Nicosia Walls Vegetation Removal; Mula Bastion – Kyrenia Gate

TECHNICAL SPECIFICATIONS

Contents

1. GENERAL

1.1. GENERAL SUMMARY AND SCOPE OF THE WORKS

The scope of works is the removal of vegetation from the historic walls of Nicosia and any works related to this scope. The Contractor shall complete the works and provide all materials, equipment and labor, in accordance with the terms of Technical Specifications, Conditions of the Contract and drawings/details. All the works will be realized by using first class materials and labor for the implementation of the project.

These specifications must be used in combination with the Bills of Quantities and Drawings & Details; It is the responsibility of the contractor to request clarification to this, or any subsequent document, to the ENGINEER, should there be any questions or misinterpretation.

1.2. PROJECT LOCATION AND SITE

The works are located in Nicosia, on the historic Venetian Walls.

The Project area is as shown below and divided in **three lots/sections** between part of the Mula Bastion and Kyrenia Gate. The project area is divided in three lots/sections for ease of reference and for tendering purposes. The contracting authority may implement all the three lots/sections or any one of the lots/sections or any two of the lots/sections depending on the availability of budget. The contracting authority may contract each section to different contractors or all the lots/sections to one contractor.

The Contractor shall be deemed to have inspected and examined; projects, technical specifications, the site and its surroundings and to have satisfied himself before submitting his Tender and signing the Contract as to all matters relative to the nature of the work, the quantities and materials necessary for the completion of the Works, the means of access to the site, and the site set-up he shall require, and in general to have himself obtained all necessary information as to risk

contingencies, climatic, hydrological and natural conditions and other circumstances, which may influence or affect his Tender and implementation of the works and no claims will be entertained in this connection against the Employer.

SITE FACILITIES

In each lot/section, the contractor shall establish his site facilities and have temporary water and electricty as per the General Requirements and these specifications.

The contractor will propose to the approval of the Engineer a site setup, showing the details of his site arrangements, site facilities, accesses and other pertinent details.

If the same contractor is awarded more than one lot/section, site facilities may be rationalised by the Engineer and the relevant costs will be pro-rata reduced.

1.3. DISPOSAL OF SURPLUS MATERIALS

Due to the nature of the works no debris other than vegetatition is expected to arise but if any unwanted surplus excavated or graded material arise from the Works, they shall be promptly disposed to an approved disposal site at the expenses of the Contractor.

Removed/cut vegetation shall be dipsosed in line with the municila garden waste disposal arrangements.

The Contractor shall indemnify the Employer against any claims arising from disposal of such materials.

1.4. STANDARDS AND CODES

1.4.1. Valid Standards and Codes

All materials and workmanship shall comply with requirements of applicable codes. The following abbreviations are used in these Specifications:

E.N.	European Standards
C.E.	European Conformity

If not otherwise specified in the project drawings, all materials supplied shall comply with approved European Standards.

1.4.2. Material Samples and Tests

Before application of any material, contractor will provide catalogue and/or samples and/or C.E. Certifications to the Engineer for their approval. Tests may be required for technical verification of materials and supplies.

All samples and tests shall be supplied by the Contractor at his own expense.

Biocide and Herbicide will be used for vegetation removal treatment.

For biocide* the contractor will use ‘Kimistone Biocide’ or equivalent product approved by the Engineer.

For herbicide** the contractor will use ‘Roudup Bio’ or equivalent product approved by the engineer.

SUBMITTALS – Submit the biocide and herbicide for approval.

Information related:

* Biocidal Products Directive (Directive 98/8/EC)

The European Chemicals Agency (ECHA) works for the safe use of chemicals. It implements the EU's groundbreaking chemicals legislation, benefiting human health, the environment and innovation and competitiveness in Europe.

https://echa.europa.eu/en/regulations/biocidal-products-regulation/understanding-bpr

**Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

http://data.europa.eu/eli/reg/2009/1107/oj

1.5. CONTRACTOR'S MACHINERY & EQUIPMENT

The Contractor's machinery and equipment at the site shall be deemed to be for the purposes of carrying out of the Works. The Contractor shall not remove them without the written consent of the Engineer unless the Contractor shows that the said machinery and equipment are no longer required for carrying out the Works.

No machinery and equipment or vehicles other than those required to carry out the works will be permitted in the areas designated for the vegetation removal. Any equipment used to process invasive materials, such as transport vehicles, must be cleaned prior to further use. Processing equipment must also be cleaned prior to further use.

1.6. MATERIALS AND WORKMANSHIP

All materials to be used under this Contract shall be of best quality, first-class in every respect and purchased from known and approved manufacturers/suppliers.. Materials shall be suitable for the services intended and selected and fabricated in accordance with the best practice. Unless otherwise specified herein, all materials shall conform to the appropriate standard specification requirements (Also See Clause 1.4).

The Engineer has the right to require tests for the verification of the quality of the materials. All work done by the Contractor shall also be subject to inspection. Defective work shall be repaired or replaced as directed.

1.7. WORKS SITE

1.7.1. General

The Contractor shall take all necessary health and safety measures in accordance with the health and safety plan before starting the works.

During the progress of the works, the contractor shall keep the site reasonably free from all unnecessary obstruction and shall store or dispose of any constructional plant and surplus materials

and clear away, remove from the site any wreckage, rubbish or temporary works that are no longer required (Also See Clause 1.3).

1.7.2. Health and Safety

The contractor shall engage one health and safety officer who will be on site every day to insopct and direct the health & safety aspects. The Contractor shall submit a Health and Safety Plan as required by the contract conditions based on the applicable HS norms.

It is the contractor's responsibility to provide a health and safety risk evaluation report written by a licenced health & safety officer and apply all mitigation measures described in this aforementioned risk evaluation report report.

The contractor shall be responsible for the safety of all workmen and other persons entering the project site and shall, at his own expense, take all measures necessary to ensure their safety.

The Contractor shall ensure that all his employees are fully conversant with the regulations, emergency and rescue procedures, etc., and the Contractor shall enforce the rule that any employee committing a serious breach of such regulations shall be instantly dismissed and shall not be re-employed.

Personal protective equipment shall be available and used by all personnel including: safety helmets, high visibility jackets, eye protections, ear protections, hand protections, foot protections.

Foliar application and cleaning works has to be carried out by hand using low pressure sprayers, nylon brushes.

For woody plants using pruning shears, injection applicators, loppers, saws, adjuvants (wetting agents, dyes, etc) therefore precaution should be taken in terms of health and safety.

Note: Before using Biocide and Herbicide products, Material Safety Data Sheets must be provided and recommendations on the MSDS must be executed.

The most frequent way of penetration occurs through the skin, therefore this risk of exposure must be prevented. It can be done by wearing opaque clothing:

- long sleeves and long-legged trousers;
- gloves resistant to chemical agents, for example neoprene or nitrile;
- non-permeable shoes;
- anti-slash protection grasses;
- Half Mask Respirators with changeable filters

Always keep the containers away from the eyes during the preparation of the dilutions and carefully avoid any loss. Do not operate in conditions of unstable equilibrium, if possible lean on the ground.

Working at Heights

It is the contactor's choice to either use a scaffolding system or machinery (i.e. boom lift, telescopic lift, etc.) while cleaning the vegetation on the walls at heights. It is the contractor's resbonibility to meet all health and safety measures for any of the choices. Health & safety officer must approve any of these items for working at heights.

Safety Fences

The contractor should use safety fences with netting with necessary structures to delimit the project area, to prevent unauthorised access and to prevent chemicals to scatter.

The nets should be allocated both on top and bottom of the walls (L:110m) at the eastern region of section 1, the Mula bastion and both on top and bottom (L:130m) of the walls at the western region of section 2 as well where there are living trees and pedestrian walkways. The estimated total fence length to be applied in section 3 is 150m. The contractor should install signboards and barriers to control access to the project area.

The contractor can use portable fences (Lmin: 30m at the same time) so that the fences can be replaced in case the works will not take place on all of the walls at the same time.

It is contractor's responsibility to obtain permission for fencing and installing site facilities from the relevant authorities for each section.

The height of the net (fence) should be at least 2 metres. The material of the net should be either Polipropilen or HDPE with a density of at least 140gram/m^2.

SUBMITTALS – submit samples and manufacturer's data of fences to Engineer for approval before erecting fencing. Submit plan for all fences to the Engineer for approval.

1.7.3. Transportation of Materials and Equipment

The Contractor shall take all reasonable precautions to ensure that public streets and thoroughfares used by him either for the Works or for the transport of plant, labour and materials are not made dirty. In the event of their becoming dirty, according to the opinion of the Engineer, the Contractor shall take all necessary and immediate steps to clean them.

1.7.4. Workplan and Methodology

The contractor will propose a workplan with his tender to show that the works will be completed in 3 calendar monsth for any of the sections or for all the sections. Once the contract/s awarded the workpkan will be more detailed and updated.

The Contractor shall have sole responsibility for identifying all invasive species present within the invasive removal areas defined in the contract documents prior to the Pre-Construction Meeting.
For this purpose the contractor shall engage the services of an horticulturalist or agriculturalist.
The Contractor shall submit the required invasive removal plan at the Pre-Construction Meeting for the review and approval of the Engineer. This plan shall include a list of all invasive species present on site, along with a schedule of operations and an outline of construction methodologies for the required control and removal of invasive vegetation specific to each species listed. While the engineer will review the contractor's delineation and removal plan, the Contractor must be competent to identify invasive vegetation to prepare a plan for its eradication or shall obtain the services of an experienced horticulturalist to identify the plant species and recommedations on.

It is only expected to update the areas of invasive species removal. The contractor and the engineer can review the areas of invasive species removal. If changes are required to the originally submitted plan, these changes must be submitted to the Engineer at least 7 days prior to the beginning of work.

Upon receiving the instruction to proceed, the contractor will delineate all areas designated for invasive species removal. The Contractor will be responsible for maintaining this delineation throughout the life of the contract.

The Contractor will not be allowed to begin any activity in the designated removal areas until all schedules, outlines, and methodologies are approved in writing by the Engineer. This schedule must take into consideration; the time period required between biocide and/or herbicide application and the physical removal of the target species wherever such removals are to occur. No removal work can occur for a minimum of two weeks after biocide and/or herbicide application. In all cases, the submitted schedule shall consider methods for removal before proposing herbicide application.

The workplan shall include:

1) The type(s) of invasive species identified in the designated area(s);
2) Species specific treatment methods describing a full course of treatment for each species to achieve eradication. These methods must show:
    a. Removal methods planned (e.g. pulling, cutting, spraying, etc);
    b. Types and concentrations of any biocide and/or herbicide to be used, including any adjuvants (a term used for chemical treatments); and
    c. Schedules showing dates and types of initial, intermediate and final treatments;
3) Any construction activities planned in designated removal area(s) during the eradication period;
4) Disposal methods, including:
    a. Onsite methods and locations; and
    b. Off-site disposal locations;
5) A description of safety equipment required; and
6) Procedures for handling chemical spills.

The Contractor shall also:

a. Maintain the labels for biocides and/or herbicide being used in his/her possession;
b. Provide a 7 – day work notice prior to proceeding so that the Engineer can schedule to be present on site when appropriate;
c. Conduct all biocide and/or herbicide formulations and applications, including the addition of appropriate surfactants and other adjuvants (such as an ingredient (as in a prescription or a solution) that modifies the action of the principal ingredient), in strict conformance with the manufacturer's recommendation;
d. Maintain a written record of biocide and/or herbicide application, including the formulation, concentration, area treated, and date for each applicationand submitted to the Engineer following each treatment.

A “treatment period” for each designated area will be derived from the schedule submitted by the Contractor and determined by the following:

1) The first treatment date of the earliest treatable vegetation; and
2) The last treatment date of the latest treatable vegetation

Period of application of biocide and/or herbicide will be between September and October.

NOTE: It is anticipated that some species will require more than one season to obtain complete eradication. The treatment period must take into consideration those species that will require follow up treatments and more than one season for complete eradication.

Upon completion of the treatment period, the contractor shall notify the engineer in writing of the status of eradication. If the eradication has not been successful, the contractor shall also submit additional treatment plans.

If the contractor believes that eradication has been achieved, the contractor shall request a site inspection by the Engineer for concurrence. If the Engineer concurs that eradication has been achieved, the area will be subject to a one (1) year warranty starting on the first day following the inspection by the engineer. During this period the contractor will be responsible for any further occurrences of the invasive species inside the delineated area. It has been assumed that %20 of the removed vegetation will reoccur within this one-year-period and corresponding cost is included in the bills of quantities.

2. VEGETATION

2.1. DESCRIPTION

Plants growing on the curtain walls attach themselves to the structure in different ways. In many cases, the chemical action softens the underlying wall material and provides a pathway for the plant to insert a portion of itself into the stone as an anchor. As the plants grow, the plant's roots get larger as well. With taller plants the roots may actually break off small pieces of masonry or cause a total disintegration of small areas of mortar.

Secondly, the roots provide a pathway for water to run into the building material. Water saturation will cause deterioration of the materials. In cold climates, water in masonry subject to freeze/thaw cycles generally causes spalling. If a plant grows sufficiently large, the main vine can develop into a trunk, which is strong enough to heave stone, unsettle a foundation, or even collapse part of a structure.

Different types of invasive vegetation growing on the structure are noticed. To simplify, according to their species they could be divided in categories.

2.2. CATEGORIES OF VEGETATION

2.2.1. Macroflora

Definition: Plants that are large enough to be seen with the naked eye. The types are:

i. Small plants in different dimensions with thin roots (Oxalis pres-caprae, Poa, Eclballium elaterium)
ii. Taller plants or bushes with bigger and harder roots (Capparis spinosa, various trees and bushes species that have been noticed in the project area, for example eucalyptus tree is growing on the walls)
iii. Algae

The invasive vegetation of macroflora is observed in different cases according to the orientation of the walls. Type of plants i (small plants) and ii (big plants) are more potent where the walls are exposed in the South and West. Type iii (algae) is mostly observed in the North or in humid places and areas hidden from the sun and air.

2.2.2. Microflora

Definition: Bacteria and microscopic algae and fungi; crustose lichens and mosses.
The mass of each phenomenon whose development, on the stone surfaces, is favoured by the presence of disruptions of the structure such as injuries, cavities , interstices, etc., inside which humus can accumulate (formed by deposits made up of atmospheric particles and dead organisms), on which the spore deposits carried by the wind facilitate the reproduction of mosses and lichens; lichens create covering, fracturing, decohesion and corrosion phenomena; the moss covers the surface and when penetrated in depth, performs a mechanical disruption action.

3. APPLICATIONS

3.1. GENERAL

Vegetation removal of types i and iii of macroflora has to be done with herbicide application whilst proceeding with the Engineer's instructions.

This should be followed with the closing of cavities so this phenomenon will not be repeated in 6 months when flora is starting the second circle of the year.
As far as the upper vegetation is concerned, the destructive action carried out by the roots established inside the discontinuities cause mechanical damage which in many cases lead to the fall of the material.

Note: Herbicide **should not** be applied in:
- wet weather when rain is forecast for the next 24 hours.
- windy weather
- surface temperatures below + 6 °C or over +30 °C

The appearance of moss and lichens (Microflora) implies the presence of a high level of humidity and further increases its persistence, facilitating the accumulation and stagnation of water. Microflora has to be treated with biocide application whilst proceeding with the Engineer's instructions.

Suggested actions

Before starting biocide and herbicide application a testing period of 15 days must be dedicated for the approval of the biocide product suggested. This testing period of 15 days could be at the end of September start of October.

Surface preparation

Biocide should be applied in dry weather ideally when no rain is forecast for the next 24 hours.

Vegetation Removal Schedule

- Small plants in different dimensions with thin roots and algae

Biocide application

Apply liberally over the entire area by brush, when the plant is very small or inside a cavity, or low pressure spray when the plants are bigger. DO NOT apply in wind, rain or surface temperatures below + 6 °C or over +30 °C.

On horizontal surfaces start spraying from low to high in sequential order.

Leave for 14 days

In this period of time after 7 days undertake Monitoring to check if all the plans treated have changed colour or form. If any of them are left inducted must reapply biocide in that accurate area and leave 14 days starting as day one the application day.

Vegetation removal

Manual removal of infesting vegetation, where the plan has a dimension that could be extract by hand, with particular attention to the removal of the root system.

Cleaning

Brushing, scraping or soft hosing works for deposits of dead biological growth removal from the treated surface.

Washing with potable water so as to remove residues of material.

- Taller plants or bushes with bigger and harder roots

Herbicide application

This application as it takes more time it could be 2 weeks before the previous case of vegetation. Cut the trunk, in the area of the root collar, and then perform a treatment chemical, with injections of solutions herbicide concentrated in the cut part. To facilitate the penetration of the product, some holes are drilled with a drill with a maximum of 10 mm diameter, distributed at short intervals throughout the colar.

Leave for 3 to 4 weeks

The period between 3 or 4 weeks depends from the plant dimension.

Vegetation removal

Manual removal of infesting vegetation, where the plan has a dimension that could be extract by hand, with particular attention to the removal of the root system.

Cleaning

Washing with potable water and brushes so as to remove residues of material.

- Lichens

Biocide application

Remove the colonies by removing fruiting bodies and their colored deposits. The application is carried out by picking up the material gradually removing with wooden or Teflon spatulas, and letting the roots dry with biocide treatments to be applied in aqueous solution at a low concentration of 1 to 3%.

For the areas to be treated which are heavily biological colonized the application will be sprayed.

For the very deteriorated stone surfaces the application will be with "compressed" system. Treatment, which limits the dispersion of the biocide product in the environment and is effective against the incrustations, it is the so-called "compressed" system.

It is generally made of paper pulp or clay, to which biocide solutions are added. Covered with polyethylene sheets (or with aluminium foil, cotton wool, gauze ...) to avoid too rapid water evaporation, it is left in situ for a time ranging from one to a few days.

Leave for 3 to 4 weeks

Cleaning

Rinsed away with potable water by removing the dried organic waste with soft brushes or nylon brushes.

The order of the actions to be undertaken are summarised as below:

Pre – Application

Testing Period: Before starting biocide and herbicide application a testing period of 15 days must be dedicated for the approval of the biocide product suggested. This testing period of 15 days could be at the end of September or October.

Do not apply spay application in case of rain the day before. Repeat application in case of rain on the same or the day after application.

Surface preparation: Biocide should be applied in dry weather, ideally when no rain is forecast for the next 24 hours.

Vegetation Removal Schedule

Small plants in different dimensions with thin roots and algae

Biocide application: Apply liberally over the entire area by brush. If a plant is very small or inside a cavity, the application should wait until the plants get bigger. DO NOT apply in wind, rain or surface temperatures below + 6 °C or over +30 °C.

On horizontal surfaces start spraying from low to high in sequential order.

Leave for 14 days for biocide to do its work. In this period of time after 7 days undertake Monitoring to check if all the plans treated have changed colour or form. If any of them are left inducted biocide must reapplied in that accurate area and leave for 14 days.

Vegetation removal: Manual removal of infesting vegetation, where the plan has a dimension that could be extracted by hand, with particular attention to the removal of the root system.

Cleaning: Brushing, scraping or soft hosing works for deposits of dead biological growth removal from the treated surface. Washing with potable water so as to remove residues of material.

Taller plants or bushes with bigger and harder roots

Herbicide application: Cut the trunk in the area of the root collar, and then perform a chemical treatment, with injections of herbicide solutions concentrated in the cut part. To facilitate the penetration of the product, some holes are drilled with a maximum of 10 mm diameter, distributed at short intervals throughout the colar.

Leave for 3 to 4 weeks

The period between 3 or 4 weeks depends on the plant dimension.

Vegetation removal: Manual removal of infesting vegetation, where the plan has a dimension that could be extract by hand, with particular attention to the removal of the root system.

Cleaning: Washing with potable water and brushes so as to remove residues of material.

Lichens

Biocide application : Remove the colonies by removing fruiting bodies and their colored deposits. The application is carried out by picking up the material gradually removing with wooden or Teflon spatulas, and letting the roots dry with biocide treatments to be applied in aqueous solution at a low concentration of 1 to 3%.

For the areas to be treated which are heavily colonized the application method will be spraying.

For the very deteriorated stone surfaces the application will be with "compressed" system. Treatment, which limits the dispersion of the biocide product in the environment and is effective against the incrustations, it is the so-called "compressed" system.

It is generally made of paper pulp or clay, to which biocide solutions are added. Covered with polyethylene sheets (or with aluminium foil, cotton wool, gauze) to avoid too rapid water evaporation, it is left in situ for a time ranging from one to a few days.

Leave for 3 to 4 weeks

Cleaning: Rinse away with water by removing the dried organic waste with soft brushes or nylon brushes.

3.2. Rubble Surface Cleaning

The three steps of cleaning these areas are; (1) preconsolidation / grouting to prevent water to penetrate into the structure, (2) spray washing, (3) cleaning the residues.

Preconsolidation:

This type of operation, which often precedes the grouting or sealing procedure of stone blocks, will have the task of "securing" fragments or fractures of the stone segments that otherwise could be detached or lost during the cleaning operations.

In order to support light stone flakes, not wider than 10cm, a thin mortar can be used as glue (the mixture must contain a little lime, so as to be more easily removed after cleaning) with an inert lime ratio 1: 4 or 1: 5 with very fine granulometry in small portions. These weak groutings can be spread with flat double-sided spatulas or with nozzles and must be positioned, unless otherwise specified, as bridges connecting the fragments being detached

and the main mass; furthermore, it may be advantageous to choose a mortar which presents, after being taken, a colour in strong contrast with the neighbouring appliance so as to be clearly identifiable as temporary stuccoing. See also section 3.5.2 for limitations on pointing.

Washing & Cleaning:

The pressure applied should not be higher than 3bar. Washing should start from the top of the walls and soft/nylon brushes and plastic/wooden spatulas can be used to finish cleaning.

3.3. Ashlar Surface Cleaning

The aim is to remove biological patina from the surface of the stones. First step is to gradually remove the visible patina with the help of wooden or teflon spatula followed by biocide application in aqueous form at a concentration of 1 to 3% to dry the roots. The residues should be rinsed away within 4 weeks after biocide application.

3.4. REMOVING VEGETATION

Cleaning procedure for different types of vegetation differs from each other:

3.4.1. Mosses & Lichens

- REMOVAL WITH SCALPELS AND SMALL SPATULAS
- BIOCIDE APPLICATION
- WASH WITH WATER AT MODERATE PRESSURE

The cleaning will be performed with manual operations to remove the vegetation by using soft brushes and spatulas. The order of application is as below:

- Remove the colonies by removing fruiting bodies and their coloured deposits: The application is carried out by picking up the material and gradually removing with wooden or Teflon spatulas.
- Let the roots dry with biocide treatments; applied in aqueous solution at a low concentration of 1 to 3%.
    - For the areas to be treated which are heavily biological colonized spraying will be applied. Manufacturer’s recommendation should be taken into consideration for the mixed-design of the spray.
    - For the very deteriorated stone surfaces the application will be with a "compressed" system. This treatment, which limits the dispersion of the biocide product in the environment and is effective against the incrustations, is the so-called "compressed" system.
- Leave for 3 to 4 weeks for the biocide to dry the vegetation.
- Rinse away the dried organic waste with potable water with the help of soft brushes or nylon brushes.

3.4.2. Small Plants in Different Dimensions with Thin Roots and Algae

- BIOCIDE APPLICATION – SPRAY TREATMENT
- MANUAL EXTIRPATION (Pull up by the root)
- WASHING WITH WATERSPRAY AT MODERATE PRESSURE

The biocide must be diluted in water (generally 0.1-1%) and the amount of solution depends on the total surface to be treated. Spraying can be carried out with particular watering cans, equipped with manual pumps similar to those for disinfecting the vines or more specific nebulizers; spray treatment is preferable for large surfaces. The order of application is as below:

- Cover as much of the foliage as possible with low pressure spray until wet,
- Apply over the entire area by brush, when the plant is very small or inside a cavity.
    - On horizontal surfaces start spraying biocide from low to high level in sequential order.
- Leave for 14 days for the biocide to dry the vegetation.
    - In this period of time after 7 days monitor to check if all the plans treated have changed colour or form. If any of them are left exposed, you must reapply biocide in that specific area and leave 14 days with day one as the application day.
- Remove vegetation:
    - Manual removal of infesting vegetation, where the plan has a dimension that could be extract by hand, with particular attention to the removal of the root system.
- Cleaning:
    - Brushing, scraping or soft hosing works for deposits of dead biological growth removal from the treated surface. Removed plants should be collected in a container and dispose.
- Wash with low pressure potable water sprayed at moderate pressure so as to remove residues of material.

3.4.3. Woody Plants or Bushes with Bigger and Harder Roots

- HERBICIDE APPLICATION – INJECTION TREATMENT
- MANUAL EXTIRPATION
- WASHING WITH POTABLE WATER SPRAYED AT MODERATE PRESSURE

To eliminate woody plants of a certain size, which are anchored into the substrate in a way that they can not be mechanically removed without damage, the trunk must initially be cut, in the area of the root collar, and then perform a chemical treatment, with injections of concentrated herbicide solutions in the cut part. To facilitate the penetration of the product, some holes are drilled with a drill with a maximum of 10 mm diameter, distributed at short intervals throughout the stump. The desiccation of the entire plant takes place generally 3/4 weeks after treatment.

This procedure has the advantage of avoiding the dispersion of the herbicide product outside the treated area and its possible unwanted interference with the element and with its material and constructive components. The order of application is as below:

- Cut the trunk; in the area of the root collar, and apply to cut stumps immediately after cutting,
- Perform a chemical treatment; with injections concentrated herbicide solutions in the cut part.
    - To facilitate the penetration of the product, some holes are drilled with a drill that has a maximum diameter of 10 mm, distributed at short intervals throughout the colar.
- Leave for 3 to 4 weeks for the herbicide to dry the vegetation.

- The period between 3 or 4 weeks depends on the plant dimension.

- Remove vegetation:
  - Remove vegetation manually; where the plant has a dimension that could be extracted by hand, with particular attention to the removal of the root system.
  - Removed plants should be collected in a container and disposed of.
- Cleaning:
  - Wash with potable water and brushes so as to remove residues of material.

Note: The biocidal products must have following characteristics:
- be colourless or transparent with active ingredients not very soluble in water,
- have a low degree of toxicity,
- be degradable over time,
- do not cause physical or chemical reactionsin masonry structures,
- do not persist after application on the treated surface, leaving residues of stable aggregates (this should avoid oily or coloured substances).
- The dilution should take place in the following phases:
  - place approximately half of the water required for treatment in the equipment container (eg hand pump);
  - measure the correct amount of product and pour it into the water;
  - add the amount of water that is missing to the final volume;
  - shake the container well.

The herbicide products must :
- be used only by injection, spray or other kind of application is not permited.
- not permited that the product will be intouch with masonry structures
-in case of leaving residues on treated surface, clean immediadly with pleanty of potable water.

3.5. POINTING & INTEGRATION OF WALL PORTIONS

3.5.1. GENERAL

Before putting pointing into practice, the following operations should be undertaken:

3.5.1.i. Preliminary checks

Before carrying out any operation, it is necessary to check if there is a crack pattern, to be able to identify any "dynamic" lesions; in this case the pointing and integration.

3.5.1.ii. Removal of non-compatible parts

The removal and repointing of parts not compatible with the stone masonry (wood, iron, plastic, mortars eroded or severely degraded, etc.), will only take place for the areas only where woody plants or pushes with bigger and harder roots will be removed. The operation must be carried out with the utmost care, carefully avoiding damage to the stone.

3.5.1.iii. Cleaning of the surface

Cleaning cycle with potable water and subsequent brushing of the surface to be treated in order to remove dirt, dust, oils, slag and any other substance foreign to the stone material. All cleaning operations must leave the inside of the lesions or the joints free of debris or patina, but with a rough surface, so as to favour cohesion of the repair mortar.

3.5.2. POINTING

Pointing will take place after the removal of vegetation defined in section 3.4.3. MasterEmaco N275 TIX or equivalent must be used for pointing.

Mortar colour:

In order to make an adequate chromatic reading possible, the colour of the mixture can be "helped" by adding coloured earth and pigments (maximum 5% mineral pigments or 10% earth). The colour of the stone will be reached amalgamating, dry, the charges until obtaining the exact but darker tone to balance the subsequent clearing that will be produced by adding lime.

Once the test mixtures have been carried out, it is necessary to write down the proportions and prepare small samples of mortar on stone slab, so that they can be brought closer to the surface to be plastered for the verification of the final tone. For the grouting that will affect large wall portions, it may be preferable to obtain a chromatic resolution that is slightly different from the original stone.

Final treatment:

After setting, in order to obtain an opaque grouting, the affected surface will be washed and / or buffered (exerting a slight pressure) with a sponge dampened with potable water, so as to compact the stucco, and eliminate any residual mortar.

NOTE: It will not permitted to carry out any pointing, integration or, more generally, use of products, without the prior execution of pre-intervention samples carried out under the control of the Engineer; each sample must necessarily be catalogued and labelled; on this label the date of execution, the type of product and / or the percentage of the mixture used, any solvents and consequently the type of dilution or concentration used, the methods and times of application must be reported.

3.5.3. INTEGRATION OF WALL PORTIONS

The operation of integrating portions of walls may be necessary in situations where the wall unit is particularly degraded. No integration will take place for incomplete elements. All applications should be performed in conjunction with procedures defined in 3.5.1 and 3.5.2.

3.5.3.i. Replacing existing stone:

In principle, the procedure will be identified as a real constructive intervention that, comparing itself with the pre-existing manufactured article, will have to evaluate each time the relations between the parts or, the implementation of elements similar in terms of shape, size, technique processing and installation compared to those "original" (or better pre-existing).

The operation of integration with elements of material, shape, size, type of processing equal to those of the existing equipment and with the same type of equipment (camouflage integration); The integration operation procedure must follow the steps specified after a survey of the sections of masonry are integrated according to an analysis needed to define the quality, the forms and the methods of installation of the new elements. Prior to securing the structure with suitable temporary works, it will be possible to proceed with the removal of particularly disconnected and / or incoherent elements. The removal will have to take place for a limited number of successive sites from top to bottom so as not to cause further stress to the building organism. After this removal phase, it is necessary to perform a generalized cleaning of the support and connection surfaces of the new segments. The cleaning, unless otherwise specified, should take place with the use of instruments such as brushes, and if necessary, with clean water, always taking care not to damage the existing materials. Usual steps of replacement will include:

- Number the stones by element and schedule.
- Remove the existing stone (which allows vegetation grow behind it)
- Clean both the existing surface and the removed stone
- Install the stone and apply mortal.

3.5.3.ii. Implementation of the new elements:

In case of neccessity to make an addition with new stone elements, the location of the area will be consolodated with mortar and no installation of a new element will take place.