise and vibration reduction programme designed to identify the source(s), to measure/estimate noise and vibration exposure, to characterise the contributions of the sources and to implement prevention and / or reduction measures.	No assessment possible at this stage. As part of the site-specific operating procedures (to be developed) documented procedures should be developed to ensure that relevant controls are implemented to minimise noise and vibration.	Too early in development to assess.
In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below: ▪ Appropriate location of equipment and buildings; ▪ Operational measures; ▪ Low-noise equipment; ▪ Noise and vibration control equipment; and / or ▪ Noise attenuation.	No assessment possible at this stage. As part of the site-specific operating procedures (to be developed) documented procedures should be developed to ensure that relevant controls are implemented to minimise noise and vibration. Noise and vibration control measures (e.g. selection of low noise equipment, physical barriers, attenuation, etc.) should be factored into site design.	Too early in development to assess.
Emissions to Water		
In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below. ▪ Water management; ▪ Water recirculation; ▪ Impermeable surface; ▪ Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels; ▪ Roofing of waste storage and treatment areas; ▪ Segregation of water streams; ▪ Adequate drainage infrastructure; ▪ Design and maintenance provisions to allow detection and repair of leaks; and ▪ Buffer storage capacity.	No assessment possible at this stage. Site drainage systems should be designed with consideration of the measures listed in the BAT guidance.	Too early in development to assess.
In order to reduce emissions to water, BAT is to treat waste water using an appropriate combination of the techniques given below: Preliminary and primary treatment: ▪ Equalisation; ▪ Neutralisation; and ▪ Physical separation. Physico-chemical treatment: ▪ Adsorption; ▪ Distillation / rectification; ▪ Chemical precipitation; ▪ Chemical oxidation; ▪ Chemical reduction; ▪ Evaporation; Biological treatment: ▪ Activated sludge process; and ▪ Membrane bioreactor. Nitrogen removal: ▪ Nitrification / denitrification. Solids removal: ▪ Coagulation and flocculation; ▪ Sedimentation; ▪ Filtration; and ▪ Flotation.	No assessment possible at this stage. Wastewater treatment systems for the proposed MBT Facility should be designed with consideration of the measures listed in the BAT guidance. As part of the site-specific operating procedures (to be developed) documented procedures should be developed for management and monitoring of wastewater.	Too early in development to assess.

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
▪ Ion exchange process; and ▪ Stripping.		
Emissions from Accidents and Incidents		
In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given below, as part of the accident management plan. ▪ Protection measures; ▪ Management of accidental emissions; and ▪ Incident / Accident registration and assessment system.	No assessment possible at this stage. Site-specific operating procedures (to be developed) should include formal accident management plans covering all potential environmental accidents.	Too early in development to assess.
Material Efficiency		
▪ In order to use materials efficiently, BAT is to substitute materials with waste, BAT is to use of waste instead of raw materials for waste treatment option.	No assessment possible at this stage.	Too early in development to assess.
Energy Efficiency		
In order to use energy efficiently, BAT is to use both of the techniques given below: ▪ Set up and implement an energy efficiency plan; and ▪ Establish a detailed energy balance record.	No assessment possible at this stage. Documented procedures covering the management of water, fuel and energy should be developed as part of the environmental management system and / or site-specific operating procedures (to be developed).	Too early in development to assess.
Reuse of Packaging		
In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of a residues management plan	No assessment possible at this stage.	Too early in development to assess.
General BAT Conclusions for the Biological Treatment of Waste		
In order to reduce odour emissions and improve overall environmental performance, BAT is to select the waste input.	No assessment possible at this stage.	Too early in development to assess.
In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds including H_2S and NH_3, BAT is to use one or a combination of the following techniques: ▪ Adsorption; ▪ Biofilter; ▪ Fabric filter; ▪ Thermal oxidation; and ▪ Wet scrubbing.	No assessment possible at this stage. If channelled emissions to air are generated, the techniques in the BAT guidance should be considered during design.	Too early in development to assess.
In order to reduce the generation of waste water and to reduce water usage, BAT is to use all of the techniques below: ▪ Segregation of water streams; ▪ Water recirculation; and ▪ Minimisation of the generation of leachate.	No assessment possible at this stage. If relevant, the BAT guidance should be considered during design and development of operating procedures.	Too early in development to assess.
BAT Conclusions for the Aerobic Treatment of Waste		

BAT REQUIREMENT	ARRANGEMENTS IN PLACE	BAT?
In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and / or control key waste and process parameters, including: ▪ Waste input characteristics; ▪ Temperature and moisture content at different points in the windrow; ▪ Aeration of the windrow; and ▪ Windrow porosity, height and width.	No assessment possible at this stage. If relevant, the BAT guidance should be considered during design and development of operating procedures.	Too early in development to assess.
In order to reduce diffuse emissions to air of dust, odour and bioaerosols from open-air treatment steps, BAT is to use one or both of the techniques given below: ▪ Use of semipermeable membrane covers; and ▪ Adaptation of operations to the meteorological conditions.	No assessment possible at this stage. If relevant, the BAT guidance should be considered during design and development of operating procedures.	Too early in development to assess.
BAT Conclusions for the Anaerobic Treatment of Waste		
In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and / or control the key waste and process parameters including: ▪ PH and alkalinity of the digester feed; ▪ Digester operating temperature; ▪ Hydraulic and organic loading rates of the digester feed; ▪ Concentration of volatile fatty acids and ammonia; ▪ Biogas quantity, composition and pressure; and ▪ Liquid and foam levels in the digester.	No assessment possible at this stage. If relevant, the BAT guidance should be considered during design and development of operating procedures.	Too early in development to assess.
BAT Conclusions for the Mechanical Biological Treatment of Waste		
In order to reduce emissions to air, BAT is to use both of the below techniques: ▪ Segregation of the waste gas streams; and ▪ Recirculation of waste gas.	No assessment possible at this stage. If relevant, the BAT guidance should be considered during design and development of operating procedures.	Too early in development to assess.

2 London Square
Cross Lanes
Guildford, Surrey
GU1 1UN

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