ORDINANCE NO. 2001-01

AN ORDINANCE OF THE PAJARO VALLEY WATER MANAGEMENT AGENCY ESTABLISHING CHARGES FOR THE COST OF WATER DELIVERED FROM THE HARKINS SLOUGH LOCAL WATER SUPPLY PROJECT

SUMMARY

This ordinance provides for the sale and delivery of water from the Harkins Slough Local Water Supply Project to parcels within the Harkins Slough Local Water Supply Project service area, and provides the basis for establishing charges.

* * *

The Board of Directors of the PVWMA makes the following findings:

1. The Pajaro Valley Water Management Agency (Agency) was formed, among other reasons, to provide integrated management of the ground and surface water resources within the Pajaro Basin. As the sole local agency responsible for the integrated management of water resources for the Pajaro Basin, the Agency bears responsibility for the management and augmentation of water supplies for domestic, agricultural, municipal and industrial purposes.

2. On March 15, 2000 the Pajaro Valley Water Management Agency ("PVWMA") adopted Ordinance 2000-02, establishing regulations for the classification and operation of groundwater wells in the PVWMA Local Water Supply Project Service Area, in order to protect the Pajaro Valley groundwater basin against further seawater intrusion. The Board determined that the PVWMA Local Water Supply Project, of which the Harkins Slough Water Supply Project is a component, would provide a substitute water supply that will be adequate to replace the water supply previously available from the wells that will be affected by the prohibition against pumping. Section 1.02.02 of Ordinance 2000-02 requires, with certain exceptions, that after the expiration of one year following the date on which Project Water becomes available in sufficient quantity and quality within the Project service area, no person shall operate any well, within the Project Service Area to provide water to such property for agricultural irrigation. In the event that Project Water is not delivered to a person in the Project Service Area, and that person operates an extraction facility within the Project Service Area pursuant to the terms of Ordinance 2000-02, then that person shall not be subject to the charges established herein, but shall be subject to the charges for the Groundwater Augmentation Charge established by Ordinance 93-1, as amended.

3. Pursuant to the PVWMA Act, Sections 124-502, the Board finds that the protection and augmentation of groundwater supplies is necessary for the public health, welfare and safety of the people of this State and of all people residing within the Agency, and further that the public necessity requires that the PVWMA take this action, in order to reduce groundwater overdraft, deter the further intrusion of seawater into the Basin and protect the quality of the groundwater, by providing a source of supplemental water that is an alternative to the extraction of groundwater.

4. The owners of all parcels within the Agency benefit substantially from the Agency's water conservation activities and from the Agency's activities and regional planning for the reduction of overdraft in the groundwater basin and augmentation of existing water supplies for use within the Agency.

5. PVWMA charges extraction facility owners a Groundwater Augmentation Charge, pursuant to Ordinance 93-1, as amended, for each acre foot of water extracted within the jurisdictional boundaries of the Agency. This Groundwater Augmentation Charge, coupled with the cost of pumping the water incurred by the extraction facility owner, represents the total cost for each acre foot of water extracted from the groundwater basin. It is the Board's intention to provide an economically feasible alternative to groundwater extraction.

6. The Board has conducted engineering and economic analyses to determine the charge for Project Water ("Project Water Charge"), which charge appropriately includes components for a) construction of capital facilities and b) operations and maintenance of the facilities, which includes reasonable costs to the Agency of administering the Harkins Slough Water Supply Project. Based on these analyses, it has been determined that the cost of delivered Project Water would be substantially higher than the current cost of pumping groundwater. (A Memorandum summarizing these analyses is attached as Exhibit A to this Ordinance, and is incorporated herein.) The Board recognizes that imposition of a Project Water Charge in the amount determined by Exhibit A would be economically burdensome to persons receiving Project Water, and could result in the unsuccessful implementation of the Project due to economic disadvantage. As such, the Board finds that it is in the best interest of the Agency and its constituents to provide the persons receiving Project Water with a water supply that is substantially similar in cost to the cost of pumping groundwater at this time. This charge is based on a technical analysis of the cost of pumping groundwater, based upon the cost to operate, maintain, and provide electric power to the average groundwater extraction facility. (A memorandum summarizing this analysis is attached as Exhibit B to this Ordinance, and is incorporated herein.) The Project Water Charges imposed by this Ordinance have been reviewed and approved by the PVWMA Water Quality and Operations Committee.

7. The cost of electric power is a substantial component in the charge for delivery of Project Water. The Board recognizes that due to certain circumstances beyond its control related to the supply of electric power in the State of California, the cost of electric power is a cost that is subject to frequent adjustment by the California Public Utilities Commission. It is the intent of the Board to pass the cost for electric power to deliver Project Water directly on to those receiving delivery of Project Water through the charge established by this Ordinance. This component of the charge shall be calculated in accordance with the formula described in Exhibit A, which is incorporated herein.

8. Project Water Charge revenues shall be used for capital costs and operations and maintenance related to the Project and any and all services provided by the Agency which are reasonably related to the successful implementation and operation of the Project.

9. The Agency Board of Directors does hereby find and determine that any owner of a Turnout who believes that a billed Project Water Charge is inaccurate or incorrect shall have the right to an administrative appeal for up to sixty (60) days after the receipt of such bill. Any credit determined to be owed by the Agency as a result of an appeal shall be applied as a credit to the account of the Turnout owner to lessen the Project Water Charge in the year or years immediately following the inaccurate or incorrect bill.

10. On May 19, 1999, by Resolution No. 99-05, the Board of Directors approved the Local Water Supply Project and certified that the Final EIR for the Project was complete and was prepared in compliance with the California Environmental Quality Act. As so described and approved, the

Project included the proposed restriction of further pumping of groundwater and the delivery of Project Water. The present ordinance is proposed as part of the Local Water Supply Project and is within the scope of the project described in the EIR; it will cause no new environmental effects beyond those considered in the EIR and no new mitigation measures need be considered for this ordinance; and it does not require further environmental review.

11. The Board has conducted a public hearing upon the proposed determination, with notice of the hearing given in the manner prescribed in Government Code Sec. 6066.

NOW, THEREFORE, based on the above findings, the Board of Directors of the Pajaro Valley Water Management Agency ordains as follows:

SECTION ONE. DEFINITIONS

1.01.01 GENERAL APPLICATION

As used in this ordinance, the following words shall have the meaning provided in this part.

1.01.02 GROUNDWATER AUGMENTATION CHARGE

The amount charged by the PVWMA for the extraction of groundwater pursuant to Section 124-1001 of the PVWMA Act and PVMWA Ordinance 93-1, as amended.

1.01.03 OWNER OF AN EXTRACTION FACILITY

The person who owns the parcel upon which the extraction facility is located.

1.01.04 PERSON

"Person" means any individual, organization, partnership, business, association, corporation or governmental agency.

1.01.05 PROJECT SERVICE AREA

"Project Service Area" means the area in the PVWMA service area that will receive project water from the Harkins Slough Project.

1.01.06 PROJECT WATER

"Project Water" means water supplied to property in the project service area by the Harkins Slough Project for use in the irrigation of crops.

1.01.07 TURNOUT

"Turnout" means a pipeline connection from the main water line for delivery of water to an individual parcel(s).

SECTION TWO. CHARGES

The Board of Directors of the Agency does hereby set and apply a perennial water charge for delivery of Project Water against all persons receiving delivery of Project Water within the boundaries of the Project Service Area. The Project Water Charge shall be first applied no earlier than the Effective Date of this Ordinance, and shall continue thereafter each year until modified or repealed.

The Project Water Charge shall be comprised of two Components. Component 1 of the Project Water Charge is based on the cost of construction of capital facilities and is set at the same rate as the Groundwater Augmentation Charge. Component 2 is based on operations and maintenance of the facilities, which includes reasonable costs to the Agency of administering all aspects of the Harkins Slough Water Supply Project, including the cost of electric power for delivery of Project Water. This Component shall be adjusted pursuant to Section 5 of this Ordinance in accordance with the power rates, and other factors, using the methods described in Exhibit A. Component 2 shall be based on the cost of pumping each acre foot of groundwater as determined in Exhibit B.

Beginning on the Effective Date of this Ordinance, the Project Water Charge shall be $142.00 for each acre foot of Project Water delivered.

SECTION THREE. MEASUREMENT OF PROJECT WATER DELIVERED

The amount of water delivered to each person shall be measured by a flow meter installed at each Turnout.

SECTION FOUR. COLLECTION OF CHARGES

4.01. METHOD OF COLLECTION. Charges shall be billed to the owner of the Turnout. Any delinquent Project Water Charge obligations shall be charged interest at the rate of 1.5% per month.

4.02. ENFORCEMENT. In the event of delinquency of payment of any Project Water Charge obligation, the Agency may avail itself of any or all of the following methods of enforcement, as well as any other remedy available at law:

4.02.01. Court Action. Upon the violation of any provision of this Ordinance the Agency may, as established in Section 1104 of the Agency Act, petition the superior court of the county of jurisdiction to recover sums due to the Agency.

4.02.02. Temporary Restraining Order. Upon the violation of any provision of this Ordinance the Agency may, as established in Section 1101 of the Agency Act, petition the superior court of the county of jurisdiction for a temporary restraining order or preliminary or permanent injunction prohibiting the person from taking delivery of Project Water or for such other injunctive relief as may be appropriate.

4.02.03. Civil Penalties. Upon the intentional violation of any provision of this Ordinance, the Agency may, as provided in section 1108 of the Agency Act, seek civil penalties of up to One Thousand Dollars ($1,000) per day for each day of violation, in addition to any other penalties that may be prescribed by law.

4.02.04. Attorneys Fees. The Agency is authorized to recover any and all legal expenses incurred, including costs of suit and attorney's fees, as the prevailing party in any action filed in a court of law by the Agency to collect delinquent Project Water Charges or any action filed in a court of law by persons challenging the Agency's authority to impose or collect Project Water Charges, or the validity or amount of such charges.

SECTION FIVE. REVIEW AND ADJUSTMENT OF CHARGES

The portion comprising Component 2 of the charges established by this Ordinance shall be reviewed annually by the PVWMA Board of Directors, and adjusted to appropriately reflect the cost of providing Project Water through the Harkins Slough Water Supply Project. Any change in the Project Water Charge as a result of this annual process shall become effective on March 1 of each calendar year. Additional adjustments for power costs may be made quarterly, if necessary, pursuant to the formula set forth in Exhibit A.

The portion comprising Component 1 of the charges established by this Ordinance shall be adjusted to be equal to the change, if any, in the Groundwater Augmentation Charge at any time, whether that Fee is increased or decreased.

SECTION SIX. APPLICATION OF ORDINANCE

The provisions of this ordinance shall be administered in conjunction with and complement all other Agency ordinances and resolutions, including Ordinance 93-1, as amended, and Ordinance 2000-02, and these provisions shall apply to all parcels within the Project Service Area. Section headings used in this ordinance shall not be deemed to govern, limit, modify, or in any manner affect the scope, meaning, or intent of the provisions of any section. Words used in any gender include any other gender. The singular number includes the plural, and the plural the singular. Words used in the present tense include the future as well as the present.

SECTION SEVEN. SEVERABILITY

If any section, subsection, paragraph, sentence, clause, or phrase of this ordinance is for any reason held to be invalid or unconstitutional by a decision of a court of competent jurisdiction, it shall not affect the validity of the remaining portion of this ordinance, including any other section, subsection, sentence, clause, or phrase therein.

SECTION EIGHT. EFFECTIVE DATE

This ordinance shall take effect 30 days after it is adopted by the Board of Directors.

PASSED AND ADOPTED this 20th day of June, 2001, by the following vote:

AYES: Directors: Capurro, Carroll, Dobler, Eiskamp, Gallino, Imazio, Koenig
NOES: Directors: None
ABSENT: Directors: None

Frank Capurro, Chair

ATTEST:

Secretary

EXHIBIT A

Technical Memorandum

Pajaro Valley Water Management Agency

Task:	Technical Memorandum for Harkins Slough Cost of Service Evaluation
To:	Charlie McNiesh, PVWMA
Prepared by:	Lidia Gutierrez, RMC
Reviewed by:	Lyndel Melton, RMC
Date:	May 31, 2001
Reference:	PVWMA

I. INTRODUCTION

The purpose of this memorandum is to analyze and describe the cost per acre-foot of developing and delivering surface water diverted from Harkins Slough for agricultural irrigation in the Pajaro Valley. This analysis includes three components:

1. Capital costs for construction of diversion and delivery facilities;
2. Operations and maintenance costs for PVWMA, including operation and administration of the project; and
3. Power costs (considered separately to allow for anticipated rate changes).

This analysis will be used to establish the cost of delivery of agricultural irrigation water from the Harkins Slough Local Water Supply Project.

II. BACKGROUND

In 1993, the PVWMA adopted the Basin Management Plan describing and evaluating options to restore balance between supply and demand for water in the Pajaro Valley and to reverse seawater intrusion in the coastal areas of the valley. The Basin Management Plan also identified a preferred water supply project that includes both local and imported water supplies. The Harkins Slough Local Water Supply Project is one of the projects identified as a preferred alternative.

The Harkins Slough Local Water Supply Project was designed and constructed to divert a maximum of 2,000 acre-feet of flood waters from the slough during the winter. The project is expected to yield an average of 1,100 acre-feet per year. Construction of the Harkins Slough facilities was completed this spring at a cost of approximately $15 million.

The following sections analyze and describe the cost per acre-foot of Harkins Slough project water and the basis for establishing these costs.

A. CAPITAL COSTS

The Harkins Slough capital costs, including the costs for both the Harkins Slough supply and the associated distribution system, engineering, legal and administrative costs, are shown below in Table 1. The capital costs are based on actual dollars spent in fiscal years 1999-2000 and 2000-2001, with the exception of the construction costs which are based on the total of the two construction project bids.

TABLE 1
HARKINS SLOUGH CAPITAL COSTS

	FY 99-00	FY 00-01	TOTAL
Harkins Slough Land Acquisition	$48,105	$650,145	$698,250
Harkins Slough Land Acquisition Service	0	$29,916	$29,916
Harkins Slough Environmental/Permits/Legal	$292,471	$125,291	$417,762
Harkins Slough Engineering	$1,940,096	$227,888	$2,167,984
Harkins Slough Construction	0	$10,500,000	$10,500,000*
Harkins Slough Construction Management	0	$1,145,981	$1,145,981
TOTAL	**$2,280,672**	**$12,679,221**	**$14,959,893**

*Estimate based on total of two construction bids: (1) Harkins Slough Supply and (2) Harkins Slough Distribution

To get an annualized cost, the project was assumed to have a project life of 30 years. The total project cost of $14,959,893 is amortized assuming a straight-line depreciation at a discount rate of 6%. This results in an annualized cost of $1,086,088. Dividing the annualized cost by the average annual water supply of 1,100 acre-feet results in an annual per acre-foot cost of $987. This total cost includes capitalization of both the Harkins Slough supply and distribution projects.

The capital cost of the distribution system includes the cost of constructing capacity and facilities that are larger and more extensive than those required to distribute water to the initial customers only. The sizing and alignment of the distribution system was accomplished in a manner to be consistent with future expansion of delivery and delivery area.

B. OPERATION AND MAINTENANCE COST

The non-power operation and maintenance (O&M) cost estimates are based on facility design, size and layout as presented in construction drawings. Estimated annual O&M

costs for the facilities include equipment and facilities maintenance, operation of pump stations, filter systems, wells, and reasonable costs associated with the PVWMA's administration of the Project, including applicable costs attributable to Agency personnel. Electrical power is considered separately in this analysis. Following are the annual maintenance costs represented as a percentage of the initial capital costs for the various facilities:

- Pipelines - 1.0%
- Pump Stations/Filter Facility - 2.5% (not-including power)
- Recharge Basin - 2.0%
- Monitoring/Extraction Wells - 2.0% (not-including power)
- Miscellaneous Structures - 2.0%
  (valve vaults, intake, discharge valve structures)

Table 2 presents detailed O&M costs by facility based on itemized construction costs.

TABLE 2
ITEMIZED O&M COSTS

	Construction Cost	O&M Percentage	O&M Annual Cost
Mobilization	$665,000	0%	$0
Pipelines	$5,500,000	1.0%	$55,000
Pump Stations/Filter Facilities	$2,150,000	2.5%	$54,000
Recharge Basin	$350,000	2.0%	$7,000
Extraction Wells	$926,000	2.0%	$19,000
Miscellaneous Structures	$164,000	2.0%	$3,000
Other Site Work	$453,000	0%	$0
TOTAL	**$10,208,000**		**$138,000**

The initial annual non-power O&M costs are estimated to be $138,000 for the first year of full capacity operations. Dividing the annualized cost of $138,000 by the average annual water supply 1,100 acre-feet results in an annual per acre-foot non-power O&M cost of $125. This number will be adjusted, pursuant to Ordinance No. 2001-01, to reflect the actual operations and maintenance costs.

C. POWER COSTS

Electrical power costs were developed based on Pacific Gas & Electric (PG&E) rates for large agricultural users (see Schedule AG-1B: Agricultural Power below). PG&E has a range of rate structures to address many special considerations outside of the scope of this analysis. Based on the general horsepower loads and operating schedule for the project facility, PG&E's AG-1-B rate was used to calculate power costs. The rate has three primary components; a flat connection charge per meter of $16/month, a per horsepower (nameplate) load charge of $2.40/month, and a kilowatt-hour charge of $0.1198.

SCHEDULE AG-1B: AGRICULTURAL POWER

APPLICABILITY A customer will be served under this schedule if 70% or more of the energy use is for agricultural end-uses. Rate B applies to single-motor installations rated 35 horsepower or more and to multi-load installations aggregating 15 horsepower or kilowatts or more. This schedule is not applicable to customers with a "maximum demand" of 500 kW or more. The number of kW the customer is using is recorded over 15-minute intervals; the highest 15-minute average in any month will be the maximum demand for that month.

RATES Under Schedule AG-1B the electric customer will pay the following rates and charges (effective 1/1/01):

Energy Charge (per kWh per month)	$0.11984
Demand Charge (per kW of seasonal billing demand)	$2.40
Connection Charge (per meter per month)	$16.00

Power Charge

Power charges are based on the following assumptions:

- Kilowatt-hour cost of 12 cents;
- Pumps and motors operate at an 80% efficiency rate;
- 1,100 acre-feet of water will be diverted, extracted, and delivered; and
- Delivery pressure of 80 psi (185 feet).

Power consumption for diversion, treatment and delivery to recharge basin:

1,100 acre-feet * 110 feet * 1.024 / .80 = 155,000 kWh

Power consumption for extraction and delivery to distribution system:

1,100 acre-feet * 380 feet * 1.024 / .80 = 535,000 kWh

Estimated power charges are:

(155,000 + 535,000) * $0.1198 = $83,000

Dividing the annual power consumption charge of $83,000 by the average annual water supply 1,100 acre-feet results in an annual per acre-foot power consumption charge of $75.

Demand Charge

Demand charges are based on PG&E Rate Schedule AG-1B. According to this rate schedule, the minimum summer demand charge is 75% of the pump nameplate rating in horsepower/kilowatts, which are shown in Table 3. Summer rates apply May through October, winter rates apply November through April. The normal irrigation season for the Pajaro Valley is April through October. So in calculating the winter demand charge for the month of April, the peak 15 minute demand is assumed to be 700 hp as shown in Table 3. In all other non-irrigation months (November through March), the peak 15 minute demand is assumed to be zero.

TABLE 3
HARKINS SLOUGH FACILITIES
CONNECTED LOAD

	No. of Pumps	Motor HP	Total HP
Inlet Pumping	2	7.5	15
Intermediate Pumping	2	100	200
	1	200	200
Surge Tank	1	2	2
Recovery Wells	5	25	125
	5	30	150
Miscellaneous			8
Total			**700**

Demand Charge, April (1 month) = 700 hp * 0.7457 kW/hp * $1.75/kW = $900

Demand Charge, May-October (6 months) = (75% * 700 hp * 0.7457 kW/hp * $2.90/kW) * 6 = $7,000

Demand Charge, November-March (5 months) = 0 hp * 0.7457 kW/hp * $1.75/kW = 0

Total Annual Demand Charge = $900 + $7,000 + $0 = $7,900

Dividing the annual demand charge of $7,900 by the average annual water supply 1,100 acre-feet results in an annual per acre-foot demand charge of $7.

Connection Charge

Assuming there are only two meters required for project facilities, the connection charge is negligible.

TABLE 4
TOTAL POWER COSTS

Power Consumption	$ 75 per acre-foot
Demand Charge	$ 7 per acre-foot
Connection Charge	----
Total Power Cost	**$ 82 per acre-foot**

III. SUMMARY

The cost per acre-foot of developing and delivering surface water diverted from Harkins Slough for agricultural irrigation in the Pajaro Valley is approximately $1,194 per acre-foot, as summarized in Table 5. This cost analysis includes three components: capital costs, O&M costs, and power costs. This analysis will be used to establish the cost of delivery of agricultural irrigation water from the Harkins Slough Local Water Supply Project.

TABLE 4
HARKINS SLOUGH COST OF SERVICE

Cost Component	Annual Cost	Cost Per Acre-Foot
Capital Costs	$ 1,086,000	$ 987 per acre-foot
O&M Costs	$ 138,000	$ 125 per acre-foot
Power Costs	$ 91,000	$ 82 per acre-foot
Total Cost of Service	**$ 1,315,000**	**$ 1,194 per acre-foot**

EXHIBIT B

Technical Memorandum

Pajaro Valley Water Management Agency

Task:	Technical Memorandum for Subtask 1.10 - Groundwater Pumping Cost Evaluation
To:	Charlie McNiesh, PVWMA
Prepared by:	Lidia Gutierrez, RMC
Reviewed by:	Lyndel Melton, RMC
Date:	May 9, 2001
Reference:	PVWMA

I. INTRODUCTION

The purpose of this memorandum is to provide an estimate of the average cost of pumping groundwater for agricultural irrigation in the Pajaro Valley

This evaluation assumes a design delivery pressure of 80 psi at the turnout from the distribution system. This delivery pressure was selected because it is adequate for sprinkler irrigation techniques. Drip irrigation techniques require a lower delivery pressure, approximately 35 psi. Most growers use both irrigation techniques and would require the higher delivery pressure at least some of the time. However, it is possible that growers using only drip irrigation may never require the higher pressure. Calculations are presented for the design discharge pressure of 80 psi. In addition, the cost calculated for the lower delivery pressure of 35 psi is presented in the final cost summary table (Table 9).

Derivations of the groundwater pumping costs are summarized in the following sections.

II. BACKGROUND

In 1993, the PVWMA adopted the Basin Management Plan describing and evaluating options to restore balance between supply and demand for water in the Pajaro Valley and to reverse seawater intrusion in the coastal areas of the valley. The Basin Management Plan also identified a preferred water supply project that includes both local and imported water supplies. This project, the Local Water Supply Project, includes development of three local surface water supplies.

Water augmentation fees for groundwater extraction are utilized by the PVWMA to form a financial basis for project development. Currently, PVWMA assesses a $50 per acre-foot augmentation fee for each acre-foot of groundwater pumped within its service area.

In addition to the augmentation fee, the cost of pumping groundwater can be broken down into three components:

- Energy costs,
- Capital costs, and
- Operation and Maintenance costs.

The following sections describe and estimate each of these costs for groundwater pumping in the Pajaro Valley.

A. Energy Costs

Electricity is the dominant fuel source for groundwater pumping in the Pajaro Valley. There are three components of the cost of electricity: 1) an energy charge per kilowatt hour (kWh); 2) a monthly demand charge based on the kW or horsepower (hp) capacity of the pump; and 3) a flat connection charge per meter. Based on PG&E's rate structure and pump test reports, the applicable rate schedule for growers in the Pajaro Valley is PG&E Schedule AG-1B – Agricultural Power, as described below.

SCHEDULE AG-1B: AGRICULTURAL POWER

APPLICABILITY A customer will be served under this schedule if 70% or more of the energy use is for agricultural end-uses. Rate B applies to single-motor installations rated 35 horsepower or more and to multi-load installations aggregating 15 horsepower or kilowatts or more. This schedule is not applicable to customers with a "maximum demand" of 500 kW or more. The number of kW the customer is using is recorded over 15-minute intervals; the highest 15-minute average in any month will be the maximum demand for that month.

RATES Under Schedule AG-1B the electric customer will pay the following rates and charges (effective 10/30/98):

Energy Charge (per kWh per month)	$0.11984
Demand Charge (per kW of summer billing demand)	$2.90
Connection Charge (per meter per month)	$16.00

Calculation of the energy portion of the cost of pumping must include consideration of PG&E's energy, demand, and connection charge. As a result, there are five steps to calculate the energy costs per acre-foot:

1. Calculate the average energy use per acre-foot pumped as obtained from pump tests and historic meter data, and theoretical assumptions;

2. Calculate the energy charge per acre-foot based on average energy use;

3. Calculate the demand charge per acre-foot based on average pump size and average energy use;

4. Calculate the connection charge per acre-foot based on average water use; and

5. Calculate the total energy costs per acre-foot.

The average energy use per acre-foot pumped has been calculated using three different methods. These calculations have been completed utilizing: (1) pump test data, (2) historic electrical and water meter data, and (3) theoretical assumptions. The pump test data was obtained for 13 wells located throughout the PVWMA coastal service area from PG&E and private pump test reports collected during the last decade. Historic meter data was collected by the PVWMA for both water meter readings and associated electric meter readings. Well numbers have not been included in the tables to preserve confidentiality of all proprietary information. Wells were selected based upon location and availability of electric and water meter data that are exclusive of additional electric uses. A total of 28 wells with electric and flow meter data and 13 wells with pump test data, all located within coastal service area, were selected for this analysis.

Each of these five steps is described in the following sections.

1) CALCULATE ENERGY COSTS--STEP 1

Calculate the average energy use per acre-foot of groundwater pumped as obtained from pump tests, historic meter data, and theoretical assumptions.

Table 1 shows the pump test data for 13 wells located throughout the PVWMA coastal service area. This information was obtained from PG&E and private pump test reports collected during the last decade. The average depth to water is 86 feet and the average well discharge pressure is 106 feet (46 psi). The existing cost of boosting the discharge pressure was not calculated due to lack of adequate data. The Local Water Supply Project will deliver water at a pressure of 80 psi or 185 feet. Therefore, the total lift has been adjusted to allow comparison with proposed project conditions.

Table 1
Pump Test Data

No.	Pump (hp)	Depth to Water (ft)	Discharge Pressure (ft)	Total Existing Lift[1] (ft)	Discharge @ 80 psi (ft)	Adjusted Lift[2] (ft)
1	40	69	35	104	185	254
2	40	60	35	95	185	245
3	100	88	72	160	185	273
4	75	118	208	326	185	303
5	75	69	203	272	185	254
6	40	29	118	147	185	214
7	100	159	173	332	185	344
8	100	104	164	268	185	289
9	100	74	143	217	185	259
10	30	83	37	120	185	268
11	60	139	157	296	185	324
12	30	54	6	60	185	239
13	30	66	28	94	185	251
AVG	**60**	**86**	**106**	**192**	**185**	**271**

Source: PG&E and private pump test reports
[1]Total existing lift (ft) is the sum of the depth to water (ft) plus the discharge pressure.
[2]Adjusted lift (ft) is the sum of the depth to water (ft) plus the project design discharge pressure (ft).

Table 2 shows the average energy use per acre-foot of groundwater pumped using the first method, based on the pump test data and the adjusted energy use based on a delivery pressure of 80 psi. The adjusted energy use is calculated as follows:

Adjusted Energy Use = Adjusted Total Lift/Total Lift x Existing Energy Use

As shown in Table 2, the adjusted energy use per acre-foot of groundwater pumped to a discharge pressure of 80 psi, based on pump test data, is 466 kWh/af.

Table 2
Adjusted Energy Use (kWh/af)

No.	Depth to Water (ft)	Pump (hp)	Total Existing Lift (ft)	Adjusted Lift (ft)	Existing Energy Use (kWh/af)	Adjusted Energy Use (kWh/af)
1	69	40	104	254	162	396
2	60	40	95	245	150	387
3	88	100	160	273	239	408
4	118	75	326	303	614	571
5	69	75	272	254	409	382
6	29	40	147	214	287	418
7	159	100	332	344	616	638
8	104	100	268	289	418	451
9	74	100	217	259	313	374
10	83	30	120	268	272	607
11	139	60	296	324	480	525
12	54	30	60	239	127	506
13	66	30	94	251	203	542
AVG	**86**	**60**	**192**	**271**	**330**	**466**

In the second method, the average energy use per acre-foot of groundwater pumped is based on PG&E electrical and PVWMA water meter data, shown in Table 3. The table shows the meter data for 28 wells located throughout the PVWMA coastal service area. This information was obtained from PVWMA meter data collected since 1996. The average energy use based on meter data is 461 kWh/af, which is consistent with the average energy use based on pump test data.

Table 3
Historic Electric and Water Meter Data

No.	Well Depth (ft)	Pump (hp)	Booster (hp)	Energy Use (kWh/af)
1	588	40	50	372
2	565	40	60	193
3	Unknown	50	50	431
4	Unknown	60		502
5	180	30		329
6	Unknown	30		572
7	300	75		518
8	320	50		580
9	560	40	60	403
10	510	60	75	490
11	690	100		389
12	650	40		424
13	420	30		696
14	240	30		646
15	540	25	60	377
16	450	100		518
17	600	100		357
18	140	40		611
19	305	30	40	401
20	300	60		408
21	400	15	40	336
22	150	15	25	387
23	600	60		397
24	408	20		203
25	Unknown	50	30	512
26	350	15		744
27	280	40		565
28	305	30		536
AVG	**410**	**45**	**50**	**461**

Source: PVWMA Meter Readings, June 1996 – June 1998

The third method of calculating average energy use per acre-foot of groundwater pumped is based on theoretical assumptions. The typical values for pumps and wells located throughout the PVWMA coastal service area were used in this analysis. The following assumptions were used:

Pump efficiency (η_p) @ 1800 rpm (assumed speed)

250 gpm	$\approx$ 75 %
450 gpm	$\approx$ 76 %

Efficiency increases as pump size increases. Use η_p=75%.

Motor efficiency (η_m) @1800 rpm (assumed speed)

20 hp	$\approx$ 92%
100 hp	$\approx$ 94%

Use η_m=92%.

System Head

Head = Pumping Lift + Delivery Pressure

Pumping Lift = 86 ft (based on Table 1 Pump Test Data)

Delivery Pressure = 80 psi or 185 ft (based on project design)

Head = 86 ft + 185 ft = 271 ft

Calculated pump horsepower

$$hp_{pump} = \frac{(gpm)(head)}{3960\,\eta}$$

$$\eta = (\eta_m)(\eta_p) = (0.92)(0.75) = 0.69$$

$$hp_{pump} = \frac{(gpm)(271)}{(3960)(0.69)}$$

$$= (0.0992)(gpm) \text{ or}$$

$$\frac{hp_{pump}}{gpm} = 0.0992$$

Convert $\frac{hp_{pump}}{gpm}$ to $\frac{kWh}{acre\text{-}foot}$

$$\frac{kWh}{acre\text{-}foot} = \frac{0.0992\ hp}{gal/min} \times \frac{1\ hr}{60\ min} \times \frac{.746\ kW}{hp} \times \frac{325{,}800\ gal}{acre\text{-}foot}$$

$$\frac{kWh}{acre\text{-}foot} = 402$$

The average energy use per acre-foot of groundwater pumped based on theoretical assumptions is 402 kWh/af. This calculated energy use of 402 kW/af is less than observed values. This should be expected since pumps actually in service would likely have efficiencies that are less than optimal or theoretical values.

The energy use for each method of calculation is shown in Table 4. The average of the three, 443 kWh/af, was used to estimate the average cost of pumping groundwater for irrigation in the Pajaro Valley.

Table 4
Summary of Energy Use

Method of Calculation	**Energy Use**
Pump Tests	466 kWh/af
Meter Data	461 kWh/af
Theoretical Assumptions	402 kWh/af
Average	**443 kWh/af**

2) CALCULATE ENERGY COSTS--STEP 2

Calculate the energy charge per acre-foot based on the average energy use per acre-foot of groundwater pumped and the PG&E rate schedule.

Energy Charge = Energy Use per acre-foot (kWh/af) x Energy Rate ($/kWh)
= 443 kWh/af x $0.11984/kWh
= $53.09/af

3) CALCULATE ENERGY COSTS--STEP 3

Calculate the demand charge per acre foot based on average energy and water use. Assumes 60 hp pump (see Table 1).

Demand charges are calculated based on PG&E Rate Schedule AG-1B. According to this rate schedule, the minimum summer demand charge is 75% of the pump nameplate rating in horsepower/kilowatts. Summer rates apply May through October, winter rates apply November through April. The normal irrigation season for the Pajaro Valley is April through October (see Table 6). So in calculating the winter demand charge for the month of April, the peak 15 minute demand is assumed to be 60 hp. In all other non-irrigation months (November through March), the peak 15 minute demand is assumed to be zero. The weighted average demand charge per acre-foot is calculated based on the demand charge per month (based on the rates presented below) and the average groundwater demand by month (presented in Table 6).

Demand Charge, April ($) = 60 hp x 0.7457 kW/hp x $1.75/kW

Demand Charge, May-October ($) = 75% x 60 hp x 0.7457 kW/hp x $2.90/kW

Demand Charge, November-March ($) = 0 hp x 0.7457 kW/hp x $1.75/kW

Table 5
Average Annual Water Use (af/y)

No.	Use (af/yr)	No.	Use (af/yr)	No.	Use (af/yr)
1	141.23	11	287.25	21	118.44
2	153.45	12	252.19	22	156.34
3	40.353	13	357.72	23	138.08
4	166.60	14	249.49	24	39.822
5	136.85	15	31.166	25	98.180
6	111.56	16	33.800	26	103.68
7	99.245	17	191.45	27	91.340
8	176.28	18	202.97	28	33.002
9	65.198	19	358.90	29	52.786
10	40.782	20	130.06	30	41.876
AVERAGE 137 af/y					

Table 6
Demand Charges

Month	Percent of Annual Groundwater Demand[1] (%)	Average Water Use per Month[2] (acre-feet)	Demand Charge per Month ($)	Demand Charge per Acre-Foot ($/AF)
January	0.2	0.27	0	0
February	0.4	0.55	0	0
March	1.5	2.06	0	0
April	7.0	9.59	58.72	6.12
May	18.1	24.80	97.31	3.92
June	17.7	24.25	97.31	4.01
July	22.2	30.41	97.31	3.20
August	14.2	19.45	97.31	5.00
September	10.2	13.97	97.31	6.96
October	7.9	10.82	97.31	8.99
November	0.4	0.55	0	0
December	0.2	0.27	0	0
TOTAL	**100**	**137**	**642.61**	**6.82[3]**

[1] Percent monthly demand based on coastal service area data presented in PVWMA Water Supply Project Technical Memorandum No. 2.4, Table 2.4-4.
[2] Average water use by month based on average total water use from Table 5.
3 Weighted average of demand charge per acre-foot.

4) CALCULATE ENERGY COSTS--STEP 4

Calculate the connection charge per acre foot based on the average annual water use as shown in Table 5.

Connection Charge = $16/mo x 12 mo/y / 137 af/y
= $1.40/af

5) CALCULATE ENERGY COSTS--STEP 5

Calculate the total energy cost per acre foot as the sum of the energy charge, demand charge, and connection charge.

Table 7
Total Energy Cost

Charge	Energy Cost ($/af)
Energy	53.09
Demand	6.82
Connection	1.40
TOTAL	**$61.31/af**

B. CAPITAL COSTS

Average capital costs for a well, pump, and associated equipment in the Pajaro Valley are shown in Table 8. The information on new well construction costs is based on a phone conversation with Dave Magiora of Magiora Brothers, the primary well drilling company of the Pajaro Valley. The pump costs depend on well capacity, the depth to water, and the depth at which the pump bowls are set. On average, the pump horsepower is between 75 and 100 hp, with an average cost of $20,000. Costs are amortized assuming a straight line depreciation, with wells and pumps having an assumed life of 50 and 20 years, respectively. Dividing the annualized cost by the average annual water use yields an annual per acre foot cost of the pump and motor.

Table 8
Capital Costs

	Low	Medium	High
Well Cost	$48,000	$150,000	$200,000
Pump Cost	$20,000	$20,000	$20,000
Total Cost	$68,000	$170,000	$220,000
Annualized Cost	**$1,960**	**$4,000**	**$5,000**
Average Water Use	**137 af**	**137 af**	**137 af**
Per acre-foot Cost	**$14**	**$29**	**$36**

C. OPERATION AND MAINTENANCE COSTS

For this analysis, annual O&M costs have been assumed to be eight percent of the medium capital costs, or approximately $2/af.

III. SUMMARY

A. Assumptions

The following assumptions were made in the analysis to determine the estimated average cost to pump and acre-foot of groundwater in the Pajaro Valley:

1. In calculating energy costs, PG&E schedule AG-1B was used. Smaller wells (less than 35 hp for a single motor, less than 15 hp for a multiple load) would use schedule AG-1A. It is expected that there are very few wells of this size in the Pajaro Valley so this assumption should have little effect on the final result.

2. Three methods for computing energy use per acre-foot were used--based on pump test data, based on meter data, and based on theoretical assumptions. The three methods yielded results within 4% of each other so the use of an average value for the analysis was used.

3. A delivery pressure of 80 psi was assumed at the turnout from the distribution system. Lower delivery pressures would come at lower costs. For example, reducing the

delivery pressure from 80 to 35 psi reduces the energy costs by $20 per acre-foot (see Table 9).

4. In calculating the demand charge per acre-foot the assumption was made that groundwater pumping ceases in the winter months (November through March). This assumption is expected to skew the average cost per acre-foot ***down***.

5. The well data used throughout the analysis is based on a collection of coastal wells only. Coastal wells may tend to have shallower depths to water (e.g., less pumping lift) than inland wells. This will tend to skew the average cost per acre-foot ***down***.

B. Costs

Based on the above calculations, the estimated cost to pump groundwater at a discharge pressure of 80 psi is approximately $92/af. The cost of energy is approximately $61/af ($41/af for a discharge pressure of 35 psi) and the additional cost of pumping groundwater for the water user to account for capital and O&M costs is approximately $31/af. The final cost component is the PVWMA Augmentation fee of $50/af. Thus, the total cost to pump groundwater to a pressure of 80 psi in the Pajaro Valley is currently $142/af, including energy, augmentation, capital, and annual operation and maintenance costs.

Table 9
Total Estimated Cost of Groundwater

	Cost to Pump to 80 psi	**Cost to Pump to 35 psi**
Energy	$61/af	$41/af
Capital	$29/af	$29/af
O & M	$2/af	$2/af
SUB-TOTAL	**$92/af**	**$72/af**
Augmentation Fee	$50/af	$50/af
TOTAL	**$142/af**	**$122/af**