DESIGN AND DEVELOPMENT OF A ROOF GARDEN

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McCaren Designs Inc.

Creating memorable places and unique experiences to improve the business performance of our customers.

Our knowledge and practical experience enables McCaren Designs to provide imaginative yet enduring landscape concepts. At the heart of our approach is our knowledge --- knowledge based in practical application. We've not only created award-winning designs, we have also installed and successfully maintained them.

McCaren Designs is committed to seeing the possibilities where others see the limits. Narrow thinking often limits one to the same old solutions. At McCaren Designs, we take a bold approach. Very often, we discover a whole new range of possibilities, and that's where the best solutions lie. Each project receives creative solutions for its most challenging problems.

To insure a successful project, we share our knowledge by addressing critical infrastructure questions about plants and plantings, irrigation and drainage systems, load capacities, paving systems and materials, furnishings and seating requirements and general project specifications. Our design/build projects receive detailed plans and presentation documents, as well as accurate construction budgets and performance specifications. This process insures a delivered project: as designed and within the established budget. Most importantly, our design decisions not only enhance the beauty of the project today, they also protect our client’s landscaping investment for years to come.

We trust you will select McCaren Designs, Inc. to create your project’s roof garden. We invite you to experience the environmental, sociological and psychological benefits of our innovative landscapes.

McRae Anderson, ALSA, CLP
President
McCaren Designs, Inc.
Design Parameters

The sharing of knowledge leads to better projects, more carefully conceived and therefore able to stand the test of time.

The purpose of this portion of the report is to address the major technical and use factors affecting the success of the project's roof garden or green roof. These are practical and usage factors that need to be addressed by various project designers and consultants.

This report reviews several areas of design that are of importance to the “Healing Pad” roof garden’s success and should be shared with those designers and consultants affected by the requirements set forth. These are the technical requirements of a long-lived, healthy roof garden. Failure to attend to these requirements can result in costly mistakes and increased lifetime project costs.

Every effort has been made to outline the general requirements necessary for this particular roof garden feature. The variety of design elements used in a roof landscape is limited only by the design team’s imagination. Almost anything that can be installed in the ground can be used in the roof landscape, providing certain design criteria are met in the development of the infrastructure and systems of the roof landscape.

OTHER CONSULTANTS

McCaren Designs has had significant experience in the creation of specialized landscapes including plantings over structural areas. However, we recommend the employment of other consultants to insure the project’s success. We recommend, a structural engineer be retained to determine the existing, or required, load capacity of the roof. Also a mechanical engineer should be required to discuss integration with existing and proposed rooftop mechanical equipment, electrical and drainage needs. Depending on the desired function of this green roof the owners may also want to consider retaining a horticultural therapist consultant.
The Basic Green Roof Garden

A green roof is a green space created by adding layers of plants on top of a traditional roofing system. The layers of a contemporary green roof system, from the top down, include:

- The plants, often specially selected for particular applications,
- an integrated irrigation system and controls
- an engineered growing medium, which generally will not include soil,
- a landscape or filter cloth to contain the roots and the growing medium, while allowing for water penetration,
- a specialized drainage layer, sometimes with built-in water reservoirs,
- the waterproofing/roofing membrane, with an integral root repellent, and
- the roof structure, with traditional insulation either above or below.

Design Considerations

There are several important design and structural differences between ground level landscape development and rooftop developments. The following are the special construction requirements and considerations when developing a roof garden.

- Protection of the integrity of the roof and structure
- Positive drainage
- A long-term, lightweight planting medium
- Irrigation for optimum plant growth and sustainability
- Adaptation to the climatic conditions
- Selection of hardscape materials (paving, structural materials, site furnishings and water as a design element) and their special use and requirements as part of a roof garden system
- Provisions for utilities
- Public safety and security
- Ease of maintenance
Protection of the Roof and Structure
The single most important element in rooftop garden construction is protecting the integrity of the roof and the structural components under the garden. For this reason there must be waterproofing of exceptional longevity to prevent damage and to reduce the possibility of long term expensive reconstruction. For this reason it is recommended a completely new waterproofing layer be added to the existing structure to insure the longevity and integrity of the waterproofing system.

Load Bearing Capacity
The structural engineer should verify the maximum load bearing capacity of the existing structure. These figures should be available from the records of the previous construction of the helipad. Typically, a minimum additional dead load limit of 150 psf between columns is needed to accommodate the construction of a roof garden. Loads above columns and at the roof’s edge can be considerably higher, however a structural engineer should be consulted to establish the load bearing capacity of those areas. These higher load bearing areas should be used to accommodate larger specimen plantings and trees.

Waterproofing
As mention before, a completely new waterproofing system should be installed to protect the building’s structure. There are several types of waterproofing available, however, elastomeric materials offer the greatest protection. Bituminous waterproofing should be avoided. Over time the organic components in bituminous waterproofing interact with the soils and the plant materials and therefore increase the likelihood of system failure.

A properly installed waterproofing system can last the lifetime of the building, however a single small leak may require the removal of the entire garden to find and repair the damage. Therefore, in order to insure the integrity of the waterproofing it is recommended a protective topping coat of concrete be applied, as soon as possible, following the installation of the new waterproofing.

KEY POINTS: Protection of the Structure
The single most important consideration regarding roof and deck garden construction is protecting the roof and structure from damage due to excessive loading or leaks.

- A structural engineer should always be consulted prior to roof garden landscape design and construction.
- Rooftop structures must typically be able to support a dead load of 150psf to accommodate the construction of a garden.
- The roof must be completely covered by an elastomeric material and protected by a concrete topping slab.
**Planting Provisions**

Like the roof on which the garden is to be built, a roof garden is constructed in layers. Just as failure in the roof components can cause significant damage to the building, so too can failure of the planting components cause significant and costly damage. Therefore, it is imperative to take care in choosing and installing materials of the highest quality and species conductive to a rooftop’s environment.

**The Roof Drains**

The existing roof drains are appropriate for use within the roof garden. Some minor modifications may be required to accommodate the new waterproofing and topping slab. Nevertheless, the four roof drains and their size are adequate to support the roof garden’s needs. Special care should be taken and accommodations made to allow access to those roof drains should there ever be the need to access them for cleaning.

**The Drainage Layer**

The drainage layer, directly above the concrete protective slab, should be very porous to permit water to pass easily through it. It must be permanent and continuous over the entire roof surface and strong enough to support the weight of the plant materials and hardscape above it. This layer must be kept free of any materials that could prevent the free flow of water to the drains. Because of its lightweight and integrated filter fabric, McCaren Designs recommends the use of Enkadrain for this drainage layer. Further, its .75 inch thickness allows for more planting media in areas next to paved areas.

**Filter Fabric**

To prevent the planting media from going into solution and being lost in or clogging the drainage layer and roof drains, a water-permeable barrier of filter fabric is needed. As mentioned previously we recommend Enkadrain because the filter fabric is integral with the drainage course.

**Planting Media**

The critical criteria in the formulation of a suitable planting media for roof gardens include: lightweight; the ability to hold nutrients; adequate moisture holding capacity; and the capability of developing a firm (for plant stability) yet easily drained soil structure. There are several ready mixed medias available that meet these requirements. However, care must be taken in selecting these lightweight soils to be sure there are adequate non-organic components incorporated into the mix. Soil mixes consisting of solely organic material will decompose, losing nearly 30% of its mass every year, thereby requiring frequent topdressing to maintain the soil mass. Therefore one should incorporate sand and expanded shale into these prepared planting medias. When this mixture is properly moist it will weigh approximately 60 pounds per cubic foot.

This soil mixture will weigh approximately 60 pounds per cubic foot.
Irrigation
The relatively thin, well-drained soil mixtures used in roof garden construction cannot provide the plantings with the subsurface water normally available to ground level plantings. Care must be exercised to prevent the soil mass from drying out and causing damage to the plant materials. Hand watering is too labor intensive and is not cost effective. Therefore, we recommend the installation of a sensor controlled drip irrigation system. Drip irrigation is preferred in roof garden applications because the effects of wind can cause above ground systems to perform inconsistently.

Mulch
Drying and overheating of the soil can be prevented by the application of 2-3 inches of shredded hardwood mulch. Besides providing protection of the plant materials this mulch serves to hide the drip irrigation lines and emitters.

KEY POINTS: Planting Provisions
An important consideration regarding roof and deck garden construction is the substrate supporting the plantings.

- The existing roof drainage system is adequate to support the installation of a roof garden.
- Planting media and the drainage course should provide for fast percolation of water and be free of fine silts that can clog the filter blanket and block drainage.
- Planting media should contain sufficient mineral content to stabilize the plantings and maintain soil mass.
- On a regular basis soils require topdressing to replenishment decayed organic material.
- Drip irrigation is the prefer method of providing moisture to the planting.

Climatic Considerations
Climate and exposure can be prime contributing factors in the success or failure of any outdoor space. This is both a consideration in the selection of plant materials but also a factor in human use and comfort.

Wind, sun and shade, and extremes of temperature, as well as long dry or wet periods, snow loads and frost are much greater problems for roof gardens than for other landscapes.

Climate:
The Minnesota climate is one of extremes and therefore care must be exercised to make provisions for these extremes. As much as possible, increasing the depth of the soils will mitigate some of these extremes. A minimum of 12” of soils is required for sod, groundcovers and annual planting areas. For perennials and small shrubs a
minimum of 16” of soil is required. For small trees and large shrubs 24” is needed and shade trees require a minimum of 30” of planting medium.

**Wind:**
Trees and vertical structures (such as fences, walls, gazebos, trellises and light standards) and other similar elements must be designed or selected to resist wind damage due to overturning or breaking. Plants are also subject to flagging (lopsided growth) due to strong persistent winds, which are typical in a roof garden application. Further, even normal wind flow can cause excessive drying of plant materials and soils and high evaporation of water used in water features. Special guying and support of trees is required to offset the effects on trees of persistent winds. Automatic water fills are required on water features to compensate for evaporation and to protect pumping equipment. And irrigation is required to replenish the soil moisture.

Wind direction should also be considered in the design of the barrier system, designing such systems to mitigate the effects of wind on the garden’s visitors.

**Sun and Shade:**
Heat and glare can make a roof garden quite uncomfortable. Except for the confirmed sun worshiper, few people prefer to be in the sun for more than a few minutes on a hot day. Shade relief, usually found under trees, may be at a premium. Trees should be located where they cast the greatest shadow. Artificial shade should be provided in areas where trees cannot adequately shade the area. Providing adequate shade maybe the single most important design consideration in relation to the use of the roof garden. If adequate shade is not provided, the garden will receive little or very limited use.

Glare is also a significant problem even in areas where heat is not an issue. Avoid using light colored paving or paving that has a high reflection value. Glare is not relieved by immediate shade in the area of the user and a rooftop garden is seldom planted so closely with trees as to eliminate the problem. Glare reduction can, however, be achieved by using lawns and groundcovers and light absorbing paving materials.

**KEY POINTS: Climatic Conditions**
The effects of wind, heat, cold and precipitation are amplified on roof gardens.

- Provide adequate soil mass to support the desired plantings.
- Make appropriate provisions to replenish soil moisture and water in features to combat the effects of evaporation.
- Use windscreens to mitigate the effects of wind on the users.
- Plant trees in areas that will cast the maximum amount of shade.
- Avoid using paving that increases the amount of glare.
Selection of Hardscape Materials
The selection and construction of light standards, walls, fences, wind screens, pergolas, curbs and other structural elements should all be considered in relationship to the structural limitations of the roof and its supports below. The omnipresent factor of weight has a strong effect on which materials are used and their placement in the landscape. Lightweight materials should be used wherever and whenever possible.

Paving:
As previously mentioned, the consideration of the paving material’s reflectance should be of primary consideration. Secondly, the type and pattern of paving materials chosen are as important to the viewers from surrounding buildings as they are to the actual user of the space. The color, tone and contrast of these materials can create a strong visual interest. Paving materials should be selected for lightweight qualities and durability. Paving if at all possible should allow for the permeation of water to aid in the drainage and removal of heavy rainfall amounts.

Methods of Anchoring:
The structural elements, including lighting fixtures need to be carefully anchored when used on rooftops. Special care and method must be employed to avoid penetrating the waterproofing systems. There are many such methods for anchoring and these will be fully developed and detailed during the project’s design phase.

Furniture:
Furniture and site amenities are a critical component in the roof garden’s success. Frequently, adequate and abundant seating is often overlooked and is one of the most important elements in the comfort of the user, as well as, in the actual overall project usage. Furniture should be heavy enough to not require anchorage. Wood furniture or heavy poly-resin furniture is more comfortable to the user than metal or concrete seating.

Pools and Fountains:
The use of water and fountains add greatly to the enjoyment and use of roof deck gardens. There are several factors to consider when using water as a design element.

The weight of water in roof top gardens in most reference materials is widely misunderstood. Most, if not all, reference materials assume the weight of water to be greater than that of the plantings. This is in error and for the most part a water feature will weigh less than the planted areas. Therefore, no special provisions to support the weight of the water are required in planning the garden. However, lightweight manufactured cap stone should be used when creating a naturalistic water feature. The finishes weight is the area of concern when designing the feature.

Generally in our climate, a flexible water retaining system is preferred to a rigid system because although drained during the winter season, water will still accumulate in the basin. If a rigid system is used there will be cracking and eventual failure of the system.
Also, as previously mentioned, automatic fill and management of the water levels is an important consideration in the feature design. Evaporation will easily reduce the water level by 3-4” per day in hot windy conditions. An auto-fill feature will protect the expensive pumping and filtering systems.

Planting of water plants will greatly improve the quality of the water and prevent algae from becoming a problem. Additionally, the use of a biomass filtering system will provide the necessary filtering without the use of chemical agents.

**KEY POINTS: Selection of Hardscape Elements**

The omnipresent factor of weight has a strong effect on which materials are used and their placement in the landscape.

- Consideration of the reflectance of the paving materials should be of primary consideration.
- Provide adequate seating, the comfort of the user impacts the overall usage of the project.
- Furniture should be heavy enough to not require anchorage.
- Wood furniture is preferred.
- Make appropriate provisions to replenish water in features to combat the effects of evaporation.
- Use a flexible water retainage system to mitigate the effects of the Minnesota climate on the pool system.

**Provisions for Utilities**

**Electrical**

Standard 110-120 Volt ac electrical supply is sufficient for most roof garden uses, such as lighting, appliances, fountains and irrigation controllers. All electrical requirements should be met in accordance with the electrical engineer’s recommendations.

**Water**

A supply of clean water is needed for irrigation, pools and fountains and the cleaning of paved surfaces and furniture. Water pressure of the irrigation system should be provided from a minimum of 35 psi to a maximum of 70 psi.

**Storage**

Provisions should be made for the storage of gardening materials and supplies. This storage should be water tight and readily available to the horticultural staff caring for the garden. Additionally this area can function as the location of controllers and electrical panels for the garden.
**Safety and Security**

This site should be easily accessible, accommodating a wide range of visitors, from children to the elderly, including strollers, walkers and wheelchairs. Extra safety features may be required insuring the safe use by such a diverse group. Items such as safety and hand railings and plant area curbing must be considered to make the area safe. Also, because the area will be somewhat unsupervised, water feature restraint and boundary height must be considered.

**KEY POINTS: Safety and Security**

- Who will use the garden and how will they be using it?
- Who will organize and be accountable for the garden?
- How many people will be using the garden at any one time?
- When will the garden be used / accessible?
- How will access to the garden be controlled a) for staff b) patients and families?
- Are there any physical barriers, which would make access and use by children, seniors, and/or the handicap difficult or unsafe?
- Are there any physical barriers which are necessary to keep the garden safe?

**Maintenance**

Regular professional maintenance of the plantings and facilities should be accounted for in budgeting and planning. Special attention should be given to pruning trees and shrubs in order to maintain balance between branching and root growth (based on availability of rooting area). Regular maintenance will not only prolong the life of the plants but will also prevent overturning of top-heavy plants due to strong winds. Periodic thinning should be done to allow wind to pass through the foliage, except where plants are used as windbreaks.

Plants on roofs or decks are, in effect, growing in containers. Therefore, the roots of large trees and shrubs will tend to dominate the planting medium and inhibit the growth of smaller plants. The areas near the edges of the planters should be checked for roots and if they appear to be affecting the growth of smaller plants, these roots should be pruned.

Roof gardens, because the media is so porous, do not retain nutrients as well as regular soils and therefore plants require more frequent feeding. A year after installation, all planted areas should receive a top dressing, approximately 2 inches thick, made up of a mixture similar to the original planting medium. This should be continued annually or adjusted to maintain the original level of the grades and planting mixture.

Failing plants should be replaced as soon as their condition becomes apparent. Usually, these plants should be replaced with the same variety unless it can be determined that the particular plant is not hardy in a specific location.
Lastly, maintenance can be simplified if plants are selected for their zonal hardiness, for their resistance to wind and human abuse, for their noninvasive root systems, and for their reliability in not exceeding a specified size. There are few ornamental landscape plants used in the world, which will not grow in well-designed roof gardens in their own locality. However, just as designers must carefully choose plants for the specific microclimate, soil, and other habitat conditions found in ground level landscapes, so we must exercise sound judgment in selecting plants for roof landscapes.

**KEY POINTS: Maintenance**

- Plant should be under professional care and maintenance and checked on a regular basis.
- Monitor irrigation systems regularly and monitor soil fertility
- Special attention must be given to maintaining the balance between foliage area and root mass.
- All planted areas should receive annual topdressing to replenish soil.
Statement of Probable Cost

Experience is the best estimator of costs. McCaren Designs has installed hundreds of specialized planting. Many of these, although interior projects have similar requirements as roof gardens.

PROJECT: Sample
LOCATION: Minneapolis, MN
EST. FOR: Project Director

SUMMARY OF ESTIMATED COSTS:

I. PROFESSIONAL SERVICES ................................................................. $16,676.94
II. LANDSCAPE & SITE FURNISHINGS MATERIALS AND EXPENSES .................................................. $136,276.94
III. HARDSCAPE MATERIALS AND EXPENSES ................................................. $147,261.81

TOTAL ............................................................................................................ $283,538.75

These estimates are based upon the following assumptions:

BASED UPON TOTAL SQ. FT. PLANTING (sq) ................................................... 1800
BASED UPON A PLANTER DEPTH OF (pd) ..................................................... 1.5
BASED UPON TOTAL SQ. FT. WATER FEATURE (sqwf) .................................. 192.0
BASED UPON TOTAL LIN. FT. OF POND EDGE (lfpe) ...................................... 72.0
BASEED UPON A WATER DEPTH OF (wd) ......................................................... 1.0

I. PROFESSIONAL SERVICES:

A. DESIGN FEES ......................................................................................... $14,176.94
   Preliminary Design ........................................................................... $4,253.08
   Design Development .......................................................................... $4,253.08
   Construction Documents .................................................................... $5,670.78

Notes and Comments: Work includes design of all landscape and water feature elements, does not include architectural, structural or mechanical engineering costs.
B. CONSULTANT ALLOWANCES

Mechanical Designs Allowance (Water features only) $1,500.00

Notes and Comments: Work includes developing, sizing and specification of mechanical systems for the water feature elements. Does not include any architectural, structural or mechanical engineering.

C. MISCELLANEOUS EXPENSES $1,000.00

Notes and Comments: Costs include miscellaneous design expense.

II. LANDSCAPE MATERIALS AND EXPENSES:

A. PLANT MATERIALS $19,080.00

Notes and Comments: Cost are the nursery prices and do not reflect any markups or additions.

- Specimen Trees:
  Trees per Sq. Ft of Planting Area 150
  Est. # of Specimen Trees 12
  Cost per Plant $375.00
  TOTAL SPECIMEN PLANTING COST $4,500.00

- Middlestory (4-8 ft. plants):
  Est. # of Middlestory Plants 75
  Cost per Plant $82.50
  TOTAL MIDDLESTORY PLANTING COST $6,187.50

- Understory (2-4 ft. plants):
  Sq. Ft. of U.S. Planting Area 513
  Est. # of Understory Plants 151
  Cost per Plant $31.25
  TOTAL UNDERSTORY PLANTING COST $4,718.75

- Ground cover (less than 1 ft. plants and grasses):
  Sq. Ft. of G.C. Planting Area 513
  Est. # of Groundcover Plants 513
  Cost per Plant $3.75
  TOTAL GROUNDCOVER PLANTING COST $1,923.75

- Freestanding (Plants & Containers):
  Est. # of free standing Plants 10
  Cost per Plant & Container $175.00
  TOTAL FREE STANDING PLANTING COST $1,750.00

B. FREIGHT CHARGES $300.00

C. SOIL $14,377.50

Notes and Comments: Costs are for custom premixed soils to work with the sub-irrigation system. Cost per cubic ft. is $3.55 and there are 4,050.00 cubic ft. estimated for the project.

D. DRAINAGE $4,325.75

Notes and Comments: Underlayment drainage of all roof top areas.
STATEMENT OF PROABLE COSTS

E. IRRIGATION SYSTEM (Drip Emitter System)............................................. $7,070.00

Notes and Comments: Costs for a drip-irrigation system. This system waters only the plants and effectively reduces weekly maintenance time.

F. INSTALLATION LABOR................................................................................. $5,914.80

Notes and Comments: Costs for installation labor, at non overtime rates. Time required to complete the installation is 2 weeks. If less time is available additional overtime rates may apply.

G. ON-SITE SUPERVISION AND PROJECT COORDINATION ...................... $4,250.00

H. MISC. EXPENSE ALLOWANCE............................................................... $2,000.00

I. EQUIPMENT RENTALS............................................................................... $2,000.00

J. ACCENT LIGHTING ALLOWANCE............................................................. $6,500.00

K. SITE FURNISHINGS ALLOWANCE............................................................. $11,165.00

Notes and Comments: Allocation for benches and other site furnishings. I have allowed for more seating than you had allocated, since I believe this is a critical factor in determining the success and use of the project.

L. CONTINGENCIES.......................................................................................... $6,581.81

Per Cent of Contingency Items................................................................. 0.0%

M. OVERHEAD ALLOCATION......................................................................... $33,309.07

Overhead Allocation................................................................. 28.5%

N. PROFIT........................................................................................................... $14,746.74

Percent Profit................................................................. 15.0%

O. SALES TAX (taxable items)........................................................................ $4,656.28

Percent Tax................................................................. 7.0%

III. WATER FEATURE, PAVING, RETAINAGE, WALL, ETC.
EXPENSES: (Subcontracted Services)

A. WATERPROOFING...................................................................................... $46,037.50

# Sq. Ft. roof deck ................................................................. 3575
# Sq. Ft. Ponds ........................................................................ 192
Lin. Ft. Ponds ........................................................................ 72
Square Foot Cost .................................................................. $12.50

Notes and Comments: Membrane waterproofing

B. GUARD RAIL AND RETAINAGE SYSTEMS............................................. $23,375.00

Notes and Comments: 275 Lin ft. of retaining walls and guardrails
C. PAVING TREATMENTS............................................................................... $12,500.00
Notes and Comments: Light Weight Colored Stamped Colored Concrete

D. ROCK WORK................................................................................................. $16,500.00
# Sq. Ft...............................................................300
Square Foot Cost ..............................................$55.00
Notes and Comments: GFRC castings and natural rock, including painting and special effects

E. MECHANICAL ALLOWANCE.......................................................................... $2,500.00
Notes and Comments: pump, filter unit

F. MISC. EXPENSES............................................................................................. $2,000.00
Notes and Comments: Miscellaneous expense items

G. EQUIPMENT RENTALS.................................................................................. $1,000.00
Notes and Comments: Miscellaneous equipment rentals

H. LIGHTING STANDARDS ALLOWANCE....................................................... $7,500.00
Notes and Comments: Does not include the electrical installation work to be provided by others

I. ARTIST COMMISSION.................................................................................... $5,000.00
Notes and Comments: Sculptural Wind Chime element.

J. CONTINGENCIES........................................................................................... $11,641.25
Per Cent of Contingency Items .........................10%

K. Markup................................................................................................................. $9,208.06
Per Cent Markup .................................................................15%

IV. LANDSCAPE MAINTENANCE
A. ANNUAL SERVICE COST (7 MONTHS OF SERVICE):............................... $2,649.36
C O R P O R A T E  C A P A B I L I T I E S
Our Corporate Capabilities

When we decided to begin to approach the roof garden market, I thought I’d need to do a great deal of research. Then it dawned on me, we had done a great deal of them without even thinking about it. — McRae Anderson

Every interiorscape or zoological exhibit we have designed and installed that is over a parking structure or above another level of the building is, in fact, a roof top garden. Most of ours just happen to have a roof over them. So without thinking about it McCaren Designs has been designing and installing roof gardens for over twenty-five years.

Admittedly, conditions in the exterior landscape roof garden are a bit more extreme — wind and solar exposure are definite considerations, also species selection and planting techniques require more care. However, the notion that plant life can be supported in a defined thickness of planting medium on an impenetrable structural layer without damage to the supporting structure remains the constant.

The Tennessee Aquarium in downtown Chattanooga opened in 1992 as the largest aquarium in the world devoted to freshwater fish. Fish and fowl, otters and alligators, live in the 130,000 square foot aquarium gracing the riverfront. The recreated habitats illustrate the working link in a river’s watershed chain of life support.

The aquarium takes the visitor on a river’s journey — beginning with a Cove Forest, found in the Appalachian Mountains, and ending in a Cypress Swamp, where the river meets the Gulf of Mexico. McCaren Designs task was to recreate these two diverse habitats high atop the structure and within an enclosed interior environment.
CORPORATE Capabilities

(ADDITIONAL CORPORATE Capabilities will be included in...)

ADDITIONAL CORPORATE Capabilities will be included in...
WOODBURY CENTRAL PARK contains extensive landscaping, miniature mountains and cliffs, a waterfall and small stream. The intent was to create an indoor park that would look, as much as possible, like the natural landscape of St. Croix River Valley. The result is a rustic, naturalistic look.

Developing a landscaping plan that would carry out that theme was entrusted to McCaren Designs, Inc. Our involvement began in February 1999, with a report outlining the environmental parameters required for such a landscape to grow indoors and above the structures.

We've tried to create the intimate feel you'd get in a woodland garden. The interior landscape includes artificial rockwork to capture "the essence of the river valley with its coloring and dramatic changes in elevation."
FIFTH STREET TOWERS is another example of plantings over a roof structure. Special considerations are given to selecting hardy plant materials that can tolerate the high wind conditions occurring in the downtown Minneapolis streetscape. Further considerations are given to the selection of trees, shrubs, perennials, and groundcovers that can stand the harsh elements in the above-ground planters. Careful selection of these materials has created a stable planting that can tolerate such a unique and challenging environment.
ECOLAB’s landscape, while at the street level, is created over the buildings basement office level. The special concern in this project is the drainage of the planting areas. These planters are subject to massive amounts of rainfall that cascade off the side of the building’s 19 stories above the plantings.
COMMONS ON MARICE is designed to be a healing environment. Wandering gardens, courtyards, ponds, pathways and interior atriums all contribute to this intergenerational living center.

The Commons is uniquely designed to bring the outside inside. In the two-story atrium, residents can tend a garden, enjoy entertainment or simply gather for conversation with neighbors.

The mission of The Common’s Memory Center is: preserving capabilities while protecting the dignity and individuality of each resident. It is a special community for those with Alzheimer’s disease and related memory loss. Located in a separate area of The Commons, The Memory Center is designed to maximize independence. Visual cues and prompts familiarize residents with their surroundings. And an enclosed wandering garden allows residents to safely move about.

The Commons on Marice is truly a remarkable senior community. Everything the residences need is there, enriching and, most importantly, providing a satisfying independent lifestyle.
Awards
McCaren Designs, Inc. delivers award-winning performance. Below is a list of local, regional and national honors for Design, Installation, Maintenance, Natural Habitats and Special Events.

**JUDGES & GRAND AWARDS 1994**
- ALCA Environmental Improvement Special Award
- Michael Singer Sculpture Denver, CO

**JUDGES & GRAND AWARDS 1992**
- ALCA Environmental Improvement Special Award
- Tennessee Aquarium Chattanooga, TN

**GRAND AWARD 1999**
- ALCA Environmental Improvement Design/Build
- Seagate Technology Shakopee, MN

**MERIT AWARD 1999**
- ALCA Environmental Improvement Installation
- IDS Center Crystal Court Minneapolis, MN

**MERIT AWARD 1998**
- MN Society of Landscape Architects Landscape Design
- The D.C. Smith Greenhouse and Conservatory, University of Wisconsin Madison, WI

**BEST PROJECT AWARD 1998**
- Interiorscape Magazine Andersen Windows Bay Port, MN

**GRAND AWARD 1997**
- ALCA Environmental Improvement Design/Build
- The D.C. Smith Greenhouse and Conservatory, University of Wisconsin Madison, WI

**AWARD OF DISTINCTION 1997**
- ALCA Environmental Improvement Special Event
- Norwest’s Shed A Little Light National Diversity Campaign

**AWARD OF DISTINCTION 1997**
- ALCA Environmental Improvement Containerized
- Centennial Lakes, Phase I Edina, MN

**BEST PROJECT AWARD 1996**
- Interiorscape Magazine McCaren Designs Atrium St. Paul, MN

**AWARD OF EXCELLENCE 1996**
- EMP Corporation Design and Workmanship
- Cardigan Road Project St. Paul, MN

**GRAND AWARD 1994**
- ALCA Environmental Improvement Design/Build
- Sam’s Town Atrium Las Vegas, NV

**GRAND AWARD 1994**
- ALCA Environmental Improvement Design/Build
- Cockrell Butterfly Center Houston, TX

**GRAND AWARD 1994**
- ALCA Environmental Improvement Design/Build
- Dakota Country Casino Prior Lake, MN

**GRAND AWARD 1993**
- ALCA Environmental Improvement Maintenance
- Knott’s Camp Snoopy Bloomington, MN

**GRAND AWARD 1993**
- ALCA Environmental Improvement Design/Build
- The Rainforest, Metroparks Zoo Cleveland, OH

**AWARD OF DISTINCTION 1993**
- ALCA Environmental Improvement Design/Build
- Sister Generose Gervaise Building Rochester, MN

**GRAND AWARD 1992**
- ALCA Environmental Improvement Design/Build
- Knott’s Camp Snoopy Bloomington, MN

**GRAND AWARD 1989**
- ALCA Environmental Improvement Design/Build
- Conservatory on Nicollet Minneapolis, MN

**MERIT AWARD 1989**
- ALCA Environmental Improvement Maintenance
- Edinborough Leisure Park Edina, MN

**MERIT AWARD 1989**
- ALCA Environmental Improvement Design/Build
- The Colonnade Minneapolis, MN

**MERIT AWARD 1989**
- ALCA Environmental Improvement Design/Build
- Edinborough Leisure Park Edina, MN

**INC 500 1988 & 1989**
- INC. Magazine’s 500 Fastest Growing Privately Held Companies in America

**HIGHEST HONOR AWARD 1986**
- Interior Plantscape Association Design/Build
- Embassy Suites Hotel Irving, TX