Initial Environmental Examination

May 2013

UZB: Solid Waste Management Improvement Project

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ABBREVIATIONS

ADB	Asian Development Bank
BEP	best environmental practices
BOD	biological oxygen demand
BPEO	best practical environmental options
CP	collection points
EHS	environmental health and safety
EIA	environmental impact assessment
EMP	environmental management plan
EU	European Union
FS	feasibility study
GRM	grievance redress mechanism
GoU	Government of Uzbekistan
GW	groundwater
IEE	initial environmental examination
MSW	municipal solid waste
LARP	land acquisition and resettlement plan
PM	particulate matter
PGA	peak ground acceleration
PPE	personnel protective equipment
PPTA	project preparatory technical assistance
RA	risk assessment
SEE	State Ecological Expertise (*Glavgosecoexpertisa*)
SLF	sanitary landfill facility
TDS	total dissolved solids
THW	toxic and hazardous waste
TS	transfer station
TSS	total suspended solids
UZB	Uzbekistan

WEIGHTS AND MEASURES

ha – hectares

NOTE

(i) The fiscal year (FY) of the Government of Republic of Uzbekistan ends on 31 December. “FY” before a calendar year denotes the year in which the fiscal year ends, e.g., FY2012 ends on 31 December 2012.

(ii) In this report, “$” refers to US dollars

Definition of Terms

"Biological Oxygen Demand" *(also BOD)***:** An indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic waste.

"Carbon Monoxide" *(also CO)***:** A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

"Carbon Dioxide" *(also CO_2)* A colorless, odorless, incombustible gas, CO_2, formed during respiration, combustion, and organic decomposition and used in food refrigeration, carbonated beverages, inert atmospheres, fire extinguishers, and aerosols. *Also called carbonic acid gas*

"Gas Chromatograph/Mass Spectrometer": Instrument that identifies the molecular composition and concentrations of various chemicals in water and soil samples.

"Ground Water": The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

"Laws" means state and local laws and all regulations, rules, orders, decrees, decisions, instructions, requirements, policies and guidance which are issued or made by any Relevant Authority and which are legally binding, as any of them may be amended from time to time.

"Mahalla" Is a local level community-based organization recognized official by the GoU that serves as the interface between state and community and is responsible for facilitating a range of social support facilities and ensuring the internal social and cultural cohesiveness of its members. Mahalla leaders are elected by their local communities.

"Methane" *(also CH_4)***:** A colorless, nonpoisonous, flammable gas created by anaerobic decomposition of organic compounds. A major component of natural gas used in the home.

"Municipal solid waste" (**MSW**) is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes collected by a municipality within a given area. The term *residual waste* relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing

"Operator" means the SLF operator employed or contracted by the EA to operate, maintain and manage the facility.

"Particulates" *(also PM_{10})***:** 1. Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. 2. Very small solids suspended in water; they can vary in size, shape, density and electrical charge and can be gathered together by coagulation and flocculation.

"Personal Protective Equipment" (*also PPE*)**:** Clothing and equipment worn by pesticide mixers, loaders and applicators and re-entry workers, hazmat emergency responders, which is worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

“Peak Ground Acceleration” *(PGA)* is a measure of earthquake acceleration on the ground and an important input parameter for earthquake engineering.

“Recyclables” Any materials that will be used or reused, or prepared for use or reuse, as an ingredient in an industrial process to make a product, or as an effective substitute for a commercial product. This includes, but is not limited to, paper, glass, plastic and metal.

“Recycling” means the process by which recovered materials are transformed into new products or feedstock for new products.

“Residual Waste” means all municipal solid wastes that are not processed and/or recycled.

“Risk Assessment”: Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

“Solid Waste” means the sum of household waste.

“Solid Waste Management” means any activity involving the handling, treatment and disposal of Solid Waste. Also means any supervised handling of waste materials from their source through recovery processes to final disposal.

“Solid Waste Management System” The entire process of storage, collection, transportation, processing, and disposal of solid wastes by any entity engaging in such process as a business, or by any state agency, city, authority, county or any combination thereof.

“Sewage”: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

“Special Waste" means items that require a special or separate handling or disposal such as abandoned vehicles, tyres, bulky waste (including [furniture, beds, fridges and freezers]), [used oil or petroleum-related products], gas bottles. This also means items that require a special or separate handling such as bulky waste and tyres.

“Sulfur Dioxide” *(also SO2)***:** A pungent, colorless, gas formed primarily by the combustion of fossil fuels; becomes a pollutant when present in large amounts.

“Total Dissolved Solids” *(also TDS)***:** All material that passes the standard glass river filter. Term is used to reflect salinity.

“Total Suspended Solids” *(also TSS)***:** A measure of the suspended solids in wastewater, effluent, or water bodies, determined by tests for "total suspended non-filterable solids

“Transfer Station” means the facility where solid wastes are temporarily stored and consolidated before being transported elsewhere for further treatment or disposal.

“Volatile Organic Compound” *(also VOC):* Any organic compound that participates in atmospheric photochemical reactions.

“Waste” means any movable articles or material for which their owner wishes to relinquish responsibility by Disposal or which must be removed from their holding place as waste to safeguard the common welfare and to protect the environment.

1. Executive Summary

1.1 Overview

The city of Tashkent intends to improve its solid waste management (SWM) system for its 2.3 million residents. This endeavor will involve rehabilitating the existing waste collection and transfer systems, and establishing an environmentally acceptable disposal facility reducing any potential environmental impacts. This is taken into consideration the continuous and ever increasing wastes being generated vis-à-vis the open dumping and exhausted disposal space at the Akhangaran dumpsite. Given the current SWM practices, the option converting and allocating an area adjacent to the existing dumpsite to an engineered Sanitary Landfill was decided. The proposed sanitary landfill facility (SLF) concept is based on the Best Environmental Practices (BEP) resulting to a *state-of–the-art* design consistent with international acceptable standards. This is under that premise that this "stand alone" facility will drastically improve the SWM system (i.e. the handling and final disposal of MSW) with a possible integration capability for a long-solution to cover the entire Tashkent Oblast. The inclusion into the design of a multi-barrier system, leachate and gas collection systems will result in a significant reduction in anticipated impacts. With the significant environmental issues identified and evaluated, mitigation measures and monitoring plans are also proposed to prevent or minimize the negative impacts and further enhance positive effects.

In view of the potential environmental impacts, the SLF project is subjected to an environmental assessment. In accordance with ADB SPS 2009, the SLF project is classified as category B, a project with site-specific impacts, few if any of which are irreversible and where in most cases mitigation measures can be designed more readily compared to projects classified as category A. In turn, an Initial Environmental Examination (IEE) was conducted to determine the current environmental conditions and assess the potential impacts to be brought about by the proposed SLF project. The scope of the IEE is dictated and is consistent to the requirements of the Asian Development Bank (ADB) classified as a Category B project resembling the "OVOS" format used by *Goskompriroda* in the conduct of an Environmental Impact Assessment (EIA) for Sanitary Landfill (SLF). It is important to note that other components of Output 1 for the SWM improvement project namely the rehabilitation and refurbishment of collection points and transport components including the planned improvements for the transfer stations were subjected to a separate environmental audit to determine its compliance. Lastly, it is acknowledged that the conduct of a full blown Environmental Impact Assessment (EIA) should be considered taking into account *Goskompriroda's* project categorization and OVOS requirement which will be performed by the EA at a later stage.

1.2 Identified Impacts, and Mitigation/Enhancement Measures

Given the technology to be used and the information about the receiving environment, the impacts of the SLF were identified and quantified. Potential adverse environmental impacts induced by the construction and operation of the proposed SLF include: (a) Dust emissions from construction works. (b) Potential generation of odours (c) Potential attraction of vermin and pest in the area (d) Generation of noise from increased vehicular traffic, construction works, and mechanical equipment such as pumps or compressors and (e) associated occupational health and safety hazards. Such impacts are likely to be short-lived, temporary and is expected that the project will bring about a positive environmental benefits wherein impacts are reduced below threshold levels during project implementation.

Based on the assessment, the identified negative impacts can be controlled and should not be significant as long as the design and control measures are implemented and properly maintained. Appropriate design and management of the SLF are already incorporated to ensure the elimination of these impacts. Emission levels are expected to be within standards set by SCNR (*Goskompriroda)*. After assessing the operating conditions of all collection points and waste logistics (e.g. transfer stations), sub-project related works (e.g. replacement of bins, replacement of electromechanical equipment, repair of operator's station and gates, etc.) constitute as standard maintenance works. This are considered to be minor restorations and does not pose any impacts on the environment, resettlement or indigenous people. Identified areas of concern are more inclined towards the operational aspect (e.g. efficient facility operation and monitoring). It has been reaffirmed that the rehabilitation works is essential should these facilities and its operators desire to maintain the installed environmental controls and abate any potential MSW crisis. Significant impacts on public and occupational health and safety are anticipated only if standards are not met and planned control systems are not implemented. On the other hand, positive impacts with respect to public nuisance and human health as a function of a proper and functional waste management system are a direct consequence and key goals during project implementation. The project concept and its findings were presented in a public consultation held at the Tas Public Utilities Operations Office on April 11, 2013 which was attended by representatives from the concerned government and non-governmental organizations. The attendees expressed their concerns mainly on the choice of SWM technology, the SWM approach and the anticipated environmental impacts. At the end, participants were pleased to note the timely implementation of the SLF with emphasis on the environmental control features of the SLF.

To address and resolve any environmental concerns linked to the project, a project-specific grievance redress mechanism (GRM) will be established by the EA. In order to provide a transparent mechanism, the EA will ensure that grievances and complaints are addressed in a timely and satisfactory manner to avoid any potential delays in the establishment of the project.

1.3 Environmental Management Plan (EMP)

With the significant environmental issues identified and evaluated, mitigation measures and monitoring plans were also proposed to prevent or minimize the negative impacts and to enhance positive effects.In order to ensure the proper establishment and operation of the SLF, management and control systems must be implemented which include (***a***) site management and security (***b***) effective traffic management (***c***) slope stabilization and installation of drainage systems (***d***) installation of environmental control measures (e.g. establishment of a “green” buffer zone, implementation of landfill cover, liner system, leachate collection system and drainage systems) as planned and design (wherein additional control elements shall be implemented whenever deemed necessary or when required) (***e***) regular checks and maintenance on the installed equipment (***f***) strict inspection and effective / immediate processing of waste being received. Proper staff training and practical engineering / operational practices (e.g. orientation and induction training, strict imposition of PPE and tool box talks) complimented with an organized record keeping, performance monitoring and reporting must also be maintained. Compliance monitoring and due diligence can be conducted at least on a quarterly basis. Continuous operational improvements as well as employing the best practical environmental options shall also be incorporated into the project.

It is the responsibility of the PIU therefore to ensure the development of a database that includes a systematic tabulation of process indicators, performance evaluation, maintenance schedules and logbook, and operational control and performance monitoring outputs. Such database will benefit both the operator and design engineers in order to predict any adjustments needed to be performed ahead of time. In addition, formal training within the PCMU and PIU must be implemented to ensure that the EMP is easily implemented and maintained by relevant staff. The training will involve the SLF operators in team building, planning, and performance monitoring and maintaining the prescribed environmental standards. Further, provided that all planned and designed components are implemented coupled with a strict management and control of all wastes generated on site during the establishment phase, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, no significantly adverse environmental impacts are anticipated. Residual and unavoidable impacts can also be addressed by maintaining the designed components. Lastly, by putting into practice the planned design and maintaining the appropriate control systems and facilities identified in this document, the integrity of the assumptions, estimations and recommendations identified in this report can be ensured.

2. Introduction

Solid waste refers to wastes from households, municipal services, construction debris and the agricultural sector. This also includes non-hazardous, non-liquid wastes from institutions and industries. According to the World Bank (2001), its generation is greatly affected by a country's development. Moreover, the problem is even more compounded due to improper handling, disposal procedures and even at times, the choice of disposal technology.

As a result, environmental including health and safety impacts that often result from disposal of waste remains a growing concern for sustainable development. Waste posing potential hazards to human health and the environment is generated in a number of industry sectors (mining/quarrying, agriculture, manufacturing, electricity generation, medical, etc.) including households and commercial establishments. On the other hand, when properly managed, this waste will pose minimal risks to human health and the environment.

Currently, unclassified wastes are dumped within an allocated area in Akhangaran commonly referred as the "Akhangaran Landfill". Occasionally a bulldozer is available to 'clear' and 'cover' the dumped wastes. With no facilities to properly handle or treat residues even from simple domestic wastes (ex. liner or leachate collection), handling and disposal of such wastes are done haphazardly. Added to this, open burning is done indiscriminately exacerbating the situation.

All in all, the existing practices of handling such wastes does not necessarily solve the problem but instead bring about additional environmentally deleterious issues which may affect the health and safety of the adjacent communities. This situation is similar to other smaller dump site areas within the jurisdiction or adjacent of the Tashkent Oblast.

In turn, a selected group of experts was organized to develop and prepare the feasibility study, site investigation, engineering designs, technical specifications and other pre-construction requirements to ensure smooth implementation of the SWM system for Tashkent. Based on the ADB categorization, the SLF project is classified as a category B project whose impacts are deemed to be site specific, few if any of which are irreversible and where in most cases mitigation measures can be designed and implemented more readily compared to Category A projects. This necessitates the preparation of an Initial Environmental Examination (IEE) which is a vital to the final design of the system and its components. The IEE report will be used as reference in the implementation of the construction activities and later in the operation of the SLF and its on-site associated facilities.

The conduct of an IEE is a vital step which is required to be accomplished before any construction and operational activity can be initiated. An IEE is a study that assesses and predicts the potential environmental consequences of a proposed development. It evaluates the expected effects on the natural environment, human health and property. More importantly, an IEE compares and assesses the various aspects of the project and recommends remedial actions by which the project could be implemented. It seeks to identify the best combination of construction and operational methods, process, technology and equipment to ensure minimum impact to the host environment.

This Report has 14 Chapters. Chapter 1 provides the reader a summary of the report. Chapter 2 presents the need for the preparation of the report and the related environmental framework. Chapter 3 gives a detailed description of the proposed SLF Project, its location, its associated activities and components, the construction methods and more importantly, operational systems and procedures to be implemented during the operation of the project.

Chapter 4 describes the receiving environment. More importantly, it gives a brief description of the existing environmental conditions in the project site. It should be noted that secondary information made available by pertinent governmental agencies and secondary literature was maximized to establish the baseline for the site.

Given the technology of the proposed SLF project including the operational requirements and procedures, its extent and probable impacts to the host environment are assessed and presented in Chapters 5 and 6. Several measures on how to mitigate the impacts are presented in Chapter 7 while Chapter 8 discusses the SLF alternatives. Chapters 9 and 10 presents the public consultation and the grievance redress mechanism, respectively. Lastly, an environmental management and monitoring program is prepared and presented in Chapter 11 to ensure that the EA/IA, its contractors and/or sub-contractors regularly check and monitor their activities and the occurrence of the perceived impacts.

2.1 Policy, Legal and Administrative Framework

This section outlines the environmental legislation framework for the Republic of Uzbekistan (GoU) including the international conventions and treaties that were signed and ratified by the GoU and integrated into state laws and regulations. The legislative framework presented in this section focuses on the prevailing environmental laws relevant to project and aims to ensure it is compliant with the environmental policies and regulations in general and the requirements of *Goskompriroda* in particular.

2.1.1 National Environmental Administrative and Legal Framework

Environmental protection and environmental safety in Uzbekistan is considered to be a salient component in maintaining national and vital interest of the state. In turn, it enacted several legislations relating to the protection and use of natural resources and environmental protection which consists of laws, Presidential decrees, Government resolutions, ministerial regulatory acts, and local authority acts. The main principles of environmental legislation in Uzbekistan have been stipulated within the Republic's Constitution stated within the following articles:

- Article 55 stipulates that the land and its subsoil, water, flora and fauna and other natural resources are national assets that should be rationally used and protected by state;
- Articles 47 and 48 define the citizens' liabilities to comply with the Constitution and laws;
- Article 50 makes citizens responsible for careful nature treatment;
- Article 51 obliges citizens to pay legally established taxes and describes the powers of state authorities, including those arising from the regulation of ecological relations (i.e., Article 100).

These policies are backed up with mitigation and environmental management measures based on the following principles:

- Integration of the economic and environmental policy to support conservation and restoration of the environment as pre-requisite to alleviate the society's standard of living;
- Change from protection of individual elements of nature to the overall and integrated conservation of eco-systems; and
- Responsibility of all members of the society for environment protection, biodiversity conservation, environmental improvement and securing healthy environmental conditions for the population.

Environmental Protection Law (Law No. 754-XII of 1992). The key national environmental law is the Law on Nature Protection (Law No. 754 – XII of 1992). The Uzbekistan Environmental Protection Law, adopted on December 9, 1992 (as amended on May 1995; April 1997; December 1998; and August 2000) provides the framework for environmental impact assessment (EIA) and state ecological review, its requirements and processes. Article 4 establishes the mandatory nature of a **review committee** or the "state ecological expertise" (SEE) as a means to achieving environmental protection within various types of public- and private-sector economic activities. It functions is to identify and prevent irreversible environmental impacts. Likewise, whenever deemed necessary, to intervene to ensure the restoration and protection of natural resources. Article 8 stipulates that national legislations, regulations, and resolutions issued by the Cabinet of Ministers, the State Committee for Nature Protection (SCNP), and local state authorities will govern the management and use of natural resources. Article 11 establishes the *Goskompriroda* or SCNP as a duly authorized state body acting as subordinate to the parliament responsible for environmental management and protection. Annex 1 outlines some key articles from the law and the related requirements pertaining to the project

Law on Ecological Expertise. The Law on Ecological Expertise was adopted on May 25, 2000 to integrate various EIA and SEE components embodied in the aforementioned laws. Article 1 defines EE as a process necessary to obtain compliance of a proposed activity with environmental norms and standards and to determine whether or not project implementation can be permitted. Compulsory technical reviews are conducted at various stages prior the implementation of a specific project or activity. It determines potential levels of environmental risks and impacts that the proposed activity of project may have on the environment and public health. Furthermore, it assesses the proposed environmental protection and mitigation measures. Article 5 requires that the following standards are to be the basis of an EE: (a) lawfulness; (b) objectivity; (c) justification; (d) mandatory consideration of environmental security requirements; (e) presumption of environmental risks that originates from all economic and other activities; (f) comprehensiveness (completeness) of assessment of the impact of economic activities on the environment and public health; and (g) autonomy.

Article 11 specifies that the following are subject to SEE: (a) drafts of state programs and concepts and regional and spatial development schemes for various sectors of the economy; (b) site selection and construction; (c) pre-design and design documentation; (d) drafts of normative, technical, and methodological documentation to regulate economic and other activities; e) documentation related to new technologies, equipment, and materials; (f) existing facilities with negative environmental and health impacts; environmental programs and ecological disaster zones; and (g) all types of urban development, design, and planning documentation, etc.

Article 15 enumerates the documents of a proposed or an operating project (activity) which must be submitted to SEE for review. For proposed projects, EIA documentation shall include a draft EIA declaration, a declaration on environmental impacts / consequences, and, when required by the legislation, an EIA statement; and for operating projects, draft environmental norms and an EIA statement and/or an environmental audit. A proponent shall submit to the SCNP: (a) a draft EIA declaration prior to initiation of the SEE, (b) an EIA declaration prior to the approval of a project's technical and economic justification, and (c) a declaration on environmental consequences prior to an authorization of start operating the project.

Annex 2 presents the National Environmental Impact Assessment (EIA) Process while Figure 1 presents National EIA Process Flow.

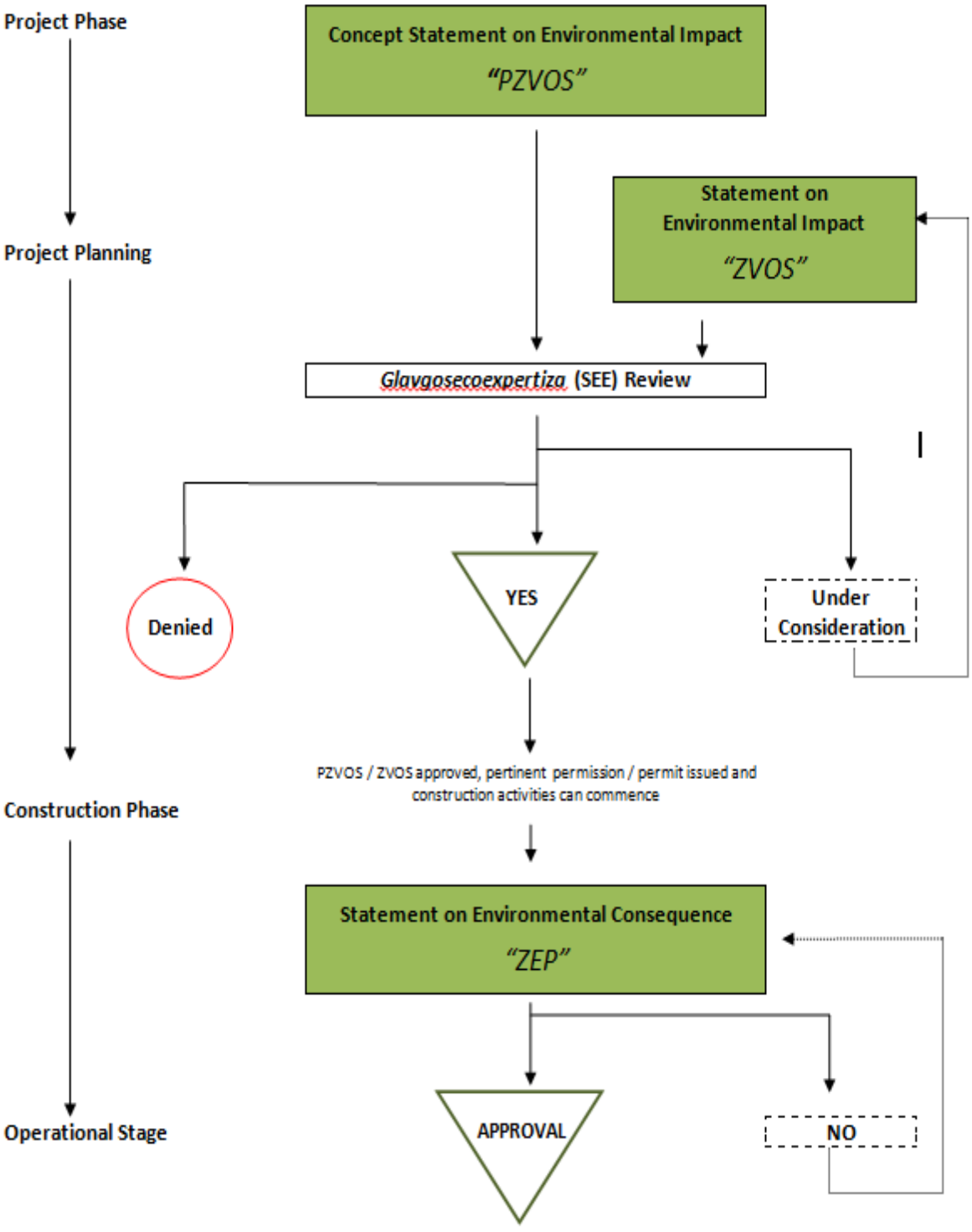

Figure 1 Uzbekistan National EIA ('OVOS') Process

2.1.2 Solid Waste Management Legislation

In 2002, The Government of Uzbekistan enacted a Solid Waste Law. The main objectives of the law are to prevent the adverse effect of waste on the life and health of the population and the environment, and to promote waste reduction and waste recycling activities. The Law establishes legal, institutional, and economic fundamentals for waste management; specifies the directions of state regulation of the sector; and establishes powers of the central and local government authorities (summarized in Table 1). The Law also regulates waste standardization, storage, and disposal; environmental certification and state registration; hazardous waste transportation; and the maintenance of the state cadastre of waste disposal and utilization sites. The Law institutes the system of compensatory payments for waste disposal, and specifies measures to promote waste reduction and recycling activities. In addition to the Law on Environmental Protection of the Republic of Uzbekistan initially adopted in 1992 and the Solid Waste Law, other laws and resolutions of the Cabinet of Ministers relating to solid waste management include the following:

National Laws:

- Law on Environmental Protection of the Republic of Uzbekistan (1992)
- Law on State Sanitary Supervision of the Republic of Uzbekistan (2000)
- Law on Radiation Safety of the Republic of Uzbekistan (2000)
- Land Code of the Republic of Uzbekistan (1998)

Resolutions of the Cabinet of Ministers of the Republic of Uzbekistan

- #247 Improving “Regulations for Imports and Exports of Ozone-Destructive Substances and of Products Containing these Substances” issued on November 11, 2005
- #151 “Regulations for Imports and Exports of Environmentally Hazardous Products and Waste” issued on April 19, 2000;
- #405 “Streamlining the Operations of Companies for Utilization and Disposal of Lamps and Devices Containing Mercury” issued on October 23, 2000;
- #199 “Improvement of the System of Fees for Pollution of the Environment and Waste disposal in the Territory of the Republic of Uzbekistan” issued on May 1, 2003;
- #111 “Approval of the Statute for Licensing Operations in Turnover of the Source of Ionizing Radiation”;
- #112 “Approval of the Statute for Licensing Operations in Mining of Precious and Rare Earth Metals, and Precious Stones”
- #250 “Approval of the Statute for Licensing Operations in Turnover of the Source of Ionizing Radiation”
- #15 “Improvement of Payment Systems for Special Utilization of the Environment”

Other Regulatory Acts

- Statute for Procedures of Establishment and Waste Cadastres of the Republic of Uzbekistan;
- RD 118.0027719.1-91-91 – Procedures to Issue Permits for Waste Storage (Land Disposal);
- RD 118.0027714.25-93 Procedures for Undertaking State Environmental Oversight of the Facilities for Disposal of Solid Household Waste of Residential Areas of the Republic of Uzbekistan;
- RD 118.0027714.31-94 Procedures for Undertaking State Environmental Oversight (Inspections) of the Facilities for Disposal of Toxic Industrial Waste of Businesses in the Republic of Uzbekistan;
- SanPiN # 0068-96 of the Republic of Uzbekistan – Sanitary Rules for Collection, Storage, Transportation, Treatment, and Disposal of Solid Household Waste in the urban areas of the Republic of Uzbekistan;
- SanPiN # 0056-96 Establishment and Maintenance of Healthcare Institutions of the Republic of Uzbekistan;
- Temporary Classificator # 4286-87 of Toxic Industrial Waste and Technical Recommendations for Identification of Toxicity Category of Industrial Waste of the Ministry of Health of the U.S.S.R. and State Committee for Science and Technologies of the U.S.S.R.
- RD 118.0027714.60-97 Environmental Protection. Treatment of Industrial and Consumption Waste. Terms and Definitions.
- RD 118.0027714.61-97 Environmental Protection. Treatment of Industrial and Consumption Waste. Introduction and procedures for stocktaking of industrial and Consumption Waste of Businesses.
- RD 118.0027714.62-97 Environmental Protection. Treatment of Industrial and Consumption Waste. Technical Guidelines for Determination of Maximum Amount of Industrial and Consumption Waste Disposal.
- KMK 2.01.12-96 Landfills for Treatment and Land Disposal of Toxic Industrial Waste. General design regulations.
- SanPiN # 0026-2002 Stocktaking, Classification, Storage, and Treatment of Industrial Waste.
- SanPiN # 0149-04 Sanitary Rules and Norms of Waste Collection, Storage, and Removal by Healthcare Institutions;
- SanPiN # 0157-04 Sanitary Requirements to Storage and Treatment of Solid Household Waste in Special Landfills in Uzbekistan.

In regards to the technical guidelines for planning and activities pertaining to waste collection, transport and storage, the UzkommunXizmat Agency has developed and approved the following:

- Regulations for Utility Services in Disposal of Solid and Liquid Household Waste 1998
- Timelines for Motorized cleanup and Sanitation of Residential Areas in the Republic of Uzbekistan – 1998
- Service Regulations for Workers involved in Sanitation Works in Households – 2001
- Service Regulations for Workers involved in Sanitation Works on Roads and relevant Infrastructure
- Regulations for Household Waste Transportation – 2003
- Qualification Requirements for Managers, Specialist, and staff of Sanitation companies – 2003
- Procedures for 2-stage removal of Solid Household Waste -2004
- Guidelines for Design and Maintenance of Solid Household Waste Landfills
- Technical Recommendations for Development of Sanitation Schemes for Urban and Residential Areas of the Republic of Uzbekistan
- Technical Recommendations to determine the Norms for Accumulation of Solid Household Wastes
- Recommendations for separate collection of Solid Household Wastes
- Regulations for Development of Urban Sanitation Schemes
- Regulations for Technical Maintenance of Facilities, Machinery and Mechanisms of Sanitation Companies

Source: *National Waste management Strategy and Action Plan of the Republic of Uzbekistan. UNDP/NZAID Project. Tashkent 2007*

Likewise, there are a number of institutions equally engaged in environmental protection and management (including solid waste management). These institutions and their key responsibilities relevant to the project are summarized in the table below.

Table 1 Roles of Different Institutions Responsible for Municipal Solid Waste Management in Tashkent

Institution	Roles and Responsibilities
State Committee for Nature Protection (*Goskompriroda*)	▪ Oversight of businesses generating industrial and agricultural waste, companies – waste management operators, facilities for waste management ▪ maintains the State Cadastre of landfills and waste processing facilities ▪ Conduct of environmental examination and assessment for research and development as well as project design and cost estimates in the area of waste management ▪ Regulating authority for implementation of all activities according to environmental laws and regulations ▪ develops and approves waste generation norms and waste disposal standards ▪ develops and approves waste disposal quotas.
Ministry of Health	▪ State Sanitary oversight of compliance with the Laws on State Sanitary oversight, on Radiation Safety and on Public Health ▪ Establish sanitary norms and rules for waste management; issues state sanitary and hygienic examination report on waste facilities ▪ Monitoring and implementation of the rules and regulations pertaining to all solid waste handling activities ▪ Oversight of the separate collection of waste in all hospitals, polyclinics, clinics and doctor's offices
UzKommunxizmat Agency	▪ Technical regulation of household waste generated nationwide ▪ Develops government waste management programs and submits them for approval of the Cabinet of Ministers ▪ Monitors the state of collection, transportation, recycling, and treatment of household solid waste
Tashkent City	▪ Monitoring all activities of the municipal solid waste management system of Tashkent to ensure its stable and smooth operation.
Local Government Bodies	▪ Participation in nationwide waste management programs; ▪ Approval of local waste management programs; ▪ Promoting business initiatives in waste management; ▪ Making decisions for location of waste management facilities in appropriate areas; ▪ Supervision of compliance with household waste management legislation.
Mahallas	▪ Participation in addressing the issues of location of waste management facilities in appropriate areas; ▪ Facilitate sanitary clean-up of residential areas and timely payment of fees for collection of household waste; ▪ Perform public oversight of sanitary and environmental state of waste management facilities.
IB Maxsustrans	▪ Coordinate all the activities of solid waste management system in Tashkent ▪ Landfilling Operations at the Akhangaran landfill site ▪ Development of the solid waste framework of the waste management plan ▪ Preparation of an annual waste report ▪ Generate data and statistics related to solid waste management ▪ Consulting services for the erection of waste treatment plants and new technologies for recycling ▪ Transfer and transport all kinds of municipal solid wastes to Akhangaran landfill ▪ Lease vehicles and contract out waste collection to private operator ▪ Supervise, control, and monitor private companies engaged in transfer and transport activities
IB Maxsustrans District Garages	▪ Collection of wastes within the districts ▪ Conclude contracts with private collectors ▪ Conclude contracts with private companies for material recycling within their jurisdiction ▪ Monitor, control, coordinate and supervise all the activities of their districts.

2.1.3 International Agreements and Protocols

As part the GoU national environmental Policies directed toward the protection and development of the environment at the national, regional and global level, the country signed, ratified treaties and became a party in a variety of regional and international environmental conventions in relation to the atmosphere, chemical and hazardous wastes, biodiversity and wildlife, desertification and the marine environment.

The table below presents a list of some of the most important International Conventions and Protocols that the GoU is currently a party of.

Relevant International Conventions and Protocols

AGREEMENT/PROTOCOL
Vienna Convention for the protection of the Ozone Layer of 1985, Montreal Protocol on Ozone Depleting Substances of 1987, London (1990) and Copenhagen Amendments to the Montreal Protocol (1992)
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their disposal of 1989
United Nation Framework Convention on Climate Change (UNFCCC) of 1992
Kyoto Protocol of the UNFCCC of 1997
United Nations Convention to Combat Desertification of 1994
Convention on International Trade of Endangered Species of Flora and Fauna (1973); ratified in 2000
Bonn Convention on Conservation of Migrating Species of Wild Animals (1998)
Convention on biological diversity of 1992

Vienna Convention for the protection of the Ozone Layer of 1985 and Montreal Protocol on Ozone Depleting Substances of 1987, London (1990) and Copenhagen Amendments to the Montreal Protocol (1992), ratified in 1998

The main objective was the preservation of human health and the protection of the environment from any harmful effects due to the depletion of the Ozone Layer. In 1987, an agreement was reached on specific measures to be taken concerning a number of chemical substances that affect the ozone layer and the Montreal Protocol on Substances that Deplete the Ozone Layer was adopted.

Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their disposal of 1989

The Basel Convention was drafted and adapted to limit the shipping of hazardous waste to developing countries and to Eastern Europe, and due to the hazardous nature of such waste and their potential impact on human health and the environment, one of the guiding principles of the Basel Convention was that the hazardous waste should be dealt with as close as possible to their production area.

United Nation Framework Convention on Climate Change (UNFCCC) of 1992 and the Kyoto Protocol of the UNFCCC of 1997

The UNFCCC sets an overall framework for inter-governmental efforts to tackle the challenge posed by climate change. And the Kyoto Protocol was adopted at the 3rd conference of the UNFCCC in 1997 requiring even stronger actions to be taken in that regard.

United Nations Convention to Combat Desertification of 1994

As signatory of the UN Convention, the state is committed to combating land degradation, which is the result of erosion and soil deterioration.

Convention on International Trade of Endangered Species of Flora and Fauna (1973); ratified in 2000

The aim of Convention on International Trade of Endangered Species of Flora and Fauna ('CITES') is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

Bonn Convention on Conservation of Migrating Species of Wild Animals (1998)

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) aims to conserve terrestrial, marine and avian migratory species throughout their range.

Convention on Biological Diversity of 1992

The Convention on Biological Diversity took place in order to promote sustainable development and effectively translate the principles of Agenda 21. In turn the country has to develop effective national strategies, legislation, plans and programs to be put in place in order to provide a national framework for implementing the objectives of the convention and to set clear national priorities. Developers must also ensure that their operations promote these priorities and follow the national strategies to avoid the loss of biodiversity within their property.

2.1.4 ADB Environmental Policies and Guidelines

The SLF Project has been classified as a Category B project under the provisions of the ADB's Safeguard Policy Statement July 2009. The ADB classification system was used to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts to the site and its immediate surroundings. This project is classified as category B due to the fact that its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects.

The scope of IEE, according to the ADB requirements, examines the project's potential positive and negative environmental impacts and recommends any mitigating measures needed. Such measures aims to prevent, minimize, mitigate and/or compensate for adverse impacts. An Environmental Management Plan detailing the mitigation measures, monitoring program, and implementation and schedule are also included in this report.

Under the guidance of SPS 2009, any ADB funded project that involves existing facilities will be required an environmental compliance audit. This audit report aims to determine whether these facilities are in compliance with the principles and safeguard requirements of ADB as well as the GoU environmental management requirements. Where non-compliance is identified, a corrective action plan (CAP) will be prepared to cover remedial actions and reduce these impacts to acceptable levels.

3. PROJECT DESCRIPTION

3.1 Project Information

Intent : **Establishment of an engineered Sanitary Landfill (SLF)**

Location : Akhangaran Rayon, Tashkent Oblast

3.2 Project Location

The proposed site is located at the eastern side of the existing Akhangaran Landfill. The Akhangaran landfill is located approximately 33 km south of the center of Tashkent City in the Akhangaran district of Tashkent Province. The facility is an operational facility currently handling the wastes collected from Tashkent and for a time, from Chirchik. The total area will cover a total area of 25 hectares of agricultural land. The picture below presents the relative distance and location of the existing landfill site from the city.

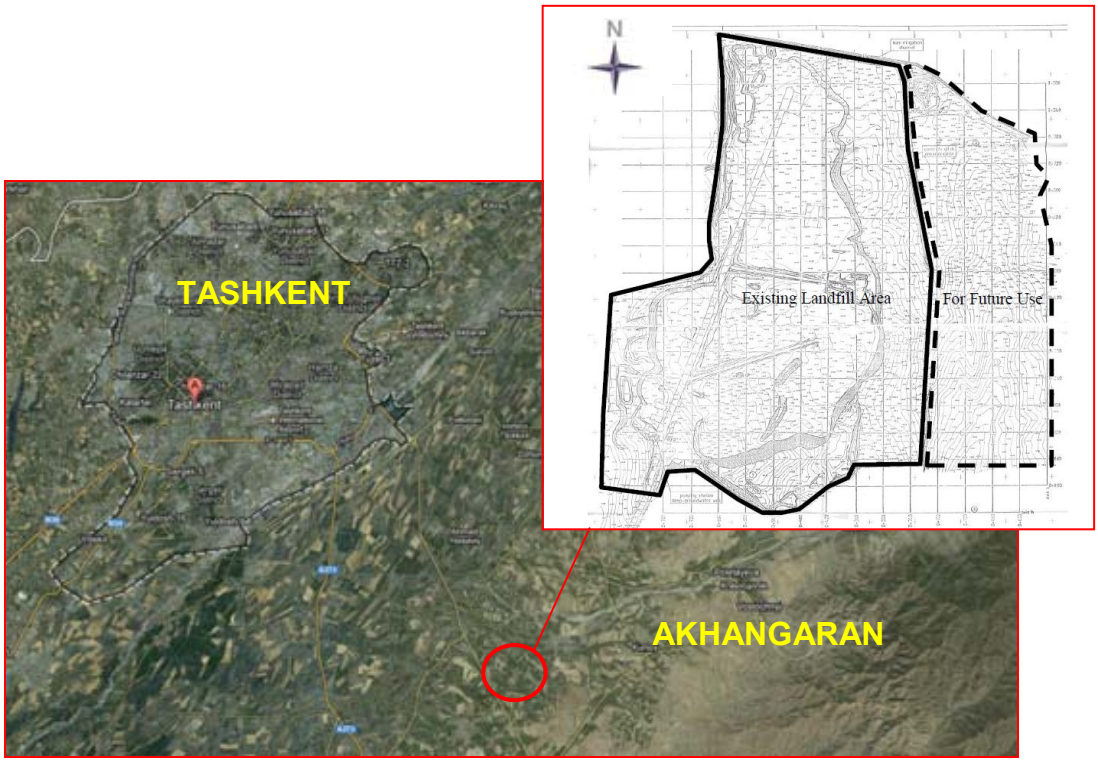

Figure 2 Location Map of Akhangaran Landfill

The project site can be reached by any form of vehicle via the national road (Highway P2) through the existing access road leading up to the site. The area is located at geographical coordinates latitude 41^{O} 5.771' N and longitude 69^{O} 29.180' E.

Figure 3 Satellite Image of the Existing Akhangharan Landfill and the proposed SLF Site

Picture 1 Access road to Akhangharan Landfill and the proposed SLF Site

3.2.1 Site Status

Visibly, the adjacent areas are irrigated agricultural areas predominantly characterized by undulating valleys. There are no residential areas or industrial facilities within a 4-kilometer radius. Farmers come primarily from villages located about 5 kilometers from the site. Aside from the typical agricultural vegetation being grown, the area is characterized by reeds often found along the boundaries of each plot. Common farm livestock are common in the area.

Picture 2 Picture showing the active disposal area of Akhangaran Landfill and adjacent Areas

At the existing landfill, it was observed that there is no fence around facility, an operational weighbridge is installed, office / administration building and social facilities for workers were established. The area is connected to the main road via an asphalt access road that leads directly into the landfill. The distance from the Akhangaran highway to the landfill area is about a kilometer from the main road.

Picture 3 Weigh Bridge Area – Akhangaran Landfill

Picture 4 Office / Administration Building – Maxsustrans

In 2010, a landfill gas (LFG) collection system was installed to recover biogas (i.e. methane). The system is composed of 40 extraction wells interconnected onto a single flare.

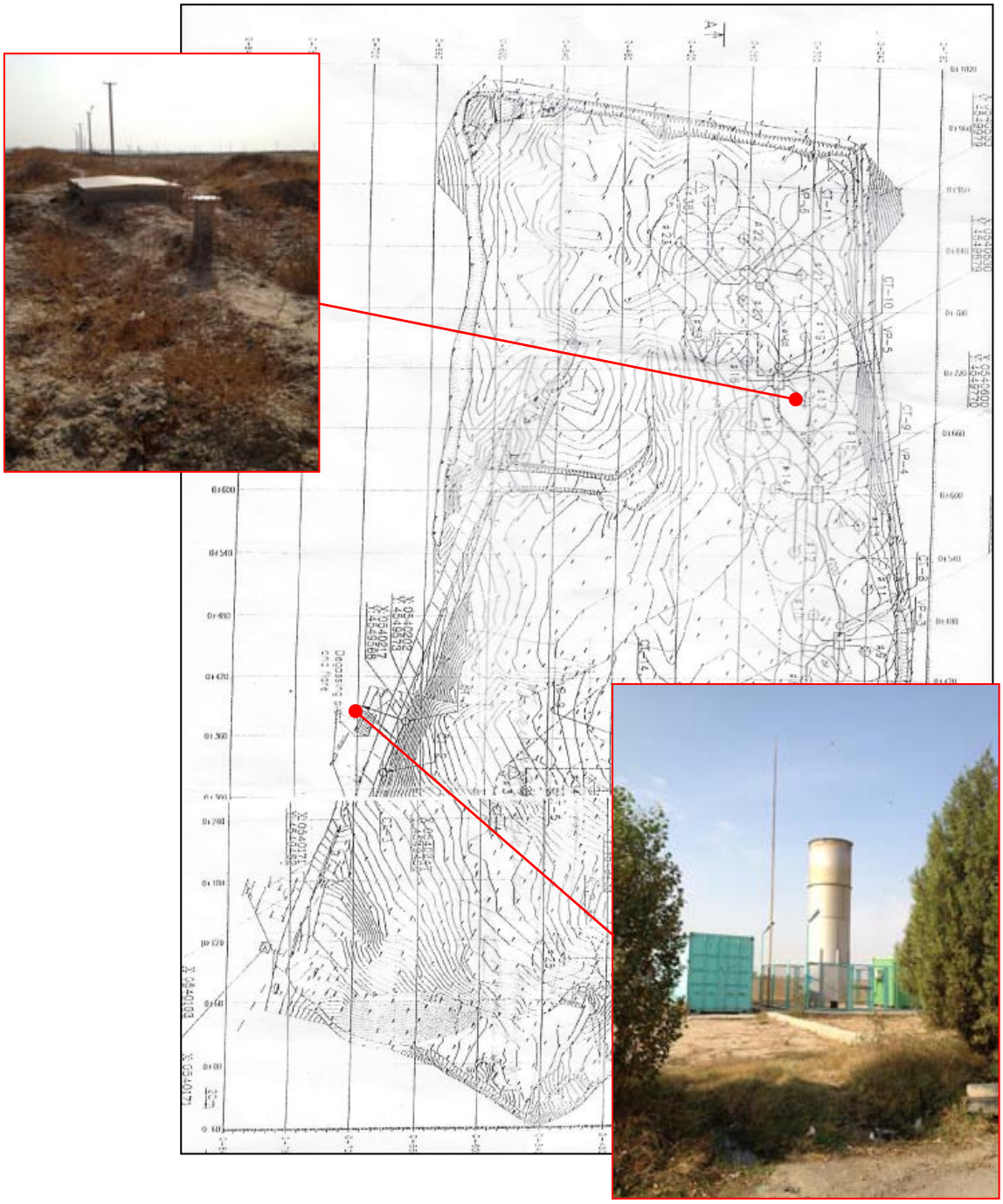

Figure 4 Landfill Gas (LFG) collection system – Akhangaran Landfill

3.2.2 Collection Points and Transfer Stations

Crucial points in the city's waste collection system are about 700 waste collection points distributed over the 11 districts of the city. The waste collection points are serving mostly residential areas, especially in high-rise residential clusters. This system in its simplicity proved to be highly efficient. Most rayons (districts) have implemented guarded (and unguarded) waste collection points (or CPs), which are supervised by two employees from Maxsustrans for the guarded CPs. Connected residents dispose their household waste at the designated waste bins at the CP. Maxsustrans collects these wastes once or twice a day to be transported to the landfill. The table below presents the existing number of CPs for the city of Tashkent.

Table 2 Existing Waste Collection Points in Tashkent

	Locations	Number of Collection Points (CP)
1	Mirabad-Maxsustrans	44
2	M.Ulugbek-Maxsustrans	63
3	Hamza-Maxsustrans	66
4	Shayhantaur-Maxsustrans	59
5	Yakkasaray-Maxsustrans	33
6	Chilanzar-Maxsustrans	118
7	Bektemir-Maxsustrans	20
8	Sergeli-Maxsustrans	64
9	Olmazor-Maxsustrans	45
10	Uchtepa-Maxsustrans	60
11	Yunusabad-Municipality	104
	Total	**676**

To complement the city's SWM, three (3) operating transfer stations in the districts of Yunusabad, Yakkasaray and Khamza were established. These transfer stations are served by varying garbage collection trucks with capacities ranging from 6 to 10 m³ waste volume (2.5 to 5 tons weight capacity). The original WB project recommended the installation of four (4) transfer stations (TS) but due to financial limitations, only three (3) TS were established.

An environmental audit describing these facilities as well as assessing its safeguard status is attached as Annex 3.

3.3 IEE Approach of Methodology in Data Gathering

The goal is to maximize the use of available secondary data in the understanding of the present condition of the project site. This is to ensure that the assessment and prediction of impacts are accurate and not based on documents that may no longer be applicable or true. An environmental baseline assessment can be undertaken at a later stage using a combination of field survey, monitoring and review of available secondary resources.

The use of available secondary data gathered from governmental / state agencies was maximized in the understanding of the present conditions at the project site. Selection of secondary data used came from available sources that are latest official documents and published only by reputable offices and institutions. Secondary data gathering entailed the conduct of a series of meetings with the concerned agencies and obtaining from the baseline data relevant to the environmental conditions at site. These included meetings with the following governmental / state agencies and the respective data to be collected from each agency:

- *Uzhydromet* (Centre of Hydro-meteorological Service) for the Climatological Normal and Air Quality for Tashkent
- *Goskomgeologia* (State Committee for Geology and Mineral Resources) for the Soil Quality, Seismic / Earthquake generator maps, geology, hydro-geology, groundwater quality
- *Oblkompriroda* (National Protection Committee) for typical flora and fauna at the site
- *Goskomgeodezkadastr* (State Committee for Land Resources, Surveys, Cartography and the State Cadastre) for the Land Use, topographic maps

The information provided was also used to predict and identify the primary and secondary impact areas, the magnitude of the impact and the mitigation measures to address the identified impact. The assumptions, analysis, findings and recommendation are presented in the subsequent chapters of this document.

3.4 Scope of the Assessment

The scope of the IEE is dictated and is consistent to the requirements of the Asian Development Bank (ADB) resembling the “OVOS” format used by *Goskompriroda* in the conduct of an Environmental Impact Assessment (EIA) for Sanitary Landfill (SLF). The broad objectives of this IEE report are:

- Identify all applicable environmental standards and guidelines for the SLF
- Identify the nature and extent of any significant potential environmental and social impacts be they positive (beneficial) or negative (adverse), temporary or long term. The assessment also reviews whether there will be a cumulative impact that requires remedial actions and mitigation.
- Identify and evaluate appropriate mitigation measures for the identified potential impacts
- Outline the management principles and controls that will apply to the project to address these impacts in an Environmental Management Plan including an Environmental Monitoring Plan

Inasmuch as it was aimed to maximize the use of secondary data in validating the veracity of the data gathered, the team was limited only to available information found or provided by the aforementioned government institutions.

On the other hand, it is important to note that other existing components of Output 1 for the SWM improvement project namely the refurbishment of collection points and transport components including the planned improvements for the transfer stations are not included in this assessment. As a rule, these components are often subjected to perform a separate assessment due to their distinct location/s (i.e. since an IEE is site specific, preparation of separate report/s for components not located on a contiguous area were taken into account). In turn, a site investigation and environmental audit were conducted to cover these project components (attached as Annex 3). Based on assessments on all collection points and waste logistics (e.g. transfer stations), project related works (e.g. replacement of bins, replacement of electromechanical equipment, repair of operator's station and gates, etc.) constitute as standard maintenance works which are considered to be minor restorations and does not pose any environmental impacts. Areas of concern are more inclined towards the operational aspect of the transfer station (e.g. efficient facility operation and monitoring). In fact, after the assessment, it is established that the rehabilitation works is vital should these facilities and its operators desire to maintain the installed environmental controls and abate any potential MSW crisis. On the other hand, it is deemed that the SLF is the only component that requires further environmental assessment. In spite of being part of the system, the impacts and its magnitude brought about by these detached components may be different and isolated compared to the impacts at the SLF site.

Lastly, it is acknowledged that the conduct of a full blown Environmental Impact Assessment (EIA) should be taken into account considering the *Goskompriroda's* project categorization and OVOS requirement which will be conducted by the EA at a later stage. This IEE report is also expected to serve as a reference for preparing the necessary documentation to obtain the relevant permit from *Goskompriroda*. For the existing project components to be rehabilitated, the conduct of a follow up environment audit to assess environmental, health and safety status and identify any concerns, if any, can be performed once the rehabilitation works are completed.

3.5 Project Rationale

At present, household waste generated from Tashkent and the surrounding districts are being disposed on a 59-hectare landfill in Akhangaran. Based on a recent Waste Characterization Study (WACS), it is estimated that the city of Tashkent generates about 1,288 tons/day for the households and 386 tons/day for the commercial sector. This translates to a total waste generation of 1,674 tons/day and is estimated to increase to 1,929 tons/day by the year 2020. The need for the project is necessitated from the city's demand for space to dispose its wastes as the Akhangaran Landfill is almost full.

Notwithstanding the installed systems for the Akhangaran landfill, the facility resembles more like a controlled dumpsite rather than a landfill as commonly referred to. The existing disposal practice at the Akhangaran Landfill may be generally characterized as:

- Generally organized but employs sporadic dumping of wastes;
- Absence of data / information actual volume of waste stored at the site
- No controls over potential pollutants and residues generated and released from waste decomposition;
- Occasional vectors are attracted to the site due to exposed wastes;
- Potential generation of odors and pungent smoke from spontaneous combustion.

Picture 5 Typical Disposal at the Akhangaran Landfill

In order to implement a proper waste management system, existing practices should be changed and an effective system should be implemented. The matrix below distinguishes the existing waste management from the proposed project.

Existing Dumping Practices	Sanitary Landfill (SLF)
• Limited capacity • No Site Preparation and no cell planning-waste deposited across large part of the site • Thin layers of waste-relatively rapid aerobic decomposition • No leachate gas management • Limited compaction of waste • Litter blown within and beyond site boundary- no fence • Uncontrolled presence of Vermin, pests and scavenging animals • Waste picking and trading	• Project design based on environmental assessment • Planned capacity with phased cell development • Full controlled emission and effluent management with abstraction and treatment • Extensive site preparation and containment Engineering • Compaction of waste to maximum specified target densities • Full record of waste Volume, types and sources • Specified operational procedure to protect local amenity including vector controls • Fence, gate and other site infrastructure to ensure no trespassing and waste picking Promotes segregation and recycling at source or at collection points • Promotes segregation and recycling at source or at collection points

The establishment of an engineered sanitary landfill (SLF) is crucial considering the diminishing utilizable area of the existing facility vis-à-vis the continuous stream of incoming waste. This would also include but not limited to negating the need for allocating additional disposal area only to be subjected again with the existing dumping practice. The proposed project shall have the following operational elements:

- Improved recording of wastes volumes, types and sources
- Proper segregation of inorganic materials strengthening recycling
- Proper disposal of residual waste into an engineered Sanitary Landfill
- Planned capacity with phased cell development for landfill
- Specified operational procedures to protect the receiving environment
- Provision for an effective site restoration and closure procedures for existing dumpsite.

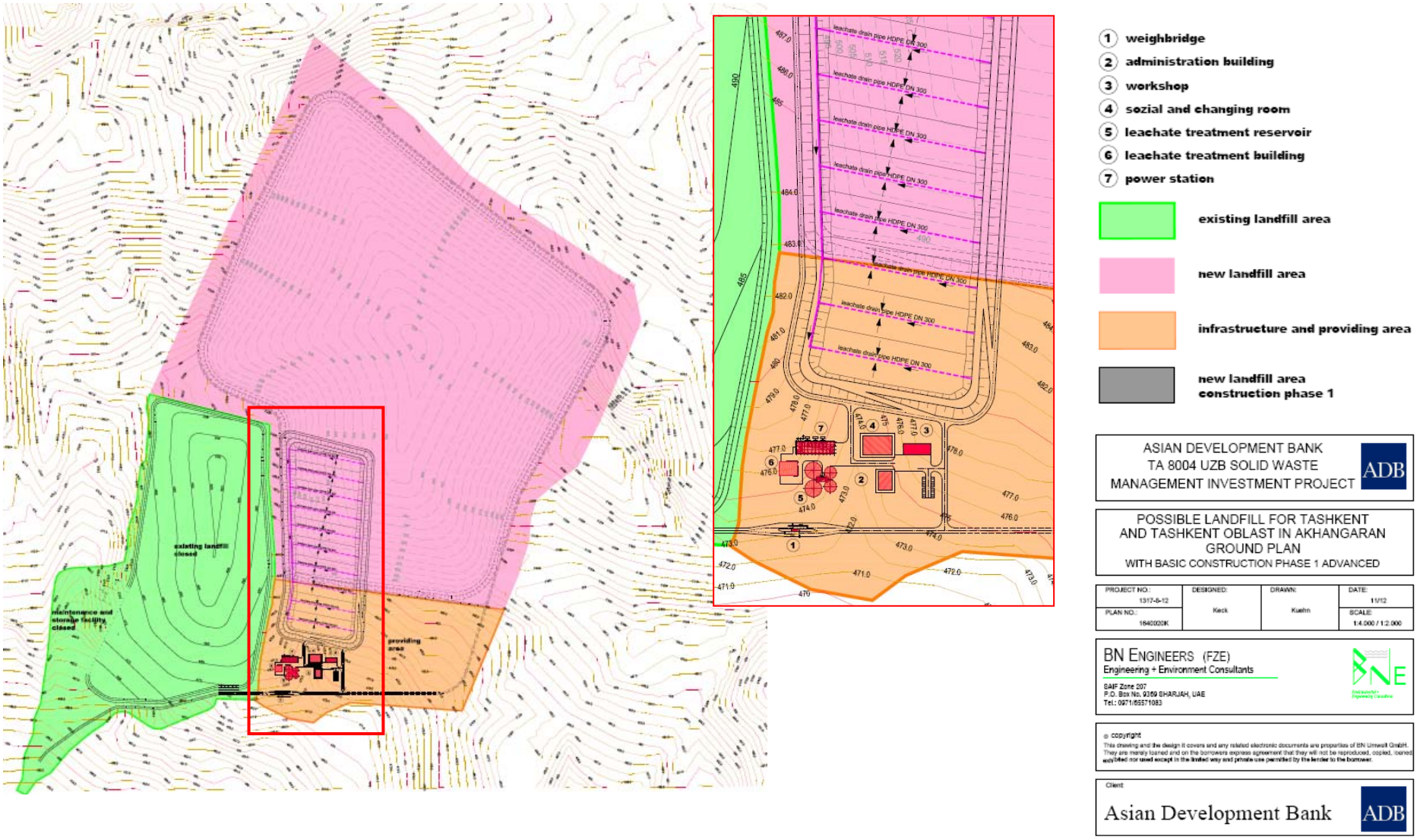

Figure 5 - Lot plan of the Proposed Sanitary Landfill Facility

3.6 Project Description

3.6.1 Tashkent Solid Waste Management Improvement Project

The challenges have recently mobilized significant resources in order to improve SWM service provision throughout the nation. While recognizing the needed improvements in the SWM sector, the government's immediate priority is to rehabilitate Tashkent's SWM system. The city's 2.3 million population currently generate over 0.5 million tons annually which will increase to over 0.7 million tons annually by 2030. This has exerted tremendous pressures on its ageing SWM infrastructure which requires immediate refurbishment. The SWM improvement project involves the following project outputs;

- **Rehabilitation of Tashkent's SWM System**. This comprises the (i) construction of 350 MSW collection points, and rehabilitation of a further 350 collection points, (ii) provision of 13,500 waste bins[1], (iii) provision of 177 MSW collection vehicles, (iv) rehabilitation of two existing transfer stations and closure of a third, (v) a new MSW transfer vehicle fleet, and (vi) a new 30-hectare SLF and closure of the existing dumpsite.[2] Description and assessment of the collection points and transfer station is detailed in Annex 3 of this report.

- **Improvement of the MSW efficiencies**, *and*

- **Project Management and Capacity Building** to develop a draft national SWM strategy and medium sector investment program (2013 – 2030).

3.6.1.1 Sanitary Landfill (SLF)

The proposed project would occupy about 25 hectare of agricultural area wherein about 19 hectares (14 hectares net) would be utilized as landfill. The remaining area would be used as environmental buffer zone and for the needed infrastructure for the landfill.

To maximize the area as well as implement an efficient final disposal operation, the landfill will be operated in the phases. The SLF is divided in several cells, which will be built and utilized depending on the actual collected waste volumes. The conceptualized sanitary landfill shall bear a maximum height of about 25m waste would have a volume of about 2,600,000 m_3 or about 3,640,000 tons capacity and would last for about 5 to 7 years for Tashkent city only. The figure in the succeeding shows the proposed sanitary landfill.

[1] Including 750-liter bins (5,000 total), and 1,100-liter bins (8,500 total).

[2] The 30-hectare SLF is to be located adjacent to the existing Akhangaran dumpsite disposal facility, southeast of the city. The new facility will include international-standard engineered environmental systems, including base liners, and leachate and landfill gas collection and treatment systems.

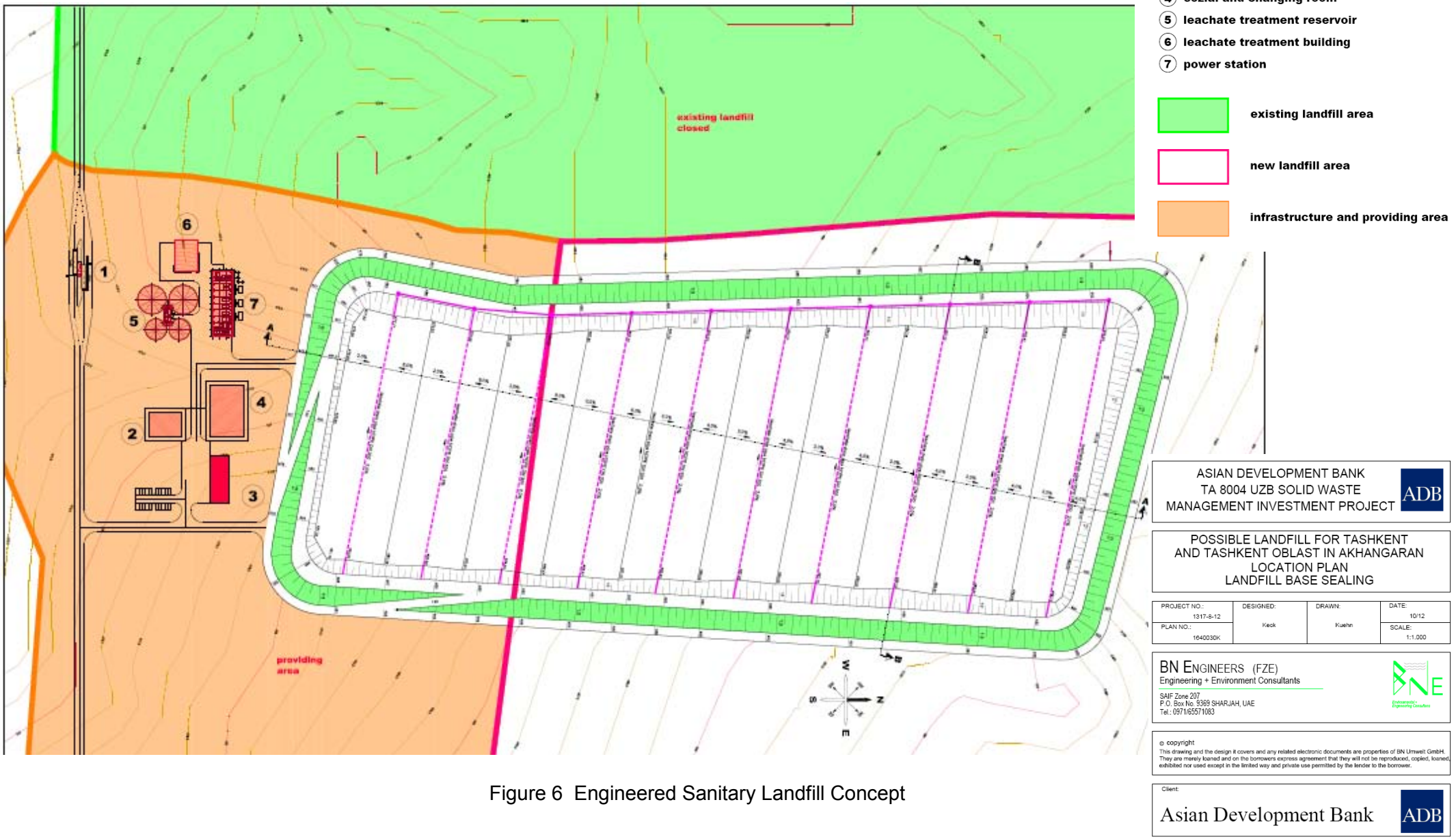

Figure 6 Engineered Sanitary Landfill Concept

As shown, the landfill concept follows mostly the natural topography of the area and therefore fits into the common visualization of the area. Minor earthmoving would be needed to construct the facility. Recognizing that the facility is only planned for a lifetime of 5 to 7 years it is recommended to construct the facility in one phase only. The typical approach to construct such project in several phases would not fit the tight schedule of the lifetime of the project and disturb the operations of the facility. The technical specifications for the project are explained in the succeeding sections of this report.

Such projects that are established in an arid-country like Uzbekistan, it is envisaged that due to a relatively low annual rainfall, leachate generation is expected to be low (i.e. considering amount of rainfall vis-à-vis the absorptive capacity of waste and evaporation during summer months). Nonetheless, sound engineering practice dictates that preventive measures should be undertaken to eliminate any leachate contamination potential. The basic technology behind every modern sanitary Landfill is typically the "Multi Barrier" approach to ensure a long term, environmental sound disposal solution. The principle of a liner system is presented in the figure below.

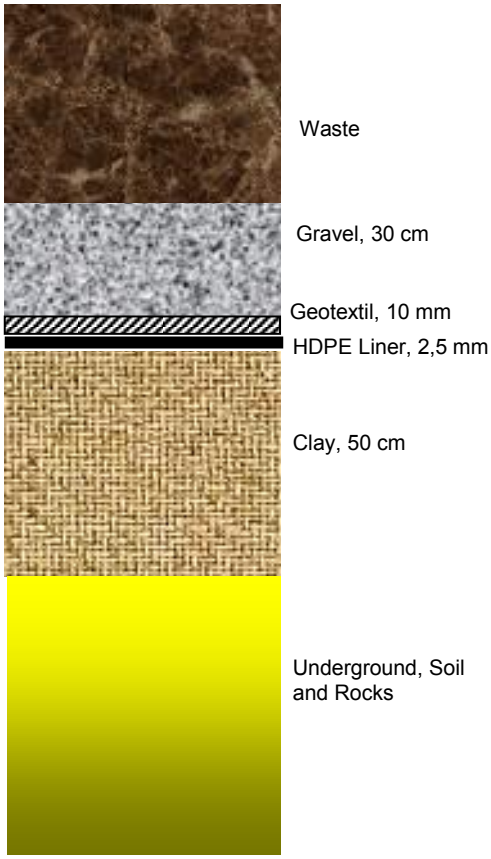

Figure 7 The Typical Liner System

This "**Multi-Barrier-System"** which will be applied at the landfill area shall consist of the following typical components:

- ***First Barrier*****:** Geological barrier. This is the subsoil of the site itself (i.e. silty clay substrate readily available at the site)

- ***Second Barrier*****:** Base sealing. The landfill base shall be covered by a redundant liner system from specially manufactured HDPE-plastic sheets and a mineral layer (clay) with a very low permeability. The HDPE liner sheets will be

welded with a double seam On top of the HDPE liner a protection layer of 10 mm thick (2000 grams per m²) geo-textile is placed to avoid any puncture of the liner by sharp items. An approximately 30 cm thick gravel layer drains the leachate toward the leachate collection pipes

- ***Third Barrier:*** Waste landfill. It is a series of layers of highly compacted waste. The technically designed highly compacted layer of waste will be made possible with the use of specially designed compacting vehicle/equipment. This method of waste landfilling provides optimal protection against blown litter / garbage as well as prevention against rodents and at least a preventive measure for fire hazards (e.g. spontaneous combustion). This barrier will form the main body of the landfill.

- ***Fourth Barrier*:** Surface sealing. It is normally established after the backfilling to the maximum design volume of the landfill disposal cell. This surface sealing or enclosure has to be made of water and gas tight HDPE plastic sheets and is covered with a layer of topsoil. This seal prevents the intrusion of surface water into the main body of the landfill. Likewise, the surface sealing allows the collection of gases from the deposited waste if necessary / applicable. During normal operation a 'temporary surface sealing' with ordinary soil will be implemented for the daily coverage of the waste.

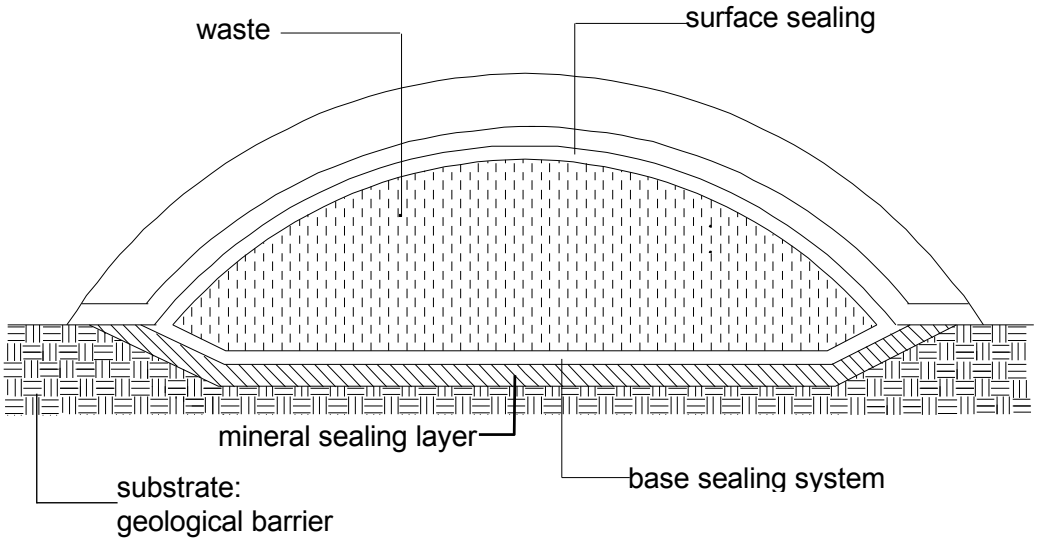

Illustration Figure 8 Typical Schematic diagram of multi-barrier system

Leachate Collection system

To properly collect and treat any leachate generated (regardless of its expected limited quantities) in the landfill area, a collection system shall be installed.

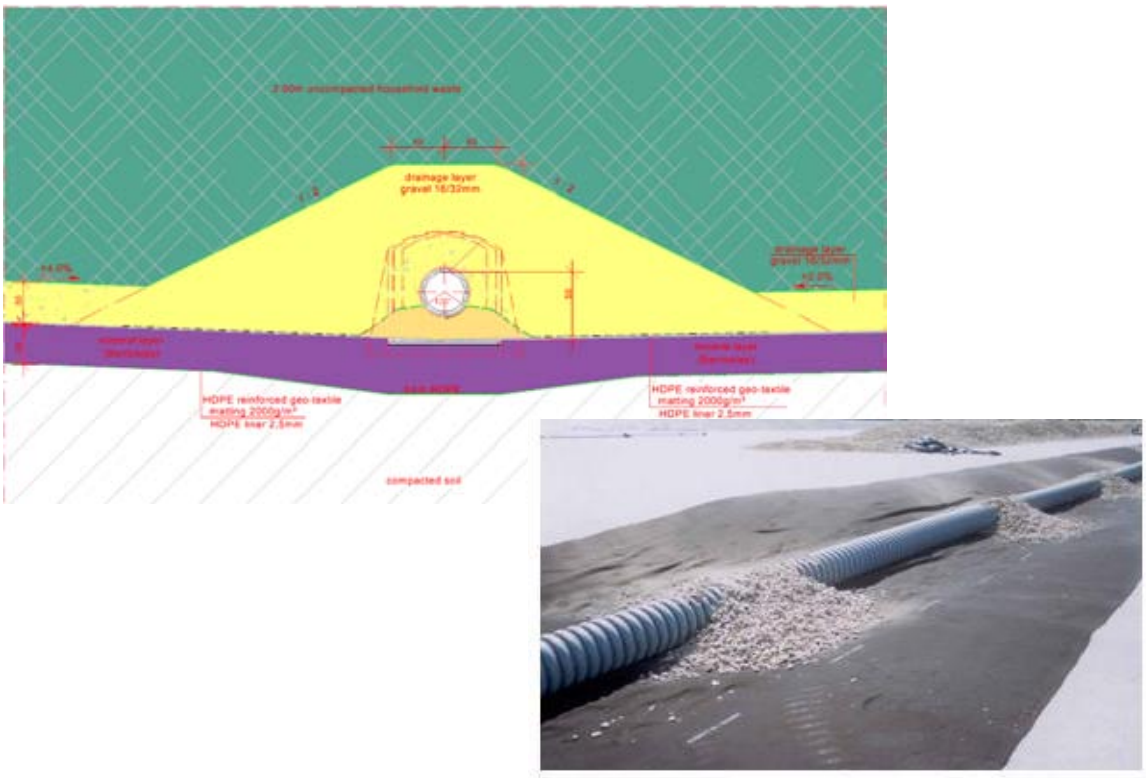

Figure 9 Typical Leachate Profile and Collection Pipe

The landfill bottom will have 2 – 3% gradient profile from one side to the other in order to allow the leachate flow into the leachate collection pipes In addition, the leachate collection pipes have 2 - 3 % gradient to let the collected leachate inside the pipes to flow to the leachate collection shafts. The leachate collection pipes are perforated. These pipes will have a diameter of 30 cm and are re-enforced. The re-enforcement is necessary so that they can carry the load of the piled-up waste without collapsing.

Figure 10 Landfill Bottom Profile with Leachate Collection Pipes

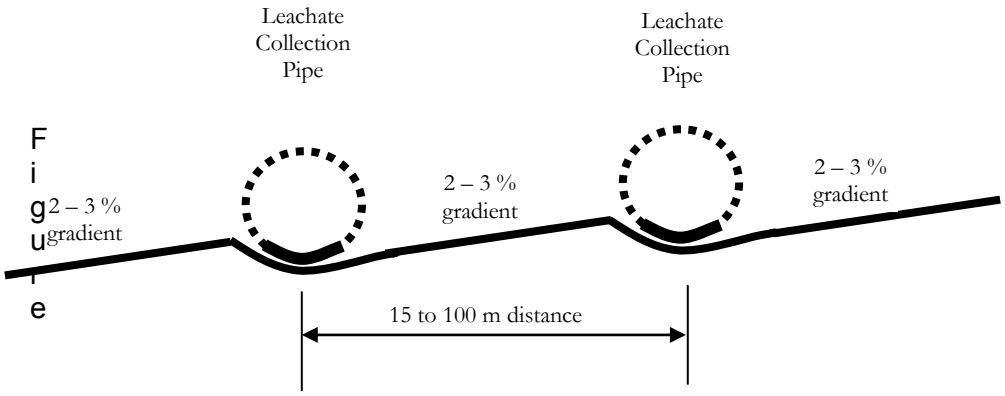

Figure 11 Reinforced Drainage Pipes

Figure 12 Leachate Collection Shaft

Leachate Treatment / Handling system

Due to the limited amount of rainfall (hence a limited leachate generation is expected) a leachate “recirculation” system is being considered. Generated leachate can be sprayed over the waste disposal area for evaporation. The system is a flexible system of pipes, hoses and sprayer connected to the hydrants at a pump station.

3.6.1.2 Auxiliary Facilities

The following auxiliary facilities and other infrastructures shall be established in support to the functional requirements of the facility;

- Perimeter Fence
- Entrance Gates / Guard House / Wash Bays
- Weigh Bridge
- Power Station
- Administration Building
- Motor Shop / Work shop
- Parking Areas
- Leachate treatment reservoir
- Social and Changing Room for Workers
- Monitoring wells.
- Drainage System

The following are brief discussions of the technical details of some of the auxiliary facilities of the facility.

3.6.1.2.1 Weigh Bridge

For proper recording and calculation of landfill space as also for accounting purposes, a truck scale (Weigh Bridge) will be installed on side. This weigh bridge should idealistically be an under floor drive through facility to assure minimal time losses on the entrance of the facility.

Figure 13 Typical Weigh Bridge (Flat Bunker)

3.6.1.2.1 Office and Staff buildings

The designed offices and staff buildings comply with the requirements local building standards.

3.6.1.2.2 Road Network

All roads and vehicle places are designed for the utilization by heavy equipment as common on such facilities. Roads will be constructed as asphalt roads whereas extreme utilized areas would be implemented in concrete.

3.6.1.2.3 Monitoring Wells

The risk that leachate infiltrating into the groundwater is expected to be extremely low. For purposes of monitoring, monitoring wells should be established to monitor the possible impact of the project to the groundwater resources, when deemed necessary. At least four (4) monitoring wells shall be established (i.e. monitoring well/s shall be established upstream and downstream of the project site). These wells are installed for early detection of any leaks which may result to groundwater contamination.

Based on available data and existing geology of the project site with a consistent clay / loam layer acting as a natural barrier to the first groundwater aquifer, a relatively deep groundwater level (>30 meters), a relatively low precipitation and the technical quality of waste to be disposed coupled with the planned liner system and quality management the actual risk of groundwater contamination is most unlikely.

This technical issue regarding the number of monitoring wells to be established has to be thoroughly discussed with the concerned agencies.

3.6.1.2.4 Drainage System

It is acknowledge that in spite of the low rainfall, the presence of irrigation canals may pose as a threat to the landfill area (i.e. damage to irrigation canals causing water infiltrating the landfill area). A drainage system is installed to divert and minimize the risk of irrigation water and/or rainwater infiltrating the waste column.

3.6.1.2.5 Perimeter Fence

A perimeter fence with an entrance gate of reasonable height, 2 meters from the ground, shall be installed in order to prevent the entry of unauthorized persons and potential scavengers.

3.6.2 Pre-construction

The pre-construction phase entails the accomplishment of activities that are prerequisite to the implementation of the construction activities. These activities include the following:

- Conduct Site Investigation / Site Selection
- Preparation of Conceptual Study
- Site Selection and Allocation
- Preparation of Development Plans / Engineering Designs and technical specifications (including plans on how to handle the dumped wastes at the site)
- Conduct of Environmental Assessments and preparation of the IEE
- Securing the necessary permits and clearances
- Hiring of building consultants and contractors

Due to the current conditions at the project site vis-à-vis the current dumping practices, establishment of the sanitary landfill is a necessity. It is envisaged that not only will it control the indiscriminate dumping activities; it will also eliminate the deleterious effects of uncontrolled dumping. For the purpose of establishing a sanitary landfill, a site selection process was undertaken to propose and eventually acquire a suitable area. This survey covered a total area of about 32,000 sq. kilometers which considered the following “site for project” compatibility criteria:

- Area capacity and availability
- Hauling distance and time
- Proximity to sensitive groundwater resources
- Proximity to perennial surface water
- Proximity to sensitive land user / vulnerable groups
- Occurrence of flooding
- Local ecological conditions
- Current and future land use
- Seismic conditions
- Geological conditions
- Soil / land conditions
- Topography
- Proximity to airports, residential areas and communities

Considering the siting criteria, it was ascertained that site conditions at the Akhangaran Landfill provides a suitable basis to establish a sanitary landfill, although it is noted that an agricultural plot will be affected. Details of the land acquisition compensation will be provided in the Land Acquisition and Resettlement Plan (LARP) report.

Securing the permits for the project is a very important aspect during the pre-construction phase. The project will also secure other permits and clearances relevant to the project prior to any construction activities unless permitted by virtue of provisional construction permits.

3.6.3 Construction Phase

The project will start with the necessary preparation for construction works. The whole construction works can be described by the following activities:

- Site preparation
- Construction of infrastructures such as Fencing and gates
- Construction of temporary facilities like warehouses, staging areas, bunk houses and related facilities
- Land preparation that include land leveling, construction of access and internal roads, drainage facilities and other horizontal earth works
- Construction of foundations for the major facilities, procurement of materials equipment and other facilities
- Construction of the weighbridge system and its components
- Construction of Landfill
- Construction of the Administrative Building and operations Buildings
- Commissioning

In order to understand the impact of all the project phases to the receiving environment, it is necessary to provide details of the activities to be performed, its magnitude and duration. The following are details of the construction activities.

3.6.3.1 Site Preparation

A 25 hectare plot beside the existing Akhangaran landfill is was considered to be the site of the Sanitary Landfill and its associated facilities. Approximately 140,000 m^2 of land (i.e. 56% of the total allocated area) will be opened for development and prepared for the establishment of the landfill, 28% for its associated facilities / expansion areas and 16% for buffer zones phase. The remaining areas shall be used for future expansions.

Picture 6 Picture of the Proposed SLF Site

There is also a need to carry out cutting and filling of the land in order to attain the designed ground elevation. During the process, areas above the design elevation shall be cut and spoils shall be used to fill areas below the designed elevation. The area is to be clean of any obstructions in areas where the general design elevation is already attained. Cut and fill activities will be carried out using mostly heavy mechanical equipment. Manual labor will be negligible.


Picture 7 Earthmoving activities during site preparation for the Establishment of a landfill

The ground will be compacted until the desired ground bearing capacity is attained. This is to ensure that all structures, particularly the foundations to be erected are stable and will not be subject to subsidence, settlements and other earth pressures.

3.6.3.2 Closure of Existing Dumpsite

In spite of recent efforts, the existing Akhangaran Landfill is comparable to a control dumpsite wherein operating conditions are poor and below acceptable standards. Further, despite of the favorable and optimum natural conditions at the site, potential environmental impacts are unavoidable and cannot be disregarded. In consonance with the establishment of the SLF, an appropriate 'safe closure plan' will be developed in the later project stage.

The main objective of the closure plan should consider the following;

- Proper and safe storage of dumped wastes.
- Any potential emissions (landfill gas) from the anaerobe bio-chemical processes within the landfill body, fuelled by the disposed organic material.
- Any potential soil contamination within the vicinity of the dumpsite. Although acknowledged that favourable geological conditions exist on site (primarily available loam material at the site), this has yet to be confirmed through detailed geological-hydrogeological study for the post closure design of the site.

- Any groundwater contamination. In relation to the favourable soil conditions, it is also noteworthy that there is minimal hydro-geological (groundwater) contamination due to the depth of the aquifer.

The closure of the existing dumpsite will involve covering the entire 59 hectares with a mineral layer of very low permeability (like clay or loam available at the site) and install a drainage system for a secure deviation of any possible run-off water away from the waste. A cover of topsoil will be placed over this mineral layer which will allow the growth of shallow rooted plants to prevent soil erosion complementing the local landscape.

Optimizing cost, the construction of the SLF will provide the necessary surface sealing for the existing dumpsite (i.e. materials from the earthmoving activities).

3.6.3.3 Construction of the SLF and its Components

The facility will have the following vital components. These are the following parts:

- Weighing System (WS);
- Multi-Barrier System for the SLF; and
- Associated Structures (AST) (e.g. leachate collection)
-

3.6.4 Operational Phase

Waste collection trucks and container vehicles will deliver wastes from the transfer station/s. After carrying out formal entrance inspection, these trucks will be ushered to the appropriate disposal area. The precise registration of waste delivered will be carried out through the proper documentation of the type and weight or volume of waste, and the specific location in the landfill where the waste will be deposited.

The acceptance and deposing of waste will be done daily, during the daytime. The prepared disposal areas, which will be filled during the transitional period, will first be covered with a layer of waste to a thickness of about 2.0 m. This will be carried out from the ring roads using a front deposing method with a wheel loader.
The waste compactors will distribute the garbage delivered in an area-filling or horizontal method in layers of <0.5 m thickness. By doing so and by driving over the layers several times, good homogenization and intensive compaction of the material will be achieved. The deposing procedures will ensure a high degree of compaction of about 0.8 to 1.0 tons/m^3 which will minimize the landfill volume required. Static security problems can be excluded on the whole as a result of these methods.

The operator will implement and provide all necessary personal protective equipment (PPE) to ensure the safety of personnel on any possible health risks and probable accidents. Regular monitoring and system checks will be conducted to ensure efficiency and to minimize the incidence of accidents.

A “Regulation of Use” manual for the proper and efficient operation of the sanitary landfill facility is mandatory. Herein included are the types and extent of waste to be disposed, the authorities as to who can dump waste, and delineation of disposal procedures. If the waste is not acceptable, it will be prevented from entering the facility.

The following are brief descriptions of how each of the components of the SLF will be operated and/or managed.

3.6.4.1 Administrative management and registration of Waste Stream

Once the facility is operational, it will require a minimum of about 10 employees in its operation (Note: this does not include employees engaged in the collection and transport of wastes). The following manpower positions are needed to operate the facility and its auxiliary facilities among the other administrative departments;

- Administrative Staff
- Equipment Operator / Driver
- Laborer

The following machineries to be used to operate the proposed SLF;

- Dozer
- Waste Compactor
- Wheel Loader
- 10-Wheeler Dump Trucks, and
- Material Handler

3.6.4.2 Waste Reception (Weigh Bridge)

For operational, administrative and environmental reasons, it is crucial to know the exact volumes of wastes being received and processed. Therefore all trucks or vehicles which deliver waste to the site have to pass a weighbridge at the entrance of the SLF for proper recording. Once the truck enters the main gate of the facility, it shall follow the following procedures until it leaves the facility:

1. The loaded waste collection / transfer truck stops on the weigh bridge
2. The waste collection truck is weighed together with the waste
3. The weight of the truck together with the waste is recorded by a computer which is connected to the weigh bridge (gross weight)
4. The truck unloads the waste at the treatment facility
5. The empty truck is properly cleaned and would be weighted when leaving the facility
6. The weight of the empty truck is recorded by the computer (tare weight)

Each registered truck should carry a chip (tack) and a sensor connected with the computer that reads automatically all information from the truck (number plate, truck number, owner or operator, address etc.). All movements of the vehicles are registered in the system. The system, however, would still be monitored by a weighbridge operator who can add information of each load to the system, whenever necessary.

Picture 8 Typical weigh bridge system

3.6.4.2 Sanitary Landfill (SLF)

All recorded wastes are then transported to the engineered sanitary landfill.

The landfill is operated in a way that only a small area is open for disposal to avoid a large portion of the disposed waste to be exposed to the environment. This is the easiest way to minimize liter and vermin occupation at the landfill. Even in an event of a heavy downpour, only a small area could be contaminated (Note: based on climatological records, Uzbekistan only receives an average of 440mm of precipitation per year with the highest recorded rainfall on the month of March with 69

mm). Therefore, disposed material would be temporarily covered with soil material readily available at the site.

After disposal, a waste compactor then spreads and compact the waste in relative thin layers to maximal compaction. Compaction is necessary because beside the simple volume reduction without this process, the fluffy mixture light materials (i.e. residual paper, cardboard, and plastic) would be easily blown away by the wind as litter and spread throughout the SLF.

Picture 9 Waste Compactor

Picture 10 Typical Wheel of a Waste Compactor

After every waste delivery, the trucks and container vans can be directed to the wash bays for cleaning to avoid the generation of foul odors if necessary.

For the estimated amount of waste for disposal, one waste compactor would be sufficient. For proper operation, one or two ‘spotter’ should assist the compactor operator, directing the delivery vehicles to the right positions.

The landfill is equipped with a drainage system for the collection of leachate (wastewater) from the site. Despite the low precipitation, it is assumed that the occasional expected rain penetrating the waste disposal would generate contaminated leachate. The leachate can be can be “re-circulated” back to the landfill (disposal) area and spread over the waste for evaporation.

The ‘spotter’ is directly exposed to the waste and protective clothing is mandatory. However, due to the expected dry conditions and the insignificant amount of organic materials, health risks for the workers are minor.

3.6.4.3 Installation of a Landfill Gas Collection System

The whole gaseous metabolic products which arise in landfill mass as a result of microbial decomposition processes are collectively termed as “landfill gas“ or LFG, which are basically they so called ‘greenhouse’ gases Methane and Carbon-Dioxide.

In order to reduce the damaging effect of methane on the atmosphere, a landfill gas (LFG) collection and utilization plant will be installed for the waste-filled areas. The LFG collection system will prevent the proliferation of nauseating odor in the landfill site, as well as in the adjacent areas. During the closure phase, the landfill facility will be equipped with systems for the collection and processing of landfill gas which is composed of gas wells, suction pipes, collection stations, transport pipes, a vacuum station and a distribution system to feed the LFG power plant or the flare systems that burn the gas.

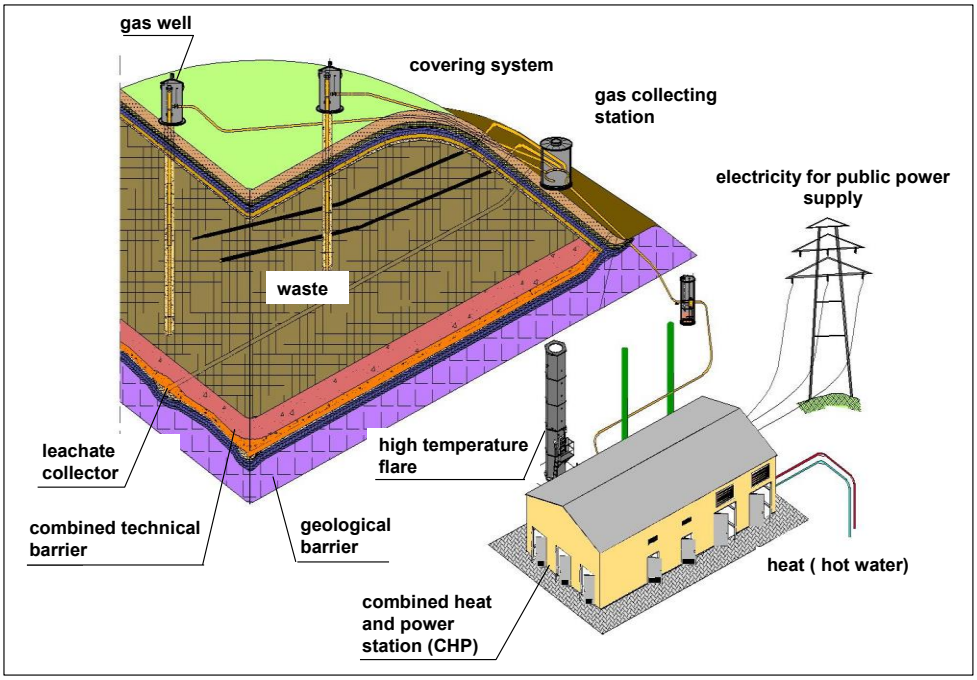

Figure 14 Typical Landfill Gas Collection and Utilization System

In order to ensure optimum extraction of landfill gas, the following basic principles are considered during the planning process:

- An effective negative pressure must be introduced into the landfill mass,
- The drawing off of air should be minimized,
- The systems must be durable over a long period of time,
- LFG removal by suction should be possible during operation, and
- The extraction capacity must be adjusted to correspond to the level of gas production.

The avoidance of pollution by the landfill gases requires the use of correctly sized gas extraction systems. Biological decomposition processes cause the production of gas that leads to gas overpressure inside the landfill site. This eventually results to gas leaks from the landfill mass due to the convective transport effect.

The extraction concept to be utilized depends on a combination of vertical and horizontal systems. During the operation of the landfill, extraction is carried out by means of horizontal gas drainage with a leachate water draining system. This system is replaced or extended by a vertical gas well after the completion of filling over the site. The sizing collection elements guarantee an optimum degree of collection over the whole period of extraction with a significant degree of reliability.

The volume of gas that can be expected from one ton of waste under certain conditions is dependent upon the medium, the substrate carbon, the prevailing microbiology, the physical conditions and other environmental factors. It was calculated that between 120 m^3 and 300 m^3 of biological gas can be extracted from one ton of household waste.

The landfill gas which arise through microbial decomposition processes are 99% methane and carbon dioxide. Trace substances that are contained within are often far more problematic than the actual landfill gas because of their toxicity and carcinogenic properties. However, this becomes insignificant since they are rendered innocuous by combustion in either the flare or the engines of the power station.

In planning the gas collection system, two application situations are considered:

- Gas collection and extraction from the operation areas where waste is still being deposited, and
- Gas collection and extraction from the closed profile areas which have already been partially or completely covered.

Extraction will be carried out by means of horizontal gas drainage with a leachate water draining system. This system is replaced or extended by a vertical gas well after the completion of the filling of the site.

Picture 11 LFG well head and LFG collection station

The collected landfill gas will run to the compressor system via the ring collector. The landfill gas that is collected from the waste material is almost fully water saturated. The cooling of the gas in the transport lines causes the condensate to separate which must then be removed from the piping system. Condensate precipitation of up to 100 g/m^3 of gas can be expected. Thus, the suction lines between the collection units and the embankment shafts will be laid with a constant downward gradient so that the condensate drains away and no water traps can form.

3.6.4.4 Utilities Requirements

The existing infrastructure at the Akhangaran dumpsite has power as also water connection; these utilities would be able to serve also the new facility.

3.6.5 Abandonment / Decommissioning & closure

It is unlikely that the project be abandoned prior to depleting the available landfill area because of its status as infrastructural necessity to Tashkent for its wastes. Once a landfill cell is completed or filled, final closure commences. If the landfill volume would be completely exhausted the landfill would be covered and landscaped, fitting to the surrounding environment. All other facilities could be maintained and operated further. If a new location for the services would be preferred, the existing buildings and structures could be demolished and the area could be landscaped in accordance to the existing surroundings.

The closure standards for SLF will require operators to install a final cover system to minimize infiltration of water; no matter how limited it is and prevent soil erosion. The SLF operator will prepare formal closure plan which must include:

- A description of the final cover design and its installation methods and procedures.
- An estimate of the largest area of the landfill requiring a final cover.
- An estimate of the maximum inventory of waste on site during the landfill's active life.
- A schedule for completing all required closure activities.

Once closure for each phase is completed, the SLF operator then must certify that the closure has been completed in accordance with the approved closure plan. This certification must be verified and attested by nominated representatives from *Goskompriroda*, *Glavgosexpertisa* and the local *Hokim*. Copies of this certification will be provided to the local cadaster.

4. BASELINE ENVIRONMENTAL CONDITIONS

4.1 Physical Environnent

4.1.1 Climate

Uzbekistan is located between the rivers of Amudarya and Syrdarya in central Eurasia between 37ºN and 45ºN and 56ºE and 73ºE in the sub-tropics (Source: *Statistical Bulletin, Uzbekistan*). The country has a Mediterranean climate with long, hot and dry summers from May to September and short but cold winters from December to February. The climate has continental influences, and features two peaks of precipitation in the early winter and spring. This slightly unusual precipitation pattern is partially due to the 500 m (roughly 1600 feet) altitude. On the other hand, temperatures can be extremely hot during July and August while the relatively low precipitation occurs during the months of winter and spring, while the period between July and September is dry.

Figure 15 Climate Indicators by Cities – Uzbekistan

Cities	Climate type	Precipitation (number of days)		Wind speed (meters per second)		Frequency of winds with the speed of 0-1 m/s, in %		Frequency of fogs in cold season (I-III, XI-XII), in %	
		2001	2004	2001	2004	2001	2004	2001	2004
Almalyk	Continental-subtropical with high summer temperatures and little precipitation. Zone of high climatic API.	96	75	2.4	2.3	29	32	1.1	1.1
Angren		81	99	1.9	1.9	52	50	1.2	1.1
Nurabad		43	60	1.2	0.8	68	80	1.0	1.3
Andijan	Continental with sharp contrast between warm and cold periods. Zone of high climatic API.	68	75	1.3	1.4	60	57	1.0	1.1
Urgench		64	80	3.3	3.4	14	14	1.0	1.1
Bekabad	Continental-subtropical with extensive periods without precipitation in summer. Zone of high climatic API.	60	57	3.4	2.3	55	64	1.0	1.0
Bukhara	Sharply continental, dry. Zone of moderate API.	51	61	3.7	3.8	13	11	1.1	1.1
Denau	Continental-subtropical with extremely hot and dry summer and warm winter	30	53	1.6	1.9	52	35	-	1.0
Karshi	Sharply continental with dry, hot and long summer, and relatively warm winter. Zone of high climatic API	48	-	3.8	-	18	-	1.0	-
Kokand	Sharply continental, hot summer, mild winter. Zone of high climatic API.	54	69	2.3	1.7	48	62	1.1	1.0
Mubarek	Sharply continental, desert. Zone of high climatic API.	7	53	1.7	1.1	58	85	-	1.4
Navoiy	Sharply continental, warm, extremely dry in summer and relatively cold and humid in winter. Zone of high climatic API.	53	58	3.0	2.9	30	36	1.0	1.1
Namangan	Continental with long hot summer and relatively mild winter. Zone of high climatic API.	65	78	2.0	1.9	32	43	1.0	1.0
Nukus	Sharply continental, hot and dry summer, relatively cold snowless winter.	71	71	3.8	4.2	12	10	1.0	1.0
Samarkand	Sharply continental, dry. Zone of high climatic API.	76	90	2.1	1.7	39	48	1.1	1.3
Tashkent	Continental, subtropical. Zone of high climatic API.	88	80	1.2	1.2	79	80	1.2	1.2
Ferghana	Continental, hot summer, and mild winter. Zone of high climatic API.	82	105	1.0	1.0	81	83	1.0	1.1
Shahrisabz	Sharply continental, dry, hot and long summer, and relatively warm winter. Zone of high climatic API.	71	77	1.2	0.9	75	87	1.0	1.0

Source: Statistical Bulletin. www.statistics.uz

Figure 16 Climate data for Tashkent (1981-2010)													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Record high °C (°F)	22.2 (72.0)	25.7 (78.3)	32.5 (90.5)	36.4 (97.5)	39.9 (103.8)	43.0 (109.4)	44.6 (112.3)	43.1 (109.6)	39.8 (103.6)	37.5 (99.5)	31.1 (88.0)	27.3 (81.1)	44.6 (112.3)
Average high °C (°F)	6.8 (44.2)	9.4 (48.9)	15.2 (59.4)	22.0 (71.6)	27.5 (81.5)	33.4 (92.1)	35.7 (96.3)	34.7 (94.5)	29.3 (84.7)	21.8 (71.2)	14.9 (58.8)	8.8 (47.8)	21.6 (70.9)
Daily mean °C (°F)	1.9 (35.4)	3.9 (39.0)	9.4 (48.9)	15.5 (59.9)	20.5 (68.9)	25.8 (78.4)	27.8 (82.0)	26.2 (79.2)	20.6 (69.1)	13.9 (57.0)	8.5 (47.3)	3.5 (38.3)	14.8 (58.6)
Average low °C (°F)	−1.5 (29.3)	0.0 (32.0)	4.8 (40.6)	9.8 (49.6)	13.7 (56.7)	18.0 (64.4)	19.7 (67.5)	18.0 (64.4)	12.9 (55.2)	7.8 (46.0)	4.1 (39.4)	0.0 (32.0)	8.9 (48.0)
Record low °C (°F)	−28 (−18)	−25.6 (−14.1)	−16.9 (1.6)	−6.3 (20.7)	−1.7 (28.9)	3.8 (38.8)	8.2 (46.8)	3.4 (38.1)	0.1 (32.2)	−11.2 (11.8)	−22.1 (−7.8)	−29.5 (−21.1)	−29.5 (−21.1)
Precipitation mm (inches)	53 (2.09)	64 (2.52)	69 (2.72)	61 (2.4)	41 (1.61)	14 (0.55)	4 (0.16)	1 (0.04)	6 (0.24)	24 (0.94)	44 (1.73)	59 (2.32)	440 (17.32)
% humidity	73	68	62	60	53	40	39	42	45	57	66	73	56
Avg. precipitation days	13.7	12.3	13.8	12.9	10.2	5.1	2.9	1.9	3.2	8.1	10.2	12.8	107.1
Mean monthly sunshine hours	117.8	127.1	164.3	216.0	303.8	363.0	384.4	365.8	300.0	226.3	150.0	105.4	2,823.9

Source: Wikipedia/Tashkent. Centre of Hydrometeorological Service of Uzbekistan,[l] World Meteorological Organization, Pogoda.ru.net (record low and record high temperatures), Hong Kong Observatory (mean monthly sunshine hours)

Based on the Climatological data for Tashkent between1981 to 2010, the total annual rainfall for the area is relatively low pegged at 440mm (17.32 inches). Almost all rainfall occurring during the months of November to May that ranges between a low of 44mm (1.73 inches) to a high of 69 mm (2.72 inches). The average recorded humidity is at its lowest in the month of July, going as low as 39% and peaks during the months of November to January, going as high as 73%. This translates to an annual average of 56.5% humidity. The cooler months are from November to April, with daily mean of 1.8°C (35.2 °F) to 16.1°C (61.0 °F) and a recorded low of -29.5 °C (-21.1 °F). During the warmer months of May to October, the daily mean temperature ranges from 14.5°C (58.1 °F) to 27.7°C (81.9 °F) with a recorded high of 44.6°C (112.3 °F) (refer to Table 5 for the climate data for Tashkent City).

Insolation is the amount of the total solar radiation incident on a horizontal surface at the surface of the earth for a given month, averaged for that month over the 22-year period. Each monthly averaged value was evaluated as the numerical average of three hourly values for the given month.

Table 3 - Solar energy and surface meteorology parameters, Tashkent

Parameter	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Insolation, kWh/m²/day	1.82	2.60	3.79	5.15	6.46	7.09	6.99	6.17	4.86	3.28	2.13	1.58
Clearness (0-1)	0.46	0.48	0.51	0.54	0.59	0.62	0.62	0.61	0.59	0.53	0.48	0.44
Temperature, °C	-2.39	-0.82	4.04	11.77	17.51	23.40	25.41	24.18	18.37	10.61	4.76	-0.31
Wind speed, m/s	6.37	6.04	5.24	5.11	4.90	5.45	6.00	6.19	6.01	5.70	5.89	5.89

Source: http://www.gaisma.com (NASA Langley Research Center Atmospheric Science Data Center; New et al. 2002)

Clearness is the average amount of the total solar radiation incident on a horizontal surface at the surface of the earth divided by the monthly average incoming top-of-atmosphere insolation for a given month, averaged for that month over the 22-year period. Clearness index is the fraction of insolation at the top of the atmosphere which reaches the surface of the earth, i.e., 0 is very overcast and 1 is sunny.

The wind speed ranges from 1-2 meters per second with a predominant 2 meters per second WNW winds from January to October. The annual wind occurrence is easily recognized from summary wind direction frequencies as shown in the annual wind rose diagram (Figure 17). The wind rose diagrams for each month are plotted in Figures 18-20.

The average wind speed ranges from 1-2 meters per second with almost a uniform average wind speed except for the month of December. The wind rose diagrams for each month are plotted in the succeeding pages.

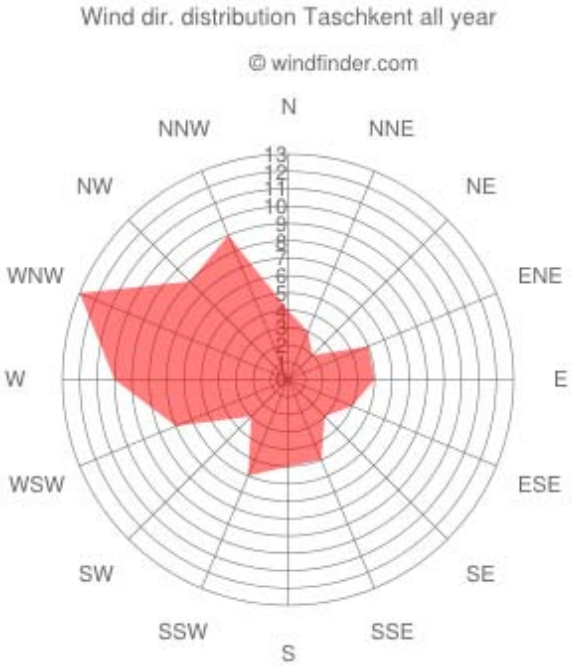

Figure 17 Annual Wind Rose Diagram – Tashkent City

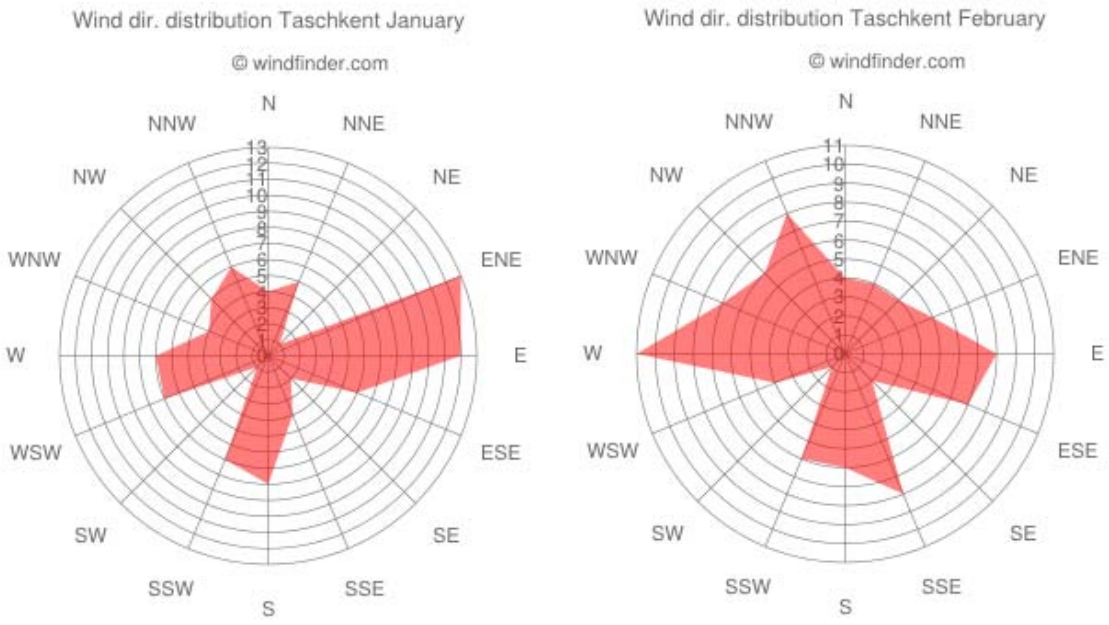

Figure 18 Monthly Wind Rose Diagram – Tashkent City from January – February

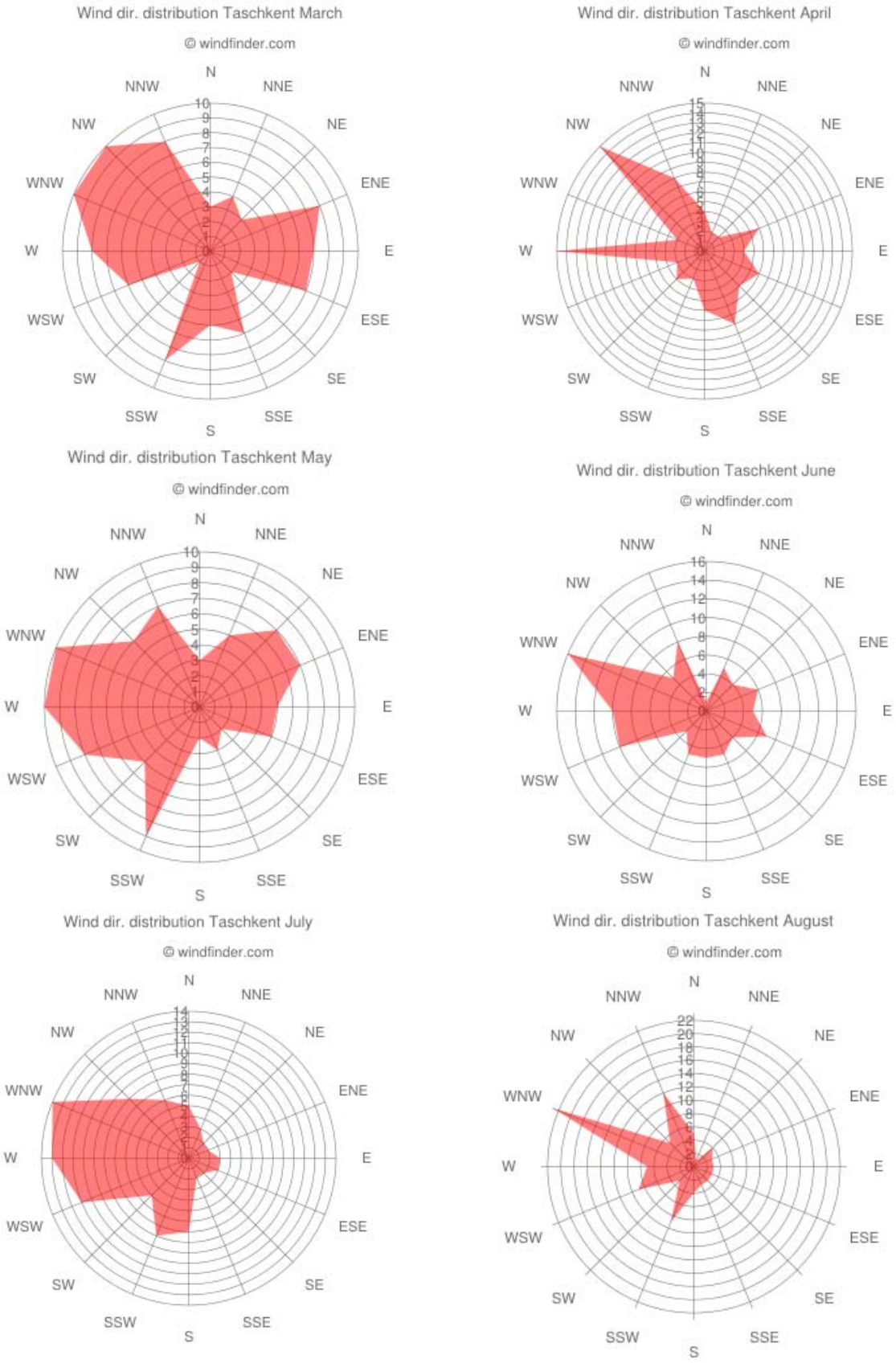

Figure 19 Monthly Wind Rose Diagram – Tashkent City from March – August

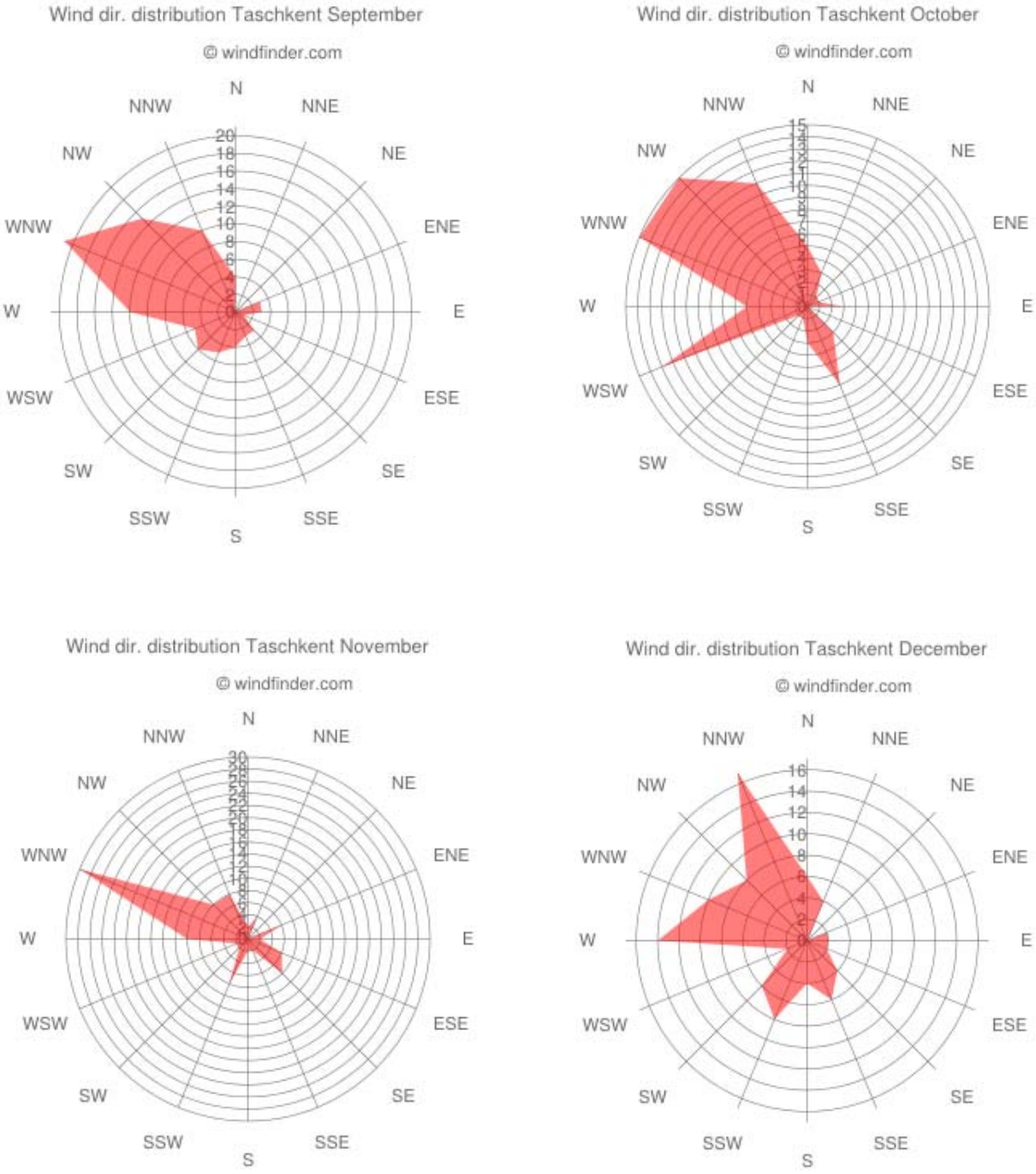

Figure 20 Monthly Wind Rose Diagram – Tashkent City from September – December

4.1.2 Air Quality

Air pollution, similar to any large cities and industrial centers, is a major environmental concern for Uzbekistan. Based on available statistics, the levels of air pollution have been decreasing primarily due to the reduction of emissions from industries. However, air quality in cities and certain regions have deteriorated due to the increase in pollution from mobile sources.

Generally, the project site can no longer be may be considered in its original state in terms of air quality standards, it being located adjacent to an existing dumpsite. In is noteworthy that based on available meteorological data suggest that the wind direction is generally WNW, making areas along these predominant wind direction prone to the potential impact of potential air emissions compared to the other wind paths. To determine the trends in atmospheric pollution, secondary data for selected cities (i.e. air quality for Tashkent City and Chirchik) was used presented in Tables 4 and 5, respectively.

Table 4 Trends in Atmospheric Pollution - Tashkent 2006

				Tashkent City		
Dust	0.15	1.3	1.3	2.0	1.3	1.3
Sulfur dioxide	0.05	0.1	0.2	0.2	0.3	0.3
Carbon monoxide	3	0.7	0.7	0.7	0.7	0.7
Nitrogen dioxide	0.04	1.8	2.0	2.0	2.0	2.0
Nitrogen oxide	0.06	0.7	0.8	0.8	0.7	0.7
Ozone x)	0.03	1.3	0.7	1.1	2.1	3.1
Phenol	0.003	0.7	0.7	0.7	0.7	0.3
Anhydrous hydrogen fluoride	0.005	0.6	0.6	0.8	1.0	0.8
Ammonia	0.04	1.3	1.3	0.5	0.8	0.3

Table 5 Trends in Atmospheric Pollution - Chirchik 2006

				Chirchik		
Dust	0.15	0.7	0.7	0.7	0.7	0.7
Sulfur dioxide	0.05	0.1	0.0	0.1	0.1	0.1
Carbon monoxide	3	0.7	0.7	xx)	0.3	0.3
Nitrogen dioxide	0.04	0.8	0.8	0.8	0.8	0.8
Nitrogen oxide	0.06	0.3	0.3	0.3	0.5	0.3
Ozone x)	0.03	3.4	2.7	xx)	2.8	1.9
Phenol	0.003	0.7	0.7	0.7	1.0	0.7
Ammonia	0.04	1.3	0.8	1.0	1.0	1.0
Chlorine	-	0.0	0.3	xx)	0.3	0.3
Hydrogen sulphide	-	0.1	0.1	xx)	0.1	0.1

Source: Statistical Bulletin. www.statistics.uz

4.1.3 Geology

In order to understand the geological composition of the area, a regional description is in order. Description of the regional geology was taken from available literature. Information on site geology was acquired from previous works in the area and from a reconnaissance survey conducted by the PPTA team. Regional and site geohazards on the other hand, were adopted from existing literature and from observations in the field.

4.1.3.1 Geomorphology

In general, the geological structure for the first 150m of soil in the subsurface area is characterized by strong layers of loam (silty clay) indicating a more or less important inclusion of sand and rocks with two clear defined groundwater aquifers. During the site selection process, the landfill area directly below the landfill is described as a 33m strong layer of compact loam (clay) with small gravel inclusions.

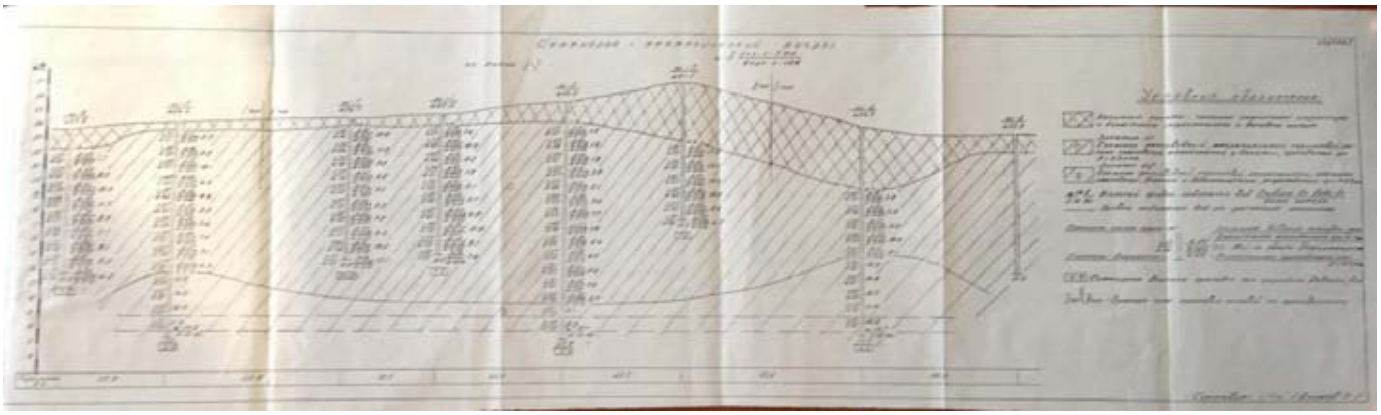

Figure 21 – Geologic Cross-Section at the project site

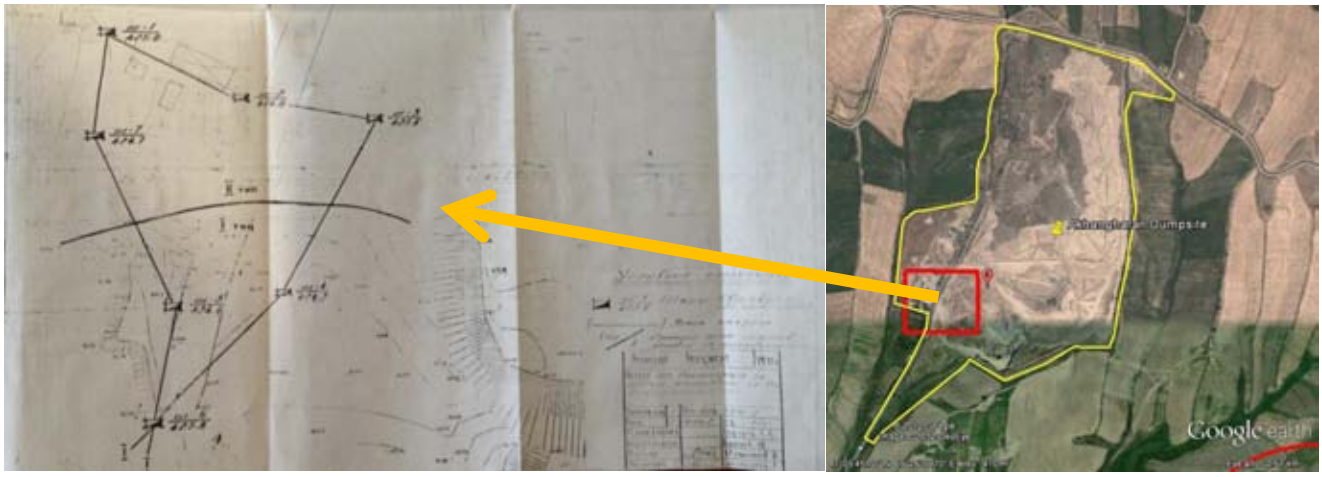

Figure 22 Location for the geological survey as shown in Figure 21

4.1.3.2 Site Hydrology and Hydrogeology

The project site is located within a Piedmont deposit, whose ground waters are commonly used for agricultural facilities and summer community drinking water supply purposes. In addition, wells often exploited horizon ground waters located at 80-110 m of depth. Based on a previous hydrological survey, the aquifer ground water quality generally meets domestic and drinking quality although reserves are quite limited and require protection from depletion and pollution.

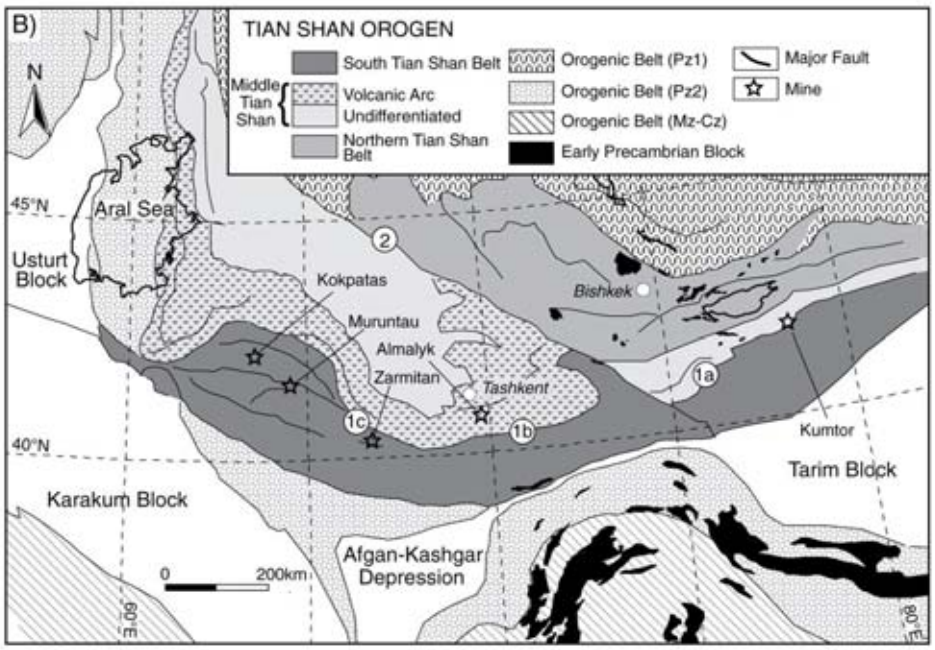

Figure 23 – Geologic Map of Kazakhstan and Central Asia

Based on a hydrogeological study conducted by "Uzbekgidrogeologiya", the site is characterized hydrogeological by the following sections as follows:

0-33	Compact loam, macroporous, brown with small pebbles and gravel inclusion (Q_{II}-tš).
33-52	Gravel mostly small, gray-colored, igneous and metamorphic rocks. Filler is sand and loam (Q_{II}-tš).
52-70	Compact loam, sanded, brown, with small pebbles and gravel inclusion (Q_{II}-tš).
70-101	Igneous rocks gravel with sand filler (Q_{II}-tš).
101-135	Heavy clay, sanded, argillite-like with sand and gravel layers (Q_{I}-sh).
135-140	Igneous rocks gravelite on calcareous cement (Q_{I}-sh)
140-145	Tight siltstone, sanded (N^3_2-?)

4.1.4.2.1 Groundwater Condition

There are two water-bearing horizons at the project site, which are situated in the quaternary sediments. Previous assessments for the local geological and hydrogeological conditions are made for this location in 1994 and in 2002. These included geological survey drillings, and the partial development as groundwater monitoring wells. In general, the geologic structure for the first 150 m of soil in the subsurface includes strong layers of loam (silty clay) with inclusions of sand and rocks and two clearly defined groundwater aquifers. For the site, the geologic formations directly beneath the proposed landfill comprise about 33 m of compacted loam (clay) with small gravel inclusions.

Between 33 m to 52 m depth, the report describes the first of two groundwater aquifers, mostly built from rock and gravel with a filler of sand and loam. This ‘upper‘ aquifer is separated from the ‘lower’ aquifer by approximately 20 m of strong loam (again with inclusions of sand and gravel). The ‘lower’ aquifer is also built from rock and gravel with sand filler. This aquifer is underplayed again by heavy clayish material, followed by partial gravel and calcareous rocks which at about 140 m depth reach tight siltstone.

The ‘upper’ aquifer is generally low watered. The ground water is characterized by a high total mineralization (solid residue 3.4 – 4.2 g/l), high sulfate content (1900-2350 mg/l) and by a higher total hardness (14.2-25.7 mg-equ/l). This aquifer is fairly reliable covered to the surface by an up to 33m thick layer of loam. Based on a previous study conducted at the site, ground water contamination was observed which is characterized by high content of nitrates (NO_3 -14-38.0 mg). It was believed that the contaminated originated from the existing dump site. However, it is noteworthy that taking into consideration the existing geological and meteorological conditions vis-à-vis the extensive agricultural activity suggests that such contaminated is likely to be due to the extensive use of fertilizer hence the high nitrate.

On the other hand, the second (lower) aquifer is characterized by a large abundance of groundwater of good quality. The groundwater is fresh; total mineralization is only up to 1 g/l and total hardness is only up to 5.0 mg-equ/l. No contamination of

groundwater was registered in this aquifer.[3] Due to the volume and quality, only the 'lower' aquifer's water is utilized for domestic use and irrigation

In general the groundwater is well protected and the geological conditions on this site can, at this stage of the project, be described as 'ideal' for the implementation of a Sanitary Landfill in accordance to international accepted standards

4.1.4.3 Geo hazards

4.1.4.3.1 Seismic Hazards

Uzbekistan is located in the middle of Central Asia within a zone of high seismic activity. It is located in the basin of the great Amudarya and Syrdarya rivers, in the desert subtropical zone, taking the part of Turan Lowland in the West and mountainous highlands in the East. Natural environment is characterized by high seismic conditions. There are many cities such as Tashkent, Samarkand, Bukhara and others which have experienced seismic activities with an intensity YIII ans IX MSK as the intensity measured on the MSK scale of the former Soviet Union (Medvedev-Sponheuer-Karnik scale; similar to the modified Mercalli scale as used in Europe and the States). Tashkent, for example, is located in a seismically active area which are influenced by two major thrust, the Tian Shan and Pamor. In 1999, the country has established a law on earthquake disaster preparedness and also a special building codes for planning and construction (KMK 2.01.03-96 "Norms and Regulations for Construction in Seismic Zones" and KMK 2.07.01-94 "Town-planning, lay-out and building of urban and village settlements").

[3] Source: Summary based on 'Geological-Hydrogeological Study Akhangaran Landfill Site'; Dr. Steffen Ingenieurgesellschaft GmbH (World Bank, 2002)

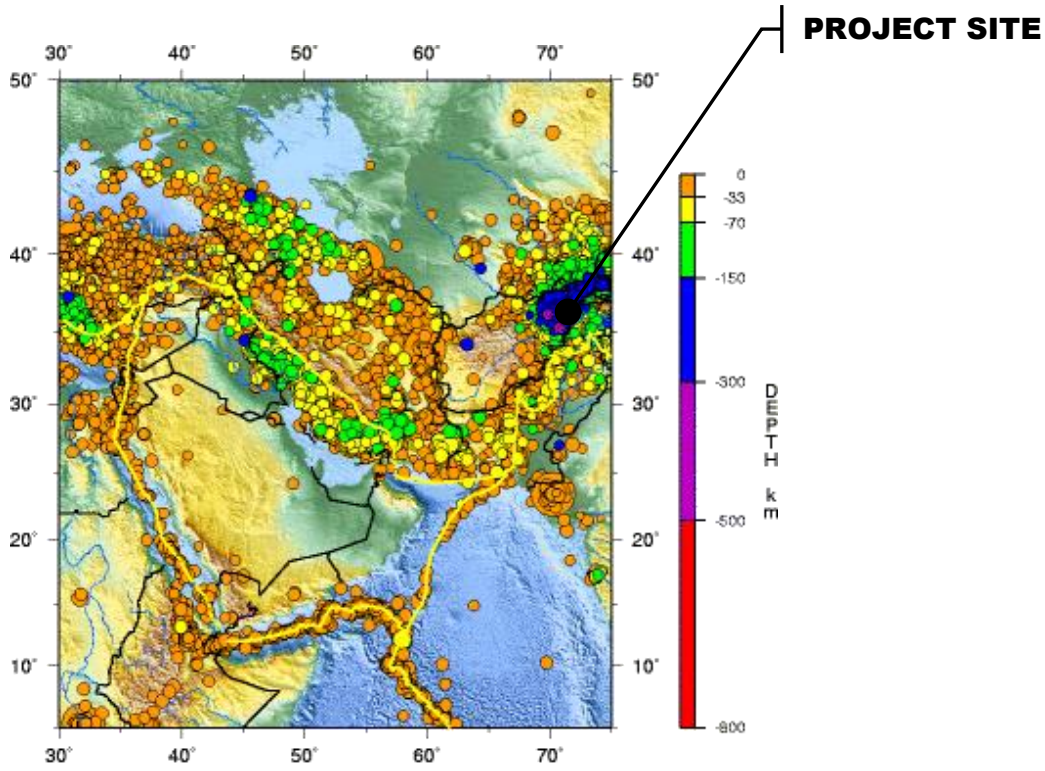

Figure 24 – Distribution of earthquake Epicenters in the region 1990-2006

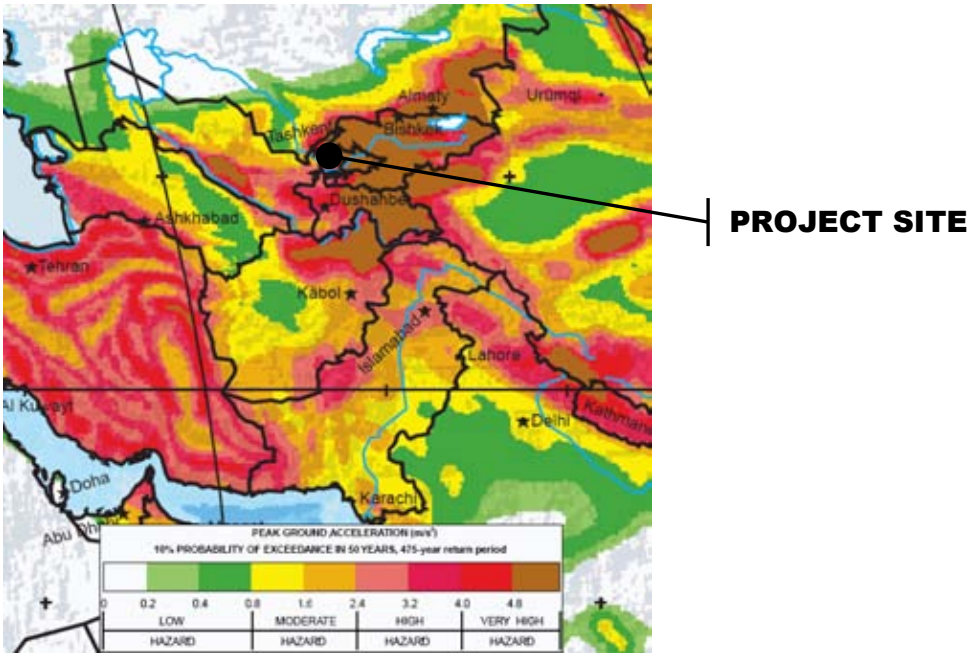

Figure 25 – Ground Peak Acceleration (GPA) Zonation – Central Asia

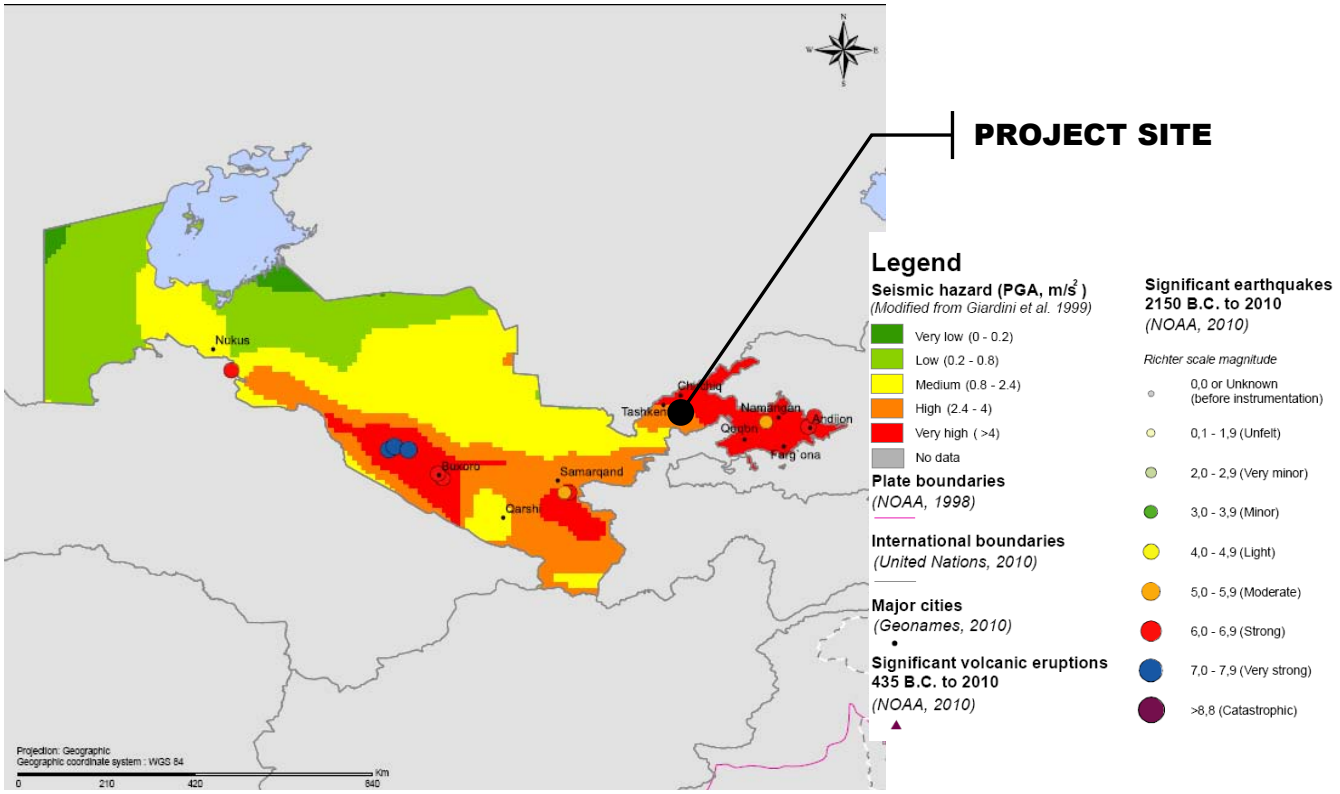

Figure 26 – Ground Peak Acceleration (GPA) Zonation – Uzbekistan

Seismic hazards for landfills and its associated structures depends on a number of factor such as depth and distance to the epicenter, intensity and magnitude, topographical features, thickness of soil strata, groundwater level among others. It is important to note that previous reports indicate that there are three potential shallow earthquake sources with a possible magnitude of M=6 within 110 kilometer radius of the project site.

4.1.4 Hydrogeology

The site has no natural surface waters. Due to necessity for irrigated agriculture, two concrete irrigation channels traverse the area in the east of the present landfill area towards the south. These water channels are partially dilapidated and subject to significant leakage. The irrigation water used within the immediate vicinity of the site is derived from a main irrigation channel that is situated in the north of the existing landfill. This irrigation channel is part of the Syr Darja System which originates from the water channel "Hanaryk" from the Chirchik River and flows into the system of the Kara Zu, a tributary of Syr Darja. It was also observed that farmers have constructed little grooves in the soil in lieu of the destroyed channels. These makeshift channels distribute water into smaller grooves that irrigate the fields. These waters are often accumulates and results to permanent wet and swampy conditions especially in depressed areas, sometimes shallow ponded areas of water (i.e., artificially created wetlands) are formed.

4.2 Biological Environment

Uzbekistan is located at the crossroads of several bio-geographical regions. It contains a variety of landscapes, including high mountain ranges, wetlands, and the infamous Aral Sea. Almost 85 per cent of Uzbekistan's territory is occupied by desert or semi desert, including the largest arid zones in Central Asia: the Kyzylkum, and

the Ustyrt Plateau. About 10. % of Uzbekistan's land, most of it in the Fergana Valley, is classified as arable, and 0.8 % is planted to permanent agricultural crops. About 0.4% is forested. Most of the rest is desert.

The project site is located adjacent to the Akhangaran landfill with adjoining areas dedicated for agricultural activities, such as corn and clover fields. The little valleys are predominantly occupied by meadows and fallow land.

4.2.1 Flora

The most common vegetation is corn, clover, fruit trees, melons, and vegetables planted in irrigated areas. Only certain arid hills and the deepest points of the little valleys, which are wet from water draining and leaking from the irrigation system, are covered by naturally occurring flora.

The majority of the plants are ephemera and ephemeredes i.e. annuals and perennials (grass) with short vegetation period. These plants grow only from autumn to the end of spring. The typical plants are those which occur in the steppe and the semi-desert vegetation and those on limited azonal locations like swamps, along irrigation channels, and the banks of streams and rivers.

Based on a previous study conducted in the area, the fallow land is characterized by nearly the same vegetation. The typical species are *Phlomis thapsoides*, *Tanacetum pseudoachillea*, *Achillea millefolium*, *Hordeum bulbosum*, *Poa bulbosa, Bromus* species., *Artemisia* species., *Amaranthus* species. Along the irrigation channels there are sparse trees and bush vegetation. The typical species are *Amydalus spinosa*, *Rosa canina*, *Hulthemia berbarifolia*, *Morus alba*, *M.nigra*. *Salix* species.

4.2.2 Fauna

Common faunal species in the area are *Pica pica*, *Corvus cornix*, *Passer montanus*, and *Turdus merula*. In grooves and on dry hills there are amphibian species such as *Rana ridibunda*, *Bufo viridis* and reptiles such as *Gymnodactylus vussowi*, *Ophisaurus apodas*, *Ablepharus deserti*, *Coluber vaverdieri*, *Elaphe dione*, and *Natrix tesselata*.

In the investigation area there are no rare, endemic or relict species that are included in the "Red Book of the Republic of Uzbekistan."

4.3 Socio-Economic Profile

4.3.1 Baseline on Socio-economic Profile

4.3.1.1 Background: Physical Environment

The project site is located beside the existing Akhangaran landfill approximately 35 km south of the center of Tashkent City in the Akhangaran district of Tashkent Province. There are no visible residential areas or industrial facilities in the immediate vicinity site. Adjacent are areas for agricultural development with little valleys predominantly occupied by meadows and fallow land.

4.3.1.2 Demographic Characteristics

Uzbekistan's population exceeded 28.5 million in April 2011, of which 51% is classified as urban and 49% rural. The average population density is 59.4 persons

per square kilometer. In terms of population size, Uzbekistan is the third largest country in the Commonwealth of Independent States (after the Russian Federation and Ukraine). There are 120 cities and towns and 115 urban centers in the country. Figure 27 shows the population of Uzbekistan disaggregated by gender as of 2010.

Figure 6.1: Resident Population by Gender, as of January 1, 2010 (000s)

	Total Population			Urban Population			Rural Population		
	Both F/M	Female	Male	Both F/M	Female	Male	Both F/M	Female	Male
Republic of Uzbekistan	**28001.4**	**13986.4**	**14015.0**	**14425.9**	**7245.4**	**7180.5**	**13575.5**	**6741.0**	**6834.5**
Republic of Karakalpakstan	1632.0	811.9	820.1	820.3	413.4	406.9	811.7	398.5	413.2
Provinces									
Andujan	2549.1	1272.5	1276.6	1358.4	680.7	677.7	1190.7	591.8	598.9
Bukhara	1612.5	809.6	802.9	622.4	306.4	316.0	990.1	503.2	486.9
Djizzak	1116.8	558.0	558.8	526.8	267.7	259.1	590.0	290.3	299.7
Kashkadarya	2616.1	1304.8	1311.3	1135.7	565.9	569.8	1480.4	738.9	741.5
Navoi	851.6	421.8	429.8	420.9	205.0	215.9	430.7	216.8	213.9
Namangan	2258.5	1122.9	1135.6	1458.8	725.2	733.6	799.7	397.7	402.0
Samarkand	3119.0	1558.1	1560.9	1160.4	584.7	575.7	1958.6	973.4	985.2
Surkhandarya	2075.0	1029.6	1045.4	767.9	388.1	379.8	1307.1	641.5	665.6
Sirdarya	714.4	355.3	359.1	294.7	145.9	148.8	419.7	209.4	210.3
Tashkent	2585.9	1293.5	1292.4	1293.2	652.3	640.9	1292.7	641.2	651.5
Ferghana	3074.6	1534.2	1540.4	1802.5	912.5	890.0	1272.1	621.7	650.4
Khorezm	1561.6	783.4	778.2	529.6	266.8	262.8	1032.0	516.6	515.4
Tashkent city	2234.3	1130.8	1103.5	2234.3	1130.8	1103.5	-	-	-

Figure 27 Uzbekistan by Gender – 2010

Tashkent is the capital of Uzbekistan and of Tashkent Province with a population of approximately 2.3 million. Ethnic groups comprise about 76% Uzbeks, 15% Russian, 5% Tatars, 1.6% Kazakhs and 2.4% other nationalities (January 2008). Over one third of residents (33.5%) are less than 15 years of age, 61.7% are between the ages of 15 to 64 years and 4.8% are 65 years and older. The average age is approximately 22.36 years. The average life expectancy is 64.19 years. The official language is Uzbek**.** Statistics from the Dept. of Statistics indicated that 76% of Tashkent's residents live in apartments, with 41.4% of urban females in the workforce.

	District	Population (2009)	Area (km²)	Density (area/km²)
1	**Bektemir**	27,500	20.5	1,341
2	**Chilanzar**	217,000	30.0	7,233
3	**Hamza**	204,800	33.7	6,077
4	**Mirobod**	122,700	17.1	7,175
5	**Mirzo Ulugbek**	245,200	31.9	7,687
6	**Sergeli**	149,000	56.0	2,661
7	**Shaykhontohur**	285,800	27.2	10,507
8	**Olmazar**	305,400	34.5	8,852
9	**Uchtepa**	237,000	28.2	8,404
10	**Yakkasaray**	115,200	14.6	7,890
11	**Yunusabad**	296,700	41.1	7,219

Figure 28 Administrative Rayon Population and Densities
Source: Tashkent website

According to Maxsustrans, the daily average tonnage collected for the city of Tashkent is pegged at 2,000 tons per day (TPD). This figure was based on the data collected from weighbridges with a collection efficiency of 100%, based on 'city norms', which are calculated as 1.0kg/d waste generated per person. Further, considering the collection efficiency, it is projected that the company is able to service 2.3 to 3.0 million inhabitants of Tashkent which includes 11 rayons (city districts) and Chirchik, a small town located northeast of Tashkent.

4.3.1.2.1 Social Indicators and Poverty Assessment

The last few years, and in particular the 2005-11 period, have been successful for Uzbekistan from the point of view of achieving macroeconomic stability and sustained economic growth of 7-9% per year, despite the global financial crisis of 2008-2009. High growth has led to greater inclusion and improved welfare of the people of Uzbekistan as measured by declining poverty, rising wages, improved access to basic services, larger investments into human capacity, and higher public expenditures for social development and social protection.

The performance of the social sectors in Uzbekistan has continued to improve as a result. The average life expectancy in Uzbekistan increased to 73.1 years in 2010 to approximate that in the developed countries. Child and maternal mortality rates have correspondingly decreased. Uzbekistan's present adult literacy level of 99.3% is already higher than the corresponding average for developed countries. Figure 28 shows the population age structure by gender.

Figure 29 Population Age Structure by Gender (000s)

	2009		2010		2011*	
	Female	*Male*	***Female***	***Male***	***Female***	*Male*
All population						
Total	**13760.8**	**13772.6**	**13986.4**	**14015.0**	**14555.0**	**14568.4**
0-2 yrs	866.2	918.4	911.6	968.8	930.9	991.6
3-5 yrs	748.7	794.1	772.3	818.4	814.7	862.4
6-7 yrs	492.4	520.4	489.9	520.2	502.1	531.0
8-15 yrs	2271.5	2381.7	2196.1	2305.6	2179.8	2286.8
16-17 yrs	654.3	676.8	636.0	662.8	625.6	651.2
18-19 yrs	611.8	635.9	641.9	663.5	661.7	682.5
20-24 yrs	1490.4	1519.0	1508.5	1544.2	1551.0	1594.7
25-29 yrs	1195.5	1208.2	1241.7	1256.7	1335.5	1345.7
30-34 yrs	1016.0	1019.5	1045.1	1050.7	1104.0	1108.7
35-39 yrs	914.0	908.8	938.4	933.7	988.5	988.9
40-49 yrs	1620.8	1534.6	1631.6	1547.7	1715.3	1624.2
50-59 yrs	1002.3	945.2	1076.8	1014.4	1189.2	1119.3
60-69 yrs	417.5	384.3	422.4	388.3	468.1	427.7
70 and older yrs	459.4	325.7	474.1	340.0	488.6	353.7
** According to a survey by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 71 "On measures on preparation and carrying out sample surveys of the population" on March 14, 2011*						

In line with the country's economic growth, absolute poverty in Uzbekistan has declined. The latest available officially estimated figures suggest that the incidence of poverty fell from 25.8% in 2005 to 17.7% in 2010, based on a consumption-based poverty line threshold. The poverty level has declined for both rural and urban populations although consumption poverty is higher in rural areas (see Figure 29).

Figure 30 Poverty Level by Consumption Expenditure (percentage of total population)

Years	Total Population	Urban	Rural
2005	25.8	18.3	30.0
2006	24.9	17.9	28.8
2007	23.6	17.6	27.1
2008	21.8	16.3	24.9
2009	19.5	15.2	22.0
2010	17.7	13.4	20.1

Source: State Statistics Committee

4.3.1.2.2 Urban / Rural Population

Akhangaran district is one of 14 administrative units in the Tashkent province with Akhangaran city recognized to be its administrative center. As of 2011, the total population of Akhangaran district is 120,100 people[4] composed of the urban population comprising 39% of the total population (46,800) and rural population comprising 61% of the total population (73,300).

[4] Statistics: Population of Uzbekistan, Tashkent 2011

People of Uzbek ethnic origin exceed 65% in the Tashkent Province, where the second largest ethnic group is Kazakhs (13.3%). The next most numerous ethnic groups are Russians (6.4%) and Tajiks (5.3%). Less numerous ethnic groups that can be found in the four provinces include Tartar, Ukrainian, Azerbaijani, Armenian, Jewish, German, Uyghur, Turkmen, Korean, Luli and Romany.

Of this population, approximately 49.75% of the population is male and the other 50.25% female. Thirty-one percent of the population is aged up to 15 years, 20% from 16-24 years, 24% from 25-39 years, 19% from 40-59 years and the remaining 6% are over 60 years of age. There are more males aged up to 15 (32.1% cf. 30.4% for females) and at the other end of the demographic spectrum more females over 60 years of age (6.6% cf. 5.4% for males). This is broadly consistent with demographic data from other regions in Uzbekistan.

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4.3.1.2.3 Waste Characterization Survey

A Waste Characterization Survey (WACS) was undertaken at representative High and Low Rise residential areas in Mirzo Ulugbek district, Tashkent City from October to November 2012.

Based on the WACS, the waste composition revealed that vegetable and organic matter constitutes the bulk of the waste generated. This component accounts for 67% and 62%[6] of the High and Low Rise household waste, respectively. The potential for such wastes to generate compost or soil conditioners was noted. Programs for the establishment of composting plants should take into consideration that such facilities would require source-segregated biodegradable materials for sustainable operations. Use of mixed waste inputs into composting plants would greatly affect processing operations and significantly lower the quality of output.

Potential recyclable materials from residential waste include PET and plastic bottles (2.5% to 3.9%), other plastic materials (2.5% to 3.4%), plastic bags and sheets (4.7% to 5.4%), metals (1.7% to 1.8%), carton/paper (5.3% to 7.9%) and glass (5.3% to

[5] Statistics: Population of Uzbekistan, Tashkent 2011
[6] Waste Characterization Study (WACS), 2012

7.5%. Collectively, these materials make up 25% to 28 % of the household waste. Based on observed sorting practices, only about half of these materials (12% to 13%) can actually be recovered for recycling.

Commercial waste contains slightly higher percentages of glass, metal and PET/plastic bottles. As observed and based on the survey of participating households, recovery of recyclable materials at source by households is not generally practiced. Recovery of recyclable materials is done by the informal sector at the collection points, collection trucks and at the Akhangaran disposal site. Sorting at the collection points focuses on the retrieval of clean PET and cartons/paper. Additional sorting of waste is undertaken at the Akhangaran disposal site where an undetermined quantity of PET, plastic sheets, other plastics, paper and carton and glass bottles is recovered and eventually sold to dealers of recyclable materials.

The survey shows that per capita waste generation of High Rise residential units is 0.55 kg while that of the Low Rise units is 0.56 kg. The slight difference in per capita generation is attributed to the observed higher affluence in the private residences in the low rise housing sector within the latter compared to those residing in high rise apartments. The weighted per capita waste generation for the residential sector of Mirzo Ulugbek District and indicatively for Tashkent residences is 0.56 kg.

Using the official projected Tashkent City population of 2.32 million, the estimated residential waste generation in 2012 is 1,288 tons per day. Commercial waste is estimated at 386 tons per day which was arrived at by applying the 30% Maxsustrans estimate for this sector. These translate to an indicative waste generation of 1,674 tons per day for Tashkent City. By 2020, it is projected that waste generation would reach 1,929 tpd and attain 2,615 tpd by 2037.

5. PERCEIVED PRIMARY AND SECONDARY IMPACT AREAS

5.1 Primary Impact Zone (PIZ)

Generally, the extent of the primary impact areas is largely influenced by several factors. These are the wind direction, geological characteristics of the area and the expected pollution load from the proposed project, among others. In this case, the most significant factor affecting the extent of the impact area are the meteorological conditions exist in the project site and the potential pollution generated by the project.

The primary impact areas cover a radial distance of 1 kilometer from the center of the project site but may be felt wider or longer depending on the wind direction and speed during a particular month. About ten (10) months per year, the impact areas are generally those areas West-North-West of the project. For two (2) months each year, the areas located East-North-East and NNW are likely to be affected which is affected only during the month of January and December, respectively.

5.2 Secondary Impact Zone (SIZ)

Secondary impact areas are areas outside the primary impact areas but within the succeeding kilometer radius starting from the periphery of the PIZ. This would impact largely the settlements located NW and WNW of the site. These areas may or may not be affected depending on the operational procedures and environmental management systems adopted by the SLF.

On the other end, it is important to note it is difficult to directly associate environmental impacts to the project due to the presence of the existing dumpsite. Environmental changes and subsequent impacts at project site might not be directly attributable to the project due to the “masking” effect of brought about the current dumping activity. It is noted that such “masking” effect will cease once the existing landfill is closed and rehabilitated. On the other hand, major and minor environmental impacts upon the establishment of the project and during its operational phase are still expected in these areas and impact identification and assessment will be focus on the perceivable environmental effects brought about by the project.

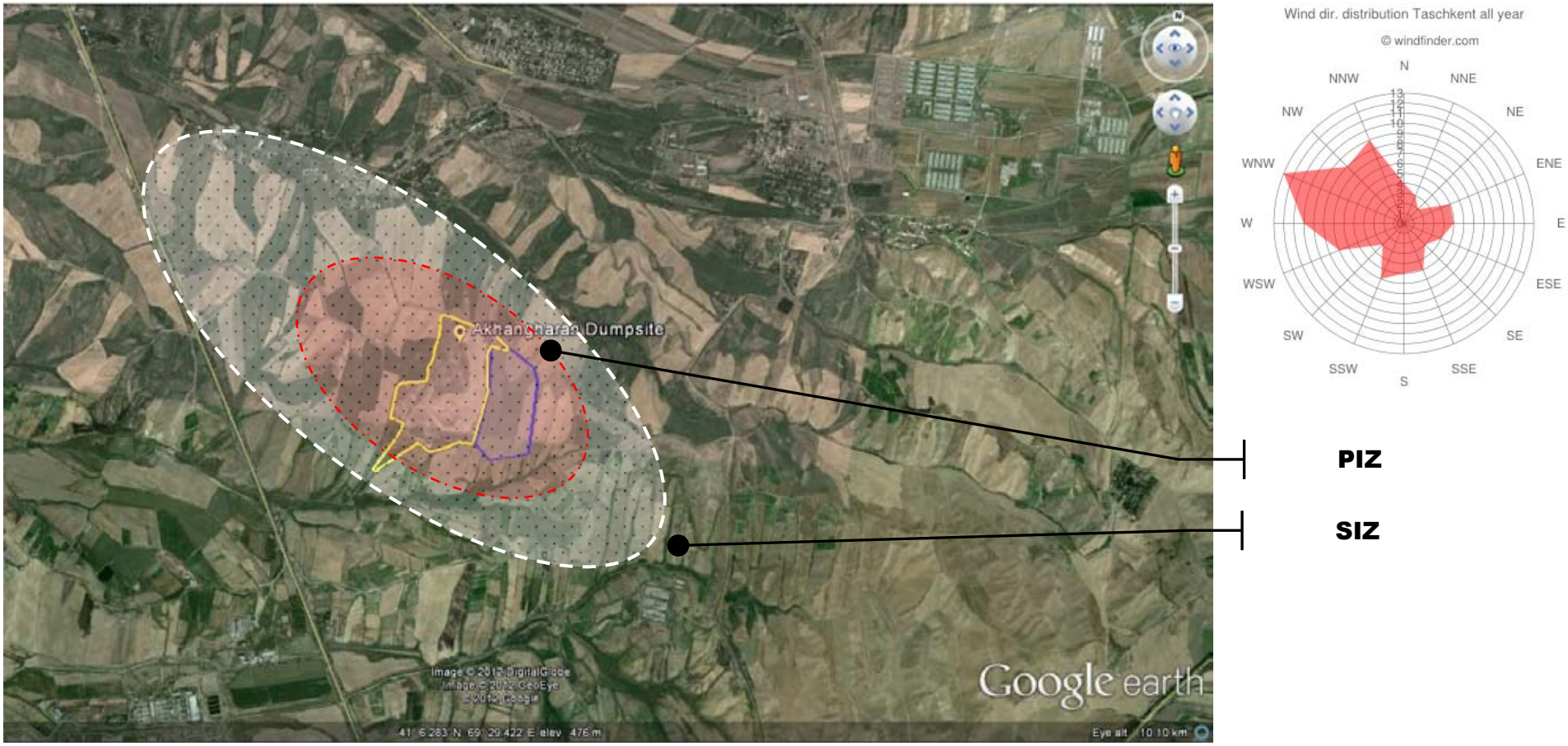

Figure 31 – Primary and Secondary impact areas

6. IMPACT IDENTIFICATION AND ASSESSMENT

This section will identify and assess the potential effects that such a project will have on its immediate surroundings upon implementation. The aim is to take account of all of the likely but important environmental/project impacts and interactions, making sure those indirect and cumulative effects, which may be potentially significant, are not inadvertently omitted. The anticipated changes brought about by the project are determined by identifying these changes or impacts using an Environmental Impact Matrix and predicting and assessing these.

6.1 Impact Identification

To facilitate the identification of the potential impacts brought about by the proposed project, a modified impact identification matrix for addressing and/or summarizing the environmental impacts was used to suit project needs[7] (attached as Annex 5).

6.2 Impact Assessment

The establishment and the eventual operation of the proposed SLF are anticipated to include environmental, health and safety concerns that need to be identified and assessed. This section will present in tabular form the identified **insignificant** impacts for each phase of project development.

Phase	Negative Impacts	Positive Impacts
Construction	• Emissions may exceed the prescribed standards or may cause changes in ambient air quality. • May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff. • Movement of additional vehicles • Construction of new roads	
Operation	• Operation will result to the generation of objectionable odors. • May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff. • Movement of additional vehicles • Possible leachate generation from old dumpsite	

The matrix below shows the **moderate and significant** impacts for each phase of project development.

[7] Modified Impact Identification Matrix based on the Leopold Matrix, Larry W. Canter 1997

Phase	Negative Impacts	Positive Impacts
Construction	• Construction shall involve extensive disruption to or displacement of soil • Changes in contours due to land preparation • Modification of the physical features common to the area • Possibly increase erosion of soils • Generation of waste from the rehabilitation of the old dumpsite • Potential create health hazards especially among workers inside the SLF • Increase exposure of workers to potentially health hazards.	
Operation	• Modification of the physical features common to the area • Potential create health hazards especially among workers inside the SLF • Increase exposure of workers to potentially health hazards.	• Safe closure and rehabilitation of the existing dumpsite • Introduce local species of plant into the area as part of the buffer zone • Changes in scenic vista or view. • Introduce new materials, colors, and forms to the immediate landscape.

The following section will discuss significant impacts identified above.

6.3 Construction Stage

6.3.1 Change in Land Use

The current land use of the area will be changed (i.e. from agricultural to waste disposal enterprise). The site will be utilized as a final waste disposal area once the SLF and its associated facilities are established and operational. The change will be long term and permanent. Based from the project design, the final covering will complement the natural surroundings. The scope of land acquisition and resettlement is discussed in detail in a separate report (i.e. LARP).

6.3.2 Landscape Alteration

The establishment of the SLF and its auxiliary facilities in the project site will have significant impact to the landscape of the proposed project. During the construction phase, modification of the terrain will be undertaken through grading, excavation and cut-and-fill operations. From the existing undulating landscape it will be replaced by a landfill and infrastructures.

The impact of the construction stage to the existing landscape is temporary and short-lived but is expected to be permanent and long terms once the SLF is

operational. The establishment of the facility is also perceived to improve the current aesthetic status of the site. The buildings and similar structures are designed to complement the rustic and natural conditions of the site.

On one end, it is noteworthy that the project will consequently result to the closure of the existing dumpsite. It is noted that the existing Akhangaran dumpsite has been operating since 1968 and its closure is envisaged to be more advantageous compared to the customary dumping practices.

6.3.3 Erosion

It has been observed that soil erosion is not so common in the area. It is expected that the level of erosion will not increase as a result of the establishment of the project. It is anticipated that erosion will be minimized due to the slope stabilization. It is expected that areas that are once open to the forces of air (*and water*) are to be covered, utilized and occupied by the project and its auxiliary facilities (e.g. drainage systems) thereby decreasing the exposed areas. The impact of the project to erosion and siltation will be short-term during the construction stage but is expected to be long-term and permanent is most areas of the project site once the project is operational.

6.3.4 Lifting of Superficial Materials

It is expected that the volume of superficial materials not significant increase as the construction of the landfill and its auxiliary facilities progresses. Among the superficial materials to be lifted are fugitive dusts. With the increased movement of vehicles, construction equipment and people in the construction site, it is expected that the volume of fugitive dust will increase. The impact though is short lived, temporary and is expected to last only during the progress of the construction phase.

This inevitable impact shall be confined within the 100 to 300 meters from the construction site. Areas more than one (1) kilometer from the project site are expected not to experience the impact of fugitive dust from the construction site. Moreover, agricultural activities (i.e. land preparation prior to planting) may contribute to such impacts which might not be directly attributable to the project.

6.3.5 Water

Water is a necessity during the construction phase. Though not vital during the establishment of the some of the components of the SLF, it is becomes necessary during the construction of the various auxiliary components of the project, particularly the buildings, road networks and other infrastructures made out of concrete. There is also no possibility that groundwater will be affected during the construction phase of the project. On the other hand, it is noted that an existing irrigation channel traverses the project site which will be affected during project establishment. This is planned to be diverted to allow the continuous supply of irrigation water to the affected plots.

6.3.6 Air and Noise Impacts

The impact to air and noise will be significant during the progress of the construction phase. The sources of impacts mostly are the vehicles and equipment that will be moving around the construction site, entering and leaving the project site.

Noise disturbance during the construction phase is inevitable due to the operation of typical construction equipment and machineries. These equipment typically have average noise levels of 70 – 105 dB at 15m. Table 17 shows the level of noise each construction equipment is capable of generating.

The noise to be generated by these equipment and machines are expected to be confined within a radius of 500 meters up to 1 kilometer from the construction site. Any distance further than 1 kilometer will no longer experience the impact of the construction activities.

Table 6 – Construction Equipment Noise Ranges

Construction Equipment	*Noise Level (dBA) at 15 m*	*Predicted Noise Level (dBA) at 60m*	*Predicted Noise Level (dBA) at 120m*
Compactors (rollers)	71-73	59-61	53-55
Front Loaders	71-84	59-72	53-66
Backhoes	71-92	59-80	53-74
Tractors	77-95	65-83	59-77
Graders, Scrapers	80-92	68-80	63-74
Trucks	82-94	70-82	64-76
Concrete Mixers	71-88	59-76	53-70
Generators	71-82	59-70	53-64
Compressors	74-88	62-76	56-70
Impact Pile Drivers (peaks)	95-106	83-94	77-88

Source: US Environmental Protection Agency, 1972, p. 2-108

Closest receptors off-site are the farmers cultivating on adjacent plots. The increase in the levels of the above mentioned pollutant types should be closely monitored and managed.

6.3.7 Impact to occupational health and safety

Impact on occupational health and safety during the construction stage is a concern of the designated contractors and its appointed sub-contractors that will be implementing the construction activities. The Contractor can indirectly influence the occupational health and safety concerns during the construction by including in the contractor's contract compliance to health and safety procedures imposed by the city administration and other related agencies (ex. Labor and Health Departments). This involves obtaining the relevant insurance policy for Workmen's Compensation.

Land development and civil works can generate substantial amount of dusts particularly from excavations and dirt roads. Air emissions from hauling trucks and heavy equipment can also be pervasive. These particulates (especially PM_{10}) and emissions from exhausts vehicles may pose some levels of health hazards to workers at the site.

6.3.8 Other Residual Impacts

Residual impacts such as generation of solid wastes and wastewater from the construction activities are deemed insignificant (i.e. temporary and short term). There may be a temporary increase in the number of people in the project site which may require additional spaces for transportation, accommodation, food and security. All these have short term and temporary impact to the host community.

A number of laborers will be employed directly for the establishment of the project. Direct employment includes those skilled workers who are needed for land

development and building construction. The former may be sourced from other countries. On the other hand, most of the workers will be billeted on-site (i.e. after obtaining the proper approval and clearances) and since there are sanitary utilities might not be sufficient in the area at present, sanitation and hygiene problems might crop up if their needs are not properly addressed, for example a meager water supply.

The basic services are food, shelter, water, and power should be provided by proponent and/or contractor.

6.4 Operations Stage

6.4.1 Operation of the Landfill

6.4.1.1 Generation of Leachate

The general risks from leachate generated from wastes are due to its normally high organic contaminant concentrations and high ammoniacal nitrogen. Pathogenic microorganisms and hazardous substances that might be present in it are often cited as most dangerous, but pathogenic organism counts have been found to reduce rapidly with time in the landfill, so this only applies to fresh leachate.

The generation of leachate is inevitable in most landfill areas. Leachate generation rates are completely dependent on the amount of liquid the waste originally contains and the amount of rainfall in the area. Some factors that can influence leachate generation are the following:

1. Climate;
2. Site topography;
3. Final landfill cover material;
4. Vegetative cover;
5. Site phasing and operating procedures;
6. Type of waste materials in the landfill.

The climate at the site will significantly influence the rate of leachate generation in the landfill. Since the site is located in an area of low precipitation, it can be expected that leachate generation is relatively low. Although plans to handle and treat even these minute quantities are incorporated in the design.

The topography of the project site may be of a concern since the site is bounded by irrigation canals. Any damage or spills from these canals may generate significant amounts of “runoff” that could infiltrate the landfill area. In view of this, the landfill is designed in a manner wherein the facility may be slightly elevated or protected to reduce the risk of any “runoff” infiltrating the landfill.

The temporary and final landfill covering can also influence the amount of water percolating into the landfill.

Finally, it is a given that vegetation will, by evapotranspiration, re-direct a portion of the infiltrating precipitation back into the atmosphere. The presence of vegetation in the landfill can also influence the generation of leachate in the landfill.

6.4.1.2 Possible Contamination of Soil and Groundwater

Contamination of the groundwater resources is among the most recognized impact of landfills. In cases of leakages, the contaminated leachate will percolate into the ground and may find its way into existing groundwater resources. As mentioned in the previous section, appropriate liner and collection systems are part of the design and will be installed. To augment this system, regular quality control checks on the equipment /accessories shall be implemented and incorporated during construction and operations. Further, it is important to reiterate that groundwater resources appear to be deep (i.e. > 50-100 meters) with a substrate that acts as a natural barrier.

6.4.1.3 Generation of Landfill Gas

Studies and research shows that landfill gas are approximately 40-60% methane (CH_4) and the remaining being mostly carbon dioxide (CO_2). There is another group of chemicals, called non-methane organic compounds (NMOCs), which may be present in the air near a landfill, though they are not likely to reach harmful levels. They are nitrogen, oxygen, water vapor, sulfur and a hundreds of other contaminants. NMOCs may occur naturally, or be formed by chemical processes. There is concern that long term exposure to high levels of NMOCs could lead to health problems, but health studies have been largely inconclusive. Table 21 shows a list of the various components of a typical landfill gas.

Though NMOCs usually make up only less than 1% of landfill gas, many of these are hazardous chemicals like benzene, toluene, chloroform, vinyl chloride, carbon tetrachloride, and 1,1,1 trichloroethane. At least 41 of these are halogenated compounds. Many others are non-halogenated toxic chemicals. More exhaustive test for contaminants in landfill gas has found hundreds of different NMOC contaminants.

Table 7 – Typical Landfill Gas Components

Component	Percent by Volume	Characteristics
methane	45–60	Methane is a naturally occurring gas. It is colorless and odorless. Landfills are the single largest source of U.S. man-made methane emissions
carbon dioxide	40–60	Carbon dioxide is naturally found at small concentrations in the atmosphere (0.03%). It is colorless, odorless, and slightly acidic.
nitrogen	2–5	Nitrogen comprises approximately 79% of the atmosphere. It is odorless, tasteless, and colorless.
oxygen	0.1–1	Oxygen comprises approximately 21% of the atmosphere. It is odorless, tasteless, and colorless.
ammonia	0.1–1	Ammonia is a colorless gas with a pungent odor.
NMOCs (non-methane organic compounds)	0.01–0.6	NMOCs are organic compounds (i.e., compounds that contain carbon). (Methane is an organic compound but is not considered an NMOC.) NMOCs may occur naturally or be formed by synthetic chemical processes. NMOCs most commonly found in landfills include acrylonitrile, benzene, 1, 1-dichloroethane, 1, 2-cis dichloroethylene, dichloromethane, carbonyl sulfide, ethyl-benzene, hexane, methyl ethyl ketone, tetrachloroethylene, toluene, trichloroethylene, vinyl chloride, and xylenes.
sulfides	0–1	Sulfides (e.g., hydrogen sulfide, dimethyl sulfide, mercaptans) are naturally occurring gases that give the landfill gas mixture its rotten-egg smell. Sulfides can cause unpleasant odors even at very low concentrations.
hydrogen	0–0.2	Hydrogen is an odorless, colorless gas.
carbon monoxide	0–0.2	Carbon monoxide is an odorless, colorless gas.
Source: *Tchobanoglous, Theisen, and Vigil 1993; EPA 1995*		

These landfill gasses are released into the atmosphere. Whenever unabated, these gasses might affect the general environment including the welfare of its employees and host community in general. Landfill gas is the main carrier of landfill generated odor which is classified to be objectionable.

Landfill gas may cause temporary discomfort, but it is not likely to cause permanent health effects. At extremely high concentrations, persons exposed may experience eye irritation, headaches, nausea, and soreness of the nose and throat. People with respiratory ailments such as asthma are especially sensitive to these effects. However, these temporary conditions are reversed as soon as the gases are reduced or eliminated. Engineered Sanitary Landfills normally have landfill gas capture systems.

6.4.1.4 Generation of Objectionable Odor and Impacts on Air Quality

Objectionable odor is expected at the SLF plant depending on various factors. Some of which are the types of wastes being handled, humidity, temperature and moisture content, among others.

The closest receptors will be the personnel who will be onsite monitoring the status of the facility. Some of the anticipated problems that may be raised during the operation of the SLF are as follows:

- the discomfort of working with offensive odors and
- concerns for the mental or psychological welfare of exposed communities

It is noted that based on the prevailing wind patterns, communities or settlements WNW and NNW of the site may be also affected.

6.4.1.5 Traffic

There is no significant traffic impact since the project will be handling a relatively similar traffic volume to the existing traffic (i.e. the number of trucks entering the existing landfill). On the other hand, possible increase in the number of trucks passing may be inevitable due to the refurbishment of the transport fleet of IB Maxsustrans.

6.4.1.6 Environmental Health and Safety

Studies on similar projects indicated that some of the more commonly reported occupational health and issues in solid waste management are as follows:

- back and joint injuries from driving heavy landfill and loading equipment;
- respiratory illness from ingesting particulates, bio-aerosols and volatile organics during waste collection, and from working in smoky and dusty conditions at open dumps;
- infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals;
- puncture wounds leading to tetanus, hepatitis, and possible HIV infection;
- injuries at dumps due to surface subsidence, underground fires, and slides
- headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide, and carbon monoxide concentrations; and
- Lead poisoning from burning of materials with lead-containing batteries, paints, and solders.

The above list of issues are commonly attributed to management of solid waste facilities in middle and lower-income countries where workers often times have direct contact to the waste being improperly handled in the landfill.

For this particular project, it is included in the project's operating design that the handling and management of wastes in the landfill will maximize the use of mechanical equipment thereby limiting exposure of workers to the wastes being deposited in the landfill area.

The landfill will be totally closed and inaccessible to the general public. Only authorized personnel, workers handling the waste compactors, pay loaders and the dump trucks are allowed entry to the facility.

The level of exposure of the workers to the health hazards of landfill operation will further be reduced by the implementation of daily soil covering of the landfill area. Once covered with later of soil, the waste no longer poses any harm to the workers. This is complemented by the strict implementation of the Personal Protective Equipment (PPE) among workers. The IA through the its PIU should commit to obtain the necessary Insurance Policy for Workmen Compensation to answer any expenses incurred for hospitalization and repatriation.

Further, exposure of the workers to any hazardous waste is not expected to occur in this particular landfill area since the SLF will only accept household waste and similar wastes (Note: it is envisaged that the SLF will only receive organic wastes and non-recyclables household wastes). All hazardous wastes or waste not classified as household wastes shall not be allowed into the premises. Upon visual inspection, any identified hazardous materials shall be directed to return its load to its source. Inspectors at the weigh bridge will be trained and fielded to discern between acceptable waste and the latter. Waste manifest and records shall be kept at all times for easy reference and reporting.

On the other hand, utmost care and attention must be observed in the handling of the following materials whenever found to be present in the household:

- lead based paint contaminated debris
- fluorescent light tubes
- aerosol cans

Fluorescent lamps, thermostats, mercury switches, manometers, natural gas meters, and other items can contain enough mercury to be classified as a hazardous waste, and may therefore be excluded from collection and not be disposed of as regular trash. Used electronics and batteries may contain enough lead, mercury, cadmium, or acid electrolytes are to be classified as hazardous waste. In such cases, they may not be collected or disposed of as regular trash or disposed together with the construction / demolition wastes. In such cases, such materials shall be handled with outmost care, properly recorded and separated from the acceptable waste. Appropriate containers shall be obtained to contain such materials. This matter shall be reported to the concerned authority for the proper and immediate action.

Since the SLF is not intending to handle such waste, maximum avoidance of such materials entering the SLF is enforced. This is achieved by following a strict procedure in terms of inspection and monitoring especially at the weigh bridge area. Any unacceptable materials shall be catalogued and reported to the concerned agency for proper action.

Compared to the current land use, it is envisaged that the project will bring about positive changes aside from its primary objective to establish and implement a proper waste management system for the City. Since part of the design is to incorporate local vegetation as part of the buffer zone, this will introduce new colors and forms to the immediate landscape.

6.4.1.5 Attraction of Vermin and other pests in the area

The operation of the SLF may attract presence of pests such as rats, cockroaches, flies, ants and other pests in the immediate area. These pests can freely move around the area and may find their way to buildings and areas adjacent to the landfill. Since these pests are known to be carriers of diseases, they may trigger the sudden occurrence of illnesses and unacceptable conditions among people of weak resistance and children.

6.4.3.2 Environmental Health and Safety

Studies on similar projects indicated that some of the more commonly reported occupational health and issues in solid waste management are as follows:

- back and joint injuries from driving heavy landfill and loading equipment;
- respiratory illness from ingesting particulates, bio-aerosols and volatile organics during waste collection, and from working in smoky and dusty conditions at open dumps;
- infections from direct contact with contaminated material, dog and rodent bites, or eating of waste-fed animals;
- puncture wounds leading to tetanus, hepatitis, and possible HIV infection;
- injuries at dumps due to surface subsidence, underground fires, and slides
- headaches and nausea from anoxic conditions where disposal sites have high methane, carbon dioxide, and carbon monoxide concentrations; and
- Lead poisoning from burning of materials with lead-containing batteries, paints, and solders.

The above list of issues are commonly attributed to management of solid waste facilities in middle and lower-income countries where workers often times have direct contact to the waste being improperly handled in the landfill.

7. PROPOSED MITIGATION MEASURES

7.1. Construction Phase

Overall the selected area is generally appropriate for the intended establishment of a waste management SLF and its auxiliary facilities. Further, waste materials have the potential to cause adverse environmental impacts during handling, transport, storage and disposal. Provided that all planned and designed components coupled with a strict management and control of all wastes generated on site during the works, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, no significantly adverse environmental impacts are anticipated.

Following measures are recommended to ensure and further enhance the integrity of the structures within the Solid Waste Management SLF and its immediate surroundings.

7.1.1. The site is a confluence of irrigation canals and channels which may cause infiltration of irrigation water into the landfill. It is therefore necessary to establish appropriate drainage to make sure that such incidents are prevented while complementing the elevated design of the landfill. Diverted water channels should allow the unimpeded supply of water to affected agricultural plots.

7.1.2. Based on the geologic and seismic records the design of structures should be determined to conform to the peak ground acceleration value and incorporated into the design of the structures.

7.1.3. The design suggested that the liner to be used should conform to the European standard. Any substitute liner other than what was intended should either be higher or equal to this standard.

7.1.4. Development and implementation of a proper and ‘safe closure plan’ for the existing dump site. It is recommended that a site assessment on the contaminated area be conducted to ascertain the presence and levels of any contaminants. Related standards such as the ‘Dutch Intervention Values’ can be used as reference. Results can also be correlated with previous studies conducted at the site.

7.1.5. A site remediation analysis should be undertaken and a remediation action plan must be developed to ensure that proper planning and implementation of the closure.

7.1.6. Continuous post- closure management of the closed dumpsite including environmental monitoring should be carried is recommended. Potential pollution / hazards and potential post-closure land use should be evaluated.

7.1.7. It is expected that fugitive dust generation due to the construction activities will happen eventually. To prevent lifting of dusts in working areas, wetting should be done using spray trucks whenever feasible and economic. The frequency of spraying depends on how intense is the development activity and shall be determined in the field - as normally observed by land development engineers. Compaction and regular maintenance of roadways is also recommended.

7.1.8. Institute proper measures to avoid accidents during the movement of vehicles and equipment in and out of the construction area. Regular monitoring and assessment to ensure that traffic flow remains optimal and clean-up of any debris can be undertaken

immediately. Appropriate parking should be identified and strategically designated by the Contractor.

7.1.9. Strict enforcement of safety rules and regulations during construction activities e.g. identifying hardhat areas. The entire area will be fenced off to control the entry and exit of personnel. Safety signs/reminders will be posted in strategic locations. Appropriate HSE manuals and insurance policy should be provided by the designated contractor.

7.1.10. No makeshift toilets shall be constructed by workers within the project site or even nearby. The contractors will be required to provide their workers portalets and be responsible in the sanitary disposal of their refuse / sewage. This will prevent fecal contamination within the project site. One portalet for every ten (10) workers will be ideal but adjustments can be made as long as it does not sacrifice the hygiene of the workers and the sanitary condition of the area.

7.1.11. Effective and proper industrial practice (or good site practices) during installation and commissioning will be followed of the project to prevent/reduce the risks of a normal workplace. Regular inspections will be undertaken using a checklist to ensure that a minimum standard is achieved and maintained.

7.1.12. Noise barriers will be established and stationary noise-generating equipment will be enclosed to reduce noise generation and buffer noise impacts on workers. Workers directly exposed to noisy equipment construction will be provided with Personal Protective Equipment (PPE).

7.1.13. Trucks and heavy equipment must be checked for compliance with emission standards before they are used during construction. All construction vehicles and heavy equipment should also be fitted with mufflers to minimize noise.

7.1.14. Preparation of an Occupational Health and Safety / Operations Manual for implementation in the plant. This is coupled by obtaining an appropriate insurance policy for workers' compensation. The costs for implementing this should be incorporated in the maintenance and operating expense budget of the proponent / operator / contractor.

7.1.15. All workers will have to undergo a health and safety induction training. Personnel / laborers engaged in actual construction activities should wear appropriate protective clothing – PPE. They should wear protective footwear with covered impact resistant toecaps (industrial boots).

7.1.16. Water consumption will be monitored and controlled. Regular inspection of water conduits and/or storage tanks will be undertaken to check leaks. Access to and around this installation should be provided for firefighting for ease to augment firefighting capabilities.

7.1.17. To further ensure the integrity final cover for the existing dumpsite, the site will be fenced off. It is generally recommended that allowing a former "landfill" site to "return to nature" is the safest, least expensive and most desirable rehabilitation measure. It is suggested that the area be planted with shallow rooted vegetation complementing the local landscape to remove odors, minimize gas leakage, reduce leachate and prevent air from entering the landfill mass. PCMU post-closure monitoring is recommended.

7.2 Operation Phase

7.2.1. Leachate Generation and Control

Depending on moisture content of the waste, leachate can be generated from the *dumped waste*. On the other hand, as envisaged that with the low expected precipitation, it is expected that leachate generation will be relatively low. Nonetheless, to address this issue, control measures such as leachate collection augmented by a leachate recirculation system were included in the design. Collected leachate can be evaporated by spreading it over the disposal area. The operators of the landfill must ensure that an effective and efficient leachate control and monitoring system is maintained. This may be complimented by establishment of groundwater monitoring wells and regularly collecting samples for laboratory analysis. Results of the analysis could aid the operators to determine the final fate of the collected leachate and/detect any potential leakages. Final decision rests with the SCNP on the final number of wells as well as the frequency of sampling for groundwater quality.

On the other hand, SLF operators must be properly and adequately trained to operate and maintain the installed control system. A procedure for the rapid repair of leaks in the pipes, pumps and other equipment must be part of SLF operations. An inventory of spare parts and repair equipment must be continuously in place to ensure immediate remedial action against breakdowns. Strict quality assurance and construction guidelines during the installation of the HDPE liner should be strictly implemented.

7.2.2 Landscape Alteration

Landfills should be designed to limit leachate generation from areas peripheral to the site by diverting possible irrigation water infiltrating into the site. The elevated design of the landfill and the diversion channels should be maintained. Appropriate rip-raps / retaining walls should be established complimented by regular checks.

7.2.3 Introduction of Vegetation

The final vegetative cover plays an integral part in leachate production control. Its basic functions are to limit infiltration by intercepting precipitation directly, thereby improving evaporation from the surface, and to reduce percolation through the cover material by taking up soil moisture and transpiring it back to the atmosphere. Preferred plant species should be of those that do not have deep roots in order to protect the surface sealing. Further, these species should require minimal maintenance and human intervention.

7.2.4 Proper Selection of Final Layer Cover

Based on the soil analysis conducted at the site, the soil substrate was found to be an ideal soil cover. Geosynthetic membranes, when used, are placed under a soil layer to protect it from the weather and to allow the establishment of a vegetative cover.

7.2.5 Health and Safety

To ensure a safe and healthy working environment for the employees of the landfill and all its auxiliary facilities, the following measures have to be strictly enforced, implemented and monitored:

- Designation of an Environment, Health and Safety (EHS) officer dedicated to the site.
- All employees must be able to reach their work stations safely. All path, walkways, staircases, ladders and platforms must be stable and suitable for the tasks to be undertaken;
- Strict use of Personal Protective Equipment (PPE) by all personnel (e.g. inspectors at the Weigh Bridge, material handler and waste compactor operators).
- Mandatory training of all employees, including sub-contractors, on Health and Safety Practices for Landfill and its auxiliary facilities. Tool Box talks are also recommended;
- Mandatory health and medical check-ups for all employees. This shall be complimented by obtaining an Insurance Policy for Workmen's especially engaged in the daily activities of the landfill;
- Develop a written program (i.e. health information, instruction and training) which sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards of working in s landfill and its auxiliary facilities;
- Mandatory monitoring of air quality and noise levels in the working stations to maintain the same within local standards and whenever possible near ambient levels;
- Accidental fires must the addressed immediately. Appropriate operational procedures involving the spreading and smothering of burning waste, rather than the use of water, should be implemented.
- Emergency plan (including fire management) must be developed and implemented.
- Availability of first-aid kits and vehicles that can be used to bring any injured employee to the nearest doctor in cases of accidents;
- Mandatory reporting of all accidents or incident of near misses of accidents and immediate adoption of corrective measures; and
- Management must provide all the necessary financial and manpower resources for the implementation and enforcement of all health and safety programs and activities of the project.

Regular training and orientation on safety practices will be implemented to impart knowledge of safe and efficient working environment. Furthermore, regular health checkups of all employees including contract workers will be conducted. Effective and proper housekeeping is recommended to reduce dust exposures to its direct vicinity. Heat levels must be monitored as well. Spot checks should be done to ensure that workers' welfare is addressed especially during summer months.

7.2.6 Noise Impacts

To minimize the impact of noise, it is most appropriate to regularly maintain the movement of vehicles within and outside the landfill and all its facilities. Properly schedule the delivery of wastes into the landfill strategically synchronized with the schedules of the transfer stations. Movement of vehicles within these facilities must also be regulated. Strict implementation of speed limits within the SLF must be imposed.

The equipment and machines used in the landfill and its facilities must be properly maintained. Whenever applicable, mufflers must be installed.

Planting of trees as buffer along the perimeter of the landfill and its facilities will not only minimize noise but will also make the project more appealing and will improve the local scenery.

7.2.7 Odor and Air Quality

Best management practices and good housekeeping measures will be implemented to minimize the release of objectionable odours. Potential odours impacts can be minimized or eliminated by adopting the following measures:

- Covering of the landfill after the final layer of waste has been deposited. This will not only prevent the odor of decaying waste from escaping from the landfill but also protect the site against intrusion of vermin and pests.

- Appropriate and regular housekeeping (i.e. cleaning) should be done in all areas where solid waste will be processed (i.e. weigh bridge area). This will prevent the reproduction of flies, generation of obnoxious odors, scattering of plastic and papers, etc.

7.3 Closure

The permeability of the final cover must be less than the underlying liner system, but no greater than 1.0×10^{-5} cm/sec. The reason for this requirement is to prevent the “bathtub effect” where liquids infiltrate through the overlying cover system but are contained by a more permeable underlying liner system. This causes the landfill to fill up with water (like a bathtub), increasing the hydraulic head on the liner system that can lead to the contaminated liquid (leachate) escaping and contaminating groundwater supplies.

8. PROJECT ALTERNATIVES

8.1. "No –Action" Alternative

The current waste disposal system has been through controlled dumpsites. These dumpsites often characterized by an area where garbage is simply transported, unloaded, and at times leveled by a bulldozer. Nearly all these sites operate with no protection against soil and groundwater contamination. The situation is further exacerbated by operators' seldom attempt to control pungent smoke, objectionable odor and vermin. Sorting is only achieved through scavenging, which at times tolerated, with no checks in place for the health and safety. Such dumpsites are inexpensive operate, but pose serious damage to the land, water, air, aesthetics, and the health of the surrounding population. These dumpsites are also difficult to rehabilitate after they are filled and abandoned. Failure to implement the project or a "No-Action alternative" will result to allocation of land only to be subjected to the existing practice. Alternatives in this context will mean the establishment of the SLF at alternative sites or the project not pushing through. Although what is obvious is such alternatives shall not negate the disadvantages of allocating land for disposal purposes only to be subjected to the existing dumping practice.

8.2. With the Project Alternative

8.2.1 Siting Options

The site where the SLF will be established is "formerly" agricultural and was allocated as an expansion area for waste disposal. Aside from the *Hokimiyat* decision, the site was selected through an intensive selection process by a SWM expert and verified also in the site assessment report; alternative areas with similar features and qualities necessary to qualify for the planned facilities where not available within the defined 50 kilometer radius (i.e. considering the maximum distance for hauling wastes, access, land use, distance to residential / urban areas).

After site selection assessment, the Akhangaran site appeared to be the most suitable site on which to develop a SLF. The site is characterized by strong layers of loam (silty clay) – an ideal natural barrier. This is also complemented by clearly defined and deep groundwater aquifers. In general the groundwater is well protected and the geological conditions on this site can, at this stage of the project, is considered as an 'ideal' site for the establishment of an SLF in accordance with international acceptable standards

8.2.2 Design and Technology

SWM Alternatives at the other end of the SWM technology spectrum include incinerators, pyrolysis chambers (high-temperature incineration in the absence of oxygen) or chemical/biochemical decomposition systems which have begun to establish in the SWM market. Of these, only incinerators are in general use in many countries to handle municipal waste. These systems are able to break down or substantially reduce the volume of waste. They also have the capacity to destroy pathogens and render most toxic substances inert. However, most of the modern incinerators are often costly to set up and operate. In addition, ash and other residue from incinerators still require a sanitary landfill for their final disposal. This has been

extensively discussed by the GoU and has deemed this alternative not economically feasible so was abandoned.

Engineered sanitary landfills, on the other hand constitute another type of solid waste disposal system. Landfills store and compress the waste without neutralizing toxins or pathogens, but have in place stronger controls against soil, water and air pollution than dumpsites. Moreover, sanitary landfills allow the recovery of methane gas, a by-product of anaerobic decomposition of organic matter, which can be used for power generation. Well sited and operated sanitary landfills provide the best option in waste management in view of their relatively low construction and operating costs and the type of wastes they are expected to handle.

Based on the site and SWM design / technology options, the SLF is the best option considering the environmental, social and economic circumstances. Further, this can be complemented and enhanced by waste minimization and recycling strategies which will be prepared by the technical assistant provided as part of the loan.

9. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

The public consultation meeting was held in the Tas Public Utilities Operations Office on April 11, 2013 which was attended by representatives from the concerned government and non-governmental organizations. Attendees included representatives from the Tas Public Utilities Operations TUED, IB Maxustrans, the Tashkent “Mahalla” Fund, Tashkent Enterprise for Waste Recycling, Tashkent City Committee for Nature Protection, Ministry of Health – Central Administrative Office, USCA and from the Labor Union within Maxustrans. The current SWM status and the proposed SLF including the design integrated environmental controls; the grievance mechanism and Environmental Management Plan (EMP) and monitoring plan were also presented. Details of the public consultation are presented in Annex 4.

A power point presentation was prepared wherein the project details including the initial environmental findings and proposed mitigating measures were translated into the local language (i.e. Russian). Invitations were sent out to relevant stakeholders. The presentation was spearheaded by the environmental consultant conducting the IEE in line with ADB’s requirement to properly inform relevant stakeholders about the project and about the likely impacts during construction and operational phases of the project.

The attendees expressed their concerns mainly on the choice of SWM technology, the SWM approach and the anticipated environmental impacts. At the end, participants were pleased to note the timely implementation of the SLF with emphasis on the environmental control features of the SLF.

10. GRIEVANCE REDRESS MECHANISM (GRM)

ADB SPS 2009 requires that the project establish and maintain a grievance redress mechanism to receive, evaluate, and facilitate the resolution of AP's concerns, complaints, and grievances about the social and environmental performance at the level of the project of affected people concerning the delivery of environmental safeguards. A project-specific grievance redress mechanism (GRM) will be established by the EA to provide a transparent mechanism to voice and resolve environmental concerns linked to the project. The EA will ensure that grievances and complaints are addressed in a timely and satisfactory manner to avoid any potential delays in the establishment of the project. Figure 32 gives the details of the grievance redress mechanism.

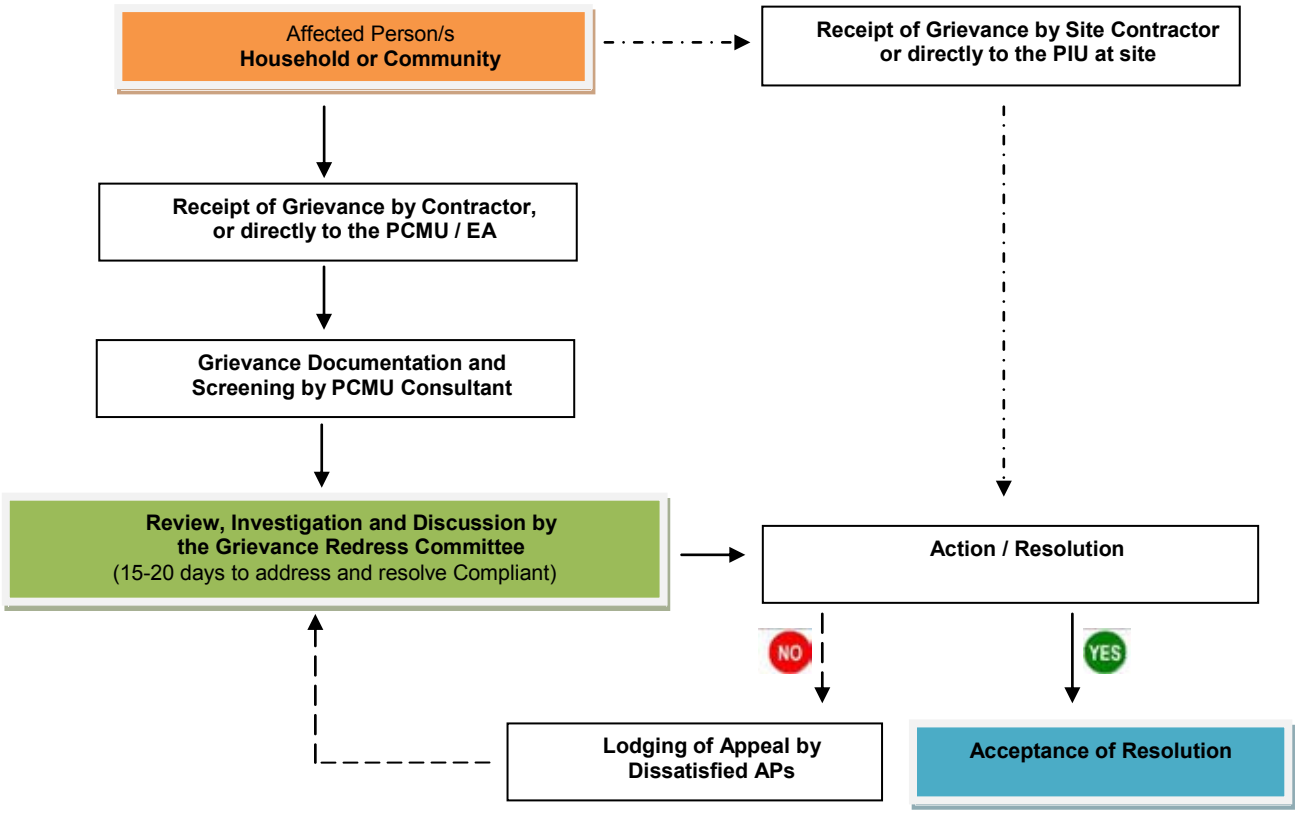

Figure 32 . Grievance Redress Mechanism

The PCMU will establish Grievance Redress Committee. This will provide any APs a venue to file complaints and queries on any environmental (or social) aspect related to the project. Grievances can be submitted in writing or orally to the contractor or directly to the PCMU / EA. These will be properly documented (i.e. indicating the date it was received, details of the complaint and complainant/s) and screened by the designated PCMU safeguard consultant for its veracity and validity. The committee will have 15 to 20 days to address and come up with a resolution. Under this GRM, unsatisfied grievances may be able to appeal for a final resolution. This mechanism also does not prevent any AP to approach regulatory agencies to assist and resolve complaints at any stage of the process.

In occasions wherein grievances are perceived the by AP to be immediate and urgent; the contractor, EHS officer and PIU on-site supervisor will provide the most accessible and practical solution for a quick resolution of grievances. Such grievances and respective resolutions will be submitted to the PCMU for proper documentation.

The PCMU will be responsible for recording the complaint, the step taken to address grievance, minute of the meetings and preparation of a report for each complaint. Records will be kept by the PCMU of all grievances received including contact details of AP, date the complaint waste received, nature of grievance, agreed remedial / corrective action and the date this was implemented, and the final outcome. The complaint handling process will be reported to ADB through semi-annual reports.

The PCMU safeguard consultant will periodically review and record the efficiency and effectiveness of the GRM highlighting the project's ability to prevent and address grievances.

11. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

11.1 Proposed Environmental Management Plan

The environmental management plan (EMP) is formulated to identify activities that will minimize or prevent negative impacts to the receiving environment. This is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive and practical planning tool to enable the assessment and monitoring of environmental performance on-site; (ii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iii) ensuring that recommendations are implemented and environmental standards are complied..

The components of the environmental management plan include a) measures for the management of the negative environmental impacts; b) contingency plan; c) environmental monitoring plan; and d) an institutional framework to implement the EMP. The PIU will be responsible for the overall implementation and compliance with the EMP and monitoring plan, including inspection, monitoring, reporting, and initiating corrective actions or measures. The PIU though its designated environmental specialist will be (i) managing the environmental activities carried out under the project; (ii) ensuring effective EMP implementation; and (iv) coordinating with site EHS officer on all relevant environmental matters. Monitoring and compliance reports will be submitted to the PCMU which will provide a copy to ADB. This is to ensure that the project complies with the provision of the EMP.

Applicable costs for the implementation of mitigating and enhancement measure shall be covered and incorporated in the project's construction and operational budgets. The EA through its PCMU will ensure that sufficient funds are available to properly implement the EMP. Annex 6 presents the detailed Environmental Management Plant (EMP) for the project.

11.2 Contingency Plan

Contingency planning is necessary for accidents occurring during the construction and operation phases of project. The main components of a contingency plan include measures to prevent accidents; methods for response and clean-up in cases of accidents; and creation and training of teams that will be implementing the contingency plan.

The plan shall include, but not limited to, the following:

Medical Emergencies

Trained personnel will be fielded and first aid kits to be used in treatment of minor wounds and ailments at the plant level should be readily accessible. Also, readily available vehicles to bring patients to the nearest hospital after application of first aid should be set in place.

Emergency Response Teams

Identify employees of the plant to be assigned members of an Emergency Response Team. The team should be equipped with appropriate communication equipment and first -aid kits to effectively respond to future emergencies. Regular training is necessary to keep the team active and prepared. Whenever possible, coordination with the representatives from the Local Government Units in-charged with Safety, Emergency and Environment has to be established.

Communications

Public address (PA) systems and other means of communication can be implemented at the project site. These will be used to issue forecasts, alarms and warnings in case of accidents and other related information to the facility' personnel as well as for adjacent locators. Hand-held radios could also be issued to selected personnel to coordinate personnel movement during emergencies.

Fire Hazards

Fire extinguishers and hoses must be strategically located within the construction site and within the buildings upon completion. The appropriate fire alarms should also be strategically located inside the buildings in case of fires. All firefighting equipment and accessories (ex. fire alarms / detectors, extinguishers) shall be in compliant as per the local standards.

11. 3 Environmental Monitoring Plan

The aim of this report is to identify the existing environmental conditions in the project site and maintain the same conditions as much as it is possible. Monitoring the impacts of the project is therefore a vital part of the activity. By monitoring the possible impacts of the project, it would be possible to act or react accordingly by instituting the most effective and efficient measures to minimize the operational impacts. The appropriate monitoring program is prepared as a framework for the project. It contains the list of environmental components to be considered, the parameters to be included during the monitoring activities, the responsible persons and the timing of the implementation of the activities. The monitoring program has the following objectives:

- monitor implementation of mitigation measures,
- monitor compliance with environmental standards, and
- monitor implementation of the interim Environmental Management Plans

The monitoring program is designed to be dynamic and effective. It can be modified to consider changes such as revision of standards, enactment of new rules and regulations and development of new methodologies and technologies for environmental compliance and monitoring. The monitoring plan identifies the parameters to be monitored and stipulates the timing and persons in charged to lead the monitoring activities. Continuous monitoring, though optional, is highly recommended to ensure early detection and mitigation of impacts. Implementation of continuous monitoring activities would prove later to be cheaper than facing operational problems, fines and to some extent, issuance of a “closure” order from the concerned authority.

It needs to be emphasized that the conduct of monitoring activities is vital not only to preserving the baseline conditions in the project site but also important in determining the efficiency of the installed components. Monitoring activities will also include visual inspections /monitoring of surface seal conditions (signs of damage, presence of unwanted vegetation) of the SLF including the old dumpsite, equipment condition and workers’ housing and sanitation facilities. Any parameter that exceeds the ambient standards means problems are incurred which may affect compliance and the operational costs notwithstanding non-conformance to the standards imposed by *Goskompriroda*. The proposed environmental monitoring plan is attached as Annex 7 of this report.

11.4 Institutional Plan for the Implementation of the EMP

Institutional Arrangements

The PIU shall be responsible for implementing and maintaining the EMP while the PCMU will be responsible for the monitoring. The role of SCNR is to review, approve and monitor the implementation of the plan. In line with their regulatory function, personnel in-charged on environmental concerns may perform applicable emission source monitoring activities. The PCMU and PIU will engage an environmental specialist to carry the implementation of the EMP, monitoring and reporting.

Set-Up for Environmental Management

A designated, on-site Environmental, Health & Safety officer (EHS officer) shall be appointed by the IA/ PIU to focus to the implementation of the EMP and compliance with them. The EHS officer will have the following tasks and responsibilities:

1. Impacts and Wastes Management

Supervise the implementation of the Plan and assess the effectiveness and integrity of the mitigating measures. Waste handling guideline will be set with a view of ensuring an effective safe and sanitary disposal of waste. He/she has to ensure that the EMP/EMoP is periodically updated.

2. Environmental Monitoring

Manage and supervise the conduct of the monitoring programs as scheduled.

3. Reporting

The EHS officer will be responsible for the formulation and implementation of an efficient reporting and database management system. He/she will be responsible for the preparation of report required by the *Goskompriroda* (SCNR), ADB, the PIU / PCMU and other institutions concerned with the operation of the Landfill for decision-making and improvements.

On the other hand, The PIU environmental specialist will coordinate with the EHS officer to (i) ensure construction works and operational activities are within the environmental criteria; (ii) conduct environmental compliance audit of existing facilities; (iii) update the IEE/EMP; (iv) inclusion of the EMO into bidding documents and civil works contracts; (v) ensure all requisite government approvals are in place to allow implementation, and that these are renewed in a timely fashion as required; (vi) oversee implementation of EMP during construction, including environmental monitoring of contractors; (vii) take corrective actions when necessary to ensure no environmental impacts; and (viii) review monthly reports by contractors and submit monthly environmental monitoring reports to the PCMU; and (ix) address any grievances brought about through the GRM in a timely manner.

12. Conclusions

Waste materials have the potential to cause adverse environmental impacts during handling, transport, storage and disposal. Given the concept / design approach to be used and the existing environmental conditions vis-à-vis the current practice and use of the site, it is most likely that the establishment of the SLF will have negligible adverse impacts to the receiving environment. Instead, the facility facilitating the proper handling and treatment of the wastes of Tashkent would actually minimize and mitigate the environmental impacts compared to the existing waste disposal practices significantly. Moreover, the project concept is in line with the National Waste management Strategy and Action Plan of the Republic of Uzbekistan, consistent with the internationally accepted requirements in establishing and operating a proper SLF. This puts emphasis on the immediate need to close the existing dumpsite and properly dispose / treat dumped materials into the SLF. Since an expansion is inevitable, the project is deemed necessary and equally important as to avoid this expansion to be subjected to the current SWM practice of disposing wastes.

This report has identified that the potential impacts which are likely to be short-lived, temporary and are expected mostly during the construction stage and commissioning of the SLF. It is expected that the project will bring about a positive environmental benefits wherein impacts are reduced below threshold levels once the SLF is in normal operation. The inclusion to the project design of a multi-barrier system, leachate and gas collection system will result to a significant reduction in impacts. With the significant environmental issues identified and evaluated, mitigation measures and monitoring plans were also proposed to prevent or minimize the negative impacts and to enhance positive effects. It is also established that the planned refurbishment and rehabilitation of the collection points and transfer station will not only improve the existing SWM conditions but also facilitate the continuous and efficient SWM service.

Further, provided that all planned and designed components are implemented coupled with a strict management and control of all wastes generated on site during the establishment phase, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, no significantly adverse environmental impacts are anticipated. Residual and unavoidable impacts can also be addressed by maintaining the designed components. Lastly, by putting into practice the planned design and maintaining the appropriate control systems and facilities identified in this document, the integrity of the assumptions, estimations and recommendations identified in this report can be ensured.

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14. Annexes

Annex 1. Key Articles and Supplemental Laws (Environmental Protection Law (Law No. 754-XII of 1992)

The table below outlines some key articles from the law and the related requirements pertaining to the project.

Article #	Particulars
#14: Environmental Norms and Standards	Stipulates the environmental norms and standards. This provides the general requirements, rules, and procedures in environment management as well as a framework establishing norms and standards for environmental monitoring.
# 19: Water and water bodies	The articles states that surface, groundwater and marine water resources of the Republic can be utilized as long as sufficient water volumes allow such use; water quality is maintained according to the stipulated standard, aquatic flora and fauna should be conserved, water pollution (or any exceedances to the water quality standard) is prohibited, the preservation of the ecological balance as well as the protection of the natural landscape elements.
#20: Air	Exceedances emissions affecting air quality promoting air pollution and air degradation shall be avoided. Emissions should conform to established standards.
#22: Waste Disposal **#41: Environmental Requirements to developments** **#45: Protection against contamination associated with wastes**	Wastes generators have responsibility for the safe disposal of their respective waste, disposed in a manner where opportunities for re-use or recycling and are maximized. It also states the responsibilities of the local authorities in waste disposal. These articles also states the following key elements: • That organizations, establishments, and individuals should seek to implement low-waste (or "zero-waste") approaches, reduce the generation of production and consumption wastes, provide for their proper disposal and utilization; encourage procedures of waste separation, storage, disposal and possibly recycling. • It is prohibited to store and dispose hazardous wastes on areas classified as settlements lands, protected areas, recreational areas, historical / cultural sites, areas within water bodies and water protection zones and/or in areas where there is a risk to the health and safety of its citizens. • Permission for the disposal of waste underground shall be considered as justified after conducting ample ground / soil investigation. Provision for the health and safety of citizens and the protection of the environment is mandatory. • The treatment of wastes and disposal or storage of wastes in landfills is only authorized by the state bodies for nature protection (e.g. SCNR).

Article #	Particulars
#34: Environmental Charges	• Resources user charges and pollution charges include environmental taxes and other compulsory fees associated with the use of natural resources as well as compensative pollution charges associated with emissions, discharges and waste disposal, and conservation and renewal fees imposed on users of natural resources; • Environmental tax rates and other payments associated with the use of natural resources are set in compliance with the legislation and depend on occurrence, quality, renewal capacity, accessibility, complexity, productivity, location, possibility of processing of natural resources and wastes re-use and recycling opportunities and other factors; • Rates of pollution charges associated with emissions, discharges and waste disposal are subject for approval by the Cabinet of Ministers of Uzbekistan as advised by the *Goskompriroda*; • Rates of conservation and renewal fees are subject for approval by the Cabinet of Ministers of Uzbekistan; • Resources user charges constitute part of the primary cost of the product (works or services); • Compensative pollution charges and charges associated with exceeded norms and non-sustainable use of natural resources are collected by levy on the user profit; • Collected resources user charges, conservation and renewal fees are transferred to the national budget; • Collected compensative pollution charges associated with emissions, discharges and waste disposal are transferred to the relevant nature conservation funds; • Paid resources user charges and compensative pollution charges does not exempt from the responsibility to undertake environmental activities and to repair the environmental damage.
#38 Emergency Response and Environmental Hazards	Where accidents occur, an organization should immediately initiate emergency response pursuant to the emergency response action plan with notification to respective governmental bodies, environmental authorities and emergency response organizations to mitigate environmental impacts associated with the accident.

Chapter VI, Articles 24-27 is directed to the SEE, which is a mandatory technical review that must be completed prior to making an economic decision. It states that the implementation of projects without a positive finding, or conclusion, from the SEE shall be prohibited. Chapter X, Articles 41-46, establishes the environmental requirements for various types of economic and commercial activities. Assessment and decisions on development and implementation of large scale projects that may have significant negative environmental impacts rest only with the Cabinet of Ministers, based on the recommendations and conclusion of the SEE.

As a supplement to the Law No. 754-XII of 1992, the following legal and regulatory laws, national decrees and resolutions are used to manage specific environmental issues;

National Laws

- Law of the Republic of Uzbekistan on State Sanitary Supervision No.657-XII of 03.07.1992 (as amended on 03.09.2010)
- Law of the Republic of Uzbekistan on Water and Water Management No.837-XII of 06.05.1993 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Local Government Authorities No.913-XII of 02.09.1993 (as amended on 31.12.2008)

- Criminal Code, Section 4. Environmental Crimes, approved on 22.09.1994 (as amended on 04.01.2011)
- Code on Administrative Liability, approved on 22.09.1994 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Subsoil No.2018-XII of 23.09.1994 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Atmospheric Air Protection No.353-I of 27.12.1996 (as amended on 10.10.2006)
- Law of the Republic of Uzbekistan on Protection and Use of Flora No.543-I of 26.12.1997 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Protection and Use of Fauna No.545-I of 26.12.1997 (as amended on 04.01.2011)
- Land Code, approved on 30.04.1998 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on State Land Cadastre No.666-I of 28.08.1998 (as amended on 03.12.2004)
- Law of the Republic of Uzbekistan on Forestry No.770-I of 14.04.1999 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on the Protection of the Population and Areas against Natural and Man-Made Emergencies, No.824-I of 20.08.1999 (as amended on 17.09.2010)
- Law of the Republic of Uzbekistan on Wastes No.362-II of 05.04.2002 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Environmental Expertise No.73-II of 25.05.2000 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Radiation Safety No.120-II of 31.08.2000 (as amended on 18.12.2007)
- Law of the Republic of Uzbekistan on State Cadastres No.171-II of 15.12.2000 (as amended on 04.01.2011)
- Law of the Republic of Uzbekistan on Protected Natural Areas No.710-II of 03.12.2004

National Decrees and Regulations

- Decree of the Cabinet of Ministers of Uzbekistan on the Red Book of the Republic of Uzbekistan No.109 of 09.03.1992
- Decree of the Cabinet of Ministers of Uzbekistan on Restricted Water Use in Uzbekistan No.385 of 03.08.1993 (as amended on 02.04.2010)
- Decree of the Supreme Council of Uzbekistan on Reinforcement of the Protection of Valuable and Endangered Species of Flora and Fauna and Harmonization of their Use No.937- XII of 03.09.1993
- Decree of the Cabinet of Ministers of Uzbekistan on Establishing Quotes for the Calculation of Penalties for Damage Caused to Flora of Uzbekistan No.293 of 27.07.1995 (as amended on 01.04.2005)
- Decree of Oliy Majlis of Uzbekistan on Approval of the Regulations on State Committee for Nature Protection of the Republic of Uzbekistan No.232-I of 26.04.1996 (as amended on 04.01.2011)
- Decree of the Cabinet of Ministers of Uzbekistan on Approval of Regulatory Documents in Conformity with the Law of Uzbekistan on Subsoil No.19 of 13.01.1997 (as amended on 17.12.2010)
- Decree of the Cabinet of Ministers of Uzbekistan on the National Biodiversity Strategy and Action Plan of the Republic of Uzbekistan 139 of 01.04.1998 (as

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- Decree of the Cabinet of Ministers of Uzbekistan on the National Environmental Action Program of Uzbekistan for the period 1999-2005 No.469 20.10.1999 (as amended on 14.04.2004)
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- Decree of the President of Uzbekistan on Measures to Improve the Procedure for Issuing Licenses for the Use of Subsurface Resources No.PP-649 of 07.06.2007 (as amended on 23.12.2010)
- Annex No.2 to Regulation of the Cabinet of Ministers of Uzbekistan "Regulations on State Control and Supervision of Subsoil Management, Conservation, Exploration and Sustainable Use of Mineral Resources" No.19 of 13.01.1997 (as amended on 19.07.2007)
- Annex No.2 to Decree of the Cabinet of Ministers of Uzbekistan "Regulations on the Procedure for Issuing Mining Allotment Permits to Develop Deposits of Mineral Resources" No.20 of 13.01.1997 (as amended on 10.07.2004)
- Annex No.3 to Decree of the Cabinet of Ministers of Uzbekistan "Regulations on the Procedure for Issuing Mining Allotment Permits to Develop Deposits of Mineral Resources" No.20 of 13.01.1997 (as amended on 10.07.2004)
- Annex No.1 to Decree of the Cabinet of Ministers of Uzbekistan "The National Strategy for Reducing Greenhouse Gases Emissions (main provisions)" No.309 of 09.10.2000
- Annex No.2 to Decree of the Cabinet of Ministers of Uzbekistan "Measures to Implement the National Strategy for Reducing of Greenhouse Gases Emissions" No.389 of 09.10.2000
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- Regulation on Water Protection Zones for Water Reservoirs and Other Waterbodies, Rivers, Main and Irrigation Canals as well as for Drinking Water and Household Water Supply Sources, and Sources of Sanatoria and Health Improving Facilities in Uzbekistan, enacted by Decree of the Cabinet of Ministers of Uzbekistan No.174 of 07.04.1992 (as amended on 24.09.2003)
- Instructions on Inventory of Pollution Sources and Rating Pollutant Emissions for Ventures in Uzbekistan, enacted by Order of the Chairman of the State Committee for Nature Protection of the Republic of Uzbekistan No.105 of 15.12.2005. Registered in the Ministry of Justice of Uzbekistan No.1533 of 15.12.2005

Annex 2. National Environmental Impact Assessment (EIA) Process

The Regulation on State Environmental Expertise (SEE), approved by Decree No.491 of the Cabinet of Ministers on 31 December 2001 and amended in 2005 and 2009, defines the need to conduct an EIA in Uzbekistan. SEE is a review process conducted by the *Goskompriroda* for SEE ('*Glavgosecoexpertiza*'). Depending on the project category, EIA reports are submitted at either the national or regional level.

The Regulation on SEE stipulates stages of technical review within the SEE context, ranging from Category 1 (High Risk) to Category 4 (Local Impact). Based on the criteria and the type of activity, the project can be categorized to fall under Category 1 projects or High Risk projects.

In line with Section 10 of the SEE regulation, the promoter must conduct the EIA assessment process (locally known as 'OVOS') in a phased approach, providing relevant documents and information for review by the Glavgosecoexpertiza at different stages of the Project. Section 11 of the Regulation on SEE outlines the information that should be within the documentation at each of these stages. The three stages and the respective report/s are enumerated below:

- The 'Concept on Environmental Impact' (Stage I – 'PZVOS'), to be conducted at the inception or pre-design stage of the proposed project prior to funds being allocated. The report is required to provide details on proposed project / technologies, project components baseline / site conditions, alternatives, anticipated impacts, proposed mitigation measures and other information for making a decision on the project's feasibility.

- The 'Statement on Environmental Impact' (Stage II – 'ZVOS'), to be prepared taking into consideration the findings and conclusions identified by the SEE. Additional investigations or analyses, supplementary field surveys and/or development of additional mitigating measures may be required. This is submitted to the SEE prior to any approval of feasibility of a project and before any construction activities can commence. This statement is also to determine the environmental viability based on the results from field investigations and the feedback from public hearings.

- The 'Statement on Environmental Consequences' (Stage III – 'ZEP') is the final stage of the EIA process. This is done prior to commissioning and project operation. This report provides any alterations done to the project design which may have been required by the SEE and considering the issues discussed during public hearings. A positive SEE endorsement will serve as basis for the project's operation.

EA Clearance and Compliance

> *SEE approval (i.e. Glavgosecoexpertiza positive recommendation) is a pre-requisite document for project financing. On the other hand, construction and operation of the proposed project can only be initiated upon receiving clearance on the EA/SEE from the SCNP.*

Since the Project is most likely to be categorized as High Risk, it is envisaged that SEE procedures for this particular project shall be undertaken at the national level. This process of environmental impact review evaluates:

- the compliance of planned project design and component with the environmental requirements and imposed standards in establishing and operating an sanitary landfill;
- the risk level associated with the project and assess any potential impact/s on the environment and public health; and
- relevance and feasibility of proposed mitigation measures.

Public Participation. Article 4 of the Environmental Protection Law establishes transparency and public participation in regards to environmental information as a principle of national development. Article 12 asserts the right of citizens to (a) live in an environment that is favorable and healthy for current and future generations; (b) demand and receive environmental information; (c) safeguard nature and rationally use its natural resources; and (d) unite in public organizations (NGOs). Article 27 stipulates that independent expert groups, on the initiative of public associations (nongovernmental organizations), can conduct a public EE and finance it *pro bono*. In cases involving expansion of an existing site, public hearings (if any) are held during the first or second phase of the EIA process.

Article 6 of the Law on EE also stipulates that SEE proponents may inform the public of the initiation of a project's SEE. Whenever a notification has been issued, project proponents are required by law to publish its results within a month.

State Committee for Nature Protection (*Goskompriroda*)

The State Committee for Nature Protection (SCNP or 'Goskompriroda') is the lead environmental agency in Uzbekistan. The committee reports directly to the Parliament and is responsible at national, regional (oblast) and local (district) levels for the development and enforcement of the national environmental and conservation policy. This committee also oversees the environmental compliance and management in various sectors, and secures a healthy environment conditions across the country. Its mandate is set within the Regulation on the State Committee for Nature Protection of the Republic of Uzbekistan enacted in 1996. SCNP is organized structurally with a central office in Tashkent with regional branches and agencies providing scientific and technical support.

In support to SNCP, other ministries and agencies in Uzbekistan have similar responsibilities related to environment protection and control. Such functions include facilitation in setting up and maintaining a solid environmental control, development and implementation of environmental programs, strategies, and action plans to address environmental conservation and sustainability issues. These agencies include:

- Ministry of Agriculture and Water Resources (MAWR);
- State Committee for Land Resources, Surveys, Cartography and the State Cadastre (or Goskomgeodezkadastr);
- State Committee for Geology and Mineral Resources (or Goskomgeologia)
- Centre of Hydro-meteorological Service (or Uzhydromet)
- Ministry of Health (or MH-GOU);
- State Inspectorate for Exploration Supervision, Operations Safety Supervision of Industry, Mining and Utilities Sector (or Sanoatgeokontekhnazorat) and
- Ministry of Internal Affairs (or MVD).

Annex 3. Site Investigation / Audit Report

The Government of Uzbekistan (Government), in partnership with the Asian Development Bank (ADB), intends to improve the solid waste management (SWM) system to assure service continuity and improve environmental conditions for Tashkent's 2.3 million inhabitants. It will minimize municipal solid waste (MSW) generation, optimize recycling, upgrade existing collection and transfer systems, and develop a sanitary landfill facility (SLF) for the safe and efficient management of generated MSW.

Solid waste management for the city of Tashkent corresponds to a collection and disposal system managed by IB Maxsustrans. Based on data provided by the SWM operator, about 2,000 tons of municipal solid waste are collected and disposed per day. Around 70% or 1,400 tons corresponds to waste generated by the residential sector with the balance accounted for by the commercial and budget sectors. The residential sector is made up of those residents occupying the High Rise, multi-unit buildings (apartments) and those which live in single detached, privately owned households referred to as Low Rise units. Based on the 2011 collection records, High Rise and Low Rise waste respectively correspond to 42% and 58% of the residential waste. Maxsustrans refers to the combination of waste from market stalls, supermarkets, restaurants, eateries and hotels, other self-financing companies, schools, hospitals, colleges, polyclinics, universities and other learning institutions as commercial waste.

While recognizing SWM sector needs nationwide, government's immediate priority is to rehabilitate Tashkent's SWM system. SWM demands in Tashkent are growing rapidly; the city's population currently generate over 0.5 million tons annually, destined to increase to over 0.7 million tons annually by 2030, and with cumulative generation over this period (2013-30) of over 10 million tons. Although the current system has served the city for over a decade, it is in need of immediate and complete rehabilitation in order to avert potentially serious service disruptions. Most of its 700 MSW collection points require restoration; its MSW collection and transfer vehicle fleets require urgent replacement, and its transfer stations require major overhaul.

1. Facilities Description (Collection Points)

   Waste collection starts at the households and / or at the premise of commercial or governmental institutions. Crucial points in the city's waste collection system are about 700 waste collection points distributed over the 11 districts of the city. The waste collection points are serving mostly residential areas, especially in high-rise residential clusters. This system in its simplicity proved to be highly efficient. There are in general two types of waste collection points within the city; these are guarded and unguarded collection points

   Most rayons (districts) have implemented guarded (and unguarded) waste collection points (or CPs), which are supervised by two employees from Maxsustrans for the guarded CPs. Connected residents dispose their household waste at the designated waste bins at the CP. Maxsustrans collects these wastes once or twice a day to be transported to the landfill. The table below presents the existing number of CPs for the city of Tashkent.

Overview of Existing Waste Collection Points in Tashkent

	Locations	Number of Collection Points (CP)
1	Mirabad-Maxsustrans	44
2	M.Ulugbek-Maxsustrans	63
3	Hamza-Maxsustrans	66
4	Shayhantaur-Maxsustrans	59
5	Yakkasaray-Maxsustrans	33
6	Chilanzar-Maxsustrans	118
7	Bektemir-Maxsustrans	20
8	Sergeli-Maxsustrans	64
9	Olmazor-Maxsustrans	45
10	Uchtepa-Maxsustrans	60
11	Yunusabad-Municipality	104
	Total	**676**

Typical Guarded Collection Point

Typical Unguarded Collection Point

On the other end, household wastes generated from rayons near the landfill and detached family housing areas are collected on a regular door-to-door basis. Unlike the previously mentioned CPs, residents would place their wastes in garbage bags for collection directly on the road for collection. The following image shows the typical scenario for a door-to-door collection.

Mahalla curb-side collection

2. Facilities Description (Transfer Stations)

There are three (3) operating transfer stations in the districts of Yunusabad, Yakkasaray and Khamza. These transfer stations are served by varying garbage collection trucks with capacities ranging from 6 to 10 m³ waste volume (2.5 to 5 tons weight capacity). The original WB project in 2002 recommended the installation of four (4) transfer stations (TS) but due to financial limitations, only three (3) TS were established.

Location Map – TS Yakkasaray

Location Map – TS Yunusabad

Location Map – TS Khamza

The transfer stations were constructed between 1998 and 2003 and were funded by the EBRD/World Bank. The rationale of establishing the TS was to install functional equipment with a high level of environmental control based on World Bank standards which is still evident up to today. These stations utilize a dual push press system, equipped with machinery from Max Aicher, Germany. The compactor pre-presses the waste and pushes it into specialized waste 27m^3 waste container. The existing 92 containers are also from the same company.

Waste Delivery Area

Installed Push Press System

The transfer stations operate 24-hours daily with two shifts per day from 7 am to 8 pm (daytime shift) and from 8 pm to 5am (night time shift). Up to two hours are allocated daily for facility inspections and cleaning prior to the resumption of daily operations.

Each transfer station has a designed average operational capacity 550 to 600 TPD with a maximum capacity 700 TPD.

Based on the field interviews, the delivered German equipment worked for about five (5) years after its installation. However, Maxsustrans changed the hydraulic and electrical systems to available Russian techniques where spare parts were available and used as replacements due to financial reasons.

The transfer stations are based on a closed container systems for pressed waste with a working capacity of volume 27 m³ each (about max. 18 tons each with a waste density of approximately 0.65 t/m³). According to site interviews, there were about 95 containers distributed for all transfer stations. However, about 50 are damaged and non-operational to date.

Press Containers

There are two (2) weighbridges installed in each transfer station; only one appears to be operational.

Weighbridges at TS

Every transfer station (TS) has a computerized waste monitoring system recoding each truck delivery of waste.

Waste Monitoring System

Based on the collection logistic assessment conducted by the TA team vis-à-vis the refurbishment component, it was deduced that two transfer stations would be logistically sufficient to service Tashkent. The transfer stations at Yakkarsaray and Yunusabad district are logistical favorable locations which would also allow possible future improvements and changes in the logistic and transport system (e.g. in case of envisioned waste to rail transport be implemented, these stations have direct access to the existing railway track).

3. Site Investigation and Audit

This assessment has been undertaken to assess the possible impacts brought about by the existing collection points and transfer station. As per SPS 2009, existing facilities will be required to conduct an environmental compliance audit to determine the safeguard compliance status. Where non- compliance is identified, a corrective action plan (CAP) will be prepared and remedial actions will be implemented. This assessment was performed by conducting actual site inspections, interviews and collation of available secondary information. Pertinent regulations related to solid waste management is discussed in the IEE.

3.1 Collection Points

Despite of logistical constraints concerning the waste collection especially with the unguarded CPs and curb-side collection, the general appearance of the city is very clean. Maxustrans has successfully implemented a workable waste management system for the City of Tashkent. The system is working well and as very visible within the city limits, it works very efficiently. According to Maxsustrans, the total households being served by the company is 420,000 households which accounts for 168,000 houses and 252,000 apartments. The household tariff (as of July 2010) is valued at 1,100 *sum*/person/month (equivalent to US$ 0.59/person/month) for every person, including children. It was also observed that apparently population records are maintained at the community level to accurately assess consumer populations. On the other hand, the curb side collection systems in the *mahallas* seem to lag behind in terms of efficiency and transportation against time compared to the CP system.

3.2 Transfer Stations

The transfer stations were established between 1998 and 2003 which entailed the installation of functional equipment with a high level of environmental control based on World Bank standards. It is obvious that the transfer stations to be retained need extensive overhauling for its buildings and infrastructure as also for its electro-mechanical components. Based on the initial assessment and the possible future concepts for the Tashkent waste management system, the existing transfer station system could be maintained. Further, the system can be integrated easily to a waste to rail option, if implemented.

The following matrix will attempt to identify and assess any potential impacts the transfer stations will have on its immediate surroundings. The aim is to take account the current activities vis-à-vis the planned rehabilitation works and determine any areas of concern where these project components may cause or is causing any environmental risks or impacts. To facilitate the identification of the potential impacts brought about by these facilities, a simplified impact identification matrix for addressing and/or summarizing possible environmental impacts was used to suit the requirement.

	YES	NO	Possible Environmental/ Social Impacts	Preventive / Mitigating Measures	Institutional Arrangements
Are relevant facility design issues considered (e.g. site location, type of facility, operational design, energy efficiency, etc.)?	✓		N/A		
Is the access to roads facilitated (i.e. waste collection and transport vehicles)?	✓		N/A		
Is there sufficient storage capacity available, for present and future waste storage?	✓		N/A		
Are there adequate available drainage systems, power supplies, water supplies?	✓		N/A		
Are site buildings situated in a way to minimise potential impacts on neighbouring properties?	✓		N/A		
Are provisions for emergency management incorporated?	✓		N/A		
Is a decommissioning plan available that will return a site to the condition prevailing prior to waste management activities so that it will be suitable for alternative use?		?	Plot remains idle; possible generation of objectionable odours if remaining wastes are not removed from the TS.	Detailed decommissioning plan to be developed by Maxustrans; alternative or subsequent use dependent on local Cadastre.	Maxustrans / Cost to be determined at a later stage

	YES	NO	Possible Environmental/ Social Impacts	Preventive / Mitigating Measures	Institutional Arrangements
Are checking/compliance measures introduced to ensure that waste acceptance is restricted to those types and quantities for which the facility was designed and permitted	✓		N/A	- Strengthen operational monitoring controls at the weighbridge	Maxustrans
Is the description of wastes checked and are records made regarding waste types, quantities, sources and waste carrier?	✓		N/A		
Is periodical testing carried out to determine the type of incoming waste complies and/or specific reference criteria (carried out by Maxustrans) (e.g. checking, sampling and recording of incoming waste and provisions for dealing with non-permitted wastes that are delivered)?		?		- Regular monitoring of incoming wastes - Regular coordination with the *Mahallas* / Tas Public Utilities Operations TUED.	Maxustrans in close coordination with the TAS Public Utilities Operations TUED
Are trainings provided to staff, including new areas of development and refresher courses?	✓		N/A		
Are vehicles subject to regular maintenance and service programmes to ensure that vehicles are running as efficient as possible?	✓		N/A	- Refurbishment of mechanical components / equipment	Maxustrans

	YES	NO	Possible Environmental/ Social Impacts	Preventive / Mitigating Measures	Institutional Arrangements
Are operational procedure/working plans in place, which set out the design, operational considerations and requirements to minimise and control potential nuisance from dust and noise?	✓		N/A		
Is the effectiveness of the design and operational provisions regularly monitored?		?		- Properly operate and maintain all installed equipment - Regular monitoring	Inclusion to operational cost of Maxustrans
Are all relevant areas (e.g. main transfer stations) as well as roadways regularly cleaned?	✓		N/A		
Are waste delivering/removing vehicles enclosed or covered?	✓		N/A		
Are all waste handling areas regularly inspected and monitored by facility staff?		?		- Regular monitoring of incoming wastes - Enforce strict housekeeping	Inclusion to operational cost of Maxustrans
Is compacting or treatment of malodorous waste carried out in an enclosed area?	✓		N/A		

	YES	NO	Possible Environmental/ Social Impacts	Preventive / Mitigating Measures	Institutional Arrangements
Are site roads regularly maintained?		?		- Repairs and preventive maintenance for access roads	Inclusion to operational cost of Maxustrans
Are perimeter planting, fencing and landscaping to reduce wind impacts installed?	✓		N/A		
Is the plant and equipment adequately maintained to mitigating noise levels?	✓		N/A		
Are noisy equipment located away from residential areas and enclosed if possible?	✓		N/A		
Is the operation carried out in a way which prevents spillage or escape of substances that could pollute the surface water system?	✓		N/A		
Are appropriate emergency procedures implemented?	✓		N/A		

4. Findings and Areas of Concern

PROJECT COMPONENT: Guarded Collection Points

Observations / Notes:

- About 650 collection points have been established. Waste bins, typical an open 0.75m^3 steel bin or into a covered standard 1.1m^3 wheeled steel bin
- Households especially high-rise residents dispose generated household wastes into designated wastes bins at the CP.
- Observably an improvement compared to previous conditions where MSW was disposed haphazardly in open, undesignated areas.
- Collection is done once or twice a day by Maxustrans
- Guarded CPs are supervised by two Maxustrans employees.
- Recyclables are “pre-sorted” by the CP personnel.

Tasks included in the TA 8004 : **Conversion of CPs to guarded CPs and rehabilitation of CPs; minor civil works, connection to public utilities, provision of new waste bins**

Remarks: Generally guarded collection points appear to be clean, working well and efficient to handle generated MSW due to its concept and simplicity. Basic, existing infrastructure elements; no permits required; no additional assessment needed due to i.e. limited measurable elements.

PROJECT COMPONENT: Unguarded Collection Points

Observations / Notes:

- There are about 350 unguarded collection points established.
- Residents in close proximity to these CPs dispose generated household wastes into these unguarded collection points.
- Collection is done at least once a day by Maxustrans
- Collection observed to be regular ; in general most CPs are clean
- Structural improvements are needed for most unguarded CPs
- Conversion to guarded CPs recommended
- This is different from the curb-side collection in the *Mahallas*

Tasks included in the TA 8004 : **Conversion of these unguarded CPs to guarded CPs ; provision of new functional bins**

Remarks: Compared to the guarded CPs, some unguarded collection points are at times full of generated household wastes. Although it is also noted that in general, most of these unguarded CPs are clean. Basic, already existing infrastructure elements; no permits required; no additional assessment needed due to limited measurable elements.

FINDINGS: The city through its designated service provider has successfully implemented a workable waste management system for the City of Tashkent. The system is working well and as very visible within the city limits, it works very efficiently. The unique system of collection points is, based on informal waste segregation activities, a very valuable and efficient recycling unit for the city. On the other hand, the door-to-door service seems to lag behind in terms of efficiency and transportation against time compared to the CP system. Despite of some problems concerning the waste collection especially with the unguarded CPs and door-to-door collection, the general appearance of the city is very clean.

COMPARISION OF SOLID WASTE CONDITIONS – Tashkent Collection Points

1997 **2012**

Comparably, there is a clear improvement of the solid waste conditions since 1997. The collection point rehabilitation works is simply to physically replace waste bins, rehabilitate existing 'guarded' facilities (providing basic concrete walls, floors, storage bays, small covered structures, gates, and the provision of shovels), and upgrade certain 'unguarded' collection points to 'guarded' collection points through provision of the same. These are micro facilities of which only involves manual-based construction works have virtually no impact. As practiced, these facilities will be kept clean and organized by Maxustrans personnel. In essence, there is virtually no change in the operations and any impacts are negligible. Therefore, there are no envisaged potential impacts on the environment, involuntary resettlement or Indigenous People.

PROJECT COMPONENT: Transfer Station

Observations / Notes:

- Three (3) operating transfer stations in Yunusabad, Yakkasaray and Khamza districts. Strategic location and adequately sized for handling collected MSW.
- Collection Truck capacities 6 to 10 m^3 (About 2.5 to 5 tons)
- Constructed between 1998 to 2003 with a dual push press system
- TS have an average operational capacity of 550 tpd to 600 tpd with a maximum capacity up to 1,500 tpd (24hr operation).
- Due to financial constraints – readily available replacement spare parts were used for its hydraulic and electrical systems.
- Most press containers are either damaged or non-operational.
- Single operating weighbridge.
- Computerized monitoring system.
- Dilapidated infrastructure with an outdated collection fleet

Tasks included in the TA 8004: **Rehabilitation of two transfer stations and closure of a third (Khamza TS). This is complemented by the provision of a new transfer fleet**

Remarks: The Transfer Stations were planned and build within a WB project in 2002 and fulfills WB technical and environmental standards. In spite of the financial and operational limitations, the transfer station is organized, clean, has a functional control system and still able to service the city's MSW. In view of the established operational control systems, there are no perceivable impacts on the environment, involuntary settlements or Indigenous People. Functional and operating TS facility, no additional permits or assessment is deemed necessary as the TA will only involve the refurbishment of electro-mechanical components. Future assessment/s (audit) can be performed to determine the efficiency of the improvements and identify appropriate corrective programs (CAP), if applicable.


Transfer Station in Yakkasaray District


Transfer Station in Yunusabad District


Transfer Station in Khamza District

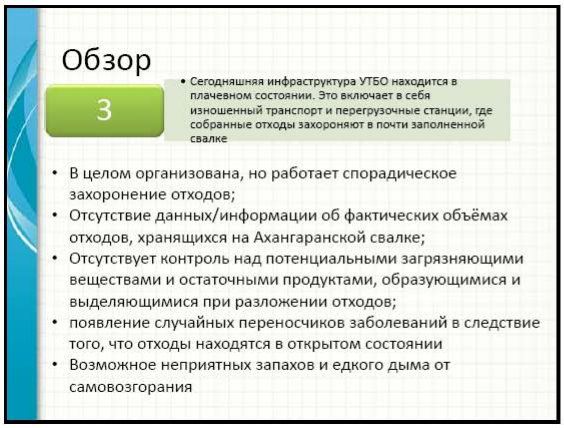
In spite of the well maintained TS equipment and good environmental controls, it is about time that both transfer stations be renovated including the needed refurbishment of its electro-mechanical components.

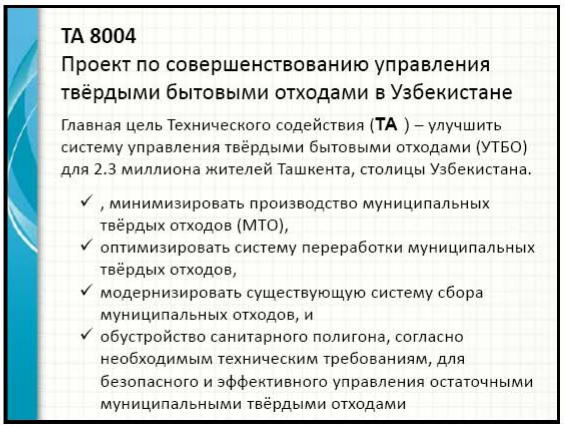


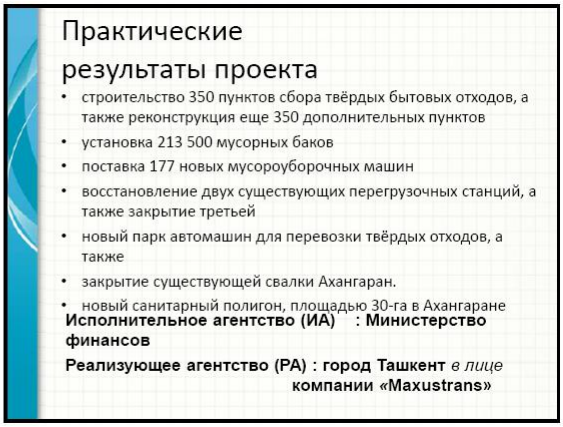
FINDINGS: Based on the existing circumstances, the entire equipment (e.g. trucks, transfer stations, containers etc.) are well maintained in spite of the logistical constraints (e.g. procurement of spare parts) \. It was also noted that the technical staff seems highly motivated to fix everything using available and local replacements. Nevertheless, due to age, lack of spare parts (mainly due to the financial pressures) and regular downtime, most of the equipment is obsolete and would most likely remain idle.

From the abovementioned description, it is clear that these facilities do not pose any environmental and social concerns. Areas of concern are more inclined towards the operational aspect of the transfer station (e.g. efficient facility operation and monitoring). In view of the existing conditions, it is tantamount that rehabilitation and refurbishment of its equipment to abate any deleterious impacts be realized as soon as possible before any equipment totally becomes non-functional and irreparable. This is to ensure not only the continuous conveyance of wastes from the city to the landfill but also to maintain the installed environmental controls and avoid a potential SWM crisis. Based on the initial discussions of possible future concepts for the Tashkent waste management system, these transfer stations system could be integrated later to a waste-to-rail, a long term sustainable waste management system for Tashkent.

Annex 4. Public Consultation







САНИТАРНЫЙ ПОЛИГОН (САН ПОЛ)

Rationale Предыстория: Почему санитарный полигон

Открытая свалка	Санитарный полигон (сан. пол.)
• Ограниченный потенциал • отсутствует подготовка места и нет планирования секций – отходы захороняются на большей части свалки • тонкий слой отходов – относительно быстрое аэробное разложение • отсутствие системы управления свалочными водами и газом • Недостаточное уплотнение отходов • мусор развевается по территории свалки и за ее пределами – отсутствует ограждение • неконтролируемое присутствие паразитов, вредителей и животные • Сбор отходов и их сбыт	• включение предупредительных контрольный мер в концептуальный дизайн проекта • запланированный потенциал с фазовым развитием секторов • полностью контролируемое управление и обработка выбросов и стоков • всесторонняя подготовка объекта и проектирование хранения • Уплотнение отходов до максимальной указанной плотности • Подробная регистрация объемов, видов и источников отходов • Особая эксплуатационная процедура для по защите благоустроенности местных жилищ, включающая контроль за переносчиками инфекций • ворота и другая инфраструктура полигона для исключения входа посторонних и сбора отходов • содействие сортировке и вторичной переработке отходов на месте источника отходов или на пунктах сбора отходов

Техническое описание проекта (Сан. пол.)

- **Расположение**
  Прилегает к существующей Ахангаранской свалке
- **Площадь**
  30 гектар

Техническое описание проекта (Сан. пол.)

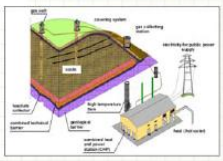
Первичная Эксплуатация - спустя 6 месяцев после начала строительства

Эксплуатационный период Санитарного полигона: 5-7 лет

Техническое описание проекта (Сан. пол.)

Основные характеристики

- **Многоступенчатая система защиты**
- **Система сбора свалочных вод и улавливания свалочных газов**
- **Система сбора и обработки свалочных вод и свалочного газа**



Техническое описание проекта (Сан. пол.)

Средства технического обслуживания

- Ограждения по периметру
- Входные ворота/ Контрольно-пропускной пункт/ Отсеки для мытья
- Мостовые весы
- Электростанция
- Административное здание
- Мастерская
- Место для парковки
- Резервуар для обработки свалочных вод
- комната отдыха и раздевалка для рабочих
- Скважины для мониторинга
- Дренажная система

ОЖИДАЕМЫЕ ЭКОЛОГИЧЕСКИЕ ПОСЛЕДСТВИЯ

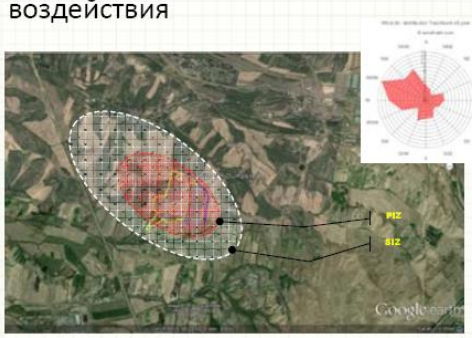
Ожидаемые экологические последствия

- Выбросы при строительных работах и эксплуатации Сан. пол.
- Возможное появление неприятных запахов
- Возможное появление насекомых и вредителей
- Сопутствующие риски, связанные с профессиональными заболеваниями и охраной труда

ПРЕИМУЩЕСТВА

- Улучшенная система записи объёмов, видов и источников отходов
- Надлежащее захоронение остаточных отходов на санитарном полигоне, отвечающем техническим требованиям
- запланированный потенциал с возделыванием секторов полигона по фазам
- Определенные эксплуатационные мероприятия для защиты принимающей среды
- Обеспечение эффективного восстановления объекта и закрытия существующей свалки

Зоны первичного и вторичного воздействия



План управления окружающей средой (EMP)
Фаза капитального строительства

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Расчистка земель	Возможная эрозия почв	Краткосрочное и временное	• включает земляные работы и другие аналогичные мероприятия на территории границ проекта • Незамедлительная стабилизация участка сразу же по завершению работ по выемке и насыпи • введение растительного покрова на тех участках, которые будут постоянно открыты • Покрытие из гальки или гравия тех зон, которые остаются открытыми в течение длительного периода времени • Использование наиболее подходящего инженерно-технического подхода при работе с крутыми подъемами и другими холмистыми частями полигона • Значения максимального ускорения грунта (PGA) для полигона должны быть определены и включены в проект
	Флора	Временное и краткосрочное	• Повторная высадка растительного покрова, характерного для местности в зоне территории Сан. пол., где это будет наиболее подходяще

План управления окружающей средой (EMP)
Фаза капитального строительства

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Расчистка земель	Образование сдуваемой пыли	Временно, но долгосрочно	• Открытие только одной зоны для возделывания согласно запланированной фазовой основе • Минимизация передвижения транспортных средств в зоне строительства • Покрытие участков, подвергающихся действию, брезентом или аналогичным материалом/применение материалов, укрепляющих склоны • создание буферных зон и заборов
	Появление шума	Временно и краткосрочно	• установка глушителей и звукопоглощающих устройств для техники и оборудования • Недопущение работы во время отдыха/ночное время • регулярное техническое обслуживание оборудования • установление заборов вокруг территории работ в качестве ограждения • ввести норму минимальной скорости в периметре объекта

План управления окружающей средой (EMP)
Фаза капитального строительства

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
	Трафик	Временно и краткосрочно	• Регулирование въезда и выезда транспортных средств и оборудования на строительной площадке • Надлежащее регулирование доставки материалов на строительную площадку • Ввод минимальной скорости на строительной площадке • Не допускать размещения транспортных средств на протяжении длительного времени на территории строительной площадки • Регулярный мониторинг для обеспечения того, что транспортный поток остается оптимальным, а также должны быть немедленно приняты меры по очистке от строительного мусора
	Охрана труда и техника безопасности	Временно и краткосрочно	• Вводное и ориентационное собрания будут посвящены всеми работниками. Кроме того рекомендуется проводить инструктаж. • только квалифицированные работники будут приняты на работу • строгое установление и контроль использования индивидуальных средств защиты работниками • Предоставление руководства по технике безопасности и охране труда, требование размещения знаков безопасности и плакатов • Ограничить передвижение персонала в опасных зонах • Должны быть предоставлены страховые полисы для компенсации работников. • Проведение информационных и обучающих программ по технике безопасности и охране здоровья должны быть проведены назначенным

План управления окружающей средой (EMP)
Фаза эксплуатации

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Эксплуатация санитарного полигона	Выбросы в атмосферу / Качество воздуха	Постоянно и долгосрочно	• Ожидается, что выброс свалочных газов (т.е. появление неприятных запахов) будет небольшим • Обеспечение всех сотрудников соответствующими СИЗ • Мониторинг качества воздуха, основанный на определенной программе мониторинга • Регулирование движения транспорта в периметре полигона для минимизации выбросов
	Техника безопасности и охрана здоровья	Значительно, постоянно и долгосрочно	• Строгий ввод и контроль использования СИЗ персоналом, особенно тех, кто занимается обработкой отходов • Обеспечение и требование знаков безопасности, а также руководства • Ограничение передвижение персонала в опасных зонах • Должны быть предоставлены инструкции по ОТТБ и страховые полисы для компенсации работников • Проведение информационных и обучающих программ по технике безопасности и охране здоровья • Сделать доступными аптечки первой помощи на территории полигона • выделить транспортные средства, на которых можно будет доставить пострадавших в больницы • Строгий мониторинг входа и выхода посторонних на территорию полигона

План управления окружающей средой (EMP)
Фаза эксплуатации

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Эксплуатация санитарного полигона	Качество подземных вод	Значительно, постоянно, долгосрочно	• Использование покрытие из полиэтилена высокой прочности, а также строительство системы сбора и обработки свалочных вод , как спроектировано и запланировано • мониторинг качества свалочных вод • Обеспечение того, что свалочные воды не просачиваются в грунт посредством проведения систематической проверки покрытия до начала захоронения • ебеспечение сбора и обработки свалочных вод • надлежащее покрытие полигона после того, как сектор заполнен. • Возсождение растительного покрова на тех участках, где это будет подходящим с целью содействия эвапотранспирации и перенаправления части осадков.
	Шум	Незначительно, долгосрочно и постоянно	• Установка глушителей и устройств звукоглощения для техники и оборудования • Недопущение работы во время отдыха • регулярное техническое обслуживание оборудования • ввести норму минимальной скорости в периметре объекта

План управления окружающей средой (EMP)
Фаза эксплуатации

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Эксплуатация санитарного полигона	Трафик	Значительно, долгосрочно и постоянно	• Регулирование въезда и выезда транспортных средств и оборудования на санитарном полигоне • Все мусоровозы должны сопровождаться транспортной накладной на вывоз отходов/юридическими документами, чтобы избежать долгого ожидания у ворот въезда • ввести норму минимальной скорости в периметре объекта • Не допускать нахождения транспортных средств на протяжении длительного времени на территории полигона • Соответствующее обслуживание внутренней дорожной сети • Использовать систему управления потоком на въезде/выезде в/с территории полигона. План движения транспорта должен быть разработан таким образом, чтобы не стесняять затруднять движение потока
	Насекомые и другие вредители	Значительно, временно и кратковременно	• Убедитесь того, что все контейнеры надлежащим образом закрыты во избежание , чтобы избежать их раскрытия • каждый раз по завершению эксплуатации должно проводиться покрытие

План управления окружающей средой (EMP)
Фаза эксплуатации

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Эксплуатация вспомогательных сооружений (например, Установка по обработке свалочных вод)	Выбросы в атмосферу	значительно, постоянно и долгосрочно	• Ожидается, что неприятный запах будет постоянной чертой установки. Поэтому необходимо, чтобы наиболее подходящие вентиляционные системы были установлены. Это система также должна обеспечивать соответствующий уровень воздухообмена для минимизации застоя воздуха в пределах установки. • обеспечение всех работников соответствующими СИЗ • мониторинг качества воздуха (внутри и вне) с помощью определенной программы мониторинга • регулярный мониторинг любых на предмет утечек (потери давления) и/или разлива
	Техника безопасности и охрана здоровья	значительно, постоянно и долгосрочно	• Обучение персонала, непосредственно связанного с эксплуатацией и обслуживанием • Обеспечение необходимых СИЗ и строго ввода и контролировать их использования сотрудниками • Обеспечить требуемых знаков безопасности и плакатов, а также ограничения передвижения персонала в опасных зонах • Проведение информационных и обучающих программ по технике безопасности и охране здоровья • Сделать доступными аптечки первой помощи • Строгий мониторинг входа и выхода посторонних на территорию полигона • Обеспечить необходимых уборных для сотрудников

План управления окружающей средой (EMP)
Фаза эксплуатации

Источники воздействия	Последствия	Тип/Степень влияния	Смягчающие меры/Меры по улучшению
Эксплуатация вспомогательных сооружений (например, Установка по обработке свалочных вод)	Качество подземных вод	Умеренное, постоянно и долгосрочно	• убедитесь, что все контейнеры и трубы герметичны • убедитесь, что не имеется утечек в контейнерах и трубах • когда бы не требовалось все полы должны быть герметичны • обеспечьте, что свалочные воды и другие разливы были тщательно собраны и не проникли в чувствительные зоны • Потребление воды должно контролироваться
	Шум	незначительно, весьма незначительно и кратковременно	**Примечание:** *Эксплуатация установки не является источником высокого уровня шума. Чрезмерный шум будет кратковременным.*

Порядок рассмотрения жалоб

Pictures of the Public Consultation
April 11, 2013 held at the Tas Public Utilities Operations Office

Public Consultation Poster


Mr. Rakhimov from the Tas Public Utilities Operations welcoming the attendees to the public Consultation

ADB Environmental Consultant explaining the SLF project, the associated environmental impacts and the Environmental Management Plan (EMP)

Open Discussions

Attendance List and Minutes of the Public Consultation
11:00 AM, 11th April 2013 held at the Tas Public Utilities Operations Office

Consultation Meeting Agenda

11:00 – 11:15 **Welcome and Introduction**

Mr. Kurbonov Rauf Asadullayevich
Deputy Director – Tas Public Utilities Operation TUED

11:15 – 11:45 **SLF Project Presentation**

Overview / SWM Status
Objectives of TA 8004 / Outputs
Sanitary Landfill Facility and its features
Environmental Assessment of the SLF
Anticipated Environmental Impacts
Environmental Management Plan (EMP)
Conclusion
Q&A Session

11:45 – 12:45 **Open Discussions**

Closing Remarks

Name of Organization	Name / Contact Details
1. IB “Maxustrans”	Mr. Shukhrat Asilovich Inogamov, Deputy Director Industrial zone “Bekabad”, Tashkent ring road, Tashkent, Uzbekistan Phone: 9053119
2. TAS Public Utilities Operation TUED	Kurbonov Rauf Asadullayevich Deputy director
3. TAS Public Utilities Operation TUED	Mr. Alimdjan Rakhimov Specialist Glinka,25, 100070, Tashkent, Uzbekistan
4. Tashkent “Mahalla” Fund	Mr. Zakhidov Azim – Senior specialist, Movarounnahr str., #6, Tashkent, Uzbekistan
5. Tashkent Enterprise for Waste Recycling	Mr. Shotursunov Anvar Sanitary Landfill Director Zebo Shamsutdinova str., #42 Tashkent, Uzbekistan Phone: 2906679
6. Tashkent City Committee for Nature Protection	Mr. Artur Airatovich Mustafin Deputy Chairman 100043, Uzbekistan, Tashkent, 7, Bunyodkor Ave

Name of Organization	Name / Contact Details
7. Ministry of Health Central Administrative Office	Mukhammedov Komil Head 12, Navoi street, Tashkent city, Republic of Uzbekistan Phone: +998 (71) 244-10-41
8. USCA	Mr. Nizom Specialist Tashkent, Niyozbek yuli str, 1 Phone: +998 97 474 0785
9. Maxustrans Labor Union	Tatyana Industrial zone “Bekabad”, Tashkent ring road, Tashkent, Uzbekistan Phone: 2470211

Question / Comment	Response
Mr. Artur Mustafin from Goskompriroda on the SWM Approach Provision of 213, 500 new collection bins considering that previous calculates fewer number of bins are needed	Considered that provision of wastes bins not only for the collection points for the high-rise but also included providing for low rise residential areas (*in lieu* of the curb side collection system) in the *mahallas*
*Mr. Rauf Kurbanov o*n the SWM Approach Provision of 177 new MSW collection vehicles in spite the acquisition of new vehicles by about 30% household unions through the housing management companies.	This development was considered in the assessment which also confirmed by Mr. Shukhrat Inomov of IB Maxustrans.
Closure of the third transfer station	Based on a detailed logistic concept, refurbishment of the two transfer station and closure of the third station is necessary to optimize costs and collection economics.

Question / Comment	Response
Mr. Mukhammedov Komil from the Ministry of Health on the SWM Technology Choice Were other technologies like incineration considered? And why such as facility with a serviceable lifespan of 5 to 7 years was chosen.	The initial environmental assessment considered available SWM alternatives like incineration. Aside from the economic constrains of procuring such technology, the government of Uzbekistan has yet to reach a consensus on this matter. Moreover, the environmental impacts of such technologies outweigh the anticipated impacts from establishing an SLF because of its design integrated control features. Mr. Artur Musafin of *Goskompriroda* confirmed this stating that this issue was tackled during the deliberations of the Reconstruction fund which was immediately rejected by the Minister due to the high investment cost. Regarding the serviceable lifespan of the SLF whilst considering the exhausted capacity of the existing dumpsite in Akhangaran, it is deemed that the establishment of the SLF will address the immediate dilemma of the continuous flow of waste from Tashkent. Moreover, it is envisaged that this time frame is sufficient for the government to decide on a long-term SWM solution not only for Tashkent city but for the entire oblast.
Mr. Shukhrat Inogamov on the SLF Design and the procurement of equipment dedicated to the SLF. Was this included in the financial calculations?	The SLF design is a far improvement from the existing SWM practice of dumping wastes. This would also improve controls as well as monitoring capabilities and provide an opportunity to properly close and effectively the existing dumpsite minimizing or eliminate the pollution potential. Financial calculations also included the procurement of equipment dedicated for the SLF

Annex 5: IMPACT IDENTIFICATION MATRIX

Topical Issues	Yes	Maybe	No
***Land form*:** Will the project result in:			
▫ Unstable slopes or embankments?			✓
▫ Extensive disruption to or displacement of the soil?		✓	
▫ Impact to land classified as prime or unique farmland?	✓		
▫ Changes in ground contours or stream channels		✓	
▫ Destruction, covering or modification of unique physical features?			✓
▫ Increased wind or water erosion of soils?		✓	
▫ Foreclosure on future uses of site on a long-term basis?	✓		
***Air/Climatology*:** Will the project result in:			
▫ Air pollutant emissions that might exceed the Standards or cause changes in ambient air quality?		✓	
▫ Objectionable odors?		✓	
▫ Alteration of air movements, humidity, or temperature?			✓
▫ Emissions of Hazardous air pollutants?			✓
***Water*:** Will the project result in:			
▫ Discharge to public water system?			✓
▫ Changes in absorption rates, drainage patterns, or the rate and amount of surface water runoff?		✓	
▫ Alterations to the course or flow of floodwaters?			✓
▫ Alteration of the direction or rate of flow of groundwater?			
▫ Alterations in groundwater quality?			✓
▫ Contamination of public water supplies, if applicable?			✓
▫ Location in a floodplain?			✓
▫ Exposure of people or property to water-related hazards such as flooding?			✓
***Solid Waste*:** Will the project:			
▫ Generate significant solid waste or litter?		✓	
***Noise*:** Will the project:			
▫ Increase existing noise levels?		✓	
▫ Expose people to excessive noise?		✓	
***Plant Life*:** Will the project:			
▫ Change the diversity or productivity of species or number of any species of endemic plants?			✓
▫ Reduce the numbers or affect the habitat of any rare and endangered species?			✓
▫ Introduce new species of plant into the area or create a barrier to the normal replenishment of existing species?		✓	
***Animal Life*:** Will the project:			
▫ Change the diversity or productivity of species or number of any species of animals?			✓
▫ Introduce new species of animals into the area or create a barrier to the normal replenishment of existing species?			✓
▫ Cause attraction, entrapment, or impingement of animal life?			✓
▫ Harm wildlife habitats?			✓
▫ Cause emigration resulting in human-wildlife interaction problems?			✓

Topical Issues	Yes	Maybe	No
***Land Use*:** Will the project:			
▫ Substantially alter the present or planned use of the area?	✓		
Natural Resources: Will the project:			
▫ Increase the rate of use of any natural resources?		✓	
▫ Substantially deplete any non-reusable natural resource?			✓
▫ Be located in an area designated as National Parks, Bird Sanctuaries, Protected Areas, etc. as prescribed by law?			✓
***Energy*:** Will the project:			
▫ Use substantial amounts of fuel or energy?		✓	
▫ Substantially increase the demand on existing sources of energy?			✓
***Transportation and traffic circulation*:** Will the project result in**:**			
▫ Movement of additional vehicles?		✓	
▫ Effects on existing parking facilities or demand for new parking?	✓		
▫ Substantial impact on existing transportation systems?			✓
▫ Alterations to present patterns of circulation or movement of people and/or goods?			✓
▫ Increased traffic hazards to motor vehicles, bicyclists, or pedestrians?			✓
▫ Construction of new roads?			✓
***Public Service*:** Will the project have an effect on, or result in, a need for new or altered governmental services in any of the following areas:			
▫ Fire protection?			✓
▫ Schools?			✓
▫ Other governmental services?			✓
***Utilities*:** Will the project result in a need for new systems or alteration to the following utilities:			
▫ Power and natural gas?			✓
▫ Communications systems?			✓
▫ Water?			✓
▫ Sewer or septic tanks?			✓
▫ Storm sewers?			✓
***Socioeconomic*:** Will the project:			
▫ Alter the location or distribution of human population in the area?			✓
▫ Involve a risk of explosion or release of potentially hazardous substances?			✓
▫ Create any health hazard or potential health hazard?		✓	
▫ Expose people to potential health hazards?		✓	
▫ Have any adverse effect on local or regional economic conditions, e.g., tourism, local income levels, land values, or employment?			✓
▫ Potentially controversial?			✓
▫ In conflict with locally adopted environmental plans and goals?			✓
▫ Displace people living within the project area?			✓
***Aesthetics*:** Will the project:			
▫ Change any scenic vista or view open to the public?	✓		
▫ Affect the views or access of natural or cultural landscape features?		✓	
▫ Introduce new materials, and forms to the immediate landscape?			✓

Topical Issues	Yes	Maybe	No
Environmental Hazards**:** Will the project: ▫ Involve the use, storage, release of, or disposal of any potentially hazardous substance? ▫ Involve generation, transport, storage and disposal for any regulated hazardous substances (e.g. asbestos from construction and demolition wastes)? ▫ Cause an increase or probability of increase of environmental hazards? ▫ Be susceptible to environmental hazard due to its location?		✓	✓ ✓ ✓
Archaeological, Cultural, and Historica**l:** Will the project: ▫ Alter any site or structure of historic significance? ▫ Affect known archaeological or paleontological sites?			✓ ✓

Prediction of Potential and Perceived Impacts

The matrix showed that the following potential impacts are expected upon the construction and operation of the project (those checked YES and MAYBE).

Impact Prediction Matrix

Environmental Component	Perceived Impact
Landform	▫ Construction shall involve extensive disruption to or displacement of soil ▫ Changes in contours due to land preparation ▫ Modification of the physical features common to the area ▫ Possibly increase erosion of soils
Air/Climatology	▫ Emissions may exceed the prescribed standards or may cause changes in ambient air quality. ▫ Operation will result to the generation of objectionable odors.
Water	▫ May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff.
Solid Waste	▫ Generation of waste from the rehabilitation of the dumpsite
Noise	▫ The project may Increase existing noise levels and ▫ Potentially expose people to excessive noise

Impact Prediction Matrix

Environmental Component	Perceived Impact
Plant Life	▫ Introduce new species of plant into the area as part of the green buffer zone
Transportation and Traffic Circulation	▫ Movement of additional vehicles. ▫ Effects on existing parking facilities or demand for new parking. ▫ Construction of New Roads
Socio-economics	▫ Potential create health hazards especially among workers inside the project site ▫ Increase exposure of workers to potentially health hazards.
Aesthetics	▫ Changes in scenic vista or view open to the public. ▫ Introduce new materials, colors, and forms to the immediate landscape.
Environmental Hazards	▫ Possible generation of leachate

Impact Assessment

The following matrix will classify the impacts identified in the preceding sections according to type (positive or negative), intensity, and project phase. A positive impact indicates an enhancement to existing, environmental conditions while a negative impact means deterioration of the existing environmental setting. **Under the Project Phase Occurring Heading**, C – Construction Phase and O – Operation Phase. **Under the Intensity heading**, I – Insignificant, M –Moderate, S – Significant, *LT – Long Term, ST – Short Term*, R – Reversible, IR – Irreversible.

Impact Assessment Matrix

Environmental Component	Positive	Negative	Project Phase Occurring	Intensity
Landform				
▫ Construction shall involve extensive disruption to or displacement of soil		X	C	M,ST,IR
▫ Changes in contours due to land preparation		X	C	M,LT,IR
▫ Modification of the physical features common to the area		X	C,O	M,LT,R
▫ Possibly increase erosion of soils		X	C	M,ST,IR

Impact Assessment Matrix

Environmental Component	Positive	Negative	Project Phase Occurring	Intensity
Air/Climatology				
▫ Emissions may exceed the standards or may cause changes in ambient air quality.		X	C,O	I,ST,R
▫ Operation will result to the generation of objectionable odors.		X	C,O	I,ST,R
Water				
▫ May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff.		X	C,O	I,LT,IR
Solid Waste				
▫ Generation of waste from the rehabilitation of the dumpsite		X	C	M,ST,R
Plant Life				
▫ Introduce new species of plant into the area as part of the green buffer zone	✓		O	S,LT,R
Transportation and Traffic Circulation				
▫ Movement of additional vehicles.		X	C,O	I,LT,R
▫ Construction of New Roads	✓		C,O	I,LT,R

Environmental Component	Positive	Negative	Project Phase Occurring	Intensity
Socio - Economics				
▫ Potential create health hazards especially among workers inside the project site		X	C,O	M,LT,R
▫ Increase exposure of workers to potentially health hazards.		X	C,O	M,LT,R
Environmental Hazard				
▫ Possible generation of leachate		X	O	I,ST,R
Aesthetics				
▫ Changes in scenic vista or view open to the public.	✓		O	M,LT,R
▫ Introduce new materials, colors, and forms to the immediate landscape.	✓		O	M,LT,R

Legend:
Under the Project Phase Occurring Heading
C – Construction Phase and O – Operation Phase.

Under the Intensity heading,
I – Insignificant, M –Moderate, S – Significant,
LT – Long Term, ST – Short Term
R – Reversible, IR – Irreversible.

Discussion of the Impact Assessment Matrix

The establishment and the eventual operation of the proposed project are anticipated to include environmental, health and safety concerns that need to be identified and assessed. This section will present in tabular form the identified **insignificant** impacts for each phase of project development.

Phase	Negative Impacts	Positive Impacts
Construction	• Emissions may exceed the prescribed standards or may cause changes in ambient air quality. • May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff. • Movement of additional vehicles • Construction of new roads	
Operation	• Operation will result to the generation of objectionable odors. • May cause changes in the absorption rates, drainage patterns, or the rate and amount of surface water runoff. • Movement of additional vehicles. • Possible generation of leachate from wastes excavated from the old dumpsite	

The matrix below shows the **moderate and significant** impacts for each phase of project development.

Phase	Negative Impacts	Positive Impacts
Construction	• Construction shall involve extensive disruption to or displacement of soil • Changes in contours due to land preparation • Modification of the physical features common to the area • Possibly increase erosion of soils • Generation of waste from the rehabilitation of the old dumpsite • Potential create health hazards especially among workers inside the SLF • Increase exposure of workers to potentially health hazards.	
Operation	• Modification of the physical features common to the area • Potential create health hazards especially among workers inside the SLF • Increase exposure of workers to potentially health hazards.	• Safe closure and rehabilitation of the existing dumpsite • Introduce local species of plant into the area as part of the buffer zone • Changes in scenic vista or view. • Introduce new materials, colors, and forms to the immediate landscape.

Annex 6 Environmental Management Plan

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
Pre-Construction Phase	**Land Acquisition**	Loss of Agricultural Land	Significant and Long Term	• Proper appraisal and timely compensation as defined in the LARP. • Ensure that irrigation to affected plot/s aside from the allocated area remains unimpeded.	PIU for implementation / PCMU for monitoring	Included in project Cost
Construction Phase Construction of the landfill and its auxiliary facilities	**Land clearing**	Generation of fugitive dusts	Temporary but long term	• Open only one area for development on a by phase basis as planned. • Minimize movement of vehicles inside the construction area • Cover exposed areas with tarps or similar materials / application of slope stabilization materials • Establish buffer zones and fences	Contractor / PIU to monitor for compliance and reporting to PCMU / SCNR	Include such measure in the Contractor's TOR
		Noise generation	Temporary and short term	• Install mufflers and silencers for machines and equipment • Avoid working during rest periods / night time • Regularly maintain equipment • Establish fences around the work area as barrier • Impose minimum speed limits within the project site	Contractor / PIU to monitor for compliance and reporting to PCMU / SCNR	Include such costs in the Contractor's contract

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
Construction Phase Construction of the landfill and its auxiliary facilities		Possible Soil erosion	Short-term and temporary	• Contain excavation and other similar activities within design boundaries • Immediately stabilize areas once cut and fill activities are completed • Introduce vegetative cover in areas that will remain permanently open • Cover with pebbles or gravel areas that are to remain open for a long period of time • Peak Ground Acceleration (PGA) values for the site should be determined and incorporated in the design.	Contractor / PIU to monitor for compliance and reporting to PCMU / SCNR	Include such measure in the Contractor's TOR
		Flora	Temporary and short term	• Re-introduce local occurring vegetative cover in areas within the SLF where it would be most appropriate. Shallow rooted vegetation is recommended	Contractor / PIU to monitor for compliance and reporting to PCMU / SCNR	Include such measure in the Contractor's TOR

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
		Traffic	Temporary and short term	• Regulate the entry and exit of vehicles and equipment in the construction site • Properly regulate delivery of materials into the project site • Impose minimum speed within the project site • Do not allow vehicles to stay within the project site for a long period of time • Regular monitoring to ensure that traffic flow remains optimal and clean-up of any debris can be undertaken immediately. • Regular maintenance of equipment.	Contractor / PIU to monitor for compliance and reporting to PCMU	Include such measure in the Contractor's TOR
Construction Phase Construction of the landfill and its auxiliary facilities		Occupational health and safety	Temporary and short term	• Induction and orientation meetings will be undertaken by all workers. Tool box talks are also recommended. • Only qualified workers will be hired • Strictly impose and monitor use of PPE by workers. Regular inspections will be conducted. • Provide HSE manuals and require placement of safety signs and placards • Restrict movement of personnel in danger zones • Insurance Policy for Workmen Compensation should be provided. • Conduct awareness and training programs on safety and health issues to be handled by the designated HSE Officer.	Contractor / PIU to monitor for compliance and reporting to PCMU	Include such cost / measure in the Contractor's contract

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
Construction Phase	**Closure of the existing dumpsite**		Temporary and long term	• Conduct a detailed site assessment covering the entire 59 hectares • Development of a 'safe closure plan' • Adequate and prompt covering and compaction to prevent exposure of wastes • Induction and orientation meetings with special focus in the use of PPE will be undertaken by all workers. • Require placement of safety signs and placards • Conduct of post-closure environmental monitoring Maintenance of installed facilities. • Precautionary measures should be taken to ensure uncontrolled fires are not started as a consequence of the closure activities.	Contractor / PIU to monitor for compliance and reporting to PCMU / SCNR Post closure management shall be handled by the IA / PIU	Include such cost / measure in the Contractor's contract
Operation Phase	**Operation of the SLF**	Air Emissions / Air Quality	Permanent and long term	• Gas emission (i.e. generation of objectionable odors) from the landfill is expected to be moderate. • Provide all employees with appropriate PPE • Monitor air quality based on a specified in the monitoring program • Regulate movement of vehicles inside the landfill to minimize emissions	Project Implementation Unit (PIU), SCNR for monitoring	Cost should be included in the operating budget

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
		Health & Safety	Significant, permanent and long-term	• Strictly impose and monitor use of PPE by personnel especially those engaged in the handling of wastes • Provide and require safety signs and manuals • Restrict movement of personnel in danger zones • HSE manual and Insurance Policy for Workmen Compensation should be provided. • Conduct awareness and training programs on safety and health issues • Make available first aid kits in the landfill area • Make available a vehicle that can bring victims to hospitals • Strictly monitor the entry and exit of outsiders inside the landfill • Precautionary measures should be taken to ensure uncontrolled fires are not started as a consequence operational activities.	Project Implementation Unit (PIU), PCMU for monitoring	Cost should be included in the operating budget
		Noise	Insignificant, long term and permanent	• Install mufflers and silencers for machines and equipment • Avoid working during rest periods • Regularly maintain equipment • Impose minimum speed limits within the project site	Project Implementation Unit (PIU), SCNR for monitoring	Cost should be included in the operating budget

Project Component	Sources of Impact	Impacts	Type/Degree of Effect	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
		Groundwater quality	Significant, permanent, long term	• use of HDPE liner and establish leachate collection and treatment system as designed and planned • monitor leachate quality, if any • ensure that no leachate percolate into the ground by consistently conducting quality checks of liner prior to disposal. • ensure that all leachate are collected and treated • properly cover the landfill after the cell is filled • Introduce vegetative cover in areas where it would be applicable to promote evapo-transpiration and re-direct portions of the precipitation.	Project Implementation Unit (PIU), PCMU and SCNR for monitoring	Cost should be included in the operating budget
		Vermin & other pests	significant, temporary and short term	• Ensure that all containers are properly enclosed to avoid manifestation • Covering should be done every end of the day's operations	Project Implementation Unit (PIU), PCMU / SCNR for monitoring	Cost should be included in the operating budget

Project Component	Sources of Impact	Impacts	Type/Degree	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
	Operation of the SLF	Traffic	Significant, long term and permanent	• Regulate the entry and exit of vehicles and equipment in the SLF • All dump trucks should carry a waste manifest / legal papers to avoid long stand by times at the gate. • Impose minimum speed within the project site. • Do not allow vehicles to stay within the project site for a long period of time • Proper maintenance of the internal road network. • Employ a traffic management system at the ingress/egress of the project site. A traffic circulation plan should be developed not to hamper the traffic flow.	Project Implementation Unit (PIU), PCMU for monitoring	Cost should be included in the operating budget

Project Component	Sources of Impact	Impacts	Type/Degree	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
	Operation of auxiliary facilities (e.g. Leachate Treatment Plant)	Air Emissions	significant, permanent and long term	• Foul odors are expected to be a permanent feature of the plant. It is therefore necessary that most appropriate ventilation system is implemented. This system should also maintain the appropriate air exchange ratio to minimize stagnation within the plant. • provide all employees with appropriate PPE • monitor air quality (indoor and outdoor) based on a specified in the monitoring program • Regular monitoring for any leaks (loss in pressure) and/or for spills	Project Implementation Unit (PIU), SCNR for monitoring	Included in the operating budget
		Health & Safety	significant, permanent and long term	• Training for personnel pertinent to operations and maintenance. • Provide the necessary PPE and strictly impose and monitor its use by employees • Provide require safety signs and placards and restrict movement of personnel in danger zones • Conduct awareness and training programs on safety and health issues • Make available first aid kits • Strictly monitor the entry and exit of outsiders inside the facility	Project Implementation Unit (PIU), PCMU / SCNR for monitoring	Included in the operating budget

Project Component	Sources of Impact	Impacts	Type/Degree	Mitigation/Enhancement Measures	Institutional Responsibilities	Cost
	Operation of auxiliary facilities (e.g. Leachate Treatment Plant)	Groundwater quality	Moderate, permanent and long term	• Ensure that all containers and tunnels are properly sealed • Ensure no leakages in the containers and tunnels • Whenever applicable, all floors must be properly sealed • Ensure that leachate and other spills are properly collected and not disposed in sensitive areas • Water usage shall be monitored.	Project Implementation Unit (PIU), PCMU SCNR for monitoring	Cost should be included in the operating budget
		Noise	insignificant, negligible and short term	*Note: There are no sources of high level noise from the operation of the plant. Whenever excessive noise is to be generated, this will be short term.*	Project Implementation Unit (PIU), SCNR for monitoring	Cost should be included in the operating budget
		Vermin & other pests	insignificant, negligible and short term	*The presence of vermin and pest will be very minimal since the facility and its equipment are totally closed. To ensure that employees are not exposed to deleterious materials;* • All workers and personnel shall be provided with appropriate PPE • Use of the PPE must be strictly implemented and monitored.	Project Implementation Unit (PIU), PCMU for monitoring	Cost should be included in the operating budget

Annex 7: Proposed Environmental Monitoring Plan (EMoP)

Environmental Components	Parameters	Frequency	Responsible Party	Station/ Location
Air Quality	▪ Nitrogen Dioxide (NO2), VOCs ▪ Particulates - PM10 and PM2. Nitrogen Dioxide (NO2), Sulfur Oxides (SOx), ▪ Noise / Objectionable Odour	▪ Quarterly ▪ Bi –annually ▪ Quarterly / Monthly	**PIU Environmental Specialist**	• On the identified point sources within the premises of the SLF and the old dumpsite • Within the project site including areas at old dumpsite • Within and outside the SLF (1-2 Km North-west and West-North-West end)
Occupational Health and Safety	▪ No of accidents per day/month/ year ▪ Top Ten causes of illness ▪ Worker's housing and sanitation facilities	Bi- Annually	**EHS Officer**	• Within the premises
Groundwater / Leachate Contamination	▪ pH ▪ Conductivity ▪ DO ▪ BOD_5 ▪ TDS ▪ Salinity ▪ Total Hardness ▪ Alkalinity ▪ Carbonates ▪ Oil and Grease ▪ Trace Metals ▪ Coli form	▪ Quarterly	**PIU Environmental Specialist**	• Ground Water Monitoring Wells (whenever installed – *see discussion*) • Leachate Collection and Pump shafts
Residual Wastes	▪ Volume / quality ▪ Characterization of wastes / Type ▪ Efficiency of storage facilities	▪ Annually ▪ Quarterly ▪ Quarterly	**PIU Environmental Specialist / EHS Officer**	• Within the SLF