ORDINANCE NO. 2002-01

AN ORDINANCE OF THE PAJARO VALLEY WATER MANAGEMENT AGENCY AUTHORIZING THE BOARD OF DIRECTORS TO INCREASE THE AUGMENTATION CHARGE TO NO MORE THAN THAT ALLOWED BY STATE LAW TO IMPLEMENT DIVERSIFIED WATER SUPPLY PROJECTS, INCLUDING LOCAL, RECYCLED OR IMPORTED WATER, AS ADOPTED BY THE PVWMA BOARD OF DIRECTORS TO STOP SEAWATER INTRUSION

* * *

The people of the Pajaro Valley Water Management Agency do ordain as follows:

FINDINGS

WHEREAS, the aquifers within the Pajaro Valley are experiencing serious seawater intrusion, resulting from the pumping of groundwater in excess of the amount of recharge to the basin; and

WHEREAS, 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; and

WHEREAS, in 1993, the Agency developed a long-term Basin Management Plan ("1993 BMP"), which identified various water supply projects involving local water sources and importation of supplemental water, to balance water demands with water supplies in the Pajaro basin; and

WHEREAS, Ordinance 98-2, enacted by the voters of Agency in June 1998, directed the Agency to postpone for the next ten (10) years and until the results of local solutions have been analyzed any decision for the design and construction of any pipeline to import supplemental water from the Central Valley Project, and the purchase of supplemental water from outside the Agency; and

WHEREAS, Ordinance 98-2 further directed that the Augmentation Charges authorized by Section 124-1001 of the Agency's enabling Act (Cal. Water Code App. Ch. 124) shall not exceed $50 per acre-foot until modified by a vote of the people; and

WHEREAS, in accordance with Ordinance 98-2, the Agency has implemented viable conservation measures and constructed viable local water projects, including the Harkins Slough Local Water Supply Project and a component of the Coastal Distribution System; and

WHEREAS, Ordinance 98-4, enacted by the voters of Agency in June 1998, directed the Agency not to enter into any contract with the State or Federal government for water from the State Water Project or the Central Valley Project ("CVP") without approval of the voters of the Agency; and

WHEREAS, in response to the directives in Ordinances 98-2 and 98-4, and based on studies, technical data, hydrologic analysis and engineer's reports, the Agency issued a Draft Revised Basin Management Plan ("Draft Revised BMP") in August 2001 which identifies additional viable local water projects, water reclamation and recycling, and projects for the importation of water in order to most efficiently and cost effectively balance the groundwater basin; and

WHEREAS, the Agency has issued a Draft Revised BMP Environmental Impact Report ("Draft EIR") which evaluates the environmental effects of, and recommends applicable mitigation measures for, the various projects considered in the Draft Revised BMP; and

WHEREAS, based on the information presented in the Draft Revised BMP and various economic analyses performed by and for the Agency, the Agency has concluded that any viable combination of projects presented in the Draft Revised BMP will require funds beyond those currently authorized under Ordinance 98-2; and

WHEREAS, pursuant to Ordinances 98-2 and 98-4, in order to increase the Augmentation Charge above $50 per acre-foot, or take certain action in connection with the importation of water, the Agency must obtain approval from the voters; and

WHEREAS, unless Ordinances 98-2 and 98-4 are amended in accordance with this Ordinance, the Agency will be unable to develop diversified water supply projects to stop seawater intrusion as described in the Draft Revised BMP.

ORDINANCE

SECTION 1: STATEMENT OF PURPOSE

The people of the Pajaro Valley Water Management Agency ("Agency") hereby enact this ordinance in order to permit and fund implementation of water supply projects identified in the Draft Revised Basin Management Plan, ("Draft Revised BMP"), subject to certification of the Final Revised BMP EIR and adoption of applicable feasible mitigation measures by the Agency Board of Directors ("Board").

SECTION 2: AUGMENTATION CHARGE

2.1 The Board may increase the Augmentation Charge authorized pursuant to Sections 124-1001 of the Pajaro Valley Water Management Agency Act (Cal. Water Code App. Ch. 124), to an amount not to exceed the maximum charge as described in Section 124-1003 of the Agency's Act, which is fifteen percent (15%) of the highest charges for water levied by the City of Watsonville.

2.1.1 Any actual increase of the Augmentation Charge by the Board of Directors beyond the current Augmentation Charge of $50 per acre-foot, as established by Ordinance 98-2, shall be based upon all of the following:

a. A selection by the Board of water supply projects to be implemented pursuant to the Final Revised BMP and in accordance with the Final Revised BMP EIR, certified by the Board, including adoption of feasible mitigation measures, as applicable; and

b. The actual cost of water supply projects to be implemented, based on an engineer's estimate of the cost to implement the projects, including costs associated with capturing, storing, purchasing and distributing supplemental water; and

c. Compliance with the requirements of the Agency's Act.

SECTION 3: ACQUISITION OF SUPPLEMENTAL WATER

The Board may take all steps necessary to acquire supplemental water from the Central Valley Project (CVP) or State Water Project (SWP) or any other sources outside the Agency's boundaries, and design and construct a pipeline to import supplemental water from the CVP or any other source into the Agency's boundaries.

SECTION 4: COMPLIANCE WITH CEQA

Nothing in this Ordinance is intended to provide authority to the Board to take any action or implement any project without first complying with all applicable laws, including the California Environmental Quality Act ("CEQA").

SECTION 5: APPLICATION OF ORDINANCE

The provisions of this Ordinance shall be administered in conjunction with and complement all other Agency Ordinances. To the extent the terms of this Ordinance conflict with any other Agency Ordinance, upon its effective date, this Ordinance shall revise, amend and supercede any and all previous Ordinances of the Agency.

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 6: EFFECTIVE DATE

If approved by the voters, this Ordinance shall take effect thirty days after certification of the election results, pursuant to California Elections Code Section 9191(b).

SECTION 7: SEVERABILITY

If any subdivision, paragraph, sentence, clause or phrase of this Ordinance is, for any reason, held to be invalid or unenforceable by a court of competent jurisdiction, such invalidity or unenforceability shall not effect the validity or enforcement of the remaining portions of this Ordinance. It is the people's express intent that each remaining provisions of this Ordinance would have been adopted irrespective of the fact that one or more subdivisions, paragraphs, sentences, clauses, or phrases be declared invalid or unenforceable.

Certification of the Votes Cast

State of California
County of Santa Cruz } *ss.*

I, Richard W. Bedal, County Clerk of the County of Santa Cruz, do hereby certify that the following is a full, true and correct statement of the result of the official canvass of the returns of the March 5, 2002 Gubernatorial Primary Consolidated Election.

I hereby set my hand and seal this 26th day of March, 2002.

By Richard W. Bedal
Richard W. Bedal
Santa Cruz County Clerk

3/26/2002 1:03 PM
March 5, 2002

Gubernatorial Primary Election

Absentee Totals

26

Non Partisan
Local Measures L, M, N and S

	Registration	Ballots Cast	Turnout (%)	L-Repeal of County Utility Tax Vote for t Yes	No	M-Referendum of SV Glenwood Project (1) Yes	No	N-Pajaro Valley Manage. Agen. Seawater Intrusion Yes	No	S-Aromas-San Juan School Dist. Bond (1) Bonds Yes	Bonds No
Santa Cruz County	127582	16025	12.6	9435	5969	623	582	1371	1085	0	0
14th Congressional Distr	40302	5325	13.2	3337	1783	623	582	247	298	0	0
17th Congressional Distr	87280	10700	12.3	6098	4106	0	0	1124	788	0	0
11th Senatorial District	76959	8915	11.6	5010	3615	0	0	0	0	0	0
15th Senatorial District	50623	7110	14.0	4425	2354	623	582	1371	1085	0	0
27th Assembly District	110385	14042	12.7	8210	5222	623	582	291	288	0	0
28th Assembly District	17197	1983	11.5	1225	647	0	0	1080	797	0	0
1st Supervisorial Distri	27440	3836	14.0	2287	1392	0	0	0	0	0	0
2nd Supervisorial Distri	28528	3646	12.8	2186	1285	0	0	438	392	0	0
3rd Supervisorial Distri	28030	2943	10.5	1484	1320	0	0	0	0	0	0
4th Supervisorial Distri	14570	1717	11.8	1058	560	0	0	933	693	0	0
5th Supervisorial Distri	29014	3881	13.4	2400	1312	623	582	0	0	0	0
City Of Santa Cruz	30617	3336	10.9	1720	1475	0	0	0	0	0	0
City Of Capitola	5535	716	12.9	376	294	0	0	0	0	0	0
City Of Watsonville	12150	1419	11.7	857	459	0	0	816	515	0	0
City Of Scotts Valley	6477	1265	19.5	787	398	623	582	0	0	0	0
Unincorporated Area	72909	9267	12.7	5696	3233	0	0	555	570	0	0

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**

CURRENT BILL STATUS

MEASURE : A.B. No. 1864
AUTHOR(S) : Salinas (Coauthor: Senator McPherson).
TOPIC : Pajaro Valley Water Management Agency.

TYPE OF BILL :
Inactive
Non-Urgency
Non-Appropriations
Majority Vote Required
Non-State-Mandated Local Program
Non-Fiscal
Non-Tax Levy

LAST HIST. ACT. DATE: 05/29/2002
LAST HIST. ACTION : Chaptered by Secretary of State - Chapter 50, Statutes of 2002.

TITLE : An act to amend Section 316 of the Pajaro Valley Water Management Agency Act (Chapter 257 of the Statutes of 1984), relating to water.