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NATIONAL WESTERN CENTER

NextGen Agribusiness Economic Development Strategy



ACKNOWLEDGMENTS

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ACRONYMS

BRIC	acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa.	GMO	Genetically Modified Organism
CAC	National Western Citizens Advisory Committee	NAICS	North American Industrial Classification System
CAGR	Compound Annual Growth Rate	NDCC	North Denver Cornerstone Collaborative
CSA	Consolidated Statistical Area	NWC	National Western Center
CSU	Colorado State University	NWSS	National Western Stock Show
EIA	US Energy Information Administration	OED	City of Denver, Office of Economic Development
FAO	United Nations Food and Agriculture Organization	R&D	Research and Development
FSMA	Food Safety Modernization Act	SDI	Subsurface drip irrigation
FDA	Food and Drug Administration	STEM	Science, Technology, Engineering, Math
FDI	Foreign Direct Investment	TAC	Technical Advisory Committee
GDP	Gross Domestic Product	USDA	US Department of Agriculture
		WSSA	Western Stock Show Association

KEY TERMS

Agriculture Innovation Triangle	Centered along the Front Range, this triangle is anchored by the National Western Center, Denver International Airport, and Colorado State University.
Food Hub	According to USDA, Food Hubs are overseen by an organization that actively organizes and aligns food producers, distributors, marketers, and consumers. The intent of a Food Hub is to offer these services at an affordable price, allowing producers to gain entry into new markets, with facilities that can support greater volumes of food.
Innovation Districts	Locations where federal funding for basic research can be leveraged to support private sector opportunities. These place-based environments become key ingredients in innovation, as immediate proximity creates opportunities for “accidental collisions” between people to drive information exchange. Over time, successful innovation districts are able to leverage greater density & interest in mixed use to create place-based outcomes that private-sector companies increasingly seek out to access and cultivate talent.
Next Gen Agriculture	A term that speaks to the impact of new technologies and innovations that are transforming traditional agriculture, including mapping, drones & robotics, and sensors. Connections between agriculture and food production, bio-energy, water, waste management, and sustainability have also grown in prominence.
Front Range	A group of counties along the Front Range of the Rocky Mountains, extending generally from Pueblo through Colorado Springs, Denver and Boulder to Fort Collins.
Location Quotient	A Statistical tool that quantifies the level of regional concentration for a particular industry, cluster, occupation, or demographic group relative to national averages. It can reveal what makes a particular region “unique” in comparison to the national average.

PRELUDE

The adoption of the National Western Center (NWC) Campus master plan in March 2015 by Denver City Council has set the stage for a unique opportunity for the Front Range, Colorado, the Rocky Mountain West, and the World.

Plans to transform the historic home of the National Western Stock Show (NWSS) have triggered critical conversations about the role of this dynamic, year-round campus in driving innovation in agricultural-related sectors.

Over time, NWC will become a key driver to advance the Front Range economy, resulting in technology innovation and adoption, business creation and growth, and new employment opportunities. Already, partnerships announced in 2016 between Colorado State University (CSU) and Denver Water have laid the groundwork for a nationally-significant water research center at NWC.

The intention of this NWC NextGen Agribusiness Economic Development Strategy is to expand the NWC conversation beyond entertainment, competition, and education and into research and innovation. Outcomes are anticipated to leverage the site's rich history and our key economic and research factors to expand interconnections across a growing public and private agricultural innovation community, one that is both intensely local and increasingly global in nature to help address global food and resources challenges.

While plan components affirm the ideals of heritage, discovery, stewardship and leadership, there is a clear intent that NWC will also serve as the “front door” for Colorado agriculture and the global destination of consequence for agriculture innovation, strategically positioned to address global food challenges (quality, quantity, and cost) in new and compelling ways, setting new standards for how we care for the land and feed the planet.

To be clear, as the most successful of Innovation Districts (Boston, San Diego, Silicon Valley) have taken years to mature, our expectations for the pace of business and job creation linked to research and innovation at NWC need to be tempered. For this reason, the NWC NextGen Agribusiness Economic Development Strategy is but the first in a series of engagements to refine and confirm the NWC master plan's bold vision and mission, anchoring it in a fiscal and economic development context, with the clear intent of creating a dynamic place-based platform for agriculturally-focused innovation, as well as job creation.

The NWC is poised to be a global example of how thoughtful design and intentional programming can bring together a range of stakeholders to solve issues, both community and regional in scale. This report continues Denver's efforts to diversify and create opportunities for job growth and provide a range of opportunities to develop local business and workforce training opportunities.

APPROACH

The Team (composed of AECOM, the Technical Advisory Committee (TAC), and partners and entities of the City, CSU, and WSSA) was engaged to complete an analysis of economic development implications associated with National Western Center (NWC) revitalization. The team assembled for this effort included Vicky Salin with Texas A&M University. The team effort was supported by a Technical Advisory Committee, made up of individuals from all facets of Front Range agriculture, including Colorado State University and the National Western Center.

The approach was anchored by three missions:

1. Place NWC revitalization in an economic and market context, leveraging work already completed by Colorado State University (CSU) focused on the emerging agricultural value chain along Colorado's Front Range.
2. Consider Colorado's existing businesses, research and activities, which combined with new innovation and practice, will determine key business clusters that may grow and

evolve to directly or indirectly serving the global marketplace. Investing in these clusters potentially would grow businesses, revenue and sales, and / or employee opportunities.

3. Establish a high-level understanding of the opportunity for commercial and private sector activity at the NWC site, framing order of magnitude land requirements and employment levels.

Within these missions, AECOM:

- Identified industry sector, cluster, and end-market opportunities that build on the inherent strengths and comparative advantage of NWC and the Front Range.
- Summarized national and global agriculture industry trends, in context with priority clusters identified in the CSU study.
- Evaluated regional commercial real estate trends to frame the ability of regional office,

retail and industrial markets to sustain private sector development at NWC.

- Completed case studies of innovation districts focused on agriculture, the plant and life sciences, and biotechnology, to understand economic development implications for NWC.

Geographies

The study focuses on several geographies as a focus of the analysis:

1. The National Western Center site, covering about 250 acres
2. A larger area of influence surrounding the NWC, covering about 800 acres
3. The Front Range, generally extending from Pueblo to Fort Collins
4. The Rocky Mountain West, extending from New Mexico and Arizona through Colorado to Idaho and Montana

PROJECT CONTEXT

Economic opportunity unfolds over time from harnessing linkages across innovation, economic positioning, and leveraged private and public efforts to enhance and grow “the enterprise”. In a similar fashion, the NWC NextGen Agribusiness Economic Development Strategy should be understood in context with evolving Front Range economic opportunities, research undertaken by Colorado State University (CSU) and its public and private research partners, and the history and opportunities linked with the National Western Center's traditions and its partner organizations.

Chain along Colorado's Front Range” forms the analytical basis for this effort, highlighting the importance of a holistic strategy that looks across food-related sectors to identify emerging opportunities. While other regions are looking at discrete pieces of the food chain, the Front Range has an opportunity to identify larger emerging opportunities.

The CSU study identified 460 companies involved in innovation within the Agricultural Value Chain. Economic research demonstrates that investment in research and innovation results in many positive outcomes for the economy, from sustaining and evolving existing sectors and business to generating new business and products opportunities. Our study incorporates the findings and outcomes from the CSU study to understand these firms and others businesses connections across industry sectors. With the resulting goal of strengthening businesses, evolving and innovating new products and methods, and encouraging investment and creating economic outcomes (such as sales, revenue, and employment).

The importance of a holistic strategy that looks across food-related sectors to identify emerging opportunities.

The 2014 CSU study, “Emergence of an Innovation Cluster in the Agricultural Value

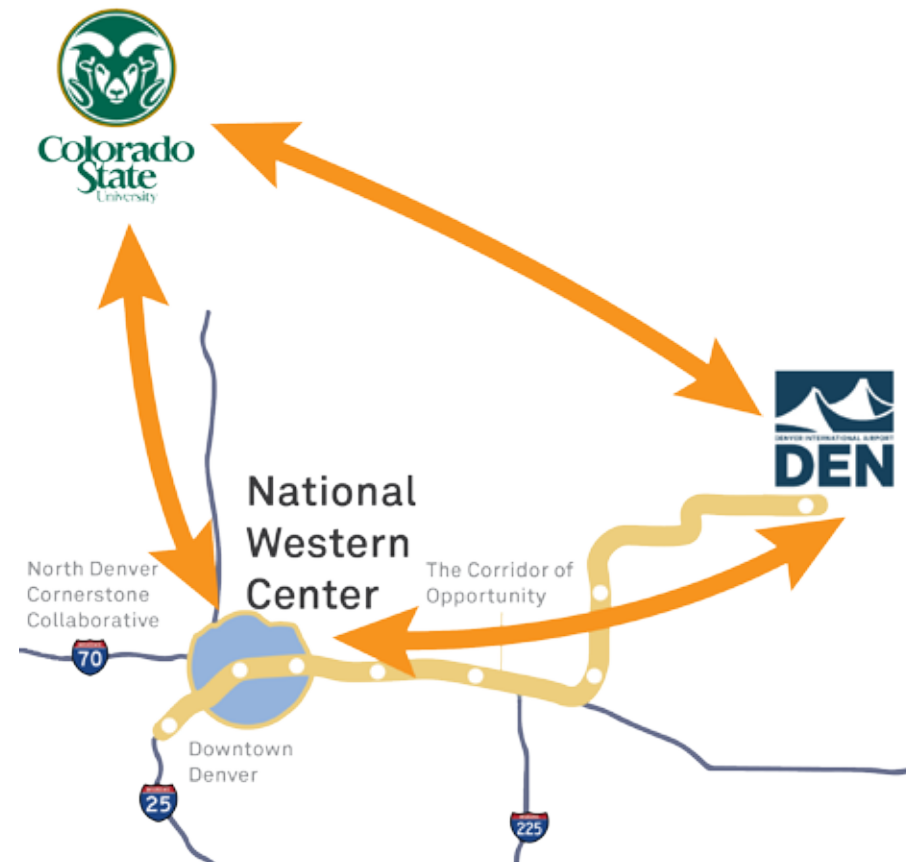
The CSU study identified specific industry clusters for further study:

- Water technology, infrastructure, analytics, and management
- Soil fertility and pest control, plant genetics and new crop varieties
- Animal health, nutrition, and herd management
- Agricultural information systems
- Sensors, testing, and analytics for product quality and biosafety
- Bioenergy
- Commodity processing and food manufacturing, including dairy
- Beer, wine, & spirits production and marketing
- Natural, organic, and local foods, including “Fast & Fresh” food service

The intent of this initial effort is to better define the NWC economic opportunity, identifying next steps that drive outcomes which enhance job growth and regional economic development. The resulting strategy has focused energy on three areas of emphasis:

1. Leverage NWC agriculture-related innovation to drive economic opportunity for the Front Range and the State of Colorado.
2. Leverage reinvestment to facilitate infill redevelopment, both within NWC, as well as the broader area of influence.
3. Frame new revenue streams to address project capital requirements and long-term NWC operating needs.

Figure 1. The Agriculture Innovation Triangle™



Understand and create deliberate connections to Denver International Airport, CSU and NWC for agricultural field research, establishing the regional “Agriculture Innovation Triangle”

Vision for Economic Development

This effort has clarified emerging elements of an economic development vision for NWC, anchored by research which shows that NWC has the clear ability to expand Front Range opportunities in industry sectors related to agriculture, technology, innovation and research:

Food	Including Nutrition, Safety, Security, Quantity, Quality, Affordability
Animal Health	Including connections between humans and companion animals
Water	Including research, demand, supply, & quality

Emerging anchors of the economic vision are clear:

1. Leverage private sector opportunities emerging across the “Agricultural Innovation Triangle” to drive neighborhood and regional job growth.
2. Understand and leverage connections to the CSU One Health Initiative, which is

focused on evaluating relationships and inter-connections between humans, animals, and the environment, in context with factors such as infectious disease, environmental toxicology, and food safety. The One Health Initiative was initially launched in 2013, and received further university grant funding support in 2015 to drive promising areas of One Health research.

3. Leverage the CSU / Denver Water partnership for water research at NWC.
4. Connect with existing food-linked clusters in adjacent neighborhoods such as RiNo, Globeville, Five Points, and Elyria Swansea.
5. Understand connections to Denver International Airport for agricultural field research, establishing the regional “agriculture innovation triangle”.
6. Confirm broader ways in which local supply chains connect restaurants, wholesalers, and warehouses with manufacturing facilities and agricultural fields.

IMPACT OF GLOBAL AGRICULTURAL TRENDS

The analysis found that global agricultural markets are under strain, linked with growth in global population (9.7 billion people by 2050), growth and urbanization, gradual decreases in the amount of arable agricultural land, and pressure on water resources. Recent cyclical economic factors linked with decreasing commodity prices and a strong US Dollar relative to other world currencies have been very significant. While these headwinds have been offset to an extent by lower fuel costs, lower commodity prices have encouraged considerable consolidation among traditional agriculture and food production companies. Implications for NWC include:

- Emergence of a global middle class is driving demand for higher value food, and creating opportunities for Front Range companies to expand markets through export assistance.
- Across North America and the U.S. in particular, consumer tastes are shifting, linked with debate about food safety, food quality,

& health. Traditional producers are now reacting, pivoting toward healthier ingredients.

- Regulatory Factors: The 2011 Food Safety Modernization Act (FSMA) gives the Food and Drug Administration (FDA) a legislative mandate to require science-based preventive controls across the food supply, more rigorous inspection and compliance measures, greater oversight over imported food, and greater authority to recall food products.

AGRICULTURE SECTORS STRONG IN COLORADO

The Team undertook an analysis of employment trends for Colorado and the Front Range, looking at changes in employment between 2009 and 2014, with the intent of understanding how the State has accelerated out of the Great Recession. In 2014, Colorado agriculture employment ranked 25th in the US with a location quotient of 0.69 (representing 14,900 jobs), pointing to an employment level in “traditional” agricultural production that is “under-sized” relative to national averages. Statewide strengths in “traditional” agriculture include cattle and dairy production as well as meat processing, wheat, and potato production. For the Front Range, there is clear manufacturing and food processing

strength in non-alcoholic beverages, breweries, distilleries, dairy, grains, and specialty foods manufacturing.

For NWC, the analysis also points to opportunities linked with agriculture-related sectors that would not be traditionally seen as connected to agriculture, including veterinary services, research and development in biotechnology, and water-related technology and engineering services. The cluster analysis sheds considerable additional light on these emerging cluster opportunities that are likely to shape the future economic development opportunity at NWC.

FRONT RANGE ECONOMIC CONTEXT

The NWC NextGen Economic Development Strategy is unfolding at a unique moment in time for the Front Range and Colorado. Unlike other U.S. Metropolitan Areas, the Front Range has accelerated out of the “Great Recession” at a dramatic pace and now competes favorably with the top 20 U.S. metropolitan areas, including established bio-technology hubs in Boston, San Francisco/Silicon Valley and San Diego. This consequential rate of growth has direct bearing on the future trajectory for development of NWC, focused on demand for agriculture, food, water, built commercial and industrial real estate, and regional job creation. Our analysis yielded key performance metrics that frame market opportunities for NWC:

Regional Real Estate: Future private sector development at or adjacent to NWC ultimately needs to unfold in context with broader regional demand for office, retail, residential, and industrial real estate. Since 2006, the Denver Region has sustained relevant shares of growth in occupied commercial real estate since 2006, for example capturing about 745,000 square feet per year out of total growth in regional occupied space of about 1.8 million square feet per year.

Regional Water Consumption: Denver Water provides drinking water to a large service area along the Front Range. Since 1970, while their

service area has grown by 442,000 residents, total treated water consumption has only increased from 59.5 million gallons to 60.1 million gallons. With the Front Range poised to see population growth of up to 80,000 residents per year according to the Colorado State Demography Office, organizations such as Denver Water will need to:

- Fund new approaches to help customers become more efficient with water
- Identify sources of reusable water (i.e. grey water systems)
- Support innovation

Growth in Denver Metropolitan Area Food Exports: According to the Brookings Institution, between 2003 and 2014, 9 out of 10 food manufacturing sectors experienced annualized growth in exports of greater than 10% per year. Sectors such as Meat and Poultry remained largely constant over the period. Beverage products accounted for the largest aggregate increase, followed by dairy products and grain & oilseed products. With the Front Range offering a number of firms with strength in food production and processing, opportunities to support new job creation through export assistance will be important.

INNOVATION DISTRICTS AND ECONOMIC DEVELOPMENT

Agriculture and innovation served as the focal point for the groundbreaking 2014 CSU study, *The Emergence of an Innovation Cluster in the Agricultural Value Chain along Colorado’s Front Range*, clearly delineating emerging opportunities to grow an innovation-led industry cluster in agriculture and food. This effort brings the economic development implications for NWC in supporting innovation into sharper focus, to frame how deliberate policy choices can be leveraged to accelerate regional job creation and enhance the international competitive position of the Front Range.

Our experience shows that university-linked research and development (R&D) as an economic development driver is a recurring theme, closely associated with the development of research parks. Over the last 30 years, attraction of R&D has been consistently seen as a route to expand local economic activity, create new businesses that foster productivity improvement and innovation, and drive job creation.

Universities like Colorado State University (CSU) have always been crucial anchors for research and development, initially sponsoring the global emergence of research parks to create locations where public and private research grants can be leveraged to create new spin-off companies. In looking at U.S. data from the National Science Foundation, it is clear that basic agricultural research represents a relatively small portion of overall university R&D spending, about 5% nationwide in 2014. Spending in the medical and biological sciences represents more than 45% of total R&D activity. For NWC, future activities need to unfold across a spectrum of R&D activity in the plant and life sciences, rather than only in agriculture; strategies that link animal and human health could be one example.

While the research park model has been around for more than 30 years, recent evolution in the model is important for NWC, linked with two explicit transitions that have emerged in the past 15 years:

For NWC, future activities need to unfold across a spectrum of R&D activity in the plant and life sciences, rather than only in agriculture; strategies that link animal and human health could be one example.

1. From traditional university-led research development to explicit tech transfer and partnership with the private sector
2. From isolated suburban corridor and campus locations to increasingly urban, more compact and dense locations, connected by transit and anchored by a more diverse mix of uses

Innovation Districts are increasingly seen as essential locations where federal funding for research in the plant and life sciences can be leveraged to spin off ideas into private sector opportunities. These place-based environments become key ingredients in innovation, as immediate proximity creates opportunities for “accidental collisions” or “deliberate serendipity” between people. Ultimately, successful innovation centers are able to leverage greater density & interest in mixed use to create place-based outcomes that private-sector companies increasingly seek out to access and cultivate talent. The combination of growing critical mass and a technical workforce facilitates innovation and supports employee retention.

For NWC, the analysis highlights three primary variations linked with varying levels of university participation:

Research and innovation Districts: Place-based districts linked to health care and life sciences research; CORTEX in St. Louis is one example

Food Hubs: Districts which align farmers with food producers and consumers; the Louisville Food Port and Detroit Eastern Market District are examples.

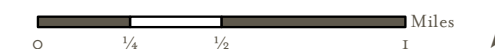
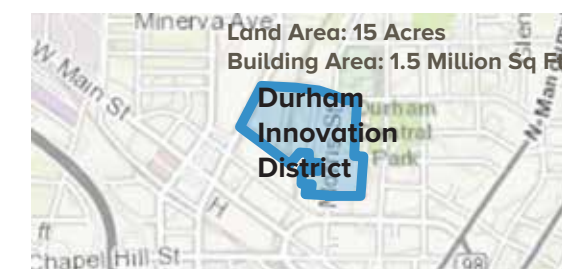
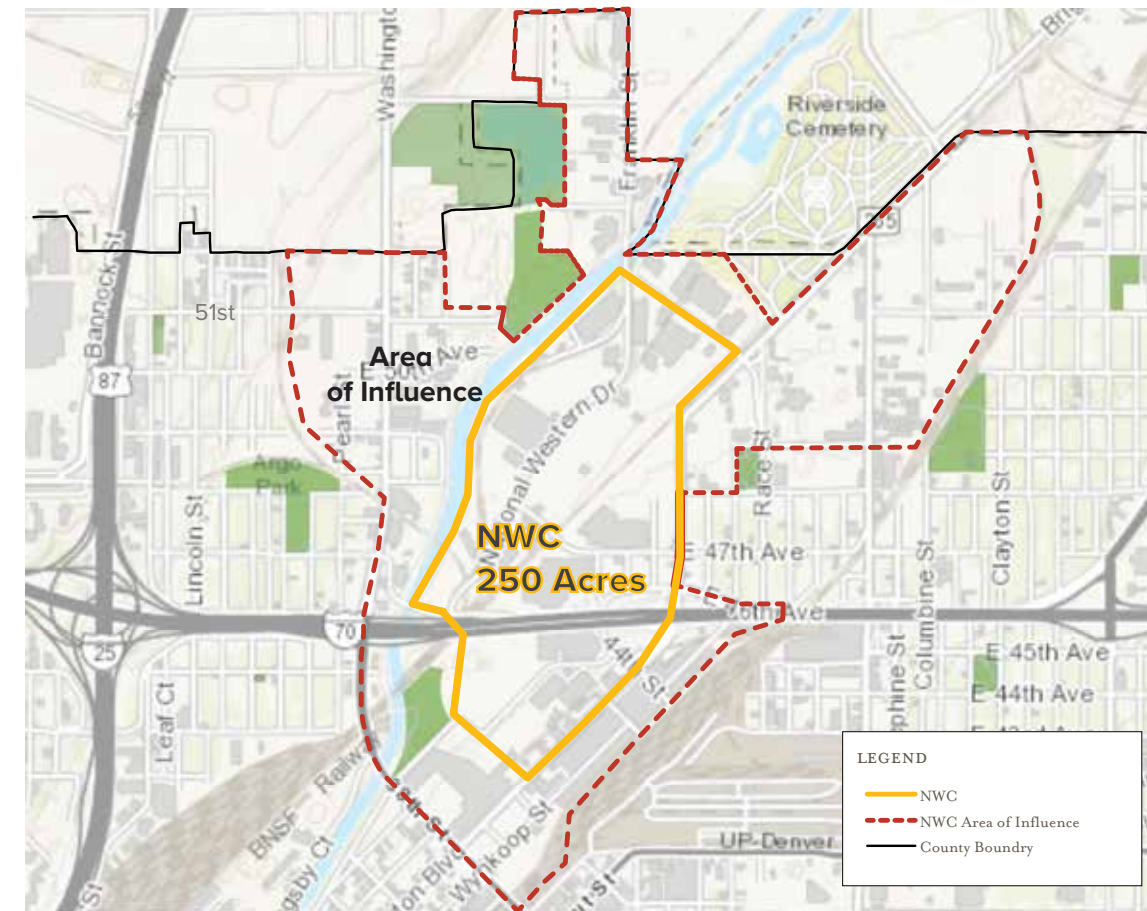
Regional Value Chain: regional focus on a specific sector, but more about corridors and branding; KC Animal Health Corridor is an example

Core Implications for NWC Include:

- Place based innovation districts tend to incorporate up to 3 million sq. ft. of office & lab space, at urban / neighborhood development density (i.e. floor to area ratios between 1.0 to 7.0), with mixed use and transit connectivity. Lab spaces tend to cover up to 50% of these programs.
- Successful districts tend to have a focus or emphasis; research related to health care is an example.
- Successful districts incorporate partnerships with the private sector, including companies and developers.
- NWC innovation will require a minimum amount of land, which may or may not be available within the Core NWC site, extending to a larger “Area of Influence”, defined below.

The following map summarizes the geographic scale of several specific Innovation Districts, all placed in scale with the size of NWC and a broader “Area of Influence” around the site. The other area of influence shown in figure 2 represents possible areas where industry associated with the NWC could consider locating in the future.

Figure 2. NWC - Innovation District Size Comparison



STRATEGIES FOR URBAN INFILL AND FOOD-LINKED MANUFACTURING

NWC revitalization is unfolding within a broader “area of influence” which has a significant and unmistakable industrial tradition. Our national experience regarding these areas reinforces several ideas:

1. Districts similar to NWC (i.e. close-in older industrial areas proximate to downtown) can be found across the country.
2. Many districts still support industrial activity, including modern “advanced manufacturing” activity, which necessitates conversations about freight movement and truck impacts.
3. Many districts are seeing pressure for land use change; in Chicago, areas zoned for planned industrial use, such as the Clybourn Corridor and the Near West Side (long the traditional home of wholesale food companies) are now in transition.

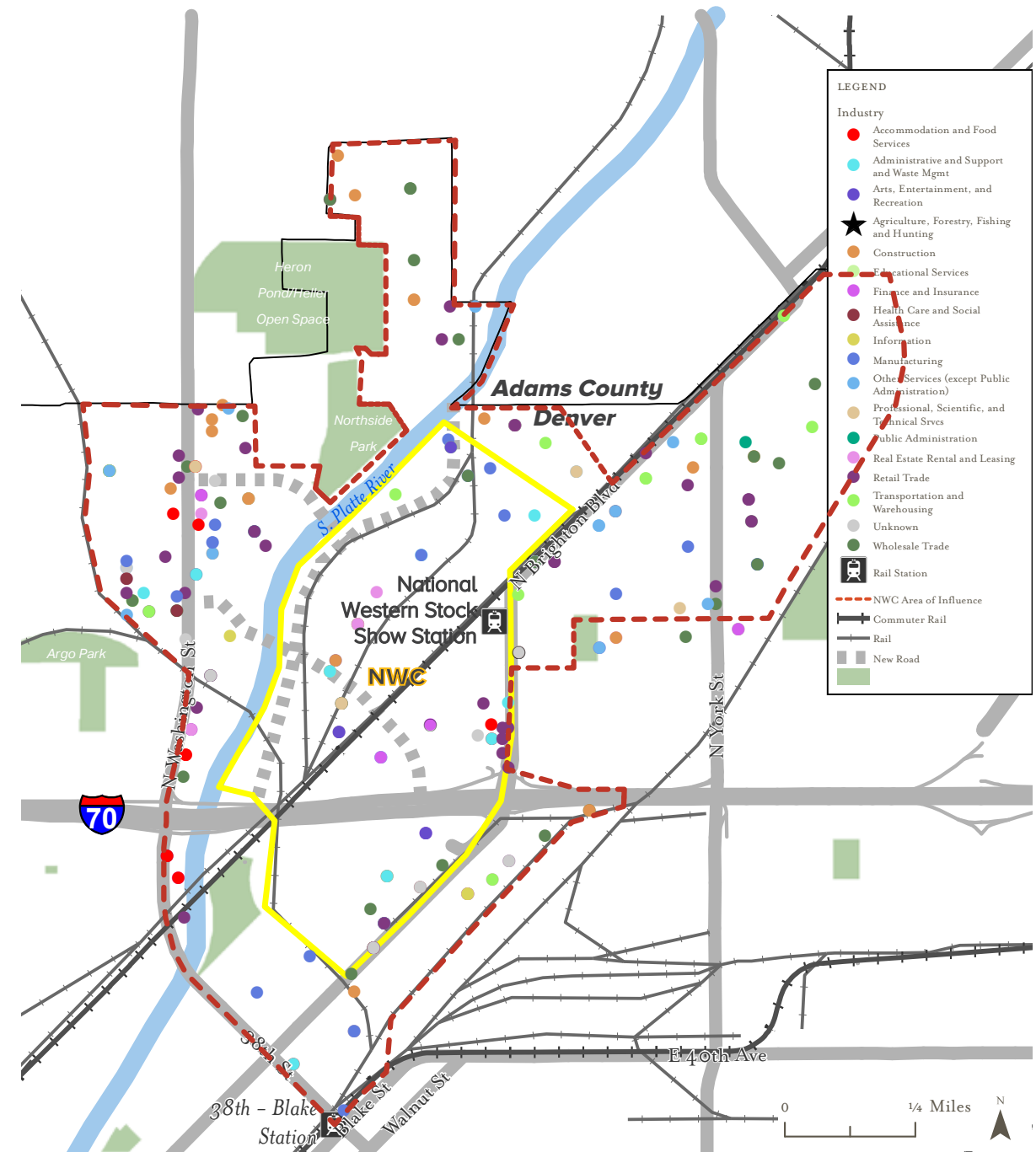
These Districts tend to move along one of two divergent trajectories:

1. Districts that are clearly in transition toward higher value mixed use: CORTEX in St. Louis, RiNo in Denver, the Menominee Valley in Milwaukee, Goose Island in Chicago, and Scotts Addition in Richmond, VA.
2. Districts that are expected to remain largely in industrial use: Examples include the Mt Elliott Corridor in Detroit, and the Park Hill Industrial Corridor in Louisville.

NWC Implications:

- End markets are increasingly global in nature, and that tools to grow exports, as well as strategies that maximize supply chain connections will matter more and more to regions that continue to specialize in manufacturing.
- The defined area of influence around the NWC includes more than 3,000 jobs in companies across a broad number of industry sectors, including manufacturing, distribution, services, and construction. Data suggests that the majority of people commute into this area daily. (Map on following page).
- The broader set of infrastructure improvements proposed as part of NWC revitalization as well as transit-oriented improvements are likely to improve access through the area of influence and gradually encourage land use change.
- As NWC revitalization unfolds in coming years, new companies will consider relocating to sites within the area of influence. The following section summarizes sectors that are viewed as being more likely to consider the NWC site and broader area of influence.

Figure 3. NWC - Economic Area of Influence in the City and County of Denver



Source: Colorado Department of Labor

PRIORITY CLUSTERS FOR NWC


AECOM took a deeper dive into specific 5-6 digit NAICS code level industry sectors focused on traditional agricultural and food-related sectors as well as a broader set of industries which provide support to agriculture. The analysis focused on the 2009 to 2014 period for the State of Colorado and an area defined as “the Front Range”. Employment data from the Colorado Department of Labor was used, and correlated with patent-based employer listings provided by Colorado State University (CSU). The resulting dataset included more than 34,000 firms as of the third quarter of 2014. AECOM identified the following “clusters” of economic activity that have clear potential to anchor future job creation at NWC. Each circle provides a sense of

the total employment in each cluster along the Front Range, as well as the number of new jobs created between 2009 and 2014. Each identified cluster includes a circle that is sized to reflect the number of Front Range Jobs associated with agriculture. For example, in Water, Infrastructure, Energy, Engineering, the Front Range saw the addition of 1,260 new jobs between 2009 and 2014.


The below matrix table highlights clusters that drove creation of more than 10,000 jobs since 2009. The table includes **clusters that appear to be clear elements of an NWC strategy, including:**

- **Water, Infrastructure, Energy, and related Engineering**
- **Manufacturing - Beverages**
- **Manufacturing – Specialty Foods**
- **Manufacturing – Cattle and Dairy**
- **Aerospace UAV Mapping – Ag Related**
- **Cattle, Dairy, Animal Health and Testing**


Water, Infrastructure, Energy, and related Engineering

	Statewide Avg Hourly Wage	\$43	Cluster added 17,200 jobs since 2009, with growth in scientific consulting and oil & gas; the Front Range added about 1,260 jobs. Opportunities include Environmental Consulting Services, Water Supply & Irrigation systems, and associated infrastructure.
	2014 Average State-Wide Location Quotient	1.82	
	2014 Front Range Jobs	7,625	
	Annual Rate of Job Growth, 09-14	0.037	


Manufacturing - Beverages

	Statewide Avg Hourly Wage	\$21	These processing and manufacturing sectors are heavily reliant on water; while sectors such as soft drinks, ice, and bottled water are mature, sectors such as beer, wine, & spirits have grown since 2009. This cluster has added > 900 jobs since 2009
	2014 Average State-Wide Location Quotient	1.54	
	2014 Front Range Jobs	6,949	
	Annual Rate of Job Growth, 09-14	0.031	


Manufacturing – Specialty Foods

	Statewide Avg Hourly Wage	\$22	Seven processing & manufacturing sectors are grouped as a specialty foods cluster. Water is important to the production process. This cluster has added about 800 jobs since 2009. Includes firms involved in processing of pet food, coffee, confectionaries, and snacks.
	2014 Average State-Wide Location Quotient	1.02	
	2014 Front Range Jobs	3,892	
	Annual Rate of Job Growth, 09-14	0.048	


Manufacturing – Cattle and Dairy

	Statewide Avg Hourly Wage	\$19	Includes cattle and dairy. Slight increases in employment. Significant connections into animal health, nutrition, and herd management; sensors, testing, and analytics for product quality and biosafety; and dairy production and dairy product manufacturing. Access to water and related infrastructure is important.
	2014 Average State-Wide Location Quotient	1.78	
	2014 Front Range Jobs	9,466	
	Annual Rate of Job Growth, 09-14	0	

Aerospace UAV Mapping – Ag Related

	Statewide Avg Hourly Wage	\$44	This cluster includes firms that produce drones for agricultural purposes as well as firms involved in surveying and mapping services. The cluster added about 1,000 jobs across the Front Range since 2009. This cluster has connections to software as well as advanced materials.
	2014 Average State-Wide Location Quotient	2.03	
	2014 Front Range Jobs	3,197	
	Annual Rate of Job Growth, 09-14	0.083	


Cattle, Dairy, Animal Health and Testing

	Statewide Avg Hourly Wage	\$36	This Front Range cluster saw growth of almost 1,800 jobs between 2009 and 2014. Research and development related to bio-technology is heavily concentrated along the Front Range. Across Colorado, these sectors added more than 4,000 jobs since 2009.
	2014 Average State-Wide Location Quotient	0.99	
	2014 Front Range Jobs	20,390	
	Annual Rate of Job Growth, 09-14	0.019	


The below table also includes sectors for which more research is needed to ascertain industry-to-industry connections, as well as place-based opportunities associated with anticipated future development in the area of influence. As one example, in 2016 CSU undertook research related to the development of nutrient rich “purple potatoes”. Sectors of emerging interest include:

- **Manufacturing - Sensors Instruments**
- **Manufacturing - Urban Vertical Agricultural Production**
- **Grain & Oil Seed Processing**
- **Potato Farming**
- **Wholesale Food**
- **Software Development – Ag Related**
- **General Office / Professional Services – Ag Related**
- **Financial Services**


Manufacturing - Sensors Instruments

	Statewide Avg Hourly Wage	\$42	This cluster includes companies that make devices and components that support agriculture related activities (such as lab instruments and sensors). Statewide, this cluster added about 900 jobs, with 170 concentrated in the Front Range.
	2014 Average State-Wide Location Quotient	1.79	
	2014 Front Range Jobs	1,581	
	Annual Rate of Job Growth, 09-14	0.023	


Manufacturing - Urban Vertical Agricultural Production

	Statewide Avg Hourly Wage	\$14	Cluster is focused on the emergence of urban vertical farming (companies such as FarmedHere, for example). Cluster has largely remained static in job creation along the Front Range since 2009. Cluster is relatively concentrated along the Front Range.
	2014 Average State-Wide Location Quotient	0.89	
	2014 Front Range Jobs	2,985	
	Annual Rate of Job Growth, 09-14	-0.005	


Grain & Oil Seed Processing

	Statewide Avg Hourly Wage	\$20	Grains processing, and associated manufacturing are viewed as a strategic sector for the state. These sectors added 1,140 jobs along the Front Range. This cluster has important connections into beverage manufacturing, as well as pet food production. “Growth opportunity”
	2014 Average State-Wide Location Quotient	0.92	
	2014 Front Range Jobs	5,464	
	Annual Rate of Job Growth, 09-14	0.048	


Potato Farming

	Statewide Avg Hourly Wage	\$13	While Potato Farming is not concentrated along the Front Range, the sector is highly concentrated in the State of Colorado (LQ>3.0). The primary of further study is whether there are in-state opportunities to add value to raw potatoes that are being grown in state.
	2014 Average State-Wide Location Quotient	3.7	
	2014 Front Range Jobs	74	
	Annual Rate of Job Growth, 09-14	0.073	


Wholesale Food

	Statewide Avg Hourly Wage	\$26	The wholesale cluster added 2,475 jobs between 2009 and 2014 along the Front Range. Wholesale opportunities need to be viewed in context with logistics and distribution strategies that align with export markets. Food related wholesale is seen as an opportunity for the area of influence. IT connections are also important
	2014 Average State-Wide Location Quotient	1	
	2014 Front Range Jobs	16,277	
	Annual Rate of Job Growth, 09-14	0.034	

Software Development – Ag Related

	Statewide Avg Hourly Wage	\$52	A major employer for Colorado, with attractive location quotients. Software is highly important in advanced technology, with particular impact on aerospace (drones) and manufacturing. For the Front Range, the above data likely under-estimates the number of agriculture-related software firms.
	2014 Average State-Wide Location Quotient	1.8	
	2014 Front Range Jobs	496	
	Annual Rate of Job Growth, 09-14	0.148	

General Office / Professional Services – Ag Related

	Statewide Avg Hourly Wage	\$36	This cluster includes several “general office” activities commonly associated with regional HQ, financial services and legal. For Front Range ag-related, employment increased by more than 600. NAICS 551114: Corporate, Subsidiary, & Regional Managing Offices includes companies which may be conducting research and testing; more research is needed
	2014 Average State-Wide Location Quotient	1.41	
	2014 Front Range Jobs	3,099	
	Annual Rate of Job Growth, 09-14	0.05	

Financial Services

100 New Jobs

Statewide Avg Hourly Wage	\$40	This cluster includes financial firms that provide services to the farming and agriculture sectors along the Front Range. The Front Range job estimates under-represent the number of ag-related jobs, as many banks provide loans to farmers. More research in this cluster is needed.
2014 Average State-Wide Location Quotient	1.32	
2014 Front Range Jobs	609	
Annual Rate of Job Growth, 09-14	0.037	

NEXT STEPS

Findings

The study has resulted in an improved understanding of the economic opportunities related to the National Western Center redevelopment and adjacent area development, including:

1. Reaffirmed the economic significance of an emerging agriculture innovation economy across the Front Range.
2. Focused on the catalytic role of the NWC in context with the Agriculture Innovation Triangle, to serve as a place-based innovation anchor to accelerate Front Range economic development and job creation, with emerging focus on food, water and animal / human health innovation sectors.
3. Identified the critical role and importance of anchors, such as CSU and Denver Water, as institutional anchors for the development projects and ensuring related economic opportunities.
4. Recognized the National Western Stock Show's role as critical link to both to NWC's agricultural roots and future economic opportunities, from cattle markets to environmental sustainable agriculture and livestock production. NWSS plays an important connecting role in all facets of the NWC, entertainment, education, research and economic opportunities.
5. Defined and measured key industry clusters across the Front Range that likely will drive economic sustainability, business development, and employment opportunities.
6. Emphasized innovation and commercializing research will lead to commercial successes (i.e. expanded opportunities in existing and new end markets), which takes a step beyond scientific and applied research in labs leading to new products, services and business success.
7. Framed the scale of opportunity, mix of business and innovation opportunities, which influences types and timing of development and supportive programs. Specifically, the NWC-led agri/innovation economy could lead to roughly 1 - 3 million square feet of lab, office and flex space for the homes of hundreds of companies and joint ventures, and thus thousands of jobs.
8. The broader area of influence around NWC includes a significant number of companies that support more than 3,000 jobs. The analysis reinforces the need to further clarify the types of business opportunities that are likely to emerge at the NWC and across the area of influence in coming years.

The concluding finding is that the NWC and the Agriculture Innovation Triangle must be a critical partner for the economic success of Denver, the metro area, and Colorado, and serve in at least four focused efforts:

- **Agricultural and sustainable resource literacy and awareness**, as the place where rural and urban Colorado connect to the world and the future – and serving as a formal and informal place where the exploration of an idea, our history, or our connection to the world occurs in a living classroom.
- **Entertaining and convening the best of Colorado and the American West**, from the NWSS to new events that brings the best of the world to our community and allows Colorado to show, demonstrate, share and promote products, skill and prowess, and ideas to the world.
- **Research**, from the lab to the “dining room table”, focused on developing products, tools, and technologies to meet the food and resources challenges facing our nation and the world.
- **Innovation and Business**, along with public-private ventures, are delivering innovative products, services, technologies, and practices – created through the linkage of science, technology, and agriculture and resource practice and knowledge – to meet food and resource demands of the world.

Next Steps

The NWC NextGen Agribusiness Economic Development Study has evolved and advanced our understanding of partnerships with the private sector, as well as community and institutional partners. The study builds a foundation for an economic strategy and business development work program, which together will enable the realization of economic opportunity for NWC, the adjacent area of influence, and the Agriculture Innovation Triangle in Colorado. The following provides a roadmap, and some of the specific next steps for building on this foundation, through four linked elements: active engagement, advanced analysis, strategy development, and foundational implementation.

1. **ENGAGE:** Active engagement with current and future stakeholders and partner, including elected and appointed officials, institutional anchors, neighborhood residents and organizations, business leaders (local and in identified clusters), and education leaders.
 - a. Hold an Agriculture Forum (Fall 2016), featuring the business and agriculture changes and opportunities, briefing and a release of this report, and a discussion on economic/business opportunities and challenges.
 - b. Continue engaging and communicating with neighborhood residents and stakeholder groups.
 - c. Brief partner and industry business organizations to discuss business and contracting opportunities.
 - d. Leverage and advance opportunities for Denver Water and other water-oriented partners at NWC.
 - e. Convene educational partners and global university research networks to begin developing the future workforce training and education opportunities and promote local residents access.
 - f. Inform and convene business technical assistance providers, financing and other business services partners and organization to coordinate and provide business services to Globeville Elyria-Swansea (GES) firms.
2. **ANALYSIS:** This study explored global, national, state and local economic and demographic data to frame the economic situation and opportunity, investigate current business activity, and identify economic clusters where apparent comparative advantages exist for NWC, the Agriculture Innovation Triangle, and Colorado. Additionally, the study focused on best practice NWC-type innovation district developments to analyze factors influence their success. The next steps call for an advancing of this analysis, both a continuous updating to ensure data-driven information for decision choices and digging deeper into the data for specific actionable strategies and steps. Recommended advanced analysis includes:

- a. Update agriculture-related patent data (matching the strong research completed by CSU) for local companies to support identification of priority companies that can support ag-related innovation at NWC.
- b. Continuously update firm data analysis, at the national and local level, to monitor market changes and identify gaps and opportunities for business cluster prioritization. Additionally, expand the outcomes data to provide information for determining attraction and growth targets.
- c. Link firm data from public and private sources, like CSU's patent data, Denver tax data, and other economic data, to confirm market leading firms and clusters.
- d. Evaluate industry output per worker trends or employment / output multipliers for agriculture-linked sectors in comparison with the broader economy.
- e. Update information and analysis regarding regional venture capital as well as university R&D spending, with emphasis on ag-related sectors.
- f. Monitor business and cluster performance and characteristic information to better understand location and business requirements to ensure the NWC and the Agriculture Innovation Triangle are focused on providing lab, office and flex space and program support desired by the targeted firms.
- g. Maintain information of foreign direct investments and export activity, in partnership with other global economic development efforts, with an emphasis on national and local activity in products, services and technology related to agriculture production and resource sustainability.
- h. Regarding the area of influence, conduct additional infrastructure and land use assessments to better frame re-use and revitalization opportunities, consistent with neighborhood plans.

Providing the opportunity for serendipitous collisions on-site is necessary to encourage innovation and economic development.

Strategies

Create a comprehensive economic development strategy, with a specific focus, leading to growing an innovative, globally-focused business area. This strategy builds on the economic cluster findings, and sets a plan for growing, starting, and attracting firms that would strategically benefit from locating in or working with businesses, researchers, and stakeholders within the envisioned NWC campus.

- a. Update trends in global agriculture that will influence demand for Colorado products in existing and emerging end-markets.
- b. Complete interviews with companies in specific NWC economic clusters to understand specific dynamics and sector linkages/needs, as well as evolving workforce requirements, both short- and long-term.
- c. Identify connections and systems which will enable serendipitous collisions between businesses, researchers and thought leaders causing an environment of innovation and cross cluster opportunities or solutions,
- d. Assess the extent of and capacity within the supply chain in Colorado and the Front Range for manufacturing, to understand source markets for raw materials, B2B products and services, and commodity flows, as well as local global end markets for finished goods.
- e. Understand the existing and evolving economic development strategies for key areas in the Agriculture Innovation Triangle. Identify shared strategy elements, opportunities to collaborate, and mutual reliance in specialization across these local and regional strategies.

- f. Create workforce and business development programs that both link with the broader strategy and explicitly drive job creation.

- e. Build on the existing workforce data to better link neighborhood residents with job training, and connect firms with capable employees.
- f. Actively recruit and grow existing firms in agriculture-related sectors to Denver, with a goal of locating or relocating these firms (at the appropriate time) in the NWC influenced area.
- g. Host partner organizations and programs to provide technical business assistance in the co-working laboratory and flex space building – serving building and area businesses.
- h. Continue collaborative partnership development work between Denver Water and CSU at NWC.
- i. Develop a 10-year job training plan that links with agribusiness opportunities. Possible workstreams include:
 1. Focus on Science, Technology, Engineering, and Math (STEM) programs at the K-12 educational levels.
 2. Increase deliberate linkages between companies, schools, and workforce intermediaries.
 3. Align training priorities with end market industries that have growth prospects.

Implementation

A business development program that aligns public and private resources should be initiated. Denver OED's city-wide economic development strategy and the JumpStart work plan identify a number of initiatives that are critical for achieving the NWC economic and business success, these initiatives include, but are not limited to:

- a. Development of a building with laboratory in the NWC influence area, for the purpose of locating and growing cluster-identified firms into the area to begin building the business cultural connections and provide a location where the scientific and applied research can be commercialized and created into business enterprises.
- b. Further strengthen global business connections through Foreign Direct Investment (FDI) and export development activities (building on City and State resources) to identify and foster export ready companies, linking them with global market opportunities.
- c. Establish an NWC Innovation Investment Fund to support growth of agribusiness opportunities that align with identified priority sectors. Federal agencies such as the U.S. Department of Commerce, Economic Development Administration should be pursued for funding.
- d. Identify potential neighborhood businesses with potential interest and capacity (existing or to be developed) for prime or sub-contracting projects related to the infrastructure, public and/or private building construction, or other needed services and products,



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