# Managing for Complexity [1]

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Managing complex projects and programs requires a shift in mindset, and sometimes simply nuanced variations on traditional management techniques. This article aims to share solutions and tools used to manage the challenges inherent to the complex stormwater Watershed Master Plan Program at the City of Fayetteville in North Carolina, US.

The Fayetteville Watershed Master Plan program was initiated in 2018 through Council direction. Prior to the program, the stormwater program was primarily reactive, with small projects developed and built without an understanding of the citywide needs. In 2018 Council directed staff to study the entire city and to provide a prioritized list of projects both for short-term implementation as well as long-term implementation. Staff was faced with building a program from the ground up while also providing projects as soon as possible. The existing stormwater system needed to be understood, teams lined up to conduct the modeling (hydrologic and hydraulic modeling), guidance developed to support the teams, and more.

Each of the program characteristics of **High Level of Complexity**, **Aggressive Schedule**, **Large Distributed Team**, and **Local Government Constraints** surfaced numerous challenges, which required a portfolio of solutions and tools. At a high level, the primary solutions used were Iterative and Adaptive Process, Continuous Collaboration, Templates and Automations, and Frequent Measurable Results. When selecting which tools to discuss, we asked *What's the Difference that Makes a Difference?* While many of these tools may be familiar, the iterative and adaptive nature underpinned by Agile principles make the difference (Lanier, 2023).

## High Level of Complexity

The first characteristic is 'High Level of Complexity'. The program is very large, spans multiple years, and has faced many unknowns during these first few years. The team had a goal to complete the citywide comprehensive analysis within four years, yet had limited information about the existing stormwater system. This data needed to be collected before models could be developed. Guidance for the studies was continuously being developed as stormwater data were collected and models begun. While there were some ideas about the end product, the vision evolved as more results became available.

Specific challenges included scoping work under uncertainty, and improving the process and technical approach, while remaining aligned with the vision. Tools in solution categories Iterative

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and Adaptive Process and Frequent Measurable Results used to address the specific challenges include *Phased Contracts*, *Standards Manual*, and *Retrospectives,* and are described below.

**Challenge: How to scope work?** Study durations ranged from 1.5- to 2-years, and modeling was begun while the guidance was being developed, the geodatabase was being built and survey data collected. The scope to complete proposed solutions could not be developed until flooding concern areas were identified. *Phased Contracts* allowed an incremental approach to planning.

**Challenge: How to improve process and technical approaches?** Many requirements evolved as studies were ongoing, such as Level of Service determination. This necessitated continuous updates to the *Standards Manual* and other tools supporting the studies. Another tool was *Retrospectives***,** a whole-team brainstorm of *What went well, what could be changed, and ideas for improvement*. One outcome was a decision to hold a Technical Modeling Workshop to discuss challenges teams were facing and share solutions.

**Challenge: How to align with vision?** The vision for the products developed over time, as more information emerged from studies. Teams provided early and frequent results to the Sponsor to obtain feedback.

## Aggressive Schedule

The second program characteristic discussed is **Aggressive Schedule**. The team was faced with an aggressive schedule while also required to produce high quality products. The pandemic hit just after the program was initiated and that created many challenges as well.

Challenges included how to meet the schedule, and support individual team and overall program progress. Tools are selected from categories Iterative and Adaptive Process and Frequent Measurable Results, and include *Citywide Prioritization* and *Interim Deliverables*.

**Challenge: How to meet schedule?** The *Citywide Prioritization* was critical in helping meet schedule. The city understood that studying all 15 watersheds comprehensively would be a slow process, and extremely expensive. In order to meet the schedule and work with available resources, it was imperative to develop an approach to prioritize study areas. Citywide modeling was conducted and potential hot spots identified.

**Challenge: How to support individual and program progress?** The intentional use of *Interim Deliverables* helped understand progress and allowed time to adjust and redirect as needed. The interim deliverables were stream assessment, concern areas, proposed solutions, and completed reports.

## Large Distributed Team

The third program characteristic discussed is **Large Distributed Team**. The team included ten consulting firms and the city team. A program of this complexity required a dedicated involved Sponsor, who could interact frequently with the team. An Internal Program Manager acted as a Bridger between the Sponsor, city staff and the External Program Manager. The External Program Manager served as Bridger between the city and technical consulting teams.

A large distributed team surfaced challenges related to supporting consistency, avoiding duplicate effort, and ensuring technical excellence. Honoring the commitment to 'value people over process' where possible supported the team.

Tools in solution categories Continuous Collaboration and Templates and Automations that were used to overcome specific challenges include *Standards and Methodology*, *Exhibit & Report Templates*, and *QA Workshops*.

**Challenge: How to support consistency?** *Standards and Methodologies* were critical to support consistency across the parallel studies. Those evolving requirements mentioned above were captured in the Standards manual and continuously updated as needed. Other methodology included developing a robust geodatabase, guidance for conducting the asset surveys, and developing standard unit costs for proposed solution cost estimates.

**Challenge: How to avoid duplicate effort?** The *Exhibit & Report Templates* were helpful in that each individual team used a standard set of templates to convey and visualize results.
Avoiding duplicate effort not only ensured consistency but saved time and money.

**Challenge: How to ensure technical excellence**? The consultant teams had proven track records of adhering to high technical standards. Interim check-ins with individual teams helped answer any questions or concerns. Each interim deliverable culminated in a *QA Workshop***.** These workshops were invaluable in reviewing results, addressing concerns, and determining next steps.

## Local Government Constraints

The fourth characteristic is working within **Local Government Constraints**. At the city many factors can surface challenges: budgets are examined annually and funding priorities may shift; City council terms are 2 years, which can lead to shifting political will; and, visualizations need to be appropriate for a variety of stakeholders.

Some of the challenges for this program included planning for funding uncertainty, showing progress, planning for political shifts, and visualizing results. Tools are selected from the solution categories Iterative and Adaptive Process and Frequent Measurable Results to illustrate how the team addressed some of these constraints, and include *Encumbrance Sheet* and *Early and Frequent Deliverables to Council.*

**Challenge: How to plan for funding uncertainty?** The *Encumbrance Sheet* developed for the program served for tracking and scenario planning to help with uncertainty. For example, at the beginning of each fiscal year we knew how much money had already been encumbered, how much we could spend over the next FY, and then use the tool to plan scenarios for the uncertain future.

**Challenge: How to Show Progress, and Plan for Political Shifts?** *Early and Frequent Deliverables* were presented to Council as often as possible. The first studies kicked off in 2019, and the first tranche of projects from those studies was taken to Council in 2020. Large cornerstone projects were taken to Council in mid-2021. These deliverables showed progress and helped gain commitments for larger solutions.

**Challenge: How to Visualize Results**? One example was a Council-ready map that summarized the study plans for the watersheds. Council could see at a glance in which years each watershed was planned for study. Other Council-ready visuals included watershed summary maps for completed studies showing at a glance the areas of flooding concern and proposed solutions for those areas.

## Summary

The Program has many successes already, with five out of 15 watersheds completed, over 200 proposed solutions developed, and about $40M of projects taken to council. Several projects are now in design. While these first few years have been dedicated to both building the program and developing projects, we now have a strong foundation to continue studying the remaining watersheds.

At the heart of overcoming the challenges was the **continuous collaboration** among team members with steady involvement by the Sponsor. The success of the program relied on the ability to reflect at regular intervals in order to adapt and respond to change; show continuous progress by delivering frequent measurable results; and strive to honor the commitment to value people over process.

A high level of complexity, aggressive schedule, large distributed team, and local government constraints understandably create many challenges. The solutions and tools described in this article are iterative and adaptive, and can be applied to many complex programs.

## About the Author

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