

IRRIGATION TECHNOLOGY CENTER

Texas Agricultural Experiment Station

Texas Cooperative Extension

April 2002

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EXECUTIVE SUMMARY

IRRIGATION TECHNOLOGY CENTER

Texas Agricultural Experiment Station

Texas Cooperative Extension

April, 2002

Vision

The vision of the Irrigation Technology Center (ITC) is to reduce irrigation water use in Texas while maintaining profitable agricultural production and quality urban landscapes. The ITC will coordinate the development of world class, statewide irrigation programs and facilities for education, testing and research by expanding existing programs and constructing new facilities to promote efficient irrigation and water conservation practices.

Background

Texas' rapidly growing population and industries are placing increased demands on existing water supplies and conveyance systems. Regional water shortages are expected to become prevalent in the next decade. In Texas, agricultural irrigation accounts for 65% of the total freshwater consumed annually, and landscape irrigation accounts for 20 to 40% of total municipal water use. As much as half of this irrigation water can be lost because of inadequate equipment and systems, and uninformed management. To ensure adequate water supplies, we must utilize the full benefits of existing technologies; expand adoption of water reuse practices; develop more efficient irrigation products and more effective management practices; educate agricultural and landscape irrigators; and identify policies that encourage and reward conservation.

Mission

The mission of the ITC is to:

- Develop new and improved agricultural and landscape irrigation technologies, management, and reuse practices.
- Provide training and educational services for irrigators, agency and industry personnel, and the public.
- Establish an equipment testing and certification program.
- Develop design and performance standards for agricultural and landscape irrigation systems.
- Promote opportunities for linkages with undergraduate and graduate academic programs.

Strategic Functions

The ITC will perform its mission through five programmatic divisions: Urban Programs, Agricultural Crops, Equipment Testing and Certification, Wastewater Reuse and International.

Administrative Governance

The ITC will be administered through the Texas Water Resources Institute (TWRI) in College Station as an organizational part of the Texas Agricultural Experiment Station (TAES) and Texas Cooperative Extension (TCE). The Vice Chancellor/Dean and Director of TAES/TCE will appoint a Director, in consultation with the TWRI Director and the Deputy Directors of the respective agencies. Division Heads will manage the activities of the five divisions. Advisory Committees will provide input on research and educational goals,

and perform programmatic reviews for their respective divisions. An ITC Advisory Council, comprised in part by designated representatives from Division Advisory Committees, will assist in strengthening collaborations and communication among the five Center Divisions. An ITC Program Review Team will be appointed by the TWRI Director and Vice Chancellor/Dean and Director of TAES/TCE to perform programmatic reviews of the Center and the respective Divisions.

Facilities

As funds become available, a facility in San Antonio will be constructed to address the Research and Extension programs in the Urban Programs Division, Equipment Testing and Certification Division, Wastewater Reuse Division and International Division. The Halfway Research Center/Helms Farm Complex in Halfway, Texas, will be a key facility of the Agricultural Crops Division. Funds will also be sought to enhance programs in College Station and at select Agricultural Research and Extension Centers throughout Texas.

Development Planning

Beach Ramirez (BR), Inc. of Houston, Texas, a consulting firm with expertise in facility and resource development, was contracted to provide an independent evaluation for the need and feasibility of the ITC, assess demand for services, and produce a development plan for the proposed facilities in San Antonio. The development plan recommends that, as funds become available, a six-phase construction plan be implemented for the San Antonio facility.

Resources

Resources and personnel within the Texas Agricultural Experiment Station and Texas Cooperative Extension will be redirected to initiate the center's programs. Funding to expand existing programs and develop new facilities will be solicited from local organizations, state and federal sources, industries, municipalities, groups and individuals. Funding will also be sought through Congressional and State initiatives, as well as a capital campaign effort.

Cooperators and Collaborators

Irrigation programs of the ITC will be closely coordinated with complementary programs of other agencies, universities, commodity groups, industries, municipalities, river authorities, groundwater districts, regulators, producers, homeowners, and the private sector.

IRRIGATION TECHNOLOGY CENTER

Texas Agricultural Experiment Station

Texas Cooperative Extension

April, 2002

I. PURPOSE

Vision

The vision of the Irrigation Technology Center (ITC) is to reduce irrigation water use in Texas while

maintaining profitable agricultural production and quality urban landscapes. The ITC will coordinate the development of world class, statewide irrigation programs and facilities for education, testing and research by expanding existing programs and constructing new facilities to promote efficient irrigation and water conservation practices.

Background

In Texas, agricultural irrigation accounts for 65% of the total freshwater consumed annually, and landscape irrigation accounts for 20 to 40% of total municipal water use. As much as half of this irrigation water may be lost because of inadequate equipment and systems, or uninformed management. In addition, Texas' rapidly growing population and industries are placing increased demands on existing water supplies and conveyance systems. Regional water shortages are expected to become increasingly prevalent in the next decade and beyond.

To ensure adequate water supplies, we must utilize the full benefits of existing technologies; expand adoption of water reuse practices; develop more efficient irrigation products and more effective management practices; educate agricultural and landscape irrigators; and identify policies that encourage and reward conservation. However, achieving true water savings in irrigation is a difficult and complex task since both technology and human behavior are involved. Furthermore, agricultural and urban irrigation industries are largely variable and unregulated.

Equipment manufacturers and retailers often make claims regarding the efficiency and performance of their equipment without adequate testing. No independent design standards exist for irrigation systems, and most consumers do not have the expertise to determine if the system they are purchasing will perform as claimed. Only one small, independent sprinkler irrigation testing facility exists in the United States.

In addition, options for reusing wastewater vary from irrigation of agricultural crops, turf grass, and landscape plants to direct reuse in our drinking water system. Each of these demands for reclaimed water requires a specific water quality. Without effective pretreatment, application technologies and management, this potentially valuable resource is a threat to human health and the environment.

The demand for education relating to the use and conservation of water in all its forms continues to grow. Specific needs have been identified for continuing education classes for licensed professionals, basic training for licensed irrigation candidates, and international training programs for outreach across national borders.

Mission

The mission of the ITC is to:

1. Develop new and improved agricultural and landscape irrigation technologies, management, and reuse practices.

The ITC will cooperate with industry and scientists to utilize field-based conditions and conduct practical irrigation research. With its land and equipment resources, the ITC will serve as an avenue for the development of new irrigation and reuse practices such as the integration of advanced sensors and computer control systems. The ITC is also expected to lead in the use of geographic information systems, information technologies, and systems analysis applications in irrigation.

2. Provide training and educational services for irrigators, agency and industry personnel, and the public.

Continuing education courses will be designed for a wide variety of audiences including licensed irrigators and those involved in production agriculture and the landscape industry. Structured training and short course programs, publications, software, and Internet resources will be developed on irrigation technologies, water management strategies, water reuse, and other topics. Regional and state educational events including field days, seminars, and tours will be conducted in cooperation with municipalities, utilities, industry and agency groups, and educational institutions.

3. Establish an equipment testing and certification program.

Industry and professional groups have expressed a desire to work with the ITC to test irrigation equipment and systems, and to certify their performance. New products as well as those in pre-production stages will be certified based on specific performance standards through tests conducted under laboratory and real-world operating environments. The ITC will collaborate with other centers, and national/international organizations and institutions to further the development of standards for equipment testing and certifications.

4. Develop design and performance standards for agricultural and landscape irrigation systems.

The ITC will have the capabilities to establish system design and performance standards. These standards will be developed under real-world operating conditions and can be utilized by manufacturers, state agencies, municipalities, water supply corporations, interest groups, and irrigation professionals to ensure efficient water use and conservation.

5. Promote opportunities for linkages with undergraduate and graduate academic programs.

As the facilities of the ITC are developed, its capabilities will support academic teaching and research programs at the undergraduate and graduate level to include hands-on instruction and experience in irrigation system design, operation, management, and repair. Many educational research programs focus on water use efficiency in agricultural, urban and recreational sectors as well as quality issues of ground and surface water. The ITC's land and equipment will be available to further these educational programs.

II. STRATEGIC FUNCTIONS

The ITC will perform its mission through five programmatic Divisions: Urban Programs, Agricultural Crops, Equipment Testing and Certification, Wastewater Reuse, and International. These Divisions will function as follows:

Urban Programs Division

The Urban Programs Division will focus on residential-scale and commercial landscape irrigation systems to provide hands-on instruction, testing and performance evaluations, and applied research. In conjunction with the Equipment Testing and Certification Division, the Urban Programs Division will develop performance standards for various classes of landscape irrigation systems and operating environments.

Educational programs will include classroom instruction, training, field days, and technical tours. Formal classroom courses and structured training programs will be expanded to meet the educational needs of licensed irrigators, landscape management personnel, irrigation industry personnel, and public utility and state agency personnel. Distance education capabilities will also be employed to offer courses statewide.

As funds become available, special features will be constructed to allow for hands-on instruction and training

on various aspects of irrigation system installations, maintenance, and in-field testing. For example, an open components facility will allow professional irrigators to learn under controlled, real-world situations. Other facilities will include various configurations of sprinkler systems for training in landscape irrigation auditing procedures.

Another major component of the Urban Programs Division is full-scale examples of irrigation systems, including golf greens, commercial properties, and home yards. These systems will serve as the focal point for technical tours to highlight improved technologies and practices for irrigation professionals, industry personnel, and homeowners. Programs will be developed on alternative low maintenance plans and landscapes, purchasing irrigation systems, installation and management of drip irrigation systems, and irrigation scheduling.

Systems will also include fully automated and manually controlled drip, sprinkler, and micro spray irrigation of various plant materials. Facilities will evaluate remote sensing technologies, precision technologies, and determine the use of evapotranspiration in urban irrigation conservation and water budgeting. The ITC will determine exact evapotranspiration with medium-sized lysimeters for turf and ground covers, and small-sized lysimeters for landscape plants. Testing and applied research programs will lead to improved methods and products for landscape irrigation.

Outdoor irrigation facilities will allow professionals to develop performance standards for specific classes of irrigation systems. These performance standards will evaluate minimum distribution uniformity for specific layouts and environmental conditions. Technical advisory groups will review all proposed standards before release. The first performance standards to be developed will be for athletic fields and other commercial landscapes. Development of performance standards is expected to be a continuing process and one of the base programs of the ITC.

Principal beneficiaries of the Urban Programs Division include city and county government utility officials, irrigation system installers, home and business owners, industry, and city and county personnel.

Agricultural Crops Division

The Agricultural Crops Division will seek to improve and expand the existing inventory of true-scale, operating agricultural irrigation systems of all major technologies to include drip, sprinkler, and furrow irrigation. The Halfway Research Center/Helms Farm Complex located near Halfway, Texas, will be a key facility for the Division's activities. Facilities will allow for hands-on instruction, testing, performance evaluations, and applied research to optimize irrigation amounts for major and minor crops. Emerging technologies, including remote sensing, feedback control, variable rate applicators, and precision irrigation systems, will be tested, improved, and transferred to the private sector.

The evapotranspiration studies previously mentioned in the Urban Programs Division will also be utilized in the Agricultural Crops Division. Additional large lysimeters will be constructed and devoted to the Agricultural Crops Division to document both water requirements and losses occurring under specific climatic and environmental growth conditions. Lysimeters are the most accurate instruments available for measuring evapotranspiration and are needed to document both water requirements and losses under specific climatic and environmental growth conditions. Through this data analysis, more efficient water use will occur with improved cropping techniques and irrigation methods. Furthermore, potential water conserving management options such

as surface mulching and vertical mulching can be evaluated on a small-scale basis prior to the traditional small plot experiments and eventual large-scale demonstrations.

Different types of irrigation systems will be tested on a large-scale basis. Drip irrigation performance will be evaluated on design considerations such as length of run, drip tape diameter, drip installation depth, and distance between drip lines. There are both advantages and potential problems associated with the application of chemicals such as pesticides and fertilizers through the irrigation system. Field-based experiments will better determine if the chemicals are adequately distributed by observing actual as compared to expected crop response. Large-scale tests will also allow systems to be implemented by growers without the traditional lag time experienced with small-plot work. Furthermore, more realistic crop response yield data can be gathered on a field basis.

Additional research will focus on yield response to varieties, fertilizers, pest control measures, and tillage systems when irrigated by the drip, sprinkler, furrow, or flood irrigation methods at water supply levels from deficit to full irrigation. By evaluating the lower levels of irrigation, dryland crop production methods can be developed and eventually improved with marginal amounts of supplemental irrigation.

The Agricultural Crops Division will also assess and develop new irrigation technologies. Studies will include the evaluation of hybrid irrigation systems using various types of applicators at different locations within a field based on physical constraints such as soil type, topography or crop needs.

Remote sensing will be used to provide early detection of field-scale plant stresses so that crop inputs can be adjusted at specific sites within the field in a timely manner. In addition, site-specific application of irrigation and chemicals will be evaluated to increase water use efficiency of both rainfall and irrigation.

Real-world scale facilities available to the Agricultural Crops Division will allow landowners, industry personnel, crop producers, water districts, commodity groups, and consultants to witness new technology at work and evaluate the performance of various systems. This will lead to more efficient irrigation techniques and conservation of water in agricultural production.

Equipment Testing and Certification Division

The Equipment Testing and Certification Division will test and certify the performance of both landscape and agricultural irrigation equipment, including laboratory testing of components and field testing of complete systems. The certification program will provide assurance to consumers, irrigators, lenders, and regulators that systems and components purchased will perform as advertised. Effects of wind, soils, landscape area, plant types, and other environmental factors will be examined, allowing for development of design standards to improve water use efficiency.

Each laboratory will be equipped with special viewing platforms and windows to facilitate public tours. All major types of water application devices will be tested including sprinklers, surge valves, gated pipe, drip, and microsprays. Research at these testing facilities will lead to the development of improved irrigation devices and technologies. Collaborative programs with the irrigation industry are also expected.

The following major testing laboratories will be constructed as resources become available:

Sprinkler Testing Laboratory: Precipitation rates and distribution patterns of sprinklers will be tested in this standard, controlled environment.

Sprinkler Testing Laboratory - Wind Tunnel: The world's first wind tunnel sprinkler testing lab will evaluate

sprinkler performance under controlled wind-speeds of up to 25 miles per hour.

Drip Irrigation Testing Laboratory: A unique laboratory (1,200 foot long) will determine distribution uniformity and precipitation rates of true length drip lines. Currently, only short sections of drip tubing can be tested. The lab will also test mechanical and material properties of drip productions.

Hydraulics Laboratory: The first of its kind in Texas, the hydraulics laboratory will test flow meters, valves, pumps, and backflow devices for independent verification of their accuracy, performance, and durability. Of interest to river authorities and state agencies, the laboratory will also have river basin and water control structure-modeling capabilities. This will allow for the development of flow meter installation procedures to ensure accurate measurements, and for proper pump selection and installation to decrease energy use.

Outdoor Systems Laboratory: The ITC will have examples of all major classes of full-sized irrigation systems for use with hands-on training and performance testing. This will be the only public laboratory in the United States with the capability to test full-size operating systems on a continuing basis to allow for the determination of performance, benefits, longevity of components, and design standards.

Industry personnel, municipalities and utility program, regulatory agencies, universities, and consultants will benefit from the programs within the Equipment Testing and Certification Division.

Wastewater Reuse Division

The Wastewater Reuse Division will develop and implement programs addressing wastewater reuse systems ranging in scale from residential to community systems. Collaborative programs will be established with water supply corporations and municipalities to promote the use of recycled water and to conduct training and applied research on the special nature of wastewater reuse. The Division will focus on salinity and water quality, plant response, system design requirements, corrosion and environmental quality.

The pretreatment, application technologies and water management necessary to ensure a long-term beneficial reuse of the wastewater will be evaluated in the Wastewater Reuse Division. As funds become available, functioning systems will be constructed, maintained, and operated to evaluate sustainable performance. This research will evaluate technologies, design and operational requirements and soil properties necessary to maintain a sustainable reuse system, as well as potential off-site impacts to surface and ground water resources.

An on-site wastewater treatment training facility will be constructed in San Antonio. Patterned after facilities located in Bryan, Weslaco and El Paso, the wastewater treatment training facility will demonstrate available technologies for the management of residential onsite wastewater treatment systems. As funds become available, the facility will be expanded to address wastewater reuse from clustered and community wastewater treatment systems.

An important component of the Wastewater Reuse Division will be training professionals engaged in the design, operation, management and inspection of reuse systems. The Division will work with other agencies in the design and delivery of these programs.

International Division

The International Division will be self-supporting through funding provided from industry, international organizations, and foreign governments. This funding will also help enhance the ITC's programs and support other Divisions within the center. The International Division will provide training for individuals, industry, and

governmental personnel, and will support international irrigation education and technology transfer programs.

Training programs will include one- to three-week formal courses and longer, individually tailored programs. The ITC will work with national and international organizations, and other U.S. universities to develop and deliver these training programs. Other possibilities include joint international training and tours with the United States Department of Agriculture.

Initially, the ITC will pursue formal collaborative programs in Mexico with the Center for Irrigation and Assistance (CEAR) in Guanajuato and with the Monterrey Tech Agriculture and Irrigation Center. These programs will serve as a model for other international programs to be developed in Latin America and in the Far East. Initially, these cooperative training and technical assistance programs will focus on the training of personnel, one-day workshops for farmers, and a formal certification for irrigation district and system operators. CEAR has also expressed interest in joint equipment certification programs.

III. ADMINISTRATIVE GOVERNANCE

The ITC will be administered through the Texas Water Resources Institute (TWRI) in College Station as an organizational part of the Texas Agricultural Experiment Station (TAES) and Texas Cooperative Extension (TCE). The Vice Chancellor/Dean and Director of TAES/TCE will appoint a Director, in consultation with the TWRI Director and the Deputy Directors of the respective agencies. Division Heads will be appointed to manage activities within each of the five Divisions and will report to the ITC Director for related program activities and to their respective unit administrator (e.g., Department Head, Resident Director or District Director) for direct supervision. An organization chart is attached as Appendix A.

Advisory groups will provide input on research and educational goals, and perform programmatic reviews.

ITC Director: The ITC Director will:

- Serve as the administrative director and spokesperson for center programs and will report administratively to the TWRI Director.
- Allocate and oversee the ITC budget.
- Work with Division Heads to provide program guidance and facilitation.
- Coordinate the activities of and serve as liaison with the ITC Advisory Council.
- Provide input to TAES/TCE administrators concerning the activities and recruitment of Division Heads and faculty working on irrigation issues.
- Work collaboratively with the TWRI Director for program coordination.

Division Heads: The Head of each Division will:

- Assume primary leadership for planning, advocacy, funding implementation, and communication of Division research and Extension education programs.
- Interact with the ITC Director and unit administration for coordination of Division programs.
- Facilitate communications among faculty, external individuals and groups involved in the execution and use of Division research and Extension programs.

Advisory Committees and ITC Advisory Council: Each Division will be guided by input from an Advisory Committee that will be comprised of representatives from industry, university and agency experts (including TAES and TCE), financial supporters and international partners. Advisory Committees will provide input concerning research and educational goals for each Division and will advise Division Heads on activities. An

ITC Advisory Council, comprised in part by designated representatives from Division Advisory Committees, will assist in strengthening collaborations and communication among the five Center Divisions.

An ITC Program Review Team will be appointed by the TWRI Director and Vice Chancellor/Dean and Director of TAES/TCE to perform programmatic reviews of the Center and the respective Divisions.

Center Associates: Individuals who wish to participate in ITC programs will be designated as Center Associates. Representatives may include professionals from industry and university/agency faculty. Responsibilities will vary and may include providing guidance to Division's staff and researchers, incorporating research ideas within each Division and promoting ITC developments to industry and the public.

Center Review: The ITC will provide an annual activity report to the Vice Chancellor, the TWRI Director, and the ITC Advisory Council. In addition, the ITC will undergo a comprehensive review three years after its establishment. Thereafter, the Center will be reviewed every five years. The ITC Program Review Team will conduct reviews.

IV. FACILITIES

The TAES and TCE have active irrigation programs located at facilities throughout the state. Because of the critical nature of water resources in San Antonio, the ITC will seek resources to construct a major facility in the San Antonio region which will focus on the needs of the Urban Programs Division. Funds will also be sought to improve facilities at the Halfway Research Center/Helms Farm Complex in Halfway, Texas, and to enhance programs at selected statewide Agricultural Research and Extension Centers (AREC). Existing facilities will be used to support the outdoor testing and hands-on training mission of the ITC, assuming such support does not interfere with ongoing research programs.

San Antonio Facility

As funds become available, a facility in San Antonio will be constructed to address research and Extension programs in the Urban Programs Division, Equipment Testing and Certification Division, Wastewater Reuse Division, and International Division.

San Antonio is a large urban metroplex that shares its limited water source with irrigated agriculture and other interests. Residents are well aware of water supply issues and the need for conservation efforts. In support of the Urban Programs Division, the San Antonio facility will focus on optimizing urban and landscape water use and irrigation. Facilities will support sprinkler performance and testing, runoff collection, microclimate effects, irrigation scheduling, and surface and subsurface landscape irrigation. Recreational water use will be evaluated on an experimental two-hole golf course constructed on site.

The San Antonio facility will also support activities of the Wastewater Reuse Division. It will house various systems to include: plots and facilities to address storm water catchment and recirculation; on-site water treatment and reuse; collection of water and wastewater; wastewater storage and disinfection; and pumps, filters, instrumentation, and application equipment.

A unique component of the San Antonio facility will be several indoor laboratories in addition to traditional outdoor testing facilities. (See Equipment Testing and Certification Division) These laboratories will be used to test and certify equipment and components of complete systems. The controlled conditions in the laboratories will also be used to evaluate the effects of wind, soils, landscape area, plant types, and other environmental factors, thus allowing for the development of design standards to improve efficiency.

As funds become available, an administration building will be constructed at the San Antonio facility for

educational and outreach activities. An outdoor pavilion is also proposed for use during field days and technique workshops. Future plans also include the construction of a visitor center.

Halfway Research Center/Helms Research Farm Complex

The Halfway Research Center/Helms Research Farm Complex, administered as components of the Texas A&M University Agricultural Research and Extension Center at Lubbock, will serve as key facilities of the Agricultural Crops Division. Other important irrigation facilities associated with the Lubbock Center include the AgCares Farm in Lamesa and the Western Peanut Growers Farm in Gaines County.

Activities at the Halfway Research Center/Helms Research Farm Complex will be directed to providing long-term irrigation water availability under conditions of a declining aquifer. The ITC will seek funding to improve its facilities. Integrated research and outreach activities will focus on improved water application technologies, irrigation for maximum yield potential, development of drought-tolerant crop varieties, and nutrient management with a limited water supply. Because research will be demonstrated under operating farm conditions on a large scale, technology and developments will more be easily adopted by producers.

The Helms Research Farm covers 373 acres and includes two water wells, one 130-acre center pivot, 9,900 feet of underground water line, and 86 acres of drip irrigation. The installation of an additional water well and pipeline is planned for 2002. The Halfway Research Center covers 320 acres and includes three water wells, four experimental irrigation systems, an office and storage buildings.

Other Facilities

Faculty members within the Experiment Station and Cooperative Extension Service have extensive experience in agricultural and urban irrigation, water management and conservation, crop production, technologies, economics, and nutrient and pest management. Related research is underway on the Texas A&M University campus in College Station as well as several statewide ARECs. Interested faculty at these locations will serve as Center Associates. Irrigation scientists at Texas A&M University and at ARECs will be eligible to participate in and receive funding from ITC programs.

Irrigation scientists at College Station and ARECs throughout the state will participate in and receive funding from ITC programs. Cooperating locations are expected to include:

Amarillo AREC: Efficient irrigation systems for crops grown in the High Plains.

Beaumont AREC: Irrigation water conservation in rice production systems.

Corpus Christi AREC: Efficient irrigation systems for cotton, grain sorghum, and corn in the Coastal Bend.

Dallas AREC: Efficient urban landscape irrigation for Northeast Texas.

El Paso AREC: Efficient agronomic crop and landscape irrigation for Far West Texas.

Fort Stockton AREC: Irrigation systems for use with saline water.

Lubbock AREC: See discussion of Halfway Research Center/Helms Research Farm Complex.

Temple AREC: Development of irrigation scheduling and management software.

Uvalde AREC: Subsurface drip and high-efficiency sprinkler irrigation for vegetables and cool-season forage production in the Winter Garden.

Vernon AREC: Subsurface drip irrigation for cotton the Rolling Red Plains.

Weslaco AREC: Increasing efficiency of irrigation water transmission systems; drip irrigation for vegetables, sugarcane, and citrus; high efficiency sprinkler irrigation for sugarcane.

V. DEVELOPMENT PLANNING

Beach Ramirez (BR), Inc. of Houston, Texas, a consulting firm with expertise in facility and resource development, was contracted to provide an independent evaluation for the need and feasibility of the ITC, assess

demand for services, and produce a development plan for the proposed facilities in San Antonio. Water utilities and districts in the San Antonio region provided funding for this study. The plan recommends that, as funds become available, a six-phase construction plan be implemented over a period of at least ten years.

The long-term vision and plan anticipates that land for the San Antonio facility will be donated by community supporters. Site selection criteria are proposed, including access to transportation, infrastructure, cost, location, terrain, and political and regulatory considerations. The plan also addresses the demand, facilities and land requirements, costs associated with building and operating the facility, and economic impact.

Phase IA will include the construction of the world's first wind tunnel for irrigation studies, a sprinkler testing laboratory, and a temporary building with offices and conference rooms. Contingent on resources, Beach Ramirez envisions the construction to continue as follows: Phase IB will consist of a standard sprinkler laboratory and a laboratory for testing drip irrigation tubing. Phase II includes the construction of a hydraulics laboratory. Construction will continue with Phase III which includes a storage and central shop facility, in addition to the development of outdoor plots on 449 acres for testing urban and agricultural irrigation systems. The wastewater reuse unit will be constructed in the Phase IV, and the administration/education building will be constructed in Phase V. Beach Ramirez suggests reserving Phase VI for expansion, private sector research, and a visitor's center.

VI. RESOURCES

TCE and TAES will seek funding to support the ITC from local organizations, state and federal sources, industry, municipalities, groups, and individuals. Local entities in the San Antonio area have already contributed approximately \$150,000 to assist in initial planning. Contributors include San Antonio Water Systems, San Antonio River Authority, BexarMet, and the Medina County Groundwater District. It is anticipated that land and associated utilities will also be provided by local entities. In addition, the San Antonio City Council and Edwards Aquifer Authority have provided statements of support for the ITC, as have other important organizations including the Texas Water Wise Council and the Texas Turf Irrigation Association.

The Beach Ramirez analysis suggests that, following initial development phases, a minimum of \$625,000 in annual revenue can be realized from the Drip Irrigation Testing Laboratory, the Hydraulics Laboratory and from marketing/analytical studies. The report further suggests that applied research will generate between \$1.2 and \$1.3 million annually; training and certification will have the capacity of generating more than \$500,000 annually. The analysis anticipates that 9,000 individuals will visit ITC facilities for training and educational programs; the ITC will have 15,000 leisure visitors.

Existing resources and personnel within TCE and TAES will be redirected to initiate programs and activities for the ITC. To complement these existing resources, a comprehensive ITC strategic plan is under development with future financial support to include:

June, 2002 Expand efforts to obtain grants and contracts.
 Initiate capital campaign for facilities and operations
 Continue coordination and plans for local support in the San Antonio area.

January, 2003 Submit request to the 78th state legislature for operations and maintenance.

March, 2003 Submit FY2004 federal initiative for equipment and associated facilities.

To be determined Submit proposal for federal agency support for facilities construction.

June, 2004 Initiate plans and construction for San Antonio facilities.

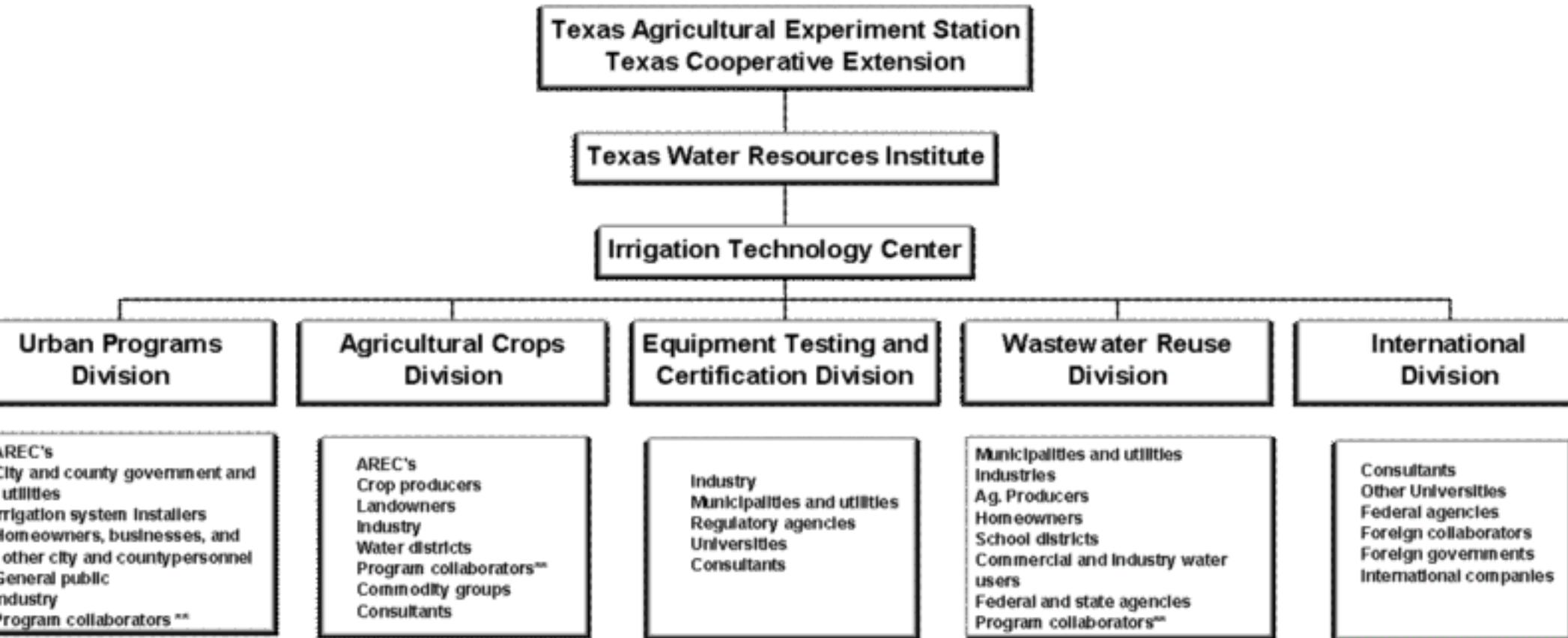
ITC funding will be used to support the research and educational programs at the Halfway Research Center/Helms Research Farm Complex, including the construction of a multi-purpose research support building, irrigation wells, and precision, high-efficiency drip irrigation and sprinkler equipment. ITC funds derived from selected grants and contracts, state legislative initiatives and federal initiatives will be used to enhance existing research and education programs throughout the state.

VII. COOPERATORS AND COLLABORATORS

Irrigation programs of the ITC will be closely coordinated with complementary programs of other agencies, universities, commodity groups, industry, municipalities, river authorities, groundwater districts, regulators, producers, homeowners, and the private sector. Principal scientific and technical collaboration will include USDA Natural Resources Conservation Service, USDA Agricultural Research Service, scientists and engineers at other universities and within industry, consultants, and personnel with river authorities and municipalities. The ITC will also collaborate with state and federal regulatory and resource agencies such as the Environmental Protection Agency, U.S. Geological Service, U.S. Bureau of Reclamation, Texas Water Development Board, Texas Natural Resource Conservation Commission, Texas State Soil and Water Conservation Board, Texas Department of Agriculture, and irrigation districts.

Organizational Chart

Irrigation Technology Center



* Selected Texas A&M University System (TAMUS) Agriculture Program scientists, engineers, specialists and agents at Agricultural Research and Extension Centers and in counties throughout the State.

** Program collaborators include scientists and engineers within TAMUS and those with other universities and agencies and in the private sector.