

FINAL REPORT

VISIONING AND PLANNING TOOLS | EXPLORATORY SCENARIO PLANNING

XSP DEMONSTRATION PROJECT

WITH THE KEYSTONE POLICY CENTER



06.01.2017

Western Lands
and Communities

— A Joint Venture of the —
Lincoln Institute of Land Policy and Sonoran Institute

XSP | FINAL REPORT OUTLINE

VISIONING AND PLANNING TOOLS | EXPLORATORY SCENARIO PLANNING

KEYSTONE POLICY CENTER | COLORADO WATER AND GROWTH DIALOGUE

- 1. Intro/About this Report**
- 2. Executive Summary**
- 3. Phase One: Scoping + Formation**
 - a. Stakeholder Identification/Participation/Organization
 - b. Focal Question Development
 - c. Stakeholder Interviews
- 4. Phase Two: XSP Workshop #1 & Wrap Up**
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 - b. Critical Drivers | Certainties + Uncertainties
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- 6. Phase Four: Workshop #2 & Wrap Up**
 - a. Introduction and Review Focal Questions and Matrix
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EXECUTIVE SUMMARY

VISIONING AND PLANNING TOOLS | EXPLORATORY SCENARIO PLANNING

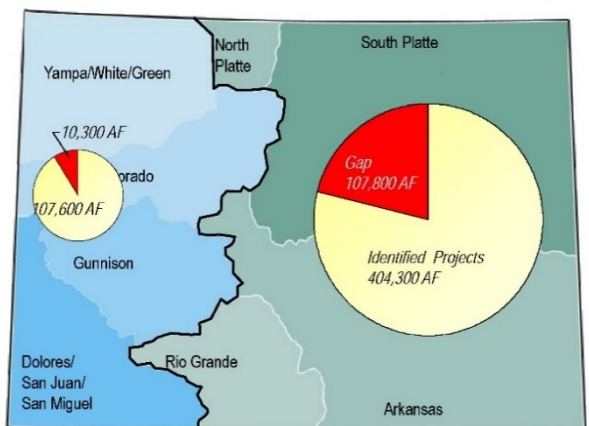
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This report summarizes a series of conversations and workshops conducted by **Western Lands and Communities (WLC)** and the **Keystone Policy Center's Colorado Water and Growth Dialogue** as part of an Exploratory Scenario Planning demonstration initiative. **Exploratory Scenario Planning (XSP)** is a strategic planning process adapted from the Global Business Network's Scenario Planning method used by many Fortune 500 companies to strategize their course through a sea of uncertainty. WLC, a joint-program of the Lincoln Institute of Land Policy and the Sonoran Institute, has tested the application of Exploratory Scenario Planning to strategizing the management of natural resources and delivery of municipal government and services. The methodology goes beyond "traditional" planning and scenario planning. With an emphasis on the assessment of multiple plausible futures and uncertainties in the planning environment not in control of the planning agency, XSP can reveal the robust, no-regret strategies that are common to all plausible futures fostering the efficient allocation of resources towards ensuring a desirable future. WLC will reflect on the applications of this planning methodology, refine the process and create a "How to" guide to help advance the practice of Exploratory Scenario Planning and integrate it into traditional planning processes.

The exploration WLC and the Keystone Policy Center's Colorado Water and Growth Dialogue have endeavored on aims to answer the Focal Question:

How can changes in urban form and landscaping practices for new growth and redevelopment assist in meeting future urban water demand along the Colorado Front Range?

2030 M&I Water Demands and Gaps



Source: CWCB

The Continental Divide is causing a cultural divide as Front Range communities divert water from rivers and ecosystems on the Western Slope, pumping resources over the Rockies to sustain Front Range lifestyles. People keep moving to Colorado for the natural, built and social environments and markets the state offers; population has surpassed 5 million and is projected to be near 10 million by 2050. Though the Western Slope is projected to grow at a faster rate, the Front Range, between Fort Collins and Pueblo is expected to house about 80% of Colorado residents. Further growth poses even more tradeoffs as Colorado residents attempt to nourish and balance urban and natural and environments.

PHASE 1 | SCOPING + FORMATION

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The first phase of this **Exploratory Scenario Planning (XSP)** project started with the formation of a **Working Group** from which a **Technical Sub-Committee** and a **Steering Committee** were identified. It commenced with the scoping and definition of a Focal Question and an extensive round of personal interviews. Given the Keystone Policy Center's Colorado Water and Growth Dialogue had been occurring for nearly four years, the groups were easily defined by Matt Mulica, on-going Project Manager for the Keystone Policy Center.

| Colorado Water & Growth Dialogue - Participant List | | | | | | |
|---|-------------|---|---|--------------------|-------------------------|---------------------------|
| First | Last | Title | Org | Steering Committee | Technical Sub-Committee | Working Group Sector |
| Peter | Pollock | Ronald Smith Fellow | Lincoln Institute of Land Policy | X | X | X Land Use Planning |
| Ray | Quay | Research Professional | Desert City Decision Center | X | X | X Land Use Planning/Water |
| Kevin | Reidy | State Water Conservation Technical Specialist | CWCB | X | X | X Water |
| Marc | Waage | Manager of Water Resources Planning | Denver Water | X | X | X Water |
| Tom | Gougeon | President, Gates Family Foundation | Gates Family Foundation | X | | X Water |
| Flo | Raitano | Acting Senior Managing Director | DRCOG | X | | X Water |
| Susan | Daggett | Lecturer & Executive Director | Rocky Mountain Land Use Institute | | X | X Land Use Planning |
| Greg | Fisher | Manager of Demand Planning | Denver Water | | X | X Water |
| Karen | Hancock | Planning Supervisor | City of Aurora | | X | X Land Use Planning |
| Mitch | Horrie | Planner - Demand Planning | Denver Water | | X | X Water |
| Daniel | Jarrett | Regional Economist | DRCOG | | X | X Land Use Planning |
| Jeff | Tejral | Manager of Water Conservation | Denver Water | | X | X Water |
| Lyle | Whitney | Water Conservation Supervisor | City of Aurora | | X | X Land Use Planning/Water |
| Susan | Wood | Planning Project Manager | Denver Regional Transportation District | | X | X Land Use Planning |
| David | Sampson | Senior Sustainability Scientist | Desert City Decision Center | | X | ? Water |
| Gene | Myers | CEO | New Town Builders | | | X Development |
| Chuck | Perry | Managing Partner | Perry Rose, LLC | | | X Development |
| Clark | Anderson | Director, Western Colorado Legacy Program | Sonoran Institute | | | X Water |
| Drew | Beckwith | Water Policy Manager | Western Resources Advocates | | | X Water |
| Mizraim | Cordero | Director | Colorado Competes | | | X Policy |
| Don | Elliott | Director | Clarion Associates | | | X Policy |
| Steve | Gordon | Planning Services Director | Comm. Planning & Development - Denver | | | X Land Use Planning |
| Barry | Gore | CEO | Adams County Economic Development | | | X Development |
| Peter | Grosshuesch | Director of Community Development | Town of Breckenridge | | | X Land Use Planning |
| Jeff | Holwell | Economic Development Director | City of Lone Tree | | | X Development |
| Sue | Horn | Mayor | Town of Bennett | | | X Policy |
| Julio | Iturreria | Long Range Program Manager | Arapahoe County | | | X Land Use Planning |
| Peter | Kenney | Co-Founder and Principal | Civic Results | | | X Land Use Planning |
| Kevin | Puccio | Vice President of Community Development | New Town Builders | | | X Development |
| Ben | Rubertis | Director | Genus Architecture | | | X Land Use Planning |
| Chris | Treese | Manager, External Affairs | CO River District | | | X Water |
| Beth | Conover | Senior Program Officer | Gates Family Foundation | | | Observer/Funder |
| Dave | White | Director | DCDC | | | Land Use Planning/Water |

FOCAL QUESTION DEVELOPMENT

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Western Lands and Communities staff and consultant, Ralph Marra of Southwest Resource Consultants held a Focal Question Meeting with the Keystone Policy Center's Water and Growth Dialogue Steering Committee on Thursday, February 25, 2016. (Refer to Appendix for Agenda)

The meeting covered the purpose and background of the project and the process of Exploratory Scenario Planning via a PowerPoint presentation and Q+A session. The project team then facilitated a discussion based on a series of questions that allowed the group to frame their ultimate **Focal Question**. The best Focal Questions allow groups to get to the core of the solutions they seek without being too broad or too narrow. The goals are to identify the critical drivers of the conditions being considered and address reactions to critical uncertainties affecting the critical drivers.

In this case, the Steering Committee defined the following Focal Question:

How can changes in urban form and landscaping practices for new growth and redevelopment assist in meeting future urban water demand along the Colorado Front Range?

SUMMARY OF INTERVIEWS

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Interviews are often a major part of the Exploratory Scenario Planning process, offering the project team valuable insight into how participating stakeholders view and frame the issues and what they can expect to hear voiced at the subsequent XSP Workshops. They also provide insight into how to best facilitate a productive, meaningful, respectful dialogue so that at the end, stakeholders with diverse interests may see their futures more similarly and in a spirit of collaborative cooperation, take meaningful, thoughtful, equitable action.

Through March and April, 2016, Western Land and Communities conducted an extensive round of interviews, inviting everyone from the full Working Group to participate. Anonymity was maintained to foster candid responses. Interviews took about an hour and solicited answers to a range of questions designed to identify the root drivers of change and the critical uncertainties surrounding the impact of land use and landscaping practices on urban water demand. Respondents drew on their personal observations since they first found themselves home on the Front Range, individual tenures ranging from 16 to 67 years. Refer to Appendix for a list of questions and responses.

INTERVIEW HIGHLIGHTS

WHAT HAVE BEEN THE MOST NOTABLE CHANGES YOU'VE WITNESSED IN THE REGION?

1. Sprawl + Densification, Urbanization
2. Loss of Agriculture, Open Space, Rural Roots
3. Cost of Housing + Living; Increase in Homelessness
4. Traffic, Congestion
5. Climate Change – warmer – drier
6. Regional Leadership has driven positive changes, namely transportation
7. Young leaders emerging with alternative solutions
8. Notably a “City on the Rise” and causing regional growing pains but nothing but positive things to say--a functional American city.

WHICH OF THESE CHANGES SURPRISED YOU THE MOST?

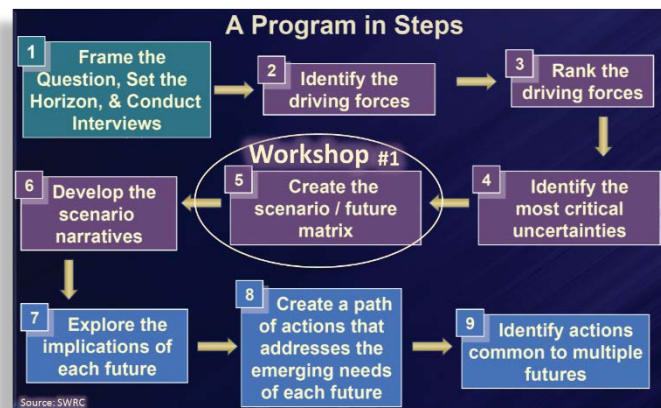
1. No surprises. Predicted growth. Many changes could be seen coming 50 years ago.
2. Scale of growth – population and development
3. Championed campaigns can trigger investment in infrastructure (i.e. Mayor Pena’s ‘Imagine a Great City’)
4. Colorado’s “Brain Drain.” There is no need to fund higher-education because Denver is attracting talent from outside.
5. How politics can create a “laboratory of dysfunction” which undermines/short-circuits the ability to productively collaborate/ converse.
6. Significant backlash to initiatives for increasing urban density...people generally like the idea and see the need but not necessarily where they live. People like “visitors” to spend their money and then leave...not to buy into the place and “change it” for those already there.
7. Adverse impacts of growth: traffic, water consumption, push out of lower-skilled workers.
8. Market forces driving sprawl and consumption of resources. Growing families are forced to sprawl. Still making large lot Single Family Household development (2-5 acre suburbs), & micro housing in urban core. Pressure against sprawl is low because much land is prairie land, not AG land and urban cost of living is high.

PHASE 2 | XSP WORKSHOP #1

THURS. 05/26/2016 | 8:30 AM – 5:00 PM | METROPOLITAN STATE UNIVERSITY, CAVEA

The goal of **XSP Workshop #1** was to identify the **Driving Forces** driving land use and landscaping practices affecting urban water demand, then rank them based on the levels of **Relative Importance** to the focal question and **Uncertainty** over the planning horizon, in this case, 2040.

Western Lands and Communities staff, Jeremy Stapleton, Summer Waters and Brandon Ruiz, with consultant Ralph Marra of Southwest Resource Consultants, conducted an all day workshop in May 2016 with the full Colorado Water and Growth Dialogue Working Group (Refer to Appendix for List of Attendees). The workshop started in a plenary session with an introduction to the day's activities and a series of presentations from experts on key topics to prime the exploration and dialogue.



LIST OF PRESENTERS + TOPICS

Mike Rinner of Meyers Research—Housing & Demographics (20 Mins)

- Identify “Most Likely” high-impact demographic trends along Front Range (i.e. 2040).
- Population growth range projections—discuss assumptions
- How many will live here? Who are they? Where will they live and work?

Becky Mitchell--State Water Plan (30 Mins)

- Identify the “Most Likely” high-impact supply-and-demand drivers and trends that will strongly influence water resources availability along Colorado Front Range thru 2040.

BREAKOUT SESSION | *Brainstorm the Driving Forces*

The full group was then split into two groups (Group A and Group 1) which convened in two smaller rooms for breakout sessions. In each breakout session, a **Facilitator**, aided by an **Assistant** to scribe on Post-It notes and a **Note Taker** typing the stream of conversation, led a discussion guided by a series of **XSP Workshop Templates**.

TEMPLATE 1

The first template is designed to brainstorm a list of **Driving Forces** affecting the planning environment over the planning horizon.

Participants were asked to consider driving forces from a range of areas including Demographic, Economic, Environmental, Societal/Political and Technologic influences. As the group discussed their thoughts, the Facilitator guided them to maintain their frame on the Focal Question and to seek the root force behind the conditions they were describing. Once the

Facilitator and group were satisfied they had identified a **Root Driver**, the Assistant scribed the Driving Force on a Post-It note and the Facilitator stuck it on a large (30" x 42"), printed copy of the template. The numbers on the template are merely intended to incite a lively, thorough brainstorm, not necessarily a goal to be reached. In this case, the conversation was vibrant for the full 120 minutes allotted for this step of the workshop. Refer to Appendix for **Workshop Results**.

The breakout groups then voted and organized the list, by placing dots, in response to the question:

Which of these driving forces WILL MOST IMPACT "new growth" and "redevelopment" patterns along the Colorado Front Range in the next 25 years?

| BRAINSTORM THE DRIVING FORCES | | | | |
|-------------------------------|----------|---------------|--------------------|-------------|
| DEMOGRAPHIC | ECONOMIC | ENVIRONMENTAL | SOCIETAL/POLITICAL | TECHNOLOGIC |
| 1 | 21 | 41 | 61 | 81 |
| 2 | 22 | 42 | 62 | 82 |
| 3 | 23 | 43 | 63 | 83 |
| 4 | 24 | 44 | 64 | 84 |
| 5 | 25 | 45 | 65 | 85 |
| 6 | 26 | 46 | 66 | 86 |
| 7 | 27 | 47 | 67 | 87 |
| 8 | 28 | 48 | 68 | 88 |
| 9 | 29 | 49 | 69 | 89 |
| 10 | 30 | 50 | 70 | 90 |
| 11 | 31 | 51 | 71 | 91 |
| 12 | 32 | 52 | 72 | 92 |
| 13 | 33 | 53 | 73 | 93 |
| 14 | 34 | 54 | 74 | 94 |
| 15 | 35 | 55 | 75 | 95 |
| 16 | 36 | 56 | 76 | 96 |
| 17 | 37 | 57 | 77 | 97 |
| 18 | 38 | 58 | 78 | 98 |
| 19 | 39 | 59 | 79 | 99 |
| 20 | 40 | 60 | 80 | 100 |

What internal and external driving forces will influence "new growth" and "redevelopment" patterns along the Colorado Front Range over the next 25 years?

RECONVENE IN PLENARY

The two breakout groups then reconvened in a plenary session and representatives shared and compared their two lists of the Highest-Impact Driving Forces and their reasoning behind their ranking of importance. A Facilitator led the group through the discussion then instructed them to vote on a combined Master List, by placing dots, on the Driving Forces they found most critically important. At the end, participants took a lunch break while facilitators compiled the highest ranked into a Master List of Driving Forces.

Which of these Driving Forces will MOST IMPACT new growth and redevelopment patterns along the Front Range over the next 25 years?

Master List of Drivers

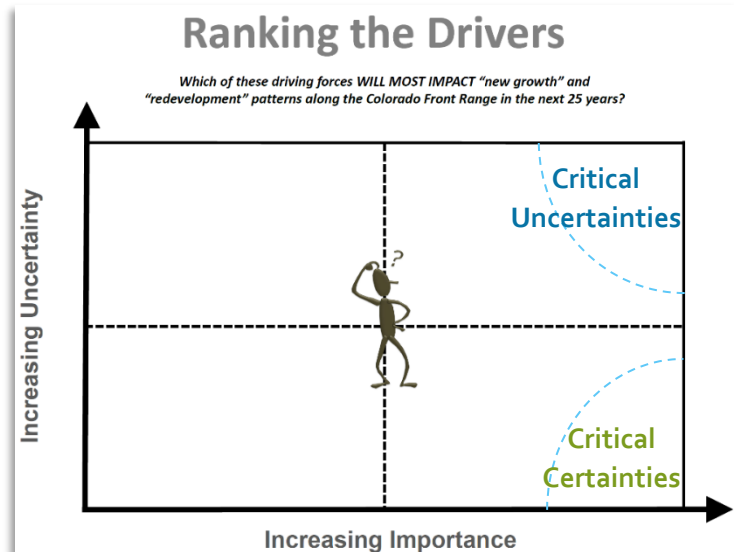
Combined as
"Lifestyle
Preferences"

1. Housing Affordability
2. Cost of Oil + Gas
3. Access to Outdoors + Recreation
4. Transportation Network / Technology
5. Economic Opportunity / Vibrancy / Volatility
6. Net Population Growth
7. Flexibility in Working Environment / Telecommuting
8. Millennial + Senior Housing Preferences
9. Millennial + Senior Transportation Preferences
10. Access to Real Estate Financing (Builder + Buyer)
11. Perceived Strength of Job Market
12. Political Will – Local Control v. Regionalism
13. Water Availability to Outlying Areas
14. Impact of Distributed Employment Centers (T.O.D.)
15. Impact of TABOR on Investments
16. Attraction of "Cool" Factor; New Urbanism

BREAKOUT SESSION | RANKING THE DRIVERS + DEVELOPING MATRICES

TEMPLATE 2

Facilitators then led the breakout groups through a 90 minute exercise ranking the Driving Forces. Participants decided how important each identified driver was to affecting urban water demand in the context of the Focal Question and how uncertain the outcome of each driver was over the planning horizon, placing corresponding Post-It notes on the “Ranking the Drivers” template. The most **Critical Certainties**, drivers placed in the lower right corner of the lower right quadrant, were recorded and set aside. These Critical Certainties later informed the **Scenario Narratives** used in **XSP Workshop 2**, generating the conditions likely “Common to All” plausible futures. The most **Critical Uncertainties**, drivers placed in the upper right corner of the upper right quadrant, were recorded and carried forward into the next step of the workshop, Developing Uncertainty Matrices.



Template 2 | Ranking the Drivers

CRITICAL CERTAINTIES

1. Net Population Growth
2. Impact of Distributed Employment Centers + Transit Oriented Development (T.O.D.)
3. TABOR's Legacy and Repercussions
4. Access to the Outdoors and Recreational Tourism

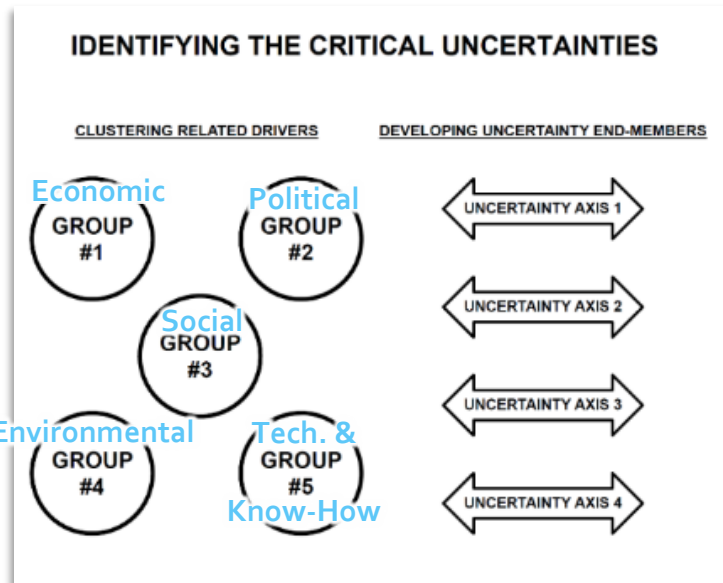
CRITICAL UNCERTAINTIES

1. INNOVATIVE TRANSPORTATION TECH.
2. LIFESTYLE PREFERENCES
3. ECONOMIC HEALTH

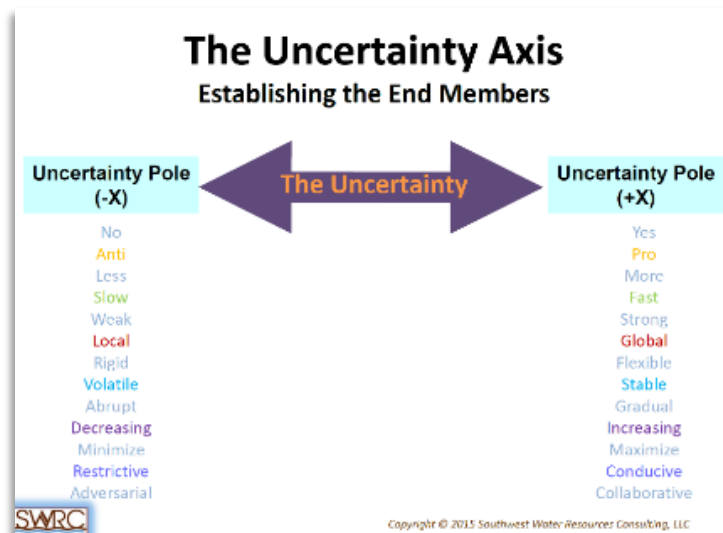
TEMPLATE 3

The next step guided the group through clustering related drivers and identifying possible Uncertainty Axes. Grouping is done informally based on participant's reasoning and can be clustered into general categories like Economic or Social drivers or more specific depending on the context. In this example, Autonomous Vehicles, a very specific technology were not differentiated from other technology that could drive land use and therefore landscaping practices, however, if the context of the exploration justifies it, a specific technologic driver could be its own category.

Each pole of the **Uncertainty Axis** was defined by conditions relevant to the specific driver. For instance, would development patterns be more compact in the future? Yes or no? Or would Political Will support infrastructure and water stewardship initiatives necessary to mitigate the urban water gap? The definition of the Uncertainty axes helps the group build further consensus on the critical drivers of uncertainty and the plausibility of various futures or end states at the planning horizon.

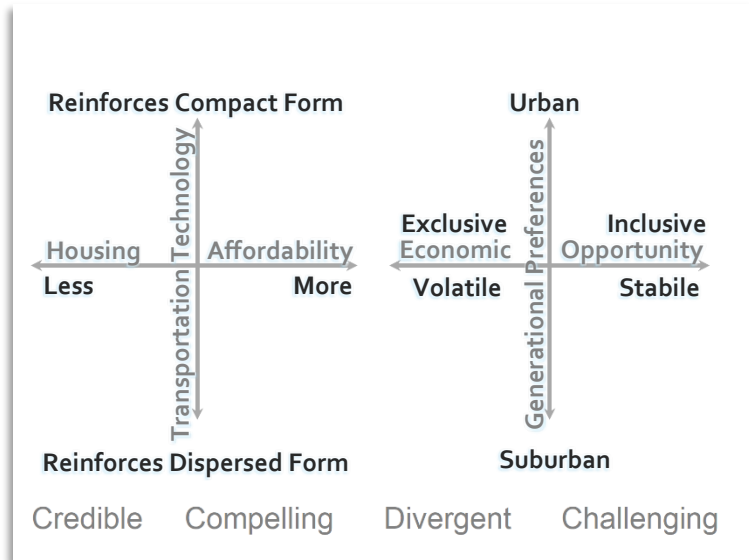


Template 3 | Group Drivers and Define Uncertainty Axes



Defining the Uncertainty Axis | Possible Uncertainty Axis End States

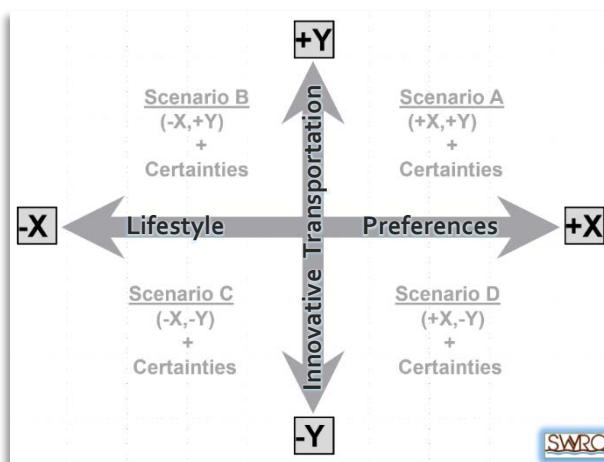
TEMPLATE 4 Once at least four Uncertainty Axes were identified, they were crossed to create a 2 x 2 or X/Y Matrix. The purpose of this step is to ensure the creation of four distinct quadrants representing four **Credible, Compelling, Divergent** and **Challenging** and *Plausible* futures. The group created matrices by crossing every axis they had brainstormed, then reviewed them to select the two axes that created the most valuable set of futures to analyze. The process of review eliminates combinations that are interdependent or create similar futures in more than one quadrant and those that don't pass the subjective plausibility test. This step concluded work conducted in Breakout Sessions and the group reconvened in a final plenary session to summarize the results of the day.



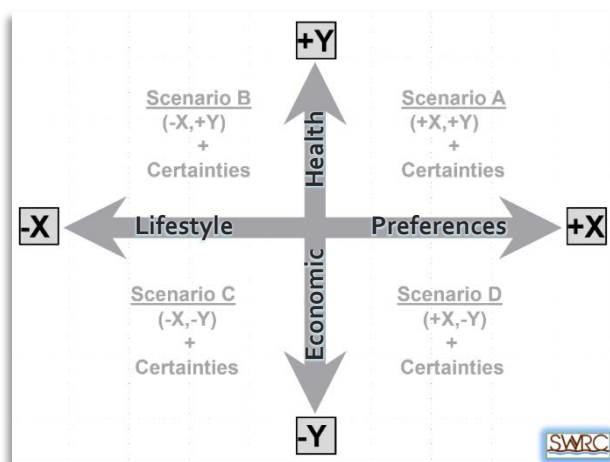
Template 4 | Cross Reference Uncertainty Axes to Develop Scenario Matrices

FINAL PLENARY

At this point, the two breakout groups progressed two similar alternative Uncertainty Matrices for the Steering Committee to consider the following day in a Workshop Wrap Up.



Group 1 | Proposed Scenario Matrix



Group 2 | Proposed Scenario Matrix

KEYSTONE | XSP WORKSHOP #1 | WRAP UP

FRIDAY, 05/27/2016 | 11:30 AM – 2:30 PM | GATES FAMILY FOUNDATION, DENVER, CO

The following day, WLC convened the Water and Growth Dialogue's Steering Committee for a **Workshop Wrap Up**. The goals of the Wrap Up are to confirm the conclusions drawn from the workshop meet the project's intent and confirm the **Uncertainty Axes** that set the alternative plausible futures described in the subsequent **Scenario Narratives** used in **Workshop #2**. Consultant, Ralph Marra, also extracted a cognitive history of Colorado's planning environment from World War II through 2016 to provide context for the details of the Scenario Narratives. That part of the workshop, though invigorating for those enthralled or sentimental about history, proved less valuable to the final scenario narrative product and could be eliminated to expedite the XSP process.

ATTENDEES

Matt Mulica, Keystone Policy Center
Jonathan Guertz, Keystone Policy Center
Flo Raitano, DRCOG
Kevin Reidy, CWCB
Lyle Whitney, Aurora Water
Ray Quay, Arizona State University
Peter Pollock, Lincoln Institute
Tom Gougeon, Gates Family Foundation

SI Team

Summer Waters
Jeremy Stapleton
Ralph Marra, SWRC

SUMMARY OF DECISIONS

An alternative Focal Question was used during Workshop 1 in order to broaden the scope or universe of the exploration and strategy development:

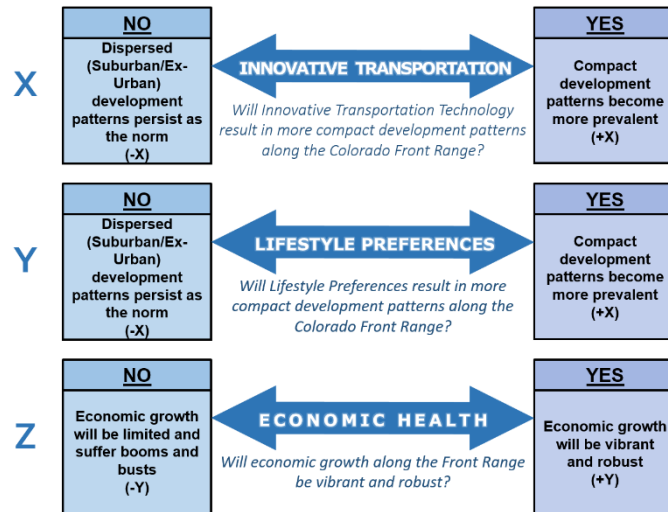
What internal and external driving forces will influence "new growth" and "redevelopment" patterns along the Colorado Front Range over the next 25 years?

The Steering Committee chose to keep the original focal question:

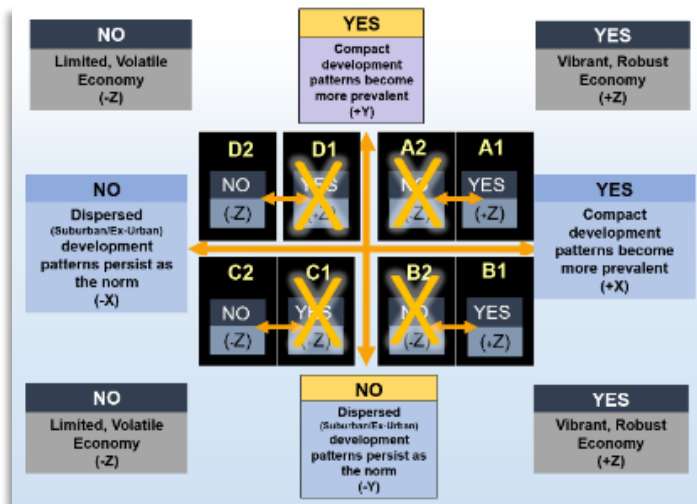
How can changes in urban form and landscaping practices for new growth and redevelopment assist in meeting future urban water demand along the Colorado Front Range?

The decision was primarily based on the pre-defined scope and purpose of the Colorado Water and Growth Dialogue to identify best practices specific to land use and landscaping and the extent to which these focus areas can close the municipal and industrial water supply gap.

Critical Uncertainties Considered



The Steering Committee reviewed the two Uncertainty Matrices advanced by the Working Group the previous day and confirmed two Critical Uncertainties impacting the Focal Question, **Innovative Transportation Technology** (X-axis) and **Lifestyle Preferences** (Y-axis). They also considered adding a third Critical Uncertainty, **Economic Health** by adding a Z-axis.



The addition of a third axis creates additional futures that must be addressed or discarded. Though it is more complicated to add a third axis and further stresses time constraints, the process may deliver a more informed outcome. The Steering Committee and WLC proceeded through the Workshop Wrap Up assuming a 3 axis Uncertainty Matrix.

Adding a Z-Axis Requires More Time or Elimination of Scenarios

DRIVERS OF UNCERTAINTY END STATES

Drivers That Could Make Axis End Members Happen

| +X | | +Y | |
|--|---|--|--|
| LIFESTYLE PREFERENCES | | ECONOMIC HEALTH | |
| <ul style="list-style-type: none"> Abundant Amenities Big City Services + Stuff Anonymity Gathering + Connection Opportunities Higher Cost of Oil + Gas Mobility Options | <ul style="list-style-type: none"> Perception of Schools Affordability Privacy Perceived Safety Desire for Private Open Space Family Size Slower Pace of Life More "green"/vegetation Inability to sell suburban home and move to cities | <ul style="list-style-type: none"> Available Financing Rapid Population Growth Skilled Work Force In-migration of Talent The "Cool" Factor Available, Affordable Housing Overturn of Construction Defects Law TABOR Reform Alternative Funding/Delivery Methods for Education + Infrastructure Ability to Remain Competitive in Global Economy | <ul style="list-style-type: none"> Lack of Financing Lack of Skilled Labor Global/National Economic Disruption Climate Change/Drought Frequency + Severity |

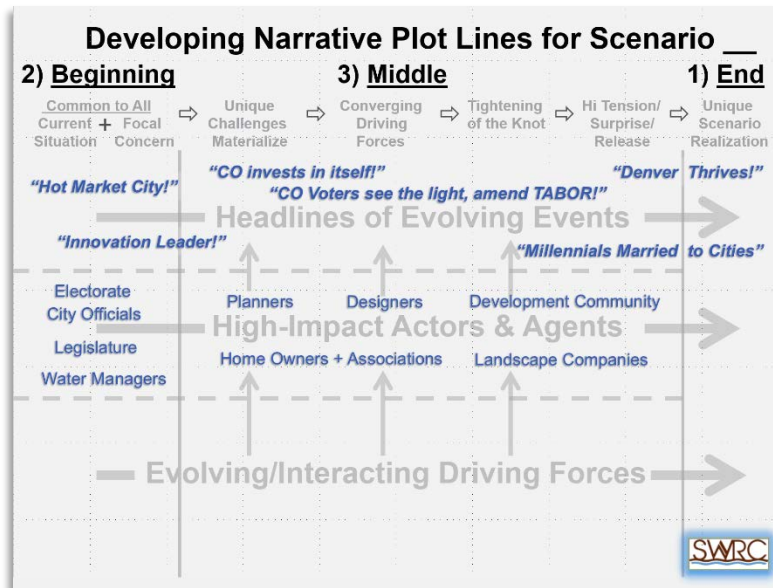
The Steering Committee was then prompted and provided the major drivers that could create the conditions of the various futures described in the Scenario Narratives written by WLC staff and used in Workshop 2. While the group was still exploring a 3rd or Z-axis, there was no time to list the drivers of the Z-axis end-states independently but the group identified drivers of Scenario A (see below).

EXAMPLE

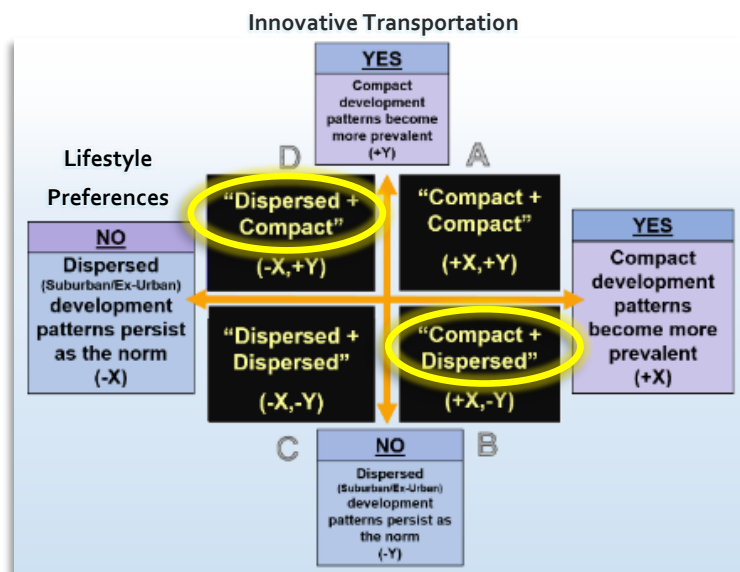
DRIVERS OF SCENARIO A (X⁺, Y⁺, Z⁺)

- Better Mass Transit over time
- Autonomous Vehicles
- SMART Routing Technology
- SMART Traffic Management
- Preferred Urban Lifestyle
- Walkability - Ability to live car-free
- Abundance of Urban Services + Amenities
- Downsizing
- Highly Social Energy
- Increasing Diversity/Variety
- Look @ DOLA's materials for race/ethnicity data/trends
- Hispanic/minority populations dispersing
- Larger % of pop growth coming from minorities; bigger families, multi-generational, education of households
- TABOR overturned/modified (approx.. 2025)
- Importation of Talent
- Available and affordable housing
- Diversification of education funding
- Competitive in the Global Economy
- Overturn/Reform of Construction Defect Law (Statewide) sooner than later
- Financing Available
- Skilled workforce
- Speak to market rate vs. affordable housing approach
- COLORADO CONUNDRUM – not growing our own, importing talent
- Importing \$/wealth w/ talent

The Steering Committee was also asked to consider the Drivers of Uncertainty and brainstorm potential Narrative Plot Lines. This process inquired about plausible Headlines, High-Impact Actors and Agents, and the Evolving and Interacting Forces, sketching out the Scenarios to establish initial buy-in and consensus on the direction of the Scenarios. Time allotted for the Workshop Wrap Up was exhausted and this step of the process was not fully completed. In hindsight, the headlines, actors, agents and interaction of Driving Forces could be articulated by anyone either well versed in the subject matter or having tracked the conversation of the Workshop and Workshop Wrap Up and this step could be eliminated.

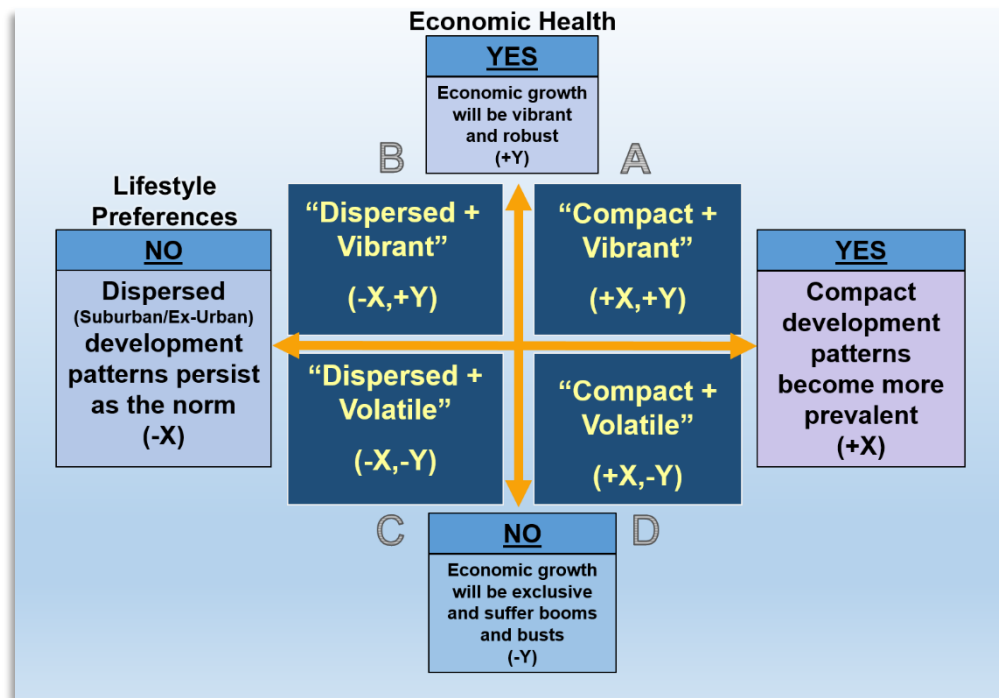


Upon further analysis and a follow up phone conference between WLC and the Steering Committee, the implications of *Innovative Transportation Technology* and *Lifestyle Preferences* were found to be related and at times functions of each other, creating scenarios too similar to create meaningful variations. This combination did not pass the "**Credible, Compelling, Divergent** and **Challenging**" test.



Avoid Correlating or Contradictory Drivers and End States

In the end, two Critical Uncertainties were advanced to create a traditional 2-axis Uncertainty Matrix: **Lifestyle Preferences** and **Economic Health**.



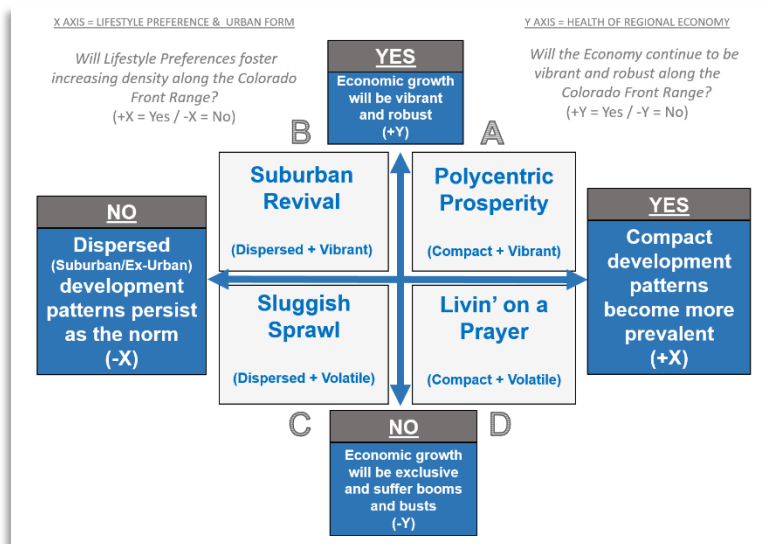
Final 2-axis Scenario Matrix Advanced to Scenario Development

WORKSHOP WRAP UP PROCESS ASSESSMENT

The Workshop Wrap-Up generated a lot of dialogue and general consensus that the project was moving in the right direction to deliver an answer to the Focal Question. Much of the dialogue was an exchange between members of the two breakout groups informing each other of their respective breakout group process and reasoning behind the results. While valuable to all in bonding and progressing towards seeing an uncertain future more similarly, time constraints prohibited the completion of the entire Workshop Wrap Up agenda. More time is needed to conduct a more thorough process; alternatively, this step could be eliminated and time allotted for additional research of historical context. Authors knowledgeable about planning can then craft plausible Scenario Narratives and deliver a Final Draft reviewed by the **Steering Committee** for use in Workshop 2. Also, given the need to mitigate the length of the Scenario Narratives to comply with time and attention span limits, there is little room for embellishment and use of the information generated in the Workshop Wrap Up. Groups well informed about their planning issues and environment can benefit from more succinct narratives; those with less experience navigating the Focal issue and planning environment might find more contextually detailed narratives more engaging and easier to work with. Given the collective knowledge and experience of the Colorado Water and Growth Dialogue Working Group and Steering Committee, less was considered more.

PHASE 3 | SCENARIO DEVELOPMENT

FOUR FUTURES TO GUIDE GROWTH



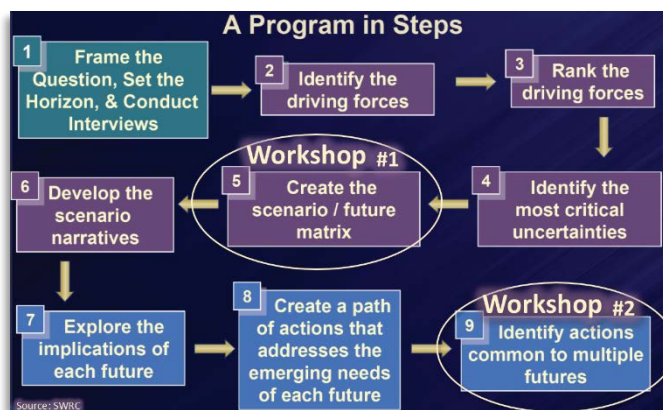
Four credible, compelling, divergent and challenging futures were identified through the first of two workshops in the XSP process. A list of critically important and uncertain drivers of change were noted and prioritized. The working group and steering committee decided to further study the implications of Lifestyle Preferences and Economic Health on the ability to manipulate urban form and landscaping practices to better ensure future municipal and industrial (M+I) water demand can be met along the Colorado Front Range. The two drivers were placed on

perpendicular axes to create end states of four plausible futures (See above). The Scenario Narratives describe the conditions that these four futures would likely present and are used to explore and test which strategies may prove the most effective at "closing the Colorado Water Gap." WLC and the Colorado Water and Growth Dialogue working group assessed these futures in a second workshop, identified implications and developed a list of robust, resilient strategies for communities across Colorado's Front Range. (Refer to Appendix for Scenario Narratives)

PHASE 4 | XSP WORKSHOP #2

WED. 07/27/2016 | 8:30 AM – 5:00 PM | METROPOLITAN STATE UNIVERSITY, CAVEA

WLC and the Keystone Policy center reconvened the Colorado Water and Growth Dialogue Working Group for a second full day workshop. The group read and discussed the Collected Cognitive History leading to the context of the Scenario Narratives and the implications **Common to All** implied by the Critical Certainties identified in Workshop 1.



BREAKOUT SESSION | IDENTIFY IMPLICATIONS OF THE FUTURES

Participants were split into two breakout groups. Each group read and clarified each Scenario Narrative with the facilitator before listing the **Critical Implications** on the planning issue and planning environment. This step in the process is essential. An acute assessment and conclusion of implications specific to each scenario is essential for the determination of robust strategies, or those common to multiple futures.

Once Critical Implications are identified for each Scenario, the breakout groups reflected on and brainstormed strategies to *promote*, *prevent*, or *prepare* for each implication. These four lists of Critical Implications and subsequent Strategies were then consolidated by WLC staff and presented to the Steering Committee the following day in a Workshop Wrap Up.

KEYSTONE | XSP WORKSHOP #2 | WRAP UP

THURS. 07/28/2016 | 11:30 AM – 2:30 PM | GATES FAMILY FOUNDATION, DENVER, CO

The day after Workshop 2, WLC and the Keystone Policy Center convened the Colorado Water and Growth Dialogue's Steering Committee to review the resulting list of Implications and Strategies. The group reviewed and continued to consolidate similar and redundant implications and their associated strategies, confirming the language and strategy were appropriate and conveyed the group's intent. Strategies that applied to three or four of the futures are considered to be highly robust, low-regret actions. The highly robust, low-regret strategies could be implemented in an initial effort to promote, prevent or prepare for factors affecting the region's ability to meet the Urban Water Gap. Strategies common to two or only one strategy are those to be implemented at some point in the future, if the conditions and context of the time deem those strategies appropriate. Preparedness planning is about contingency planning but it is important to update the plans and contingencies as the planning environment changes and reacts to actions taken.

ATTENDEES

Matt Mulica, Keystone Policy Center
Jonathan Guertz, Keystone Policy Center
Flo Raitano, DRCOG
Kevin Reidy, CWCB
Lyle Whitney, Aurora Water
Ray Quay, Arizona State University
Peter Pollock, Lincoln Institute
Tom Gougeon, Gates Family Foundation

SI Team

Summer Waters
Jeremy Stapleton

LESSONS LEARNED

KEYSTONE POLICY CENTER | COLORADO WATER AND GROWTH DIALOGUE

1. **Focal Question** | Developing the right Focal Question is critical to developing useful results. The scope must not be too broad nor too narrow. Defining the groups' goals defines the confines of the exploration and strategy development. In this case, the Colorado Water and Growth Dialogue had already committed to focusing on the extent to which Land Use and Landscaping practices can close the urban water gap. However, throughout the workshops, it was observed that significant mitigation of the urban water gap could come from strategies unrelated to Land Use and Landscaping practices. Dozens of strategies identified but unrelated to Land Use and Landscaping were essentially dropped from further refinement and dissemination.
2. **Stakeholder Interviews** | Thorough interviewing of stakeholders can provide most of the data gathered in Workshop 1 that feeds the Scenario Narratives as well as the context and reasoning behind their identification as drivers and the degree to which they are certain or uncertain. Workshop 1 could potentially be reconfigured to focus on revising and expanding the list facilitators create from interview responses, sharing personal perspectives and reasoning to exchange knowledge and build consensus.
3. **Workshop #1** | The day is long. Stamina fades as the heavy lifting begins. Alternative formats and additional streamlining of activities would benefit the vibrancy and quality of participation. Splitting Workshop #1 into two half-day workshops (perhaps an afternoon and the following morning) could be a preferable option. Participants generally recognize the people they met and the conversations they had as the main value of the workshop. Organizing a happy hour after the workshop can entice participants to stay through the day, build better working relationships with their peers and continue conversations informally.
4. **Workshop #1 Wrap Up** | If the workshop is fully completed and the results relatively clear, it may be possible to eliminate the Workshop Wrap Up and complete the objectives of the Wrap Up either as an internal facilitation team or through a or a series of conference calls with the Steering Committee. The critical thing is to identify and/or confirm the Uncertainty Matrix and the drivers of the resulting scenarios. Collecting the cognitive history of the Steering Committee and brainstorming potential headlines did not prove significantly useful in developing the Scenario Narratives. The need to keep Scenario Narratives short compromises the ability to include the details of that conversation in any meaningful context beyond laying a foundation or context for the Common to All narrative.
5. **Scenario Development** | Scenario Narratives can take many forms. They can be a few well-crafted sentences or bullets that convey the concept to subject experts, a short (1-2 page) descriptive narrative that tracks the actions of strategically designed characters responding to the conditions they find themselves in the various plausible futures or even, if resources allow, a series of sketch

performances that reveal the varying conditions and human responses. When facilitating groups with a professional command of the subject matter, it is often preferred to keep the narratives concise, objective, and generally non-objectionable. When working with groups with less command of the subject matter or varying perspectives, developing characters and scenarios that the group can connect and empathize with can foster more engaging participation, exchange of perspectives and consensus building. There is no right or wrong way to craft Scenario Narratives and utilizing a Steering Committee to review drafts in advance of Workshop #2 can ensure the final narratives set the group up for a successful exploration and brainstorming of implications and strategies.

6. **Workshop #2** | Building consensus and buy-in on the Scenario Narratives is critical to launching a smooth and effective workshop process. Reading the Collected Cognitive History and the Common to All portions of the Scenario Narratives in a plenary session allowed for questions to be asked and any inaccuracies or objectionable statements to be revised so the entire group was addressing the same information from a similar context; a common launching point for the exploration. Addressing each scenario independently and listing implications is time consuming and can be confusing for facilitators and participants. Creating a “system” to list and cross-reference implications across scenarios is critical to time management and the quality of the results. If done poorly, participants paint implications across scenarios with a broad brush and may inaccurately assume an implication applies to a scenario when it actually doesn’t which could result in a strategy becoming seemingly more robust than it actually is. Be diligent. Going through and listing new implications for each scenario can generate a discussion that consumes time and makes it more difficult to go back and cross-reference previously listed implications after finishing. Before listing new implications for each scenario after the first, identify which implications from the previous scenario(s) apply to the current scenario being explored. This approach can save time and keep the connection between each scenario’s implications clearer throughout the process.
7. **Workshop #2 WrapUp** | Workshop 2 resulted in an Excel spreadsheet of 100 strategies responding to the implications of the various plausible futures. WLC staff spent several hours after the workshop cleaning and compiling data so it was somewhat presentable to the Steering Committee the following day. Regardless, Workshop #2 Wrap Up resulted in WLC staff and the Steering Committee going through each strategy to eliminate redundancies, clarify language and intent and confirm which implication(s) or scenario(s) the strategy applied to. The group was barely able to get through the entire spreadsheet in the four hours allotted for this step of the exercise. Additional time between Workshop 2 and the Wrap Up would have allowed the facilitation team to prepare a better launching point for the Steering Committee’s portion of the effort. Additionally, the Steering Committee elected to vet and filter the remaining list of strategies to eliminate those not directly relevant to Land Use or Landscaping practices as indicated in the Focal Question, meaning much time was spent on strategies that may not continue to be disseminated.

PHASE 5 | STRATEGIES + ACTIONS

TO MITIGATE THE URBAN WATER GAP THROUGH LAND USE AND LANDSCAPING

DRAWN FROM WORKSHOP 2 + WRAP UP W/ STEERING COMMITTEE

1 FIND THE SWEET SPOT – DENSITY + PT. OF DIMINISHING RETURNS

Density will not solve the urban water gap by itself. Density plays a role, but is not the sole solution and it is one that is fraught with complexity and uncertainty. Academic and professional research suggests that the relationship between residential density and water demand 1) is complex in that there are many factors affecting it such as climate, socio-economic, culture, and regulations that vary from one region to another, 2) has high variation among different density classes, and 3) is not linear with the relationship stronger at lower densities and weaker at higher densities.

Further regional specific studies into the relationship between density and water demand and the factors driving this relationship would provide a foundation for optimizing water stewardship through land use and landscaping practices. However, it is not likely this will take the form of a Best Management Practices tool box of actions, rather it will be a tool box of assessment methods that will enable each community, no matter how it is currently configured, to be able to embrace solutions ideal for their community given their specific character and what they have built and invested in.

2 CREATE WATER WISE LAND USE PLANS

Development of Integrated Water and Land Use plans or Land Use plans based on best water management practices may provide the most progress in mitigating the urban water gap. Policy and/or collaborative action is needed to consciously integrate these two professional practices which have historically operated independently. Water managers have typically responded to land use and development plans, securing the water resources they need to service their new planned customers. However, increasing population and water supply uncertainty puts the region at risk. Groundwater dependent communities may be exposed the most. If and when communities need assistance, they will lean on those with supply to spare, stressing the sustainability of the region's economic, social and environmental quality of life.

Utilizing the latest data and understanding of "The Sweet Spot" (Strategy 1, above), growth can be designed and distributed to best steward water resources while balancing other systems near and far. Water and Land Use planning can happen in tandem, with water managers informing planners and the development community how many people can be supported given supplies and proposed development concepts. This exchange will empower stakeholders of all interests with information and opportunities to tailor their efforts to attain more goals, those of both personal self-interest and sustained social accountability.

3 MEASURE, MONITOR + MESSAGE/MARKET DATA + SUCCESS STORIES

People make choices. They witness, hear and remember stories and model behavior. Improving transparency of data and exchanging honest, accurate, engaging stories of water use, conservation, cost savings and environmental implications will inform the choices people make, encourage water stewardship and support a rise in personal and social accountability. These stories and behavioral choices need to be shared across communities from elected officials, water managers and municipal staff, to business owners, commercial operations, residents, students and visitors in engaging ways that drive thought and empower action. Action requires awareness, safety and convenient access to resources for action to expedite adoption of best practices at all scales, individual and organizational. Emerging technology for collecting, monitoring, sharing and broadcasting data provides opportunity to escalate and scale awareness of best practices and foster an abundance of success stories and ideally, water supply.

4 DEVELOP/TRACK NEW METRICS: WATER USE/SF CATEGORIZED BY LAND USE

That which gets measured gets improved. Flow Science is ...New metrics and data are needed to best frame the issue and raise awareness of the role individuals, industry and organizations play in scaling solutions to meeting future urban water demand. One metric proposed is that of **Water Use/Square Foot of Land Use**. Calculating and categorizing this metric would allow land uses like Restaurants and Commercial Kitchens to compare their water use to comparable/peer users and allow single family homeowners to better understand how their water use compares to other single family homeowners of comparable context. This understanding and awareness can lead to better decision making on how to best invest and where to conserve water. However, the development of a new metric must account for how it might unintentionally skew perceptions and behavior and should be developed and agreed upon by professionals in planning, engineering and water management disciplines.

Other areas for metrics worth tracking and improving include:

1. Groundwater depletion and costs and opportunity costs of recharge
2. Dependence on sources outside of natural watershed
3. Changes in water quality and aquatic life
4. Changes in and equitable access to ecosystem services, ie. Urban Heat Islands
5. Changes in the water poverty index - Improvement in the livelihoods or reduction in poverty levels of the regional population and geographies supplying water

5 DEVELOP SUITE OF STEWARDSHIP INCENTIVES | TAP FEE CREDITS, SMALL LOTS, ETC.

A “Suite” of Incentives would entice a commitment from some to steward water resources in new and effective ways. These projects would serve as case studies to entice or even disrupt the market, scaling adoption of best practices. The Land Use Leadership Alliance (LULA) Guidance Manual developed by the Land Use Law Center at Pace University offers a checklist of various water conservation measures that can be encouraged or enforced through traditional land use and/or water management planning, building regulation or specific incentive programs.

Beyond encouraging or requiring efficient systems and specific conservation measures like low-flow fixtures, incentives like cluster development, density bonuses, increased lot coverage, reduced setbacks and demand based tap fees can entice developers to build products and projects that value the long term maintenance and return on investment as much or more than the return on initial sale and their individual self-interest. Adopting zoning and overlay districts to foster in-fill, density and reduced need for irrigated landscaping will also provide opportunities for developers and those choosing to live in their communities to profit from reduced demand for increasingly scarce and expensive water supplies. It should be noted, however, the desire and need for meaningful vegetation and open space must be maintained in these densifying neighborhoods to make them sustainably desirable.

| WATER CONSERVATION AND BUILDING REGULATION | | | | | | |
|--|-----------|--------------------|-------------------------|-----------|---------------|---------------|
| Water Conservation Measures | Comp Plan | Zoning Regulations | Subdivision Regulations | Site Plan | Building Code | Plumbing Code |
| LANDUSE | | | | | | |
| Urban growth boundary | ✓ | | | | | |
| Denser development(more homes/acre) | ✓ | ✓ | ✓ | ✓ | | |
| Cluster development (reduce lot size) | ✓ | ✓ | ✓ | ✓ | | |
| Mixed-use development | ✓ | ✓ | ✓ | ✓ | | |
| Mixed housing types | ✓ | ✓ | ✓ | ✓ | | |
| Compact mixed use | ✓ | ✓ | ✓ | ✓ | | |
| Transit oriented development (TOD) | ✓ | ✓ | ✓ | ✓ | | |
| In-fill zoning | ✓ | ✓ | | | | |
| Overlay zone | ✓ | ✓ | | | | |
| Floating zone | ✓ | ✓ | | | | |
| Setback requirements | | ✓ | | | | |
| Highway intersection overlay zones | ✓ | ✓ | ✓ | ✓ | | |
| Open space dedication | ✓ | ✓ | ✓ | ✓ | | |
| Open space preservation | ✓ | ✓ | ✓ | ✓ | | |
| Demand based tap fees | ✓ | | | | | |
| Other incentives | ✓ | | | | | |
| EQUIPMENT | | | | | | |
| Green plumbing code | ✓ | | ✓ | ✓ | | ✓ |
| Indoor fixture efficiency standards | ✓ | | | | ✓ | ✓ |
| Reuse of water | ✓ | | | | ✓ | ✓ |
| Smart meters | ✓ | | | | ✓ | ✓ |
| Sub metering multifamily units | ✓ | | | | ✓ | ✓ |
| Incentives | ✓ | | | | | |
| LANDSCAPE | | | | | | |
| Landscape codes matched to land use type | ✓ | | ✓ | ✓ | | |
| Landscape plan requirements(xeriscaping) | ✓ | ✓ | ✓ | ✓ | | |
| Soil quality requirements | ✓ | | ✓ | ✓ | | |
| Plant list/Allowable plants | ✓ | | ✓ | ✓ | | |
| Tree size requirement | ✓ | | ✓ | ✓ | | |
| Turf limitations (type and quality) | ✓ | | ✓ | ✓ | | |
| Artificial turf | ✓ | | ✓ | ✓ | | |
| Irrigation system efficiency requirements | ✓ | | ✓ | ✓ | | ✓ |
| Water waste rules | ✓ | | ✓ | ✓ | | |
| Rain sensors | ✓ | | ✓ | ✓ | | ✓ |
| Spray nozzle | ✓ | | ✓ | ✓ | | ✓ |
| Water harvest | ✓ | | ✓ | ✓ | | ✓ |
| Water harvesting into landscape irrigation | ✓ | | | | | ✓ |
| Fixture efficiency standards | ✓ | | | | | ✓ |
| Water loss limits | ✓ | | ✓ | ✓ | | ✓ |
| Positive shut off | ✓ | | | | | ✓ |
| Incentives | ✓ | | | | | |
| MONITORING AND ENFORCEMENT | | | | | | |
| Penalties – civil and criminal | ✓ | ✓ | | | | |
| Post occupancy violations | ✓ | | | | | |
| Intermunicipal inspections and prosecutions | ✓ | | | | | |
| OTHER | | | | | | |
| Goal to be water wise | ✓ | | | | | |
| Percent reduction in water use | ✓ | | | | | |
| Water fee based on size of structure and lot | ✓ | | | | | |
| EPA water-sense standards | ✓ | | | | | |
| Model home requirements | ✓ | | | | | |
| Rebates | ✓ | | | | | |
| KEY: ✓ = Standard is applicable | | | | | | |

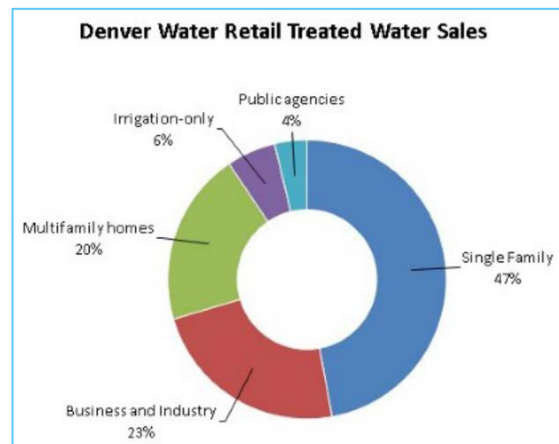
Water Conservation and Building Regulation Checklist from LULA Guidance Manual, Land Use Law Center, Pace University

| Water Conservation Management Plan Components | | | | | | | | | |
|---|--------------|--------------------|-------------------|------------|-------------------------|-------------------|------------------------|-----------|------------------------|
| Land Use Element | Water Supply | Demand Projections | Goals/ Objectives | Incentives | Ordinances/E nforcement | Direct Assistance | Certification Programs | Education | Monitoring/E valuation |
| LANDUSE | | | | | | | | | |
| Urban growth boundary | | ✓ | | | | | | | |
| Denser development (more homes/acre) | | ✓ | | | | | | | |
| Cluster development (reduce lot size) | | ✓ | | | | | | | |
| Mixed-use development | | ✓ | | | | | | | |
| Mixed housing types | | ✓ | | | | | | | |
| Compact mixed use | | ✓ | | ✓ | | | | | |
| Transit oriented development (TOD) | | ✓ | | | | | | | |
| In-fill zoning | | ✓ | | | | | | | |
| Overlay zone | | | | | | | | | |
| Floating zone | | | | | | | | | |
| Setback requirements | | | | | | | | | |
| Highway intersection overlay zones | | | | | | | | | |
| Open space dedication | | ✓ | | | | | | | |
| Open space preservation | | | | | | | | | |
| Demand based tap fees | | ✓ | | ✓ | ✓ | | | | |
| Other incentives | | | | ✓ | | | | | |
| EQUIPMENT | | | | | | | | | |
| Green plumbing code | | ✓ | | | ✓ | | | | |
| Indoor fixture efficiency standards | | ✓ | | | ✓ | | | | |
| Reuse of water | ✓ | | | | | | | | |
| Smart meters | | | ✓ | | | | | ✓ | ✓ |
| Sub metering multifamily units | | | | | | | | | |
| Incentives | | | | ✓ | | | | | |
| LANDSCAPE | | | | | | | | | |
| Landscape codes matched to land use type | | ✓ | | | ✓ | | | | |
| Landscape plan requirements (xeriscaping) | | ✓ | | | ✓ | | | | |
| Soil quality requirements | | | | | ✓ | | | | |
| Plant list/Allowable plants | | | | | ✓ | | | ✓ | |
| Tree size requirement | | | | | ✓ | | | | |
| Turf limitations (type and quality) | | ✓ | | | ✓ | | | | |
| Artificial turf | | ✓ | | | ✓ | | | | |
| Irrigation system efficiency requirements | | ✓ | | | ✓ | | | | |
| Water waste rules | | ✓ | | | ✓ | | | | |
| Rain sensors | | ✓ | | | ✓ | | | | |
| Spray nozzle | | ✓ | | | ✓ | | | | |
| Water harvest | ✓ | ✓ | | | | | | | |
| Water harvesting into landscape irrigation | | ✓ | | | | | | | |
| Fixture efficiency standards | | ✓ | | | ✓ | | | | |
| Water loss limits | | ✓ | | | | | | | |
| Positive shut off | | | | ✓ | | | | | |
| Incentives | | | | | | | | | |

Water Conservation Management Plan Components Checklist from LULA Guidance Manual, Land Use Law Center, Pace University

6 RECOMMEND NEW DESIGN GUIDELINES FOR GOVERNMENT OWNED BUILDINGS, PUBLIC SPACES AND RIGHTS OF WAY.

New Design and Engineering Standards that drive a systems approach and the employment of best practices including the water harvesting and passive irrigation benefits of green infrastructure offer an opportunity to build an urban environment that better stewards water resources. This applies to systems both in and outside of buildings. Reducing demand is a sure way to steward resources and can be achieved with low flow fixtures and interactive monitoring to inform behavior, but the biggest water use is often outdoor irrigation. The efficiencies of investing water where it falls and flows are similar to those of clean dispersed and/or distributed power supply systems,



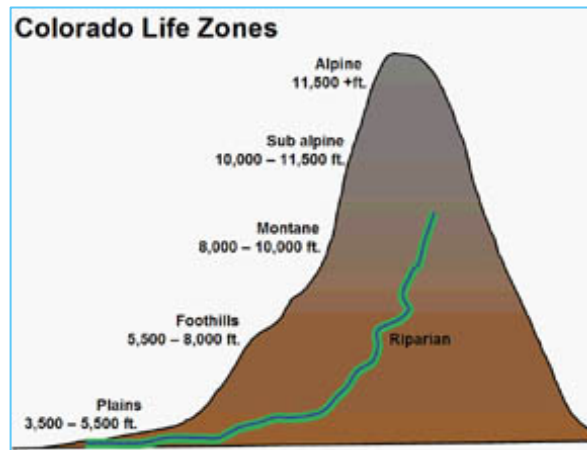
Source: Denver Water, 2011-2015 Average Billed Water Use

reducing waste resulting from production and distribution of the resource supply. Sites can be designed so that stormwater percolates into pervious surfaces, supplementing or replacing the need for irrigation as it makes its way downstream. As in nature, these flows could sustain an urban forest and canopy cover nurturing ecosystem services like shading/cooling and improving air quality. Buildings could be plumbed to reuse graywater (from sources other than toilets) and in cases, even blackwater (sources contaminated with fecal matter) if properly designed and maintained. Governments should lead by example by designing, building and maintaining sustainable sites and buildings that provide or contribute to optimal resource efficiency AND environmental quality. However, these examples need to be replicated in the private market on private property to make a meaningful difference in overall consumption, conservation and stewardship of the watershed and economic and social quality of life; public agencies only account for 4% of treated water sales.

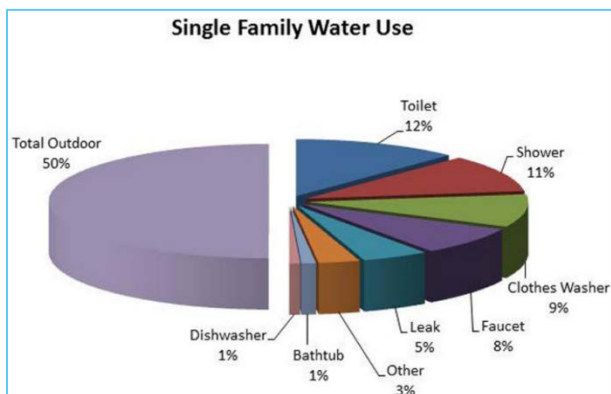
7 DEVELOP MODEL MUNICIPAL LANDSCAPING CODES BASED ON BEST PRACTICES.

The State has the authority and responsibility to lead its counties, cities and towns in setting model policies and establishing best practices. A State driven effort to establish model landscaping ordinances for the various life zones in Colorado would encourage the development and adoption of local, context-sensitive landscaping codes that best steward water use in the landscape and ensure the landscapes residents and investors value and rely on endure in the event of drought or necessitated restrictions.

Given the water invested in total outdoor use, native plant and landscaping ordinances can be effective tools at mitigating water use while sustainably nurturing nature's services. [Arizona's Department of Water Resources](#) has a list of Low Water Use and Drought Resistant Plants for each Active Management Area (AMA). Many cities and towns require plants in new developments to be on this list and limit turf to certain coverage limits or require installation of Evapotranspiration (ET) sensors and automatic shut off valves on irrigation systems in case of leaks.



Source: Colorado State University, www.nrel.colostate.edu



Source: Denver Water, 2011 Residential End Use Study

8 ADOPT A **ONE WATER** APPROACH TO WATER RESOURCE MANAGEMENT

Conventional water management approaches are obsolete; barriers to adopting best practices must be overcome. Codes and standards should be regularly updated to reflect evolving best practices and water conservation technology. Integrated management plans should de-silo water management and foster collaborations from utility to individual scales to instill the good habits and social norms that will stem a growing population from expanding the urban water gap. **One Water** is a concept that promotes efficient and equitable systems and integrated management. But a complex and often overlapping patchwork of water supply, stormwater and wastewater management regulation and a lack of systems thinking, leadership and political will inhibit the transition to this promising approach. Building understanding, support and consensus for One Water system design and management may prove a solutions multiplier as the philosophy permeates professional and domestic paradigms and practices.

Table 1. The key differences between conventional and integrated approaches to urban water management.

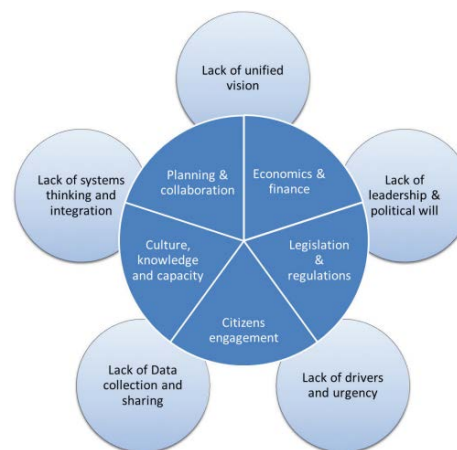
| Aspect of urban water management | Conventional approach | Integrated approach |
|-----------------------------------|--|--|
| Overall approach | Integration is by accident. Water supply, wastewater and stormwater may be managed in the same agency as a matter of historical happenstance, but physically the three systems are separated | Physical and institutional integration is by design. Linkages are made between water supply, wastewater and stormwater, as well as other areas of urban development, through highly coordinated management |
| Collaboration with stakeholders | Collaboration = public relations. Other agencies and the public are approached when approval of a pre-chosen solution is required. | Collaboration = engagement. Other agencies and the public search together for effective solutions |
| Choice of infrastructure | Infrastructure is made of concrete, metal or plastic | Infrastructure can also be green including soils, vegetation and other natural systems |
| Management of stormwater | Stormwater is a constant that is conveyed away from urban areas as rapidly as possible | Stormwater is a resource that can be harvested for water supply and retained to support aquifers, waterways and biodiversity |
| Management of human waste | Human waste is collected, treated and disposed of to the environment | Human waste is a resource and can be used productively for energy generation and nutrient recycling |
| Management of water demand | Increased water demand is met through investment in new supply sources and infrastructure | Options to reduce demand, harvest rainwater and reclaim wastewater are given priority over other sources |
| Choice of technological solutions | Complexity is neglected and standard engineering solutions are employed to individual components of the water cycle | Diverse solutions (technological and ecological) and new management strategies are explored that encourage coordinated decisions between water management, urban design and landscape architecture |

Based on Pinkham (1999) – adapted by ICLEI (2011)

Source: P Mukheibir, C Howe, D Gallet
http://aquadoc.typepad.com/files/one_water_awwa.pdf



One Water Road Map, USWaterAlliance.org



Barriers and underlying causes to a One Water approach
 Source: P Mukheibir, C Howe, D Gallet

9 ENCOURAGE THE USE OF COMMUNITY **WATER BUDGETS** TO INFORM POLICIES, PROGRAMS, PLANS AND PRACTICES THAT ENSURE DEMAND REDUCTIONS

Personalized water budgets are tools that allow individual water customers to manage their water use in relation to a set goal. Sometimes these are “educational water budgets” while other times they are tied to an inclining block rate structure, providing price signals as water use goes up.

Water budgets promote water efficiency while allocating the optimal amount of water for that water customer’s needs based on number of people in the household and amount and type of irrigated vegetation on a specific property.

With the advent of GIS and smart meter technology, water budgets are much more a reality than they were 10 years ago. As new development occurs, water budgets can play an important role in verifying and enforcing the estimated demands assigned to new developments. When system development charges are set for a new development or property, a water demand is generated based on what the estimated indoor use will be plus what the landscape will require. With this estimate, a water budget could be developed for the property that ties directly into the system development charge demand estimate.

Several Front Range municipalities have implemented water budgets over last 15 years. Notably, the City of Boulder has included language in their water budget rules that states, “the treated water quantity charge portion of water bills were calculated using a water budget block rate structure such that the price of water increases as more water is used, particularly when the amount of water used exceeds the customer’s water budget. The increasing price is necessary not only to promote water conservation, but also is related to the additional marginal cost associated with water development and water conservation.”¹ This allows municipalities to use water budgets to track the larger water supply-demand balance in their water system as the community grows and assign a more accurate cost to new development for securing and delivering that additional water.

While not widely implemented together, the connection between system development charges, water budgets and the actual water demand occurring in new development should be encouraged and studied.

¹ https://www-static.bouldercolorado.gov/docs/water-budget-rules-1-201304191236.pdf?_ga=1.264938636.204301362.1492545213

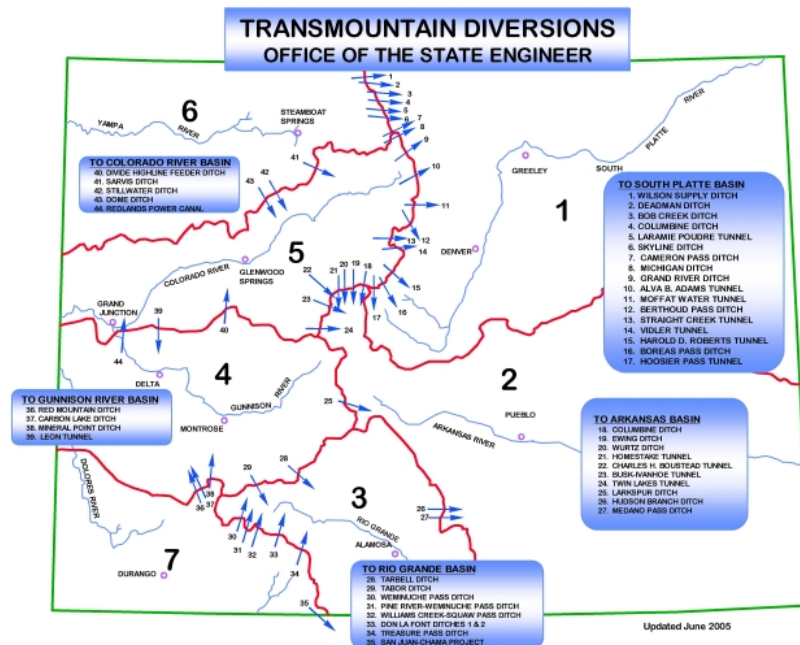
ROBUST STRATEGIES NOT ADVANCED BY THE STEERING COMMITTEE

10 AGRICULTURAL EFFICIENCY + CONSERVATION MEASURES

Traditionally, growing cities mark agriculture as a source of future water supply. This has led to some cities investing in agricultural efficiency measures to improve conservation in order to transfer the water saved to municipal and industrial users. However, using less water per plant also provides opportunity for higher yields at current consumption rates and does not force reallocation of the water intended to be transferred. Markets encouraging production over conservation require a balanced compromise or commitment to optimizing returns on water resource investments. Calculating the “True Cost” AND returns of that investment, the net balance of intended, unintended, positive and negative externalities, is needed to make significant achievements in managing a safe and sustainable hydrologic cycle and maintaining food security while developing a resilient, human engineered and managed supply distribution system and water investment portfolio.

11 INCREASE REGIONAL COLLABORATION B/W FRONT RANGE/WEST SLOPE COMMUNITIES + REPRESENTATIVES

There is a need to plan water infrastructure with a collaborative, trans-boundary perspective. While human resources are increasingly abundant, natural and fiscal resources are becoming increasingly scarce. The resources needed to plan, design, build and maintain the infrastructure to meet the demand of an expanding Front Range may best be attained and managed through inter-jurisdictional, trans-boundary collaboration. Developing projects with shared visions, values and interests present a way to best manage and balance the impacts of growth across the state and region.



Source: Colorado Department of Natural Resources

12 **"WATER IN THE WEST WELCOME WAGON" FOR NEW + EXISTING HOMEOWNERS, RESIDENTS, DEVELOPERS, POLICY MAKERS**

Many Colorado Natives and long-time residents know and practice water wise living principles, understanding the impact their use has on the environment that is the state's image and lure. However, the environment that lures people to Colorado also imports their knowledge and behaviors developed in less arid regions with more abundant precipitation and water supplies. Delivering empowering education campaigns to targeted users and market influencers would help drive demand and supply of water wise growth and better advance the adoption of water wise behaviors that would mitigate the urban water gap.

13 **ELIMINATE BARRIERS, PERMIT + INCREASE WATER SHARING AGREEMENTS**

Water Sharing Agreements are an effective strategy to sustain Colorado's rivers and ranchers through ecologic and economic uncertainty. Eliminating barriers water sharing agreements would encourage the increased development and adoption of this tactic. An examples of success are the restoration of flows to the [Little Cimarron](#) and the preservation of access to quality agriculture, recreation and tourism resources.

14 **ADOPT "TRUE COST" PRICING POLICY**

"True Cost" pricing would send price signals and encourage conservative use/investment, helping to close Colorado's urban water gap. True cost, however, is only understood once a complete and thorough life-cycle assessment has been conducted to assess the triple-bottom line value of that asset, resource or behavior. A Life-Cycle Assessment calculates all the known externalities or effects on economic, social and environmental quality. Certain resources and behaviors may prove to be profitable or economically desirable though they cause social and ecologic harm, creating problems that the economy can't fix. Adopting a **True Cost Pricing Policy** for Water would restructure rates and revenues generated by developing and distributing water resources which could be distributed to pay for the social and environmental externalities/costs of service.

15 **NURTURE A WATER EFFICIENT ECONOMY FOUNDED ON EFFICIENT INDUSTRIES**

Businesses that harvest and steward Colorado watersheds and water resources should be nurtured and become the foundation of local economies. Economies produce waste and unintended consequences that communities and society struggle to resolve. Efficient economies consume less and produce more. Circular economies, are restorative or regenerative, eliminating waste and undoing the harm of prior negative impacts. Colorado economies should be nourished by markets and industries that can thrive and prosper despite uncertainty surrounding supply and the costs of supplying water resources. This approach considers a holistic calculation of value within the context of community at a local,

regional and global scale, filling in the balance sheet of positive and negative externalities as well as their geographic and social flow and distribution.

16 **FUND IMPLEMENTATION OF LONG-RANGE PLANNING STRATEGIES VIA UTILITY REVENUES**

Scarcity of fiscal resources are a ubiquitous barrier to planning and progress. Dedicated Funding mechanisms for planning, design, and maintenance of plans, policies and infrastructure would help ensure Colorado is operating at peak performance and efficiency. A potential funding mechanism could be created through utility revenue rate structures or alternative creative financing mechanism could be employed to address the ubiquitous need for capital.

17 **INCLUDE "DESIGNERS" IN ENGINEERING DEPARTMENTS**

Engineering is critical, but so is design. Design produces the art of the dream, the solutions that keep it from being a nightmare. Engineering is the science of making the dream work. Resource constraints have led to the elimination of design positions in engineering departments and limited scopes of work for designers on development projects. As a result, very well engineered projects often fail to reach their design potential because the problems being solved are limited in scope of the problems the projects could address if designed with a more holistic and creative approach. Empowering designers and integrating design thinking into project teams, departments, and infrastructure and development projects will result in more creative solutions in our built environment and help address problems caused by their form and function. Evidence rests in the value and perceived value of endless products and places that serve similar functions but are designed to be more desirable. One opportunity is using infrastructure as art to celebrate the science and educate people that interact with the infrastructure, breeding understanding of and support for the complex resource requirements infrastructure demands.

18 **PARTNER WITH TRAINED WATER STEWARDS | DESIGNERS, BUILDERS, MAINTENANCE CREWS, ETC.**

Watershed management is everyone's responsibility. Professionals who design, build and maintain our buildings, environments and systems play an even larger role in stewarding resources and empowering others to follow their lead. Partnering with professionals specifically trained in stewarding water resources will drive conservation and wise investment of water resources.

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Western Lands and Communities would like to acknowledge and thank the Keystone Policy Center, Colorado Water and Growth Dialogue and its dedicated steering committee who helped us successfully demonstrate how Exploratory Scenario Planning can inform and improve the results of natural resource management, planning and preparedness collaborations. Special acknowledgement must be given to Ralph Marra of Southwest Water Resource Consultants for training and guiding facilitators and participants in Exploratory Scenario Planning and to Matthew Mulica and Jonathan Geurts who wrangled the focus and logistics of this successful effort. Finally, we must acknowledge the diversity of communities, experience, skill sets, perspectives and leadership capacity that we had on this project. We hope the experience of Exploratory Scenario Planning continues to inspire and improve collaboration on ensuring a prosperous future for both people and nature throughout Colorado and the intermountain west.

ABOUT

THE AUTHOR

Jeremy Stapleton is Program Manager of Western Lands and Communities, a joint-program of the Lincoln Institute of Land Policy and Sonoran Institute. Jeremy served as the main facilitator of the XSP Workshops and author of the Scenario Narratives used in this and other XSP demonstration projects. He brings over a decade of experiences as a wilderness guide, urban designer, city planner and policy maker to his exploration of how to build economies and cities that nurture social harmony and sustain healthy, prosperous environments for people and nature.

LINCOLN INSTITUTE, SONORAN INSTITUTE AND WESTERN LANDS AND COMMUNITIES

The Lincoln Institute of Land Policy (LILP) and Sonoran Institute (SI) have partnered since 2005 to assist communities in the West in applying innovative approaches to the challenges associated with growth, economic development, climate, and natural resource management. This partnership has involved research, policy analysis, tool development, local capacity building, demonstration projects, and policy engagement. The Lincoln Institute of Land Policy is a private operating foundation whose mission is to be a leading center for the study of land policy and land-related tax policy throughout the world. The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them. SI works at the nexus of commerce, community, and conservation to help people in the North American West build the communities they want to live in while preserving the values which brought them here.

GLOSSARY

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| Assistant | Assistants are tasked with providing the visual cues for breakout groups, scribe drivers, implications, strategies, etc. for the facilitator and group to reference while exploring. |
| Common to All | Scenario conditions common to all scenarios explored; derived from the identified Critical Certainties, collected cognitive history and relevant trends. |
| <i>Credible, Compelling, Divergent</i> and <i>Challenging</i> | It is optimal to explore scenarios that could likely happen (<i>credible</i>), entice participants into thoughtful, expansive dialogue (<i>compelling</i>), differ enough in context to afford alternative perspectives (<i>divergent</i>), heighten the explorers' awareness and contest their perspectives and understanding of the problem, available resources and potential strategies to attain goals (<i>challenging</i>). |
| Critical Certainties | Driving forces identified as critically important to the focal question and certain to prevail despite uncertainties. |
| Critical Implications | Conditions implied in scenarios that significantly impact the Focal Question. |
| Critical Uncertainties | Driving forces identified as critically important to the focal question and highly uncertain over the planning horizon. |
| Exploratory Scenario Planning (XSP) | A form of Scenario Planning that utilizes multiple plausible scenarios to develop broader strategy, action and policy coordination to achieve goals despite uncertainties in the planning environment. |
| Facilitator | Facilitators lead the Workshop plenary and breakout sessions. |
| Note Taker | Note takers capture the stream of consciousness/conversation for later reference in clarifying details of the conversation and informing the Scenario Narratives. |
| Focal Question | Frames the boundaries and goals of the exploration. A good focal question will solicit the root drivers of the issue(s) and scenarios being explored. |
| Driving Forces | Influences or causes of certainties, uncertainties and scenario conditions. |
| Root Driver | The core driver causing or resulting in a specified condition; the driver which other drivers come from. |

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|-------------------------------------|--|
| Uncertainty Axis | One axis of an Uncertainty Matrix; identifies a Critical Uncertainty and the two end-states that may reveal themselves in a plausible future. Combine 2-3 axis to create an Uncertainty Matrix. |
| Relative Importance | Driving forces are identified then ranked by relative importance to the determinants of the Focal Question. |
| Scenario Narratives | Descriptions of conditions in plausible futures; used in Workshop #2 to derive implications and relevant strategies. |
| XSP Workshop 1 | Convening of the Working Group to: Identify and Rank the Driving Forces, Identify the most Critical Uncertainties and create the Uncertainty Matrix that informs Scenario Narratives. Typically a full day gathering. |
| XSP Workshop 2 | Convening of the Working Group to: Explore the implications of each future described in the Scenario Narratives, Create a pattern of actions that address the emerging needs of each future, and identify actions/strategies common to multiple futures. |
| Workshop Wrap Up | Convening of the Steering Committee and Facilitators to refine and confirm the conclusions drawn from a workshop. |
| Workshop Templates | Exhibits used in Workshops to cue participants and solicit responses. |
| Steering Committee | A group of highly engaged stakeholders selected from the overall Working Group that guides and oversees the development and execution of the XSP initiative. |
| Technical Advisory Committee | A group of experts selected to fill gaps and disseminate pertinent details of subjects relevant to the exploration being commenced. |
| Working Group | The entire group of participants undertaking the Exploratory Scenario Planning process. |

APPENDIX

EXPLORATORY SCENARIO PLANNING DEMO

COLORADO WATER AND GROWTH DIALOGUE