PROJECT PLAN

FOR THE

DELTA LAKE IRRIGATION DISTRICT
WATER CONSERVATION IMPROVEMENTS PROJECT

PREPARED FOR:

DELTA LAKE IRRIGATION DISTRICT
ROUTE 1, BOX 225, EDCOUCH, TEXAS 78538

UNDER THE AUSPICES OF:
TEXAS WATER DEVELOPMENT BOARD and
TEXAS STATE ENERGY CONSERVATION OFFICE

TWDB Contract No. G18900

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1 INTRODUCTION

The purpose of the Delta Lake Irrigation District's *Water Conservation Improvements Project* (the "Project") is to preserve and extend the existing water resources of the Lower Rio Grande Valley. In general, water will be preserved by constructing improvements, which will reduce or recover losses due to seepage and evaporation and will allow for a more efficient operation of the water delivery system as a whole. The Project is being developed under the *Lower Rio Grande Valley Water Resources Conservation and Improvement Act of 2000* (Public Law 106-576) and was prepared in accordance with the *Guidelines For Preparing and Reviewing Proposals for Water Conservation and Improvement Projects* associated with the Act. Public Law 106-576 was passed to encourage water supply improvement projects in select locations within the Rio Grande basin. It provides funding for study, evaluation, design, and construction of irrigation water system improvements. This Project Plan was prepared to partially fulfill the requirements of Contract Number G18900 between the Texas Water Development Board and the Delta Lake Irrigation District.

The proposed Project will be comprised of four separate components. The first component, the *Reservoir Renovation Project*, consists of building a 17,000 linear foot by-pass canal along the eastern edge of the eastern reservoir of Delta Lake. The second component, the *Seepage Recovery Pilot Project,* will consist of a feasibility study into the possibility of collecting water that seeps from the Main Canal and pumping it back into the system. The third component, the *Telemetry and Flow Measurements Sites Project,* includes the installation of flow measurement devices at 20 water diversion points to monitor deliveries and send this information, by telemetry, to the District headquarters. The fourth component, the *Canal Rehabilitation Project,* will replace approximately 17,800 linear feet of open channel laterals with new gasket joint PVC or RCP pipe.

2 DISTRICT INFORMATION

The Project Applicant, Delta Lake Irrigation District (DLID or the District) was established on June 22, 1914. The District is a political subdivision of the State if Texas, organized under and by virtue of Article XVI, Section 59 of the Constitution of the State of Texas. It is operated under the statutes of Chapter 49 and 58 of the Texas Water Code. The Delta Lake Irrigation District Board consists of the following five Directors:

Mr. Neal Galloway	President
Mr. Glen Hester	Vice President
Mr. Dale Murden	Secretary

Mr. James Carlson	Director
Mr. Tom Wetegrove	Director

DLID provides irrigation, drainage, flood control and water supply functions to 148.95 square miles of Hidalgo and Willacy Counties. As shown in Exhibit 1, the District boundary includes the cities of Hargill, La Sara, Monte Alto and part of the City of Raymondville. The DLID legal address is Delta Lake Irrigation District, Route 1, Box 225, Edcouch, Texas 78538. The general manager, Max Phillips, may be reached at (956) 262-2101. TNRCC District information reports are included as Exhibit 2.

3 DISTRICT FACILITIES AND WATER DELIVERY SYSTEM DESCRIPTION

The Rio Grande is the only water source for DLID. All of the water diverted by the District, from the Rio Grande, originates as surface water released by the International Boundary and Water Commission from Falcon Reservoir. The District pumps water northward through a 32-mile canal originating at the Rio Grande and terminating at the southeast corner of the East Reservoir of Delta Lake. The District water supply system consists of 250 miles of lined or partially lined canals, 42 miles of unlined canal and 122 miles of unlined laterals. DLID operates Delta Lake (a.k.a. Monte Alto Reservoir) as a buffer for absorbing changes in daily producer uses as well as equalization mitigating the four-day travel time of water from Falcon Reservoir. As indicated on Exhibit 1, Delta Lake is separated by a roadway that divides the lake into a larger East Reservoir and a smaller West Reservoir. The two reservoirs are connected via a culvert running under the dividing roadway and can be isolated from one another using a valve. Exhibit 3 depicts the District's water supply system.

The Delta Lake Irrigation District has 174,776 acre-feet of authorized water rights and has the largest amount of irrigated agriculture of the 28 irrigation districts in the Lower Rio Grande Valley of Texas. The District is located within the boundaries of the Texas Water Development Board's Rio Grande Regional Water Planning Group (Region M) and delivers water to the North Alamo Water Supply Corporation and the cities of Raymondville, Lyford, Hargill, La Sara and Monte Alto. The District's 5-year average annual agricultural water diversion was 97,295 acre-feet for 1994 to 1998.

4 REGION M WATER SUPPLY AND DEMAND ASSESSMENT

An assessment of the current and future water supplies and demands for Lower Rio Grande Valley is included in the *Adopted Regional Water Plan* (the "Region M Plan") published in January 2001 by the Texas Water Development Board's (TWDB) Rio Grande Regional Water Planning Group. According to the Region M Plan, the population in the Rio Grande Valley is expected to more than double in the next 50

years. With population growth, some of the land currently used for farming and ranching will be converted to urban use. As such, municipal water demand is expected to increase over the next 50 years while irrigation demand is expected to decrease over the same period.

The Rio Grande is currently the only water source for the District and is expected to remain the only source in the foreseeable future. Water in the Rio Grande downstream from Fort Quitman, Texas is apportioned between the United States and Mexico according to the 1944 Treaty. The apportionment is administrated by the International Boundary and Water Commission (IBWC). Two international reservoirs, Amistad and Falcon, provide controlled storage capacity for over eight million acre-feet of water owned by the United States and Mexico. According to the Region M Plan, it is estimated that (by 2050) the firm yield of the Amistad-Falcon Reservoir System will decrease by nearly 10 percent.

5 DISTRICT'S CONSERVATION COMMITMENT

Water conservation by the District has become increasingly important due to an enduring drought that has affected the lower Rio Grande Valley over the past several years. The drought and the projected decrease in irrigation water supply has required the District to place a greater emphasis on water conservation to ensure the delivery of water to the customers they serve. Historically, the District has aggressively sought to develop ways to deliver the maximum amount of water possible to each turnout. The District has implemented metering of all irrigation deliveries and has invested approximately $400,000 per year replacing small open laterals with buried pipelines. Last year the District installed 4,800 linear feet of 36" RCP and 10,000 linear feet of 18" PVC pipe. This has increased the efficiency of the District and the growers by reducing the energy used per acre irrigated.

The proposed *Water Conservation Improvements Project* is proposed to continue the District's commitment to conserve water and energy. The components were selected as priorities from a list of 11 major and 37 minor projects identified throughout the District's water delivery system. The installation of the flow measurement devices will allow the District to remotely measure the amount of water delivered from each of the 20 diversion points to the different canal systems. By monitoring the information, the District will be able to reduce the amount of excess water that is passed through the system. Eliminating and recovering seepage will allow more water to be available to each customer in times of shortages. Given that the Rio Grande is the District's only anticipated water source, it is their goal to maximize efficiency by reducing over pumping and seepage losses.

6 PROPOSED PROJECT DESCRIPTION

As discussed earlier, the proposed *Water Conservation Improvement Project,* consists of four components. Due to the diversity of each component of the Project, an independent set of Construction Drawings and Specifications will be prepared for each component. A single Project Report will be prepared and will contain a water supply and demand assessment, and regulatory compliance documentation for the project as a whole, and an economic and conservation analysis, cost estimates, schedules and detailed project descriptions for each of the components. The design effort will be performed in accordance with established engineering practices.

6.1 Reservoir Renovation Project

The *Reservoir Renovation Project* will consist of the design of a by pass canal along the eastern edge of the East Reservoir of Delta Lake. This by pass canal will begin at the southeastern corner of the reservoir where the Main Canal supplies the lake and terminate at a pump house along the reservoir's north edge. A project location map showing the bypass canal location is included as Exhibit 4.

This project is crucial to supply irrigation and domestic water to the northern and eastern portions of the District including the cities of Raymondville and Lyford during periods of drought. With the current system, raw water is transported to these areas via the Delta Lake. It has been estimated that in a dry summer month, that over 1,700 acre-feet of water would need to be placed in the East Reservoir to deliver about 400 acre-feet at the northeast corner to overcome losses due to evaporation. This represents a loss rate of approximately 77 percent. If current drought conditions continue and expected future decreases in water supplies occur, the delivery of raw water through Delta Lake will not be possible.

In 1998 and again in 2002, the Rio Grande Valley was under extreme drought conditions. As such, the Delta Lake Irrigation District came very close to depleting its allocation of irrigation water and thus the "transport water" that is necessary to convey the municipal water through the East Reservoir of Delta Lake. Since the North Alamo Water Supply Corporation (NAWSC) supplies the municipal water to 90% of the residents in Willacy County, they applied to the Texas Water Development Board for emergency grant funds to construct the by pass canal described above. Rain in late summer of 2002 averted the short-term water shortage, but not the risk that the shortage will occur again. Grant money was approved in early 2003 for the project submitted by NAWSC. NAWSC is responsible for any technical or administrative activities under the funding authorized by TWDB Resolution 03-9 and no funds for such activities are being provided to Delta Lake Irrigation District or their consultants for such

activities. Copies of all technical information developed in conjunction with the DLID SECO project will be provided to North Alamo WSC. DLID and North Alamo will have periodic meetings to coordinate the project and make sure that no duplication of effort is occurring.

Four potential project alternatives were identified and analyzed. Alternatives include the following:

- Construction of a new canal and associated improvements (the recommended alternative)
- Construction of a 24-inch transmission main.
- Construction of a 36-inch transmission main.
- No-build alternative

Preliminary cost estimates for the 24 and 36-inch transmission mains were estimated to be $770,000 and $1,584,000, respectively. The alternatives range from 2.2 to 4.6 times the estimated cost of the new canal (the recommended alternative). Due to the limited availability of funds, significantly higher priced alternatives must be accompanied by significantly higher benefits to warrant serious consideration. Unfortunately, both pipeline alternatives will require significant clearing along the same general alignment proposed for the canal. Typical working space widths for cross-country transmission mains run on the order of 40 to 50 feet to accommodate delivery of pipe, trenching and haul off of spoil. Although these widths are roughly half of that required for channel construction, a clear-cut swath would still be required through the project alignment. Additionally, the transmission capacity of the pipelines is extremely limited (12 to 27 percent) relative to the canal alternative.

No overwhelming environmental benefits were identified that justified the additional cost and limited capacity of the transmission main alternatives. Construction of either transmission main was therefore eliminated as a viable alternative.

Numerous potential negative impacts are associated with the “no-build” alternative. Potential impacts include:

- Severe curtailment of water use resulting in damage to small-scale agriculture, lawns, trees, landscaping, etc.
- Development of emergency interim water supplies, resulting in increased cost, fuel usage, air pollution and traffic.

- Higher potential for public health and safety problems typically associated with inadequate water supplies including loss of system pressure, system contamination, longer distribution system residence times, etc.

As a result of the significant potential negative impacts, the "no-build" alternative was eliminated from consideration. Construction of a by pass canal and associated improvements is therefore the recommended alternative.

The proposed by pass canal will be constructed along the inner edge of the eastern embankment, utilizing the existing berm. Six new control structures will also be designed to accommodate the existing diversion points along the eastern edge of the reservoir. Radial gates will be installed at the Main and "J" Canals to provide better flow control. Even with the proposed improvements, the East Reservoir of Delta Lake will continue to be utilized as a reservoir for the District, but in an "off-line" instead of "in-line" capacity. The proposed control structures will allow the steady flow of water to the by pass canal and excess water will be diverted into the East Reservoir. In times of extreme water shortages, this system will allow the District to still provide domestic water when lake levels are low. A schematic cross-section of the proposed by pass canal is depicted in Exhibit 5.

6.2 Seepage Recovery Pilot Project

The *Seepage Recovery Pilot Project* will consist of a feasibility study into the possibility of collecting water that seeps from the Main Canal and pumping it back into the system. Because of the size of the canal, concrete or urethane lining is estimated to be prohibitively costly. The seepage recovery project is proposed as an alternative to lining. It is anticipated that the energy required to pump the recovered seepage back into the Main Canal will be approximately 25% of the energy required to pump water from the Rio Grande, or for every acre-foot of seepage water that is salvaged, the District will reduce energy cost per acre-foot by 75%. A Project Location Map showing the proposed study area is included as Exhibit 6.

In conjunction with this component, studies will be conducted to better determine the actual loss rate from the canal, the quality of the water recovered and the ability to collect and return the lost water back to the canal. A survey will also be completed to determine the area with the greatest water loss rate to ensure the project location is the most cost effective. Once the project location is determined, a 5 cfs seepage recovery system will be designed consisting of a subsurface telescoping toe interceptor drain running adjacent and parallel to the banks of the Main Canal and a low head lift station to pump the water back into the canal. A schematic cross section of the collection system is included as Exhibit 7.

6.3 Telemetry and Flow Measurement Project

The *Telemetry and Flow Measurement Project* includes the installation of flow measurement devices at 20 diversion points within the District's water supply system. These devices will be permanently installed to monitor deliveries into particular laterals of the system and send this information, by telemetry, to the District headquarters. This information will allow the District to track water usage, identify where losses are occurring and allow the District to forecast and provide for future water uses. By having more information, the District can operate the system more efficiently. A project location map showing the flow measurement sites is included as Exhibit 8.

The 20 diversion points will contain one or multiple measurement devices depending on the diversion structures located on the site. Each of the measurement devices on the individual sites will be connected to a single telemetry system. The diversion structures can be broken into two categories, pump houses (closed conduit flow) and check structures (open channel flow).

At all of the pump house sites, water is drawn from the supply canal with single or multiple pumps and discharged to a pump well. Once the water enters the pump well it is distributed to single or multiple distribution lines for delivery to the customer(s). Each pump discharge pipe will be equipped with a strap-on propeller meter to measure flow from the individual pumps and a calibration port to ensure accurate measurements. These meters will be enclosed in either a concrete or steel vault to protect them from the weather and vandalism. A submersible pressure transmitter will be installed in each pump well which will measure the water level and shut off the pump(s) if excess water is recycling back into the canal. A typical Site Plan for a pump house is included as Exhibit 9.

At each of the check structures, the flow will be measured downstream from the check structure using a flow measurement structure or device. The canals containing the check structures could be divided into two categories; large (top width in excess of 20-feet), earthen canals and small, concrete-lined canals. Based on their ability to be computer calibrated using as-built dimensions, long-throated flumes were selected for flow measurement of the small, concrete-lined canals. A cross-section from the existing canal will be utilized to design a flume for each of the sites using the WinFlume software. Rating tables will be prepared for each of the flumes based on the proposed design. Once the flumes have been constructed, as-built dimensions will be utilized to prepare revised rating tables for use in determining flows at different elevations. Each flume will be equipped with a submersible pressure transmitter, housed in a stilling well, for determining the water level in the approach section of the flume and a staff gage for visual verification. A typical Site Plan for a flume is included as Exhibit 10.

It was decided that a velocity flow meter would be the most cost effective and accurate metering device for the large earthen canals. A Doppler meter, which measures velocity in the channel, will be installed at each of these sites. The meter will be installed in a concrete slab constructed along one bank of the channel. The slab will be located sufficiently downstream from the check structure to minimize unsteady flow. The meter will measure the velocity of the water and will be equipped with an integrated pressure sensor for water surface level measurement. A rating curve will be developed for each of the canal Doppler meter sites to determine the flow. The meters will be calibrated using a portable metering device. A typical Site Plan for a Doppler meter is included as Exhibit 11.

A telemetry system will be installed at each of the 20 diversion points for the District to periodically, and on demand, poll for data from the field devices (remote telemetry unit (RTU)), process the data into a central data base (base computer), send controls to field devices and display the data in useful formats to water operation personnel. A Base System will be located at the District Headquarters and will consist of a base computer, which will hold the central database to store and convert all of the data from the RTUs, and an antenna to receive from and transmit data to the remote telemetry systems. The base computer will be equipped with software that will display current, last 24 hours and monthly water and flow level data of any or all of the RTUs. It will also store all engineering and conversion data necessary for converting flow.

A remote telemetry system will be installed at each of the flow measurement sites. Each system will consist of the following:

1. Remote Telemetry Unit (RTU)
2. Radio and RF Modem
3. AC/DC Linear Power Supply

These items will be mounted inside a steel NEMA 12 enclosure on a panel with room for a storage battery to be placed on the bottom of the enclosure. A radio antenna will be mounted on a 20-foot antenna mast for transmitting and receiving data from the Base System.

At sites equipped with a pump house, the telemetry system enclosure will be mounted inside, on the specified wall, and wired to the existing power source. At sites without a pump house, but where electricity is available, the telemetry system enclosure will be installed in a steel vandal box and wired to the existing power source. When electricity is not available, the telemetry system enclosure will be installed in a steel vandal box and a solar panel will be added to the antenna mast to provide power.

Once the telemetry system enclosures are mounted, the RTU will be wired to the metering device(s), the pressure transmitter, the existing pump panel(s), solar panel

and antenna, as specified in the construction drawings. The system will then be programmed with the calibration coefficients for each site and DLID personnel will be trained in the operation and calibration procedures for the Telemetry System.

6.4 Canal Rehabilitation Project

The *Canal Rehabilitation Project* is to replace approximately 17,800 linear feet of existing concrete lined canal with buried pipeline. This component will save water by eliminating seepage and evaporation and their associated pumping requirements and costs. This will result in the flow rate of water delivered to individuals to be increased or allow for a greater number of fields to be simultaneously irrigated. A project location map showing the canal repair sites is included as Exhibit 12.

Four potential project alternatives were considered for the repair of the deteriorating concrete lined canal segments. Alternatives include the following:

- Replace the existing canal with concrete.
- Line the existing canal with a polyurethane liner.
- Replace the existing canal with a pipeline.
- No-build alternative

Preliminary cost estimates were prepared and found that replacing the existing concrete was 100 to 200 percent more expensive than lining the canal with a polyurethane liner or replacing the canal with a pipeline. Additionally, the soils in the area shrink and swell extensively in the presence and absence of moisture. Concrete lining would always be susceptible to cracking and separating resulting in the problems the District is currently experiencing. No benefits were found to justify the additional cost and future problems of replacing the existing concrete lining. Replacing the existing canal with concrete was therefore eliminated as a viable alternative.

According to an on-going study by Texas A&M University, concrete lined canals similar in size and soil type can lose from 220 to 375 acre-feet/mile per year of water due to seepage. Adding this to a loss of 2.2 acre-feet/mile per year due to evaporation converts to a total from 749 to 1396 acre-feet of water loss per year for the proposed 3.37 miles of canal. With the ongoing drought and the District's commitment to water and energy savings, the no-build alternative was eliminated from consideration.

Both lining the canal with a polyurethane liner and replacing the canal with a pipeline had the positive benefit of eliminating seepage and low maintenance costs, but each had its limits on cost-effectiveness. It was found that at higher flow rates, it was more

cost-effective to line the canal with a polyurethane liner. At low flow rates, replacing the canal with a pipeline was more cost-effective. Since both the liner and the pipeline would be installed along the existing canal alignment, the environmental impacts of the projects would be very similar. However, the segments selected for replacement are small laterals with low flow rates and based on the above observations, replacing the canals with pipeline will be the most cost-effective alternative.

In conjunction with this component of the Project, a detailed hydraulic study of each segment of the lateral will be performed using the EPANET software to determine the flow requirements and pipe sizes. All proposed pipelines larger than 24-inches will be installed as reinforced concrete pipe (RCP) and those smaller than 24-inches will be installed as polyvinyl chloride (PVC) pipe. Each of the pipelines will be installed in one of the embankments of the existing canal, with its alignment parallel to the edge of the existing canal. A concrete inlet structure will be constructed at the intersection of the proposed pipeline and the supply canal. This structure will be located to ensure the inlet of the pipeline will remain submerged and thus, ensuring the pipeline will remain pressurized. A turnout connection box will be constructed at each point of delivery along the alignments. A drain pipeline will be provided at the end of each pipeline. Once the pipelines are in place, the existing canal will be backfilled with material from each of the embankments to provide a uniform slope across the District right-of-way. A typical plan and profile sheet for the pipeline is attached as Exhibit 13.

7 DETERMINATION OF WATER AND ENERGY CONSERVED

In conjunction with the preparation of the Project Report, estimates of the quantity of water and energy saved for each component will be prepared. Existing studies of seepage, evaporation and evapotranspiration will be reviewed for their relevancy to this Project and additional studies may be performed to supplement the information. In addition, historical water and energy usage data will be reviewed to quantify the savings. Once the potential quantity of water and energy savings is determined, a value analysis will be performed to show the cost associated with the water and energy savings for each component and the project as a whole.

8 PROJECT BUDGET AND FUNDING

Funding for the proposed project will be provided by multiple sources. The project plan and report, as well as construction drawings and specifications will be completed using funds provided by the State Energy Conservation Office (SECO) through the Texas Water Development Board (TWDB). The estimated construction cost for the project is estimated to be $7,120,000. Detailed construction and O&M cost estimates for each component will be included in the Project Report. DLID is also seeking a grant from

NADB for 50% of the construction cost. The District will provide funding for the remaining 50% of the construction cost.

9 REGULATORY COMPLIANCE DOCUMENTATION

An Environmental Summary Report will be prepared for the Project. Preparation of the report will utilize information from a wide variety of sources including the TCEQ, the U.S. Census Bureau, the U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, the Texas Historical Commission, the National Weather Service, the U.S. Soil Conservation Service, the Texas Department of Transportation and others. Additional information will also be collected through field reconnaissance and interviews with District personnel. The report will include a description of the proposed project including its purpose and need, and funding sources. The Environmental Summary will also detail the environmental impacts of the project based on the regulatory compliance requirements of the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), Section 404 of the Clean Water Act, and other relevant Federal and State statutes. The database for the Native American Indian Tribes will be reviewed for possible tribal lands in the area.

Upon completion, the Environmental Summary Report will be submitted to the Texas Parks and Wildlife Department, Texas Historical Commission, U.S. Army Corps of Engineers and the United States Fish and Wildlife Service for review. Any comments received from the reviewing agencies will be addressed in the Construction Drawings, Specifications and/or Project Report.

It is the District's goal to protect the environment and its inhabitants. The Construction Drawings will include specifications requiring the contractor to protect existing waterways, vegetation and wildlife from unnecessary disruptions during construction. In addition, the District will file the required Notice of Intent with the TCEQ and prepare a Storm Water Pollution Prevention Plan prior to construction.