Feasibility Study and Detailed Design for Solid Waste Management
Gaza Strip

Al Fukhary Landfill Operational Manual

UNDP - PAPP
DHV-ENFRA-TECC
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Draft vs 2
ABBREVIATIONS

BD  Basic Design
BOQ  Bill of Quantities
CBO  Community Based Organization
EIA  Environmental Impact Assessment
EMP  Environmental Management Plan
EU  European Union
EQA  Environmental Quality Authority
ESIA  Environmental & Social Impact Assessment
FD  Final Design
FIDIC  Fédération Internationale des Ingénieurs-Conseils
FS  Feasibility Study
HSM  Health and Safety Manual
ISWM  Integrated Solid Waste Management
JSC  Joint Service Council
LA  Local Authority
MLDF  Municipal Lending and Development Fund
MoD  Ministry of Defense (Israeli)
MoF  Ministry of Finance
MoH  Ministry of Health
MoP  Ministry of Planning
MoLG  Ministry of Local Government
MSW  Municipal Solid Waste
MSWM  Municipal Solid Waste Management
NGO  Non Governmental Organization
NSR  Noise Sensitive Receivers
PA  Palestinian Authority
PD  Preliminary Design
PEnA  Palestinian Environmental Authority
PHG  Palestinian Hydrology Group
PIU  Project Implementation Unit
PM  Program Manager
PTL  Project Team Leader
PMT  Project Management Team
RCV  Refuse Compaction Vehicle
SW  Solid Waste
S/W N/E  South/West, North/East
SWEMP  Solid Waste Environmental Management Project
GSWMP  Gaza Solid Waste Management Plan
ToR  Terms of Reference
UNDP - PAPP  UNDP – Programme of Assistance to the Palestinian People
UNRWA  United Nations Relief and Works Agency
WB  World Bank
# CONTENTS

<table>
<thead>
<tr>
<th>1</th>
<th>INTRODUCTION .................................................................................................................................</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>PURPOSE ...........................................................................................................................................</td>
<td>4</td>
</tr>
<tr>
<td>1.2</td>
<td>ACCEPTABLE WASTE STREAMS FOR DISPOSAL ......................................................................................</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>GENERAL MANAGEMENT STANDARDS .....................................................................................................</td>
<td>5</td>
</tr>
<tr>
<td>2.1</td>
<td>ADEQUATE AND QUALIFIED PERSONNEL ............................................................................................</td>
<td>5</td>
</tr>
<tr>
<td>2.2</td>
<td>CONTACT PERSON ON-SITE .................................................................................................................</td>
<td>8</td>
</tr>
<tr>
<td>2.3</td>
<td>SAMPLING PERSONNEL ......................................................................................................................</td>
<td>8</td>
</tr>
<tr>
<td>2.4</td>
<td>MANAGEMENT OF EMISIONS ................................................................................................................</td>
<td>8</td>
</tr>
<tr>
<td>2.5</td>
<td>NON-ACCEPTABLE WASTE STREAMS ....................................................................................................</td>
<td>9</td>
</tr>
<tr>
<td>2.6</td>
<td>LANDFILL ACCESS ...........................................................................................................................</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>LANDFILL FACILITY OPERATIONS .....................................................................................................</td>
<td>11</td>
</tr>
<tr>
<td>3.1</td>
<td>OPERATOR QUALIFICATIONS ...............................................................................................................</td>
<td>11</td>
</tr>
<tr>
<td>3.2</td>
<td>LANDFILL SCALES ............................................................................................................................</td>
<td>11</td>
</tr>
<tr>
<td>3.3</td>
<td>STANDBY EQUIPMENT .......................................................................................................................</td>
<td>11</td>
</tr>
<tr>
<td>3.4</td>
<td>WASTE FILLING AND COVER MATERIAL ..........................................................................................</td>
<td>12</td>
</tr>
<tr>
<td>3.5</td>
<td>PROTECTION AND SAFETY MEASUREMENTS ......................................................................................</td>
<td>12</td>
</tr>
<tr>
<td>3.6</td>
<td>CONTROL AND MONITORING MEASUREMENTS ..................................................................................</td>
<td>12</td>
</tr>
<tr>
<td>3.7</td>
<td>FINAL COVER SYSTEM ......................................................................................................................</td>
<td>13</td>
</tr>
<tr>
<td>3.8</td>
<td>LEACHATE MANAGEMENT (3.10) .......................................................................................................</td>
<td>13</td>
</tr>
<tr>
<td>3.9</td>
<td>LANDFILL GAS MANAGEMENT ..........................................................................................................</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>COLOPHON .......................................................................................................................................</td>
<td>16</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1.1 Purpose

UNDP-PAPP has contracted the Joint Venture DHV B.V. (Netherlands), ENFRA Consultants (Gaza) and TECC (Gaza) on the 16\textsuperscript{th} of May 2011 to undertake the project: “Feasibility Study and Detailed Design for Solid Waste Management”. The current document is Operational Manual for the Al Fukhari Landfill in Gaza.

This Operations Manual covers:

- General standards applicable to all solid waste facilities
- Operation of Cell 1 disposal area
- Operation of recycling and residential drop-off areas
- Environmental Monitoring for the entire site
- Reporting and record keeping
- Emergency and contingency plans
- Closure and post-closure care for closed portions of the site
- Waste collection/transportation operation at the site

In case any requirement according to the Palestinian Legislation would conflict with information provided in this Manual, such requirement shall have precedence over this Manual. Copies of all Palestinian permits shall be kept with the master copy of this Manual.

In addition to this Landfill Operations Manual, the facility operators should be familiar with the facility’s Environmental Management Plan, which will be provided by UNDP through EcoConserv – Egypt. Operators must also be familiar with the requirements of all other facility permits issued by the Palestinian Authority.

This Manual is intended to serve as a guide for the day-to-day operations of the Al Fukhari Sanitary Landfill so that the operation and maintenance of the facility will conform to existing design plans and Palestinian Waste Management regulations. The Operator should have access to the complete set of design drawings of the sanitary landfill design-as-built for additional information.

The new Al Fukhari landfill includes:

- a Short Term Cell with a lifetime up to two years, located on top of the existing landfill
- Cell 1, divided into two sub-cells, with a total life time of about 9 years
- Cells 2 and 3, with a life time of 5 years each

The facility intends to accept 152,000 m\textsuperscript{3} MSW per year, or about 400 m\textsuperscript{3} of MSW per day during the initial operation period, growing to 212,000 m\textsuperscript{3} per year in 2017. The base sealed cell area of the Short Term Cell is approximately 29,000 m\textsuperscript{2}, that of Cell 1(a) is 40,700 m\textsuperscript{2}; of Cell 1(b) is 48,500 m\textsuperscript{2}; of Cell 2 is 46,200 m\textsuperscript{3} and Cell 3 is 40,400 m\textsuperscript{2}. Table 1 provides an overview of the related surface areas.
### Table 1 – Surface areas for all Cells

<table>
<thead>
<tr>
<th>Cell</th>
<th>Base sealed area (m²)</th>
<th>Cumulative Base sealed area (m²)</th>
<th>Slope Area (m²)</th>
<th>Surface Sealed area (m²) (after filling up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term</td>
<td>29,000</td>
<td>29,000</td>
<td>12,000</td>
<td>17,000</td>
</tr>
<tr>
<td>1(a)</td>
<td>40,700</td>
<td>69,700</td>
<td>50,500</td>
<td>19,200</td>
</tr>
<tr>
<td>1(b)</td>
<td>48,500</td>
<td>118,200</td>
<td>35,700</td>
<td>82,500</td>
</tr>
<tr>
<td>2</td>
<td>46,200</td>
<td>164,400</td>
<td>57,000</td>
<td>107,400</td>
</tr>
<tr>
<td>3</td>
<td>40,400</td>
<td>204,800</td>
<td>42,600</td>
<td>162,200</td>
</tr>
<tr>
<td>4</td>
<td>120,800</td>
<td>325,600</td>
<td>36,000</td>
<td>289,600</td>
</tr>
<tr>
<td>5</td>
<td>136,500</td>
<td>462,100</td>
<td>0</td>
<td>462,100</td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td>Sum</td>
</tr>
</tbody>
</table>

#### 1.2 Acceptable Waste Streams for Disposal

The Al Fukhari Landfill provides solid waste disposal privileges to municipalities in the south of Gaza, including Deir al Balah, Khan Yunis and Rafah. These municipalities intend to establish a overall South Gaza Waste Management Utility that will provide collection and transportation services for the region.

The acceptable waste streams include non-hazardous municipal solid waste from households, enterprises; street sweeping and market waste, and excludes:

- materials that are collected separately for the purpose of recycling and/or composting
- hazardous waste materials in accordance with Palestinian regulations
- infectious waste and hospital waste in accordance with Palestinian regulations
- Building debris
- Odoriferous wastes

#### 2 GENERAL MANAGEMENT STANDARDS

##### 2.1 Adequate and Qualified Personnel

Adequate and qualified personnel will be retained to operate the Al Fukhari landfill facilities. A qualified operator familiar with procedures and the facility management plan, including this Facility Operation Manual, shall be on-site during all hours of operation. Contact information shall be made available to all municipalities in Southern Gaza.

As the rate of waste received at the landfill increases so does the need for additional staff members. The following table indicates the approximate level of staffing expected to be required for various rates of waste acceptance at the landfill.
<table>
<thead>
<tr>
<th>Volume</th>
<th>Equipment operators</th>
<th>Laborer</th>
<th>Lead Operator</th>
<th>Total Staff</th>
<th>Scale Attendant</th>
<th>Facility manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 175 m³ / day</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Up to 350 m³ / day</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Up to 700 m³ / day</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Up to 1000 m³ / day</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Equipment operators shall be cross-trained on each piece of equipment required for normal daily operations. One operator may be responsible for operating more than one piece of equipment where continuous usage is not required. One or more operators and/or laborers may also be cross-trained as a scale attendant. Where three or more operators are employed, one operator will be designated as lead operator or foreman.

Total landfill field staff includes personnel directly working in landfill operations, including, operators, laborers, foreman and managers other than scale attendant and office manager. Scale attendant or cross-trained operator or laborer shall be present during all hours that waste is received at the facility.

Where only one manager is required, the manager shall serve as the landfill field operations manager. The facility manager may also designate an individual to serve as the operations manager. An individual designated as operations manager, if any, shall have the same duties and responsibilities as the Facility Manager for purposes of this Manual.

A minimum of two staff members shall be present at all times during the hours of landfill operation. There shall be at least one operator in the active area during all times that waste is received at the working face of the landfill. During weekends and during periods of reduced waste acceptance at the facility, the operations staff may temporarily be reduced, as consistent with the table above.

The Facility Manager shall ensure that all requirements of the Facility Certification and Solid Waste Management Rules are adhered to and shall have overall responsibility for ensuring that landfill operations staff are properly trained and are properly equipped to carry out all assigned duties.

1. Staffing

The Facility Manager shall ensure that there is sufficient staff properly trained to perform their assigned duties. The Manager shall be responsible for developing job descriptions for each employee, to be kept on file at the facility.

2. Equipment
The Facility Manager shall ensure that there are sufficient resources and equipment available to carry out all landfill operations. The Facility Manager shall be responsible for ensuring that equipment is maintained at regular intervals and shall arrange for emergency replacement equipment if needed.

3. Traffic Direction

Operators acting on the Facility Manager’s instructions shall direct all vehicles to the proper disposal area, and shall also be on the lookout for disposal of prohibited wastes.

4. Area Policing

The Facility Manager shall supervise the placement of refuse and daily cover within the landfill Cell. Additionally, the Facility Manager and site Foreman shall supervise the cleanup of windblown litter from the site and access roads and facility monitoring for landfill gas, odors and other nuisance conditions. The Facility Manager shall be responsible for inspecting the facility to ensure that adequate daily and intermediate cover is in place, to ensure that litter is removed promptly.

5. Daily Transactions

Under the supervision of the Facility Manager, the scale attendant shall maintain a record of daily transactions and other records as required for Record Keeping.

6. Record Keeping and Reporting

The Facility Manager shall ensure that all reporting requirements for the facility are met. The Facility Manager shall also be responsible for ensuring that verbal notifications as required under site permits are provided.

7. Permit Compliance

The Facility Manager shall ensure that all required permits are current and valid and that the facility maintains compliance with requirements of each permit.

8. Leachate Management

The Facility Manager shall ensure that leachate collection systems are working properly and in compliance with requirements for limiting depth of leachate on the liner. The Facility Manager shall also be responsible for ensuring that leachate disposal permits and contracts are in place and that leachate facilities comply with applicable site requirements.

9. Landfill Gas Management

The Facility Manager shall ensure that landfill gas collection and treatment systems are working properly, and shall ensure that the facility’s odor management plan is implemented. The Facility Manager shall also be responsible for ensuring that facility requirements for odor monitoring and explosive gas monitoring are conducted, consistent with site permits, the
Facility Management Plan, and this Operations Manual. The Facility Manager shall be responsible for determining when contingency plan measures are required to address odor problems.

2.2 Contact Person On-Site

At least one of the contact persons of its replacement shall be available during all hours of operation. Contact information is to be provided to all relevant stakeholders. The operator shall maintain a current listing of contact personnel at all times.

2.3 Sampling Personnel

All the required waste and groundwater sampling performed shall be performed by properly trained and qualified personnel. Qualified groundwater sampling personnel must have a minimum three (3) months training and six (6) months experience in sampling or analysis.

2.4 Management of Emissions

More detailed information regarding control of nuisance conditions, including dust, vectors, litter and odors is provided in sections covering landfill operations, landfill gas management and contingency plans. This section is intended to address the general requirements for control of nuisance conditions at all solid waste management facilities.

Spills
The Operator shall take all steps necessary to prevent or control spills including during leachate operation procedures. Spill control kits for emergency use shall be kept on-site. Spill kits are kept at the leachate facilities, but may be used elsewhere on-site should the need arise. The kits include absorbent socks and mats.

Dust
Excessive dust shall be controlled by applying water spray, sweeping paved access roads and tire washing as required. Clean water spray may be used if necessary to control dust on haul roads in the active landfill area. Water use in the landfill area shall be kept to the minimum necessary for dust control. The Facility Manager shall be responsible for identifying when conditions warrant each specific dust control measure based on direct observation of the area contributing to the dust problem and current and forecasted weather conditions. When tire washing is deemed to be necessary, the landfill operators shall be instructed to direct haulers to the tire wash facility.

Vectors

Vector problems are controlled through the application of the daily cover material programs. If a problem develops, alternative plans are used that include the use of poisons for vectors.

Litter
The Operator shall perform litter control and clean-up on a routine basis. Daily patrols for litter along the landfill are to be conducted. Cleanup of wind scattered debris on the site shall include the removal of any debris that may occasionally blow into adjacent areas of the site. The Facility Manager shall determine the frequency of litter removal operations needed in each area of the site based upon the area of active operations, weather conditions and the amount of litter that is present based upon inspection. Particular attention shall be given to areas of the site that are visible from off-site.

Permanent and temporary litter control fencing may be used to minimize windblown litter. Permanent litter control fencing are to be installed along the access road and around the landfill cell under operation. The Operator shall furthermore avoid migration of surface water and to prevent the release of landfill gas.

**Odors**
Odor problems are managed by the Operator with use of the active landfill gas extraction and treatment system, application of daily cover and by prohibiting the disposal of odoriferous wastes. Additionally, chemical odor control agents are to be considered for use on site. The Operator shall conduct twice daily patrols to identify areas experiencing odor problems.

### 2.5 Non-acceptable Waste Streams

The Operator shall take all practical steps to prevent the inclusion of non-acceptable wastes, as defined in section 1.2, into the waste stream being managed by the facility. Examples of banned wastes include tires, mercury containing devices, liquid wastes, cathode ray tubes, commercial batteries, white goods and Freon containing devices. This shall include implementation of a load inspection program for incoming wastes and maintenance of an on-site spill kit to contain spills that may occur on-site from hydraulic or fuel leaks or other similar occurrences.

The scale attendant shall screen incoming waste prior to disposal, by obtaining hauler identification and querying if the load is known to contain any unusual wastes. Load inspection forms should be used to document any loads with prohibited waste.

In the event that a load with prohibited waste is received, the hauler will be immediately notified. If the hauler is still on site, the hauler will be directed to remain with his vehicle until a determination is made as to the specific type of prohibited waste. If the prohibited waste is determined to be non-hazardous, the load will be reloaded into the hauler’s vehicle, if feasible, and the hauler directed to dispose of the waste at a facility approved to accept such material.

If the load is found to contain hazardous materials, the responsible authorities should be immediately notified and operational activities will be relocated away from the suspect load. Employees shall direct all traffic away from the suspect load and shall secure the area until an emergency disposal plan is identified specific to the particular hazardous material identified.

Immediate steps to be taken include:
1. Remove personnel from area if there may be imminent danger.
2. Contact responsible authorities, including fire department in case of inflammmable waste
3. Secure the area until further assistance arrives and divert traffic from the area.

2.6 **Landfill Access**

Access to the site is controlled by a gate on the entrance road. The gate will be closed during non-operational hours and locked when no Facility personnel are present on-site. The landfill will be open 6 days per week. Hours for receipt of refuse are from Sunday to Thursday, between the hours of 7:00 AM and 4:00 PM and Saturday 12:00 AM and 4:00 PM.

Recycling Facility hours are the same. Operating hours for the landfill are Sunday – Thursday 6:00 AM to 6:00 PM and Saturday 11:00 AM to 6:00 PM. Upon approval of the South Gaza Waste Utility, the Operator may extend operating hours for emergency conditions, special events, green-up days, or to address special conditions arising at other facilities that transfer waste to the Landfill. Approval shall be in writing and shall provide specific limitations on the extended hours of operation as deemed necessary.
3 LANDFILL FACILITY OPERATIONS

3.1 Operator Qualifications

The Facility Manager shall ensure that the operating staff receives the training required to operate the landfill in accordance with the approved plans and specifications. Training shall include the following elements:

- Orientation for all new permanent landfill employees (to be held within one month of commencement of employment);
- Full set of engineering plans, relevant permits, Facility Management Plan and Operation Manual shall be reviewed;
- A copy of the Operation Manual shall be provided to the new employee. All landfill operations personnel shall receive copies of any amendment to this Operations Manual;
- The Operator's Duties shall be reviewed, and the ones for which the new employee is responsible shall be clearly specified;
- The Facility Manager shall conduct a facility operations meeting on a monthly basis with landfill employees. The meeting will provide the opportunity to review safety and compliance requirements and to improve landfill operations through the exchange of ideas;
- All requirements for operation of the recycling and convenience drop-off area shall also be reviewed with each new operations employee within one month of commencement of employment;
- The Safety and Health Management Plan shall be reviewed on a periodic basis with all landfill employees and the Facility Manager.

3.2 Landfill Scales

The Operator shall properly maintain and calibrate the scales used to measure the weight of solid waste received and disposed at the facility.

3.3 Standby Equipment

The Operator shall make provisions for standby equipment needed for daily operation of the landfill within twenty-four (24) hours of breakdown of the primary equipment. Where a major piece of equipment will be out of service for more than 24 hours, the Operator shall provide verbal notification to the South Gaza Waste Utility and advise on steps being taken to repair or replace the equipment and to provide standby equipment. Where the Operator has facility equipment on-site that is capable of performing the same essential functions as the unit requiring repairs, such on-site equipment may be used on an interim basis, provided that all refuse is covered by the end of the day.

A landfill compactor and/or bulldozer will be used for the compaction and placement of waste materials and daily cover. Back-up equipment shall be used in the event of a breakdown.
3.4 Waste filling and Cover Material

Cover material shall be in place at the end of each operating day, or at more frequent intervals if necessary to control disease vectors, fires and odors, to prevent blowing litter, and to discourage scavenging by animals, without presenting a threat to human health and the environment.

The delivering waste vehicles have to unload the waste in a distance of about 10 m to the actual waste filling area. The waste is transported to the filling area with a compactor and will be built in by the compactor in layers with a maximum thickness of 50 cm.

Waste will only be covered with ground material daily and in areas which will be not under operation for a longer time. The filling shall be carried out as follows:

- Size of the waste filling area is dimensioned in such a way that after approximately 3 days the next waste layer can be started.
- Areas where no waste has been placed for a longer time are covered with a soil layer of about 20 cm in thickness. The soil cover is applied in these areas immediately after waste filling.

3.5 Protection and safety measurements

The following measurements are to be implemented:

- Ground material of a volume of at least 200 m³ will be stored near the waste filling area for fire fighting on landfill.
- A utility water pipe sufficiently dimensioned for fire fighting will be constructed nearby and around the disposal area.
- Smoking is only allowed in the staff room of the operation building.
- In all buildings fire extinguisher have to be fixed.
- Outside slopes will be covered with ground material until the surface sealing system is constructed.

Safety boots, safety gloves, weather protection clothes, ear protection and warning clothes for the staff guiding the truck to the place of disposal for vehicles are available for every person who has to work on the landfill.

3.6 Control and monitoring measurements

The Operator shall do the following control measurements regularly respectively if required on the landfills:

- Control of the delivering vehicles (every vehicle)
- Looking through and eventually control analysis if waste is declared in a wrong way (if suspected)
- Gas analysis (once a year)
- Leachate analysis (once a year)
- Inspection of all roads in the landfill area and of the fence during filling process (daily)
• Inspection of all roads in the landfill area, the fence and the recultivated areas after closing time (weekly)
• Topographical survey during filling (once a year) and after closing (once in 2 years)
• Control of the quantity of leachate.

Three ground water wells are to be drilled at the landfill; 1 well in ground water afflux and 2 wells in effluent direction. These wells will allow a proof of the tightness of the base sealing system. Due to the considerable depth of the existing ground water levels all wells will have a depth of at least 50 m.

3.7 Final Cover System

At the close of operations in a landfill cell, the final cover system as described in the design plans shall be in place within ninety (90) days of attaining the approved final elevation or of the last date of receipt of waste for disposal. Grass or ground cover shall be established within four (4) months of final cover or as soon as weather permits. The Operator shall provide partial final cover in a phased installation prior to attaining approved final elevation of each cell in order to facilitate landfill gas collection and minimize leachate generation during the life of each cell. The schedule for partial closure activity will depend upon actual fill rates and the area available for closure.

3.8 Leachate management (3.10)

Adequate management of leachate is an essential element of the landfill operators. The Operator will provide adequate training to the responsible leachate operating staff, so that the operation requirements and safety procedures are well understood.

In the Short Term Cell the leachate runs via the collector directly (by gravity) into the leachate collecting pond (basin). The pond is constructed with a wide surface, causing evaporation of the biggest portion of the leachate and precipitation of contaminated components due to the climatic conditions in Gaza. In danger of flooding the leachate has to be pumped back to the disposal site. The leachate pond will have a size of about 8,000 m² and a water depth of about 2.30 m. In total the pond will be have a volume of at least 16,000 m³ for leachate.

Cells 1 to 5 of the Al Fukhari Landfill will be constructed with a base sealing system located 20 m deep from the ground level. This is based on the necessity to generate additional volumes considering the limited surface areas for landfill sites. This requires that it will be necessary to pump out the leachate during at least 50 years from the pumping shafts. In the designs, access by workers to the pumps located at the low points of the cells has been included for maintenance and replacement.

In Cells 1 to 5 all leachate has to be pumped from the deep point in the pumping shaft to the leachate pond.

The leachate that is not evaporated from the pond will be pumped and sprayed back to the landfill using re-circulation pumping system. The pumping station is connected to the leachate
pond via a PE-HD pipe. The water flow will be restricted with a slide valve to manage the water pump capacity. Two pumps in the chamber (shaft) will bring the water to the distribution valve. One engine will pump the authoritative water flow, a second pump has been constructed for emergency reasons, and shall be used by the Operator if needed.

A high pressure water pipe PEHD Di 150 transports the water from the chamber to a distribution valve. The distribution valve split the incoming water into max. 5 outgoing flexible pipes normally used from the fire brigade. The necessary pumping head vacillate between 30 and 70 m. The water can now go throw the landfill layer and carry on the way to the leachate pond. The required time should be enough to pass the heavy rain and allow the planned evaporation.

Two submersible pumps have been installed for the re-circulation of leachate from the leachate pond to the landfill. One of the pumps is meant for redundancy reasons in case of failure.

For monitoring reasons the pumps includes a central switch board. The major equipment connected to the board is the incomer feeder (cable supply from the Landfill Substation) equipped with a fused load break switch, each one motor feeder for each of the both Leachate Pumps, one motor feeder for the motor driven leachate valve and one feeder for auxiliary supply to the control devices of this board.

Outside the manhole there is an alarm signal, which the Operator shall use to notify the landfill staff in case of high water levels in the shaft. Next, the slide valve located in “manhole 1” (Cell ST) is to be closed.

There is a mode selector switch at each of the leachate pumps for selecting either “Automatic” or “Manual” mode of operation. The manual mode position will be used for manual local operation and for testing in case of maintenance only. There is another selector switch enabling to activate either “Leachate Pump 1” or “Leachate Pump 2”.

For control of the pumps and the motor operated valve, a free programmable control system with LCD display is to be installed with the following options:
- automatic start of the pre-selected leachate pump on “high” leachate level
- stop of leachate pump on “low” leachate level
- “very low” leachate level will be supervised by the a.m. vibration limit switch device and will switch OFF both leachate pumps to assure dry protection for the pumps as well as give an alarm. Manual pump operation is also prevented!
- “very high” gives an alarm to the landfill staff

Data storage equipment shall be provided for the following data:
- leachate pond input flow (actual and total)
- level of leachate pond
- operating time of each pump
- pump output flow (actual and total)
These data are to be measured every minute and to be stored at least for a time period of one month. Complete data storage equipment, compatible with Microsoft Office software, shall be provided including a lap top computer, interface adapter/cable, software and CD burner. The leachate pumps inside the temporary leachate pump station (Cell 1) and inside the gallery (Cell 2) will be operated similar to the leachate recirculation pumps. However, the pumps have to be dimensioned for the following base data:

- Pressure High 25 m by flow rate 36 m³/h
- Electric power max. 5 kW

It is the responsibility of the Operator to ensure that all leachate management devices are properly working, and that appropriate trained staff is assigned to perform leachate pumping operations, to arrange for leachate collection, treatment and spraying, and to maintain appropriate safety measures and records of the amount of leachate.

3.9 Landfill Gas Management

The landfill gas management system at the landfill includes a landfill gas collection system, a landfill gas compression station and a candlestick flare system. The current design does not include a gas to energy device, although it may be decided to add such a device in a later stage.

The flare shall be fitted with a flow restriction device in order to keep the flare running at low flows and during instances of excess gas flows above the capacity of the gas compression station. A second skid mounted flare owned and operated by the Operator has to be installed as a backup system.

The active landfill gas system consists of solid and perforated HDPE piping as well as 12 gas extraction wells for the Short Term cell and 36 gas extraction wells for Cell 1. Each of the landfill gas extraction wells is separately valved to allow the gas extraction rate for each well to be adjusted.

Operational monitoring of the active landfill gas collection and control system includes:

- Daily visual inspections (during operational days) to confirm the landfill gas collection and flare are operating;
- Monthly landfill monitoring of landfill gas composition and flow from each extraction point and adjustment of flow rates as needed to minimize air intrusion into the extraction system;
- Monthly start-up of the flare and checks on the equipment;

The landfill gas collection and treatment systems are operated in accordance with the Facility’s Environmental Management Plan. It is the Facility Manager’s responsibility to ensure that landfill gas equipment is operating effectively, and that appropriately trained personnel carry out all monitoring and routine maintenance required for the gas collection and treatment systems.
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