



Mitigation Changing the Tide: A Case Study of the 56th and Morton Flood Risk Reduction Project

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LOWER PLATTE SOUTH
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A Dangerous Problem

After rainstorms, walking into work is a nightmare for Rick Wagner. It seems reasonable to expect your business to mostly remain dry, even when it rains. Instead, Wagner frequently finds four inches of standing water inside his buildings, with up to four feet of standing water outside. Wagner is the president of Lincoln Tool and Design, a locally-owned and operated manufacturing plant. His business presses against a drainage channel whose ditch runs along 56th and Morton Street in Lincoln, Nebraska. Since moving his business here in 1997, he and other property owners in the area face serious trouble with flooding.

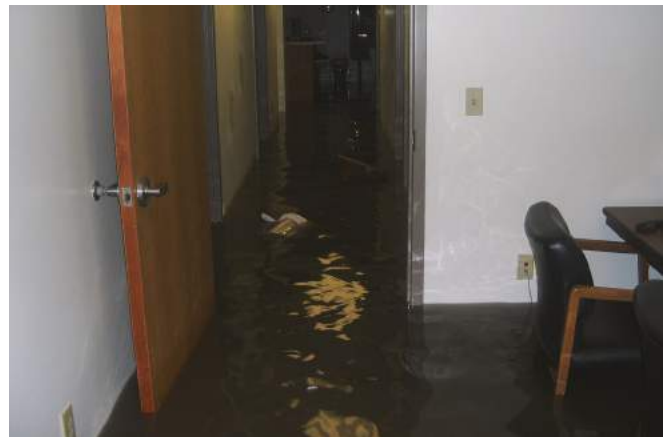
In 1996, before purchasing land at 56th and Fletcher Avenue (which is next to Morton, the project's namesake), Wagner was wary of the area's drainage ditch and the threat it might pose to his business. During rainstorms, he would drive over to see if the ditch overtopped. At the time, he couldn't see any localized flooding. But as the years went on, he couldn't help but notice that the channel started to flash flood when it rained.



Water levels rise in the 56th and Morton complex

Whenever Wagner's buildings flood, as often as three times a year, business grinds to a halt. Production stops, deliveries don't go out, customer services cease, and critical day-to-day operations come to a standstill. All 48 employees, from the machinists to the administrators, stop what they're doing to address the flood damage. Usually, clean-up efforts take a full 24 hours, if not longer. Wagner estimates that every hour spent not working costs his business \$2,500. After a particularly damaging flash flood in 2010, Lincoln Tool and Design filed a \$25,000-dollar insurance claim for office repair.

Adjacent businesses and property owners have long endured these surprise expenses, ones that impact productivity, and routinely damage warehouses, production areas, expensive technical equipment, and office furnishings. Road Builders, another nearby business, stopped using the lower drawers of filing cabinets, and taped power cords high up walls; everyone knows the lower half of the office floods.



Flooded offices in the 56th and Morton complex

A Dangerous Problem

These frequent flash floods aren't good for businesses' pocketbooks or for morale, Wagner said. His employees are frustrated, and not just because of new job requirements as flood fighters. The implications of this hazard go beyond damage to businesses. Each aspect of employees' lives is impacted during flash floods. Even when rain events are minor, like a two-year flood event—a little less than 2 inches of rain an hour—the whole area is submerged within a small window of time.



Water levels rise in the 56th and Morton complex

As a 24-hour operation, Lincoln Tool and Design is always at work with employees on-site. Whenever water levels in the channel rise, people are stranded until waters recede, because there is only one road into and out of the 56th and Morton complex.

As the road and area flood, people can't get to or leave work. Their ability to pick up children from school or attend other commitments is compromised. On top of this, flooding has ruined employees' personal vehicles, and damaged cars require more time away from the job to coordinate repairs or replacements. The effects of flooding reach into the personal lives of those in the area, and the broad economic impact of flooding is no less significant.

The economic burden of flooding weighs heavily on business owners and city officials. Cyndi Lamm, current City Council Member for this district, expressed concern about this issue. For years, her office has received complaints about the severe

flooding her constituents experience. She recognizes the importance of business owners' ability to maintain safe working conditions for their employees. When employees don't feel safe, local businesses have trouble retaining and recruiting talent, which can inhibit economic growth. These routine flood events hinder the momentum of an industrial area that generates significant revenue within Lincoln's economy.

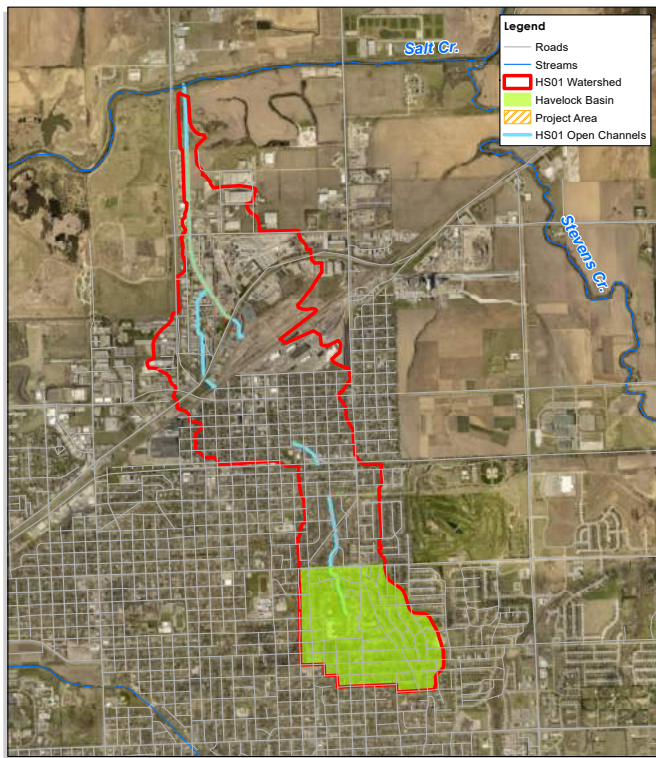
There's little hope of attracting new businesses to the area, because 56th and Fletcher Avenue is generally identified by its pock-marked road, its dilapidated ditch, and, of course, its flash floods. These dangerous conditions bring with them troubling implications beyond headaches, inconveniences, and income loss. Perhaps most concerning is if an emergency occurred during a flood, emergency personnel simply would not be able to respond. When the channel rises above its narrow banks, the road floods completely, and any vehicles attempting travel—even emergency response vehicles—could be swept away. As these flooding impacts make clear, 56th and Fletcher Avenue has a dangerous problem.



High water levels in the channel

Flooding primarily strikes this highly urbanized, commercial, and industrial complex where businesses like Lincoln Tool and Design and Road Builders operate. The problem lies with the channel itself, the drainage ditch that runs to Salt Creek, a tributary of the Platte River. The channel is an unmanageable and narrow wasteland, and its roadway crossings are undersized, prone to overtopping. Water in the channel sources from the 56th and Morton Watershed at Fletcher Avenue in northeast Lincoln. The whole drainage area is about 1,300 acres and drains north.

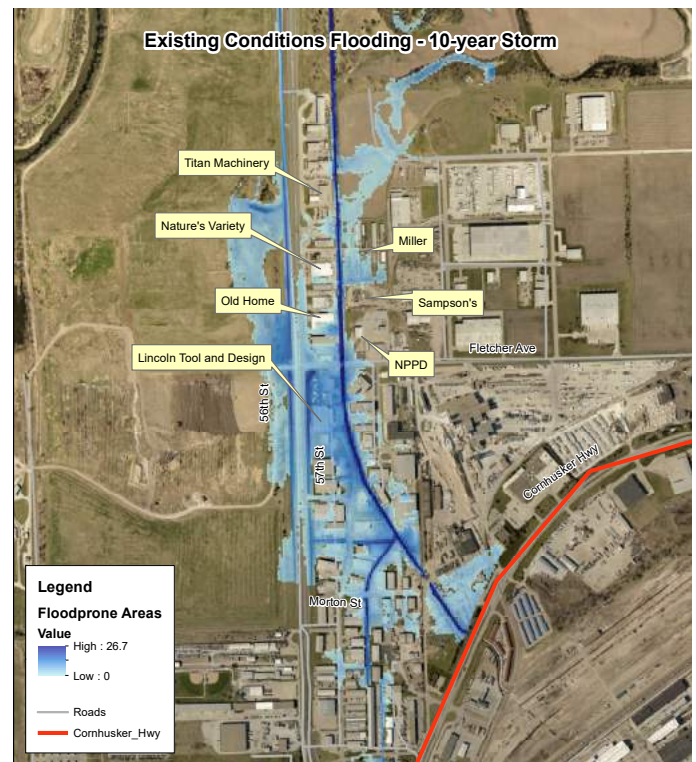
A Dangerous Problem



Salt Creek to Havelock Area

This drainage channel was developed between the 1950s and 1960s to carry water from the Havelock area to Salt Creek. The intersection and business district of 56th and Fletcher Avenue developed right in the channel's path. Ben Higgins, senior engineer with the City of Lincoln, explained that after the channel's construction, flooding became inevitable. Construction standards at the time did not include detention requirements (established in the 1990s) which mandate detention basins hold a certain amount of runoff—requirements specifically designed to reduce flood risk.

Development in the area bloomed as rainfall averages and thunderstorm severity increased, all without modern detention requirements. The channel and bridge quickly proved insufficient. While more businesses moved into the vicinity, the problem spiraled out of control. The city could hardly maintain the channel, as over decades property owners spread out, making it nearly impossible for maintenance crews to access the channel at all. Without the city's regular maintenance, the channel became a dump, where washing machines, old tires, and other trash could be found dropped in its belly.



Preliminary 10-year floodprone areas

After Lincoln Tool and Design flooded the first time in 2002, Wagner called the city. Initially, not much happened; one issue weighed against the needs of a whole city takes its place in the queue. But Wagner is nothing if not persistent. The second time his property flooded, he called again. This time, the city paid closer attention.

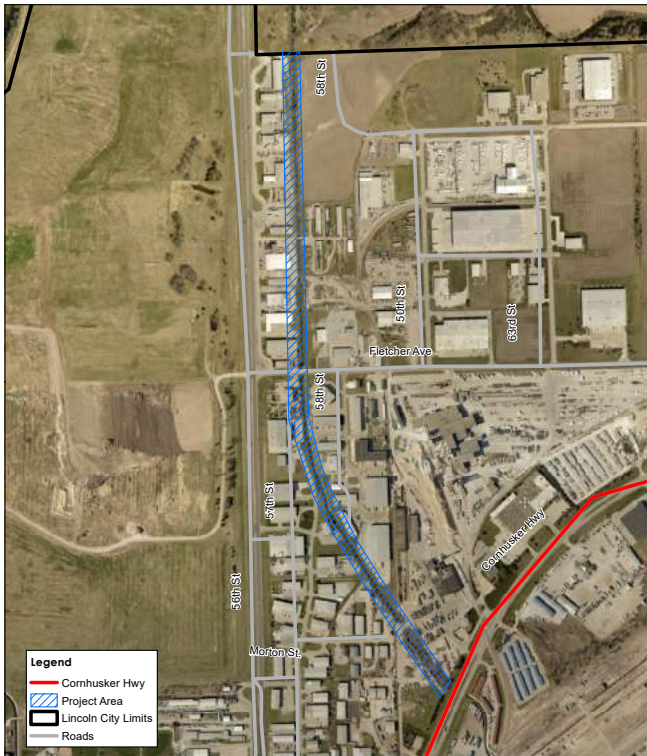
In addition to Rick Wagner's complaints, Ben Higgins fielded calls about flooding from other area property owners *and* received multiple anonymous letters from a concerned citizen, with pictures of the flooding included in the envelopes.

When interviewed, Higgins explained that as funding allows, the City of Lincoln takes a proactive stance on mitigation. Once aware of the mounting flooding problem in northeast Lincoln, the city acted. In 2005, they officially hired JEO Consulting Group (JEO) to conduct urban drainage studies to locate Lincoln's biggest flooding issues. JEO conducted a broad, conceptual analysis of the Havelock Salt Creek Sub-Basin 01 (HS01)—the watershed which includes the 56th and Morton channel. Engineers looked upstream of the channel to evaluate the

watershed and stormwater system at large. It identified severe sub-basin deficiencies and an open channel problem downstream, where the drainage channel in question lies.

After engineers delivered the HS01 urban drainage report to the city—while flash flooding continued to occur—Ben Higgins recognized the need for further action. As a senior engineer for the City of Lincoln, Higgins juggles a large number of projects. So in 2010, the city worked with consulting engineers to develop a preliminary engineering study that specifically examined the open channel problem identified in the urban drainage study: the 56th and Morton drainage channel.

A Promising Project



56th and Morton Project Area

Preliminary engineering studies zoom in, precisely quantify a problem, and outline the benefits and costs of potential solutions. Consulting engineers detailed and weighed possible mitigation projects based on the city's needs. Several were discarded

for being too expensive without much benefit, and others for being short-term solutions that passed the problem downstream. Trying to fix the root of a significant problem, and not just the symptoms, takes time and can be expensive. The preliminary engineering study ultimately recommended one course of action that would most benefit stakeholders long term through an integrated and resilient project. They proposed a rehabilitation of the whole area; widen the drainage channel and replace the bridge.



Proposed conditions that reduce floodprone areas

The engineers recommended this project because it significantly reduced flooding risk and provided the greatest number of sustainable benefits. The initial project design proposed replacing the existing twin 5'x5' box culvert with a 70' concrete slab bridge; widening the channel for approximately 5,000 LF; and removing a privately-owned bridge that bottlenecked the whole channel. The preliminary engineering study indicated the amount of flood risk reduction made possible by this project would be substantial: By widening the channel, the project would lower the water's surface elevation between two and four feet during heavy rainfall. This project would also designate access points for city maintenance workers; for years the channel had been too dangerous to maintain due

to its hazardous trash and steep sides. (In 2010, a city worker died in the channel when their mower rolled. After that city officials refused to mow it.) A flood risk reduction project would address critical problems in the channel and make it safer for everyone.

The other reason to support this project involved its long-term view of an integrated solution. By addressing the root of the problem and investing in flood risk reduction, the city would be solving a grave concern of city residents while reaping environmental, social, and economic benefits. But even as the most cost-effective option, this solution would be expensive, somewhere in the range of three or four million dollars. There was no way the City of Lincoln could shoulder the costs on their own.

A Committed Collaboration

What seemed like an insurmountable funding issue was averted in part through a strategic partnership. The City of Lincoln and the Lower Platte South Natural Resources District (LPSNRD) have a committed and reciprocal relationship. At the heart of their partnership is the understanding that together they are stronger than apart, and that each entity is dependent on the other's success. When city leaders and natural resource managers act separately, communities suffer and resources dwindle. But when they unify, effective change is far more likely. Lincoln and the LPSNRD's coalition benefits the region.

Officials from the city and LPSNRD meet once a month to discuss upcoming projects and opportunities to lend each other a hand. Throughout the duration of the city's urban drainage studies and preliminary engineering study, the city kept the LPSNRD informed. When the LPSNRD began planning the development of their Multi-Jurisdictional Hazard Mitigation Plan (HMP) in 2009, communities throughout the district, including the City of Lincoln, were included as participants. The LPSNRD and city knew that without significant funding assistance, the proposed 56th and Morton flood risk reduction project would be impossible. The funds secured by

a hazard mitigation plan, however, could actualize the project.

Through the HMP process, the LPSNRD and City of Lincoln, with support from JEO, conducted a risk assessment and ranked the area's natural hazards. With flooding defined as a hazard of significant concern for the city, the 56th and Morton flood risk reduction project was included in the HMP as a mitigation alternative to reduce vulnerability and build local resilience. The benefit of including the project in the HMP was the potential to pursue funding assistance through FEMA's Hazard Mitigation Assistance (HMA) program. One funding arm of the HMA is the Hazard Mitigation Grant Program (HMGP). Projects submitted to the HMA (and approved for assistance) receive up to a 75% federal cost share, leaving the local jurisdiction 25% of the mitigation project's costs. Given the risk ranking for flooding within the City of Lincoln as a part of the LPSNRD's HMP, there was the potential to apply for FEMA funding assistance.

Through the diligent work of the city and LPSNRD, as well as the support of their hired consultants, the 56th and Morton flood risk reduction project was viable. With approval of the HMP in 2009, the city could apply for project funding through HMGP monies. The project team first sent the 56th and Morton flood risk reduction project to FEMA in 2013 for approval. At this point, the total project cost estimate hovered at \$3.25 million. Because of this mitigation project's inclusion in the HMP, the project team assumed 75% of its costs would be covered by FEMA. Invested in the city's success, the LPSNRD agreed to fund 12.5% of the remaining 25% for which the city was responsible. In other words, there was a gleaming way forward.

The project's feasibility was also due in part to the city's decision to contract urban drainage studies in 2005 and the preliminary engineering study in 2010. Drainage and engineering studies are comprehensive and take years to complete. To be included and approved in the HMP, FEMA needed documented proof of the flooding problem. Without these studies, there simply would not have been time to do the necessary research while writing the HMP.



Aerial view of the drainage channel

A Funding Odyssey

In addition to funds granted by the HMP, the city worked independently to secure its portion of project funding. Since Lincoln's various engineering studies proved the importance of continuous improvements to the stormwater system, Lincoln's city leaders issued a bond in 2012 to address this need. The bond intended to fund the city's 12.5% portion of the 56th and Morton flood risk reduction project. Though the bond passed, federal funds weren't available. Without FEMA's 75% contribution of project costs, the city couldn't move the project forward. Disappointed but undeterred, the city allocated the bond funds to other projects.

Later in 2013, FEMA's HMGP conditionally approved Lincoln's 56th and Morton flood risk reduction project, pending federal funding availability. Project approval had been dependent on an initial benefit-cost analysis (BCA) JEO conducted, which evaluated the project's future benefits (projected damages or losses avoided) against the costs.

Many federal grant programs, including FEMA's HMGP, require an analysis of project benefits compared against overall design and construction costs. The typical expectation is that a project will yield a minimum return equal to the overall project cost (every one dollar spent the project will save or reduce future damages by one dollar). The 56th and Morton project's first BCA demonstrated that for every dollar spent on the project \$1.70 would be saved. In short, this analysis provided critical documentation that made FEMA funding assistance possible.

The primary benefits considered in the first BCA included the reduction of flood damage to structures, utilities, and infrastructure, whose avoided losses equaled some \$6.6 million in benefits.

Despite the positive results of the BCA, the project team faced challenges as it navigated the complicated terrain of securing project funding. Although FEMA had approved the project in 2013, funding for Phase I project design wasn't issued until March of 2016. Even with funding secured, the project team had a few

more barriers to hurdle before beginning project work. To meet federal procurement requirements, the city moved forward with a competitive selection process to pick the engineering firm best suited to support them in this project. This procurement process added several more months to the project timeline.

While the contracting call went out, the city again turned its attention to locating funds for its respective 12.5% of the project's costs. Lincoln issued a second stormwater bond in 2016. Like the 2012 bond, funds would be directed to the 56th and Morton flood risk reduction project. Supporting the city, the LPSNRD activated its group of professional engineers to remind the public of the benefits of the stormwater bond. Once again, the relationship between the city and the NRD changed the game; the bond passed overwhelmingly. With support from the 2016 stormwater bond, FEMA funding, and the local match from the LPSNRD, full funding was guaranteed.

When interviewed, Council Member Lamm spoke about the success of the 2016 bond and drainage studies that ultimately secured HMGP funds. She remarked that "city leaders worked to ensure that this project would have the city's share of funding ready so that we could move forward immediately if federal funds were made available. City staff diligently developed studies, reports, and plans that allowed the city to apply for and make the most effective use of available funds." Through proactive planning, the city made certain all the necessary pieces were in place for impactful mitigation.

Once the procurement period concluded in the summer of 2016, the city selected JEO to continue the project. Now, JEO had nine months to complete all design. As design and initial permitting began, the project team discovered a problem: widespread easement encroachment. Over the years, property owners along the channel slowly crept onto the channel's easements. Many had unwittingly moved driveways, parking lots, and equipment yards closer and closer to the ditch, which was part of the reason the city couldn't access it safely. Without those easements, channel widening would be impossible.

After the city and their legal team reviewed local records, their lawyers found discrepancies in easement documentation. Property ownership had changed hands and original easement documentation was unreliable. Furthermore, some property owners had no knowledge of the easements, and were surprised when they learned of them. Still, the project team needed to acquire 42 easements to construct the improvements. Even with this challenge, Phase I had to be completed by March 2017 or funding would expire. The clock was running.



Easement encroachment along the channel

A Community Engaged

To facilitate easement negotiations, JEO tapped their Community Engagement team. The city and JEO understood that when working with citizens, compromise and communication often garner success. While the project team was working to secure easements, they also sought public input on the 56th and Morton project's design. To meet the city's goals of easement acquisition as well as public participation, JEO's Community Engagement team crafted a community-informed design strategy. This strategy employed three methods to activate the public: one-on-one meetings with property owners; local stakeholder meetings; and open houses.

JEO's Community Engagement team met individually with over thirty property owners in the 56th and Morton area. They talked with people as non-tech-

nical advocates, non-engineers who wanted to hear community members' concerns and ideas. By providing the community with multiple opportunities to get involved and provide comments, the team prioritized local feedback. After all, the property owners were on-the-ground experts with invaluable knowledge about the area they inhabit.

In community discussions about the project, two related construction projects were suggested. Community members brought up the neglected state of Fletcher Avenue's road. When the project's construction crews were already working in the area, why not resurface Fletcher? In addition, an old water main laid right in the project's path; could a new water main be installed? While these projects were not eligible for FEMA funds, the project team was able to include them in design plans and the city located local funding sources.

This community engagement strategy met the city's goals. All property owners occupying channel easements eventually sold them back. For most, this was a win-win situation even if they lost a little ground. This project would reduce the damages their properties suffered, so the easement return seemed worth it. Some hadn't experienced as serious property damage as others, but still realized the vast indirect benefits of the project; the city was mitigating the flood risk that jeopardized the safety of everyone near the 56th and Morton complex. By fostering stakeholder involvement, the team was deepening the community's sense of ownership and investment in the project.

A process that could have been disastrous ended in success; *almost* all easement negotiations were completed before FEMA's Phase I deadline. Because of the city's dedication to community-centered planning, the relationship between the project team and citizens made easement acquisition possible.

Benefits Sown, Benefits Reaped

Community members knew the project would bring them wide-spread benefits. Primarily, it would increase the safety and attractiveness of 56th and Morton and the city as a whole. Speaking on the impacts flooding has on a city, Council Member Lamm commented, "Flooding affects a city's ability to grow geographically and economically. In addition to prohibiting useful economic development, the hazard adds great expense to the city itself to mitigate damages caused by flooding. Flooding also reduces private investment and redevelopment interest in places with high flood risk." In short, reduced flooding would encourage commerce and investment in the area, as well as make Lincoln more desirable. Environmentally speaking, the waste-filled drainage ditch would be replaced with an aesthetically-pleasing channel lined mostly with grass and strategic riprap.



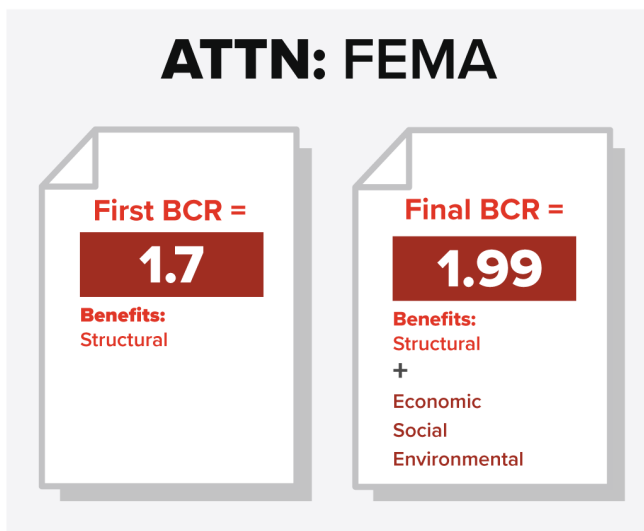
The new channel and bridge would look something like this

In March of 2017, FEMA's deadline, JEO finished the project design and sent it to federal reviewers for Phase II construction approval. The design included the following components: 5,000 LF of channel work; Fletcher Avenue bridge replacement; private bridge removal; Lincoln Electric System relocations; 2,500 LF of water main improvement; sewer line protection; and 4,650 LF of Fletcher Avenue mill and overlay.

The Phase II application included the result of the project’s most current BCA, as the project design had adapted since earlier submittals. The revised analysis of project benefits surpassed the initial estimate; the updated BCA established that the project would benefit the community nearly two dollars for every one dollar spent. Those additional projects community members suggested only added to the benefits and didn’t raise federal price tags. The first BCA only quantified the benefits gained from reducing structural flood damages, and that alone hit a 1.7 BCR. As the project grew and the design included the additional projects—even though the city was funding those—the overall contract cost rose slightly. To illustrate the larger impact of the 56th and Morton project, the final BCA still accounted for the benefits of reduced structural damage, but formally included the social, economic, and environmental benefits that would serve the community.

and out of the 56th and Morton complex. Through the protection of this road, emergency vehicles and personnel can consistently access the area.

Economic losses make obvious the pervasive effects of severe flooding; they exemplify how loss snakes into other realms beyond structural damage. During 56th and Morton’s flash floods, nearby businesses temporarily close and often sustain equipment damages, which equal lost revenue. When businesses close, even briefly, the overall economic health of a community is jeopardized. FEMA has reported that 40-60% of small businesses never reopen after closing due to natural hazard events. Flood mitigation increases the resilience of local businesses and avoids economic losses. Through this project, businesses will remain open more often—not losing valuable work time—and continue to invigorate the local economy.

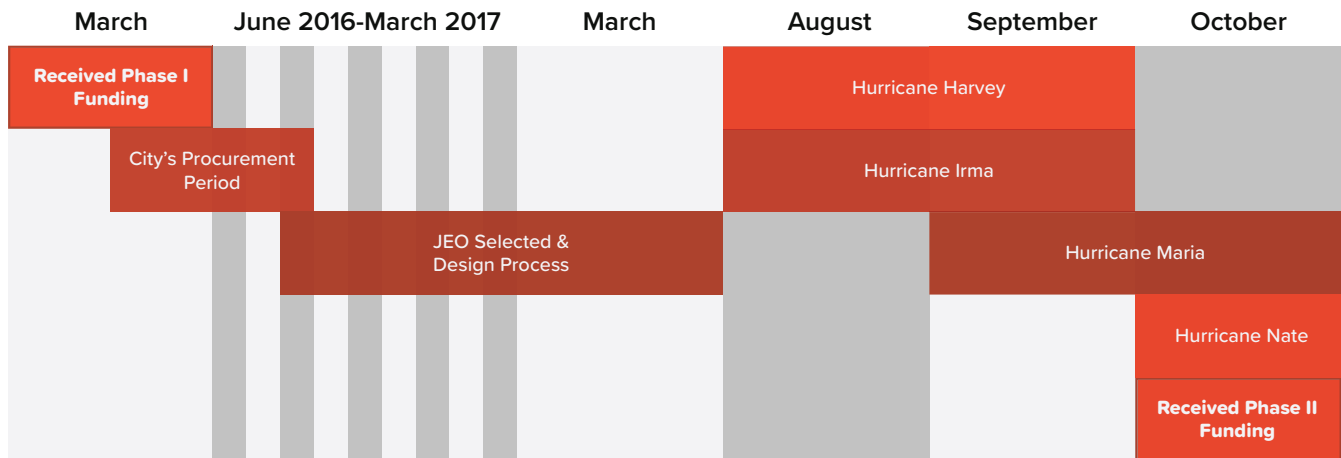


When finished, the 56th and Morton flood risk reduction project will reduce the frequency of critical services lost during floods. Public and private electrical infrastructure services are threatened when water levels rise, and often sustain damages and require repair – while people go without. Reducing the risk of flooding protects electrical services and utilities on which the community relies. Transportation infrastructure, like roads and bridges, are also at risk of damages during frequent floods. The project’s new bridge and resurfacing of Fletcher Avenue will significantly improve the reliability of the area’s infrastructure, safely maintaining the only road into

The social losses of floods span personal safety and financial security. As the 56th and Morton channel is rehabilitated, city maintenance crews can feel safe again working in it. The project team specifically included designated channel access points so city staff can access the channel without worry. Drivers can travel through the area during rain. And people who work in the area won’t suffer from decreased productivity, which costs employees and businesses more money. Through the flood risk reduction project, these potential losses are avoided, and save the community money, becoming quantifiable in BCAs.

The final BCA also reevaluated the environmental benefits of the 56th and Morton project. The creation of green space and riparian areas for erosion control in the channel will boost the environmental health of the area. In fact, the channel’s redesign creates some \$750,000 in environmental benefits. As a partially grass-lined channel, it will naturally grow into a wetland and create valuable habitat for wildlife.

The Funding Timeline 2016-2017



At final submittal, the total project cost including annual maintenance reached \$5,413,732. In comparison, the benefits totaled \$10,796,628, resulting in the 1.99 BCR – nearly two dollars saved for every dollar spent on the project.

Benefit-Cost Analysis =

\$10,796,628 / **\$5,413,732**

- Avoided Structural Flooding
- Avoided Economic Losses
- Avoided Social Losses
- Creation of Riparian Areas
- Total Project Cost

=

1.99

When a jurisdiction submits a grant application, FEMA needs time to conduct a thorough review. And at the time of this application's submittal, FEMA had its hands full. The spring and summer of 2017 were riddled with natural disasters. During this review period, many FEMA employees were actively out in the country, responding to events like Hurricanes Harvey, Irma, Maria, and Nate. The offices were understaffed; it wasn't possible to immediately respond to the Phase II design application.

Because the majority of funding for the 56th and Morton project existed through its inclusion in the LPSNRD's Hazard Mitigation Plan, funding only became available when there were HMGP funds to draw from. The summer's pressing natural disasters had depleted that fund, and funding availability was delayed.

This delay frustrated community members and the project team who were anxious to start construction. This extra time did, however, give the project team additional time to acquire those last few easements.

Once the traveling FEMA employees concluded their summer disaster management, they returned to the office. When normal proceedings resumed, they began reviewing applications. In October 2017, they authorized emergency federal funds for the 56th and Morton mitigation project. Phase I's final design had officially been approved, and Phase II began.

Phase II opened bids for construction on February 1 of 2018, and the city hired a contractor under budget at \$3.7 million. The winning contractor requested to keep the dirt removed in construction, so the anticipated hauling costs vanished. Construction began on March 19 of 2018, and should be completed in the fall of 2019.

15 Years of Persistence

Arriving at the final project required a meticulously orchestrated process. The project team carefully balanced myriad considerations: financial constraints; the exceptionally long timespan (15+ years) a project of this magnitude demands; permitting obstacles; stakeholder needs; and others. Although, at times, the process might have felt interminable and the project impossible, its methodical and thorough progress created opportunities for unexpected and valuable projects to be included. The beauty of this project is that even components funded by different sources, under different jurisdictions, could be part of one comprehensive plan. As long as respective funding sources were clearly delineated, all project goals could be in the contract, and vital community needs could be met.

Mitigation projects are high-yield investments. And like any good investor knows, investments take time to grow. Throughout this process, the project team members supported this investment with detailed planning and gave this project time to be done right. The City of Lincoln, the LPSNRD, and JEO know that these large-scale mitigation projects don't happen overnight. Rushing this kind of project would have limited the range of benefits that make this effort so worthwhile.

This fifteen-year effort is paying off, as this project provides a resilient and integrated long-term solution to severe flooding. The integrated nature of this solution can be seen in the project's broad view of the problem. The team continually considered any adverse impacts the project might cause the entire drainage area, and they analyzed a system, not just a localized problem. This intervention serves the whole 56th and Morton watershed, from the Havelock area to Salt Creek.

Chris Beutler, Lincoln's Mayor, expressed pride at the project's positive impact:

"The flood risk reduction project in the area of 56th and Morton demonstrates the power of collaboration to solve problems. The city's partnership with JEO, the Lower Platte South NRD and the property owners has resulted in an effective solution, one that can serve as a model for other areas and other cities that face flash flooding issues. I also want to thank the voters of Lincoln for passing the stormwater bond issue that funded the city's share of this important project."

What makes good mitigation great is the determined collaboration of people who share a community. Effective mitigation requires broad perspective; it needs people who each see a specific aspect of a hazard and can bring their particular insight to solve a problem. That's what creates mitigation projects with the most impactful benefits. Without the skills, attention, and determination of each team member, this mitigation project would not be as successful as it is. With only one view, with only one expert, the benefits a project might yield are only partial. By our nature, one person or entity can only do so much. We need others. We are a city, a community, that can only thrive when diverse groups persist as a whole.

And as for Rick Wagner, he's looking forward to the day when he can walk into work after it rains, and just start another day at the office.

What makes good mitigation great is the determined collaboration of people who share a community.
