Re-engineering the Water Distribution Operation: A Charleston Experience

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Reengineering is the rethinking, reinventing and redesign of operational processes and systems to bring about significant improvements in performance, production, morale and customer service. The evolution of process development involves the "stacking" of policies, procedures and processes, encompassing old trades, tools and technologies which quickly become outdated. We must all revisit and rethink our operations periodically to improve our processes and practices -- this is why reengineering is imperative to the providing of quality, cost-effective service to our customers. Through reengineering, productivity will improve, morale will multiply, process costs will decrease, and most importantly competition will be cultivated.

Water utilities, including water distribution operations, are under the constant threat of privatization. By improving the performance of our operations, the threat of privatization is reduced and our jobs become more secure. This can be accomplished through the reengineering process.

The Charleston Experience:

First and foremost, the Commissioners of Public Works (CPW) Water Distribution Department was brought together in a formal forum to define reengineering, to explain the need for reengineering, to identify the goals associated with reengineering, and to stress the sincere commitment of management to the reengineering process. This initial meeting took place in August, 1996, and the reengineering process lasted through January, 1997, encompassing approximately six (6) months time.

One of the keys to the successes of the reengineering process was the maintaining of open communications throughout the course of reengineering. Associates were kept informed by posting meeting minutes in highly visible and strategically placed areas, by frequent staff meetings held to discuss team progress, and by encouraging team members to share agenda items within and progress made through team meetings.

Teamwork:

Reengineering requires teamwork. Teams were constructed of associates who were familiar with the processes of which they were evaluating. Also, regarding team establishment, organizational boundaries were crossed within each team to provide fresh ideas and to promote "thinking outside of the box".

Drafting the "best" of our organization while encompassing all areas and levels was essential to the success of each team and to the reengineering process. Team members were the most motivated and influential associates of the department. Their interest and appetite for change was sparked by leading them to understand and accept the need for change, encouraging them to share their knowledge and expertise with each team, and providing incentives which were realistically attainable.

Business Strategy Team:

The first work team, the Business Strategy Team, was created whose objectives were to establish attainable goals for our department, and to identify, simply stated, *"what do we do" and "for whom do we do it"*. The department's established goals were as follows:

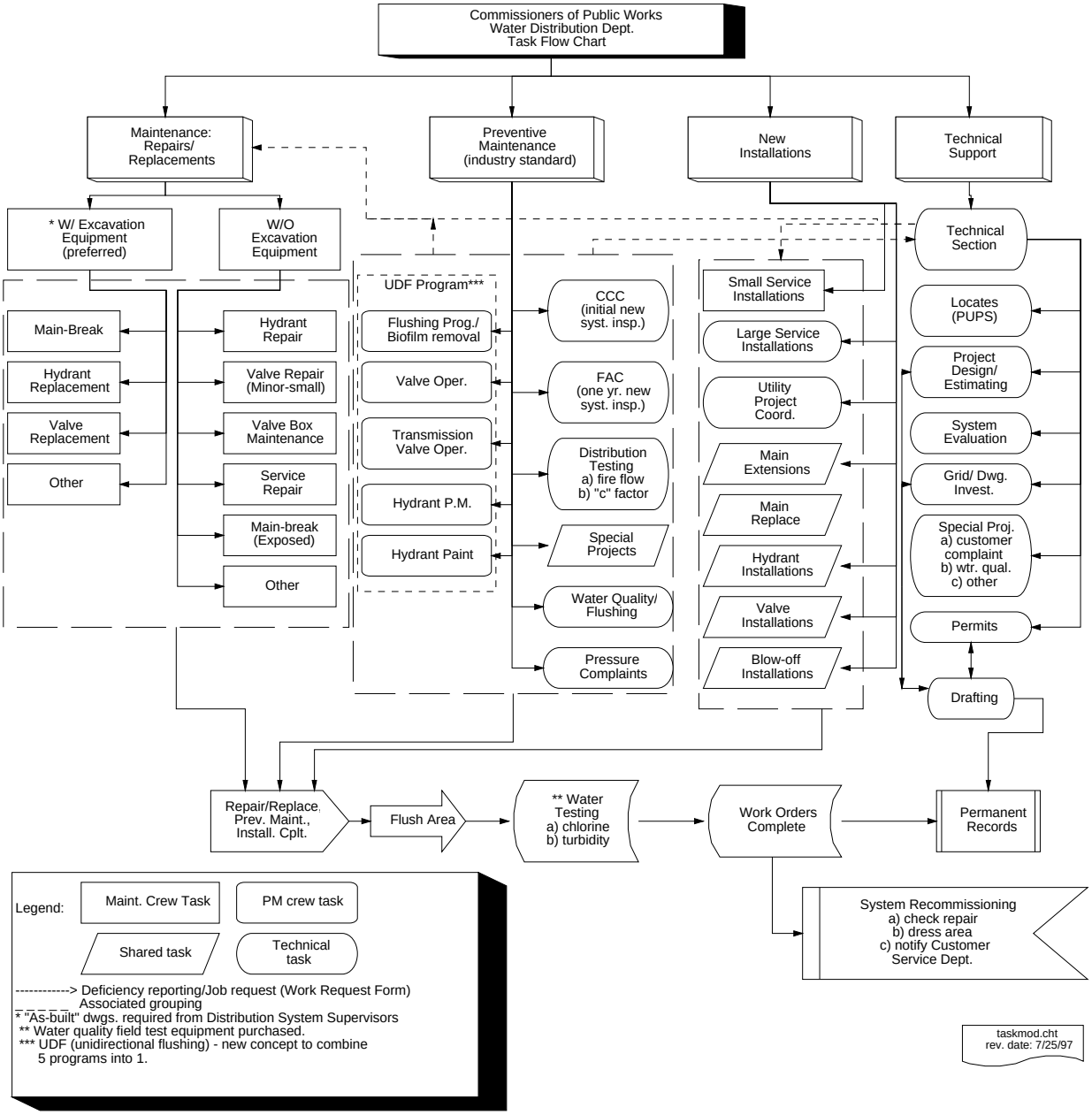
- ✔ The ultimate goal of the Distribution Department is to ensure a continuous supply of treated, potable water to our customers. This should be accomplished at the lowest possible cost to the consumer without compromising water quality or customer service in the process.
- ✔ Of equal importance is the need to maintain a safe working environment for our associates and those exposed to our operations.
- ✔ As "front-line" representatives of the CPW, it is our responsibility to reflect these goals on a continuous basis. Furthermore, as part of the department's ongoing commitment to promote customer service, a "3-C" (Courtesy, Concern, and Competence) program will be implemented, and will remain a regular feature of our operations.
- ✔ Our business, and the prime purpose of our existence, is to provide service to our customers. Customers expect and deserve value for their money, and judge us by the level of satisfaction they receive. Customers are the focal point of all endeavors and will be treated with courtesy, concern and competence.
- ✔ All of our business is accomplished through people. Associates are our most valued asset and we are committed to their personal development, well-being, and self-realization. We believe that frank and fair associate relations, recognition of achievement, open communications, training and development, and participative decision making are essential to the development of progressive, motivated and dedicated associates.
- ✔ We will strive for excellence by promoting the unity of authority, responsibility and accountability for each job, and by placing the emphasis on high standards of achievement at all levels, and in all areas.
- ✔ We will strive to develop strong leadership, characterized by a propensity for action, leadership by example, a high profile within the CPW and the community, and a commitment to the philosophy and values of the CPW.
- ✔ We will strive to be the best water distribution department in the country.

Secondly, the team revisited and reassessed our processes and identified the required activities and tasks which should occur within our department's responsibility. Another goal was to establish processes that were "*program-based*". Prior to reengineering, areas of responsibility overlapped into several sections. By establishing "*program-based*" processes, duplication of work was eliminated, resulting in a more efficient work flow. Furthermore, the team worked to establish programs that were "*preventive*" rather than "*reactive*". By improving our preventive maintenance programs, reactive responses to emergencies were reduced, allowing for additional preparation and planning of job tasks, which contributed to the department's increase in productivity.

Finally, the team created flow charts showing the paths that required tasks must follow, which in turn allowed the team to appropriately categorize the tasks by relationship. Listed under each category were tasks or "activities" which previously fell under the responsibility of the department, and activities which should be implemented to benefit the department were included. Four (4) general categories were established, as follows: ***Maintenance, Preventive Maintenance, Technical Support, and New Installations***.

The following Task Flow Chart delineates the related activities and how the designed grouping occurs. Maintenance activities involve construction or repair tasks. Preventive Maintenance activities involve jobs associated with preventive tasks such as hydrant and valve maintenance, system flushing, biofilm removal, new system inspections and pressure complaints. New Installations activities involve service installations, main extensions and replacements, and hydrant, valve and blow-off installations. And

finally, Technical Support activities involve project design and estimating, system evaluation and investigation, drafting and utility protection.



Many projects are designed by the Technical Support Section and forwarded to the Maintenance Section or New Installation Section for execution. As deficiencies are discovered by the Preventive Maintenance Section, they are forwarded to the Maintenance section for repair, or forwarded to the Technical section for investigation. Finally, as work is executed, the affected area is thoroughly flushed, water quality testing is performed, work order paperwork is completed, and the system is recommissioned for use.

Steering Committee:

A Steering Committee was formed which included the senior staff who possessed considerable experience and the greatest seniority. Their purpose was to guide the department through the reengineering process using their experience and knowledge as a compass and catalyst. The Steering Committee met once per month or as required to review the progress of the work teams, to provide guidance, and to determine the direction in which the reengineering process should proceed. This team had a significant responsibility and made an unequaled contribution to the reengineering process.

Work Teams:

Based on the findings of the Business Strategy Team, four additional work teams were created: the *Maintenance Work Team*, the *Preventive Maintenance Work Team*, the *Technical Support Work Team*, and the *New Installations Work Team*. All job tasks were revisited, discussed, rethought, and redesigned in an open team forum, allowing all participants to share their thoughts, experience and expertise.

The Maintenance Work Team evaluated operation and maintenance tasks such as: emergency control; temporary service procedures; excavation, shoring and backfill procedures; water system repair procedures; and paving procedures. These activities involved tasks associated with construction and system repair.

The Preventive Maintenance Work Team evaluated operations relating to maintaining the integrity of the water distribution system, and inspection of the system. Activities included: distribution and transmission valve and valve casing preventive maintenance (PM) and inspection; hydrant PM and inspection; water service PM and inspection; vehicle PM and inspection; and a new program referred to as Unidirectional Flushing (UDF).

CPW is leading the water distribution field by embarking on a new program referred to as *Unidirectional Flushing (UDF)*. This state-of-the-art program greatly improves the quality of water within the distribution system, and into our customers' homes. This program is environmentally friendly and extremely cost effective. UDF uses 40% less water than conventional flushing methods, and combines tasks previously performed by multiple crews into one united task, which includes: hydrant preventive maintenance, valve preventive maintenance, system flushing, hydraulic testing, and water quality measurement.

The Technical Support Team evaluated services performed to support other operations, and those performed which require a technical background. Activities included: customer service support and education; water quality and pressure investigation; distribution testing; water system identification; leak surveying and detection; water main deficiency identification, rehab and replacement engineering; plan review; and drawing and records maintenance.

The New Installation Team reviewed the requirements and responsibilities surrounding the installation of domestic and commercial water meters, the installation of new water mains and appurtenances, the disinfection and testing of new water mains, and the installation of anodes for cathodic protection.

Crew Structure:

As a result of the Reengineering Process and the findings of the work teams, specialization of crews was required to utilize personnel expertise and to streamline operations. Crew structure, tool and equipment needs, and vehicle requirements were analyzed. As a result of the discussions of the work teams, activities, jobs and projects were reviewed, and needs were determined to successfully execute projects. Crew restructuring was then accomplished based on the complexity of future assigned activities.

Prior to reengineering, there existed **9** crews consisting of 4 to 5 members each. Excavation equipment totaled **4** pieces which were shared by all 9 crews. Subsequent to the reengineering Process, crews were reduced to 3 crew members. One additional crew was formed for a total of **10** crews, and excavation equipment was increased to **7** pieces. The 3 crews without excavation equipment were assigned less taxing projects which could be accomplished, based on the established SOP's, without excavation equipment. Several positions were either eliminated or reclassified.

Regarding position elimination or reclassification, there were **37** total crew members in the Maintenance Section of the department prior to reengineering. As part of the restructuring of the crews, 3 positions were eliminated by attrition, 2 positions were established as "floater" positions, one position was reclassified as a Maintenance Coordinator, and one position was transferred to the Technical Section to be utilized for preventive maintenance. Subsequent to the restructuring process, **33** crew positions remained in the Maintenance Section.

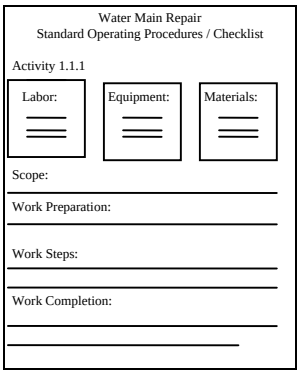
The "floater" positions are positions available to the crews when crew members are on leave. The availability of these positions reduce crew disruption and productivity loss. The Maintenance Coordinator position was created to track equipment inventory and repair, to provide equipment replacements for inoperable equipment, and to transport materials as required. As a result of this position establishment, "down-time" for the crews has drastically decreased, resulting in a significant increase in crew productivity. Also, as a result of the crew structure changes, job security for our associates has become increasingly stable.

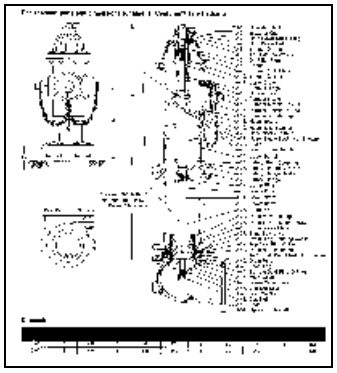
Standard Operating Procedures - The Water Distribution Operations and Training Manual:

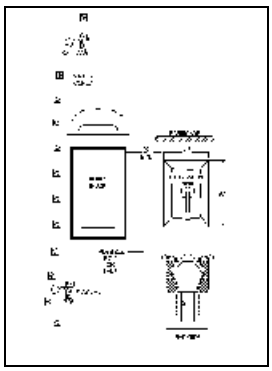
As with most organizations, Standard Operating Procedures (SOP's) are generally grouped within organizational boundaries, written for a select group, and not readily accessible. Our objective was to develop standard operating procedures (SOP's) from the information gathered through the work teams, and compile them into one format, grouped by association, and written in terms all would understand. This has become the Water Distribution Operations and Training Manual. Within the manual, tasks are referred to as *activities*. It was conceded that activities required various levels of manpower, equipment and materials to successfully execute a task or project. Those levels were determined and activities modified until all team members agreed that the established levels and procedures were accurate, beneficial and easy to follow.

The introduction includes the department's goals, the organizational structure (including transition periods), reengineering flow charts, CPW history, and a description of the water system. The Maintenance, Preventive Maintenance, Technical and New Installation Sections are structured by information discussed and agreed upon during the work team meetings. Also included were all standard details and forms used within the department, a description of the Productivity Measuring Program (PMP), special product information, and a copy of the SC Department of Transportation Manual.

The basic Activity format of the Manual includes a section describing the labor requirements to complete a task, a section listing the equipment required, and a section listing the materials required to complete the task. Next, the scope of the activity is described, followed by Work Preparation steps, actual Work Steps, and Work Completion steps. Many activities include cross-sectional details, tables, diagrams and pictures to assist with the execution of the activity. The following frames depict the type of information included in the Manual, and include format examples:







Activity Layout *Details *Pictures Diagrams

*Compliments of the Mueller Company

Construction of the Manual began in September, 1996, and was completed at the end of January, 1997. Upon completion, a copy was given to all crew supervisors, all technical personnel, and administrative support personnel for use as a training guide for new and existing personnel, and as a reference for daily operations. A considerable amount of positive feedback and appreciation has been received from our associates, along with many success stories regarding the convenience, accessibility and benefit of the Water Distribution Operations and Training Manual.

Paperwork Reduction:

Paperwork is created through the evolution and development of processes, tasks, duties and activities. Therefore, we must reevaluate our forms, work orders and associated paperwork periodically to determine if the flow is efficient and the paperwork is appropriate for our needs.

A Paperwork Reduction Work Team was established to review and critique all departmental paperwork, eliminate paperwork when possible, and standardize forms. The Team's main objective was to reduce the number of forms utilized within the Department, to streamline work-flow, and to simplify operations overall. The Team consisted of associates from all sections and departments who used and relied upon the forms as part of their job functions.
During the critique and evaluation process, several significant questions were asked, as follows:

- What departments used the information, and how?
- How is the information beneficial to the operations of the department?
- Is the information vital to operations?
- Is the information historically significant?

It was discovered that with many tasks, associates were completing several different forms for the same task. Many of the forms included the same generic information, resulting in a loss of productivity with respect to repetitive information acquisition, logging and transfer. In most cases several forms were combined into one form, resulting in paper cost & material savings, time savings, and productivity improvement.

Work Request Form:

The Work Request Form is a tool used to initiate response to customer concerns, the repair of deficiencies, and the execution of projects. Project status and completion is tracked through the use of this form. The main objectives regarding the modifications and additions to this form were:

- Combine 2 existing forms into one new form.
- Coincide with the new Water Distribution Operations and Training Manual.
- Simplify worksheet to ensure ease of information acquisition.
- Prompt the user to ask the right questions and obtain the required information.
- Utilize "check boxes" wherever possible.
- Track water distribution valve position - ensuring closed valves are reopened.
- Track hydrant service status by maintaining open communications with the local fire departments regarding out-of-service hydrants.
- Prioritize repairs based on customer involvement, minimizing inconvenience to customers.

Work Order Form:

The Work Order Form is a tool to report all details of a construction or repair project. This form reports:

- Project Scope
- Material, labor and equipment description and costs
- Description and condition of the water distribution system

The main objectives regarding the modifications and additions to this form were:

- Combine seven forms into one form.
- Coincide with the Water Distribution Operations and Training Manual.
- Ensure only one form is required for each job.
- Include information critical to the new programs initiated through the reengineering process.
- Categorize information by department to streamline processing.
- Include new or modified information which will be beneficial to the department and to the company.
    - As-built drawing area
    - Main break and material failure history
    - Corrosion status
    - Soil and backfill description
    - Utility damage and damage claim information
    - Unaccounted-for water usage
    - Water quality readings
    - Anode installation information
    - Productivity Management Program (PMP) information
    - "3-C" Card (Courtesy, Concern, and Competence) Program tracking

Time Sheets:

Time sheets are tools used for technical and administrative staff payroll disbursement. The main objectives regarding the modifications and additions to this form were:

- Reduce time sheet submittal from 25 sheets per day to 5 per day.
- Combine 3 forms into one form.

- Establish weekly time sheets for administrative personnel.

A testing period was established allowing the associates involved to become familiar with the new forms and providing an opportunity to work out the problems associated with implementing new forms. Test forms were filled out by the initiators and sent through the proper channels and departments to evaluate the streamlining efficiency.

As a direct result of the paperwork reduction process, administration position requirements were reduced from 5 positions to 4 positions through attrition. Also, the routing of paperwork was modified, resulting in the reduction of review time associated with each form. Furthermore, as a result of paperwork reduction, additional time was relinquished to initiate and implement additional departmental projects.

With the reduction of paperwork and forms, and paperwork route modifications, a considerable measure of material and labor costs savings are being experienced. A projected yearly cost savings of approximately $75,300 was estimated. Additional benefits include an increase in supervision availability, productivity, and environmental conservation.

Training:

Due to the vast number of changes occurring in a short time period, continual training was required during reengineering. Training sessions were conducted targeting recent changes and affected personnel. Training was implemented in phases so as not to overwhelm our associates. Currently, all supervisors are responsible for providing weekly Manual training.

As a result of the rapidly changing job requirements, job responsibilities and technology within the water distribution field, and the upcoming SC certification requirements, GED and Certification training classes were established in September of ‘96. These classes are held separately once a week and associates are encouraged to enroll and attend all available sessions. We are encouraged and very proud of the initiative displayed by and the success achieved from our associates in the new GED classes, and in the new Certification Training classes.

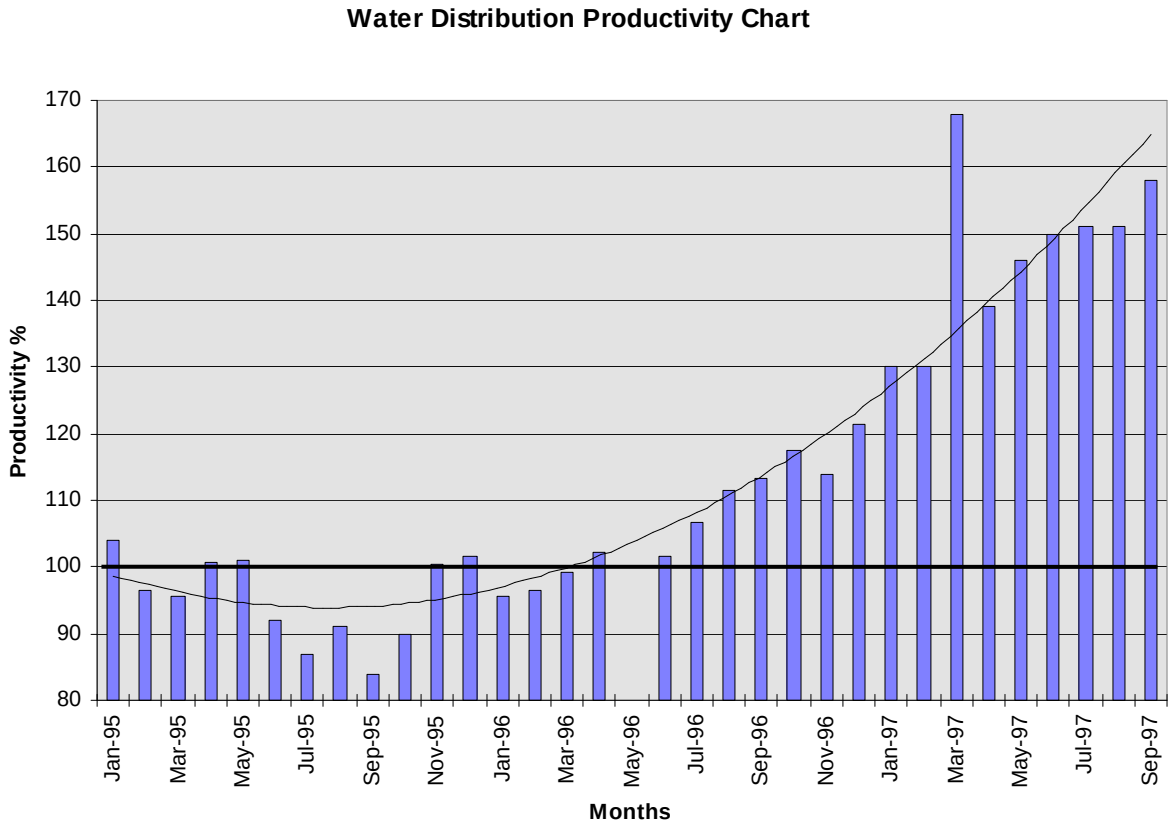
Customer Service:

As previously stated in our goals, without our customers our organization would not be needed. Therefore, a program was implemented to provide our customers an opportunity to comment on the quality of our service. This program is referred to as the “3-C Program”, which involves presenting an uncomplicated survey card to each customer for them to fill out. Each card is self-addressed and stamped for the customer’s convenience. The 3-C’s of customer service represent ***Courtesy, Concern*** and ***Competence***. On all Activities and when construction occurs, a “3-C” card is issued to the customer supplying them a means of rating our performance. Also, these cards are affixed to our water service interruption notices for additional convenience.

To promote the distribution of these cards, rewards are offered to Teams which receive the most returned cards, with no retribution for the receipt of negative comments. To date, almost all of the cards received have included positive reports; and most of the negative reports were not related to the job at hand. Another benefit from providing the customer with this opportunity is that the team leader is more prone to ensure a quality, finished product.

Productivity Measurement:

Prior to reengineering, a Productivity Management Program (PMP) was in place, providing a means of measuring and comparing productivity before and after implementation. Upon total completion of reengineering, an absolute *productivity increase of thirty percent (30%)* was attained which included all sections and job responsibilities within the Water Distribution Department. Currently the productivity increase measures *fifty-eight percent (58%),* with a one-month high increase of *sixty-eight percent (68%)* - (see the following *Water Distribution Productivity Chart*). As the reengineering process progresses, this percentage continues to rise.



The PMP Program allows teams to review their performance on individual projects, review their overall performance on a monthly basis, and discuss ways to improve the teams approach to specific tasks. The team concept promotes the "*ownership*" of their "*business*", a working- together attitude, and promotes the mind-set that their *business* must succeed. This *ownership* of their operation also fosters the desire to take care of and maintain their vehicles and equipment. The Program was not designed to compare team against team, but to compare the team's individual monthly performance to past months performance, and to reward them accordingly. Rewards are given for high productivity, for significant increases in productivity, and for outstanding performance.

Recognition:

The reengineering process includes a Recognition Program which involves the rewarding of associates and teams for exceptional performance. Awards include: Employee of the Quarter, Employee of the Year, Productivity Management Program (PMP) Awards, Crew of the Month Awards, and Outstanding Performance Awards. The Outstanding Performance Award offers the availability to immediately reward an associate for performance above and beyond the required; rewards include: plaques; meal and movie coupons; gift certificates; privileged parking spaces; and recognition in the CPW newsletters, the local newspaper, and in Department Head and interdepartmental meetings. These awards promote team unity, competition, incentive to continually improve, and team pride for a job well done.

Departmental Monthly Report:

As part of the reengineering process, a departmental report was constructed to summarize the progress achieved each month. Four sections make up the report: Major highlights and Staff recognition, Training, Customer relations, and Operation performance. To keep the lines of communication open, the report acts as a means to relay important information and significant accomplishments to the associates within our department, and to senior management.

The Major highlights and Staff recognition section includes major accomplishments achieved as a team or on an individual basis. Also, promotions and certification credentials are listed within this section.

The Training section encompasses OSHA training requirements, Water Distribution Operations and Training Manual instruction progress, and specialized in-house and outside training sessions. This section compares the targeted departmental goals and OSHA requirements to the actual hours attained by each crew. Also included in this section is a summary of the work site safety inspections performed for the month.

The Customer Relations section reports water quality status, and the number of "3-C" Cards issued by our crews, and received from our customers for the month. Also recorded are the number of new services installed for the month.

The Operation Performance section relays the productivity accomplishments achieved for the month, including detailed calculations and trend graphs. Also included are main break statistics with charts, unaccounted for water reporting, new system inspections, and scheduled project status, which includes water main, hydrant and valve installations and replacements. Also included in this section is the status and progress of our Unidirectional Flushing Program (preventive maintenance).

Conclusion:

In conclusion, by rethinking our operations and redesigning our processes through teamwork, significant improvements in productivity, morale and customer service have been achieved. As by-products of the reengineering process, consistent work standards have been established, additional crews created, and additional equipment procured. Customer sensitivity has been enhanced, productivity has greatly improved, and associate recognition is promoted.

The reengineering project has been significantly beneficial to CPW operations and to the quality and productivity of the Water Distribution Department. We conclude the results have been worth the time and effort expended to conduct this project, and wish to share our experience with our colleagues in the water industry.