



## CENTRAL DELTA WATER AGENCY

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August 10, 2011



Via email [commentletters@waterboards.ca.gov](mailto:commentletters@waterboards.ca.gov)

State Water Resources Control Board  
1001 I Street  
Sacramento, CA 95814

Re: Water Diversion Measurement  
Public Workshop - July 21, 2011- Additional Submittals

Dear Ladies and Gentlemen:

Attached hereto please find Technical Memorandum dated July 11, 2011, from Kjeldsen, Sinnock & Neudeck, Inc. to Reclamation District No. 2030, McDonald Island, regarding Cost of Diversion Flow Monitoring and Reporting. Although the attached memorandum does not account for the cost related to vandalism and theft due to location of diversions along the waterways which are open to the public, the attached memorandum confirms that measuring the multitude of the individual diversions in the Sacramento-San Joaquin Delta will result in annual costs in the range of \$12.00 to \$20.00 per acre and is not locally cost effective.

For many years the consumptive use modeling by the DWR has been recognized as the best technology for determining water use in the Delta. The constantly fluctuating water levels due to tides and underflow or seepage (in some cases artesian flow) into the islands and tracts negates the relevance of measurement of diversions in the Delta. Excess water is typically recirculated to the channels with float controlled drainage pumps and there is no apparent water saving that would result from measurement of such water diversion. There is also no apparent saving in cost that could offset the cost of installing measuring devices and recording measurements.

We would like to work with the SWRCB and other interested parties in developing an area-wide reporting mechanism which would eliminate the need for individual water diversion measurement and reporting.

Thank you for your consideration.

Yours very truly,



DANTE JOHN NOMEILLINI  
Manager and Co-Counsel

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## TECHNICAL MEMORANDUM

July 11, 2011

To: Reclamation District 2030, McDonald Island

Subject: Cost of Diversion Flow Monitoring and Reporting

Project: McDonald Island Diversion Flow Measurement Pilot Project

Prepared By: Neal T. Colwell, P.E.

Reviewed By: Stephen K. Sinnock, P.E.

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### 1.0 Purpose and Background

Water Code Section 5103(e)(1) provides as follows:

(e)(1) On and after January 1, 2012, monthly records of water diversions. The measurements of the diversion shall be made using best available technologies and best professional practices. Nothing in this paragraph shall be construed to require the implementation of technologies or practices by a person who provides to the board documentation demonstrating that the implementation of those practices is not locally cost effective.

This memorandum summarizes the probable cost of retrofitting existing surface water diversion structures at McDonald Island for Reclamation District No. 2030 and the estimated annual cost to operate and maintain the monitoring and recording system to allow reporting as required.

### 2.0 Conceptual Diversion Monitoring Program

There are fifty six known diversions of surface water to McDonald Island, consisting of fifty five diversions under claims of riparian or Pre-1914 appropriative rights. Delta Farms Reclamation District 2030 holds Appropriative License No. 1323, which allows for diversion from "...gates and movable siphons along the shore line of McDonald Island...".

Surface water diversions occur through approximately forty three (43) fixed siphons and pumped diversion structures with two mobile pumping plants. At least eight (8) of the existing diversion structures are used to supply surface water to more than one area of use. The flow measurement requirements for Statements of Water Diversion and Use are understood to require the installation of a device to directly or indirectly (through velocity or level measurements) measure the total volume of water diverted through each of these structures. These measurement devices may also need to monitor and may be equipped to record the rate of diversion (flow rate). The conceptual flow measurement and recording system described herein, is intended to meet that purpose.

#### 2.1 Flow Measurement and Recording Systems

For the McDonald Island diversions, this memorandum assumes that each siphon or pumped diversion is equipped with an insertion type flow meter based on an ultrasonic measurement of flow velocity. The flow sensors are assumed to be installed on the suction side (water side) of the siphons no less than two (2) pipe diameters upstream from the bend at the top of the levee, e.g., no less than 24 inches down-levee from the bottom of the bend on a 12 inch siphon. This installation is intended to avoid complications with the potential for the siphon to not flow full at the crown of the levee or on the land-side downslope. On the pumped diversions, the flow meters are assumed to be installed on the discharge piping at a location providing a minimum of five (5) pipe diameters upstream and two (2) pipe diameters downstream of straight pipe without tees, valves or other flow obstructions. The flow meter systems are assumed to include the following elements:

1. Insertion ultrasonic velocity sensor,
2. Cable and conduit from sensor to panel,
3. Flow meter panel with;
  - 3.1 Flow converter,
  - 3.2 Flow totalizer,
  - 3.3 Data logger,
  - 3.4 Flow rate and total display, and
  - 3.5 Battery,
4. Solar panel; and
5. Security enclosure.

Examples of this installation are shown in Figures 1 and 2.



**Figure 1: Velocity Sensor Installed on Water Side of Siphon**



**Figure 2: Example Security Enclosures**

Flow meter systems assumed for this conceptual diversion monitoring program include:

- MACE FloSeries 3
- GE Panametrics AT868 AquaTrans

The MACE FloSeries 3 is the subject of the flow measurement pilot project being undertaken by the District. Information on the FloSeries 3 equipment is contained in Appendix A to this memorandum. An alternative equipment option is the GE Panametrics AT 846 AquaTrans flow meter, however recent experience with this equipment indicates that its cost is approximately 50% to 100% more than the MACE system.

As an additional optional item, the flow measurement and recording systems could be equipped with cellular or satellite communications to allow centralized data recording and collection. This would entail adding remote telemetry in the form of a cellular or satellite based radio system and either on-line data collection and storage services, or centralized data collection and storage.

Equipping each diversion structure with flow measurement and recording systems as described above would allow collection of flow data per Water Code Section 5103, however for the eight or more diversions that supply water to multiple points of use, additional differentiation (possibly consisting of measurement of individual deliveries) of the volumes supplied to each use area under their respective Riparian or Pre-1914 claim of right would be necessary.

## **2.2 Probable Capital Cost**

Recent planning level quotes for the flow meter equipment range from \$4,400 to \$7,800 per siphon. The cost of the MACE FloSeries 3 system installed under the pilot project on one McDonald Island siphon is \$4,396.48 (See Appendix A). Installation and setup of each MACE FloSeries 3 system is estimated to be approximately \$1,000 per site for a security enclosure similar to one

shown in Figure 2. Table 1 summarizes the range of probable capital cost to equip up to 43 diversion points in McDonald Island with flow meters and data recorders.

The costs in Table 1 assume that Reclamation District No. 2030 would facilitate procurement of the flow metering equipment through a competitive public bid process, by developing a Request for Proposals with meter, data recorder, and installation specifications and details. If individual land owners purchased meter systems, the type of meter and appurtenances could vary and we would anticipate individual costs to reflect actual site specific requirements. This also assumes that post-installation inspection and set-up validation would be provided by a third-party (i.e., to review the proper installation and setup of the instrumentation).

Table 1  
 McDonald Island Flow Measurement Capital Cost

Description	Quantity/Units	Range of Unit Cost	Extended Cost
Request for Proposal Process <sup>(a)</sup>	Lump Sum	\$10,000	\$10,000
Installed Flow Meter System	43 Each	\$5,400 - \$8,800	\$232,200-\$378,400
System Setup and Validation/Inspection <sup>(b)</sup>	Lump Sum	\$8,000	\$8,000
		Total	\$250,200-\$396,400
Cellular or Satellite Radio System	43 Each	\$1,000 - \$3,000	\$43,000-\$129,000
		Total w/Radio	\$293,200-\$525,400
		Capital Recovery/Replacement Annualized Cost <sup>(c)</sup> :	\$40,000-\$71,400

(a) Assuming competitive Request for Proposal process pursuant to public procurement requirements.

(b) Installation inspection and independent meter validation.

(c) Annualized cost based on system life of ten years and 6% discount rate, rounded.

## 2.2 Flow Data Management and Reporting

Surface water diversions to McDonald Island are exercised under claims of Riparian rights, Pre-1914 Appropriative Rights, and under Appropriative License No. 1323. A total of 55 Initial Statements of Water Diversion and Use and one Report of Licensee were prepared and submitted for the various surface water diversions to McDonald Island in 2010. It is our understanding that supplemental statements will be required for the following:

- Riparian and Pre-1914 Claims: By July 1, once every three years, to include monthly records of water diversion and use for the previous three calendar years.
- Post-1914 Appropriative Permits and Licenses: Annually by July 1, to include monthly records of water diversion and use, and other information as pertinent to the permit or license.

Based on the Supplemental Statement and Report of Licensee forms and Section 920(c) of Title 23, surface water diversion data for each of the McDonald Island diversions must include:

1. Maximum rate of diversion by month (flow rate such as gallons per minute, gallons per day, or cubic feet per second), if available;

2. Total volume diverted by month (in gallons, million gallons, or acre-feet)
3. Total amount (volume) used by month per diversion, if different from the amount diverted
4. Specified purpose of use for each diversion including acres irrigated by each diversion;

Table 2 estimates the staff time and cost for data collection, management, and form preparation for the 55 supplemental statements of water use and diversion and the single Report of Licensee under a post-1914 Appropriative Right.

Table 2  
 Estimated Annual Cost for Data Management and Reporting

Task Description	Annual Time/Unit	Units	Staff Cost \$/hr <sup>(a)</sup>	Estimated Cost
Monthly Data Collection	3.0 hrs/ea	43 ea	\$95	\$12,225
Monthly Data Management <sup>(b)</sup>	3.0 hrs/ea	43 ea	\$95	\$12,225
Differentiation of Use (for eight diversions)	3.0 hrs/ea	8 ea	\$95	\$2,280
Annual Report Data Compiling and reporting <sup>(b)</sup>	0.5 hrs/ea	55 ea	\$95	\$2,600
Annual Report of License # 1323	1 hr	1 ea	\$95	\$95
<b>Total Estimated Annual Data Management and Reporting Cost:</b>				<b>\$29,400</b>

(a) Assumed fully loaded cost for engineering technician equivalent.

(b) Excluding month-to-month estimates of water used vs. diverted.

If remote data collection were employed, the monthly data collection effort would be nearly eliminated, reducing the estimated annual cost by approximately \$12,225 to \$17,200; however management of the data remotely collected would still be required.

### 2.3 System Operating Cost

In addition to annual maintenance and replacement cost (assumed to be built into an annualized cost for system replacement) and staff time for data collection, management, and reporting, certain additional annual services are anticipated for the conceptual diversion monitoring program. Table 3 summarizes the estimated annual system operation and maintenance costs including:

1. Annual flow meter validation/calibration and system maintenance;
2. Cellular or satellite communications service
3. On-line data storage

Table 3  
 Estimated Annual Operating Cost

Service	Annual Cost/Unit	Units	Estimated Cost
Annual Flow Meter Validation/Calibration	\$250/ea	43 ea	\$10,750
Annual Cellular Data Service <sup>(a)</sup>	\$120/ea	43 ea	\$5,160
On-Line Data Service	\$1,500	L.S.	\$1,500



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Total Estimated Annual Operation Cost:      \$17,400

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(a) Monthly cellular data service assumed at \$10/month per site.

#### 2.4 Cost Summary and Cost Allocation

Implementing a diversion monitoring program as envisioned in this memorandum, and consistent with our current understanding of the diversion measurement and reporting requirements, is estimated to have a capital cost range of \$250,200 to \$525,400, depending on the equipment used and the appurtenances included in the system (e.g., security enclosures and cellular or satellite data collection). Annual cost to operate this system, including data management and reporting, is estimated to be \$34,600 to \$46,800. If capital recovery/replacement is added to the annual cost, this increases the estimated total annual cost to \$74,600 to \$118,200 per year.

Assuming that the cost for installing, operating and maintaining, and eventual replacement of the system is funded through the Reclamation District's annual assessment, the annual per acre assessment would be approximately \$12.70 to \$20.20 (spread evenly over the approximately 5,869 acres of assessed land on McDonald Island).

Table 4  
 Range of Annual RD 2030 Assessment  
 to Implement Diversion Flow Monitoring

Component of Cost	Range of Annual Assessment (\$/acre)
One-time Capital Cost (from Table 1)	\$42.60 - \$89.50
Annual Operating and Reporting Cost (from Table 2 & 3)	\$5.90 - \$8.00
Capital Replacement (Annualized cost from Table 1)	\$6.80 - \$12.20
Range of Annual Assessment Per Acre:	\$12.70 - \$20.20

(a) Spread over 5,869 acres.

The current total annual Reclamation District assessment for agricultural landowners within the District is approximately \$50 per acre. The typical District assessments in the Central Sacramento-San Joaquin Delta are more in the range of \$35.00 to \$50.00 per acre. The ability to pay for agricultural uses is generally the limiting factor on such assessments. The annual assessments fund the capital improvement projects, and operation/maintenance of the District's levees and drainage system. For McDonald Island, implementing the diversion flow monitoring as described herein will result in an estimated 25% to 40% reduction in District funds available for levee improvement and drainage system maintenance projects. Such a reduction would drastically impair the District's ability to adequately operate and maintain its levees and drainage systems.

#### 3.0 Alternative Monitoring and Reporting

An alternative means of reporting agricultural water use on McDonald Island is by documenting cropping patterns and calculating irrigation water demands. Any recreational use of water can also be estimated in a similar manner, based on estimated evaporation rates. Such calculations will yield the most direct estimate of actual agricultural water use on the island. Because of the

hydrologic character of this delta island, water diverted in excess of the soil/crop combined evapotranspiration will be limited to:

1. Evaporation from water surfaces including irrigation and drainage water conveyances;
2. Tailwater
3. Such water flooding for agriculture, waterfowl, recreational purposes (sometimes referred to as winter flooding) combined with seepage from the adjacent surface water bodies, is all conveyed back to the adjacent surface water bodies by the District's drainage pumps, thereby reducing the net water use on the island.

Assuming annual documentation and reporting of estimated evaporation and evapotranspiration, also assumed to be calculated on a monthly basis, as a means of reporting water diversions and use, Table 5 summarizes the estimated annual cost and potential required assessment per acre associated with such a program. This program assumes the following elements:

1. Mapping of total estimated irrigable acreage.
2. Tracking on a monthly basis, the types of crops and application of water,;
3. Existing interpolated monthly reference evapotranspiration and precipitation data is collected (e.g., interpolated from the Tracy, Brentwood, and Manteca CIMIS stations) each year or a site meteorological station is set up to record McDonald Island data at an approximate cost of \$2,500;
4. Annual water use estimates are prepared for each of the 55 supplemental statements of water diversion and use.
5. Rates of diversion would be determined with representative correlations to consumptive use developed through comparisons to actual measurements from the currently installed meter.
6. This program assumes that any industrial or incidental domestic water use and water diverted under the post-1915 license are recorded separately.

Table 5  
 Estimated Cost of Alternative Monitoring and Reporting

Component of Cost	Estimated Annual Cost
Annual Cropping Summary	\$10,000
Consumptive Use Calculations	\$10,000
Supplemental Statements Reporting	\$5,000
Estimated Annual Total:	\$25,000
Total Estimated Annual Per-Acre Assessment <sup>(a)</sup> :	\$4.30

(a) Spread over 5,869 acres.

This alternative monitoring and reporting means has the potential to reduce the annual assessment cost by approximately \$8.40 to \$15.90 per year, to approximately \$4.30 per year per acre.

Attachment:

Attachment A: MACE FloSeries 3 Cost.

Attachment A

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**MACE FloSeries 3 Cost**

**EXHIBIT A**  
**McDonald Island, Reclamation District 2030**  
**Identification of Statements of Diversion**

<b>Identification Number</b>	<b>Owner</b>	<b>Name of Diversion Works</b>	<b>Use(s)</b>
	Delta Farms Reclamation District No. 2030	16" Siphon (17+87A)	
	Delta Farms Reclamation District No. 2030	16" Siphon (17+87B)	
	Delta Farms Reclamation District No. 2030	12" Siphon (720+59)	
	Clavius Club Company, LLC	8" Siphon (358+00)	Ag./Ind./Dom.
	Clavius Club Company, LLC	10" Siphon (358+00)	Ag./Ind./Dom.
	Clavius Club Company, LLC	12" Siphon (361+37)	Ag./Ind./Dom.
	Clavius Club Company, LLC	12" Siphon (390+70)	Ag./Ind./Dom.
	Clavius Club Company, LLC	12" Siphon (433+23)	Ag./Ind./Dom.
	Clavius Club Company, LLC	18" Siphon (439+43)	Ag./Ind./Dom.
	Clavius Club Company, LLC	18" Siphon (449+30)	Ag./Ind./Dom.
	Clavius Club Company, LLC	12" Siphon (450+05)	Ag.
	Heritage Land Company, Inc.	12" Siphon (267+20)	
	Heritage Land Company, Inc.	12" Siphon (267+24)	
	Heritage Land Company, Inc.	12" Siphon (279+78)	
	Heritage Land Company, Inc.	12" Siphon (304+45)	
	Heritage Land Company, Inc.	12" Siphon (342+97)	
S020546	Pacific Gas and Electric Company	14" Siphon (7+36)	
S020542	Pacific Gas and Electric Company	16" Siphon (17+87A)	
S020538	Pacific Gas and Electric Company	16" Siphon (17+87B)	
S020534	Pacific Gas and Electric Company	16" Siphon (43+43)	
S020530	Pacific Gas and Electric Company	12" Siphon (450+05)	
S020526	Pacific Gas and Electric Company	24" Siphon (651+20)	
S020522	Pacific Gas and Electric Company	14" Siphon (651+25)	
S020518	Pacific Gas and Electric Company	12" Siphon (720+59)	
	Robert/Carolyn Reynolds Family, LLC	12" Siphon (255+85)	
	Spaletta Reynolds, PTP	14" Siphon (114+85)	
S020483	Zuckerman-Heritage, Inc.	16" Siphon (90+75)	
S020640	Zuckerman-Heritage, Inc.	14" Siphon (114+85)	
S020644	Zuckerman-Heritage, Inc.	14" Siphon (136+25)	
S020648	Zuckerman-Heritage, Inc.	18" Siphon (151+60)	
S020652	Zuckerman-Heritage, Inc.	12" Pump (151+70)	
S020656	Zuckerman-Heritage, Inc.	12" Siphon (167+70)	
S020660	Zuckerman-Heritage, Inc.	12" Siphon (198+50)	
S020664	Zuckerman-Heritage, Inc.	12" Siphon (218+65)	
	Zuckerman-Heritage, Inc.	12" Siphon (255+85)	
	Zuckerman-Mandeville, Inc.	14" Siphon (7+24)	
	Zuckerman-Mandeville, Inc.	14" Siphon (7+29)	
	Zuckerman-Mandeville, Inc.	16" Siphon (17+87A)	
	Zuckerman-Mandeville, Inc.	16" Siphon (17+87B)	
	Zuckerman-Mandeville, Inc.	12" Siphon (450+05)	
	Zuckerman-Mandeville, Inc.	12" Siphon (478+65)	
	Zuckerman-Mandeville, Inc.	10" Pump (501+35)	

**EXHIBIT A**  
**McDonald Island, Reclamation District 2030**  
**Identification of Statements of Diversion**

<b>Identification Number</b>	<b>Owner</b>	<b>Name of Diversion Works</b>	<b>Use(s)</b>
	Zuckerman-Mandeville, Inc.	12" Siphon (506+45)	
	Zuckerman-Mandeville, Inc.	16" Siphon (514+20)	
	Zuckerman-Mandeville, Inc.	12" Siphon (538+00)	
	Zuckerman-Mandeville, Inc.	14" Siphon (528+60)	
	Zuckerman-Mandeville, Inc.	12" Siphon (607+65)	
	Zuckerman-Mandeville, Inc.	16" Siphon (620+00)	
	Zuckerman-Mandeville, Inc.	12" Pump (624+33)	
	Zuckerman-Mandeville, Inc.	24" Siphon (651+20)	
	Zuckerman-Mandeville, Inc.	14" Siphon (651+25)	
	Zuckerman-Mandeville, Inc.	12" Siphon (569+45)	
	Zuckerman-Mandeville, Inc.	10" Pump (664+95)	
	Zuckerman-Mandeville, Inc.	12" Siphon (685+00)	
	Zuckerman-Mandeville, Inc.	12" Siphon (699+90)	
	Zuckerman-Mandeville, Inc.	12" Siphon (720+59)	