Q. Please state your name, business address and occupation.

A. My name is Charles A. Beyer. My business address is 220 NW Second Avenue, Portland, OR 97209–3991. I am Chief Information Officer (CIO) and Director of Information Systems (IS) for NW Natural (company).

Q. Please briefly describe your education and employment background.

A. I have more than 25 years of experience in information systems management. I joined NW Natural in June 1995 as Customer Information System (CIS) Project Director. Before that, from 1992 until 1995, I was Vice President of Development for KnowledgeWare, Inc., where my duties included running the Redwood City, California software development lab. Overall, I spent five years with KnowledgeWare, first in Michigan as a software startup, then in California to run the development lab. From 1989 through 1992, I was First Vice President and Manager of Information Services for Michigan National Bank, responsible for the data center, communications, and PC support.

Since the late 1960's, I have been a computer operator, shift supervisor, programmer, systems programmer, programming manager, data center manager, and Director of Data Processing. I also have 20 years' experience in the banking industry, in various technical and management positions.

Q. What is the purpose of your testimony?

A. My testimony supports the company's request for inclusion of the company's investment in a new residential and small commercial

customer computer Customer Information System (CIS) in utility plant, and thus in rates. The residential and commercial CIS went into service in November 1997. The company added the capability to bill large commercial and industrial customers through an upgrade to the CIS in November 1999. Both of these systems are in useful service today.

Q. Please describe the major components of your testimony.

A. In Section I of this testimony, I describe NW Natural's old customer information system, called the "Legacy" system, and further explain why that system had to be replaced. In Section II, I describe how NW Natural's management went about selecting a replacement CIS for the Legacy system. This section also describes the history of the CIS project development and how the company was able to successfully implement a new system well ahead of the Year 2000 changeover. In Section III, I describe what comprised the final CIS, including software, hardware, networking systems, and other essential components of the computer system. Section IV describes the benefits to the company and customers of the new CIS.

Q. Does your testimony describe how the company accounted for its costs of CIS development?

A. No. The testimony of Mr. Stephen P. Feltz explains the company's request for regulatory treatment of the CIS investment, and also describes how NW Natural accounted for investment costs of the project.

Q. Do you have any other preliminary comments?

A. Yes. Attached to my testimony as Exhibit 18 (CAB-Exhibit/1-2) is a glossary of terms and acronyms. Many of the concepts and terms used in my testimony have technical meanings that can be difficult to remember. The purpose of the glossary is ease in reference.

I. THE LEGACY SYSTEM.

Q. What was the Legacy system?

A. In brief, the Legacy system was NW Natural's old customer information system. The Legacy system was about a 30-year-old system; the new CIS replaced the Legacy system in 1997.

Q. Why did NW Natural decide to replace the Legacy system?

A. The Legacy system had a number of deficiencies that obstructed the company's ability to offer new services or make changes in existing services. The Legacy billing system had been constructed in stages beginning in the 1960s. At that time, it was built on a mainframe system called SEGAM. As of the time of the new CIS project initiation in 1992, NW Natural was believed to be the only remaining user of SEGAM internationally. Because of the technology available in the 1960s, primarily limited and expensive data storage technology, a system was developed that incorporated a multitude of compromises and limitations, which are no longer necessary in modern database systems. The design of the Legacy system was dominated by these limitations, and therefore, set the stage for future limitations on the adaptability of that system.

The Legacy system was thus an increasingly difficult impediment to a changing business environment. It was difficult to maintain, posing significant risk of major business interruption. Among the deficiencies in the Legacy system was its inability to maintain information about relationships between the company and its customers involving changes of address, changes in service address or other events. In addition, the Legacy system was not capable of handling information about equipment inventories, business agreements and other elements of the financial record of customer accounts. It was unusually difficult to modify for even the most minimal changes.

Last, but not least, the Legacy system was not Year 2000-compliant.

Q. Please describe some of the technical problems with the Legacy system.

A. Early in the process of replacing the Legacy system, NW Natural identified the flaws in the existing system as follows:

- Lack of a meaningful but changeable account number.
- Cycle driven processing rather than logical, business (date or event) driven processing.
- Inability to expand master files.
- Outdated and restrictive data structures.
- Orders must be printed in advance, which requires manual processing.

Because of the many limitations of the Legacy system, NW Natural sought a system that required less time to be spent on manual tasks such as key entry, data verification and tracking orders, and enabled customer

representatives to spend more time answering customer calls. We hoped this would lead to: quicker response time on customer calls; more data stored on-line and less time spent searching files; fewer delays in order processing and fewer hand-offs between employees; more accurate and detailed billing statements; more billing flexibility to offer new services for customers; more timely information regarding the status of pending service calls; more edit capability and input control built into the automated system resulting in fewer errors; and more time available to spend on customer requests for service.

With the Legacy system, we could not provide detailed billing statements for customers unless we prepared them manually. Our system was set up to bill routine gas services only at regular, dated intervals. Our bills did not even provide the most basic information such as payment amount received, special charges, account adjustments, and local and state tax details. Any new programs that required billing details (*e.g.*, energy conservation programs, electronic payment options, increased state and local taxes, etc.) were very difficult to implement. Eventually, we found ourselves trying to make new programs conform to the more traditional type of utility service, which did not meet customer needs very well.

It was clear by the early 1990s that, if NW Natural did not acquire a new CIS, the company would be unable to meet customer needs without significant delays and costly overhead, or would not be able to satisfy their

needs at all. Our ability to address even the simplest of our customers' changing needs was greatly impaired by the limitations of the old CIS, the Legacy system.

Q. Please give an example of the kind of operational problem the Legacy system created.

A. Key among its flaws was the dilemma of how the Legacy system stored account numbers. This number, assigned to a customer, incorporated important data about meter reading routes. The implications of this design feature were huge. As customers were added, meter reading routes required constant adjustment. Each meter reading route change resulted in account number changes which, in turn, broke continuity of customer records. Similarly, if a customer moved to a new address, or if a residence became occupied by a new party, the continuity of records around either the individual customer or the individual premise was broken as well.

By way of further example, there were many methods to access data on the Legacy system. Notice I did not say database. The original A/R (accounts receivable) Master File built in the late 1960's was implemented using SEGAM, a file system that was never really supported by IBM. It was written by an IBM Systems Engineer (not by IBM Software Development) and was never an official product. It was only used by three or four utilities in the Northwest. To my knowledge, the last utility

(other than NW Natural) converted off of this obsolete environment in the 1980's.

NW Natural had to modify SEGAM each time we did an operating system upgrade. It was the critical path software for migrating to DOS VSE in 1980, upgrading to release 2 in ’82, and so forth. Not only was it hardware dependent, it was operating system dependent. Every time IBM changed their file access routines, we had to change SEGAM to work with the new architecture. IBM was forced to keep obsolete disk drives on our mainframe in Boulder to continue running the Legacy system until we replaced it in late 1997. This resulted in extra cost, lower performance, and increased reliability problems. In essence, we were using company resources to make the technology work, instead of making the needed application work. This costs more, takes longer, and delivers less for the investment.

Finally, the Legacy system was built over a 30-year time frame using a multitude of programming languages (assembler code, PL/1, Cobol, CSP, and Focus.) While many formats of data storage were used (VSAM, flat files, Focus, etc.), most of the developed “new” files had to move this new data back to the original A/R SEGAM master file. This resulted in delays, since this was a batch process. As a result, the information in the key file was usually the last to be correct. Worse, if something happened to the batch process (rejects, other errors, or just

operational problems) it was possible for the file to remain different or wrong.

Chart 1, attached hereto as Exhibit 18 (CAB-Exhibit/3) describes the number of sub-systems developed after the original A/R (and when they were developed), as well as the number of sub-systems that flowed data back to the A/R system. Please note the systems with arrows in and out.

Each access to each file was hard-coded into each program. The navigation was entirely up to the programmer. Any changes to any of the files involved required changes to ALL of the programs involved. In a nutshell, that is why there were not many changes to this environment. Too many things "broke" when you changed the data. The A/R file had no significant changes made to it since the 70's because of this.

This type of environment was pretty common in the 1970's. Most companies had moved to a database environment in the 1980's in order to manage this data complexity. As we found in the 90's, it was a very difficult and expensive proposition to convert such data files to a true database. It was made worse by an extra 10-15 years of adding features in older and non-database technologies.

Q. Did the old Legacy system lack critical functionality?

A. No, with one exception. Lack of functionality was not the primary reason for needing a new CIS, although there was definitely one necessary feature missing: the ability to function with the Y2K date, which would

have become a problem for our customers sometime in late 1999. The Legacy system had been both systematically and unsystematically expanded to perform most of the critical business functions needed by the company. It performed customer information lookups, order processing, meter reading, billing, credit and collections, adjustments, cash posting, energy services billing (somewhat) and general customer reporting. It was certain to have failed in that processing sometime in 1999.

Q. In your opinion, could NW Natural have salvaged the Legacy system and modified it to be Year 2000-compliant?

A. Perhaps, but only at considerable cost and with a high risk of failure. It would have been a very poor use of our resources, since we would still be saddled with an extremely inflexible and outdated system for the future. It was inconceivable to commit multi-millions of dollars to try to salvage the 30-year-old Legacy system, especially when success was so very questionable.

II. MANAGEMENT OF CIS REPLACEMENT PROJECT.

A. History.

Q. When did NW Natural recognize the problems with the Legacy system?

A. The problems of the Legacy system were recognized as early as 1984. In February 1984, NW Natural's Computer Project Review Committee reviewed the top needs for the company's information systems. The most critical needs identified were expansion of the customer master files,

development of an automated industrial billing system, improvements in meter reading data capture and migration to database technology. In April 1984, NW Natural brought IBM Corporation in to perform an application transfer study. The objective of that study was to identify and prioritize development of critical pieces of the Legacy system. At that time, IBM was working with internal users at NW Natural and with NW Natural's IS staff to develop a strategy to migrate the Legacy system to a new system. The first pieces identified involved industrial billing, industrial reporting, appliance tracking, reserve tracking and merchandise billing. Although these represented significant improvements to the existing system, there were several fundamental design flaws still embedded in the Legacy system. These included the account number, which could not be changed without disrupting continuity of records. The new system would be required to process information not only on cycles, but also at intervals responsive to other business events. It would have the ability to expand master files and relieve limitations on the ability to manage print and dispatch orders.

Q. What happened next?

A. In January 1986, NW Natural formed a System Review Board to prioritize and provide executive direction to information systems development. The objective was to recommend a long-range plan to guide the company's allocation of resources for IS developments. The top three projects in

order of priority were the industrial customer systems, accounting and budgeting systems and the residential and commercial customer systems.

In November 1987, the company reevaluated its strategic information systems plan and included an additional project for meter order service transactions, otherwise known as the MOST system. That activity is now included in the scope of the new CIS, which services residential and commercial accounts.

Q. Did NW Natural consider whether existing applications could be adapted to fit the company's customer information requirements before engaging IBM to develop a new application?

A. Yes, we did. The Actron system, which had been selected as the basis for our new industrial information system, was developed to serve the needs of NW Natural's 2,000 largest customers. The company that developed this product was later acquired by Price Waterhouse.

In the early 1990's, a project was initiated to evaluate use of the Actron product for residential and commercial customers. Price Waterhouse had released a new version based on IBM's DB2 database product. This was the first product deemed potentially suitable for NW Natural's new CIS, which incorporated a modern database product as the basis for its design. However, planning and design proceeded to the point where it was determined that the product could not be completed satisfactorily within NW Natural's budget and time constraints. Initial

design and development work from this effort was used in the planning of the subsequent residential/commercial new CIS system.

Q. Did NW Natural review existing CIS software packages to determine whether on off-the-shelf product could be used?

A. Yes. We looked extensively at products available on the market ("off-the-shelf" products) from 1990-1992, and found none that met the company's needs. IBM had a concept, which was in various stages of development at other companies, that would meet NW Natural's needs. We hired them for a preliminary study, liked the results, and negotiated a fixed-price contract with them to develop our own system, which we sometimes call the "custom" effort. The system was intended to replace existing functionality, not to add costly "bells and whistles."

Q. Please describe the process which led to initiation of the company's new CIS project.

A. In 1991, NW Natural requested proposals for a consulting company to perform a detailed study to determine the application scope, analysis of technology and record recommendations for new CIS implementation strategies. IBM was awarded the contract to conduct the study in a competitive bidding process. The successful IBM team included experts in CIS applications, open systems technology, object-oriented development, Graphical User Interface (GUI) development, data migration and project management. The IBM team conducted this study with full involvement and support from NW Natural users and technical personnel.

Q. Why was IBM selected to perform the study? Were objective criteria used?

A. A NW Natural cross-functional team selected IBM using a matrix of objective criteria. IBM was selected for this engagement because of a solid project approach, experienced and skilled experts to staff the project and because it had as a part of its solution an existing data and process model for customer information systems, which NW Natural felt would provide a valuable head start to the project analysis. That model was called the Utility Customer Design System Information Model ("UCDS").

Q. Was the new CIS intended to provide new functionality or to replace existing functionality?

A. The original intent was to replace existing functionality, but to do so with an updated and more flexible system.

Q. Did the study produced by IBM lead to a plan for development of an application tailor-made for NW Natural's use?

A. Yes. IBM was awarded a contract to develop a new CIS for NW Natural, using the UCDS model they had developed with other clients. IBM was building on a proven methodology for defining requirements of a utility customer information system. Several projects preceded NW Natural's, and we expected to gain from the experience of those projects. The UCDS model was developed jointly by IBM and several utilities over a period of three years. The UCDS information model was being used as a baseline for the application scope, general design and database

strategies. Since NW Natural was looking for a vendor with which to "partner" on this project, to share risk while at the same time delivering on its commitments for the life of the project, IBM's prior experience and development work on the UCDS model was very appealing.

Q. What management controls were put in place to monitor the progress of the new CIS project?

A. NW Natural provided a multi-layer management and oversight structure for the new CIS project. The NW Natural and IBM project managers were monitored by a management steering committee comprised of individuals from NW Natural and IBM. An additional layer of oversight was provided by an IBM project review structure, independent of the project team. In addition, NW Natural engaged a third party outside auditor to advise the company on project problems and progress.

Another management tool the company utilized was to negotiate a fixed-price contract with IBM, under which IBM would be obligated for specific deliverables at a fixed price. As the company had surveyed the CIS efforts of other utilities across the country, it became clear that one risk of CIS development was almost uncontrolled cost escalation. This was because many utilities signed contracts for CIS development that paid for development services on an hourly basis. Given how complicated all computer development projects can be, and how often these projects turn up unexpected difficulties, NW Natural sought a contract that would minimize that risk.

Q. What was the reason behind the open systems technology choice for the new CIS?

A. NW Natural had a number of technical platforms in use throughout the company. One of the concerns was the complexity of supporting multiple platforms. As systems integration became more important, we struggled to interface systems on the different platforms. We had done pilot projects using open systems to test their feasibility with satisfactory results. One of the factors in moving to open systems was the desire to avoid proprietary technology and, if at all possible, to avoid single vendor reliance. In an attempt to simplify NW Natural's technical environment over time, we committed to the open system technologies for new development activities. This was in order to standardize on a single set of technologies already used within the company. At the time, IBM was establishing an open systems practice in Portland.

Q. One of the elements in selecting IBM was their object-oriented capability. Why was this important?

A. One of the most critical elements in the design of the system was the design of the user interfaces. We wanted these to be as simple to use and as productive as possible. Graphical User Interfaces (GUIs) were recognized to be the most powerful tools available to support this requirement. The best development tools for GUIs are object-oriented. Thus, that capability was deemed critical to reaching the design objectives of the project.

Q. Was the custom project phased, or did the company intend to deliver a single completed application?

A. One of the basic design strategies of the new custom CIS project was phased implementation. The five phases were designed to convert data and processes step by step without making the ultimate commitment to a "big bang" changeover. At each of the phases, this could be tested without jeopardizing the serviceability of the Legacy system. The phasing strategy was also designed to enjoy early benefits from such features as "statement of account," so that old work practices, which were completely manual and very inefficient, could be replaced with automated features early in the implementation.

B. <u>Application Function Group (AFG)</u>.

Q. Please define what "Application Function Group" means.

A. Application Function Group (AFG) was simply the name that NW Natural and IBM ascribed to the various phased deliverables of the custom CIS project. AFG1 was thus the first deliverable of the phased custom project.

Q. Why is the AFG1 deliverable important?

A. As I will describe later in my testimony, NW Natural ultimately decided, in 1995, to change course away from a custom CIS buildout to a purchase-and-modify strategy. NW Natural and IBM had successfully completed the first phase of the custom approach, AFG1, and put it in service in 1994. However, we mutually agreed that the custom approach would not deliver a useable product within the company's time and budget constraints. The

final, successful CIS was a modified, off-the-shelf product. This product was not available in 1992, but was available in 1996. Virtually all of the substantial work involved in the development of the first phase of the custom effort, AFG1, was nevertheless used in and became part of the successful completion of the modified off-the-shelf product. I will describe the AFG1 effort in some detail, because its components were transferred to and became a part of the off-the-shelf, modified package.

Q. Describe how AFG1 was developed.

A. The logic behind the development of the first Application Function Group (AFG1) was to begin benefiting from the project development as soon as possible. AFG1 consisted of two software components distributed over a three-tier client server network:

1. Graphics User Interface, or GUI - This component included data retrieval and workstation display routines. This software component was loaded mainly on the workstation client.

2. Cleansed and converted database - This ObjectStore-based database was loaded with cleansed and converted live NW Natural data. Included in this component were data conversion and cleansing rules, code to implement them and the data manifestation of the object model. This software component was loaded mainly on the database server.

3. Documentation - This included system requirements, standards, Joint Application Development (JAD) notes and Business Rules.

AFG1 was developed using an object-oriented development approach. Several successive steps resulted in the aforementioned software components. These steps were:

1. JAD sessions - These sessions identified business areas impacted by the CIS and the desired CIS functions for those affected areas. The results of these sessions were documented in the JAD notes.

2. Business rule development - These sessions documented the business processes for all CIS affected business areas. These are documented in the Business Rules.

3. Object Model development - This process developed the baseline object model for the new CIS. The object model included definitions of the data structure for storage and the methods (processes) to be followed within the system based on anticipated events.

4. Data cleansing and conversion - This included definition of the data cleansing and conversion rules to be applied to NW Natural's existing data and collection rules for the storage of new customer data.

5. GUI development - This included the analysis of user interaction types and desired customer call flow from initiation to closure. Based on this analysis an interface was developed and refined into the final production product.

Q. In the course of the custom CIS development, the IBM/NW Natural team switched to an object-oriented database. Why was that done?

A. The development of interfaces between the object-oriented code in the GUIs and the old relational database was proving very difficult. In the meantime, problems with the relational database product were delaying the project and posed the risk of having to change vendors to resolve these difficulties. Although these were corrected in time, the combination of factors drove us to evaluate alternatives. One of those alternatives was to move to a fully object-oriented design. Another was to change from the object-oriented based GUI design. In the investigation, NW Natural staff, including myself, traveled to IBM's database laboratory in California to discuss the alternatives with IBM database experts. At the time, IBM was

an investor in ODI, one of the leaders in such products. At the presentations, the advantages of the all object-oriented strategy were discussed. In the subsequent analysis, it was decided that an all object-oriented design was the best available alternative to achieve NW Natural's project goals.

Q. Did the all object-oriented strategy work?

A. No. It eventually became clear that the development plan would not lead to satisfactory results, partly due to the complexity and cost of implementing the object-oriented design, data conversion difficulties and a host of other challenges. In late 1995, both IBM and NW Natural concluded that a different strategy using newly available off-the-shelf products would be the only way to conclude the project within an acceptable time and budget horizon. Both were significant concerns, not only because of the development costs being incurred, but also because of the ongoing risk of Legacy system problems and the looming Year 2000 deadline. In addition, IBM’s AS/400 hardware product line had grown in capability to a point where NW Natural could rely on its ability to meet NW Natural's growth requirements while simplifying operations support.

Q. What software/hardware were to be used for the AFG1?

A. SGI “L” 4 CPU Unix processors were the prime database server, SGI “M” Unix processors were the middle tier concentrators, and Sun Sparc Workstations were used for the user access. A complete TCP/IP network

was built to support this environment using Cisco routers and Sun servers. Various flavors of Unix ran on the different platforms selected.

Both Sun and SGI development tools were used (compilers, testing tools, etc.). The object database was from ODI, although the original design required the purchase of Sybase relational database.

Q. What were the main factors that led NW Natural to change direction after the development of the AFG1?

A. This project had all the usual start-up and team-building problems that nearly all large development efforts face. In addition, I would say the three worst obstacles the NW Natural/IBM team faced were:

1. the GUI;
2. object database (versus the original relational database), and;
3. data conversion.

Q. Please describe the problem with the GUI.

A. The GUI was a problem because of the relationship between the vendor (IBM) and our end-user community. IBM had not intended (nor was it contractually required) to develop an expensive user interface. As I have noted earlier, it was NW Natural's intent from the beginning to only replace existing functionality, not create new functionality; however, users were hoping for a lot more. IBM did respond, and designed and programmed a very powerful client application for AFG1, and the users were very pleased. This was a problem because it consumed resources. It put the project further behind and drained budget. However, the schedule was

not actually impacted by this delay, since the data conversion became critical path.

Taken together, these problems were so significant that IBM and NW Natural concluded in Fall 1995 that an alternative to the custom development approach was warranted. The assessment was that it would be too costly in time and money to complete the custom development.

Q. Please describe the problem with the object database.

A. The object database has been described earlier. The switch to an object database was made to allow faster delivery of AFG1, based on the strong position taken by the contract developer/consultants that had been engaged by IBM.

While it may be true that it was easier to write C++ programs using an object database, there were problems generated by the decision. Object database technology is still very immature and was especially so in 1994. There were no tools to manage the environment and there were very few people with the necessary expertise. There were no major success stories in building a comparable application with this technology.

A considerable amount of resource was used to implement AFG1 using this object database. Unfortunately, AFG1 was an inquiry-only phase of the project. The updates to the AFG1 database came from daily batch runs from the mainframe Legacy system. In my opinion, that object database could not have been upgraded to support the real-time updates and batch processing updates necessary to run a utility CIS. The effort to

make the read-only AFG1 system work is sufficient evidence. This is why I believe the $30,000,000 estimate from IBM to complete the AFG1 custom development project was probably low. We would have needed to eliminate the object database and to return to solving the problems with a relational database.

Q. Please describe the data conversion.

A. The data conversion was a monumental effort. A significant delay to the original AFG1 implementation occurred because the contract team underestimated how complex this conversion would be. The Legacy system data files had many problems. I will list some of them:

- Incorrect data (due to poor or no edits)
- Coded data (poor, if any documentation on what the codes meant)
- Free form data (just like it sounds – text entered by the user that was "supposed" to conform to some conventions, but absolutely no way to enforce those conventions)
- Inconsistent data (what was in the A/R master could be different from the "same" field in another file)
- Multi-use fields (due to shortage of space and inability to modify the original database, some fields would be used for different things, based on some other condition existing. Every program and user needed to know to look elsewhere to determine what the field contained.)
- Deliberately wrong data (an invalid date could mean a special program)
- Truncated data (due to field size constraints in the old database)

This is not a complete list. It took the data conversion team the better part of two years to find these problems and write the rules for converting.

Q. What was the data conversion process.

A. The 30-year-old Legacy system was reflected in the composite of four primary database files:

Billing Master File (SEGAM)

Billing History File (VSAM)

Payment History File (VSAM)

Contract Configuration and History File (VSAM)

The Billing Master File was the original database file while the other three files were developed as requirements dictated over the following years.

The original Billing Master File utilized a custom and unsupported access method (SEGAM) for retrieving and updating the data. The format of this database file was in itself its own complete database composed of various segments of varying length for each account/premise. Aside from basic account, customer, premise, and meter information, other account state/set-up information was contained in various segments of the Billing Master record.

Included in the three other Legacy (VSAM) files were unique record types for tracking summary data for 12 months of utility billing and payments along with up to 36 months of contract billings and payments. It should be noted that only summary information was contained in some of the key files (*i.e.*, in some cases, detail data was overlaid in as short a period as a few days time).

A primary requirement for the conversion processing was to be able to retain detail history during the project life. This was estimated to be

more than 18 months. The data collected during this period needed to be capable of being audited between the Legacy and replacement CIS systems.

Before we could develop a conversion "system," the data conversion team had to build a mainframe test environment. There was no test system for the Legacy system. Testing was accomplished by using test accounts in the production data files. This was not sufficient for conversion purposes, since we needed to validate the impact of data changes to the complete customer base. The reason there was not a test environment was the complexity of the Legacy system files and the cycle orientation of the processing. Since there was not a single database, but many files of CIS data with all the problems mentioned previously, this was an extremely difficult effort.

The first step of the conversion development included the creation of a unique extract program for each segment or record type of the Legacy database. The creation of these programs included the design, development, and testing of program normalization (*i.e.*, the creation of re-usable code) between the various file formats.

The second step included the design and creation of daily “delta” files. These files represented the addition, update, or deletion of records (*i.e.*, database changes) from the prior day’s file states. The data represented therein would later be utilized as “transaction” data to be posted to the intermediate conversion database.

The third step of development included the creation of transmission process for each of the extract files and delta files. The design and development of these programs included much error checking, such as insuring that duplicate or prior days' transmission were not wrongly represented for presentation as the current day's work.

The fourth step of development included creating and installing a production batch stream for the execution of the extract, delta, and transmission processing. All in all, there were approximately 80 programs developed for 80 batch jobs. A batch job had one or more requisite predecessors and some batch jobs had more than one successor job. The creation of the batch stream involved five people over approximately two months.

The final development step included the creation of a Balance and Control (B&C) process, which was designed and developed in order to compare data between the Legacy and replacement CIS system. For this requirement an independent extract process was created for the Legacy system. The data in this extract reflected the key summary state (set-up and A/R balance) elements to be compared to the equivalent fields of the new CIS. Likewise, a companion extract B&C file was created for the new CIS. Subsequent to the two B&C files being created, a B&C audit program was developed to supply summary (or optionally, detail) reporting of differences between the two systems.

It should be noted that in order to provide early view capability of the collected history, an interim object-oriented database was developed along with a windowing GUI (Graphical User Interface). By providing this interim interface, the customer representatives were able to view and print data on-line which had traditionally required excessive amounts of manual look-ups against paper and microfiche reports. The interim database also provided the first testing grounds for the B&C processing.

Q. What was the data conversion-balancing problem?

A. Because of the previously mentioned problems with the Legacy data, it was impossible to ensure we had 100 percent accuracy, primarily because the Legacy system had something "wrong" almost every day, in addition to the corrupt history information. We built balancing reports for the Legacy system that did not exist before this project, in order to have something to balance back to when we created the object database, and then the Mirror Pond database. We built balance and controls into the extract and load programs for the object-oriented database. We built balance reports for the load of the Mirror Pond database. Unfortunately, it was still not possible to get all these to agree on any given day because of the variances in the batch processes on the mainframe. Different sub-systems of the legacy CIS had different and incorrect information that

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would feed both the balancing reports and the new databases. We did find and fix the problems that impacted a large number of accounts.[1]

C. Changeover to Mirror Pond.

Q. Please describe the change of direction in the CIS project.

A. The team approach used by IBM and NW Natural throughout the project was extremely beneficial to resolving the problem. IBM and NW Natural met in the fall of 1995 for frank and open discussions about the project direction. Both companies determined that the best course was to go back to the market to see whether there was, in 1995, an existing system that could be purchased and modified, at reasonable cost, in place of continuing the AFG development effort. This was accomplished by the team, with the help of outside consultants and IBM's own database of existing utility systems. During the late summer and fall of 1995, the team and consultants analyzed approximately 60 systems available for purchase for compatibility with NW Natural's needs. None of the viable candidates had been available in 1991 and 1992, when NW Natural did its initial review and determined that custom development was its most cost-effective choice.

The choice of systems was narrowed rapidly to two. Orcom's Mirror Pond was selected as the most flexible, cost-effective, and easiest to access. Its developers were in close contact with IBM. The system ran

1 This balancing problem was not related to General Ledger dollars, which were managed, and all significant variances were accounted for.

on a well-known and well-understood mainframe, the AS/400, and the developers were easy to reach in Bend, Oregon. The other system in contention was developed in New Zealand, which alone was a factor that gave NW Natural concern about ongoing support and ease of the modification effort. Both IBM and NW Natural determined that Mirror Pond was the best option.

Q. Were you responsible for the ultimate decision to select the Orcom product, Mirror Pond, to purchase and modify?

A. Yes, I was.

Q. Please describe the process NW Natural followed to select the Orcom product, Mirror Pond, for purchase and modification.

A. Rather than perform an extensive internal search, we decided to tap existing knowledge bases. IBM did a review of all IBM partners with CIS packages. NW Natural, as a member of the CIS Technical and Users Group, had access to a document describing all member CIS activity. We engaged Micon, an Arizona consulting group, to provide us with performance data on key CIS vendors. Micon specializes in selecting CIS packages for utility clients. In addition, we engaged Mr. Martin C. Wilson, of the Seattle-based Wilson Group, who has an extensive background as a CIS vendor and consultant. Mr. Wilson educated us on the remaining packages and vendors not covered by our other resources.

Q. Did NW Natural personnel make extensive visits to other operating sites to examine products available in the market?

A. No. NW Natural personnel visited only a few sites to view existing products, preferring to leverage the experience of others, or bringing the vendors to Portland, to save time and money.

Q. When did the selection of the Orcom product occur?

A. By the end of 1995, we were quite certain that the best product for our needs was Mirror Pond. It appeared to have the most flexibility. However, we were uncertain whether all of the "gaps" between what that product could do, and what NW Natural's business needs were, could be bridged economically. Therefore, we set up a structure to do a "Gap Analysis" during the first three months of 1996, before making a final commitment to purchase the product.

Q. Please describe the criteria you considered and the reasoning behind choosing Orcom's Mirror Pond.

A. Orcom's Mirror Pond met many of the application requirements developed by NW Natural; where it did not meet those requirements, the necessary modifications fit within our fixed budget. This qualified Orcom for consideration. Orcom was selected based on our assessment of the vendor, the technology, the product, the support team, and the alternatives.

<u>The Vendor</u>

Orcom is an IBM Business Partner located in Bend, Oregon. They have been in business over 20 years and have 200 utility customers. Their close location to NW Natural was conducive to investigative visits

and allowed us to meet their people. The quality and communications ability of a few of their key technical people gave us confidence.

The Technology

Mirror Pond was written in a high level language (easy to maintain and modify), using a relational database (IBM's DB2) that is considered by many to be the easiest to use database on the market. The product runs on the IBM AS/400, a computer that has evolved over many years to utilize the most advanced state-of-the-art technology without making the customer written software obsolete. There is no comparable success story in the industry.

Mirror Pond

Mirror Pond was designed and built as a package to be used by many utilities in many states and countries. It makes heavy use of tables and parameters that allow the client to tailor the actions of the software without actually changing the programs.

Mirror Pond was a re-write of Orcom's original CIS system. Every programmer wants to re-write and correct any major system they have written. Tim Fischer and Alan Thomsen (the two key product architects for Orcom) had their opportunity to do that with Mirror Pond, but they were not satisfied that they had completed the re-writing before Orcom began marketing the product. NW Natural was fortunate to acquire the services of Mr. Fischer and Mr. Thomsen full time in 1997 to finish the job specifically to NW Natural requirements. They continue to work on

contract with NW Natural today, working on the modifications to Mirror Pond to support our commercial and industrial customers.

The Team

There is absolutely no substitute for people who have “been there, done that” on a major project. We had a very experienced and competent project manager from IBM, Mr. David Weber. IBM was motivated to get past the problems of AFG1 and turn NW Natural’s CIS into a success story. We had a running start on the data conversion due to the effort for AFG1. NW Natural’s executives and Board of Directors were intensively involved and supportive of any necessary direction changes to get the job done. Knowing the architects of the product were only an hour away was the final criteria necessary for me to make the Orcom recommendation.

The Alternatives

We had already eliminated continuing development of AFG. We knew it was not feasible to further extend the life of our 30-year-old system. Most of the other options were eliminated due to being “vaporware” (only existed in marketing slides) or too expensive (Big 5-type systems that would have cost from $40,000,000 to $60,000,000 in additional funds). The main alternative company that remained for assessment was Peace Systems, a New Zealand company.

The Peace system had several desirable features. It had a “look and feel” that our users liked. It would run on existing hardware. Peace

Systems personnel were compatible with NW Natural personnel.

However, there were overriding reasons to select Orcom above Peace.

- Peace was not a package, *per se*, but a system written for one utility, then modified for another. Peace had the competence to modify it again for NW Natural, but there was concern about the depth of their resources, and the distance between NW Natural and those who would need to modify it -- who lived and worked in New Zealand.
- Ongoing support of the resultant system would require more programming support based on “hard coded” features versus table-driven features.
- Any severe problems would be exacerbated by the New Zealand location. They did not have any other North American customers.
- The platform was still Unix, which I believe requires more administrative and technician support than the AS/400.
- Programming language and database technology was from a good technology firm (Informix), but one competing head-to-head with Oracle, Sybase, Microsoft, and IBM. I had great concern for their survival, and their stock (which was in the $30.00 range when we did the review) is currently at $10.00, and has been as low as $3.00.

Q. How long did the Gap Analysis, modification, and implementation of the Mirror Pond system take?

A. We finished the Gap Analysis and committed to Mirror Pond in April 1996. Modifications began in May 1996, and we implemented in November 1997. This effort consumed 19 months.

Q. Please describe in summary the modification process.

A. We had created an extensive set of requirements for the AFG custom development effort to create a new CIS. That requirements document was used during the Gap Analysis to determine what was missing, and necessary to our business needs, in the Mirror Pond system. If a gap was

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covered by an equivalent capability, or it was determined not critical, then no modification was necessary.

The vendor, Orcom, gave us estimates of the cost of modifications to fill the critical gaps. We allocated $1,500,000 for modifications (based on 12,000 hours at the vendor cost of $125/hour.) Our users sorted their needs by a priority scale of 1 to 3. Modifications with low priority that exceeded budget were deferred to be reconsidered after implementation.

Q. Please describe the main work components from the project custom development phase that were used in the Mirror Pond phase.

A. The work done in the AFG custom phase, prior to the decision to purchase Mirror Pond, was essential to the successful modification of Mirror Pond as NW Natural's new CIS. It would not have been possible to complete the project in 19 months, within the budget, if this work had not already been done.

First, NW Natural had created an extensive requirements document. This document did not exist when the project began. It consisted of a detailed analysis of all of NW Natural's business processes that needed to be duplicated or otherwise provided in a new CIS. This was a time-consuming process, involving not only IS personnel, but extensive involvement of current system users. When the project began, users knew how to use the old CIS (Legacy system), which had been in place for 30 years. But they did not understand their own processes in enough technical detail to allow a comparison with a modern system.

Once the requirements were analyzed and set out, this comparison was possible.

Second, prior to the Mirror Pond decision, NW Natural and IBM had created data conversion programs to move data from the very complicated Legacy system to an object-oriented database. This work was directly transferable to the new Mirror Pond system.

Third, the project had a completely new TCP/IP data network with high capacity capability at headquarters and the district offices. Basically, we had built a completely new data network, based on the same technology that drives the Internet for the world. This replaced the proprietary IBM SNA network the company had built and used for 20+ years.

Fourth, the quality assurance and testing methodologies and organization were in place. This was transferable to the Mirror Pond modification project.

Finally, the project management team was in place, with extensive knowledge of the user community and requirements. Keeping this well-functioning team in place so that Mirror Pond could be modified and implemented expeditiously was of critical importance to the success of the project. In my judgment, had NW Natural been forced to start over with a new vendor and team, when it determined that the application development effort needed to change direction, it would have been

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impossible to complete the project as quickly or as cost-effectively as we did.

Q. Can you quantify the advantage the early development project work gave to the modification project?

A. I can estimate it. Data conversion gave us nearly a year's head start. Requirements provided at least six months for a quicker start and finish to the Gap Analysis. The new data network was a six- to nine-month advantage. While some of these activities could have been overlapped, I estimate that we finished nearly a year earlier than if we had started cold.

Q. Mirror Pond runs on an AS/400 platform. What are the advantages to NW Natural and its customers of the AS/400 platform, compared to the system contemplated in the development project?

A. The AS/400 is a very mature technology that was designed to be a very reliable database machine. The operating system and the relational database software are tightly integrated with the hardware. The AS/400 had proven in other applications to be a very reliable, low maintenance environment. Because of this very integrated environment, critical functions such as recovery can be automated. For example, we have experienced two outages since November 1997, and both times the system made a complete recovery with no human intervention. I am aware of no other platform with the capacity of the AS/400 that is capable of this kind of recovery. In contrast, the former direction relied on an object-oriented, rather than a relational environment. Object-oriented

environments are still in the early development cycle. While they provide some very interesting capabilities, the tools to support these platforms are either missing or very immature, which leads to what is currently a very high maintenance system. These were the pitfalls we sought to avoid by switching to the AS/400 technology.

Q. How did you determine what modifications needed to be made to the Mirror Pond system?

A. We matched our requirements to the capabilities of Mirror Pond during the Gap Analysis. We then estimated the effort to make the appropriate changes and additions to Mirror Pond. The user team then selected which changes were mandatory, using the $1,500,000 budget as the limiting factor.

Q. How did NW Natural assess its own business needs to be certain that Mirror Pond would meet those needs?

A. The original requirements were drafted by a technical- and user-staffed team. The same team reviewed the Mirror Pond product before and during the Gap Analysis. This team set the priorities for customization effort based on business needs.

Q. When was the budget for the purchase, modification, training and implementation established?

A. The fixed part of the amended contract with IBM was established in December 1995. This established what IBM would be paid to change from a custom development project to a purchase/modify program. After

the Gap Analysis was completed, NW Natural established a total budget in June 1996 to complete the project (including the IBM contract costs.)

Q. Were there any significant deviations from that budget?

A. No.

Q. When did the Mirror Pond system become available as a usable system for a purchaser like NW Natural?

A. Mirror Pond was scheduled to be installed for the first time in December 1995, at another utility, when we made the decision to do a Gap Analysis. Subsequently, that installation was cancelled and rescheduled. Orcom installed two systems before we made the final "go" decision in April 1996.

Q. What portions of the AFG1 were salvageable and used in the Mirror Pond (final) CIS?

A. The requirements developed were later used for the Gap Analysis meetings with Orcom. The data cleansing and conversion, including the definition of the conversion rules for existing Legacy data, and the collection rules for storing the new customer data, were necessary to the Mirror Pond conversion. Had this work not been done for AFG1, it would have had to be performed anyway before the Gap Analysis. AFG1 itself was used in a production mode for more than a year.

Q. What portions of AFG1 were not salvageable?

A. Only one aspect of the company's custom CIS effort was not salvageable for use in the second, purchase-and-modify phase, and that was the effort

of IBM to write code to implement the Graphical User Interface (GUI). In 1995, when the company and IBM were considering whether to change course from the custom approach to the purchase-and-modify course, IBM presented the company with its analysis of what parts of the custom approach were usable and what parts were not usable. *See* attached Chart, Exhibit 18 (CAB-Exhibit/4). The GUI code writing, which was an IBM obligation, was not transferable to the second purchase-and-modify phase. NW Natural estimated the cost to the company of the GUI was $1.7 million. This figure was based on the amount NW Natural had paid IBM under the fixed price contract at the time that the companies changed course and further based on IBM's estimate of the percentage of its effort that had been expended on GUI code writing at the time of the course direction change.

Q. Was the GUI never used?

A. No, the GUI was used for approximately one year when NW Natural was using the first phase of the AFG effort, AFG1. However, it is not used now in the final successful CIS.

D. <u>Mirror Pond CIS in Service</u>.

Q. Is the new CIS in use?

A. Yes. We were pleased to successfully convert from the Legacy system to the new CIS in November 1997, several months ahead of the schedule we had established for completion and implementation of the modified Mirror

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Pond system. All elements of the new CIS have been in useful service since the changeover.

III. DESCRIPTION OF MIRROR POND CIS.

Q. Please describe NW Natural's Mirror Pond CIS architecture and components, including the hardware and server elements for operating the Mirror Pond CIS system.

A. NW Natural's CIS, based on Mirror Pond, is designed to track its residential customers, their gas usage, their bills and payments, and their equipment. It is used mainly by those employees of NW Natural who are responsible for customer service, rates and billing. Mirror Pond CIS runs on an IBM AS/400 (4 CPU's, 2 gigabytes of memory, 200 gigabytes of disk.) This AS/400 is connected to the new NW Natural network, which was built during the AFG1 phase of the original development project. Via this network, the AS/400 is connected to a SGI L 4 processor UNIX server that contains a data warehouse. This data warehouse is a relational database that is used for marketing information, ad hoc reporting, and connects to our new mapping system. Our user community connects to the AS/400 via PC's running Windows 95. The accounting for all components of NW Natural's CIS, including software development costs, licenses, hardware and computer networking facilities, are described in Mr. Feltz's testimony.

Q. Please describe how the modularity capability of the AS/400 fits with the overall CIS system design.

A. The AS/400 is a unique system. The tight integration of the hardware, software, and application development tools insures a very reliable environment. The hardware protects the operating system from application programs. The operating system and hardware protect the application programs from application data, and vice-versa. The relational database manager is integrated into the operating system and hardware. The resulting performance and stability is not attainable in pure software solutions (such as Oracle or Sybase). I would strongly recommend reviewing the significant number of independent consultant reports on the AS/400 posted at www.as400.ibm.com.

The major benefits realized by NW Natural with this architecture are high reliability and ease of maintenance. Since the AS/400 provides an easier development environment, of both development and support costs have been lower.

The AS/400 – Mirror Pond decision allowed NW Natural and IBM to focus on the CIS application, not the underlying technology. This resulted in a 19- month effort instead of the more traditional 3-4 year effort experienced by the utility industry and would have been experienced by NW Natural had we not changed directions. It is not unusual to commit significant resources to developing, testing and debugging, and implementing the technology to support a major system such as CIS. NW Natural and IBM were doing exactly that with the AFG1 (custom)

development program, devoting resource to the UNIX platforms, various development tools, Sybase, and ODI (Object Database development).

IV. BENEFITS OF CIS TO CUSTOMERS.

Q. What productivity improvements were expected as a result of implementation of a new CIS?

A. NW Natural believed that the new CIS alone would not generate greater earnings. Other process reorganizations and resulting process improvements in which the company was simultaneously engaged were expected to be the instruments for productivity improvements. As mentioned above, because of the limitations in its capability and flexibility, the Legacy system was often the fatal flaw in the company's other efforts to improve productivity. We intended the implementation of a new CIS to remove that barrier.

Q. Has the new CIS provided business management benefits for NW Natural?

A. Yes.

Q. Please describe the staffing impact of the new CIS.

A. To date, the Customer Service Department reports a 3.5 FTE (full-time employee) reduction as a result of the implementation of the new CIS. This represents savings of $85,000 per year. Process hours were saved in the Customer Service Representative, Billing Clerk, and Office Clerk areas.

Q. What is the impact of the new CIS on NW Natural's ability to train new customer service representatives?

A. There have been three new Customer Service Representative ("CSR") classes since the new CIS was implemented in November 1997. The training team reports a two- to three-week time savings for the initial training of a new CSR.

Q. How does the new CIS affect the ability of a customer representative to update customer information?

A. The update of customer information in the new CIS is real-time. This allows the CSR to discuss the most current information with the customer. In the old CIS (Legacy system), a CSR would have to wait for the nightly batch update, which would provide the updated information the next day.

Q. What is a control file?

A. A control file is a list of valid codes and parameters used to define how the system works. The control files in the new CIS are extensive and fall into three main areas. There are control files for service/customer-related descriptions (*e.g.*, rate schedule codes, billing classes, fixed charge types, service order types, etc.). There are control files used to calculate data for system-generated events (*e.g.*, billings, collection notices, etc.). There are also control files used to define system attributes (*e.g.*, system printers, security, etc.).

Q. How does the control file system benefit NW Natural?

A. A programmer is not required to maintain the control files. Because of the programming behind the control files, a trained user can add new values to a control file as needed and in real time. For example, the Rates and Regulatory Affairs Department maintains the rates control file tables at NW Natural. They can set up a new rate, test it, and give it an effective date without involving IS. By further example, the deposit rate is changed by a user.

Q. How does the new CIS affect NW Natural's ability to add and bill non-gas charges?

A. Unlike the Legacy system, the new CIS has the capability to easily add and bill non-gas charges. The new CIS supports one-time charges, contract sales, merchandise sales, and monthly fixed charges. The definitions just have to be set up in the control files.

Q. Is the new CIS Year 2000-compliant?

A. Yes, the new CIS is Year 2000-compliant. The Legacy system was not compliant and the projected cost to make it compliant (without adding any extra functionality) made such a fix not feasible.

Q. Did the new CIS affect NW Natural's decisions regarding outsourcing of mainframe operations? Please explain.

A. The new CIS operates on the AS/400 platform rather than the mainframe as did the Legacy system; therefore, IS was able to reduce their mainframe outsource cost once the new CIS was fully implemented. The net savings-per-year is projected to be around $180,000.

Q. Does the new CIS affect the amount of time it takes the company to program in a new fixed charge?

A. A new fixed charge can be added in the new CIS in a fraction of the time it took in the Legacy system. For example, in the Legacy system it took 80 programmer hours on average to add a new fixed charge. The new CIS takes less than 15 minutes to add the values to the control files and test the results. It is then available for immediate use.

Q. How does the new CIS affect the expansion or change in customer files?

A. In most cases, the new CIS requires significantly less effort for a programmer to expand and/or change files. For example, the Legacy system took seven person-months to add a second line of comments to a service order. The new CIS takes less than a one person-week to do the job.

Q. Please describe any other problems with making changes to the Legacy system that have been remedied with the new CIS.

A. Much of the Legacy system was written in an old, unsupported language, and much of the file structure was difficult to expand. It was difficult to hire programmers with appropriate skills. With the new CIS, programmers with suitable or appropriate skills are more available.

Q. How well does the new CIS interface with other existing or planned NW Natural applications? Is this comparable to the Legacy system?

A. The design and flexibility of the new CIS supports building interfaces to other applications that were very difficult or impossible with the Legacy system. For example, NW Natural could not fully take advantage of the interface to the Mobile Data Terminal application in the Legacy system.

Since the implementation of the new CIS, five interfaces have been implemented that had not been accomplished in the Legacy system.

Q. Please describe the new CIS with regard to its report-generating capabilities.

A. Unlike the Legacy system, fields in the new CIS are not used for multiple business concepts. This allows easy access to accurate data for management reports and decision support. There are multiple reporting options with the new CIS to access the data.

The new CIS has standard reports run in batch by computer operators as part of production procedures. There are production reports designed for the users to request as needed. Users can supply parameters for date ranges, districts, printers, etc. to meet their reporting needs. Users can view reports on line or print them. Users can rerun a report multiple times.

The new CIS also came with Query/400. Query/400 is a decision support tool that can be used to obtain information from the AS/400 database. It is being used for quick analysis of data and for prototyping some of the production reports.

A data warehouse has been created to facilitate ad hoc reporting for power users without having to go against the AS/400 database. This feature allows ad hoc reporting without affecting online performance. The data in the warehouse are updated real time.

Q. What has been the effect of the new CIS on customer satisfaction?

A. Immediately following implementation of the new system, customer satisfaction survey results were initially lower, as customer representatives struggled for mastery of the system and billing bugs were being ironed out. However, the company's July 1998 customer satisfaction survey showed a sharp rise back to NW Natural's normally high customer satisfaction ratings (sixty-six percent ratings at 9 or 10 on a scale of 10). There has been a learning curve for the users and customers as a result of the new CIS. Customers have had to get used to the new bill presentation, and users have had to learn how to use the new CIS.

Q. How does NW Natural measure customer satisfaction? Is there a specific measure that can track the new CIS-related customer satisfaction?

A. There are several customer satisfaction surveys conducted for NW Natural: (1) a monthly survey of residential customers who have had an office contact or field visit; (2) a monthly survey of customers that have converted to gas, and; (3) a survey of commercial customers. None of the surveys has a specific measure to track the new CIS-related satisfaction but the residential survey does ask the customers the reasons why they

would not give NW Natural a rating of 9 or 10. An analysis of the responses is being used to measure some of the new CIS related satisfaction. Also in the new CIS the CSR categorizes each customer's office contact. The categories include customer complaints, customer compliments, bill design issues, and service not offered customers. Reports on the contact types are being used to help measure the new CIS-related satisfaction.

Q. What additional information can customers receive on the new CIS that were unavailable on the Legacy system?

A. There are more line items on the bill, such as:

- payments and credits;
- summary, group billing, and other detailed information on the bill;
- bill usage graph, and;
- management of customer service order appointments.

Q. The new residential and commercial CIS has been in operation for over two years. What other benefits would you expect to see in the future?

A. Future benefits will include:

- The flexibility to define and display different bill detail for different customer groups.
- Offering some customers preferred bill due dates.
- Flexibility to e-mail bills to customers.
- Flexibility to e-mail or other file transfers of data to outside agencies such as sending bad debt info to collection agencies.
- Telecheck Interface – pay by phone.
- Serve customers and save time in payment processing.

Q. One of the reported advantages of the new Mirror Pond CIS system is its flexibility and ease of modification. Have you actually been able to take advantage of this flexibility?

A. Yes, two years after implementing our residential and small business customers on Mirror Pond, we were able to replace the non-Y2K compliant CIS running on the mainframe that supported our Industrial and Commercial customers. At a fraction of the cost to bring in a completely new CIS system, we modified Mirror Pond. We now have all customers on one CIS system. The low cost and very smooth conversion was due to our talented team of contractors and employees that are very experienced with this flexible software.

Q. Were modifications to Mirror Pond the only changes required to support the Industrial & Commercial customers?

A. No, we also acquired another software package called Billing Expert. This package allowed the very complex billing calculations needed for our most complex Industrial accounts to be programmed and calculated separate from Mirror Pond. Mirror Pond decides whether to calculate the bill, or send the data to the Billing Expert to calculate the few hundred accounts that require the complex code.

Q. Did you have to acquire additional hardware to move the Industrial and Commercial customers to the modified Mirror Pond?

A. We are running on the same AS/400, but we did add main memory and additional disk storage to support the additional customers.

1 **Q. Does this conclude your testimony?**

2 A. Yes, it does.