

Green Roof Review Task Force
Meeting #2 – February 7th 2018 – 9:00-12:00
200 W 14th Ave, 2nd Floor, Grand Mesa Room

Meeting Objectives:

- Dig into the Data about the benefits and costs of the ordinance as it stands today.
- Begin to Generate Ideas about Possible Modifications

9:00 Opening

- Welcome – Opening – Introductions
- Preliminary Matters – Facilitator – Agenda Preview and Operating Protocol Reminder
- Multi-Tasking During This Meetings – Ideas/Options/Possibilities for Ordinance Change to Achieve Ordinance Benefits and Address Costs

9:10 Inventory – Buildings the Ordinance Applies to Building Stock information

How Many Roofs, How Much Area?

- Existing Buildings
- Projects of Building Construction
- Q&A
- Next Steps

9:20 Potential Benefits of the Ordinance – Starter List

- Climate Change
- Heat Island
- Water Quality and Quantity
- Air Quality
- Food Production
- Q&A
- Next Steps

10:15 Costs – Ordinance as Is – Starter List

- Examples and Hypotheticals
- Three Typical Buildings
- Q&A
- Next Steps

10:45 Not Reinventing the Wheel – Cities that Have Walked This Path Already – Ordinance Similarities and Differences – Other Similarities and Differences – Lessons Learned

- Toronto
- Chicago
- San Francisco
- Q&A
- Next Steps

11:00 Ideas/Options/Possibilities for Ordinance Change to Achieve Ordinance Benefits and Address Costs

11:45 Data Needed to Evaluate these Ideas and Options

11:55 Summary, Next Steps, Wrap-Up

12:00 Adjourn

Green Roof Review Task Force
Summary – Meeting #2 – February 7, 2018

Meeting Objectives:

- Data – Presentations, Questions and Answers – building inventory, costs and benefits of the ordinance
- Generating Options – First Effort

The summary below includes questions and answers and discussion and does not replicate the presentations. For the presentation materials, please refer to the PDF of the presentation slides.

I. Building Inventory

Katrina presented the inventory of existing building and a projection of construction activity.

II. Benefits

The Stantec team and some of the task force members presented information about the ordinance benefits in these categories – climate change, heat island, water quality and quantity, air quality, and food production – please refer to presentation materials for the details

A. Climate Change and Energy Use

1. Heating Energy Use
 - i. Green roof may or may not provide a benefit
 - ii. No benefit from partial green roof
 - iii. Increased insulation is more cost-effective
 2. Plants process CO₂
 3. Cooling Energy Use
 - iv. Green roof – absorbs significantly less sunlight and lowers roof temperature compared to black or conventional roof
 - v. Less heat transferred to building
 - vi. Photovoltaics – would have a positive impact on energy savings
 4. Energy Use to Provide Water to the Roof – Small Offset to Energy Benefit
 - vii. Energy to pump water to the roof
 - viii. Energy used to make clean water
 5. Solar
 - a. Energy generation from 70% solar option under the current ordinance has a large potential climate benefit of a 4.5% total ghg emission reduction below 2005 levels in Denver.
 6. Net Climate benefit
 - a. Significant, but small for green roofs alone
 - b. Significant and large for 70% solar option
- Q: Cooling benefit for a 10-story building – does it extend below the top floor or two?
A: We are looking at total btu for the whole building; yes, the taller and narrower the building the less the effect on the building's energy use
Q: Energy use for water for the green roof, included?
A: The 750 kwh is an all-encompassing number, so it's included already

B. Heat Island

- ix. Denver has a heat island problem – areas of the city don't cool at night
 - x. Tree canopy makes a big difference
- Q: Are images of hot roof black roofs?
A: Yes, comparing the ordinance to conventional roofs – we will consider white roofs when we get to the options

Q: What about the benefit of a black roof in the winter?

A: Overall, the effect is small. I don't expect it to be a large contribution

Q: Why is the airport area land so hot?

A: No tree cover – the prairie heats up – the soil can heat us too, but those areas cool off at night and are not the problem

Q: What kind of green roof are you analyzing to achieve these benefits?

A: Basic, low-cost range

Q: Does partial vs. whole green roof make a difference?

A: The green roof will have an impact in cooling either way

C. Water Quality

xi. Runoff reduction

xii. Vegetated roof reduces impervious surface from 80% to 70%

xiii. Green roofs can reduce localized flooding when we have big storms

Q: Did you consider fertilizers on green roofs?

A: Best practices are not to use much fertilizer on a green roof

Q: Does temperature impact aquatic life?

A: yes

Q: Is it a problem if less runoff means less water in streams?

A: No, normal consumption by vegetation is allowable

Q: What assumptions underlie these benefits?

A: We looked at the general benefits of green roofs, not trying to model the ordinance and a mix of green and solar, etc

Q: Would residual pollutant concentrations on streets increase?

A: Not clear; we talked about that; roof has far less pollution than a road; lots of nuances

Q: Is Denver's current stormwater system able to handle growth and expected runoff?

A: The city is researching this; we have areas that may not be able to handle increased runoff

D. Water Quantity

xiv. We have been above the historic median for potable water supply

xv. We need to keep our eye on water demand; it is not critical, but it may be someday.

Q: Would a building save water over time if it has a green roof?

A: Yes, the reduced cooling load would be a benefit

E. Air Quality

xvi. Ozone is the main pollutant of concern; we are out of attainment

xvii. Reduced urban heat island can reduce wind and pollution (small % difference)

xviii. Enough to off-set GHG temp increase

xix. All studies show reduced UHI

xx. Small effect and mixed positive and negative

xxi. The best strategy is to prevent air pollution at the source; it is less expensive

xxii. Green roofs do not address the source, so are not a significant contributor to improving air quality

Q: No solar in these studies?

A: Today, we focused on green roof; more later

Q: Don't plants improve air quality?

A: The studies point to mixed results; and all effects, positive and negative are very small

F. Food

- xxiii. Hard to predict how many new buildings would plant a rooftop garden, so hard to quantify the benefits
- xxiv. The builder and the tenants are making a commitment based on values, on a desire to provide food for the tenants and on a willingness to make the investment and take care of the garden over time
- Q: Aren't many roofs off limits?
- A: Green roofs for food production would not be on buildings like that
- Q: If used for food production, would the roof require ADA compliance and access?
- A: yes
- Q: OSHA compliance as well?
- A: Yes, it basically turns your roof into another floor
- Q: Is there analysis on yield on roof vs on the ground?
- A: An area aimed at feeding all people in a residential building is significant; it is easier on the ground if space is available; often garden roofs also include PV or other amenities as well
- Q: Aren't there examples in Brooklyn of roof gardens that providing for an entire community?
- A: Yes, often with stacked production; it can be done, and it has benefits, but it is not clear how many would make the commitment

III. Costs

Stantec presented assessment costs and implementation costs for four building examples – residential, retail, industrial, office

Q: Why is the retail requirement higher?

Q: Why do the largest buildings have the smallest requirement?

A: Concern that industrial buildings have long spans without support; Toronto has made changes in their industrial requirements

Q: So, it was a cost consideration?

A: More a feasibility consideration

Q: Do the differences between industrial and retail warrant this difference?

A: This is the kind of question the task force will have to consider when thinking about possible amendments

Q: Will we look at cost/benefit?

A: Yes, when you evaluate options

Q: Are cost/sqft numbers inclusive?

A: Yes, in appendix, we asked for all-inclusive costs

IV. Discussion – Benefits and Costs

- What about buildings that are LEED certified; can they get an exemption for already doing things?
- Alternative paths to compliance make sense
- For large building owners – tenants are demanding green amenities
- I think the voters cared most about climate and sustainability

Q: Can we get more analysis on solar?

A: Yes, PV adds a lot to the benefits

- Changing supplier for your roof can cut off the warranty
- The green roof website focuses on climate, air quality, water quality
- Yes, climate change and sustainability; and people also want green spaces

- Our work shouldn't abandon green altogether
- There are other many ways to get all the benefits
- Urban heat island benefit is the most affected by green roofs.

- Heat island and heat waves have direct health consequences
- Urban heat island is linked to climate change because of the increase on energy demand

V. What Other Cities Have Done

- xxv. San Fran
 1. Green roofs – one of many options; focus is on better roofs
 2. Result of conversations since 2006
- xxvi. Toronto
 1. Green roof by law
 2. There are other strategies as well
 3. It was well received
 4. Amended for industrial
- xxvii. Chicago
 1. Green roofs are one option
 2. New buildings have to reach a score of 100 points through a variety of options
 3. City wanted to address 2007's heat wave deaths
 4. New construction and city funding only
- xxviii. Seattle
 1. Green roofs are one option
 2. Points-based system
- xxix. Conclusion of other Cities
 1. Usually only one of many compliance options
 2. None included existing buildings – that is unique to Denver
 - Green roofs fit into a broader set of policies; maybe we need to think more about our broader context and Denver's goals and programs that already exist
 - Look for less expensive options with the same benefit
 - Denver is surrounded by other cities that don't have this ordinance, so developers may move right across the line.

Q: Were the other laws citizen-initiated?

A: San Fran started with residents, the others were created by policymakers

VI. Options

Throughout the meeting, the task force members, and the observers, wrote down their ideas for amendments to the ordinance and posted them (see the list below). At the end of the meeting, a brief discussion of the ideas included:

- Building codes are now performance-based instead of prescriptive; this means different options and cost possibilities tailored to the individual circumstance; this ordinance is very prescriptive; we should look at performance-based solutions

Q: What about swimming pools on roofs?

A: They use a lot of energy

- PACE loans allow people to implement bigger, more expensive solutions and make them financially viable
- European studies keep coming back to green roofs as a solution; builders in Europe are using them without a mandate because people see their value
- Give builders options – that could prevent developers from building outside the city
- Use a point system like Chicago did
- Denver does have a list of sustainability goals that we could weave into this ordinance
- Flexibility, similar to LEED-type approach

VII. Next Steps and Next Meeting

- ✓ Next meeting Feb. 14 at 11 am
- ✓ Agenda may include – options, a look at Denver’s sustainability efforts, project examples from Denver Housing Authority, more data
- ✓ Please keep sharing data or ideas about where to get the data – we will keep adding to the information we’re giving to you

VIII. Observer Comments

- I worry about the retail requirements and the risk that retail, especially grocery stores won’t build in the city
- Having choices and options – makes sense
- Parking structures – as we use cars less, we should build them in ways that allow us to use them for something else; rooftop gardens on top of parking structures
- Think broadly – address mental health too
- There is pervious pavement
- National Western Center – ordinance could allow campuses to concentrate their green roof and solar elements and consider the campus-wide result
- We have to find a way to make the city sustainable and affordable; performance-based approach makes a lot of sense

Appendix

a. Options from the Task Force

Performance based approach with menu items / options	20
Solar	11
White or cool roof	10
Green space, aesthetics	9
Energy efficiency as a menu option	8
Exemption for Efficient Buildings	8
Water quality	7
Ground level options with focus on perviousness	6
Eliminate existing buildings from ordinance	5
Urban heat island	5
Exemption for affordable housing and nonprofits	4
Different rules for existing buildings vs. new buildings	3

Task Force Member Ideas

- Density Bonus
- Expedited permit if green roof
- Height waiver for roof / amenity space
- Energy efficiency option: Energy Star score of, say, 80 – or – Significant increase in efficiency of, say, 20-25% - or – LEED certification (LEED Gold or above)

- Meet intent of ordinance with performance-based solutions (not prescriptive)
- Performance-based makes great sense; all energy components lose the initial intent – H2O quality, pollinators, urban heat, etc.

- Consider “campus” building scenarios (DU, National Western Complex). Total percentage of the required sq ft of the overall campus be applied to a single large “green roof” rather than 20% etc. on numerous smaller buildings
- Existing LEED buildings – some level of exemption
- Prioritize different ways to meet ordinance based on where in city – Green/white for heat island downtown, energy generation, water quality in suburban areas, etc.
- Opt-out fee used to help others to build so that we get more – built with opt out money
- Option for alternative storm water improvements in the tree lawn or onsite that get the same or better results on water quality
- Alternative source to potable water for new construction i.e. graywater or direct potable reuse
- White roof
- Allow white roofs vs. green roofs
- Require white roofs in lieu of vegetated green roofs
- For existing buildings whose impact is massive look at trading out impervious parking or hardscape for greenspace on ground level that could achieve the same goals
- LEED certified buildings should be exempt from ordinance
- Exemption for energy-savings buildings, i.e. LEED
- Change retain and detain water
- Performance-based with multiple benefits – for example, must achieve benefits in 3 areas – energy efficiency (climate), heat island, stormwater. Each area has list of compliance paths:
 - Energy
 - Energy star compliance
 - Improve ES score by 10 pts.
 - Stormwater
 - Heat island
 - White roof
 - Pervious pavement
 - Holistic
 - LEED Gold
 - Etc.
- Implement a non-profit waiver; think about shelters, churches, non-profit orgs in all sectors; this will detract from the funds they have for social good
- Allow solar that overlaps/shades green roof to count towards required area
- Allow existing buildings total exemption, or at least allow menu of options
- Must analyze Denver’s ordinance in light of its similarity to Toronto’s and address provisions that do not apply to Denver, or conflict with Denver requirements and regulations
- Is this better as a DEH requirement, rather than buildings code?
- Allow for credit for off-site solar & other impact – similar to air rights or selling of tax credits
- Redefine available roof space to exclude access and mechanicals
- No in-lieu or exemptions instead – alternatives of offsite solar and/or deep energy efficiency only when exemption would otherwise apply
- Mandatory study and report with possible modification after 3-5 years
- Add regulation – smart irrigation, timers and sensors
- Allow buildings to retain water and look at current costs related to water retention & detention
- Property owner can use green roof to offset required on-site water quality
- Add flexibility to ordinance – sustainability requirements based on need for area; for example: green roofs required where urban heat island, additional water quality where water quality is a concern
- If a building owner is already taking steps to address climate changes and minimize impacts, they should be exempt from the ordinance: LEED certification, rooftop solar, cool roofs – set science-based target; sign “we are still in”; set a science-based target, disclose goals and progress, show transparency around initiatives
- Option for 100% green roof, 100% solar or combination
- 100% solar

- Option to meet the required area with only solar
- Need to get planning board out of this process; their role in the existing ordinance conflicts with the general responsibilities
- May not need requirement of technical advisory group in light of CPD and DDPHE expertise and knowledge in building/construction and sustainability matters, respectively
- Option to pay the cash-in-lieu rather than comply; we should call it an opt out
- Different ordinance for new construction vs existing buildings
- Performance-based options on existing buildings; much stricter standards/requirements for new construction
- Exempt affordable housing that is certified Enterprise Green Communities
- Redefine “available roof space” to take into account egresses, edges, and walkways required by the fire code, as well as mechanicals, skylights, etc
- As an exemption: allow buildings to subscribe to Xcel programs like wind source and renewable connect
- Metric based design goals:
 - Save energy and associated GHG
 - Reduce heat island
 - Increase quality green spaces
 - Increase perviousness
- Provide private sector any and all opt-out options that are afforded to public-sector buildings
- Allow swimming pools on roofs to meet criteria
- Require plants to be native, xeriscape, or drought-tolerant or intended for human consumption; and explicitly prohibit additional herbicides, pesticides, and fertilizers
- Alternate method to achieve climate change and sustainability goals; on-site or off-site energy star 85+
- Increase green spaces
- Use the scorecard option from Chicago; building owners have flexibility to meet the goals to address climate change, minimize impacts, etc.; design features could include broad corporate goals on climate change
- Xcel energy should create an incentive program for rooftop solar for commercial buildings owners
- Green roofs menu options; implementing small green roof portions at scrapper areas on white roofs; pulling energy from urban solar fields.
- Possible alternative if IGCC stretch code is adopted to follow those guidelines
- Flexible compliance options:
 - Xeriscape / landscaping a % of land relative to buildings size
 - LEED certification
 - Cool roof
 - Solar
 - Or some combo
- Delete or significantly revise the existing buildings component of the ordinance; focus on building codes and options for new construction
- Exempt existing buildings
- Several possible compliance options / pathways: Vegetated roofs – Solar only – Energy efficiency (LEED, etc.) – Cash in lieu (opt out) – Exemption (limited) – Or combination
- Possible option: provide white roof and change existing impervious surface at grade to pervious surface – possible easement required to ensure longevity
- Ordinance should only apply to new construction; existing buildings should be exempt or at minimum subject to a menu of options
- In lieu of – possible option – energy savings, production (on-site), LEED Gold, white roof, combination of above
- If a building cannot structurally make the change – do not ask them to pay the city – not a capital improvement
- Put all the vegetative roof technical standards in a separate document, not in the rules and regulations, so it can be more easily modified/updated
- Offsite or ground floor options to meet criteria

b. Options from the Observers (commentary removed)

- Variances / alternative compliance pathways for:
 - Affordable housing meeting enterprise green communities (required by CHFA LIHTC)
 - Projects that meet LEED Gold/Platinum for new construction or O&M or Arc/Dynamic plaque
 - Menu that meets intent, ex:
 - Energy star certification for existing bldg. or 20% better than code for new construction
 - Meet stormwater quality & quantity requirements w/ green infrastructure (rain gardens, rain capture, etc.)
 - Cool roofs (photovoltaic, white, or green)
 - % of site vegetated open space (ground or roof) or give \$ to support more green space in city
 - Keep in mind, we want buildings to be more efficient without photovoltaic rather than inefficient with photovoltaic,
- Chicago's approach is ideal – but cater to Denver's needs and demands
- Eliminate Existing buildings
- Needs to be a baseline that a building must achieve before relief / trade-off is applied. As an example, a really energy inefficient building should not get significant relief just by becoming moderately energy efficient. Analogous to Chicago model.
- Can we include a requirement or incentive for the construction & maintenance to be done by local organization, so the jobs & economic stimulus stay here
- To help with affordable housing projects allow exceptions for solar only & use organizations like GRID alternatives that offer free financing & installation
- In addition to cash in lieu, expedited permitting for buildings that comply with green roofs to incentivize
- Suggest that buildings on a pathway to achieve LEED Gold or higher be on the exemption list or offer alternative pathways to compliance
- Recommend allowing additional solar radiation management best practices to qualify toward meeting the green roof requirement, especially if they are proven to be as (or more) effective as vegetated roofs in reducing cooling energy demand. Same request but for rainwater harvesting and reducing stormwater runoff.
- Scorecard should include something for additional externalities – aesthetics, food, excess renewable energy production, community benefits, public health improvements, etc.
- Maintenance requirements by regulation, who monitors?
- How about having a replacement area on ground that reduces the heat island effect and allows people to interact with a green healthy environment. Much like replacement of habitat elsewhere for endangered species.
- Trade green roof for more landscaping on ground