Infusing Sustainability into Planning and Development for UMore Park

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I. EXECUTIVE SUMMARY

This section contains a summary of the goals and approaches for infusing sustainability concepts into the planning and design for UMore Park.
Goals and Approaches for Infusing Sustainability into Planning and Design for UMore Park

The overall goal of the visioning process was to infuse sustainability into the planning and design for UMore Park. This means striving for an integrated and comprehensive master plan development with the highest quality sustainability strategies. The UMore Park vision based on the University’s Board of Regents principles for UMore Park is inclusive and has engaged local partners since 2006. The development is to provide academic opportunities, address real estate market opportunities, and generate revenue for the University.

The main starting points for this document were the Concept Master Plan of September 2009 by Design Workshop and the forthcoming Sustainability Action Plan, which is being developed by the UMore Development LLC in conjunction with BioRegional. Both were developed through workshops and with the participation of the University, external consultants and the local partners.

The visioning process was to project the goals and strategies of the Sustainability Action Plan onto the Concept Master Plan and its sectorial concepts. The experience of the European study tour to best practice sustainable neighborhoods, which was undertaken by a University of Minnesota group in April 2010, led to insights on how to develop and implement outstanding sustainable model projects. In addition to this, the cutting-edge integrated design strategies of the European framework for sustainable urban design Eco-City and the brand-new assessment system for sustainable city districts of the German Sustainable Building Council were used to enhance the sustainability performance of the UMore Park plan.

The main elements of the visioning process were working sessions in Minneapolis and Rosemount, Minnesota in September 2011. These were structured with presentations by external experts and Joachim Eble Architektur (JEA), including many hands-on workshop planning sessions. Sessions were divided into four topic areas, including Overall Sustainability Approach, Real Estate Development and Sustainability, Energy-efficiency, Renewables and Outdoor Comfort, and Sustainable Landscape, Water and Local Foods.
Sustainability Concepts

Among of the most important outcomes of the working sessions was the idea of reconstructing the landscape. The partly visible and partly hidden landscape structure that was shaped by the ancient glacier should be the key driver of the urban form. Based on the gravel mining timelines and the different site characteristics, a phasing project with three differentiated main character areas has been developed. Among the most important outcomes was that education and life-long learning, linked to the involvement of the University, Dakota County Technical College, Independent School District 196 and others, should play a key role for the development and can create a unique selling point. Design and development that achieves transit goals based on population density is considered to be the biggest challenge for sustainability.

Sustainable lifestyles and marketing of sustainable homes can be promoted with walkable neighborhoods by locating community functions within a five-minute walking distance. Maximum outdoor comfort in the Minnesota climate conditions can be achieved through screening cold northwestern winds and by cooling the city with ventilation corridors for southern summer winds to come across water landscapes.

The energy strategy should address energy-efficiency and renewable energy sources with district energy systems in combination and the introduction of innovative material flows systems such as the Terra Preta technology. This system can be used to treat organic waste and wastewater for the production of a bio-char that can be used for agro-forest systems. The energy generated from this process can be utilized to run zero carbon district energy systems. The public realm and the building structures should be designed for place-making, which is used as both a process and philosophy, to incorporate community assets and inspiration into the design, planning and management of public spaces to promote health, happiness and wellbeing.

Through the use of landscape amenities, accessibility of urban agriculture and distinct corridors linking each of the character areas, sustainable healthy lifestyles can be achieved.
EXECUTIVE SUMMARY

Integration Plan and Sustainability Concepts

Reconstructing Landscape
Phasing
Character Areas
Life-Long-Learning
Sustainable Mobility
Walkable Neighborhoods
High Outdoor Comfort
Energy-Efficiency and Renewables
Place-Making
Healthy Communities
Integration Plan and Future Direction

This comprehensive integration plan for UMore Park was created through a process of projecting the sustainability concepts directly onto the site. Throughout each character area, the integration of the sustainability concepts leads to mutual synergetic effects that enhance the performance and the quality of life of the community.

The Garden City will have an urban and green character. An urban green zone will provide structure to the area and will contribute to a high quality of life together with embedded water elements and smaller green corridors. This green zone will also be utilized as an Education and Learning Band that should accommodate civic, institutional and educational uses. The character of the building schemes should have a distinct organic and landscape-oriented character. The central area of the development will accommodate a center at Boulder Trail with rail service, as well as vivid mixed-use areas around neighborhood centers with plazas. Towards the central landscape zone mainly residential edge developments with mixed-use centers are foreseen. Along County Road 42 and in the southeast, commercial and large retail could be located with the eastern border mainly supporting light industry and offices. The orientation of the grid has slight deviations southwest to southeast to maximize solar access in the public realm. At the same time, this allows southern winds to cross water bodies to ventilate the area for high summer comfort. Screening forest strips and staggered street alignments are introduced for winter wind protection. A district energy system operated with a bio-based combined heat and power system are proposed for the Garden City.

The Eco-Villages are embedded into the central landscape zone. The intention is to create a corridor for leading-edge approaches. This can mean for example innovative energy and material flows systems such as the Terra Preta technology. The land use will be mixed-use centers and residential at the edges. Summer comfort is provided by openings to the south and surrounding water landscapes, winter comfort by screening forests.
Integration Plan and Future Direction

The gravel mining lake will give the Water City its specific character. The northern part will step down towards the lower water level of the lake to maximize solar access. These solar terraces are oriented to the lake and the waterfront with radial green corridors and water cascades. The urban green zone can be developed as a Culture, Leisure and Recreation Band including, for example, a museum on the border of the lake. The Delta Quarter in the south derives its character from a waterfront, canals and ditches, and lower density development. Wind crossing the lake and water bodies will ensure comfort in summer and screening forest elements will contribute to winter comfort. The energy strategy foresees lake source heat pumps and district energy systems.

The large landscape corridor incorporates the diagonal landscape structure and links the Vermillion Highlands with the new development. This green zone is used for urban agriculture, wind protection forests and water landscapes. Special elements could include a tree nursery in the northwest or the transformation of building remnants from the former Gopher Ordnance Works into an area anchored in public art.

The following recommendations are made for potential future directions of this exciting and challenging project. In selecting a developer(s) the deepening of the visioning results should be elaborated. The process should be accompanied and steered with the advice of a design group. Furthermore, the process should be based on several principles involving integrated design developed by a good multi-disciplinary design team. Best available design tools and techniques such as bioclimatic simulations and energy use plans, as well as advanced assessment systems for sustainable neighborhoods, should be employed. The process would be embedded into a community planning process to ensure the success of the project in addressing local needs and marketing of the project.
II. PROCESS

This section contains a description of the process including goals and process structure, starting points and the applied workshop methodology.
Goals and Process Structure

The overall goal of the visioning process was to **infuse sustainability into planning and design** for UMore Park. This means:

- **The UMore Park vision**: The main outcome should be a more detailed plan of next steps and related key design features.
- **Highest quality sustainability strategies**: Cutting-edge planning and design strategies should be developed for implementing sustainability.
- **Integrated plan development**: The integration plan should be comprehensive and multi-layered with synergetic effects between the different design and sustainability strategies.

The approach was to start with the Concept Master Plan and to project the goals and strategies of the forthcoming Sustainability Action Plan onto it. The process began in September with a kick-off meeting and working sessions. The Joachim Eble Architektur team started the working process with continuous input and feedback from the UMore Park team as the first draft of an integration plan and preliminary sustainability concepts emerged. These emerging concepts were presented and discussed at the end of the September sessions. In the subsequent working phases an integration plan and concepts were drafted and expanded. The integration plan, sustainability concepts and sustainability strategies of this report were again presented and discussed at the end of November, which resulted in some modifications. A dialogue with the local partners occurred with meetings in September and November.
Starting Points: Concept Master Plan and Sustainability Action Plan

Starting with the Concept Master Plan and the forthcoming Sustainability Action Plan, a visioning process including workshops and presentations led the way to an integration plan.

The participatory visioning approach was used to project the goals and strategies of the Sustainability Action Plan onto the Concept Master Plan and its sectoral concepts. The task was to investigate how the sustainability goals can be incorporated, to check what needs to be adapted and to integrate what has not yet been addressed.

10 MAIN PRINCIPLES OF THE SUSTAINABILITY ACTION PLAN:

1. ZERO CARBON
2. ZERO WASTE
3. SUSTAINABLE TRANSPORT
4. SUSTAINABLE MATERIALS
5. LOCAL and SUSTAINABLE FOOD
6. SUSTAINABLE WATER
7. LAND USE AND WILDLIFE
8. CULTURE AND COMMUNITY
9. EQUITY LOCAL ECONOMY
10. HEALTH AND HAPPINESS
Starting Points: European Study Tour and Design Tools

The experience of the European study tour to best practice sustainable neighborhoods, which was undertaken by a University of Minnesota group in April 2010, led to insights on how to develop and implement outstanding sustainable model projects. In addition to this, the cutting-edge integrated design strategies of the European framework for sustainable design Eco-City and the brand-new assessment system for sustainable city districts of the German Sustainable Building Council (GeSBC) were used as design tools to enhance the sustainability performance of the UMore Park project.
**Workshop Methodology**

The main elements of the visioning process were intensive *working sessions in Minneapolis and Rosemount, Minnesota in September 2011*. The UMore Park Management Team and staff, key faculty members and representatives of the local partners participated in these sessions which were facilitated by Rolf Messerschmidt from Joachim Eble Architektur, Tuebingen-Germany in cooperation with Carla Carlson, a member of the UMore Park Management Team.

The following four workshop sessions were held with key experts:

- **Overall Sustainability Approach:**
  Greg Searle, BioRegional

- **Real Estate Development and Sustainability:**
  Geof Syphers, Syphers Consulting, Codding Enterprises/Sonoma Mountain Village, and Ted Nelson, Regional President Central Region, Newland Communities

- **Energy-efficiency, Renewables and Outdoor Comfort:**
  Erik Olson, Transsolar

- **Sustainable Landscape, Water and Local Foods:**
  Herbert Dreiseitl, Atelier Dreiseitl

The sessions were structured with presentations by each of the experts and a co-presentation by Joachim Eble on international best practice projects, with references to European study tour projects. The workshops included questions and answers and hands-on planning sessions for drawing up concepts.
III. THE WORKSHOP OUTCOMES

> Introduction
> Workshop Sessions 1-4
> Meeting Rosemount
> Concluding Concept
Introduction

A site visit, status report and background information on the UMore Park project, as well as the work plan, set the stage for the workshop sessions.
Visit of the UMore Park Site

In preparing for the week, JEA made a site visit to the property. The natural and man-made landscape, the historic elements from the Gopher Ordnance Works and the University activities, such as the new wind turbine, present the potential of this site as an attractive new development. The surrounding area with the beautiful Vermillion Highlands and the neighboring city of Rosemount and Empire Township were explored.
Introduction and Kick-Off Meeting

The week began with a kick-off meeting and introduction led by Carla Carlson, Vice-President, UMore Development LLC. Following, Charles Muscoplat, President, UMore Development LLC, reported on the current status of the UMore Park project and explained the strategic project goals:

- Provide a model for living in the 21st century.
- Generate revenue for the University and a positive economic impact to the region.
- Create unprecedented academic opportunities.

The socio-economic basis for the project is the expected growth of the population in Dakota County to more than 150,000 by 2030. The city of Rosemount is considered a growing community with considerable additional housing demand.

The sand and gravel resources project not only influences how the development will be phased, but it provides an important endeavor for creating revenue to the University. Great potential is seen for the expansion of the University’s academic mission through the development of the property.
Workshop Session 1:

Overall Sustainability Approach

The objective of the first session was to introduce the goals developed as the basis of the forthcoming UMore Park Sustainability Action Plan as a foundation for the upcoming visioning process. The goals will be incorporated into a more detailed integrated design to achieve a comprehensive sustainability approach.
SESSION 1: OVERALL SUSTAINABILITY APPROACH

Presentation 1 - Greg Searle, BioRegional

Greg Searle explained that the One Planet Community principles derive from the fact that we are globally consuming much more than the earth can renew. The ecological footprint shows that if everyone in the world consumed as many natural resources as the average person North America, we would need at least five planets to sustain these lifestyles. BioRegional strives to make this analysis clear to people and organizations in order to demonstrate that living and working within a fair share of our planet’s resources is vital.

He explained that the approach is based on ten main principles. Aspirational goals in each of these principles have been outlined in the forthcoming Sustainability Action Plan through an earlier visioning process facilitated by BioRegional.

The 10 One Planet Community principles are:

- Zero carbon
- Zero Waste
- Sustainable Transport
- Sustainable Materials
- Local And Sustainable Food
- Sustainable Water
- Land Use and Wildlife
- Culture and Community
- Equity and Local Economy
- Health and Happiness
Presentation 1 - Greg Searle, BioRegional

Following these principles, BioRegional presented several projects that show their approach to sustainability through carbon footprint reductions in buildings, transportation and food.

The BedZed project successfully answers the sustainable lifestyle challenge as the United Kingdom’s largest mixed-use One Planet Community. It combines high passive-house technology with sustainable water management. Moreover, it has acquired a high quality of life through the use of residents’ associations, community centers, social events, and pedestrian crossings. The community also has considerably reduced car dependency and ownership. Lifestyle changes in food, transportation and waste have contributed to a total community carbon reduction of 42 percent, which has inspired significant policy change in the United Kingdom (UK).

One Brighton is also one of the UK’s first environmentally and socially sustainable community following the One Planet Community program. There is a very strong principle on reinforcing social links; therefore the project included shared gardening equipment, communal spaces, greenways and other indoor and outdoor common areas. Rooftop gardening plots were designed for residents to grow fruit and vegetables in order to reduce the carbon footprint of food production. The development also has recycling facilities, a central chip boiler and a car sharing club.

The Sonoma Mountain Village is the first community in North America designed with the One Planet Community program. It combines new urbanism with deep sustainability and the main driver for the development was to have “five-minute living”. This concept results in locating different amenities and working areas within five minute walking distances from every home.
Co-Presentation Joachim Eble:

Joachim Eble presented sustainable urban development projects of Joachim Eble Architektur as best-practice examples for integrated sustainable design. All of these projects feature the integration of land use, energy, landscape, water and transport strategies to achieve comprehensive sustainability approaches.

The **EVA Lanxmeer** project in Culemborg, Netherlands is a sustainable urban city extension initiative for the Dutch Ministry of Housing. It shows a solarized urban structure with organic landscape of the courtyards. The energy supply strategy includes district heating based on energy gained from reusing wastewater, incorporating solar energy and using ground source heat pumps. It also has an area with a cogeneration plant that will be operated with biogas generated from wastewater management. The planners were very sensitive to the landscape and gave consideration to the various water cycles, such as seeping away rainwater from buildings, purification of street run-off and wastewater treatment. These water systems have been integrated into a permaculture landscape.

The master plan for the Zero Carbon Project **Eco-Quarter Pfaffenhofen**, near Munich, Germany, integrates housing, commercial use and agriculture. The renewable energy strategy is mainly based on biomass and photovoltaics. The sustainable water concepts include on-site black water treatment and the innovative Terra Preta technology as a new land use and material flows system. The architectural design and construction for the cutting-edge eco-housing area is partly built with passive-house standards and generally with advanced healthy building materials. The area is supplemented with a commercial area for eco-offices, retail, a hotel and an environmental education center.

The master plan for the city extension of **Nya Hemmeslöv in Bastad**, Sweden is based on JEA’s winning competition entry. The cutting-edge sustainability strategies include sustainable energy, water and waste systems.

The main approach for the integrated project **Eco Town Suzhou**, China was to find synergies between landscape, water and energy systems, as well as using bioclimatic design. The goals are to implement design strategies derived from the site’s specific characteristics and to reach a high quality of life with a low impact on the environment. Important elements from the project are the Terra Preta technology, wetlands as cleansing systems, efficient mobility and a new Eco-village with ecological farms, permaculture, symbiotic agriculture and livestock.
Key Issues of the Session 1 Workshop:

- Developers can engage the public to address the local markets. The result would be a win-win situation for developers, future residents, the city and township.
- People might be interested in higher density living in Rosemount if they see the benefits – the benefit of density is the goal and not the density itself.
- Mixed-use approaches can create jobs – by providing floor area for commercial uses, attracting services and offering jobs within the neighborhood in proximity to housing.
- New urbanism approaches and developments around farming and local food can be taken to the next level – beyond farmers markets.
- The maintenance of the sustainable urbanism approaches can be organized and partly done by the inhabitants themselves to achieve low maintenance costs for the municipality and community. Maintaining the planted landscape areas and community gardens can be achieved using topical working groups, which were successful in the EVA Lanxmeer project in Culemborg, Netherlands.
- Proven energy technologies from Europe can be effective in the United States if backup systems are considered and cost-efficiency will improve with future higher energy prices. Current utility and related regulations must be addressed.
- Advanced instruments for energy generation such as the “Energy Master Plan” in Switzerland can resolve the conflict between utilizing new innovative technology and the current strict regulations. The plan defines legally binding priorities for different systems. Flexibility in district energy systems can be addressed by starting with a mobile “energy box” which can be later moved and replaced.
- The Terra Preta black soil system can be implemented as an innovative decentralized approach complementary to the new centralized sewage plant in Rosemount. It can create jobs and can be linked with research of the University. Different resources, including the sludge of the central sewage plant, can also be used for the system.
SESSION 1: OVERALL SUSTAINABILITY APPROACH

Results of Hands-on Planning Session

Agricultural Corridors:
- Multi-purpose corridors - not only open space.
- Local food production.
- Greenways for community gardens and urban agriculture.
- Greenhouses for year-round production.
- Large quarter with residential, commercial and mixed-use.

Cluster Development:
- Wildlife corridors.
- Cluster development structure.
- Fingers of green space that integrate into the built environment.
- Pocket neighborhoods with individual character and district energy.
- Urban agriculture and community gardens.
- Phasing of development.

Triple City:
- 3 Character Areas: Water City, Delta Quarter and Eco-Village.
- Green business.
- Community gardens.
Workshop Session 2: Real Estate Development And Sustainability

The goal of this session was to generate input for UMore Park from a developer’s perspective with U.S. market expertise. The focus was on the integration of real estate development and sustainability.
SESSION 2: REAL ESTATE DEVELOPMENT AND SUSTAINABILITY

Presentation 1 - Geof Syphers, Syphers Consulting

In the first presentation Geof Syphers, presented “A Developer’s Perspective on Sustainability”. This was illustrated with three sustainable community projects.

The Centennial project has a similar size as the UMore Park project with 8,000 acres. Key elements were the job-to-housing balance with a goal of 24,000 to 31,000, the conservation of natural resources, and strong community recreation amenities for health and happiness, life-long learning and mixed-use developments.

The Sonoma Mountain Village is a 175-acre mixed-use redevelopment, which was endorsed by One Planet Community program and awarded LEED-ND Platinum. Its focus is on zero fossil energy, net zero water, and a low carbon footprint. A very impressive concept of “five-minute living” with parks, shopping, amenities and a town square all within a short walk of homes and businesses, has been used to create a highly attractive neighborhood.

Brisbane Baylands exhibits a good design for a development around a public transit hub. Attractive amenities like formally designed neighborhood parks and lake area, a natural environment and recreation features contribute to the quality of life.

The value points for sustainable developments include:
Entitlements and public approval by third party oversight.
Create a durable marketing message, such as 200-mile trail network fully integrated into town.
Community and sense of place can be worth more than square feet.
Sustainable transportation is seen as key to a One Planet Community.

Selling what people want:
Recreation – Trails, open space, zip sleds, solar jet skis.
Low cost – Challenge is to learn to sell quality over square feet.
Adequate parking – Lots versus shorter blocks.
Good schools – Great schools with strong link to the University.
Presentation 2 - Ted Nelson, Newland Communities

The second presentation was by Ted Nelson of Newland Communities. As one of the largest land developers in the U.S. and a successful member of the Twin Cities real estate market, he expressed the interest of companies in exploring new and future-oriented ways of development. He stressed the economic requirements and mechanisms for successful land development. Developments should be market based, but also influence the market with new opportunities. Key elements include:

- **Transportation as the backbone.**
- **Featuring water and landscape as amenities – landscape adds highest value to the house.**
- **Community center should be available from the beginning.**
- **Job opportunities are crucial for attracting homebuyers.**
- **There is growing interest in healthy living systems.**

The implementation process should be organized with flexible and adaptable plans, particularly for new technologies.

Presentation Discussion

- The link to the University of Minnesota as a world-class research institution and a national education center is seen as a unique selling point for UMore Park.
- The focus of the development should be on creating innovations in housing and mixed-use typologies and not only react to what today’s market asks for.
- Local job creation at UMore Park can strongly benefit from the nearby Dakota County Technical College.
SESSION 2: REAL ESTATE DEVELOPMENT AND SUSTAINABILITY

Co-Presentation Joachim Eble:

In his co-presentation Joachim Eble introduced participatory approaches to sustainable real estate development. Wide participation is seen as essential for addressing the social dimension of sustainability. In designing a project based on needs of future residents, it can be more efficient and successful to create an interested consumer base for marketing the project. Raising awareness for sustainable technologies can be promoted with presentations and discussion sessions. This has been illustrated with European projects completed by Joachim Eble Architektur.

First, Joachim Eble pointed out that high quality sustainable projects can be economically very successful. A good example is the Arkadien Asperg project close to Stuttgart, which has won the German real estate award and was created by a regional developer. A current project in Tuebingen, Germany shows that certified sustainability following the assessment system of the German Sustainable Building Council adds value and promotes the marketing of sustainable projects.

A new way of development is the introduction of building cooperatives. Private persons or families form a group who come together to build apartments, terraced houses or even city blocks without the assistance of a developer. In this participatory architectural process the group makes all decisions. Examples in Tuebingen and in Culemborg, Netherlands show a richness of social and ecological ideas for both the buildings and the open spaces which lose their sense of place when created top down by developers. The municipalities have also intensively supported these processes.

The V8 quarter in the national and international award-winning UN Habitat project Freiburg-Vauban neighborhood is a sustainable development, which has been developed by a combination of a municipality, a developer and a building cooperative as an innovative and collaborative way of project development. The outcome is a diverse project, but with coherent design guidelines including green elevations and grouped around courtyards with water landscapes. Homes using passive house design include roof-mounted photovoltaics. Low energy buildings are linked to a district energy system operated with wood chips and gas.

Holding community planning events enable participation and needs-based design for the development of large sites. For example, in Meppel, Netherlands a large scale city extension has been developed through this process for the municipality. In the United Kingdom, the developments of Fairmile Hospital and the largest zero carbon project Graylingwell Hospital in southern England were organized for private sector developers.
SESSION 2: REAL ESTATE DEVELOPMENT AND SUSTAINABILITY

Key Issues of the Session 2 Workshop

- Green technologies should pay for themselves - no extra money or funding for the development should be needed.
- Future residents will come because of jobs and lifestyle.
- Explore the building cooperative approach to development – which can work in the early stages to demonstrate its success.
- Healthy learning communities provide conditions that allow for building upon new knowledge, which is central to the University’s mission – thinking outside of the box for solutions to challenges.
- Social fabric can be encouraged first by establishing places of education and community gardens, with the physical community to follow.
- Timing the development to fit with market. With nearly three years to get through the entitlement process, the development may align with a healthy market.
SESSION 2: REAL ESTATE DEVELOPMENT AND SUSTAINABILITY

Results of Hands-on Planning Session

**Umore Park Asset Diagram:**
- Development linked to job creation and education.
- Innovative projects to attract development.
- Take advantage of the existing infrastructure to start development.
- Use existing accessibility for industrial sites.

**Highspeed Railway Village:**
- Neighborhood hub with mixed-use and higher density.
- Diverse neighborhoods in size, type and price.
- Life-cycle and multi-generational households and home designs.
- Learning communities for all ages.
- Development based on education.

**Phasing:**
- Timing - when to develop.
- Definition of phase 1 – where to start.
- Consider gravel mining plan and existing infrastructure.
Session 3: Energy-efficiency, Renewables and Outdoor Comfort

The goal for this session was to collect input and facilitate discussion regarding the impact of energy and outdoor comfort strategies on urban form, building designs, and supply and distribution technologies for zero carbon developments.
Presentation 1 - Erik Olsen, Transsolar

Erik Olsen is the director of the New York City office of the international climate engineering company Transsolar. Their philosophy is taking advantage of natural energy sources and physical effects as well as integrated, synergetic and economical designs.

He started his presentation with an analysis of the energy production strategy of the Concept Master Plan. For the set out densities and land use of the development an annual energy budget for the UMore Park project was recommended. With a zero carbon mission statement, reduction goals should be defined for each phase ending up with zero carbon for the final phase.

Erik stressed that outdoor comfort should play an important role for this project particularly in the climate conditions of Minnesota with cold winters and hot, humid summers. Quality outdoor comfort is vital for pedestrian activities.

The urban form should be optimized with regard to the solar access of building façades and public spaces, as well as by avoiding uncomfortable open space conditions such as tunnel effects and downdrafts from high-rise buildings.

Climate responsive building design should be considered. A performance and cost optimization looking at building performance (e.g. current practice to passive-houses), and overall development of district energy systems (low and high energy systems) has to be undertaken to accomplish net zero energy development. Both building improvements and renewable supply strategies should be considered in an integrated way for incremental improvements towards carbon neutrality.
SESSION 3: ENERGY-EFFICIENCY, RENEWABLES AND COMFORT

Presentation 1 - Erik Olsen, Transsolar

Local resources and other renewables should be considered for energy generation and distribution at the district level, with both high and low temperature. Examples are the biogas cogeneration systems in Fair Oaks, Indiana and Güssing, Austria, as well as the Biogas District Heating in the Dockside Green project in Victoria, Canada. The Drake Landing Solar Community in Alberta, Canada features a solar thermal approach with seasonal storage.

For the implementation a legal basis of the requirements should be established by a new energy code, land sale agreement or a zoning code. This may involve:

- Occupant training and awareness.
- Design and construction review and authorization.
- New development-specific certification program.
- Construction testing.
- Third party certification (LEED, Passive house, or other).
- Building department approval.
- Ongoing measurements.

An ownership and operation model has to be developed for a district energy system. This could be the University, the developer(s), or a third party such as an energy company or active users in a non-profit community. Furthermore, the consideration for future changes and flexibility is important.

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Energy Generation and Distribution

WORKSHOP OUTCOMES
Terra Preta, or black soil, is an innovative technology and land use approach for establishing sustainable material flows. The cutting-edge technology integrates waste and water management and energy production with urban agriculture.

To connect the eco-cycles and material flows, the building of Terra Preta facilities in the central landscape zone area in proximity to the Eco-Villages is proposed. In these facilities, digested sludge from the wastewater treatment and all organic waste from the area can be transformed into a fertile black soil full of nutrients, charcoal, and microorganisms. The heat generated in this incineration process can be used for district heating and carbon captured for growing crops in greenhouses. The black earth can then be used for soil improvement in urban agriculture and urban planting. Terra Preta facilities generate biogas that can contribute to operation of combined cooling, heating, and power plants.

This system not only reduces carbon emissions in energy production, but also supports carbon capturing by bringing the carbon that is bound in the charcoal into the ground. This system will support the movement to a post-fossil energy future and fully integrated urban eco-cycles.

This process is an extremely interesting approach that attracts enormous attention and funding in Europe and can be adapted and introduced to the U.S. in research cooperation with the University of Minnesota.
Key Issues of the Session 3 Workshop

General

- Champions are needed to generate and sell UMore Park energy.
- Optimal approaches to energy supply should consider various autonomous, district and conventional strategies.
- The energy policy model of the 2000-Watt Society, which has been developed by the Swiss Federal Institute of Technology in Zurich, is a very interesting model. The vision is that the energy demand of each person on earth equates to 2000 watts.

Urban Form

- Urban form deals best with the regional climate conditions when providing solar access to buildings and public space.
- Dense development patterns make energy-efficiency easier to achieve.
- A 45° grid is the best block orientation to maximize solar access, resulting in the democracy of solar access.
- Landscaping, such as plant screening, can contribute to energy-efficiency and outdoor climate comfort.
- Block orientation should be considered to maximize wind movement.

Climate Responsive Building Design

- Optimal energy conservation in buildings should strive for a goal of 80 percent.
- The goal for optimal energy supply with renewable technologies should strive for 80 percent.
### SESSION 3: ENERGY-EFFICIENCY, RENEWABLES AND COMFORT

**Key Issues of the Session 3 Workshop**

<table>
<thead>
<tr>
<th>Electricity</th>
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<tbody>
<tr>
<td>- Generation of electricity is the biggest challenge for a zero carbon development.</td>
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<tr>
<td>- Finding the most beneficial way to generate electricity in the first phase is an important task.</td>
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<tr>
<td>- On-site or off-site wind turbines might be better than photovoltaics as the energy system for generating electricity.</td>
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<tr>
<td>- Sterling motor is a new way for a small-scale generation of electricity.</td>
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<tr>
<td>- Production of more electricity for buildings and for electric cars.</td>
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<td>- Electric cars linked to buildings can function as a kind of battery for electricity storage.</td>
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<table>
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<tr>
<th>Heating and Cooling</th>
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<tr>
<td>- Selection of energy systems is dependent on land use and character of the development.</td>
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<tr>
<td>- Compact and mixed developments including employment centers are best for district energy systems.</td>
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<tr>
<td>- Multiple energy systems could be utilized for the 5,000-acre UMore Park site.</td>
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<tr>
<td>- In district energy systems temperature is critical – low temperature is considered as the generally preferred option.</td>
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<tr>
<td>- Flexibility for integration of future technologies would be beneficial – the ground source heat pump is not very flexible.</td>
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<tr>
<td>- Heat recovery from sewer pipes could be explored as an option.</td>
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<tr>
<td>- Utilizing wasted heat from the nearby oil refinery could be a low carbon approach.</td>
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<tr>
<td>- Heat pump from lake water can be used in the western part of the site – example in Toronto with district cooling from lake water.</td>
</tr>
<tr>
<td>- Optimal layout and size of district energy systems should be explored – linear or circular.</td>
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</table>
Session 4: Sustainable Landscape, Water and Local Foods

The goals of this session were an analysis of the landscape structure and development of a landscape, water and local food strategy integrated with the overall concept. Based on this first visioning process, a strategy could be approached through a collaborative hands-on planning session.
Presentation 1 – Herbert Dreiseitl, Atelier Dreiseitl

Herbert Dreiseitl presented examples of his international work for the integration of water and landscape elements into the urban design for UMore Park. Water as an element of life can contribute to high quality open spaces and to the eco-infrastructure at the same time. At the edge of neighborhoods, retention ponds can function as biotopes. Integrated channels in streetscapes can be part of the storm water management system and urban water squares and can be designed with aesthetic appeal. Following Dreiseitl’s philosophy, water has an elementary power. It has a fundamental value in the human environment as well as an essential role in sustainable landscapes.

At the high density Potsdamer Platz in Berlin, Germany a sophisticated storm water management concept has been realized. It includes green roofs and planted ponds that attract people and improve the urban comfort. The Tanner Spring Park in Portland is the result of a participation process and includes an Art Wall. In Akadien Asperg, Germany an award-winning sustainable housing scheme has been designed in cooperation with Joachim Eble Architektur. Residents can experience the water cycle with open ditches along pathways, channels in the street, and water playgrounds that attract children. The Hannover Kronsberg development in Germany, on the World Exposition site from 2000, features a comprehensive storm water management system including retention ponds and landscaped corridors with cascades designed for rainwater collection and retention. On the edge of the development lake an eco-business park has been developed. An early project for the Swiss village Echallens included rainwater management in a rural environment.
Analysis of the Natural Environment

The Mississippi River and its adjacent landscape lie to the northeast of the UMore Park property, with the hilly Vermillion Highlands to the south. The site itself includes agricultural land, forest areas and wetlands. Concrete built structures of the Gopher Ordnance Works are still on the site as reminders of the past. Recently, the University has erected the EOLOS Wind Research Station and wind turbine on the eastern border of the property to explore new turbines technology. The gravel mining plan was summarized in terms of locations and grading.

The most striking result was the identification of a landscape structure with topography as well as related watercourses and vegetation in a northwest to southeast direction. This is the natural landscape formed by ancient glaciers, which was then superimposed by the mainly perpendicular man-made road infrastructure.
SESSION 4: SUSTAINABLE LANDSCAPE, WATER AND LOCAL FOODS

Results of Hands-on-Planning Session

The following hands-on planning session led to an insightful discussion of the landscape and water issues. Led by Herbert Dreiseitl and supported by Joachim Eble and the entire working group, new ideas were integrated with the ideas of the former sessions resulting in an integrated design approach.

The “triple city” design of Session 1 worked very well with the idea of the diagonal landscape. The Garden City is intended as a denser, compact urban development. The Eco-Villages have surrounding landscape, and the Water City development is oriented towards the gravel mining lake.

Erik Olsen of Transsolar, contributed to the structuring of the urban form of the three character areas with particular input on summer and winter comfort point of views. The Water City area was designed with a radial system for receiving southern summer wind across the lake. The Garden City was opened with green corridors towards the central green zone for summer ventilation. The idea of stepping down the Water City to the lake was discussed along with the idea of embedding the central villages into the landscape zone. Water elements were proposed for all development areas.

Infusing sustainability into the landscape
Meeting In Rosemount

A meeting in Rosemount engaged local partners in discussion about the current status of the UMore Park project and for continued dialogue and mutual exchange of information.

After an introduction by Carla Carlson and Chuck Muscoplat of the UMore Development LLC, Mayor Bill Droste made a presentation on the history of Rosemount, the socio-economic situation and current developments.

Greg Searle of BioRegional presented highlights of the draft Sustainability Action Plan for UMore Park based on the 10 principles of the One Planet Community approach.

Rolf Messerschmidt of Joachim Eble Architektur informed the local partners about the visioning process with workshop sessions for infusing sustainability into planning and design for UMore Park.

Key Issues in Discussion

- The goal should be to create a seamless community that integrates the new development with the existing city neighborhoods, overcoming the boundary between Rosemount and UMore Park.
- Community involvement, particularly for such a large-scale project, is seen as very important for informing citizens about the project, for building trust and for citizen participation in the UMore Park development. This can be achieved with community planning events such as discussion and design workshops and a continuous consultation process that includes community forums.
- The infrastructure planning and phasing, including the road system and storm water management, is important.
- A high-quality and attractive public transportation service linking the surrounding Rosemount area to the Twin Cities and Rochester is considered to be crucial for the overall success of the UMore Park development, with expanded benefits for Rosemount and Dakota County Technical College (DCTC).
- As an institution of over 2,000 students, DCTC is very interested in cooperating with the UMore Park project. Partnerships could include joint project initiatives based on the University’s research strengths and DCTC’s customized training programs to promote businesses opportunities at UMore Park.
Concluding Concepts:

The following draft integration plan and concepts have been completed by the JEA team based on all the ideas that have been created during the sessions, in the workshops and in discussions with the participants. These were presented and discussed in the final presentation at the end of the September sessions and have been the basis for the final JEA plan and sustainability concepts.
The landscape structure has been further investigated based on satellite images. Acknowledging the glacier flow coming from the northwest led to a restructuring and shaping of the current landscape. The topography created was the under-layer for the blue structure of rivers, creeks and lakes. This direction is also visible in the green structure with forests and open landscape influencing the site characteristics from a southeast direction, including the Vermillion Highlands. This structure has been included to highlight the breath and flow of the landscapes as both a physical layer and also as a reference to the history of this specific site.

Draft sustainability concepts have been developed based on an initial approach:
The green concept integrates the existing open space with proposals for new landscape elements – all to emphasis the diagonal landscape structure.

The water concept shows designed and natural water features linked to a storm water management system. This includes swales and retention systems for the overflow as well as the gavel mining lake, watercourses and wetlands.

The energy concept features district energy systems operated with combined heating and power plants and lake source heat pumps with highly efficient and individual systems. The Eco-Villages in the central area are intended as a place for innovative technologies such as geothermal facilities, passive houses and the Terra Preta system.
Solar Access Concepts

**Solar access** for open spaces and building facades would be provided by striving for urban forms with grid angles of 45° and minor deviations. This allows sunshine in every streetscape throughout the day because one side of the street and one façade is always exposed to the sun. The housing schemes should be developed for maximizing solar access by optimizing distances between buildings. Solar terraces angled toward the lake support the Water City’s solar access.
Outdoor Comfort Concepts

**Summer Comfort**

**Winter Comfort**

**Summer Ventilation in Water City**

Summer comfort would be provided by opening the neighborhoods to the southern winds in combination with upstream water features in the south. Edges of blocks would be used to distribute the air into neighboring blocks in the Water City and other developed areas.

Winter comfort would be created through structuring forest areas to screen the built environment from the cold northwestern winds. The urban form would address this by avoiding linear street and landscape corridors in the northwest with grids including broken and staggered lines in this direction and screening elements for the unavoidable corridors.
This draft JEA plan aims to integrate the sustainability concepts and the input of the September workshops and discussions. It is a first approach to a more detailed plan based on the integrated work of the landscape session and includes the following concepts:

- The **Garden City** as a dense and compact urban development structured by green corridors leading into the central landscape zone.
- The **Eco-Villages** with a surrounding landscape and integrated with urban farming.
- The **Water City** development is oriented on a radial axis to integrate with the gravel mining lake.
- A proposal for **Phase 1** on County Road 42 based on an easy link to existing infrastructure and integrating the potential for local foods production.
- A **central green zone** linking the development with the Vermillion Highlands including wetlands, urban farming and an area anchored in public art.
- A **road infrastructure** adapted to the landscape, with slightly curved alignments and a more urban character.
IV. THE JEA VISION

> Sustainability Concept
> Vision Plan
Sustainability Concept

The starting point for working on the integration plan was to combine the results of the workshop sessions of September 2011 including the hands-on-planning sketches, the UMore Park site conditions and the draft Sustainability Action Plan (SAP). The SAP is based on BioRegional’s 10 principles of sustainability. Furthermore, the Concept Master Plan and the current Alternative Urban Areawide Review procedure have been considered in the development design.
The draft Sustainability Action Plan and its more abstract goals and strategies have been translated into the design and sustainability concepts for UMore Park. These address all identified key design and sustainability issues relevant for creating the urban form to scale. Taken first as individual layers and projected onto the site, the design and sustainability concepts have been developed graphically. Superimposing and mutually integrating these concepts then led to the creation of a comprehensive and more detailed plan for UMore Park.
This partly hidden and partly visible under layer is the main and most important driver of the urban form based on the glacier landscape transformation. The geomorphological and spiritual memory of the site will form a special and distinguishable character of the area. As a result, both the central and diagonal landscape zone, the gravel mining lake based on the geological conditions, and smaller green zones with water features and wind breaking forests have been integrated or created.
Based on the gravel mining plan the land will be available step-by-step for development. The subsequent timelines are encouraged for creating three different focus areas. Phasing starts from the northern boundary of County Road 42 and moves to the south. The first phase will start in the central and eastern part of the site and will then proceed at different speeds before finally ending at the southwestern area near the future lake.
Character Areas – Three Differentiated Developments

The overall development is differentiated into three character areas: Garden City, Eco-Villages and Water City. The aspiration is to create a new living, working and educational environment in a suburban setting by using a landscape urbanism approach including a critical mass to support public transit and a city of short distance. Community planning events would encourage the views and desires of future residents and the local economy.
The education and research focus of the project is addressed through clustering development around important facilities of both regular schools and special institutions, such as museums and science buildings. These educational and research facilities will provide structure to the area, as well as keep this important concept visible and marketable. Starting at Dakota County Technical College (DCTC), a band of education and research facilities shapes the area of the Garden City. The idea is to have campus and landscape-integrated buildings in a green zone with water features next to the neighboring residential developments. Two additional bands link the Eco-Villages and educational facilities to the Water City area. On the intersection of the public transit corridor with the education bands, an additional Learning Center next to DCTC could be created.
Several north-south and east-west roads link the site with major roads or highways. A focus will be on the central east-west link as the main transit corridor. This connects to bus rapid transit and the planned future light rail service. It also offers a potential link to the high-speed railway line along U.S. Highway 52 that has been discussed. To provide an attractive service for DCTC, a loop towards the west is proposed.
In the Garden City and the Water City two bigger centers with mainly commercial and office uses are proposed on the edge of the Boulder Trail and the public transit lines. The neighborhoods are laid out around the central locations of the neighborhood centers. The distribution and distances are based on “catchment areas”, referring to a maximum of five-minute walking. They will have mixed-use character with retail, jobs and leisure activities and a larger public plaza.
The goal is high comfort, both daily and seasonally, in a local climate with cold winters and hot summers. The grids are generally at 45° for good solar access for open spaces. The grids are broken towards the northwest and open to the south preferably with water features for cooling down the fresh air. For medium- to low-density development, the focus of the comfort strategy will lie in the scale of the neighborhoods, focusing on screening and cooling elements.
The energy generation and distribution options are based on district energy, renewable energy generation and high building performance standards. These should correspond to the character of the development in terms of land use and intended building typologies, as well as to the innovative and educational character of some sites. The strategy includes a biomass and material flow strategy for establishing and operating a Terra Preta system.
Landmark buildings will define entrances and accentuate central plazas. The combination of storm water management, shelter against cold wind, and the integration of art will form attractive open spaces to enhance quality of life. The creation of a space anchored in public art near the Gopher Ordnance Works remnants could incorporate water, solar and wind driven pieces to highlight the value of sustainability in the community. Community parks in the Garden City and the waterfront area in Water City should use a participatory process to identify themes.
Local foods from organic urban agriculture would support healthy living along with a very good health care infrastructure. Attractive ways for walking and cycling, including pathways that lead to community amenities will encourage active lifestyles and enhance a sense of community. Semi-indoor spaces like winter gardens can also provide an active community asset. Local material flows with supply and disposal strategies, including the Terra Preta system and sustainable building materials, will form the basis for sustainable lifestyles.
Superimposing the sustainability concepts shows the relevant sustainability strategies and basic principles in an abstract way. This methodology ensures that all issues are addressed and allows a mutual integration of the concepts with mutual synergetic effects. An example of this is the orientation of green corridors towards the central green zone with a water landscape for summer ventilation and accentuating this with an eco-high-rise building. The result is a multi-layered plan.
The JEA Plan

The comprehensive plan for UMore Park shows the integration of the design and sustainability concepts for the entire site and the different areas with their specific conditions. The implementation of this should boost the sustainability performance and the quality of life in the new community.
The new character areas and neighborhoods within the community are intended to reflect a new cutting-edge sustainable approach. The two main components are a landscape-oriented design and a goal of moderate density. The landscape design would give all residents good access to green spaces, landscape amenities and local foods, while a critical mass supports clusters of five-minute living neighborhoods with mixed-use development, a variety of public transit and district energy systems.

The three different character areas are all landscape-oriented, well connected and designed for a high outdoor comfort with a climate responsive urban form and design.

The Garden City would have an urban and green character. An urban green zone would structure the area and contribute, together with embedded water elements and smaller green corridors, to a high quality of life. This green zone will also be utilized as an education and learning band that starts at DCTC and should accommodate civic, institutional and educational uses. The building designs should have a distinct organic and landscape-oriented character.

Towards the large green zone, mainly residential edge developments with mixed-use centers are foreseen. Light industry and offices are located near County Road 42 and in the southeast border. The grid is oriented southwest to southeast to maximize solar access in the public realm. At the same time, this allows southern winds crossing water bodies to ventilate the area for a high summer comfort. For winter wind protection screening forest strips and staggered street alignments are introduced.

The Eco-Villages are embedded into the central landscape zone. The intention is to create a corridor of innovative approaches, building upon new technologies as the development progresses. The Terra Preta system could be implemented here as a new way to treat organic waste and wastewater for the production of a bio char which can be used again for agro-forest systems. The energy generated from this process can be used to run zero carbon district energy systems. The land use will be mixed-use centers and residential housing to the edges. Summer comfort is provided by openings to the south and surrounding water landscapes, winter comfort by screening forests.

The gravel mining lake will give the Water City its specific character. The northern part will be terraced to step down to the lower water level of the lake to maximize solar access. These solar terraces are oriented to the lake and the waterfront with radial green corridors and water features. The central urban green zone can be developed as a culture, leisure and recreation band including, for example, a museum on the border of the lake. The Delta Quarter in the south derives its character from a waterfront on the lake, canals and ditches, as well as lower neighborhood density. Wind crossing the lake and water bodies will ensure comfort in summer and screening forest elements will contribute to winter comfort. The energy strategy foresees lake-source heat pumps and district energy systems.
Description of JEA Plan

The transportation infrastructure system takes all existing and planned roads into account and picks up all connecting points on the edge of the site. Slight modifications have been made to the roads in the Concept Master Plan and AUAR to integrate the landscape-oriented design approach. Boulder Trail and Blaine Avenue are proposed as slightly more curved. The straight approach in the lake area is kept for County Road 46 and Akron Avenue. But a future new alignment of County Road 46 with a loop to the south would enhance the quality of the lake areas considerably and would lower the construction costs because this would work without a long embankment. Also, a future new alignment for Akron Avenue in the central zone is proposed as a bypass to avoid going down to the lower lake and then up again. Blaine Avenue is slightly more curved in the central part for the landscaped approach and to avoid disturbance or barriers in the mixed-use neighborhoods. All future options are presented with dotted lines.

Main arterial roads such as County Road 42, Akron Avenue, Blaine Avenue, and County Road 46 should be reserved as future public transit service corridors. In addition to this, local buses and accessible, safe cycling and pedestrian pathways are considered for connecting the different character areas and particularly within the individual neighborhoods.

The large central landscape zone incorporates the diagonal landscape structure and links the Vermillion Highlands with the new development. This green zone is used for local food production, wind breaking forests and wetlands. Special elements could include the potential for a tree nursery operated in cooperation with the University on the northwestern edge as well as the transformation of the Gopher Ordnance Works remnants into a public art area.
V. SUSTAINABILITY STRATEGIES

> Land Use Strategy
> Transport Strategy
> Landscape Strategy
> Comfort Strategy
> Water Strategy
> Energy Strategy
Land Use Strategy

- The goals for the land use strategy are to strive for a livable community, to achieve short distances in everyday life and to minimize the transport demand. To create an attractive and useful development for the future real estate market, the following principles should be applied:
- Strive for a polycentric, compact and transit-oriented structure throughout the community.
- Organize a balance of residential, employment and educational uses as well as distribution, supply and recreational facilities.
- Strive for fine-meshed mixed-use structures at building, block or neighborhood level.
- Develop quality, high-density structures to reduce land and new building demand elsewhere.
LAND USE STRATEGY

Land Use Plan

Legend:
- Mainly Residential
- Small-scale Mixed-Use
- Civic / Institutional / Educational
- Central Functions mainly Commercial / Office
- Neighbourhood Centers mainly Services / retail
- Mainly Light Industrial / Office
- Mainly Commercial / LargeRetail
- Waterfront
- Terra Preta

Water
Wetland
Forest
Agro-forest
Open space
Land forms
Parks and Parkways
Description of Land Use Plan

The largest possible part of the project should be organized as a mixed-use development creating a vivid urban environment. This contributes to walkable neighborhoods. Neighborhood centers would be distributed with a radius of one-half mile so that important neighborhood functions can be reached within a five-minute walk. Based on this, the central area of the Garden City could become mainly small-scale mixed-use development. Also, the central parts of the Water City and particularly the area that links the green zone down to the waterfront should have a mixed-use character. The northern part of the Eco-Villages, which is close to the connecting roads, could be developed with a mixed-used approach.

Civic, institutional and educational facilities are mainly organized in the educational and learning bands. These facilities include district schools as well as special facilities such as research institutes, a museum and a public art area.

Central commercial and office facilities should be located at junctions of Boulder Trail, which connects all three main developments, Blaine Avenue in the Garden City, and Akron Avenue in the Water City. These areas will also be well served by the public transit corridor.

Commercial and retail areas are located in the Garden City near County Road 42 and in the southwest towards U.S. Highway 52. Light industry and offices are foreseen at the eastern edge of the Garden City in proximity to the intended industrial area in the east along U.S. Highway 52.

The land use of the central green zone is for local food production in agro-forest systems and wetland areas. Terra Preta facilities can form the link between the landscape and the Eco-Villages for integrated material flows and as the key element of a local decentralized supply and disposal system. A tree nursery in the southwest can produce a portion of the landscaping for the site.

The urban planning and design should set the stage and prepare for the construction of sustainable buildings, which should be energy-efficient with high indoor comfort. The buildings should also conserve resources throughout their life cycle.
Transport Strategy

The goals for the transport strategy are to minimize primary energy and resource consumption, as well as the impairment of the environment (greenhouse gas emissions) and human health (noise or accidents). At the same time, satisfying the basic need for mobility should be addressed and the mental well-being of all social groups (accessibility to services, barrier-free accessibility to transport networks, etc.) should be maximized. Since the aspirational goals for transportation in the draft Sustainability Action Plan will be extremely hard to achieve early in development, the transport strategy should be dealt with as a priority for laying the groundwork.

Therefore the following principles should be applied:

- Minimize distances between activities in time and space for reducing travel demand.
- Give priority to pedestrian and cycle paths as the main network for the internal community and neighborhood traffic.
- Give priority to public transportation as the most important part of sustainable transport.
- Provide mobility management measures to support modal shifts to environmentally compatible modes.
- Reduce volume and speed of individual motorized traffic with specific concepts.
- Support the reduction of motorized traffic by parking management measures.
- Facilitate efficient transportation logistics for the commercial, office and light industry companies.
Transport Plan

TRANSPORT STRATEGY

SUSTAINABILITY STRATEGIES
Description of Transport Strategy

A central corridor is located along Country Road 46, Akron Avenue, Boulder Trail, Blaine Avenue and Country Road 42 for attractive public transit in the future. Catchment areas of one-half mile radius will lead to a good public transit service provision including the link to DCTC. In addition to this, a bus rapid transit on Country Road 42 and a local shuttle bus route can ensure attractive public transport services. A transit hub linking the local bus with bus rapid transit and the light rail is foreseen at the junction of Blaine Avenue and Country Road 42. For the light rail a possible link to a high-speed railway along U.S. Highway 52 should be taken into account as a future option. Also, innovative technologies such as hydrogen can be considered for operating the buses.

The major internal roads such as Boulder Trail can be designed with the Dutch “Driving Slowly Goes Faster” concept. A boulevard with separated lanes and reduced speed can contribute to reduce carbon emissions and increase transport safety and crossing options at the same. The community and neighborhood centers can have shared space zones for cars, cyclists and pedestrians for a urban character.
Description of Transport Strategy

The mixed-use neighborhoods, particularly in the denser central parts of the Garden City, could include car-reduced areas with home zones where there is little disturbance by motorized travel. The lower density areas can have streetscapes designed mainly for pedestrians to create a living environment for families and their children playing in the street. Mobility stations can form the backbone of sustainable mobility services: high voltage filling stations operated with roof mounted photovoltaic panels, centralized parking in multi-story garages in the Garden City or larger parking lots at the entrance of the Eco-Villages and car-sharing options for the first or at least for the second car of a family.

Both within the neighborhoods and between the large development areas attractive bike and pedestrians paths are proposed. These would be sheltered with plants, arcades and roofs against cold winter winds and hot and humid summer weather. Promenades in the parks and green zones as well as the waterfront areas in the Water City would be designed as comfortable and inviting amenities.
Landscape Strategy

The goal of the landscape strategy is to maximize respect for the natural context, understand the site's glacier history, preserve and reuse the concrete structures for cultural activities and integrate urban agriculture. Well-being and sense of community would be maximized with consideration for health, recreation and cultural identity. The interaction with regional and municipal material flows with regard to water, energy and food would be taken into account. Therefore, the following principles should be applied:

- Strive for the protection of the surrounding landscape and its natural elements.
- Promote use, re-use and revitalization of the cultural heritage.
- Make sustainable use of the surrounding landscape as a social and economic resource.
- Plan in accordance with the climatic, topographical and geological setting.
- Integrate natural elements and cycles into the urban tissue.
- Create landscape patterns for high social usability.
- Provide an attractive and livable public space for everyday life.
- Consider livability, visibility and connectivity of public space patterns.
Existing Waterbodies - Re-Establishing the Glacial Structure of the Landscape

Glaciers played an important role in sculpting the unique landscape of Minnesota. Over millions of years, large bodies of ice moved slowly across the land surface while expanding and contracting, picking up rocks and debris under their layers and cutting into the relatively soft land, to create unique, distinct textures.

Source: en.wikipedia.org/wiki/Glacial_history_of_Minnesota
Site Location and Topography

Satellite images and site boundary

Site topography

LANDSCAPE STRATEGY
Re-Establishing the Glacial Structure of the Landscape

Through the centuries of human activity on this land, much of the naturally elegant landforms have been deformed. The design proposes a reintroduction of these glacial structures as the basic organizational principle in the urban layout.

Waterways are extensions of the glacial structures from the undisturbed surroundings and into the site. Creeks, streams and rivers provide a natural rainwater conveyance network between these sculpted hills, while simultaneously providing an ecological backbone that adds vitality to the new development.
Combination of Green and Blue Infrastructure

While conserving the natural history of the place, these dynamic landforms also provide a physical context for a more interactive environment, where people can have a healthy lifestyle that brings them in closer contact to the water, hills, forests and grasslands. Landscapes and waterways are conceived of as combined, holistic system and not separate infrastructural networks. With this mindset, open spaces are seen as breathing, flowing landscapes that contribute to the natural water balance of the environment, while being an amenity for outdoor recreational enjoyment.

Organization and Hierarchy Of Space

The more urban areas are limited to the Garden City in the northeast and the Water City on the southwestern edge. This opens up a large natural area through the middle of the site. Smaller urban clusters, namely the Eco-Villages, are interspersed through this central green spine.

Such a spatial organization ensures that the residents of these urban areas have easy access to the green spine, while not imposing on it. This large natural green spine would be extended into the more urban areas through a network of parks, community gardens, playgrounds and landscaped pedestrian and cycling paths.
Characteristics of Green Elements

1. Urban Greenery
2. Grassland
3. Forest Windshield and Agroforest
4. Wetland Greenery
5. Farming Land
6. Natural Urban Greenery
Characteristics of Green Elements

Native prairie grassland and coniferous and deciduous forests in the region should be conserved. Farmlands should not be allowed to simply replace but rather to coexist in symbiosis with these unique biomes. Agro-forestry is one such example of this. Forests also play a unique urban role in shielding residents and buildings from strong winter winds. Wetlands are a source of immense biodiversity. Along waterways and temporary detention ponds, the intermittent rising and subsiding of water during and after rain events provides moisture for a host of animal and plant species to flourish.
Living with Nature

Organic Food Production
As part of the effort towards holistic healthy living, residents are encouraged to produce food in proximity to their living and working spaces. This will facilitate their appreciation of the nuances of agricultural production while also situating them within a self-sustaining ecosystem – bringing them to live not only close to, but also within, nature.

Innovative Sustainable Farming

Agricultural production can happen on various scales. On the smallest scale, there could be community and rooftop vegetable gardens. The existing larger agricultural land should also be preserved and modified to accommodate interested visitors, short-term and long-term volunteers, as well as progressive, organic farmers. Research and development for innovative farming methods, such as Terra Preta and agro-forestry can be a long-term process.
Water Strategy

The goals of the water strategy are not only to minimize primary water consumption and impairment of the natural water cycle, but also to consider water as an element of life. It can contribute enormously to the quality of open spaces, form amenities and make people experience the natural cycles of water. Therefore, the following principles should be applied:

- Use rainwater systems as a sensual experience to make people aware of the water cycle, to increase the quality of public space and to improve urban comfort.
- Maximize permeability of urban soil and paved surfaces.
- Use rainwater retention and infiltration measures to maintain the natural water balance and relieve the wastewater treatment plant.
- Strive for storm water management with gradual discharge at a natural flow rate and take into account the natural surface discharge.
- Avoid infiltration of polluted discharge (e.g. from intensively used traffic areas) or use filter technologies.
- Maintain or revitalize natural water bodies (lakes, streams and rivers with soft embankments).
- Purify black and grey water in wastewater wetland areas on-site (e.g. reed-bed sewage treatment).
- Save water through the use of more economic installations.
- Collect rainwater and recycle grey water for use in toilets, washing machines, gardening, car wash, etc.
- Design water saving planting areas.
Stormwater Management

The restored topography of the glacial structure will be used to support the natural storm water management elements, which will be connected to the existing hydrological flow of the larger site.

Swales will purify rainwater while channelling it from the urban blocks into the secondary green corridors. Here, detention ponds and cleansing biotopes will further purify the water before discharging it out to the main lake and the central green spine.

LEGEND

- bioretention
- swale
- vegetated
- swale
- detention
- ponds
Characteristics of Water Elements

1. Urban Lake / Waterfront Promenade
2. Creeks / canals in development
3. Creeks / canals in development
4. Wide Natural Rivers
5. Localized detention and cleansing in villages discharged to rivers

WATER STRATEGY

SUSTAINABILITY STRATEGIES
Characteristics of Water Elements

Unlike traditional storm water management infrastructure, holistic hydraulic landscape elements are also recreational amenities that allow inhabitants to live in proximity to water.

Larger urban lakes offer the opportunity of urban waterfront living, with outdoor dining and long strolls along promenades, while smaller creeks enhance the narrower green spaces between residential and office buildings.

This presents a backdrop to which great living could happen - children wading in pools and observing frogs and dragonflies, families having picnics on Sunday afternoons, while workers enjoy a lunch sandwich in their office’s backyard garden.

Bio-retention basins are important tools for groundwater recharge while purifying the water simultaneously.
Characteristics of Water Elements

Where space allows, these could be larger areas of constructed wetlands.

They could also be integrated into smaller, more urban areas in the form of rain gardens. As such, rainwater detention and cleansing could be localized and happen in more street intersections, small residential squares and even next to playgrounds.
Comfort Strategy

The comfort strategy is to plan in accordance with the local climate and to strive for a high daily, seasonal, and annual outdoor comfort. Therefore, the following principles should be applied:

- Consider the exposure of public spaces to bio-climatic conditions (light, wind, sun, rain, snow, etc.) to permit the use of public spaces throughout the day and the seasons.
- Develop the geometry of neighborhoods according to the requirements of urban ventilation and choose climatically favorable layouts and materials for green spaces, blocks and buildings.
- Improve the air quality by reducing emissions from traffic, commercial and industrial units, power stations and household heating systems at the source.
- Increase the filtering and absorption capacity of urban land (for air and water) by planting and maintaining trees and other vegetation, constructing green roofs and facades and by leaving the ground unsealed where appropriate.
- Consider water surfaces (e.g. part of rainwater management systems) to improve urban comfort and to contribute to natural ventilation on the block or building level.
Analysis of Local Climate Conditions

Temperature And Humidity
Minnesota has a humid continental climate with a wide range of temperatures due to its location in the central region of North America. Temperatures in the Twin Cities region range from an average of 13.1 degrees Fahrenheit (−10 °C) in January to 73.2 degrees Fahrenheit (23 °C) in July.

The winter can be very cold with considerable snowfall while higher summer temperatures are often accompanied by high humidity.

Prevailing Winds
The winds in winter are most frequently from the northwest direction bringing very cold air from Canada. In the summer the prevailing cooling winds come most frequently from a southern direction.

These climate conditions often result in low outdoor comfort. They are also a challenge for creating high comfort within the buildings when being conscious of energy-efficiency and healthy heating and ventilation systems.

Wind speed and direction at TMY3 Minneapolis – St Paul International Airport

- Outside Air Temperature [°F]
- Absolute Humidity [g/Kg]
Clustered Buildings and Prevailing Winds in Winter and Summer

The orientation and organization of the neighborhood blocks work hand-in-hand with the green and blue networks to maximize comfort in response to the climactic conditions of the site and region.

Summer
Water bodies are strategically located to the south of each character area so that the prevailing southern summer winds would be cooled down by the water before reaching the neighborhoods, thus bringing fresh, cool breezes throughout the community.

Winter
The neighborhood Blocks are oriented length-wise in a northwest-southeast direction, to minimize the chills from the prevailing northwest winter wind. Forests are employed to shield the urban clusters. In the Garden City, the forested windbreakers take on a more rectilinear form, in keeping with the urban blocks. They extend out from between the blocks into the landscaped waterways. As such, residents can still enjoy these outdoor spaces at the doorstep during the colder period of the year. To the north of the Eco-Villages, these forests are allowed to grow more freely and are connected at various points to the forested areas of the larger community.
Protected Landscaped Spaces

A narrow piece of land can be protected from cold wind when directed perpendicular to that wind direction. Large trees can be arranged on the edge to further the wind blocking. A plaza shaped from narrow to wide allows more sun access and less shading. A parkway can be protected from wind by trees and brush lined paths, oriented perpendicular to wind direction.

Plaza cut out of land Park 20/20 Masterplan - Haarlemmermeer, Netherlands
Protected Plazas

- Plaza with pergola and water features – Malmö Bo01-Sweden
- Narrow plaza perpendicular to wind direction - San Francisco
- Park with carved away spaces – Portland
- Old walls within plaza - Lake Park Seoul-South Korea

COMFORT STRATEGY

SUSTAINABILITY STRATEGIES
Covered Outdoor Areas

- Arcades for Cafés – Bo01 Malmö-Sweden
- Promenades – Hafencity Hamburg, Germany
- Roof elements Solar City Linz-Austria
- Arcades with water feature – Bo01 Malmö-Sweden

COMFORT STRATEGY

SUSTAINABILITY STRATEGIES
Greenhouses as semi-public or private sun spaces

Greenhouses can be integrated with the energy strategy of buildings for capturing solar gains, as an element of the ventilation strategy, for increasing the compactness of buildings and as buffer zones. They can function as an intermediate and balanced climate zone, particularly in the local climate with quite high and low temperatures.

Greenhouse in Mixed Use Development Prisma Nuremberg-Germany

Access Area to Townhouses Darmstadt-Germany

A house sunspace
Housing Development with Microclimate Zone

The development incorporates large microclimate zones containing Mediterranean vegetation, ponds and a fountain. Throughout the year the lofty air-conditioned spaces of light and air are green communal areas for the residents. The result is a large and impressive inner court that also contributes to the overall compactness of the housing scheme.
Building Specific

- Wind and sun protection via tunnel balconies.
- Orientation of a building with balconies is key to wind protection and allowing sun in during the winter.
- High winds can be directed perpendicular to the sides of the balcony tunnels.
- Southern sun can be captured if directed toward the opening of the balcony tunnels.
- Buffer zone to the north.
Public Greenhouses

A greenhouse can be an amenity for the community prolonging the outdoor season. This solar heated environment provides a warm space for the public. In combination with plants and water elements a nature-oriented atmosphere can be created.

Combination of photovoltaics

A greenhouse can be an amenity for the community prolonging the outdoor season. This solar heated environment provides a warm space for the public. In combination with plants and water elements a nature-oriented atmosphere can be created.

SUSTAINABILITY STRATEGIES
Implementation - Tools for Improving Outdoor Comfort

Evaluation of outdoor comfort is relative as it may never be ideal all of the time for each person; however, improvements to the condition can be made. The chart below shows a quantitative but relative comparison of different strategies that has been done for a project in Muscat, Oman for completely different climate conditions. This approach could be transferred to UMore Park by using strategies such as wind screening to address the local climate.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Impact on outdoor comfort (PT&lt;32°C, yearly day and night evaluation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shading: passive strategies</td>
<td>4.2%</td>
</tr>
<tr>
<td>-1.5%</td>
<td>5.4%</td>
</tr>
<tr>
<td>1.5%</td>
<td>13.0%</td>
</tr>
<tr>
<td>4.4%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Air movement: minor active strategies</td>
<td>1.2%</td>
</tr>
<tr>
<td>6.1%</td>
<td>7.2%</td>
</tr>
<tr>
<td>9.3%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Shading + Cooling: active strategies with high temperature sources like groundwater</td>
<td>10.1%</td>
</tr>
<tr>
<td>9.2%</td>
<td>11.0%</td>
</tr>
<tr>
<td></td>
<td>9.2%</td>
</tr>
</tbody>
</table>
Energy Strategy

The goals of the energy strategy are to minimize the primary energy and material consumption, and the impairment of environment (e.g. by greenhouse gas emissions) and to maximize healthy environments (e.g. indoor air quality, convenience of heating and ventilation system). Therefore the following principles should be applied:

- Optimize energy efficiency of the urban structure.
- Minimize energy demand of buildings.
- Maximize efficient use of energy through building services and energy supply.
- Maximize share of renewable energy sources.
- Minimize the volume of waste generated and of waste going to disposal.
- Consider concentration and decentralization for supply and disposal systems.
The passive solar potential is considered tremendous with over 100 kWh/m² per month on the south façade in January, February and March.

TMY3 Minneapolis - St Paul Int’l Airport

- Beam Radiation: 681 kWh/m²/a
- Diffuse Radiation: 354 kWh/m²/a
- Ground Reflection: 140 kWh/m²/a

Total 1175 kWh/m²/a
Passivehouses with photovoltaics and geothermal

Bio-based Combined Heat and power district energy system

Photovoltaics with seasonal solar thermal system

Terra Preta facilities for each neighborhood

Lake-source heat pump system

District geothermal system for each neighborhood

Energy Plan
The energy plan proposes multiple options for the energy generation and distribution of the large site. This allows the integration of different innovative technologies, addressing individual character areas, and a site flexible for emerging future technologies. Initially, decisions only have to be made on technologies for the first phases and if these should be linked to larger district energy systems.

A bio-based combined heat and power district energy system is proposed for the Garden City with its higher density and a mix of residential, commercial, retail and light industry. This can include several energy facilities and should be designed for phasing. District geothermal systems are proposed for the neighborhoods in the northwestern part of the Water City.

District systems linked with lake-source heat pumps can be utilized for the neighborhoods on the lake.

The energy supply and performance of the Eco-Villages should contribute to the intended innovative character of this development zone. Options would be passive house designs with photovoltaics and geothermal systems, developments with seasonal solar thermal system and neighborhoods with Terra Preta facilities.

**SUSTAINABILITY STRATEGIES**

**ENERGY STRATEGY**

**Description Energy Plan**

**Geothermal Loop Fields, Arvada, CO**

**Biogas Co-generation Plant, Güssing, Austria**

**District Geothermal – Ball State University**

**Drake Landing Solar Community Site Plan and District Heating System**
Terra Preta System

Terra Preta, or black soil, is an innovative technology and land use approach for establishing sustainable material flows. This cutting-edge technology integrates waste and water management and energy production with urban agriculture. To connect the eco-cycles and material flows the building of Terra Preta facilities in the central landscape zone area in proximity to the Eco-Villages is proposed. In these facilities, digested sludge from the wastewater treatment and all organic waste from the area can be transformed into a fertile black soil full of nutrients, charcoal and microorganisms. The heat generated in this incineration process can be used for district heating and carbon captured for growing crops in greenhouses. The black earth can then be used for soil improvement in urban agriculture and urban planting. Terra Preta facilities generate biogas that can contribute to the operation of combine heat and power facilities. This system not only reduces carbon emissions in energy production, but it also supports carbon capturing by bringing the carbon, which is bound in charcoal, into the ground. This system will support a movement to a post-fossil energy future and fully integrated urban eco-cycles. This integrated process is an extremely interesting approach that attracts enormous attention and funding in Europe and can be adapted and introduced to the U.S. in research cooperation with the University of Minnesota.
### Energy Budget

The annual budgets for electricity and fuel must be defined for the individual land uses and typologies. The total utility budget for the energy use [that was previously calculated in the 2009 Concept Master Plan] could be offset by the energy generation with the renewable energy sources of wind, biogas and natural gas.

<table>
<thead>
<tr>
<th>Annual Electricity Budget 1,000,000 kWh</th>
<th>Annual Fuel Budget 1000 MMBtu</th>
<th>Typical Co2 Budget 1000 Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Consumption</td>
<td>Budget</td>
<td>Typical Consumption</td>
</tr>
<tr>
<td>Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Family Residential – Low Density</td>
<td>83.5</td>
<td>66.8</td>
</tr>
<tr>
<td>Single Family Residential – Medium Density</td>
<td>23.4</td>
<td>18.7</td>
</tr>
<tr>
<td>Multi-family Residential – High Density</td>
<td>16.1</td>
<td>12.8</td>
</tr>
<tr>
<td>Commercial</td>
<td>53.3</td>
<td>42.6</td>
</tr>
<tr>
<td>Ground Source Heat Pump</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Electric Generation/ District Heat</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Utility</td>
<td>176.2</td>
<td>241.6</td>
</tr>
<tr>
<td>Generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>-</td>
<td>161.6</td>
</tr>
<tr>
<td>Biogas</td>
<td>-</td>
<td>80</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Generation</td>
<td>-</td>
<td>241.6</td>
</tr>
</tbody>
</table>
Zero Carbon Mission Statement

Design and maintain the UMore Park community to achieve carbon neutrality by combining high-performance, energy-efficient building design, new renewable energy generation utilizing energy sources within the community, and efficient and local distribution, as well as on-site carbon sequestration.

This means an intense reduction of energy use and carbon emissions from 60 percent in phase one to 100 percent in the final phase in relation to the average Minnesota building in 2003, as determined by the Sustainable Building 2030 Energy Standards. [Energy use and carbon emission targets are based on data from the 2009 Concept Master Plan.]

The ambition of the options set out in this energy strategy is to meet the budget and the generation goals as well as the emission targets with cutting-edge and innovative technologies. This comprises strategies that are already included in the previous chart and new suggestions such as passive-houses, solar thermals with seasonal storage, lake-source heat pumps and the Terra Preta technology. But particularly covering of the electricity demand with renewables will surely be the bigger challenge than covering the fuel demand with renewables. Therefore the utilization of technologies such as photovoltaic panels and bio-based combined heating and power plants are proposed.

Energy Use and Carbon Emission Targets

<table>
<thead>
<tr>
<th>Percentage Energy Use Intensity (EUI)* Reduction from an average Minnesota Building in 2003 as determined by the SB 2030 Energy Standard Tool (saving) kBtu/ft²/a</th>
<th>Percentage Carbon Emission Intensity (CEI)* Reduction from an average Minnesota Building in 2003 as determined by the SB 2030 Energy Standard Tool (saving) Lb CO2e/ft²/a</th>
<th>Tons of CO2e Greenhouse Gases Emitted per Person per Year in Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>First phase</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>Second phase</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Third phase</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Fourth phase</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Final phase</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Net-Zero Definition – What’s In, What’s Out

A formal definition of net zero energy or carbon must be established. An important question is if the transportation or embodied energy/carbon is included in the calculation or established later in the development. Additionally the boundaries of the carbon neutral system need to be detailed.

Possible Boundaries of Carbon Neutral Systems:
- Isolated “Eco-Block”
- Real Life Real Ecosystems

**Net Zero**

\[
\text{Gross Program Area} \div \text{Energy Use Intensity} - \text{Renewable Generation} = 0
\]

**Energy Strategy**

**Sustainability Strategies**
Portland Eco Districts have considered the need to define net zero boundaries at different scales for different systems.
Townhouses in suburban settings

Heat loss is reduced due to minimizing exterior surface area with compact building typologies. This makes the construction of energy-efficient buildings much more cost-efficient. Therefore apartment buildings and townhouses with common walls should be promoted.

Ratio Surface to Volume of Typologies

**ENERGY STRATEGY**

**SUSTAINABILITY STRATEGIES**
Passive House Design – A very viable and effective approach

Passive house design is a very viable and effective approach towards improving energy and comfort performance at the building level.

PASSIVE HOUSE CERTIFICATION CRITERIA

- The primary criteria:
  - Total heating and cooling demand <15 kWh/m²/yr (4.7 kBtu/ft²/yr)
  - Total primary (source) energy demand <120 kWh/m²/yr (38 kBtu/ft²/yr)
  - Airtightness < 0.6 ACH @ 50 Pa

Other commonly recommended measures:

- Peak heating demand < 10 W/m² (3.2 Btu/ft²)
- Total site energy use < 42 kWh/m²/yr (13.3 kBtu/ft²/yr)
- Window U-value < 0.8 W/m²K (0.15 Btu/ft²/F, R-7.1)
- High-efficiency heat recovery (over 80%)*

* Solar radiation is described in kilowatt hours per square meter per day.
Performance-Based Energy Targets (for non-Passive House Design)

Performance-based and binding energy targets have to be established and integrated with the energy supply and distribution systems for all building typologies.

<table>
<thead>
<tr>
<th></th>
<th>Heating</th>
<th>Cooling</th>
<th>Electrical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Midrise</td>
<td>70</td>
<td>3.5</td>
<td>30</td>
</tr>
<tr>
<td>Residential Highrise</td>
<td>65</td>
<td>3.5</td>
<td>30</td>
</tr>
<tr>
<td>Commercial</td>
<td>40</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>Retail</td>
<td>180</td>
<td>100</td>
<td>120</td>
</tr>
</tbody>
</table>

Example for the Definition of Energy Targets

Zero Emission Factory in Freiburg - Germany

Energy-efficient solar houses EVA Lanxmeer Culemborg - Netherlands

Eco-Offices EXPO 2000 Hannover - Germany
Optimization and Design Techniques – Energy Use Plan

Advanced design and optimization tools should be employed to optimize the supply strategies and the building structure with regard to minimizing heat loss and maximizing solar access. The energy use plan methodology is helpful for analyzing the energy density for heating (related to building typologies and performance), the energy potential and defining supply strategies. Software tools can be used for optimizing the building structure with massing, heights, distances and orientation of buildings. Simulating the heat demand or the sun hours on facades are good ways to assess design variants.

Energy Use Plan

Energy potential

Energy infrastructure

Energy density for heating

Energy Use Plan Source: www.climadesign.de

Simulation of Heating Demand

Simulation of Sun Hours on Facades

ENERGY STRATEGY

Simulation of Sun Hours on Facades

Energy Use Plan

Energy potential

Energy infrastructure

Energy density for heating

Simulation of Heating Demand

SUSTAINABILITY STRATEGIES
VI. CHARACTER AREAS

These are presented with descriptions, principle sketches and illustrated with precedents from European examples that will have to be translated into design approaches appropriate for U.S. requirements.

> Garden City – Central Area
> Education and Learning Band
> Garden City – Edge Developments
> Green Industry and Retail
> Eco-Villages and Landscape Corridor
> Water City - Solar Terraces
> Culture, Recreation and Wellness Band
> Water City – Delta Quarter
Design Principles

Transport Development Grid Orientation Winter Comfort Summer Comfort

GARDEN CITY – CENTRAL AREA
Garden City – Central Area

The Garden City would have an urban and green character. An urban green zone will structure the area and will contribute together with embedded water elements and smaller green corridors to a high quality of life.

Smaller block structure with protected squares gives the Garden City its own character. Similar to the grid structure of historic towns, the streetscape opens to some squares creating a nice atmosphere with walkable distances, following the five-minute living principle. Every square will have a high-quality public space with both greenery and water features. Some will be surrounded by community centers, small-scale amenities, mixed-use and possibly even an elementary school, to create vivid shared spaces.

The staggering of the grid will make the development less permeable from the northwest, resulting in more protection from the winter winds and a better winter comfort. Wider boulevards with trees and water features are placed from southwest to northeast to bring the fresh summer winds coming from the south. This area is mainly mixed-use development, which includes vibrant neighborhood centers with plazas.

The central area of the development will accommodate a public space at Boulder Trail with future light rail service. A sophisticated design of mobility stations strategically located to enhance public spaces, brings good accessibility and connectivity to different modes of transport, thus creating an attractive center.
Example: Bo01, Malmö, Sweden

The Western Harbour of Malmö has been transformed from an industrial park into an area for knowledge and sustainable living, a site of some 30 hectares for dense urban development. For the city of Malmö, the starting point for this project was to create a sustainable district with a high level of quality in terms of its architecture, character of public space, building performance, and standards in color, materials, energy and ecology. Located at the junction of the main arterial road and the quayside of the central plaza, the Scaniaplatsen is extended by the ocean view and delineated by apartment blocks and a raised basin of water that cascades into the sea. The other main urban elements are the taller apartment blocks defining the sea front, the marina, boulevards, ornamental canal and watercourses; plus courts, gardens and lanes to give the district an urban character. Additional urban parks, such as Daniaparken and Anchor Park, provide other waterfront meeting places.
An essential characteristic of this design is variety in the combination of residential structures, building-types and social groups. Südstadt is home to a community with a strong social network, and offering a wide range of spaces, which is attractive to different generations, social and cultural groups. Mixed-use neighborhoods are highly attractive and lively, compared to segregated, single use residential and industrial neighborhoods. The objective was to create a small-parceled, vertical mixture. Public, social and cultural facilities have been created serving the Südstadt and the entire town. The building density is exceptionally high which allows short distances to amenities.

The majority of the homeowners are private builders joined together in “private building cooperatives”, most of them with costs ranging much lower than those of typical single-family homes. Due to this development approach, Südstadt has been settled by a varied cross-section of the population; not only typical families, but senior citizens, non-German citizens, mentally and physically handicapped citizens, students and many other groups. The public spaces, roads and plazas serve mainly as communicative spaces for the residents and those who work here. Cars are not prohibited in these neighborhoods, but the vehicles of employees, residents and visitors are parked in neighborhood parking garage.
Example: Solar City, Linz, Austria

This mixed-use development with schools, childcare, local shopping, social and cultural facilities, restaurants and residences connected by a key access boulevard, forming the functional and spatial link of the neighbourhood. It has a center square creating the focal point. This transit-oriented development allows daily trips mainly to be done by walking, biking or public transit, keeping residential areas mostly free of motor vehicles. The plan included extending the tram line from Linz into the development and provision of a local bus system provided within the Solar City.

Other strategies taken into account included job creation, local renewable energy strategies, closed-loop systems for water/wastewater, integrated natural water features in the design of the community, an extensive lake system, landscaped parks and a nature reserve area. In the energy strategy, ecological advances through energy savings in production were considered, operation and recycling, and the comprehensive use of solar energy through the design of buildings and houses, solar panels and building orientation.
EDUCATION AND LEARNING BAND

Design Principles

TRANSPORT
DEVELOPMENT
GRID ORIENTATION
WINTER COMFORT
SUMMER COMFORT

CHARACTER AREAS
Education and Learning Band

This green zone will also be utilized as an education and learning band that starts at DCTC and should accommodate civic, institutional and educational uses. The character of the building designs and clustered neighborhoods should have a distinct organic and landscape-oriented character.

The landmark buildings will be placed on strategic squares and streets to offer a good connection to the housing blocks, but also to mark the entrances to the development. Throughout the educational and learning band, pedestrian and bicycle lanes will connect all the buildings, sports fields and other neighboring areas. The buildings should be integrated to the landscape and oriented following the shape of the band getting as much sunlight as possible, but protected from the north with landscape.

Forests strips should be placed sequentially in the extended green area of the band to block the cold northern winds in winter and to create protected pockets. The water feature south of the landmark buildings will bring fresh winds in summer.
EDUCATION AND LEARNING BAND

Example: Technical University Library, Delft, Netherlands

Delft’s Technical University Library building was designed by the architectural firm Mecanoo. It is a building that becomes landscape; the grass area is raised as a roof in a gentle slope bringing activities on top of the building as a prolongation of the open space at the main entrance. The large hall that this landscape roof creates has been fitted with high-performance glazed facades. An enormous cone protrudes through the grass roof as a symbol of technology. The building reaches high standards of sustainability and is very energy-efficient. The grass roof has an insulating effect and counteracts excessive temperature fluctuations. The vegetation absorbs rainwater and as this water gradually evaporates in the summer, it has a natural cooling effect.

Examples: Passive House School Aufkirchen and Solon AG Berlin, Germany

The Passive House Montessori School in Aufkirchen near Munich is a certified Passive House school in Germany. This school, integrated into the countryside, is friendly, high class and cost-efficient at the same time. It creates a living space for children with an interesting green roof that arches in a wave from the ground level of the building and has organically shaped floor plans. The building envelope, including this green roof is created by lightweight timber construction. The interior floor plan follows long radius curves. Natural light, high insulation, controlled ventilation and heat recovery technology characterize the building.
Example: German Federal Environment Agency in Dessau, Germany

The architecturally unique headquarters of the Federal Environment Agency (UBA) are located at an historic site in Dessau-Roßlau, in the former “Gas Quarter”. The site was selected in order to show the possibility of using a brownfield site for sustainable urban development.

A small existing railway station and a former factory for gas appliances were both integrated into the design. The overall form of the new building was designed to allow the residents continued access to a large part of the site as a public park. The atrium and forum, a large glass covered space, link the public areas with a library, auditorium, exhibition area, information center and a café.

Active and passive strategies were used for the reduction of energy consumption and carbon dioxide production. The building combines compact volume and high degrees of thermal insulation with strategies of intelligent services engineering and the use of renewable energy sources such as a large geothermal heat exchanger, a photovoltaic plant and thermal solar panels. Timber is largely used due to its ecological suitability.
GARDEN CITY – EDGE DEVELOPMENTS

Garden City – Edge Developments

Transport  Development  Grid Orientation  Winter Comfort  Summer Comfort

CHARACTER AREAS
Garden City – Edge Developments

Towards the larger green zone, mainly residential edge developments with mixed-use centers are foreseen. On Country Road 42 and in the southeast, mainly commercial and large retail would be located, while the eastern border could feature mainly light industry and offices. Most of this development will be low density with predominantly residential land use. Local squares with some mixed-use amenities will form a series of small-scale centers connecting neighborhoods through the walkable character of the five-minute living community. The rest of the development edges will be more residential-oriented, but still follow the new urbanism approach. As density grows in the community, a sustainable high-rise building is proposed as a landmark building. It could offer a view of the landscape corridor and the Mississippi River, as well as highlight the entire development.

The grid is oriented with slight deviations southwest to southeast to maximize solar access in the public realm. This allows southern winds crossing water bodies to ventilate the area for a high summer comfort. Winter wind protection screening forest strips and staggered street alignments are introduced.

Although the Garden City is housing-oriented, light rail on Boulder Trail and an integrated bus system will bring accessibility to one of the center of this development catching most of the residential area. This will certainly reduce car dependency even in the low density residential areas.
Example: Arkadien Asperg near Stuttgart, Germany

This project is a sustainable residential community north of Stuttgart with 84 housing units, situated on the border of the town of Asperg. Agricultural land and fruit tree orchards surround it. The transit-oriented development offers a subtle organization of streets and sidewalks that provide high quality green spaces for the community. The detailed landscape and storm water concept creates a garden city atmosphere.

A balance of economic density and the demand for individuality has been achieved in a harmonic way by mixing “chain linked” town houses, apartment buildings, “house-in-house” concepts and special forms like loft apartments and living for elderly. The construction method for these buildings combines low-energy standards and the usage of natural building materials, guaranteeing comfort and coziness through a healthy building environment.
Example: Landmark Buildings

The twisted torso in Malmö, the station tower with photovoltaics in Freiburg, and the project for a green skyscraper in Singapore by Ken Yeang are examples of eco-landmark buildings. The latest addition to the typical Dutch village of Loenen is the new urban area Cronenburgh. Inspired by the concept of an old village, no two lots are the same and the homes all feature various architectural interpretations. More than half of the houses are built through private development, though guided by a set of overall design guidelines.

Example: Loenen- Netherlands

CHARACTER AREAS
GREEN INDUSTRY AND RETAIL

Design Principles

Transport  Development  Grid Orientation  Winter Comfort  Summer Comfort

CHARACTER AREAS
Green Industry and Retail

An innovative development should integrate trade and office buildings with light industry and research areas. A series of high-tech solutions are used for carbon reduction, such as integration of photovoltaics in large roofing areas.

The grid orientation follows the boulevards and street direction of the Garden City’s mixed-used areas, which bring the fresh cooling winds in the summer and guard against the cold winter winds from the northwest. The staggering of north-south streets also helps protect from the cold winds and bring better winter comfort to the streets and public spaces.

A green band with water management areas, pocket forests and other landscapes connects the industry and retail development and leaves a green corridor as a buffer to the future growth of the industrial area to the east. This band further highlights the green and sustainable condition of the area.
GREEN INDUSTRY AND RETAIL

Examples: REWE Supermarket / Mira with Sustainability Certificate / Solar Factory, Germany

Examples: Research Institute Waageningen, Netherlands / JUWI AG, Wörrstadt, Germany

Examples: Scientific Parks Kaoshiung-Taiwan / Berlin-Adlershof, Germany
ECO-VILLAGES AND LANDSCAPE CORRIDOR

Design Principles

Transport

Development

Winter Comfort

Summer Comfort

Grid Orientation

CHARACTER AREAS
Eco-Villages and Landscape Corridor

The structure of the urban plan is mainly based on the history of the existing landscape. The reintroduction of the glacial structures as the basic organizational principle of the urban layout has embedded the subterranean structure in the overall plan. Throughout the landscape corridor Eco-Villages are embedded as cluster developments offering opportunities for living, working and recreation in a low-density residential environment with access to mixed-use centers.

The intention is to create a corridor for innovative and cutting-edge approaches. Examples may include an urban farm for local food production, education, information and conference centers, or collective permaculture gardens. It may also include innovative energy and material flows systems, such as the Terra Preta technology. This system can be used to treat organic waste and wastewater for the production of a bio char, which can be used again for agro-forest systems. The energy generation from this process can be used to run zero carbon district energy systems.

Sustainable farms could include buildings structured around a courtyard as the center of the farming activities for crop, vegetable and fruit production and could also accommodate a restaurant.
Symbiotic agriculture, permaculture, orchards and collective gardens are integrated into the Eco-Villages for local food production. Some of these will be organized in a new type of agro-forest system, providing an innovative structure to grow organic foods.

In the center there is an integration of playgrounds, high quality public green spaces and relaxing areas surrounded by mixed-used development. Summer comfort is provided by openings to the south and surrounding water ponds, extensive planting and reed beds systems. Screening forests are strategically placed for winter comfort. Together these green zones form an environment that displays the diversity and resilience of natural ecosystems.

Other innovative approaches could be created at the architectural level, such as buildings designed with a “parasol-umbrella” adapted to the regional climate, integrated photovoltaic and thermal solar roofing, integration of greenhouses as a transparent buffer zone to the south, and a rain and wind shield towards the north. The comprehensive use of solar energy, recovery of residual heat through heat pumps and sustainable timber construction could also be used.
Eco-Villages and Landscape Corridor

The Eco-Villages would integrate eco-housing with photovoltaics, greenhouses and a community greenhouse at the Terra Preta plant. The landscape concept features wetlands, agro-forest systems and community gardens for sustainable lifestyles.
Example: EVA Lanxmeer, Culemborg, Netherlands

This sustainable urban development project is a city extension initiative for the Dutch Ministry of Housing. It shows a solarized urban structure with organic landscape of the courtyards. The energy supply strategy includes district heating based on energy gained from reusing wastewater, incorporating solar energy and using ground source heat pumps. It also has an area with a co-generation plant that will be operated with biogas generated from wastewater management. The planners were very sensitive to the landscape and gave consideration to the various water cycles, such as seeping away rainwater from buildings, purification of street runoff and wastewater treatment. These water systems have been integrated into a permaculture landscape.
Example: Landwerkstätten Hermannsdorf, Munich, Germany

This project was created as a model for the ecological, economic and social development of agriculture. It relied on regional planning innovations for a new connection between agri-urban development through new comprehensive community development. It is located in the southern village of Hermannsdorf on the periphery of Munich. Because of its proximity to the metropolis, yet still in the farm belt, it was particularly suited for the integration of organic farming and food production in its marketing strategy. The main farm building is built on a courtyard that is the center of the urban farming activities. A brewery, bakery and butcher shop are integrated into the building. Featured amenities include a beer garden in the courtyard and a restaurant.
Design Principles

WATER CITY – SOLAR TERRACES

CHARACTER AREAS

Development

Transport

Grid Orientation

Winter Comfort

Summer Comfort

Design Principles

- WATER CITY – SOLAR TERRACES
- CHARACTER AREAS
- Development
- Transport
- Grid Orientation
- Winter Comfort
- Summer Comfort
Water City – Solar Terraces

The gravel mining lake will give the Water City its specific character. The structure will be a result of the gravel extraction and will give the northern part a terraced layout towards the lower water level of the lake.

This structure will be south oriented, maximizing the solar access to each terrace and consequently to the residential areas. The solar terraces have radial green corridors and water features giving the neighborhood a pleasant summer comfort. The direction of most radial corridors is against the cold winds protecting the smaller grid system and public spaces.

Two main arteries bring accessibility to the Water City from other major roads. Boulder Trail connects the Garden City to the Water City and beyond. Sequences of smaller streets connected to the public realm of this neighborhood are distributed following a radial pattern. Akron Avenue crosses the Water City development and in combination with County Road 46 would offer different modes of transport, such as a future light rail and bus system, throughout the community and make the center of the Water City more livable.
Example: Bo01 Waterfront, Malmö, Sweden

The waterfront of the Western Harbour of Malmö has been transformed from an industrial park into an attractive sustainable district that brings back the “living at the waterfront” concept.

A high level of quality in terms of its architecture with taller apartment blocks and a long promenade defines the sea front and the canal, forming a sheltering ring for terraces in the center.

Located at the junction of the main approach road and the quayside is the large town center, the Scaniaplatsen, extended by the ocean view and delineated by apartment blocks and a raised basin of water that cascades into the sea.

Other main urban elements such as the Sundspromenaden quayside, the marina, boulevards, ornamental canal and watercourses give liveability to the waterfront of the development.
Example: Hammarby Waterfront, Sjöstad, Sweden

Located south of Stockholm’s city center and on a former industrial site around the Hammarby Sjöstad Lake, the property utilizes mixed-use development strategies. Small blocks are allocated within attractive landscapes, detailed courtyards and waterside walkways ensuring all flats have a view of the greenery or the water. Other blocks are designed around courtyards with one or more open sides to allow public access. Occasionally landmark buildings are located at strategic points to provide accents and ease of orientation. The ground floors of many buildings are generally non-residential, which highlights the areas mixed-use character.

Canals and water features direct storm water towards reed bed cleansing systems on the edge of the lake for rainwater management. Each courtyard is individually designed for its surrounding residential blocks, providing the child-friendly nature of these open spaces. There is underground parking linked to reliable public transport and incentives to reduce car usage. Vacuum refuse collection systems limits the need for heavy vehicles in these residential areas. Also, there is a growing cultural and social life within the development.
Example: Freiburg Vauban, Germany

Freiburg, in southwest Germany, is known as the solar capital of Europe. Its objective has been to offer high quality buildings and spaces for families within the city boundaries to counteract suburbanization. A strategy considering the soft infrastructure, such as education and community facilities, is seen as just as important as the hard infrastructure. The main challenge was to market the benefits of adapting lifestyles with include cycling, walking and using public transport to reduce car usage. Located on a former army barracks site, the development has increased densities in order to pay for the high quality infrastructure, but also allows the accommodation of single-family housing.

The block orientation of the urban structure follows a passive solar design. Roof mounted photovoltaics and effective shading contribute to the solar strategy of the entire development. The city has led the way in reducing car dependency and promoting walking and cycling. It has done this by providing high quality public transport and by making cycling and walking easy and pleasurable. Trams run on grassed medians that contribute substantially to reducing noise. The biggest lesson learned was about including public engagement from the beginning of the planning process and how the social, economic and environmental aspects of the project must be integrated in a coherent way.
CULTURE, LEISURE AND RECREATION BAND

Design Principles
Culture, Leisure and Recreation Band

Similar to the educational and research band in the Garden City, the central urban green zone will be developed as a culture, leisure and recreation band. It could have a series of landmark buildings with different uses embedded in the landscape, for example a museum on the border of the lake. Water features will connect these buildings following a water management strategy with rainwater retention ponds and reed bed cleansing systems. All of these elements form the character of a green band that works as a continuous park with public buildings and public spaces connecting each of the major neighborhoods of the Water City.

Local bus and light rail systems could go through part of the band stressing the sustainable environment of the Culture, Leisure and Recreation Band.
The Oceanographic Museum Ozananum is located on the city’s historic waterfront immediately adjacent to the historic center of Stralsund. The design is an open structure, which is “flooded” from all sides by people and light; similar to the way that stones are periodically surrounded by water along a shoreline. The visual relationship between these ‘stones’ gives the museum its own identity and makes a unique contribution to the waterfront of Stralsund. The layout of the museum is divided into four individual sections, each of them with a particular exhibition theme. All parts of the exhibition area are situated in the upper floors. Thus, tour groups do not cross visitor traffic at the entrance, leaving the ground floor available for full integration to the public space on the water and the surrounding architecture.

The McLaren Group’s new headquarters building is a sustainable industrial building developed following the company’s high-tech philosophy and partly with the company’s own technology. Half-sunk into the hillside, the building reduces its impact on the surrounding landscape. It has a roughly semi-circular floor plan, completed by a formal lake, which is an integral part of its cooling system. The water is pumped through a series of heat exchangers to cool the building and to dissipate the heat produced by the wind tunnels and laboratories. A long, specially designed water cascade contributes to the cooling effect of the lake surface with vaporization.
Design Principles

WATER CITY – DELTA QUARTER
WATER CITY – DELTA QUARTER

The Delta Quarter on the southern part of the lake derives its character from a waterfront on the lake, canals and ditches, as well as a lower density. Still on a radial system, some boulevards connect the building blocks to the waterfront promenade and the mixed-use center form the structure of the public realm in this development.

Wind crossing the lake and water bodies will ensure comfort in the summer and screening forest elements will contribute to winter comfort. The energy strategy foresees lake-source heat pumps and district energy systems. A potential restructuring of County Road 46 is considered as an alternative to bring more accessibility to the Delta Quarter and allowing full sun exposure to the Water City waterfront.

A local bus system and a light rail stop in the northern part of the community will serve the area with public transport. Connecting this service to County Road 46 would allow the waterfront promenade to become a much more vibrant and dynamic public space.
Example: Delta Quarter, Houten, Netherlands

The Houten design is characterized by its lakefront location and housing on canals which are organized in differentiated neighborhoods. The transport concept includes a sophisticated bike master plan. Bicycle pathways form the main grid for transport within the area. Car traffic is reduced to a ring road and dead-end streets. The modal split shows a very high share of biking.
WATER CITY – DELTA QUARTER

Example: Delta Quarter: Terwijde Utrecht - Netherlands

Example: Gouda - Netherlands / Zhangjiawo New Town Tianjin - China

Example: Arkadien Winnenden - GER / Terwijde Utrecht - Netherlands