



NBU CAPITAL IMPROVEMENT PROGRAM – \$10M to \$250M IN 5 YEARS FLAT

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ABSTRACT

Public utilities face many challenges as population grows and infrastructure ages, putting increasingly greater demands on utility staff to manage large capital improvement programs to meet resulting infrastructure needs. In rapidly growing Comal County, New Braunfels Utilities (NBU or Utility) ramped up their Capital Improvement Program (CIP or Program) from \$10 million in 2016/2017 to \$256 million over a 5-year period to respond to mounting capacity and condition-related needs in their water and wastewater systems. These improvements, which were significantly greater than anything NBU had implemented in previous years, encompassed over 60 projects with costs ranging from \$50,000 to over \$40 million each.

To strategically address increasing demand and condition-related constraints, the Utility completed a water and wastewater master plan with Freese and Nichols, Inc. (FNI) that identified over 80 projects worth over \$550 million that needed to be in place within the next 25 years. Because this Program was significantly greater than anything the Utility had undertaken in prior years, NBU partnered with FNI to develop and implement an integrated delivery strategy using resources from both organizations to deliver the aggressive Program. This paper will discuss the principal components of this delivery strategy, including Program Management/Staff Augmentation, Resource Planning and Hiring Design, Construction Standards, and Program Tools and Templates.

Many water utilities across Texas, particularly those in areas experiencing rapid growth, face similar challenges in delivering large capital programs with limited staff. This paper will provide key strategies to help prioritize and deliver necessary improvements through development of a customized Capital Project Delivery Plan that takes advantage of both internal and external resources.

KEY WORDS

Capital, improvement, program, CIP, water, wastewater, budgeting, management, staffing, augmentation, standards

INTRODUCTION

New Braunfels Utilities (NBU or Utility), one of only 2,000 community-owned, not-for-profit, public power electric utilities in the nation, provides retail water and wastewater service to over 80,000 people in the greater New Braunfels region. The NBU service area, located in the fast-

growing Texas I-35 corridor between the cities of Austin and San Antonio, has doubled in population since 2000 and is expected to double again in the next 15 years.

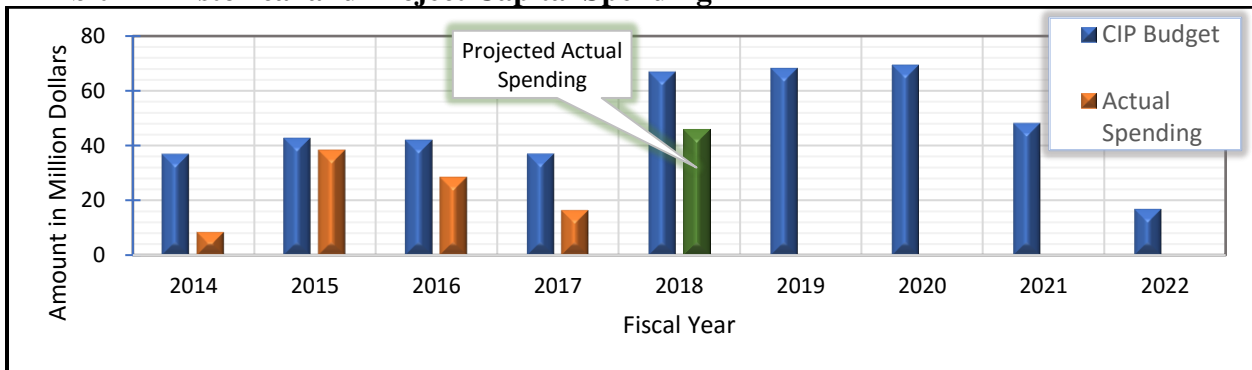
In 2015, NBU recognized that significant improvements would be required to respond to the growing demand in their service area and to address condition-related issues that threatened reliability of service provided to customers. In response, the Utility completed a water and wastewater master plan with Freese & Nichols (FNI) that identified a total of 80 projects worth over \$550 million that would need to be designed and constructed in the next 25 years, with 60 of those valued at \$256 million occurring within the next five years. This plan presented three significant challenges to NBU.

Challenge 1 – Size of Program. As shown in Table 1 and Exhibit 1, the 5-year plan requires spending 1.5 to 3.5 times more annually than NBU spent in the previous fiscal year. As a result, NBU’s existing capital project delivery process and resources were not equipped to execute a capital plan of this size.

Table 1 – 5-Year Projected Capital Spending

Type	Actual FY 17	Projected Capital Spending, \$ million					Total
		FY 18	FY 19	FY 20	FY 21	FY 22	
Water	8.8	32.9	31.5	22.6	20.4	3.3	110.7
Sewer	7.5	27.9	36.6	40.0	27.6	13.5	145.8
Total	16.3	60.8	68.1	69.3	48.0	16.9	256.5

Exhibit 1 – Historical and Project Capital Spending



Challenge 2 – Complexity of Projects. The required improvements included multiple complex treatment and utility projects, some of which had to be completed on an emergency basis, including:

- A new greenfield wastewater treatment plant
- A membrane water treatment plant
- An aquifer storage and recovery (ASR) system
- Two fast-track emergency projects using construction manager at risk (CMAR) delivery method
- Five joint-bid projects with City of New Braunfels road improvements

Challenge 3 – Limited Staff to Administer Program. At the onset of the program, the NBU Water Engineering Group only consisted of a new group manager, a contract project manager, one

engineer, and an administrative assistant. Consequently, there was a deficiency in staff resources required to execute the projects planned for FY 18 and beyond.

To address these challenges, NBU partnered with FNI to develop an integrated capital delivery strategy using resources from both organizations to deliver the aggressive Capital Improvement Program within the required timeline.

METHODOLOGY

Following development of the water and wastewater master plans in 2016, NBU contracted with FNI to integrate with NBU staff to develop an overall capital delivery strategy, provide program management services, and provide additional contract staff as required to augment the NBU team. Key tasks implemented as part of the overall capital project delivery strategy include the following:

- Program Management and Staff Augmentation – Setting up and delivering the overall Program using both FNI and NBU staff.
- Resource Planning and Hiring – Identifying project management and construction related personnel required to implement the Program both in the short- and long-term.
- Standard Project Delivery Process Mapping – Collaboration with NBU staff to develop standard project delivery processes to be used throughout the entire project life-cycle from initiation to closing.
- Standards and Templates – Development of standards and templates to be used throughout the Program during both the design and construction phases of each project.
- Program Tools and Reports – Development of program tools and templates to help manage individual projects, produce live program reports, and manage overall program data. The tools developed included a projection information management system, construction management system, and standard project templates.

Program Management and Staff Augmentation (PM/SA)

At the onset of the Program, FNI deployed two key personnel to NBU's office to integrate with the NBU Engineering Team. This included a Program Manager to help set up and monitor the overall program, and a project manager to lead individual FY 17 projects and ensure that these projects stayed on track while the FY 18 CIP was being developed.

To establish the overall budget for NBU's FY 18 to FY 22 Capital Improvement Program (CIP), the Program Manager and NBU Engineering Manager collaborated to develop an Authorization for Expenditure (AFE) for each project, which included a project description, project justification, schedule, budget, and other key information developed in the master plans, as shown in Exhibit 2. The AFEs served as a primary instrument to justify the need to upper management and eventually obtain approval of the overall program from the NBU Board of Directors (Board).

Exhibit 2 – Sample Approval for Expenditure (AFE)

NBU		APPROVAL FOR EXPENDITURES (AFE) CAPITAL PROJECT BUDGET FOR FISCAL YEAR 2018						PRIORITY 100		
Division:	Wastewater	Project:	Grueene WWTP Relocation & Expansion (IF-56%)							
New Capital Project	No	Carryover Amount		Is Carryover included in budget year?						
Project Description/Scope:										
This project will expand the capacity of the Grueene WWTP and relocate the plant out of the floodplain on property purchased by NBU. Phase 1 will be constructed within the scope of this project and will have a capacity of 2.5 MGD. The project will include odor control, sewer transfer pipe from the existing to the new, abandonment of the existing plant, abandonment of a lift station, and construction of a sewer transfer pipe from the Blieders Creek station to the new plant site.										
This project is requested on the basis of:										
The Grueene WWTP has reached organic treatment capacity and needs to be expanded to meet permitted effluent limits. In order to modify the plant, state code requires NBU to protect the plant from flooding which will require relocating the plant out of the floodplain.										
If proposed project is NOT undertaken in year proposed, NBU will incur an adverse impact of (please explain):										
This project is required for NBU to be in compliance with its discharge permit issued by TCEQ.										
Project Start Date:	8/1/2012	Estimated Completion Date:	8/31/2019							
Is this proposed AFE different by more than 5% than previous AFE for this project?										
If project increases from original plan (current FY or total), why?										
More complete cost estimate for the project was provided.										
Projected Project Expenditures:								Overhead %	10%	
	FY16 and Earlier	FY17 Actual to 1/31/17	FY17 EST REMAINDER	FY 2018 with Carryover	FY 2019	FY 2020	FY 2021	FY 2022	Project Total	
Engineering Labor	4,411	-	-	10,000	10,000	10,000	-	-	\$ 34,411	
Internal Labor	137,193	17,847	-	30,000	30,000	30,000	-	-	\$ 245,040	
Eng Contract Labo	2,465,872	132,541	677,000	512,500	471,250	-	-	-	\$ 4,259,163	
Contract Labor	15,173	135	-	8,300,000	8,300,000	4,150,000	-	-	\$ 20,765,308	
Materials	83	12	-	8,300,000	8,300,000	4,150,000	-	-	\$ 20,750,095	
Land/Easements	3,866,459	-	-	-	-	-	-	-	\$ 3,866,459	
Overhead			67,700	1,715,250	1,711,125	834,000	-	-	\$ 4,328,075	
Total	\$ 6,489,190	150,534	744,700	18,867,750	18,822,375	9,174,000	-	-	\$ 54,248,550	

Following approval of the overall 5-Year CIP, an easy-to-use spreadsheet-based project management information system (PMIS) was developed that would allow quick entry of project information and enable the program team to monitor project status and produce customized reports. Details of this model are included in the Program Tools and Reports section.

In addition, ongoing program controls were put in place to monitor the status of each project against the planned budget and schedule established during the AFE process. The program controls strategy included:

- Deployment project-level cash flow and actual vs. budget reports (discussed in later sections)
- Deployment of program level dashboards (discussed in later sections)
- Development and maintenance of action item logs by project manager
- Weekly status meetings with entire program team
- Monthly project status meetings with design engineers
- Monthly project status reports from design engineers

Resource Planning and Hiring

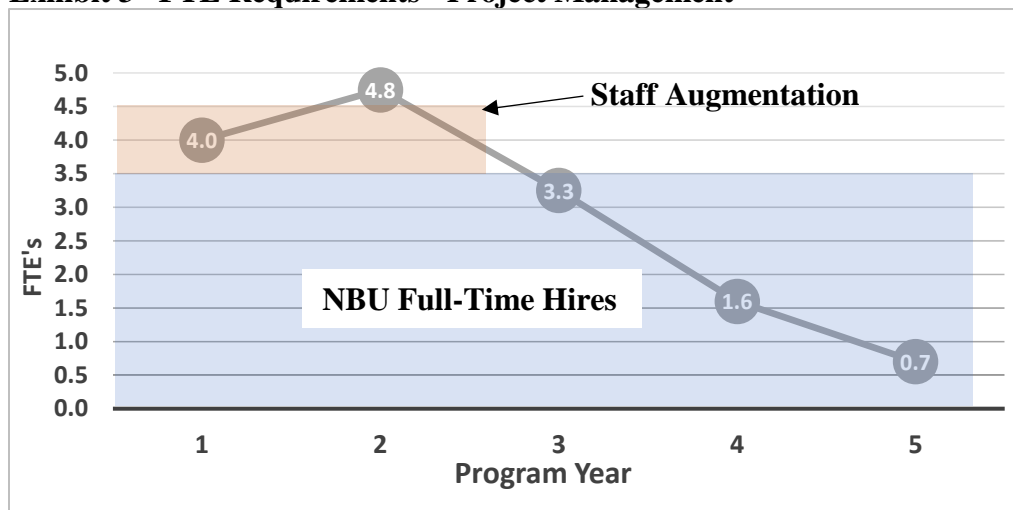
Although the engineering department is ultimately responsible for delivery of the Program, five other departments within NBU have a major role in the execution of the individual projects. These departments and their responsibilities associated with the delivery of capital projects include:

- Engineering Department – Overall responsibility for management and delivery of all capital projects
- Water Operations Department – Construction inspection
- Accounting Department – Project setup and processing/payment of invoices

- Purchasing Department – Procurement of professional and construction services, including development of construction front-end documents
- Right-of-Way Department – Acquisition of easements and fee-simple land purchase
- Legal Department – Review of all legal documents before execution by CEO

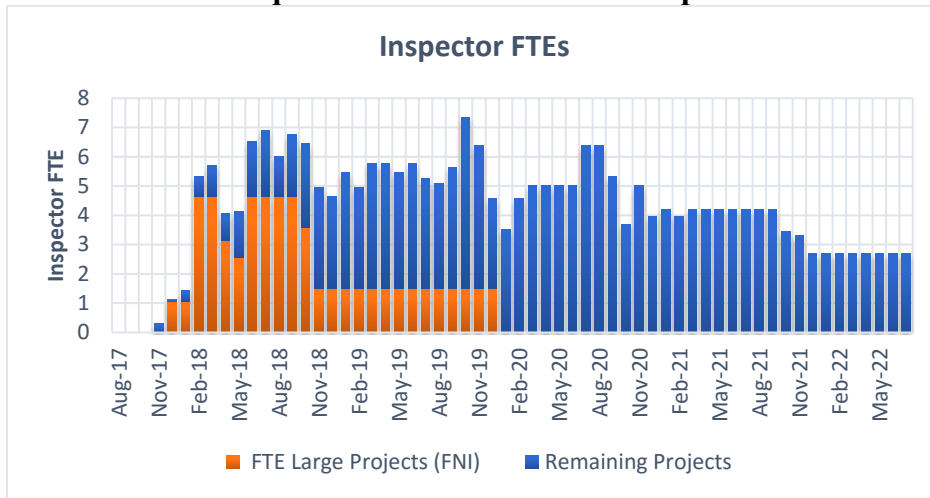
Although all these departments are important to the project delivery process, the two most impacted by the increased size of the Program were Engineering (project management) and Water Operations (construction inspection). To determine staffing needs in these departments, FNI worked with NBU to perform a resource evaluation by assigning an estimated full-time equivalency percentage to each project in the Program. For project management, as shown in Exhibit 3, it was determined that a total of almost five FTEs would be required at the peak of the Program. At the time of the evaluation, NBU had one project manager that spent approximately half of his time on capital projects. Based on this analysis, NBU determined that an additional 3 FTEs would be required long term. For the fourth project manager, they decided to utilize an FNI project manager in a staff augmentation role to help handle the peak workload during the first 18 to 24 months of the Program or until the peak period had passed. Exhibit 3 does not show the construction management time required by project managers in years 3 through 5 of the Program as projects move from design to construction.

Exhibit 3 –FTE Requirements - Project Management



For construction inspection, NBU has an internal inspection team of three inspectors whose expertise and experience is primarily in developer projects involving pipeline and small pumping facilities. For this reason, it was determined at the onset of the evaluation that NBU inspection staff would provide inspection services for all non-facility related projects, and FNI staff would provide staff augmentation inspection services for facility or other complex projects as assigned. As shown in Exhibit 4, a total of five to seven inspector FTEs was projected to be needed for the first three years of the program, with year one including mostly large, complex projects. As a result, FNI deployed two to three full-time inspectors to augment NBU inspection during year one of the Program. At the end of this period, NBU will evaluate the need to potentially hire full-time inspectors for the following years. In addition, as a contingency, NBU contracted with FNI for up to two additional full-time inspectors as needed based on non-capital project workload of existing NBU inspectors.

Exhibit 4 –FTE Requirements – Construction Inspection



In addition to project management and construction management/inspection staff augmentation, FNI also augmented NBU staff by providing technical subject matter experts to address complex issues and projects as needed. Up to this point in the Program, specialized technical services have included:

- Owner’s Representative for Fast-Track Projects Utilizing Alternative Delivery – Program manager served as the designer and owner’s representative for two construction manager-at-risk (CMAR) projects including a membrane water treatment facility and a \$12 million fast-track water delivery system that had to be delivered from start to completion in 9 months.
- On-Call Hydraulic Modeling – As part of the program management services, provided on-call hydraulic modeling for both the water and wastewater system to determine possible entry point of new water sources, assess water availability for developer requests, and identify future capital projects required.
- Cost Estimating – Provided cost estimating services in two primary areas as needed: 1) Review of opinion of probable construction costs (OPCC) from other engineers and 2) development of the annual capital improvement plan budget for individual projects.
- Constructability Review – For larger, more complex projects designed by NBU’s other consultants, provided constructability review by subject matter experts (SME) and FNI construction services team.

Standard Project Delivery Process Mapping

Since NBU’s entire Water Engineering Department was practically all new, there were very few known processes and procedures for delivery of capital projects, nor was it clear how different departments needed to interface during the capital delivery process. To address this issue, FNI facilitated a multi-department process mapping initiative to accomplish three objectives:

- Objective 1: Document the existing process.
- Objective 2: Identify areas for improving the process.
- Objective 3: Obtain agreement by all parties/departments on process to be followed

The processes selected for mapping with NBU, shown in Table 2, covered the entire capital project delivery life-cycle and were prioritized for implementation based on overall need of the specific projects at hand.

Table 2 – NBU Key Processes Mapped

Initiation/Planning	Execution - Design	Execution – Construction
Capital Planning Project Justification Budget Approval Project Setup Staffing Assignments	Procurement Contracting Change Management Engineering Design ROW/Land Acquisition Invoices Permitting	Advertisement / Procurement Contracting Change Management Construction Mgmt/Observation Pay Applications Project Acceptance Project Closeout & Archiving

The mapping was conducted with the various departments involved using Visio Software to create a Swim Lane Diagram for each process identified. A sample of the process mapping for right-of-way acquisition is shown in Exhibit 5.

Standards and Templates

Development of standards and templates is an essential step in creating consistency and efficiency throughout the life-cycle of a capital improvement program. This was especially true for the NBU Program because of the limited staff, fast-track nature of many of the projects and sheer number of projects that had to be completed. To develop these standards, the FNI program manager worked with NBU engineering, operations and purchasing staff to identify the list of standards required and then begin developing those standards. As shown in Table 3, approximately 20 standards and templates were identified for development.

Exhibit 5 - Swim Lane Diagram - Sample

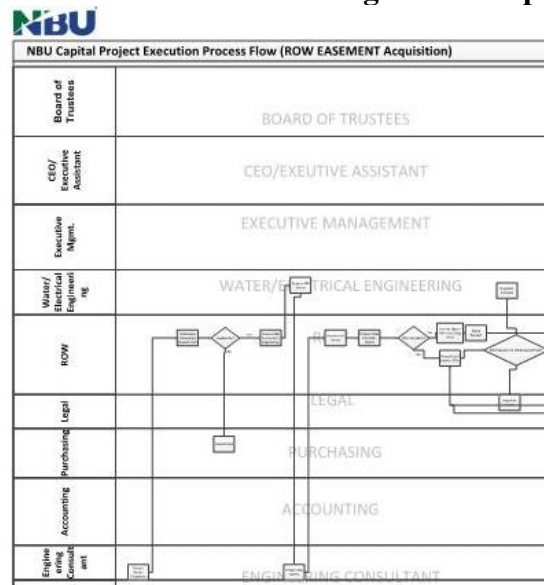


Table 3 – Primary NBU Standards & Templates for Development

Initiation/Planning	Execution – Design	Execution – Construction
Approval for Expenditure (T) 5-Year CIP (T) Project Setup Form (T) Project Mgmt Plan (T)	Procurement Docs (T) Contracts (S) Scope/Fee (T) Details & Specifications (S) Front-End Documents (S) Vendor Invoices (T) General Correspondence (T) Engineering Status Reports (T)	Advertisement Language (T) Contracts (S) Pay Applications (T) Change Orders (T) RFI, Change Order & Submittal Logs (T) Daily Observation Report (T)

(T) – Template (S) - Standards

The general process for completing these standards, shown in Exhibit 6 below, focused on utilizing existing standards as a starting point to the greatest extent possible and then collaborating with NBU’s engineering, legal, and procurement staff to develop new standards/templates that could be used for the life of the program.

Exhibit 6 – Process for Standard and Template Development



Also included in the process was a continuous improvement effort that allowed modifications to the documents as the Program was implemented to ensure that these documents changed as needed to meet the needs of Program along the way.

Program Tools and Reports

As previously mentioned, a spreadsheet-based project management information system (PMIS) was the primary tool utilized for management and reporting of project- and program-level data. The PMIS was developed specifically for the NBU Program and was built based on several key criteria, including:

- No data would be stored in more than one place.
- No data would have to be entered twice within the PMIS.
- The PMIS would be available to all project managers to directly enter data for their project(s).
- The spreadsheet-based PMIS would be located on the NBU network since all team members were local and had access to the network.

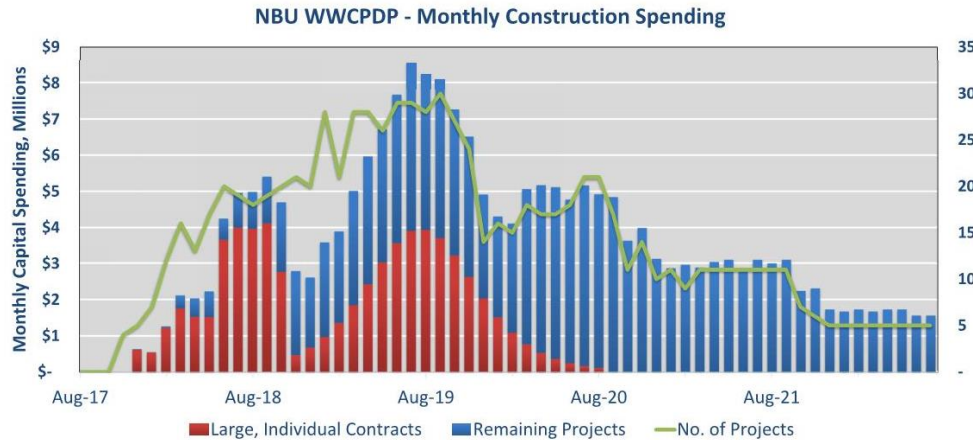
The structure of the PMIS was set up at a program level with two primary data sets: data entry and reporting. As shown in Table 4, multiple modules were created for each of these data sets to allow project managers to enter all data associated with their project and to automatically create and update reports as data is entered.

Table 4 – Data Entry Modules and Reports

Data Set	Module/Report	Description
Data Entry	General Information	Project-specific information including project name and number, project manager, engineer assigned, inspector assigned, and annual budget
	Schedule & Status	Milestone delivery dates, month of contracts to Board, easements, easement status, project status, and next milestone
	Projected Cash Flow	All projected cost information including total estimated design cost, total estimated construction cost, and projected cost by month
	Actual Costs	Actual monthly cost by project
Reports	Status Summary	Summary of project including project status, upcoming milestone, milestone dates, month to Board for approval, total projected cost, and percent complete
	Actual vs. Projected Cost	Actual vs. projected costs by month and by total with color coded variance
	Board Dates	Construction and design projects that will go to the Board for approval for each month in the current fiscal year

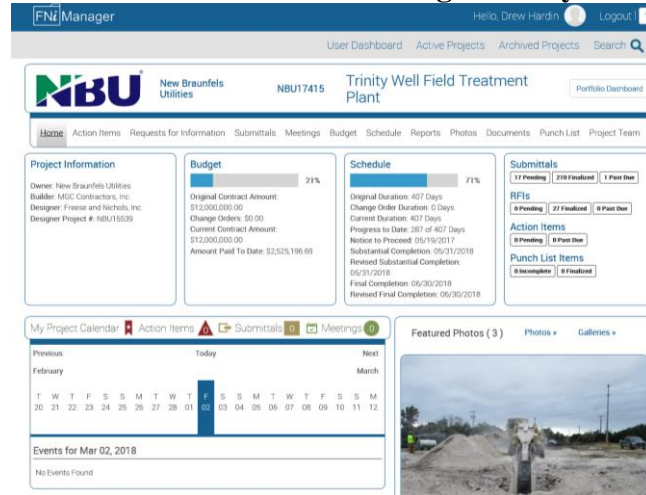
In addition to the reports included above, multiple program-level dashboards and charts were created for use by executive management and the Board to graphically show the existing status and progress of the overall Program. An example of the dashboard showing projected monthly construction spending is shown in Exhibit 7.

Exhibit 7 – Sample Dashboard



Although the spreadsheet-based PMIS and the server-based data management system served as an effective tool for design phase management, a separate web-based construction management system (CMS) called FNi Manager was utilized for managing the construction phase of all projects. This CMS, developed specifically for construction administration and management by the FNI construction management group, automatically develops submittal, RFI and change order logs and performs routing of construction documents for approval. As shown in Exhibit 8, FNi Manager includes 10 primary modules and allows access to these modules by the contractor, inspector, design engineer and internal project managers from any location.

Exhibit 8 – Construction Management System



RESULTS

Key successes and challenges encountered through the integrated program management approach during the first year of the NBU Capital Improvement Program include the following:

Successes

- Grew internal water engineering staff from three to seven over six-month period.
- Over 40 projects are currently underway with a total construction value of over \$200 million. Of those, 16 are in construction.

- On track to spend over \$40 million in capital in FY 18 which is over 2.5 times the spending in FY 17.
- On schedule for two fast-track projects totaling over \$25 million in construction delivered in less than 15 months utilizing CMAR delivery.
- Approximately 90 percent complete on Capital Project Delivery Plan that includes defined processes, program standards and resource recommendations that can be used by NBU for delivery of the CIP, regardless of the size or complexity of the projects.

Challenges

- NBU is only projected to complete \$43 million, or 70 percent, of the \$61 million budget in FY 18. Shortfall primarily due to delay of the \$43 million greenfield WWTP project and acquisition of easements on multiple pipeline and tank projects.
- Procurement of outside acquisition firm for easement acquisition took over five months, causing project delays on key pipeline project.
- Encountered unanticipated cost escalations on two emergency projects due to combination of fast-track nature and lack of contracting capacity in the region. Also, did not anticipate CMAR fees in the cost estimating phase.
- Undefined processes for contracting, procurement, legal review, and Board approval at the beginning of the Program caused delays on multiple projects.

CONSLUSIONS AND LESSONS LEARNED

Overall, the integrated program management approach to deliver NBU's \$256 million 5-Year CIP has been a success, not only to help drive timely delivery of the planned projects as planned but it has also provided a strong foundation for NBU to deliver programs like this on their own in the future. The top lessons learned in year one of the Program include:

Lesson 1: Staff the Program Properly from the Start Even If You Have to Bring on Outside Resources. NBU's parallel approach of hiring internal staff while, at the same time, augmenting staff with an outside consultant for program management, project management and construction inspection was critical to properly staff the program in a timely fashion.

Lesson 2: Develop a PMIS and Document Management Strategy Early. After the initial data collection effort, NBU and FNI worked together to develop a PMIS that worked for the NBU Team. This system gave the team a vehicle to keep information updated in a timely fashion and develop necessary reports at both a staff and executive level.

Lesson 3: Develop a Cadence of Communication and Make it a Priority. From the very start of the Program, the Engineering Manager initiated weekly meetings with the Program Manager and Project Managers to discuss status of each project, document action items and identify key project risks.

Lesson 4: Take the Time to Document Existing Processes BEFORE Trying to Make Improvements. As part of the process mapping effort, FNI and NBU were very intentional to document the existing processes in place. This allowed the team to jointly identify the specific parts of the process that needed improvement and helped obtain consensus across departments on the final, agreed upon process to be followed.

Lesson 5: Utilize Depth of Technical Resources from External Program Management Firm to Address Complex Issues and/or Projects. Throughout the Program there were many complex issues and projects that the NBU staff just did not have time to handle or that were beyond capabilities of existing staff. For these issues, NBU utilized a portion of the program management contract to involve subject matter experts from FNI to advise on how to proceed. This included on-going hydraulic modeling, constructability review of \$40+ million WWTP, serving as owner's representative for CMAR projects and construction management training.

Lesson 6: Communicate Easement/Land Acquisition Needs as Early as Possible. As mentioned earlier, one of the challenges to keeping projects on track was acquisition of easements. To mitigate this in the future, it was agreed upon that the Right-of-Way Acquisition Department will be notified of required easements well in advance of projects even starting so proper resources in place when the project starts.

Lesson 7: Keep the Consulting Engineers "On the Hook" for Providing Status Data for Their Projects. Key data was requested from each consulting engineer monthly, so the NBU project managers could update project status and schedule information within the PMIS. This data included a status report in a standard format, schedule milestone dates, updates to project costs and a look-ahead of upcoming activities.