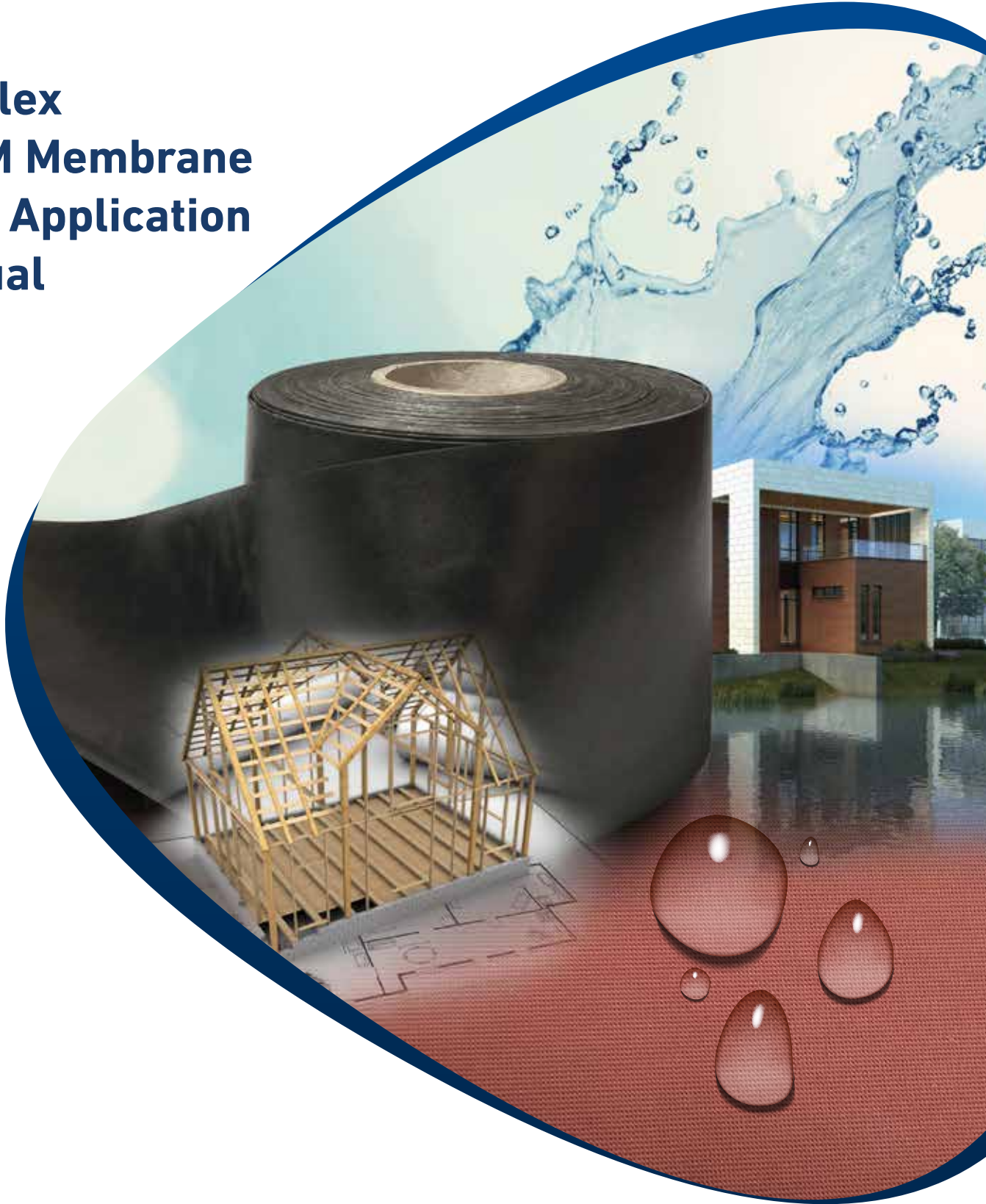




# Lineflex EPDM Membrane Pond Application Manual



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# Introduction

This manual contains the application principles of Lineflex EPDM Membrane.

In the first section, information will be provided about points that must be taken into consideration in the project design in addition to the general recommendations about the preparation areas and application sections of Lineflex EPDM Membrane. Also in this section, recommendations about applications that must be performed in excavation and site preparation after project designing phase are provided.

Second section contains information about applications such as laying, combining, detail solutions and their check activities, which are design according to the Lineflex EPDM Membrane project principles.

In the last section, information will be about the applications, which will be performed for the protection of the application in the long term, problems that may be confronted and solution methods.



# 1-Design and Project Designing

Lineflex EPDM Membrane's areas of use cover a wide scope including the pond for agricultural irrigation, decorative ponds, pond for field fishery, ponds for utility water, components such as water delivery channels, as wells as terrace roof systems, basement tanking, structural applications, facade systems. This manual contains only the applications of water components (Ponds, dams, channels etc.) which are constructed only with the jeomembrane assembly of Lineflex EPDM Membrane.

## 1.1-Site Selection

While selecting and preparing the site may seem like a simple process, it is actually an elaborate process, which requires taking several parameters into account. Except for the designs of simple projects, basic parameters, which must be taken into consideration for sites, which are planned to be constructed within the scope of large projects such as pond are:

- Type of soil (earth, loose rock, rock, mud etc.)
- Ground water level in the soil and type of movement on a yearly basis
- Internal friction angle, which affects incline of slope required of the application
- Bearing capacity for soil strata

When application site is selected; current conditions must be taken into account and several factors, especially parameters mentioned above must be considered by the expert engineer, who will select the site, in order to avoid potential problems in the future. Responsibility of site selection shall belong to project engineer.

## 1.2-Improvement Of The Site

Partial and/or complete grading works may be required on the foundation, which will constitute the pond soil as a result of the parameters checked during site selection phase. Some of the problems which may be confronted in Lineflex EPDM Membrane application site, and suggested solutions are as follows.

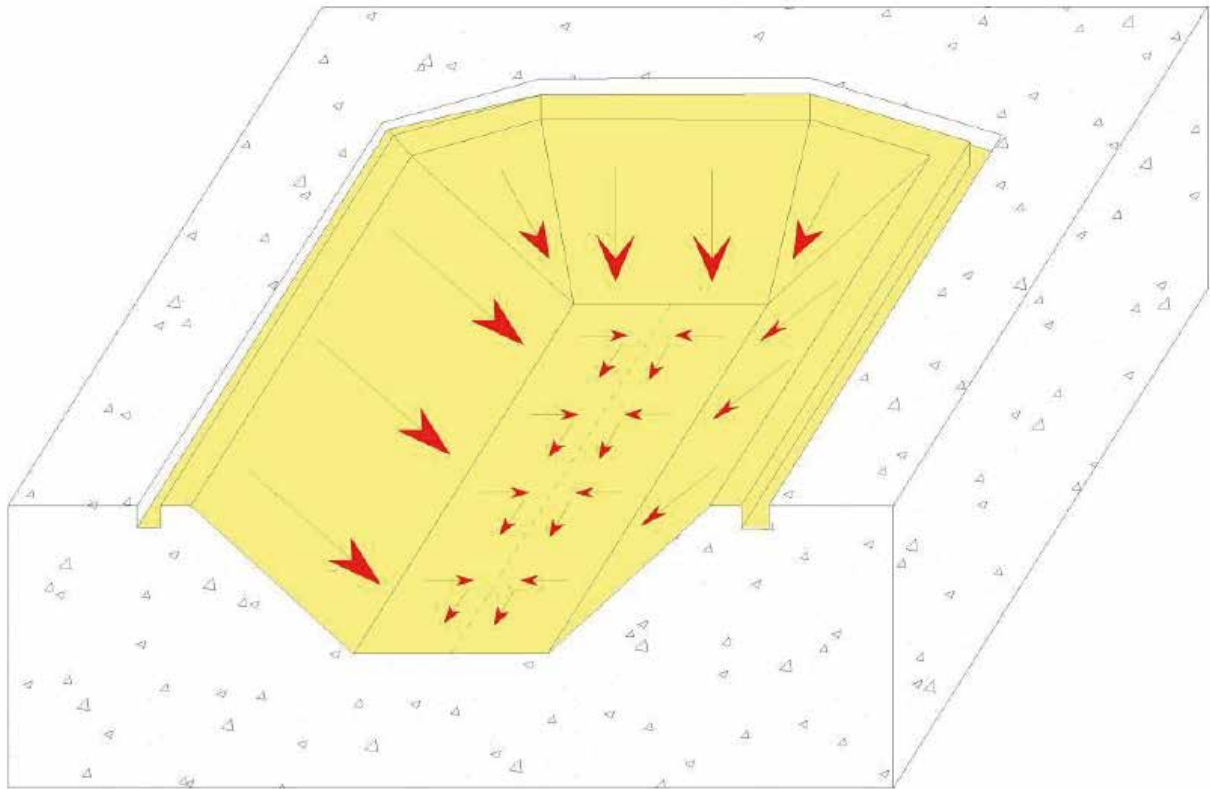
Soil	Effects	Suggestion
Embankment soil	Unexpected settlement	Compressing
Soil containing organic substance	Gas formation and gas pressure on the membrane	Performing proper gas drainage
Soil types containing gypsum rock or limestone	Sudden settlement caused by gasps formed as a result of an internal leakage	Alternative site selection. If alternative site is not available, use of soil improvement methods
Rocky soil	Formation of cutting and drilling parts.	Correcting these sections locally, use of more protective geotextile seal

**Effect of Ground Water Level:** Elevation of ground water level compresses the gas accumulating under the membrane, and therefore causes pressure increase under the membrane. As a result of this, problems such as the decrease of pond volume and rising up to membrane surface may be encountered. Also, behaviour changes may occur on the layers of pond soil, and bearing capacity may decrease as a result of the increase of ground water level. Resulting immediate settlements or landslides may cause serious problems. For this reason, project engineer must design the drainage system under the pond by considering underground water level information.

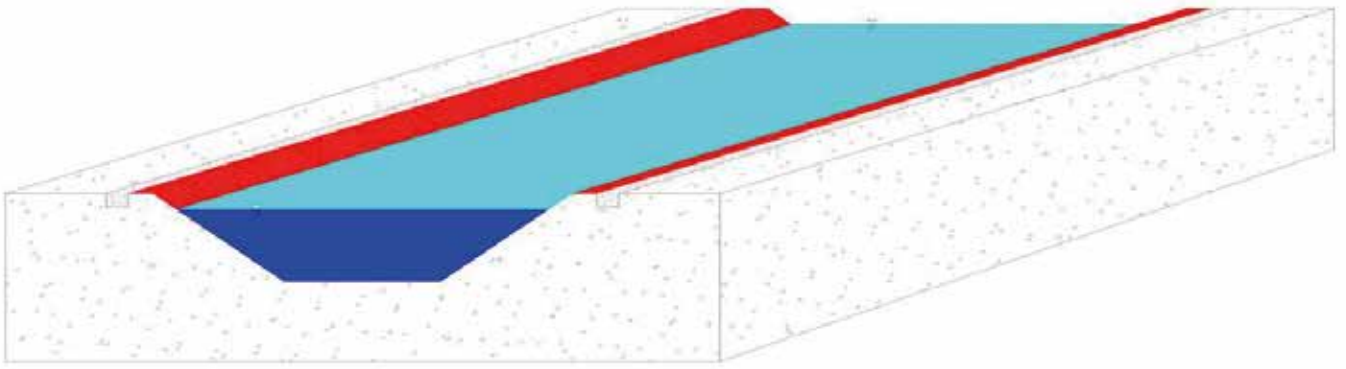
## 2-Surface Sealing Of The Pond

### 2.1-Preparation of the Site

Excavation works will commence according to project requirements after application site is subject to all kind of soil investigation and necessary improvement activities. Base and lateral slope inclination measurements to be achieved with excavations activities must be determined based on project and application requirements. **Base slope can be preferred between 2% - 5%** to provide support to drainage (gas-water) systems to be constructed and so that pond maintenance activities can be performed more easily. For activities to be carried out during the application, **lateral slope must be max. 50%**.



**Pond slope inclinations**



**Trapezoid section irrigation channel example**

## 2.2-Membrane Application

### 2.2.1- General Information and Structure of Insulation

During the laying of Lineflex EPDM Geomembrane, access to any person other than laying personnel must be prevented to the work area. Smoking is prohibited at all times when flammable-explosive adhesives and mastics are used. Lineflex EPDM Geomembrane is laid within the pond structure smoothly and without adhesion.

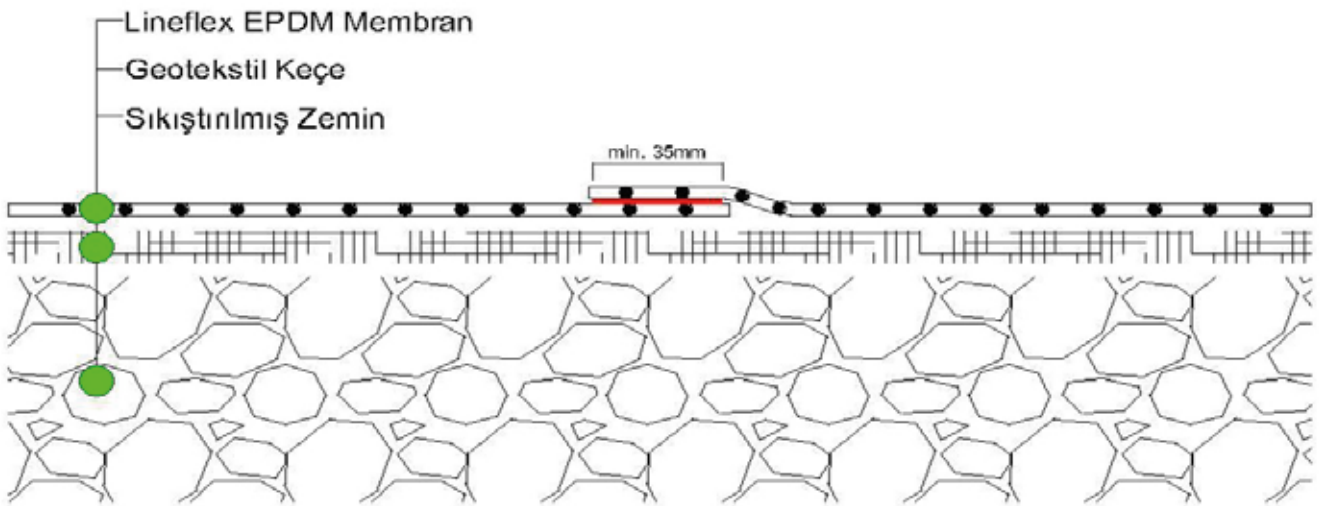
Sharp stone, iron bits etc., which may damage the membrane, must not be present on the soil.

### 2.2.2-Membrane Laying and Connecting

Laying planning is prepared in CAD program according to pond project requirements. Wide membrane panels, which are prepared in accordance with the project, are laid next to each other in a way that their edges are overlapped for min. 35mm. If the ground conditions prevent flat movement of the welding machine, hard and flat materials such as thin chipboard must be laid under the area to be welded temporarily.



**Laying of the large panel prepared in accordance with pond project**



Overlaps are checked with hot air welding control apparatus. Welding bends in "T" connection are additionally closed with finishing paste. Membrane coating operation must be performed on dry ground under 5°C ambient temperature.



**Welding with automatic welding robot**



**An Application with manual welding machine**



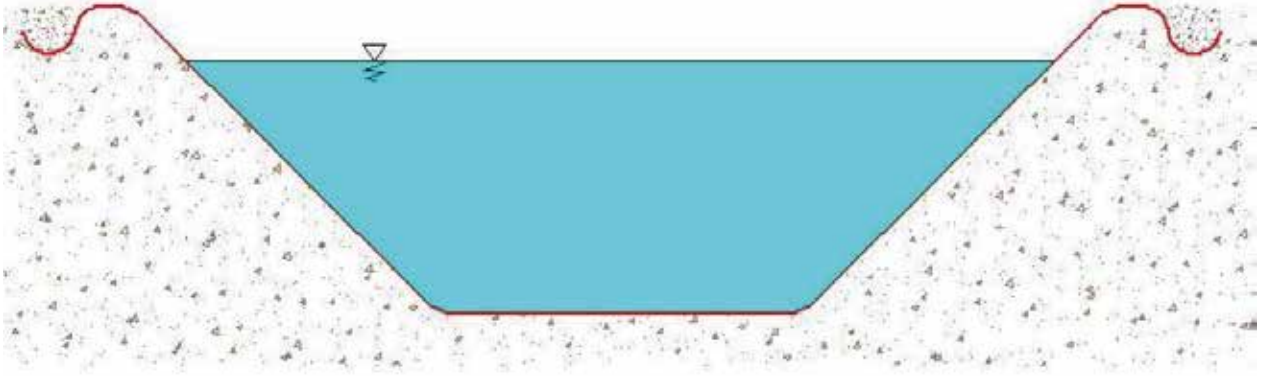
Welding controls can be performed on welded areas with vacuum test device. Welding checks are performed both visually, and then manually. Final control of risky areas must be performed with vacuum test device.



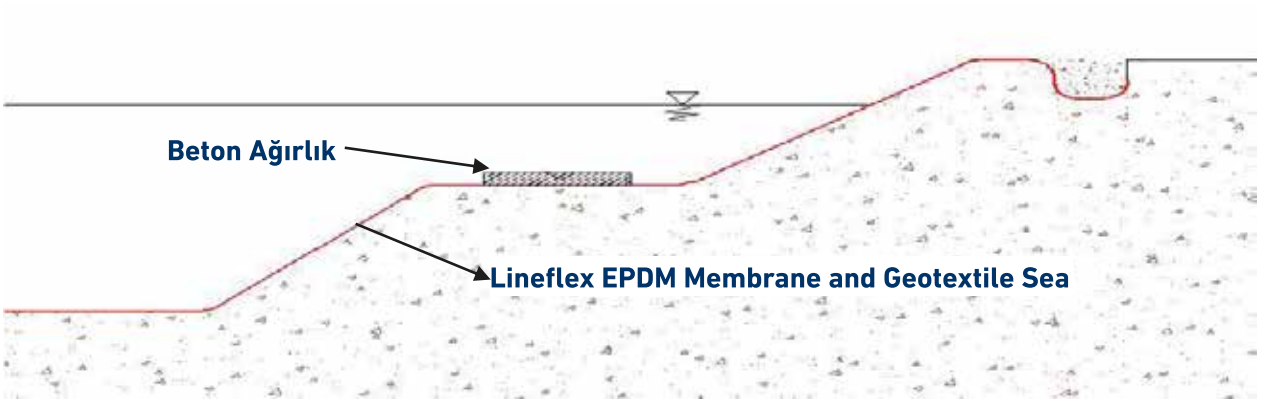
**Welding control with vacuum test device**

## 2.2.3-Membrane Locking

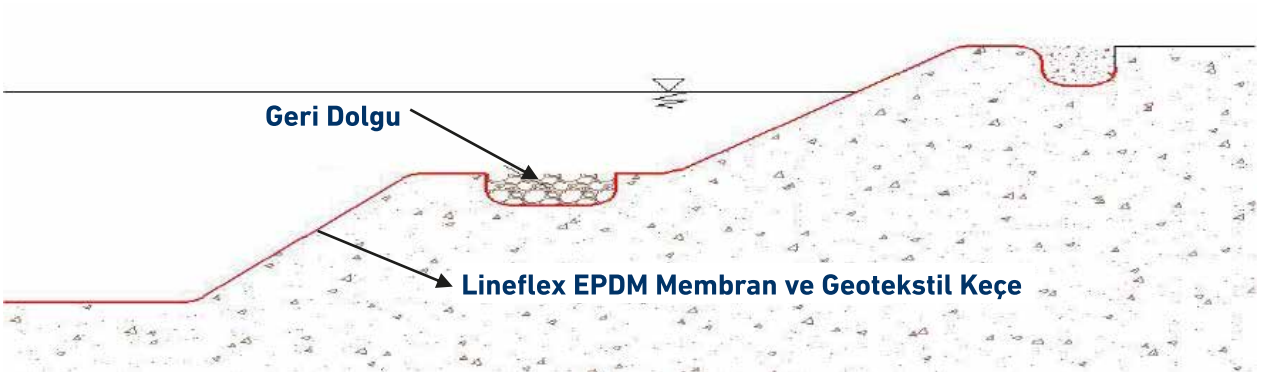
This is performed for the purpose of restricting the downward movement of the membrane, which is laid on pond surface, as a result of water pressure. Locking channel, through which membrane will be passed through on the top elevation of pond set, is opened along the periphery of the pond. The channel, through which EPDM Geomembrane is passed, is closed with backfilling in a way that a pressure is applied on it. Membrane is locked due to the pressure as a result of the weight of the backfill on the membrane.



If stepped slope is planned within the pond, two types of measures can be taken to prevent membrane slide in heel zones. Weight and fixing areas in the heel zone may be done with concrete blocks, or they can be anchored by backfilling on the membrane, which is passed through the locking channels.



**Anchoring with concrete block placed in the heel zone**



## 2.3–Protection of Pond Surface Against External Mechanical Effects

Protective and preventive measures must be taken against external mechanical effects in order to ensure the long use life of constructed applications. These effects are mainly;

**Human Effect:** Hand-line fishing and other activities.

**Wild Animal Effect:** Wild animals' going into the pond to meet their water needs.

**Natural Events :** Landslide, extreme wind.

etc. Measures to be taken against these effects are explained with examples.



Anchoring with locking channels opened in the heel zone and backfilling.



Energy dispersion bank (gabion), which is weaved around the set edge, in order to prevent rock fragments breaking off the slope is indicated in the illustration above.



Membrane on the empty pond surface may swallow and tear off due to wind effect. EPDM sand bags are prepared in order to prevent this effect. EPDM sand bags, which are prepared to be placed on the surface of the pond to be drained, are kept on the top elevation of the pond at certain intervals.

## 2.4-Maintenance and Repair

Lineflex EPDM Membrane is a waterproofing material with long service life. It provides waterproofing without requiring maintenance for a long time. Maintenance may sometimes be required for cleaning the accumulated sedimentation in the pond and other materials entering the pond due to wind effect. For the maintenance of the pond, which is insulated with Lineflex EPDM membrane, no equipment included wheeled heavy machinery must be allowed into the pond, because such machinery and equipment may pierce and damage the membrane. Maintenance can be done only by expert personnel with wellington boots by using plastic brush or water jet, and treating the area sensitively. If it is planned that construction equipment will be allowed into the pond area during construction activities, reinforced concrete service roads with minimum 20 cm thickness must be constructed on the pond surface.

Repair bands, adhesives with special solution and safety mastics are available to be used for the repair of the problematic area that is formed on Lineflex EPDM membrane for any reason. One or several of these items can be used as a result of the investigation by expert personnel.



**Areas, which require repair, are repaired easily.**

## 3-Technical Specifications

Lineflex EPDM membrane is a fully rubber based, 300% flexible insulating mat. It is resistant to plant roots and chemicals. It is a material, which is highly resistant to UV's effect of the sun and ozone effect, and as a result of ageing tests, it is determined that the service life of the material is at least 25 years. You can find all the features of Lineflex EPDM membrane in "Product Technical Specification" form.



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