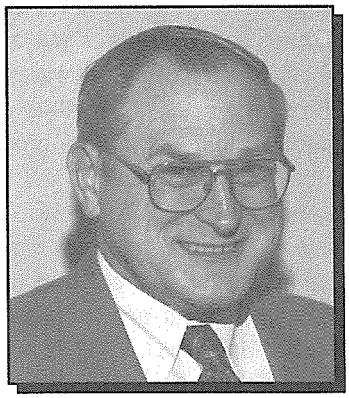
Alice Darilek is the Water Conservation Program Coordinator for the New Mexico State Engineer Office. As coordinator she is responsible for developing state water-conservation policy, initiating research efforts and demonstration projects, implementing educational and public information activities, and involving the public in program activities. Alice received a B.A. in Communications from the American University in Washington, DC. Currently, she is a member of the Santa Fe Metropolitan Board Water Conservation Committee and a member of the Santa Fe Xeriscape Council.

Jean Witherspoon is a Principal Planner with the Albuquerque Public Works Department. She was appointed the City's Water Conservation Officer in June of 1992, her primary responsibility, and has been active on the Policy Coordinating Committee for the Ground-Water Protection Policy and Action Plan for the last three years. She has worked with planning and fiscal issues in the Public Works Department for over ten years. Prior to that, she was a land-use planner with the cities of Albuquerque and Phoenix. Jean received a B.F.A. in Architecture from UNM and is now completing a master's degree in UNM's Water Resources Administration Program.



Donald L. Hutchinson graduated from the U.S. Air Force Academy with a B.S. in Engineering Science. Upon retiring from the Air Force in 1982, Don moved to Albuquerque where he joined a small manufacturing company called Intel which had also recently moved to Albuquerque. Over the past 12 years, he has served in numerous management positions and headed up the Intel team in its well-application efforts before the State Engineer. He currently is responsible for all central facilities operations. Don holds an M.S. degree in Personnel Management and an MBA.

WATER CONSERVATION PROGRAMS

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Statewide Water Conservation Efforts

We've heard a lot of discussion these past two days about the water problems and issues facing the Albuquerque area. And we've also heard that water conservation is expected to play a significant role in the solution of these problems. I believe it's important to watch closely what happens here in water conservation, because it will likely set the precedent for what may happen in other communities in the state.

Although the emphasis of this conference is on the Albuquerque area, I'd like to take the next few minutes to step back and look at water conservation from a statewide view. The Albuquerque situation is not unique. There are other communities in the state experiencing similar water issues and problems; some are experiencing them now, and others are expecting to do so in the near future.

The state has a growing list of pressures that are impacting its available water supply. First, we have a very limited surface water supply, which is fully appropriated and, in some cases, over-appropriated. In many parts of the state, we are mining groundwater, upon which we depend for about 90 percent of our drinking water, at a rate much faster than nature can replenish it. We are experiencing a rather rapid population growth that is resulting not only in an increased water demand, but also in an intensified competition for this limited resource. Many communities are finding it difficult to deal with the rising costs of water development and treatment and are turning to conservation as a less costly water supply alternative. Water pollution has been a problem in New Mexico for many years; it also affects the amount of water that is available for use. There are other environmental concerns, such as the protection of endangered fish and other fish and plants in riparian zones, that also are placing a demand on our water resources. Finally, there are continuing interstate compact obligations which also impact the way we use water in New Mexico.

Because of the increasing intensity of these water supply pressures, it is certainly time for water conservation to play a more significant role in water resource management in New Mexico. The State Engineer Office has recognized the importance of water conservation to the state's future and has begun to establish a state water conservation program. The goal of that program is to increase water use efficiency and reduce water demand in the various water use sectors. In addition, the Environment Department has recently become more interested in water conservation, and I believe you will see that agency play an increasing role in this arena.

Water conservation is receiving more attention at the regional and local levels as well. A task force of regional water planners from across the state gave water conservation an increasingly important planning role in a guidance document they recently prepared for developing regional water plans. In it, they said that water conservation must be the first water supply alternative considered in the development of regional water plans. In addition to Albuquerque, several other communities in New Mexico have begun to work on water conservation programs or activities. Some of these include Los Lunas, Taos, Santa Fe, Las Vegas, Roswell and Artesia.

So I think water conservation is definitely going to play an important part in New Mexico's water future. And I urge all of you to become involved in it, whether you participate in the state program that the State Engineer Office is developing, take part in the regional water planning activities in your area, join a local water conservation effort in your community, or do your part in your own house and back yard. For those of you who are interested in the state program, you're welcome to join the Water Conservation Network, a mailing list of interested persons across the state to whom we send regular program updates and whom we ask to comment about our program activities.

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Albuquerque's Water Conservation Program

Albuquerque's sole source of drinking water supply is the groundwater aquifer of the Middle Rio Grande Basin. The municipal water and sewer utility provides service to about 450,000 people, including about a third of the residents of the unincorporated portion of Bernalillo County. The City's water usage is typical of a Southwestern urban area in that summer usage is usually two to three times winter usage. Overall usage is 250 gallons per person per day, relatively high for this region. Albuquerque's billed sales, by billing class, are seventy-one percent Residential, seventeen percent Commercial, three percent Industrial, and nine percent Institutional.

Albuquerque initiated a water conservation program with the adoption of Resolution 49-1992 in April of 1992. This Resolution called for evaluation and implementation of moderate measures while developing a long-term strategy. The City contracted with Boyle Engineering to develop this strategy; subcontractor Amy Vickers developed the measures and benefit-cost ratios for this effort while George Raftells produced the rate analysis and recommendations. The effort was given a major "boost" in August of 1993 with the publication of U.S. Geological Survey and New Mexico Bureau of Mines and Mineral Resources findings that pumping-induced recharge is substantially less than pumping in this Basin.

The Strategy developed through this contract was presented to a Water Conservation Town Hall meeting in Albuquerque in September. Around 160 people participated in the one-and-a-half day meeting. This group of concerned citizens not only supported the proposed Strategy, but adopted amendments to make it more stringent. Today, I will be describing the Strategy adopted through this Town Hall. It will undoubtedly undergo further changes prior to adoption, but we hope the majority of the program will remain intact.

The proposed overall goal is a 30 percent reduction in the City's per capita usage over the next six to ten years. Achieving this goal would reduce the City's production from its current 250 gallons per capita per day to 175 gallons per capita per day and save an estimated 38 million gallons per day by 2004. These savings continue to multiply as new construction is built to use less water and as more customers convert to low water use landscaping. Estimated savings by 2060, the horizon year for the Long-Term Strategy, are 80 million gallons per day.

The Strategy calls for the City to catalyze a regional resource planning process including other cities, counties, tribal governments, and users with due attention to sustainable growth. While the City is by far the largest user in the Middle Rio Grande Basin, using approximately 72 percent of the total groundwater pumped, a successful conservation strategy must be regional in scope. An overly aggressive approach to conservation in Albuquerque may simply chase new business and industry to other parts of the Basin where requirements are not as stringent. Albuquerque has, to date, focused primarily on its own usage and required reductions, but will address regional issues in the future.

The proposed Strategy includes five main components or categories. Town Hall participants considered education and public awareness most important. The City has contracted with Cooney & Associates to provide the marketing and public information strategy and products. Adequate funding to continue this effort to inform the public of the need for conservation and ways to conserve is critical. In addition, the program should: 1) establish a citizens Water Conservation Advisory Committee to provide guidance and feedback, 2) hire a k-12 environmental education specialist to develop and implement an ongoing ecological approach to water conservation and related environmental issues in the schools, 3) continue live theater performances promoting conservation in the elementary schools, and 4) collaborate with existing community organizations to promote water conservation. Lastly, the City is now revising its water bill format to better inform citizens of their usage over time and relative to other similar customers.

The second major area of the recommendations addresses rates. Albuquerque's water com-

modity rate, at 57 cents per unit (748 gallons), is one of the lowest in the Southwest. This serves as a disincentive to conserve, since wasting water is usually cheaper than eliminating the problem causing the waste. A 5.5 cent per unit water commodity rate increase is proposed to fund a number of programs, including the base conservation program. To encourage reduction of particularly landscape use, much more aggressive seasonal surcharges are also proposed. These summer surcharges would double the commodity rate for usage between 150-300 percent of the winter average and would triple the commodity rate for usage over 300 percent of the winter average.

These surcharges would apply from April through November. Because they are a significant change from the existing additional 21 cents per unit charge for usage over 200 percent of the winter average, sufficient lead time for extensive public education should be allowed prior to implementation. To discourage winter waste, a surcharge would double the commodity rate for usage over 100 percent of the winter average. For Residential accounts, the winter average is determined by averaging all December through March usage for accounts with the same meter size. For all other accounts, the winter average is determined on an individual account basis.

Year-round indoor use accounts for around 60 percent of the City's total billed usage. The third category of recommendations in the Long-Term Strategy addresses this use. An amendment to the Uniform Plumbing Code requiring low volume fixtures for all residential construction was approved in June of 1993. This requirement should be extended to non-residential uses in the future. The Strategy also calls for: 1) a toilet rebate program with rebates of up to $100 per toilet, 2) a voluntary residential fixture retrofit program to install, without charge to the customers, water-saving retrofit devices in all existing residential developments and 3) voluntary, City-provided water use surveys (audits) for residential customers to identify potential reductions in both indoor and outdoor usage. The audit program would target the top 25 percent of the users, but would be available to all residential customers.

Seasonal/outdoor usage, the focus of the fourth strategy category, accounts for around 40 percent of the City's billed use. While some of this is used in evaporative coolers and pools, the vast majority is used for landscaping/irrigation purposes. Although Albuquerque is located in a high desert regime with less than nine inches of rain per year, bluegrass is the most commonly used landscape plant. Bluegrass can require up to 18 times as much water as low water use turf such as buffalo grass. Landscaping in Albuquerque needs to move from the high end of the spectrum to medium and low water use landscaping. Poorly designed and maintained irrigation systems also are prevalent in Albuquerque, leading to runoff which deteriorates streets, intersections, and storm drains. Irrigation usage also causes the high peaks during the summer months which drive system expansion. Reducing these peaks is a goal of the Strategy.

The primary component of the fourth area of the Strategy is the new Landscaping and Water Waste Ordinance, developed over the last two years through committee and task force efforts. The Ordinance calls for: 1) no watering in April through September between 10:00 a.m. and 5:00 p.m., 2) mandatory water even/water odd, 3) no water waste or fugitive water in the public right-of-way, onto adjacent property, or into storm or sanitary sewers, 4) no more than 20 percent of the landscaped area in high water use plants for new private development, 5) no high water use landscaping on City properties except parks and golf courses, 6) a surcharge on parks and golf course usage exceeding an annual allowance per irrigated acre, 7) no high water use turf in medians, on slopes steeper than 6:1, or in areas less than ten feet in any dimension, 8) efficient new irrigation systems, 9) installation of new sprinkler heads at least 8 inches from the curb, and 10) irrigation system water use audits on new properties with one acre or more turf, beginning in 1996. Water waste enforcement would be through fees rather than citations. These fees will be applied to the water bill, will increase with subsequent violations, and will eventually lead to flow restriction, if the water waste is not eliminated.

The landscaping provisions of the Strategy also call for: 1) initiating a Xeriscape landscape retrofit and rebate program offering 5 cents per square foot for replacement of high water use turf and landscape plants with low or medium use turf and plants, 2) initiating an efficient irrigation sys-

tem retrofit and rebate program offering up to $150 per customer for replacement of old, inefficient irrigation systems with approved water-efficient systems, and 3) initiation of a Xeriscape education program including additional demonstration gardens, expansion of the irrigation efficiency weather network, promotion and participation in research projects, and cooperation with other agencies on low water use events. Combining all City of Albuquerque requirements regarding landscaping into one manual is also recommended in the Strategy.

The fifth and final component of the Strategy addresses Institutional, Commercial, and Industrial (ICI) use. Industrial use accounts for only three percent of the City's billed usage. Commercial and Institutional use account for 26 percent. An analysis of the City's largest ICI customers, excluding large turf area, indicates that only 9 of the top 73 users are industrial accounts, while 26 are multi-family complexes, 6 are mobile home parks and 6 are motels. Obviously, a policy aimed at only industrial use, which might be appropriate in some cities, is not appropriate for Albuquerque.

A "strawman" Large Users Policy was proposed at the Town Hall. The Town Hall participants recommended that this Policy be revised through a public process prior to adoption, focusing sections of the policy on the very different uses affected by it. The Policy required that new customers using over 50,000 gallons per day: 1) develop a Water Conservation Plan, 2) use best management practices, 3) use low water use landscaping, 4) use low volume plumbing fixtures, 5) work with the City to evaluate and implement feasible alternative ways to use effluent, 6) promote water conservation to facility employees, and 7) keep abreast of new technology to reduce water use. The Policy also called for a prohibition of using City water for dilution purposes, initial and periodic surveys of new customers using over 300,000 gallons per day, and retrofit of existing large users to meet the above criteria by 2000.

The ICI component of the Strategy also calls for: 1) adoption of an ordinance prohibiting once-through cooling systems, 2) promoting City-provided water use surveys (audits) and retrofit for the top 25 percent of the ICI customers, 3) initiating a City and school building plumbing fixture upgrade program, 4) implementing a strategy to reduce the excess use of water for City-owned facilities or operations, and 5) the initiation of an unaccounted-for-water (UAW) loss reduction program. The UAW program would include: 1) earlier identification and repair of leaks, 2) identification and repair or replacement of inaccurate or malfunctioning meters, 3) installation of meters in all City parks (the older City parks are the only unmetered uses in the City), and 4) implementation of a strategy to reduce and use well wash water and water system discharge water.

The Town Hall recommendations will now go forward to the Administration for any modifications prior to submittal to the City Council for adoption. There is no immediate crisis, since Albuquerque's sole drinking water source is the underground aquier of the Middle Rio Grande Basin. But current usage levels must decrease to reduce depletion of the aquifer, thereby helping to ensure a healthy and economically viable future. Other water supply options such as use of surface water for drinking water supply or recharge and use of effluent for reuse or recharge will help to reduce Albuquerque's usage and sustain the aquifer. But conservation is the most effective, least expensive, and quickest way to significantly reduce Albuquerque's depletion of the aquifer. While the measures in the Long-Term Strategy may be modified through the approval and budget process, the overall message is clear: the City of Albuquerque is committed to conservation and fully intends to significantly reduce its usage over the next ten years. We have recognized the problem and expect to begin implementation of solutions in the near future, with the support and active participation of the community.

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Intel's Water Conservation Program

As many of you may know, although Intel is not within the city of Albuquerque, we have a strong sense of community. We are committed to be a good corporate citizen, and I would like to give

you a discussion of Intel's commitment to water conservation. We are in the process of implementing portions of a proposed conservation plan within our factory (see figures 1 and 2). Today's discussion is extracted from my 25-minute presentation yesterday. Today I'll summarize and get right to the crux of conservation at Intel.

Figure 1 depicts the current water flow through our site, while Figure 2 shows our projected conservation flow plan. Areas in grey represent those areas on which we currently are working. We have three different streams that flow through our manufacturing facilities: industrial, process and domestic. The water use at the far left bottom of Figure 1, domestic use, includes kitchens, restrooms, water coolers, and so on. Domestic use accounts for about 10 percent of our flow currently. We have installed in all our new buildings the low-flow water devices that Jean Witherspoon described. We plan to retrofit our older buildings with those devices. Our intention is to completely convert our site within the next five years.

Figure 2 shows areas where we are implementing our conservation plan: the cooling towers, scrubbers, factory, reverse osmosis (RO; a process for cleaning water) and acid waste neutralization (AWN). The two areas currently completed are the public areas and irrigation. We take some of our reverse osmosis reject water and use it for irrigation. It's fairly clean water, which has a higher total dissolved solid content than the groundwater we receive from Rio Rancho Utilities, however, it is still of a very satisfactory quality for irrigation.

Our first phase of conservation calls for using water that is sent to the acid waste neutralization area, where it is stored in a collection tank or series of tanks, and then is reused. We stabilize the pH of the water before it is normally discharged to the sewer, and we are now installing a $4.77 million project to use this water in the cooling towers and the scrubbers. We have completed that installation on one of our fabrication facilities, Fab 7. We are installing the necessary plumbing to implement the project on Fab 9 and Fab 11. Basically, the project consists of a highly sensitive chemical process that we need to understand before water is run through our chillers, which are subject to corrosion if the water is at a pH that will eat away at the copper tubing within our equipment. However, we think we have the chemistry stabilized now, and we currently are reusing about 67,000 gallons-per-day in our pilot project. That water is then used in the cooling towers, which basically are large heat-exchange units that use the same physical principle as swamp coolers. The units cool water down allowing us to reuse it. We also use that water in our air scrubbers, which are devices that filter the air before the air is rejected from our exhaust systems.

We also have a plan to increase the efficiency of the reverse osmosis process. Reverse osmosis does for dissolved solids what filters do for suspended solids. It takes the dissolved solids out of the water and cleans it up to point that we can put it through a deionization process. Deionization is very similar to what you have at home in your water softener. Once we send water through these two processes, it goes into the factory where it is used to rinse and clean our wafers. The water at this point will not conduct electricity. It is extremely pure. One cubic centimeter of that water with an electrode on each end presents 18 million ohms of resistance to the flow of electrical current. It is a better insulator than most insulators on electric wire.

We also have created a Cooperative Research and Development Agreement (CRADA) with Sandia National Laboratories to help us model systems to recover water from our wet stations where they actually rinse the wafers to recover that water and put it back into the reverse osmosis process, thereby saving water that would normally simply leave the factory and go to the sewer. The completion of that process is probably 3-4 years away. Obviously we are extremely interested in such a system because every one of our wafers, our product, is exposed to reverse osmosis/deionization water and if that water is not of an ultra-pure quality, we lose our product. Therefore, we must understand that process before it is implemented. However, the reverse osmosis and deionization processes currently are in place and hopefully by the end of 1995 we will be recycling and reducing our demand on the aquifer by about 2 million gallons per day.

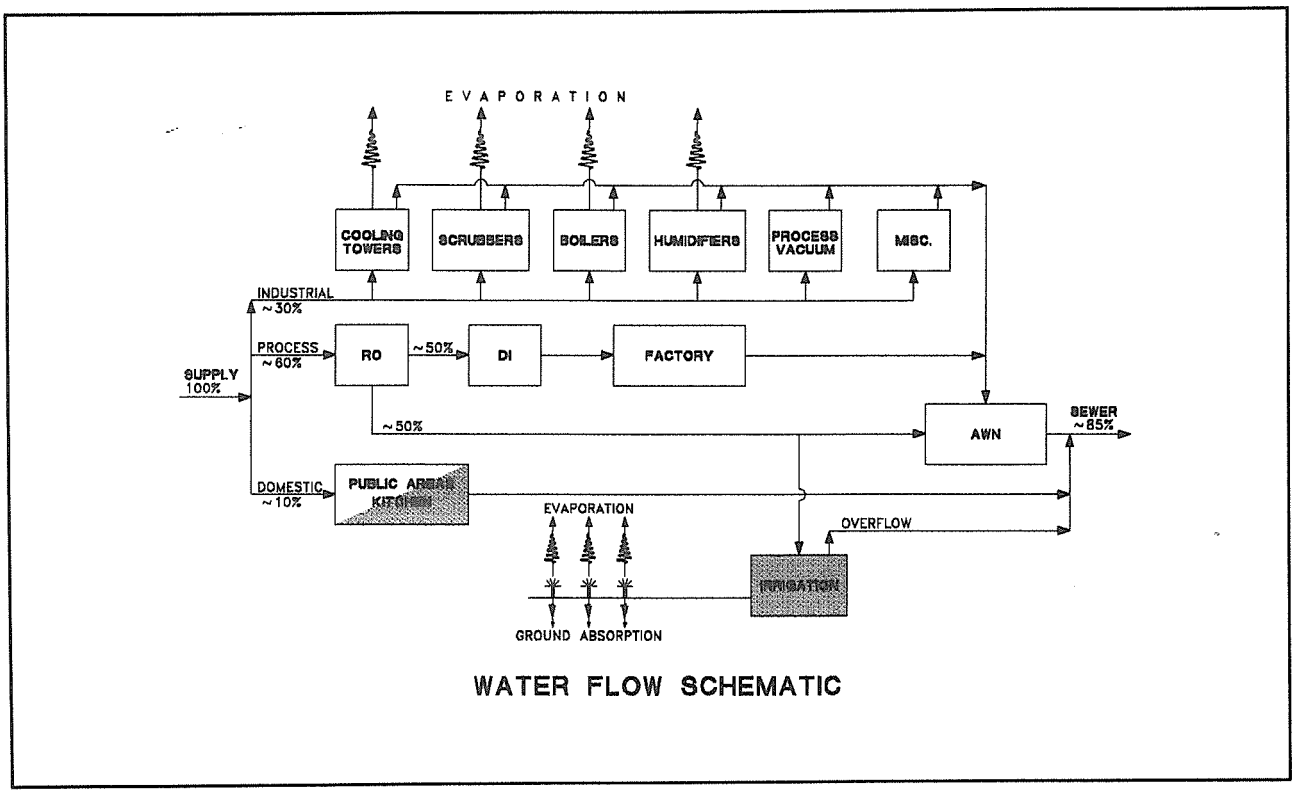

Figure 1. Intel's current water flow.

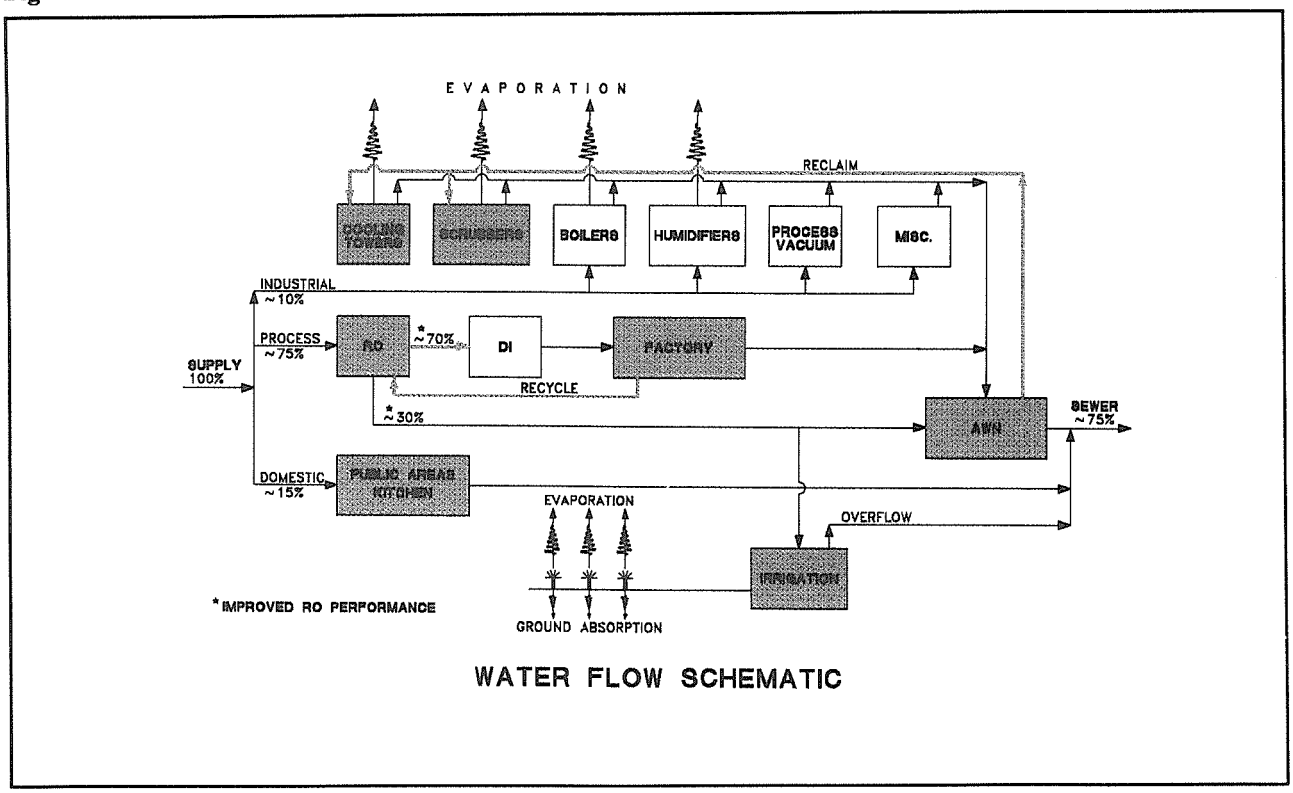

Figure 2. Intel's projected water conservation flow.