Attachments:

3h Fresno ID Flood Rights Agreements, Easements and JID Operations Agreement

3i Laguna ID Project Feasibility Study

3j Laguna Land Purchase Option

3k Laguna ID Liberty Canal Survey and Hydraulic Analysis

3l Laguna ID Property Appraisal

3m Bakman WC Approved Nitrate Blending Plan

3n Bakman, San Joaquin and Kerman Letter of Intent

3o Bakman WC Preliminary Wellhead Treatment Plans and Nitrate Blending

3p Bakman WC CPUC Approved General Metered Service Rates

3q Bakman WC Badger Product sheets

3r Bakman WC Well Sampling Results

3s Bakman WC Standard Drawings

3t City of San Joaquin CDPH Memo for Additional Well Capacity

3u San Joaquin Exemption

3v City of Kerman Utility Rate Study

3w City of Kerman City Standards

3x City of San Joaquin Utility Rate Update Study & 2009 Water Conservation Strategy

69130

THIS AGREEMENT, Made and entered into this 7th day of June, 1953, by and between JAMES IRRIGATION DISTRICT, a public corporation located in the County of Fresno, State of California, as First Party, and FRESNO IRRIGATION DISTRICT, a public corporation located in the County of Fresno, State of California, as Second Party,

W I T N E S S E T H:

WHEREAS, First Party owns and operates a system of canals and ditches in the County of Fresno used for the distribution of irrigation waters; and

WHEREAS, Second Party owns and operates a system of canals and ditches in the County of Fresno easterly of the boundaries of First Party, which said system is used for the distribution of irrigation waters and the spreading and disposal of storm and waste waters; and

WHEREAS, Second Party desires to dispose of such portions of the irrigation, storm and waste waters discharged or received into its canal system which are not used for irrigation, and First Party is desirous of receiving such waters into its canal system and providing for the disposal and receiving the benefit thereof;

NOW, THEREFORE, it is agreed as follows:

I.

First Party hereby grants to Second Party the perpetual right and easement to construct, install, reconstruct, alter, repair, improve and maintain in the northeasterly end of First Party's "McMullin Grade Canal", at the location of First Party's Pump No. C-36, in the Southwest Quarter of the Northeast Quarter of Section 2, Township 15 South, Range 18 East, M. D. B. & M., in the County of Fresno, State of California, pipelines and conduits and outlet structures, together with all rights con-

STAMMER & McKNIGHT
ATTORNEYS AT LAW
531 BRIX BUILDING
FRESNO 21, CALIF.

615 688

venient or incidental thereto, including the right of ingress to or egress from said pipelines, conduits and outlet structures in, over and across said McMullin Grade Canal and the banks thereof, and any adjoining property of First Party, and the perpetual right, but no duty or obligation, to discharge into said canal such storm and waste waters as may collect or be received or discharged into Second Party's irrigation system as Second Party shall desire. In this connection it is understood and agreed that the capacity of First Party's irrigation works which are to receive such waters does not exceed fifteen cubic feet per second (15 c.f.s.), and Second Party agrees not to discharge water into First Party's canal in excess of fifteen cubic feet per second (15 c.f.s.).

II.

First Party agrees to receive and dispose of, at its own expense, and may use such waters as Second Party shall discharge into First Party's canal, but First Party shall have no right to receive any water from Second Party.

III.

First Party grants to Second Party the perpetual right to construct, install, reconstruct, alter, repair, improve and maintain pipelines within any right of way or easement owned by First Party northeasterly from said northeasterly end of said McMullin Grade Canal.

IV.

First Party agrees to maintain said McMullin Grade Canal, or such irrigation works as may be substituted for said canal, at a capacity at least as large as that of the present canal; and to maintain, repair and keep said canal or substituted works in good operating condition, free from obstructions, and capable of receiving a flow of not less than fifteen cubic feet per

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second (15 c.f.s.) of water at all times, at its own expense.

V.

Second Party agrees to maintain and keep said pipelines, conduits and outlet structures in good operating condition and repair at its own expense.

VI.

It is agreed that if any waters discharged by Second Party into First Party's irrigation works are injurious to growing crops, then Second Party, upon receiving written notice from First Party, will use reasonable diligence to stop the discharge of such injurious waters into First Party's irrigation works.

VII.

This agreement shall apply to, bind and inure to the benefit of the successors and assigns of the respective parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the day and year first above mentioned.

JAMES IRRIGATION DISTRICT

By Harold Hale
Pres.

(Corporate Seal)

Attest: Martha Myrick
Secretary

First Party

FRESNO IRRIGATION DISTRICT

By Geo N. Skogard

(Corporate Seal)

Attest: J. V. McAllister

Second Party

69130

RECORDED AT REQUEST OF
Fresno Irrigation District
AT 11 MIN. PAST 9 A M

DEC 24 1953

BOOK 3382 PAGE 690

FRESNO COUNTY CALIFORNIA
I. E. FARLEY, COUNTY RECORDER
BY H. Hewatton DEPUTY RECORDER 3. No fee

STATHER & McKNIGHT
ATTORNEYS AT LAW
53 BRIX BUILDING
FRESNO 21, CALIF.

BOOK 3382 PAGE 693

State of California, County of Fresno } ss.

On this 7th day of December in the year one thousand nine hundred and fifty three before me, FLORENCE CARTER a Notary Public in and for said County and State, residing therein, duly commissioned and sworn, personally appeared GEO. N. SKOEGARD known to me to be the President, and J. H. McALLISTER known to me to be the Secretary of the FRESNO IRRIGATION DISTRICT the corporation that executed the within instrument, and known to me to be the persons who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that such corporation executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in said County, the day and year in this Certificate above written.

My Commission Expires November 17, 1957

Florence Carter
Notary Public in and for said County and State.

CORPORATION ACKNOWLEDGMENT—Shelburne's Stationery—1931 Mariposa, Fresno, Calif.

693

STATE OF CALIFORNIA, County of Fresno } ss.

On this 18th day of December in the year one thousand nine hundred and fifty three before me, W. M. Flynn a Notary Public in and for said County and State residing therein, duly commissioned and sworn, personally appeared Harold Hale and Martha Myrick the President and Secy. of the James Irrigation Dist. known to me to be the persons described in, whose name are subscribed to and who executed the within instrument, and acknowledged that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in said County, the day and year in this Certificate first above written.

W M Flynn
Notary Public in and for said County and State.

ACKMT. GENERAL
H. S. CROCKER CO., INC.—PRINTED IN FRESNO

RECORDED IN OFFICIAL RECORDS OF FRESNO COUNTY, CALIFORNIA
AT 30 MIN. PAST 2P M
OCT 22 1970
FEE
J. L. BROWN, County Recorder

67879

74536

RECORDED IN OFFICIAL RECORDS OF FRESNO COUNTY, CALIFORNIA
AUG 25 1970 2P M
J. L. BROWN, County Recorder

AGREEMENT TO CONSTRUCT, MAINTAIN AND OPERATE DRY CREEK EXTENSION

This Agreement made and entered into this 3rd day of August, 1970, by and between FRESNO IRRIGATION DISTRICT, COUNTY OF FRESNO, CITY OF FRESNO, CITY OF CLOVIS, FRESNO METROPOLITAN FLOOD CONTROL DISTRICT and JAMES IRRIGATION DISTRICT,

W I T N E S S E T H:

WHEREAS, Dry Creek is a waterway having its present origin in that certain flood control project and works constructed by the United States, generally referred to as "The Big Dry Creek Project," located in the County of Fresno generally north and northeast of the northerly boundary of Fresno Irrigation District, and flowing in a generally southwesterly direction through lands lying within the jurisdiction of all of the entities who are parties hereto (except James Irrigation District) to a point in Section 8, Township 15 South, Range 18 East, in the County of Fresno; and

WHEREAS, Dry Creek during its said course flows partly in the channel of a pre-existing natural waterway which has been altered, improved, maintained and operated by Fresno Irrigation District for many years for the use of said District in transporting and supplying irrigation waters to the landowners within the District and partly in canals which were built, constructed, maintained and operated by Fresno Irrigation District and its predecessors in interest for the same purposes; and

WHEREAS, throughout the years the parties hereto (except James Irrigation District) have used said channels for drainage and flood control purposes and in some instances the City of Fresno has assisted Fresno Irrigation District in the alteration and improvement of portions of said channel; and

WHEREAS, flood waters from Dry Creek have from time to

GIS 5995

time flowed beyond the southerly end of Dry Creek onto lands owned and used by others in that locality and it is the desire of all of the parties hereto that such landowners should be protected from such waters insofar as it is possible to do so; and

WHEREAS, James Irrigation District owns, maintains and operates a canal, known as James Irrigation District's McMullin Grade Canal, which flows in a southwesterly direction at a point approximately 1-1/4 miles south of the southerly end of Dry Creek; and

WHEREAS, James Irrigation District is willing to take a limited amount of water from Dry Creek into its said McMullin Grade Canal for the purpose of assisting the parties hereto in disposing of said flood waters and for its own use in James Irrigation District; and

WHEREAS, all the parties hereto believe that the extension of Dry Creek by the construction of a canal permitting said flood waters to flow into said McMullin Grade Canal is in the public interest and for the benefit of all the parties hereto.

NOW, THEREFORE, in consideration of the mutual agreements of the parties herein contained, it is agreed as follows:

1. Fresno Irrigation District shall forthwith attempt to obtain a permanent and perpetual easement and right of way over lands lying between the southerly end of Dry Creek and James Irrigation District's McMullin Grade Canal for the purpose of building constructing, altering, repairing, maintaining and operating a canal and/or pipeline connecting Dry Creek with said McMullin Grade Canal. The exact location of said easement and right of way shall be within the discretion of Fresno Irrigation District. Unless said easement and right of way is obtained within two years from the date hereof, this entire agreement shall become void and of no effect.

2. When said easement and right of way has been obtained and has been recorded, Fresno Irrigation District will construct or cause to be constructed thereon a canal connecting Dry Creek with said McMullin Grade Canal, together with all outlets, inlets, headgates, controls and other works and structures, reasonably required to carry out the purposes of this agreement. Said canal shall be known and hereafter referred to as the Dry Creek Extension and said term as hereafter used shall include all outlets, inlets, headgates, controls and other works and structures above referred to. Said canal shall have a bottom width of not less than 10 feet, shall have a flow capacity of not less than 56 c.f.s and shall have a headgate or other control at the inlet at the southerly end of Dry Creek limiting the amount of water which may be turned into said canal to 56 c.f.s. Except as above provided, the plans and specifications for the construction of said canal and said other works and structures shall be determined by and within the discretion of Fresno Irrigation District.

3. At the same time said Dry Creek Extension is constructed Fresno Irrigation District will also install approximately 300 feet of outfall pipeline connecting James Irrigation District's McMullin Grade Canal with Kings River Bypass and shall install a turnout from said pipeline into said Kings River Bypass. Said pipeline shall be installed upon an easement or right of way to be furnished by James Irrigation District at its own expense and when so constructed, and when said Dry Creek Extension is in operation, said pipeline shall become the property of James Irrigation District to be maintained and operated by James Irrigation District. At the same time Fresno Irrigation District will replace the 36 inch farm culvert located approximately 160 feet southwesterly from the outlet of said Dry Creek Extension into said McMullin Grade Canal with a new culvert of sufficient capacity to carry a

maximum flow of 71 c.f.s. Said pipelines and culvert (not including said easement) shall hereafter be referred to for the purpose of this agreement as the "McMullin Grade Canal Works." The location of and the plans and specifications for said McMullin Grade Canal Works shall be determined by Fresno Irrigation District with the approval of James Irrigation District.

4. The costs of obtaining said easement and right of way for and of constructing said Dry Creek Extension and said McMullin Grade Canal Works shall be paid by the following parties in the following percentages:

County of Fresno	30%
City of Fresno	30%
City of Clovis	10%
Fresno Metropolitan Flood Control District	30%

In determining such costs, Fresno Irrigation District shall make no charge for the services of its manager and engineer in negotiating for said easement and right of way or in designing, supervising and inspecting said construction. Said costs shall be paid as follows:

It is estimated that the cost of acquiring such easement and right of way and of constructing said Dry Creek Extension and said McMullin Grade Canal Works will not exceed $20,000.00. Immediately upon the execution of this agreement by all of the parties hereto, each of said parties will pay into Fresno Irrigation District its proportionate share of said amount. All amounts so paid into Fresno Irrigation District shall be deposited by Fresno Irrigation District in a special account to be known as "Dry Creek Extension Fund." Fresno Irrigation District shall pay from said funds all reasonable costs and expenses incurred by it in acquiring said right of way and in constructing said Dry Creek Extension and said McMullin Grade Canal Works.

5. When the construction of said Dry Creek Extension and said McMullin Grade Canal Works has been completed and said Dry Creek Extension is ready for operation, it shall be maintained and operated by Fresno Irrigation District. Such maintenance shall include necessary alterations and repairs. The costs of so maintaining and operating said Dry Creek Extension shall be paid by the following parties in the following percentages:

Fresno Irrigation District	12%
County of Fresno	26%
City of Fresno	26%
City of Clovis	10%
Fresno Metropolitan Flood Control District	26%

Said costs shall be paid as follows:

(a) When said Dry Creek Extension has been completed and said canal is ready to be put in operation, Fresno Irrigation District shall prepare and deliver to each of the parties hereto who have agreed to pay for its maintenance and operation a detailed estimate and budget of the reasonable amount of monies required for such maintenance and operation for the period from the date of completion thereof to the following June 30. Within thirty (30) days after receipt of a copy of said estimate and budget each of said parties agree to pay to Fresno Irrigation District its proportion of the amount fixed in such estimate and budget. Said funds will be deposited in said "Dry Creek Extension Fund" and shall be paid out by Fresno Irrigation District for costs and expenses incurred by it in maintaining and operating said Dry Creek Extension.

(b) On March 1 next succeeding the completion of said Dry Creek Extension and on each March 1st threafter, Fresno Irrigation District shall prepare a like estimate and budget for its maintenance and operation for the next fiscal year commencing

on July 1 through June 30. The amount of said budget shall be paid into Fresno Irrigation District and paid out by Fresno Irrigation District in the same manner provided in the preceding paragraph.

6. If any of the sums paid into Fresno Irrigation District as above set forth, are insufficient to pay the reasonable costs and expenses required in obtaining said easement and right of way or constructing said Dry Creek Extension and said McMullin Grade Canal Works or maintaining or operating Dry Creek Extension, Fresno Irrigation District shall, either at the time such insufficiency is determined by it or at the date on which its next budget is presented, furnish each of the parties who have agreed to pay said costs and expenses a statement of the additional amount of amounts which it believes will be necessary to complete such work, and each of said parties shall forthwith pay into Fresno Irrigation District its proportion of said additional amounts.

7. Except as provided in the next paragraph of this agreement, no amount estimated or budgeted by Fresno Irrigation District to be paid from said Dry Creek Extension Fund in the performance of this agreement shall exceed an amount reasonably required for the purpose for which it is budgeted, and if any party shall claim that any such amount is not so required it may pay its said proportionate share of such amount under protest or refuse to pay such amount until it is determined whether or not the expenditure of such amount is reasonably required. In no event shall Fresno Irrigation District be required by this agreement to do any work or perform any act in the performance of this agreement until and unless sufficient funds to cover all of its estimated expenditures therefor are actually on deposit in said Dry Creek Extension Fund.

8. In the event of an emergency, Fresno Irrigation District may, at its option, do any work, perform any act, make

any expenditure or incur debts or obligations in excess of the amounts on deposit in said fund, and in excess of the amount of any budget, if in its sole judgment such work or expenditures are necessary by reason of such emergency for the protection, preservation and operation of said Dry Creek Extension or to prevent damage by flooding of lands in the area of said canal. The amount of any such expenditures and of any such debts or obligations so incurred shall be paid to Fresno Irrigation District by the parties named in paragraph 5 hereof, in the proportion fixed in said paragraph, within thirty (30) days after such expenditures or debts or obligations are reported to said parties. Fresno Irrigation District shall be the sole judge of whether or not such emergency exists and whether the amount of said expenditures or debts or obligations are necessary or reasonable. This paragraph shall not apply to or require any change in the maximum 56 c.f.s. of water which James Irrigation District agrees to accept in its McMullin Grade Canal nor shall this paragraph alter any of the rights or obligations of the parties to James Irrigation District.

9. Any portion of the amounts paid into said Dry Creek Extension Fund during any period which shall not be expended during such period shall be retained in said fund and applied to the expense of the maintenance and operation of said Dry Creek Extension during the next succeeding period.

10. Except as otherwise expressly provided herein, Fresno Irrigation District may pay from said Dry Creek Extension Fund all costs and expenses incurred by it in performing this agreement, including but not limited to the purchase of supplies, tools and other materials; all costs for labor; the use of its own officers, agents, servants and employees and the payment of a proportionate share of their salaries or wages for time spent in performing this agreement; a reasonable overhead charge for the services of

BOOK 5830 PAGE 429

its manager in supervising such work and in attending to the necessary accounting therefor and the preparing of estimates and budgets as required by this agreement; the cost of necessary engineering and legal services; a reasonable rental for the District's own equipment and tools while engaged in such work; the cost of public liability, property damage, workmen's compensation or other insurance; the cost to the District of social security, health, unemployment or retirement benefits incurred by it in connection with such work; and any taxes, assessments or charges based upon wages and salaries paid by it in connection with such work or otherwise. Fresno Irrigation District may also charge to said fund the cost of construction of such fences, gates and other enclosures as in its judgment may afford protection to the canal or contribute to the efficient maintenance, upkeep or operation thereof.

11. Except as otherwise provided in this agreement and subject to all the terms of this agreement, the method and manner of obtaining said easement and right of way, of constructing said Dry Creek Extension and said McMullin Grade Canal Works and of maintaining and operating said Dry Creek Extension shall be in the discretion of Fresno Irrigation District. The other parties to this agreement shall have no authority or control over such matters except insofar as this agreement permits any such party to dispute Fresno Irrigation District's estimates and budgets for the amounts to be paid out in performing said work and except that James Irrigation District shall control the maintenance and operation of its McMullin Grade Canal and the discharge of said canal into Kings River Bypass.

12. In the event any party hereto shall fail to pay any amount required to be paid by it under the terms of this agreement, any party hereto may commence an action for the recovery of

such amount in the Superior Court of the State of California in and for the County of Fresno and shall have the right to recover such amount in said action. Any amount so recovered by any party hereto shall be deposited by said party in said Dry Creek Extension Fund.

13. James Irrigation District shall not be concerned with or liable for any breach of any of the provisions of paragraphs 4, 5, 6, 7, 8, 9, 10 and 12 of this agreement.

14. Fresno Irrigation District, County of Fresno, City of Fresno, City of Clovis and Fresno Metropolitan Flood Control District collectively agree to indemnify each of said parties (not including James Irrigation District) and to hold it harmless from and against any and all liability, loss, cost or expense which may be incurred by the party so indemnified as a result of the construction, maintenance, operation or use of said Dry Creek Extension or said McMullin Grade Canal Works under or by virtue of this agreement. Each of said indemnitors agree as between themselves as indemnitors that they will bear any such liability, loss, cost or expense and contribute thereto in equal proportions.

15. When this agreement has been executed by all parties hereto and the construction of said Dry Creek Extension and said McMullin Grade Canal Works has been completed, James Irrigation District agrees to permit Fresno Irrigation District to connect said canal with its McMullin Grade Canal and to accept from said canal into its said McMullin Grade Canal, at such times as Fresno Irrigation District may elect, such water as Fresno Irrigation District shall elect to put into said McMullin Grade Canal; provided, that no more than 56 c.f.s. of water shall ever be put into said McMullin Grade Canal at any one time without the previous consent of James Irrigation District. Said water when placed in said McMullin Grade Canal shall become the water of James

Irrigation District to be conveyed, transferred, diverted and used as James Irrigation District shall see fit. In so accepting said water James Irrigation District shall not become responsible or liable for the maintenance or operation of any portion of Dry Creek or of said Dry Creek Extension or for the conveyance, transfer, diversion or use of any water flowing in Dry Creek or in said Dry Creek Extension at any point north of said McMullin Grade Canal. Fresno Irrigation District, County of Fresno, City of Fresno, City of Clovis and Fresno Metropolitan Flood Control District agree to indemnify James Irrigation District and hold it harmless from and against any liability, loss, cost or expense incurred by it on account of the maintenance and operation of Dry Creek or said Dry Creek Extension or the conveyance, transfer or use of waters in Dry Creek of said Dry Creek Extension north of said McMullin Grade Canal. James Irrigation District accepts responsibility for the maintenance and operation of said McMullin Grade Canal and said McMullin Grade Canal Works and agrees to indemnify said other parties and to hold them harmless from and against any liability, loss, cost or expense incurred by them on account of the maintenance or operation of said McMullin Grade Canal or said McMullin Grade Canal Works or the conveyance, transfer or use of water in said McMullin Grade Canal and said McMullin Grade Canal Works as contemplated by this agreement.

16. It is understood and agreed that Fresno Irrigation District and James Irrigation District will cooperate in the use of said Dry Creek Extension and its discharge into McMullin Grade Canal and in the maintenance and use of said McMullin Grade Canal so as to carry out the purposes of this agreement and at the same time, insofar as reasonably practicable, not to interfere with James Irrigation District's maintenance or operation of McMullin Grade Canal. To this end James Irrigation District will attempt to do its maintenance and repair work on McMullin Grade Canal at times

when flood conditions affecting Dry Creek are not anticipated, and in the event an emergency does require such maintenance or repair work at any such time, it will notify Fresno Irrigation District that such work is being done. Upon receiving such notice, except in cases where conditions make it impossible or impracticable to do so, Fresno Irrigation District will not discharge water into McMullin Grade Canal which will interfere with such maintenance or repair work without notice to James Irrigation District. In the event such notices are received the parties will work together to carry out the purposes of this agreement with the least possible damage to any person or any property.

17. All water discharged from said Dry Creek Extension into said McMullin Grade Canal shall meet the required water quality standards of the California Water Quality Control Board or any other governmental body or board having the authority to limit James Irrigation District's right to discharge water into said Kings River Bypass.

18. In no event will James Irrigation District be required to accept any water in its McMullin Grade Canal at any time when it is informed by the United States Corps of Engineers or any successor governmental regulating agency controlling the use and operation of Kings River Bypass that the Bypass capacity at the McMullin Grade Canal outlet is full and that all or a part of the discharge anticipated from the McMullin Grade Canal cannot be discharged into the Kings River Bypass.

19. This agreement is not intended as a determination of the existing rights, duties or obligations of the parties in respect to Dry Creek, either among themselves or as to others. It is entered into in the public interest and as a public service and solely for the purpose of providing, insofar as possible, an outlet for flood and other waters running in Dry Creek which on occasions may constitute a threat of flooding upon properties at

the southerly end of Dry Creek. Nothing herein shall be construed to constitute an acknowledgment on the part of any of the parties hereto of any responsibility or liability for any such occurrence or condition nor, except as expressly provided, shall it create, establish or determine any responsibility or liability on the part of any party for the maintenance, operation or use of Dry Creek or any water running in Dry Creek. It is further agreed that, except as expressly provided, nothing herein shall give to any party any right to the use of any portion of the channel of Dry Creek or to any water running in Dry Creek.

20. All of the parties hereto agree that James Irrigation District is permitting the use of its facilities and services in the public interest and for the public good without prior obligation and without any prior liability on its part to accept into its McMullin Grade Canal the waters described herein.

21. It is understood that Fresno Irrigation District now owns and/or controls certain easements and other rights for the disposal of flood waters and otherwise upon and over lands in the vicinity of the southerly end of Dry Creek. It is further understood and agreed that this agreement is not intended to and shall not affect those easements and/or rights in any way.

22. This agreement shall be binding upon all of the successors and assigns of all of the parties hereto.

IN WITNESS WHEREOF, the parties hereto have executed this agreement the day and year first above written.

FRESNO IRRIGATION DISTRICT

By Garvin H. White
Chairman of Board of Directors

Attest: Florence B. Carter
Secretary

State of California }
County of Fresno } ss.

On this 8th day of September in the year one thousand nine hundred and Seventy, before me, Paul H. Willston a Notary Public in and for said County and State, residing therein, duly commissioned and sworn, personally appeared Garvin H. White known to me to be the President and Florence B. Carter known to me to be the Secretary of the FRESNO IRRIGATION DISTRICT the corporation that executed the within instrument, and known to me to be the persons who executed the within instrument on behalf of the corporation therein named, and acknowledged to me that such corporation

OFFICIAL SEAL
PAUL H. WILLSTON
NOTARY PUBLIC, CALIFORNIA
PRINCIPAL OFFICE IN
FRESNO COUNTY
My Commission Expires November

COUNTY OF FRESNO

By _____
Chairman of Board of Supervisors

Attest: _____
Clerk of Board of Supervisors

By _____
Deputy

CITY OF FRESNO

By _____
Mayor

Attest: _____
City Clerk

CITY OF CLOVIS

By _____
Mayor

Attest: _____
City Clerk

FRESNO METROPOLITAN FLOOD CONTROL DISTRICT

By _____
Chairman of Board of Directors

Attest: _____
Secretary

JAMES IRRIGATION DISTRICT

By _____
Chairman of Board of Directors

SUBSCRIBING WITNESS

Approved as to form
ROBERT M. WASH,
COUNTY COUNSEL

By _____
Assistant

90691

Dry Creek Extension

BOOK 5847 PAGE 735

GRANT OF EASEMENT AND RIGHT OF WAY

THIS INDENTURE, Made and entered into this 28th day of December, 19 70, by and between CENTRAL COAST MEATS, as Grantors, and FRESNO IRRIGATION DISTRICT, a public corporation in the County of Fresno, State of California, as Grantee,

W I T N E S S E T H:

That Grantors, for good and valuable consideration do hereby grant to Grantee the perpetual and exclusive right and easement to construct, install, operate, maintain, repair, and reconstruct a canal or pipeline, and to flow and conduct water through said canal or pipeline, across, over, through and under the following described real property in the County of Fresno, State of California, to-wit:

The Northwest one quarter of Section 16, Township 15 South, Range 18 East, M.D.B. & M.,

in, along, and through a right of way therefor sixty feet (60') wide, described as follows, to-wit:

The East 60 feet of the Northwest one quarter of Section 16, Township 15 South, Range 18 East, M.D.B. & M.,

together with all rights necessary, convenient or incidental thereto, including the right of ingress to and egress from said right of way, canal or pipeline over and across said real property of Grantors for the construction, installation, operation, maintenance, repair and reconstruction of said canal or pipeline.

IN WITNESS WHEREOF, Grantors have executed this grant the day and year first above written.

CENTRAL COAST MEATS

Subscribing Witness:

Nicholas Medina

NICHOLAS MEDINA
Notary Public
Fresno County
State of California

Commission April 3, 1971

RECORDED IN OFFICIAL RECORDS OF FRESNO COUNTY, CALIFORNIA
AT ... MIN. PAST ... M.
DEC 29 1970
J. L. BROWN, County Recorder
FEE $

FRESNO COUNTY RECORDERS OFFICE

RECORDING REQUESTED BY Accepted for and on behalf of Fresno Irrigation District this 28th day of December, 1970.
Secretary

To be recorded without fee on behalf of Fresno Irrigation District

GIS 1601

90682

Dry Creek Extension

BOOK 5847 PAGE 736

#77

GRANT OF EASEMENT AND RIGHT OF WAY

THIS INDENTURE, made and entered into this 28th day of December, 19 70, by and between HAROLD HABIB, JR. as Grantor, and FRESNO IRRIGATION DISTRICT, a public corporation in the County of Fresno, State of California, As Grantee;

W I T N E S S E T H:

That Grantor, for good and valuable consideration, does hereby grant to Grantee the perpetual and exclusive right and easement to construct, install, operate, maintain, repair, and reconstruct a canal or pipeline and to flow and conduct water through said canal or pipeline, across, over, through and under the following described real property in the County of Fresno, State of California, to-wit:

> The West one half of Section 9, Township 15 South, Range 18 East, M.D.B. & M., less mineral rights and also less road

in, along, and through a right of way therefor sixty feet (60') wide described as follows, to-wit:

> The West 60 feet of the South 60 feet of the North half of the Southwest quarter of Section 9, Township 15 South, Range 18 East, M.D.B. & M., and the West 60 feet of the South half of the Southwest quarter of said Section 9, and the South 60 feet of the South half of the Southwest quarter of said Section 9 less the West 60 feet thereof,

together with all rights necessary, convenient or incidental thereto, including the right of ingress to and egress from said right of way, canal or pipeline over and across said real property of Grantor for the construction, installation, operation, maintenance, repair and reconstruction of said canal or pipeline.

IN WITNESS WHEREOF, Grantor has executed this grant the day and year first above written.

Harold Habib Jr.

Harold Habib, Jr.

(Grantor)

Subscribing witness:

Nicholas Medina

GIS 1602

NICHOLAS MEDINA
Notary Public
Fresno County
State of California

Commission Expires April 3, 1971

RECORDED IN OFFICIAL RECORDS OF FRESNO COUNTY, CALIFORNIA
AT 12 MIN. PAST 12 M.
DEC 29 1970
J. L. BROWN, County Recorder
FEE $

FRESNO COUNTY RECORDER'S OFFICE

RECORDING REQUESTED BY

Accepted for and in behalf of Fresno Irrigation District this 28th day of December, 1970.

Secretary

To be recorded without fee on behalf of Fresno Irrigation District.

Secretary

T H I S A G R E E M E N T, Made the 13th day of February, 1909, by and between the FRESNO CANAL AND IRRIGATION COMPANY, a corporation, the party of the first part, and H. F. JONES of the County of Fresno, State of California, the party of the second part,

W I T N E S S E T H: THAT for a valuable consideration from each of the parties hereto unto the other moving, it is agreed that the party of the first part will within six (6) months from the date hereof, construct a ditch not less than ten (10) feet wide on the bottom and large enough to carry waste water from its canal near thereto to the northeast corner of section eight (8), in township fifteen (15) south, range eighteen (18) east, Mount Diablo base and meridian, situate in the said county and state, and it shall have the right to run waste waters at any time from its canals through said ditch upon said section; that when said second party, his heirs, administrators or assigns, uses, or use, any of said waste water for irrigation he, or they, agree to pay to the party of the first part fifty cents (50¢) per acre per season for each acre of said lands irrigated with said water.

It is definitely understood and agreed that the party of the first part does not obligate itself to furnish water to the party of the second part to said lands to irrigate the same, but that this agreement applies only to waste waters that first party may turn upon said land when it chooses to do so, and that the party of the second part, his successors and assigns, and said lands shall obtain no right to the continued use of water on said lands for irrigation or any other use or right, except the right to use such waste waters as the first party may choose to run upon said lands from time to time.

It is further agreed that the party of the first part may at any and all times run such waste waters as it may desire to and discharge the same upon any part or portion of sections seventeen (17)

GIS 4893

and eighteen (18) in township fifteen (15) south, range eighteen (18) east, Mount Diablo base and meridian, according to United States Government survey.

IN WITNESS WHEREOF, the party of the first part has by due resolution of its board of directors, authorizing and directing the same, caused these presents to be executed in its behalf and its corporate name and seal to be hereunto affixed by its president and secretary, and the party of the second part has hereunto set his hand, and these presents have been executed in duplicate, all the day and year first above written.

FRESNO CANAL AND IRRIGATION COMPANY,

By L. A. Rowe
President

and L. Montague Drew
Secretary.

R. F. Jones

and eighteen (18) in township fifteen (15) south, range eighteen (18) east, Mount Diablo base and meridian, according to United States Government survey.

IN WITNESS WHEREOF, the party of the first part has by due resolution of its board of directors, authorizing and directing

State of California, } ss.
County of Fresno,

On the 5th day of April in the year one thousand nine hundred and nine before me, Olive Gibbs a Notary Public in and for said county and state, residing therein, duly commissioned and sworn, personally appeared L. A. Mares known to me to be the President, and Montague Lewis known to me to be the Secretary of the corporation that executed the within instrument, and acknowledged to me that such corporation executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in said county, the day and year in this Certificate first above written.

Olive Gibbs
Notary Public in and for said County and State

ACKNT. CORPORATION—C. T. CEARLEY, STATIONER

State of California, } ss.
County of Fresno,

On this 5th day of April in the year one thousand nine hundred and Nine before me, Leon Levy a Notary Public in and for said county and state, residing therein, duly commissioned and sworn, personally appeared H. L. Jones known to me to be the person described in, whose name is subscribed to and who executed the within instrument, and he acknowledged that he executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in said county, the day and year in this Certificate first above written.

Leon Levy
Notary Public in and for said County and State

ACKNT. GENERAL—C. T. CEARLEY, STATIONER

INDEXED

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Compared

5346

A G R E E M E N T.

FRESNO CANAL AND IRRIGATION COMPANY, a corporation

and

H. F. JONES.

Dated, February 13, 1909.

FILED FOR RECORD AT THE REQUEST OF
FRESNO CANAL & IRR. CO.

April 6 A. D. 1909

at 8 o'clock ... m. and recorded in vol. 61 of Deeds, page 373 Fresno County Records

N. Brown, Clerk
By Geo Barton Deputy Recorder.

8/1/20

197

RESOLVED: That Philip A. Gordon, the President, and Edith W. Irwin, the Secretary, respectively, of the Fresno Irrigation District, either jointly or severally be, and they are, and each of them is, hereby authorized to accept in the name and for and on behalf of the Fresno Irrigation District any and all deeds, conveyances or leases made or to be made to the said Fresno Irrigation District as grantee or lessee wherein any real property or interest therein is granted, conveyed or leased to said Fresno Irrigation District and to endorse upon or attach to any and all such deeds, conveyances and leases the written acceptance thereof by the said Fresno Irrigation District.

o o o o o o o o o o

I, Edith W. Irwin, Secretary of the Fresno Irrigation District, a public corporation do hereby certify that the above and foregoing is a full, true and correct copy of a resolution duly passed and adopted by the Board of Directors of said Fresno Irrigation District at an adjourned meeting of said Board held at the office of said District on the 20th day of August, 1943, and that said resolution has been duly entered in the minutes of said Board and the same has not been revoked or cancelled.

WITNESS my hand and the seal of said District this 5th day of December, 1947.

Edith W Irwin
Secretary of the Fresno Irrigation District

GIS 5993

THIS DEED, made and entered into this 12th day of October, 1944, by M. S. SOWVLEN and DEE TOON [redacted] of the County of Fresno, State of California, as Grantors, and FRESNO IRRIGATION DISTRICT, a public corporation organized and existing under the laws of the State of California, as Grantee,

W I T N E S S E T H

That for and in consideration of the sum of Ten Dollars ($10.00), the receipt whereof is hereby admitted, Grantors grant unto Grantee, its successors and assigns, a perpetual easement and right of way sixty-six (66) feet wide within, and along the east line of, the Northeast Quarter and the North Half of the Southeast Quarter of Section 8, Township 15 South, Range 18 East, M. D. B. & M., in the County of Fresno, State of California, for the purpose of constructing thereon a canal or ditch connecting with the canal or ditch of Grantee now existing which ends at or near the northeast corner of said Section 8, and outlets, gates, weirs, dams and other structures therein and thereon, and roadways necessary or convenient to the maintenance and use thereof, for the purpose of discharging into and conducting therein and therethrough, and discharging therefrom, such waste waters and other waters as may be discharged by Grantee or flow into said canal or ditch.

Grantors further grant unto Grantee, its successors and assigns, perpetual easements and rights of way within and across said Section 8, and the Northwest Quarter, the North Half of the Northeast Quarter, the North Half of the Southeast Quarter of the Northeast Quarter, and the North Half of the Northwest Quarter of the Southwest Quarter of Section 17, Township 15 South, Range 18 East, M. D. B. & M., in said County of Fresno, for the purpose of constructing from time to time, and in such locations as Grantee may deem necessary or convenient, such levees and embankments, and such turn-out and spreading ditches leading from said canal or ditch to be constructed

along the east line of said Section 8 over and across said Section 8 and said above described portions of Section 17, as Grantee shall deem necessary or convenient for the purpose of spreading said waste waters or other waters over and upon, and conducting the same across said Sections 8 and 17, together with the right to construct in said turn-out and spreading ditches and levees and embankments such outlets, gates, weirs, dams and other structures as in the discretion of Grantee may be necessary or convenient for such purposes, and such roadways as may be necessary or convenient for the proper maintenance and use thereof, and the right to enter upon said Section 8 and said described portions of Section 17 for the purpose of constructing, maintaining and operating said canals, ditches, levees, embankments, roadways, and other works and structures, and discharging, spreading and conducting such waters.

Grantors agree that Grantee does not obligate itself in any manner to discharge into or conduct through said canal or other structures any water whatsoever, or to furnish any water to Grantors for irrigation or other purposes, and that Grantors shall not have, obtain or secure any right to the use of any of said waters on said lands for irrigation or any other purpose. Grantors acknowledge and confirm the right of Grantee at any and all times to run such waste waters or other waters as it may desire to, and to discharge the same upon, and spread and conduct the same across said Sections 8 and 17, and to divert and use said waters for any purpose, and also all of the rights of Grantee created by and expressed in that certain agreement dated February 13, 1909, executed by Fresno Canal and Irrigation Company and H. F. Jones, recorded on April 6, 1909, in Volume 61 of Covenants, at page 373, in the office of the County Recorder of the County of Fresno.

IN WITNESS WHEREOF, Grantors have hereunto set their hands the day and year first above written.

W. S. Lowden

Dee Loon.

along the east line of said Section 8 over and across said Section 8 and said above described portions of Section 17, as Grantee shall deem necessary or convenient for the purpose of spreading said waste waters or other waters over and upon, and conducting the same across said Sections 8 and 17, together with the right to construct in said turn-out and spreading ditches and levees and embankments such outlets, gates, weirs, dams and other structures as in the discretion of Grantee may be necessary or convenient for such purposes, and such roadways as may be necessary or convenient for the proper maintenance and use thereof, and the right to enter upon said Section 8 and said described portions of Section 17 for the purpose of constructing, maintaining and operating said canals, ditches, levees, embankments, roadways, and other works and structures, and discharging, spreading and conducting such waters.

Grantors agree that Grantee does not obligate itself in any manner to discharge into or conduct through said canal or other structures any water whatsoever, or to furnish any water to Grantors for irrigation or other purposes, and that Grantors shall not have, obtain or secure any right to the use of any of said waters on said lands for irrigation or any other purpose. Grantors acknowledge and confirm the right of Grantee at any and all times to run such waste waters or other waters as it may desire to, and to discharge the same upon, and spread and conduct the same across said Sections 8 and 17, and to divert and use said waters for any purpose, and also all of the rights of Grantee created by and expressed in that certain agreement dated February 13, 1909, executed by Fresno Canal and Irrigation Company and H. F. Jones, recorded on April 6, 1909, in Volume 61 of Covenants, at page 373, in the office of the County Recorder of the

State of California, } ss.

On this 12th day of October in the year one thousand nine hundred and Forty Four, before me W H Kay a Notary Public in and for said County and State, residing therein, duly commissioned and sworn, personally appeared M. S. Sowden and Ada Sowden

known to me to be the persons described in, whose names are subscribed to and who executed the within instrument, and acknowledged that they executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in said County, the day and year in this Certificate first above written.

W H Kay

Notary Public in and for said County and State.

My Commission Expires February 4, 1947

GENERAL ACKNOWLEDGEMENT - RIEGE STATIONERY CO., FRESNO

The undersigned, Trustee and Beneficiary under the provisions of a Deed of Trust dated March 7th, 1944, executed by M. S. Sowvlen, a widower, and Dee Hazel Toon, a widow, recorded March 22nd, 1944, in Book 2155 of Official Records, at Page 410, in the office of the County Recorder of Fresno County, State of California, and the Trustee and Beneficiary under the provisions of a Deed of Trust dated April 29th, 1944, executed by M. S. Sowvlen, a widower, and Dee Hazel Toon, a widow, recorded May 8th, 1944, in Book 2167 of Official Records, at Page 392, in the office of the County Recorder of Fresno County, State of California, does hereby consent to the execution of the foregoing Deed by the grantors therein named, and does hereby subordinate any right, title, claim, interest or lien which the undersigned may have in or to the real property described in said trust deeds to the rights granted to Fresno Irrigation District, a public corporation, by the foregoing Deed.

Dated: November 28, 1944.

CITIZENS NATIONAL TRUST AND SAVINGS BANK OF ~~LOS ANGELES, a National~~ Banking Association,

By _____
Vice President

(CORPORATE SEAL)

By _____
Assistant Cashier

Right of way

AGREEMENT

M. S. SOWVLEN et al
to
Goon, Lee

FRESNO IRRIGATION
DISTRICT

COMPARED
Document
Record

47261

RECORDED AT REQUEST OF
Fresno Irrigation District
AT 45 MIN. PAST 11 a M
VOL 2217 OFFICIAL RECORDS, PG. 139 et seq
DEC 19 1944
FRESNO COUNTY, CALIFORNIA
J. L. Farley
COUNTY RECORDER

16/no fee

(Also see H.F. Jones agreement
dated 2-15-1909 in envelope

34893

Return to
FRESNO IRRIGATION DISTRICT
1001 HELM BUILDING
FRESNO 1, CALIFORNIA

LAGUNA IRRIGATION DISTRICT

FEASIBILITY STUDY
FOR
RECHARGE BASIN NO. 11

JANUARY 2013

DATE SIGNED:_____

PREPARED BY:

PROVOST AND PRITCHARD
CONSULTING GROUP

EST. 1968
PROVOST&
PRITCHARD
CONSULTING GROUP
An Employee Owned Company

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List of Abbreviations

AF	Acre-feet
bgs	below ground surface
CASGEM	California State Groundwater Elevation Monitoring Program
CNDDB	California Natural Diversity Database
CPT	Cone penetration test
DOC	Department of Conservation
DWR	Department of Water Resources
ID	Irrigation District
IRWMP	Integrated Regional Water Management Plan
KRCD	Kings River Conservation District
LID	Laguna Irrigation District
NAD	North American Datum
NAVD	North American Vertical Datum
NRCS	Natural Resources Conservation Service
TDS	total dissolved solids

1 - INTRODUCTION

This report provides a feasibility-level study for the proposed Recharge Basin 11 project in Laguna Irrigation District (LID or Laguna ID), Fresno County, CA. The proposed project includes a 52-acre site that would be developed into a groundwater recharge basin. The site is currently developed as farmland. Kings River floodwaters would be the primary water source recharged in the basin. The conveyance capacity of Liberty Canal would be improved to increase the quantity of water that could be delivered to the site.

The motive for the proposed project is to address groundwater overdraft and beneficially use floodwaters that flow out of the region. In an average year, surface flows from the Kings River are insufficient to meet the total water demand of irrigated agriculture. Furthermore, some areas do not receive any surface water due to lack of infrastructure or water rights. Landowners are forced to pump groundwater to make up the difference. Above average water years mean less groundwater pumping and surface water availability can exceed agronomic needs in some areas. A common strategy in the region to increase surface water usage and reduce stress on the groundwater is floodwater capture accompanied by groundwater recharge.

The goals of the project include the following:

- Capture floodwater and recharge it into the local aquifer
- Divert floodwater to reduce flood damage along the Kings River corridor
- Create a dry-year water supply that can be pumped by private wells and used in droughts
- Provide a regulation reservoir that can temporarily hold water and deliver it to irrigators
- Improve local groundwater quality by recharging high-quality Kings River water that originates in the Sierra Nevada mountains

The project is needed for the following reasons:

- Groundwater levels are declining in the area
- The northern portion of Laguna Irrigation District does not receive surface water and is in critical need of a recharge facility to maintain groundwater levels
- In flood years large volumes of Kings River water flow out of the area and are not beneficially used
- Local communities have serious water quality problems related to arsenic, nitrates and other constituents

A reconnaissance-level study performed in 2007 (**Appendix A**) evaluated the proposed project and 15 other sites in the area for groundwater recharge potential. The proposed site was identified as the most favorable out of all sixteen sites based on physical

characteristics of surface and subsurface materials, and numerous practical considerations. This feasibility study was performed to further verify the technical and economic feasibility of the project.

This study documents the site features, local geology, estimated annual recharge capacity, preliminary project design, permitting, environmental issues, cost estimate, financial analysis, and a project schedule.

2 - PREVIOUS STUDIES

In 2007, the Kings River Conservation District, in collaboration with the North Fork Group[1], performed a study to evaluate potential recharge sites in the area of the North Fork of the Kings River. The study was entitled "*Potential Recharge Site Exploration for Kings River Conservation District North Fork Group*". The study was funded with a $250,000 grant from the Department of Water Resources Local Groundwater Assistance Fund. Some general sections of the study, and specific sections pertinent to Recharge Basin 11, are included in **Appendix A**. The entire study is not attached since it is voluminous.

The Study included a 4-phase process:

1) Identify Potential Recharge Sites. These were identified primarily by local water managers familiar with sites that had coarse grained soils, landowners that may be interested in selling the property, and other favorable characteristics.
2) Rank Sites Based on Practical Factors and Regional Geology. The sixteen sites were ranked based on 20 practical factors such as whether gravity delivery was feasible, proximity to conveyance facilities, facility relocations needed, etc. The geology documented in regional geology studies was also considered.
3) Subsurface Investigations. The seven most promising sites were investigated in more detail through hollow-stem auger drilling, cone penetration tests, laboratory soil classification, and laboratory permeability tests.
4) Rank for Recharge Potential. The seven sites were ranked for recharge potential based on the 20 practical factors and the subsurface investigations. The sites were ranked as Poor, Fair, Good or Excellent.

Recharge Basin 11 was identified as the most promising of the 16 potential sites, and was the only site identified as having '*Excellent*' recharge potential. The project site included in the study covered about 90 acres. The area now proposed for development only includes about 50 acres.

[1] The North Fork Group is an informal subdivision of the Kings River Conservation District including eight local irrigation districts and canal companies located along the North Fork of the Kings River.

3 - SITE DESCRIPTION

3.1 - Project Location

The proposed project is located in Laguna Irrigation District in Fresno County, California. The closest communities are Laton and Riverdale, which are about 3 miles to the southeast and 5 miles to the west, respectively. The project site is also located approximately 2.5 miles east of St. Hwy 41 and 1.5 miles south of Elkhorn Avenue. A project location map is shown in **Figure 3.1**.

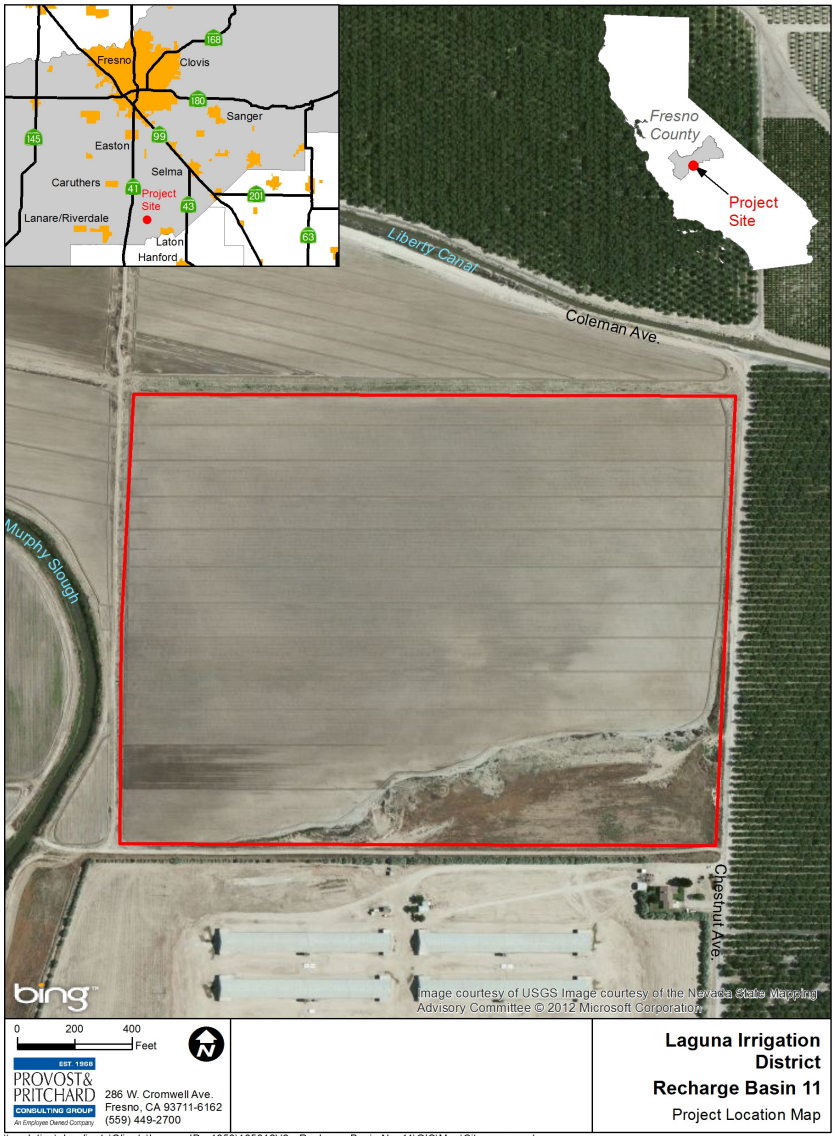

Figure 3.1 – Project Location Map

3.2 – Existing Site Features

The important features on the site are described below:

Liberty Canal. Liberty Canal is an unlined ditch located just north of the project site. The canal has a current capacity of about 60 cfs, but the capacity varies along the canal. The canal is owned and operated by the Liberty Canal Company. The canal delivers irrigation water to local irrigators. Liberty Canal is higher than the project site ground surface allowing water to be delivered by gravity.

Murphy Slough. Murphy Slough is located along the western edge of the project and is operated by the Murphy Slough Association. The slough is used to deliver Kings River water to other irrigation canals. The invert of Murphy Sough is below the project site so water could be delivered from the basin to Murphy Slough.

Depressed Basin. The main portion of the site includes a depressed basin that is currently farmed on and off with grains and alfalfa. The basin is below the natural ground level and appears to have been leveled for agriculture. The landowner has previously expressed interest in selling the land because it is too sandy for productive farming. The recharge basin will include a single cell with no interior levees.

Borrow Pile. A 5-acre borrow pile is found at the southeastern end of the site. The pile likely includes soil material excavated from the basin. The pile is large enough that it will be left in place, but some soil may be used to construct project levees.

Check Structure. An existing check structure is located on the Liberty Canal about one mile downstream from the project site. The check structure uses a sluice gate and boards to control water levels to deliver water upstream. It does not appear that the structure and turnouts immediately upstream are used very frequently due to sediment blocking most of the structures. Because of its distance downstream from the project, a new check structure is proposed to be constructed at the basin.

Wells. An existing well is located in the northwest corner of the proposed project just outside the proposed limits of construction. The well is intended to remain so the current owner can continue to farm the land adjacent to the basin.

Powerlines. Overhead powerlines feed the existing well near the northwest corner of the project site. The alignment runs due north from the well until it connects with the main road along the Liberty Canal and then follows the road northwesterly.

Pipeline. A pipeline is connected to the existing well mentioned above. This pipeline appears to run north-south along the western edge of the project site, which is divided by a dirt road. This line has alfalfa valves to irrigate the fields on either side of the dirt road. This pipeline section within the basin area will be removed.

Farmland Quality. Figure 3.2 is a Map of Farmland Importance created with data from the California Department of Conservation (DOC). A portion of the property is covered by Unique Farmland, which is described by the DOC as "*Farmland of lesser quality soils used for the production of the state's leading agricultural crops*." This patch covers the same area as the Fresno Fine Sandy Loam (see Section 4 – Geology). Some portions of the property also include Farmland of Local Importance and Farmland of Statewide Importance. However, according to the landowner, none of the farmland is productive due to the sandy soils.

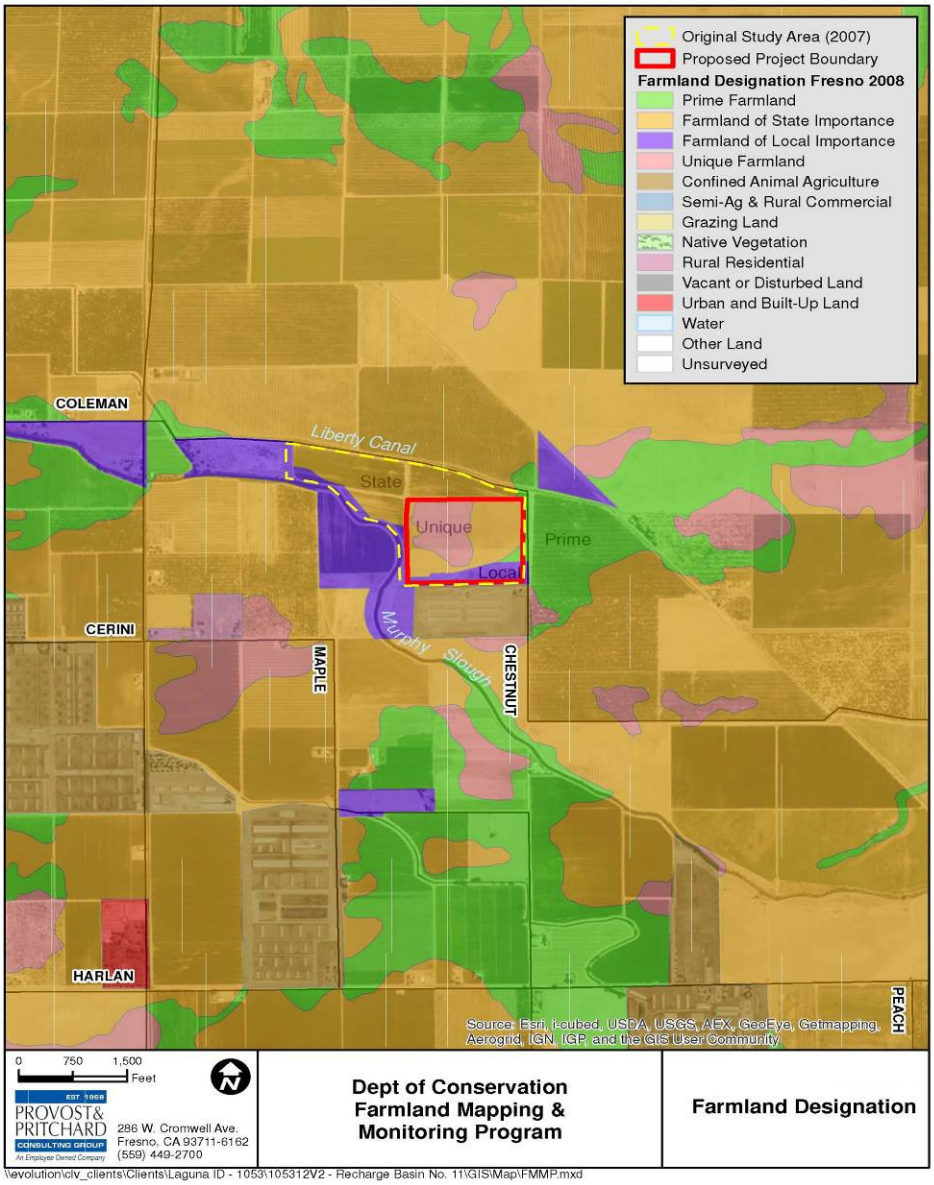

Figure 3.2 – Farmland Importance Map

3.3 - Topographic Survey

A topographic survey was performed in December 2012 to assist with the preliminary design. The survey was performed in North American Datum 1983 (NAD 1983) and North American Vertical Datum 1988 (NAVD 88). The survey data confirmed that water could be delivered to the site by gravity from Liberty Canal. The topographic data is shown on preliminary design drawings (**Appendix B**).

4 - LOCAL GEOLOGY

This section discusses the local geology from published reports and maps, and the 2007 subsurface investigation program. This data was used to estimate a likely long-term infiltration rate at the site, and the likely flow path for recharged water.

4.1 - Local Geology

Soil maps prepared by the USDA-NRCS, 2008, indicate that the majority of site soils are Fresno and Traver fine sandy loam with much smaller portions of Hesperia sandy Loam and Delhi loamy sand (**Figure 4.1**).

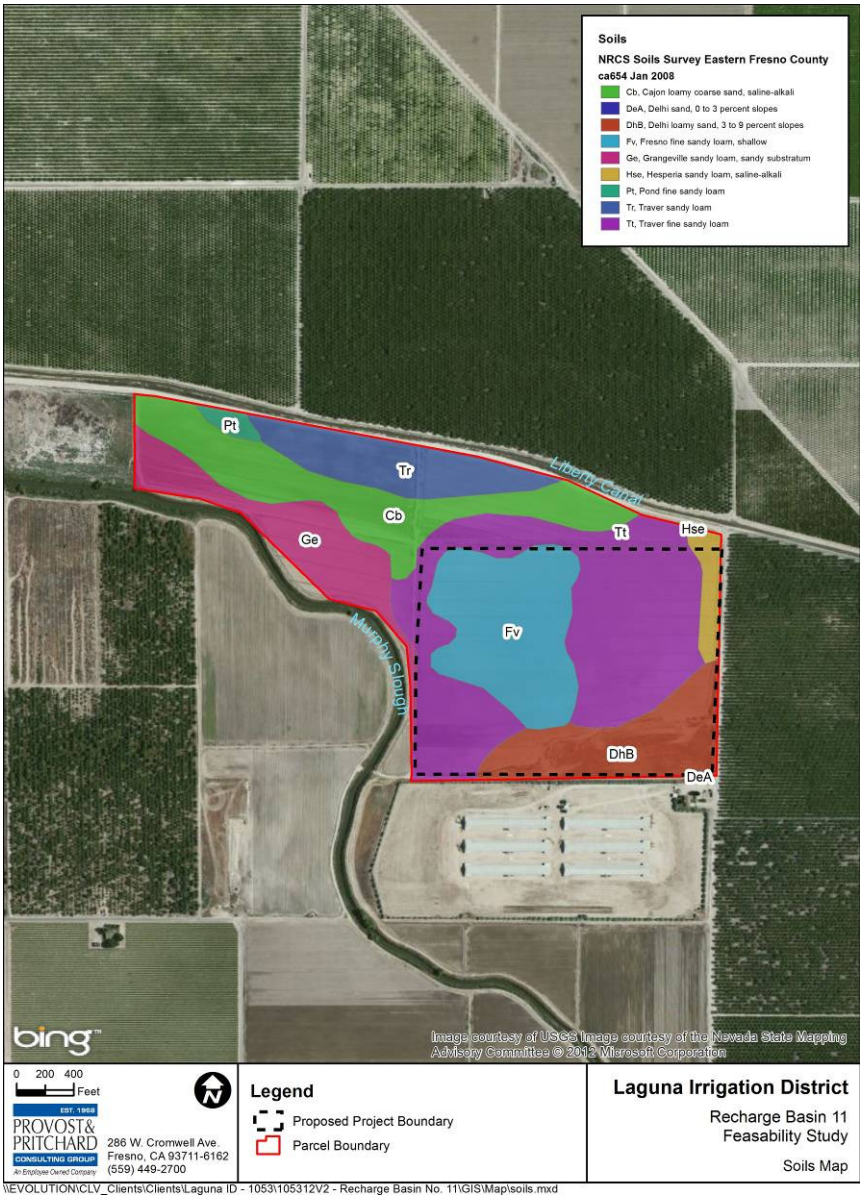

Figure 4.1 – Soils Map

The Fresno and Traver fine sandy loam are both about 60 inches deep with very slow infiltration rates. The Hesperia and Delhi soils are also 60 inches deep and have moderate to high infiltration rates. The site has been leveled and perhaps as much as 5 feet of topsoil has been removed in the area being considered for development. Soil boring logs prepared for the 2007 North Fork Group Study indicate that in the southwest and eastern portions of the study area silty sands and sands are prevalent in the upper most part of the soil profile. In contrast, the soil log for 11B-6 (completed in the area mapped as Fresno Fine Sandy Loam) shows silty sand, clay, silt and clayey sand down to about 7 feet bgs. While this is not an in-depth analysis of the near surface conditions, portions of the site appear to have less than ideal surface materials for recharge and other areas have suitable materials for recharge in the upper 5 to 10 feet. Incidentally, the information from the initial exploration roughly agrees with the information from the soil survey, although much of the soil identified in the NRCS soils surveys has probably been excavated to form the existing depression. Below depths of about 10 feet both the boring logs and cone penetration tests performed for the North Fork Group Study indicate that sands and silty sands dominate down to about 50 feet bgs. In order to maintain high infiltration rates annual maintenance should include, at a minimum, disking and deep ripping to expose the prevalent coarse grained material in the subsurface below about 5 feet.

4.2 – Long-Term Infiltration Rate

The long term infiltration rate for the site is not precisely known at this time. However, the infiltration rate was estimated considering the local soils data, regional geology data, and recharge rates for other projects in the area.

Davis et al. (1964) prepared a map of the San Joaquin Valley showing areas of relatively permeable deposits from 10 to 50 feet below ground surface and the relative permeability of soils. Their mapping separates surface and near surface materials into four main categories based on geologic materials. Areas mapped as young alluvial-fan and basin rim soils are permeable to moderately permeable, old alluvial-fan soils are moderate to poorly permeable, and basin soils are poorly permeable to nearly impermeable. Lacking in-situ or pilot scale data to estimate a long-term infiltration rate, the information provided by Davis, et al., was used to provide context to compare types of geologic deposits found at several sites in the San Joaquin Valley with known or estimated infiltration rates. General location, type of geologic deposit, and long term infiltration rates from several recharge sites in the area have been included in **Table 4.1**, below.

Table 4.1 - Summary of Recharge Basins in the Region

Project[1]	General Location	Geologic Deposits	Infiltration Rate (ft/day)
A[2]	Northern Kings County	Young Alluvial-Fan Basin Rim Soils	2.4 to 2.8
B	Western Fresno County	Basin Soils	0.25
C	Central Fresno County	Basin Soils	0.5
D	Southern Tulare County	Young Alluvial-Fan Basin Rim Soils	0.4
E	South-Central Fresno County	Basin Soils	0.5 to 1.0[3]
Recharge Site 11	Southern Fresno County	Basin Soils	0.5 to 1.5 (estimated)

Notes
1 – Project names are not given because permission to release this information was not provided
2 – Site is an abandoned river channel
3 - Estimated by WRIME, Inc. (2012)
Projects in **bold** are in areas of relatively permeable deposits from 10 to 50 feet below ground surface with relatively permeable soils

Typically, sites that lie within areas mapped as having relatively permeable soils and geologic material from 10 to 50 below ground surface have higher infiltration rates. The project site lies atop an area mapped as basin soils, however it also lies in the area that is mapped as having relatively permeable deposits and relatively permeable soils. This would indicate that a conservative estimate of the long term infiltration rate of between 0.5 to 1.0 feet per day is realistic. However, based on the 2007 investigations at the site, it is known that below a carapace of fine grained materials, coarse grained materials dominate in the subsurface, and assuming that the site is properly maintained, the long term infiltration rate may be as high as 1.5 ft/day or greater.

In addition to the geologic materials at the site, maintaining a high infiltration rate is dependent on several factors. Infiltration rates will be affected if excessively turbid water is used for recharged. While the site will take water when it is available on the system, likely flood waters, efforts should be made to take water with low turbidity. The preliminary design of this facility incorporates a settling channel that should help alleviate problems of plugging due to siltation, however, proper maintenance of the Liberty Canal upstream of the site to decrease in-channel sources of sediment will also help maintain higher infiltration rates.

4.3 – Groundwater Conditions and Direction of Flow

California Department of Water Resources groundwater elevation contour maps of the unconfined to semiconfined aquifer from 2000-2010 were reviewed to estimate the regional groundwater flow direction. Since it is likely that most recharge would occur during the spring when flood waters are available, only spring maps were reviewed.

Regionally, groundwater flows to the northwest in the area. Two main features dominate the regional groundwater flow pattern.

1. A persistent groundwater depression centered northwest of the proposed site has formed. This is an area of the Kings Groundwater Basin that receives no surface water. Based on the hydrologic flow patterns, groundwater flows toward the depression, and added recharge in this area would eventually be a direct benefit to the immediate vicinity and the region of the Kings Basin underlain by the groundwater depression.
2. A groundwater ridge has formed from recharge along the Kings River south of the project. Together the depression northwest of the site coupled with the groundwater ridge south of the site cause a consistent northwest direction of flow in the vicinity of the site. While this pattern of flow appears to be valid for spring, local groundwater flow will likely differ in the summer and fall months. During these months, groundwater will preferentially flow towards localized pumping induced depressions.

According to LID staff, one of the local depressions includes a portion of LID that receives no surface water. **Figure 4.2** shows the location of this area relative to the project site.

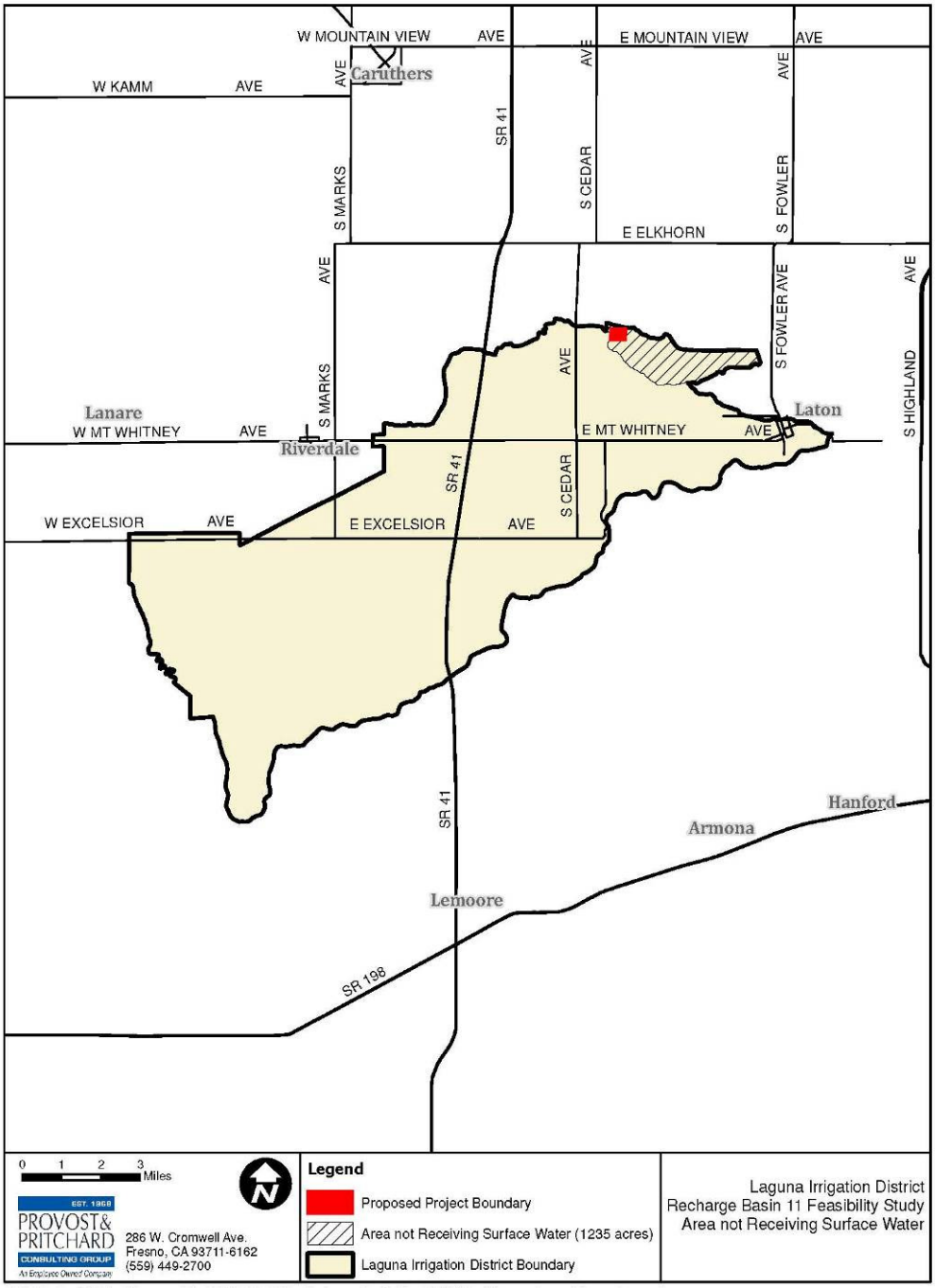

Figure 4.2 – Area not Receiving Surface Water in Laguna Irrigation District

LID staff indicates that a groundwater depression can form in this area during the growing season. While dependent on several variables such as the amount and timing of recharge operations, and pumping demands on groundwater during the growing season, it is likely that a percentage of recharged water from the project may flow east

into this depression and provide a direct benefit to growers in this area. Additionally, as recharge operations will most likely occur during springs when floodwaters are available, both Murphy Slough and the Liberty Canal should be full. The site is located between these two hydrologic features; effectively bounded to the north, west and to a lesser extent the south by local hydrologic barriers to groundwater flow formed beneath them. These temporary barriers might induce a higher percentage of flow eastward into the local groundwater depression. The benefit that the project will have on the area to the east of the site is not quantifiable at this time, therefore a monitoring well located approximately one-quarter mile east of the project is proposed. This monitoring well will need to be on the order of 125 to 150 feet deep and can be used to monitor project benefits in this area.

Table 4.2 - Summary of Spring Regional Groundwater Flow Directions from 2000 to 2010

Season/Year	GW Elevations (ft msl)	Dominant Flow Direction	Secondary Flow Direction
Sp/2010	150-140	NW	SE
Sp/2009	150-140	W	W
Sp/2008	170-140	NW	W
Sp/2007	180-160	NW	W
Sp/2006	180-150	NW	W
Sp/2005	170-150	NW	W
Sp/2004	160	W	NW
Sp/2003	165	NW	W
Sp/2002	180-170	W-NW	W
Sp/2001	190-180	NW	W
Sp/2000	190-180	NW	W

Source-California Department of Water Resources, San Joaquin District, Lines of Equal Elevation of Water in Wells, Groundwater Contour Maps of Unconfined Water Table, Unconfined and Semiconfined Aquifers Spring 2010 to 2000.

The data in Table 4.2 also shows a downward trend in groundwater levels, which have fallen about 40 feet from 2000 to 2010. This provides further justification for a recharge basin in the area.

In order to ensure sufficient vadose zone is available to transmit and store recharged water the groundwater elevations provided in **Table 4.2** were compared to the preliminary floor elevation of the basin. Based on a basin floor elevation of 240 ft msl, the vadose zone may be up to 100 feet thick. This should provide sufficient vadose zone storage to prevent groundwater from mounding into the root zone of local crops. In addition, due to the sandy nature of subsurface materials, recharged water should readily flow away from the project either to the northwest or to the east, allowing relatively rapid decay of the groundwater mound. Detailed mounding calculations are recommended prior to final design to verify these findings.

5 - RECHARGE YIELD

5.1 - Kings River Water Availability

Kings River floodwater would be the primary water source recharged in the basin. Flood release events on the Kings River occur on average about every 3 years. Millions of acre-feet of flood water have been lost from the region because insufficient infrastructure exists to capture and retain these flows.

Appendix C includes data on the availability of Kings River floodwater at James Bypass from 1954 through 2011. James Bypass is near the terminus of the Kings river where it meets the San Joaquin River. Flows at this location represent real surplus water that was not used. It was assumed that floodwater would only be available to Laguna ID when flood releases average at least 200 cfs at James Bypass, since other parties will be diverting and using floodwater. Based on this assumption and the historical data, floodwater is available in 35% of years. During wet years floodwater is available, on average, 121 days. Therefore, over the long term, floodwater is available 35% x 121 days = 42 days per year.

The primary water supply will be Kings River floodwater. Other water supplies could be recharged, including Kings River annual entitlements, and floodwater from the San Joaquin River. However, it is difficult to estimate their availability and when they would be used, so they were not considered in this analysis. As a result, the project yield may be slightly higher than estimated using only Kings River flood water.

5.2 - Canal Capacity Analysis

Water will be delivered through Liberty Canal which collects water directly from the Kings River. The capacity of Liberty Canal varies upstream of the project, but can typically convey about 60 cfs. The canal will need to be enlarged so that it can deliver water to the recharge basin while meeting downstream irrigation demands. The existing canal capacity is about 60 cfs, and it will be expanded and additional 70 cfs to accommodate 130 cfs.

The Laguna Irrigation District performed a preliminary survey and capacity analysis of the Liberty Canal in December 2012 (see **Appendix D**). The results show that the canal capacity varies and will probably require modifications, likely widening, along 1.5 miles. Along a small stretch, some vineyards may have to be removed to widen the canal. In addition, two culvert crossings will need to be replaced and expanded. A more detailed hydraulic analysis using the HEC-RAS modeling program is recommended prior to final design.

5.3 - Recharge Potential

The recharge potential for the project was estimated based on data presented below:

Table 5.1 - Project Data used to Determine Recharge Potential

Description	Value
Average duration of flood flows in flood years	121 days
Percent of years with floodwater	35%
Existing delivery capacity in Liberty Canal[1]	70 cfs
Expanded delivery capacity in Liberty Canal	130 cfs
Recharge basin turnout capacity	70 cfs
Project Infiltration capacity	1.5 ft/day (31 cfs)
Basin storage capacity	144 AF

1 – Extra capacity in canal after expansion is equal to 130 cfs – 60 cfs (existing capacity) = 70 cfs. This is the same capacity as the proposed turnouts.

The values in **Table 5.1** are considered reasonable and some are conservative. Using this data, the average-annual project yield was estimated to be 2,650 AF/year. This values was used in the project financial analysis (Section 9.2). The calculations used to derive this value are provided in **Appendix C**.

This estimate assumes that evaporation is offset by direct precipitation onto the basin, since water will be primarily recharged in the winter and spring. The infiltration capacity is based on a geologic analysis of local materials, and assumes the district is diligent in maintaining the basin.

6 - PROJECT DESIGN

The preliminary project design is included in **Appendix B**. The drawings represent a 30% design. The main project features include a check structure in Liberty Canal, turnout pipelines, settling basin, levees, outlet structure into Murphy Slough, and monitoring wells. The project has various design parameters that are addressed below:

Liberty Canal Check Structure.
A new check structure is proposed just downstream of the turnout into the basin in order to better control water level at the turnout. Wooden boards will be placed in the check structure when water needs to be diverted. The closest check structure downstream of the site is approximately one mile and would not be able to control water level as desired.

Liberty Canal Turnout
The turnout consists of an inlet box structure, two 48 inch concrete pipes, and an outlet structure that can accommodate open flow propeller meters which is the District's preferred measurement device. The outlet structure also has a set concrete sill that would maintain full pipe flow to maintain accuracy of the flow meters. The diversion pipelines were designed to accommodate 70 cfs. With this flowrate the basin can be filled in about one week.

Settling Channel
A settling channel is proposed to help settle out medium sized silts to better maintain infiltration rates in the basin.

Levee Banks
Levee heights vary with a maximum height of 5 feet. Exterior slopes are 2:1, Interior slopes are 5:1 to minimize erosion from wave action, and levee top widths are set to 16 ft to provide a more stable levee.

Murphy Slough Drain
To allow some flexibility in the way in the way water can be delivered to irrigators, a drain is proposed at the southwest corner of the basin. This drain is a single 48 inch concrete pipe with a 72-inch diameter standpipe that will house an open flow propeller meter. The measurement standpipe is proposed to accommodate a metal plate or boards allowing the pipeline to flow full in order to maintain accuracy of the flow meter.

7 - MONITORING, ASSESSMENT AND PERFORMANCE MEASURES

Monitoring equipment for the project will include the following:

Monitoring wells. Four monitoring wells will be installed for the project. These include one on the west (groundwater downgradient), east (groundwater upgradient), and north side of the basin. One additional monitoring well is proposed in the area of LID not receiving surface water.

Flow meters (Inlet Pipe). A propeller flowmeter will be installed in each of the two 48-inch diameter inlet pipes. The meters will measure water deliveries to the recharge basin.

Flowmeters (Outlet Pipe). A propeller flow meter will be installed in the outlet pipe to Murphy Slough. The meter will measure flows that are released from the basin. Water will be released if it is temporarily stored and later delivered to irrigators. This pipe may also be used for emergency releases in case the basin is overtopping, levee stability is compromised, etc.

Staff gauges. Two staff gauges will be installed in the basin to monitor water levels. These will be used to assist with operations and help to monitor long-term recharge rates.

Performance measures will include the following:

Volume Recharged. The volume of water recharged will be equal to the volume diverted into the recharge basin from Liberty Canal minus evaporation losses, which are expected to be small.

Floodwater Diverted. Floodwater diverted will be equal to the volume of Kings River and San Joaquin River floodwater diverted into the basin. This will reduce floodflow peaks in downstream river sections. In most years, this parameter will be the entire volume diverted to the project.

Increase in Groundwater Levels. Groundwater levels will be monitored in new dedicated monitoring wells and other wells in the vicinity. This data will be used to determine the change in groundwater storage and rate of groundwater outflow from the area. Improvements in groundwater storage would be evident in the accumulated groundwater monitoring efforts within the Kings Basin (KRCD's monitoring network, CASGEM, irrigation district monitoring efforts, etc.).

Volume Regulated. The volume regulated will be equal to the volume of water temporarily stored in the reservoir, and diverted through the outlet structure to Murphy Slough.

Maintenance of Recharge Rate. The recharge rate will be measured using staff gauges and accounting for new deliveries, outflow and evaporation losses. The success in maintaining the recharge rate with use of the settling channel and annual ripping/disking will also be evaluated with this parameter.

Improvement in Groundwater Quality. Groundwater quality may be periodically tested in the four dedicated monitoring wells. Groundwater quality monitoring required under the pending Long Term Irrigated Lands Regulatory Program could potentially show the improvements in groundwater quality from the introduction of large volumes of Kings River water.

8 - ENVIRONMENTAL AND PERMITTING ISSUES

8.1 - Endangered Species

The California Department of Fish and Game Natural Diversity Database (CNDDB) was used to determine if special status species (threatened or endangered species) or signs of the species (i.e. burrows, nests, etc) have been seen on or near the site. **Figure 8.1** is a map showing the records of special status species in the area. No species are known to occur on the site or within a radius of almost two miles. The site is previously disturbed farmland and probably has limited habitat for special status species. Prior to final design, it is recommended that a professional biologist perform a reconnaissance level site visit to look for signs of special status species.

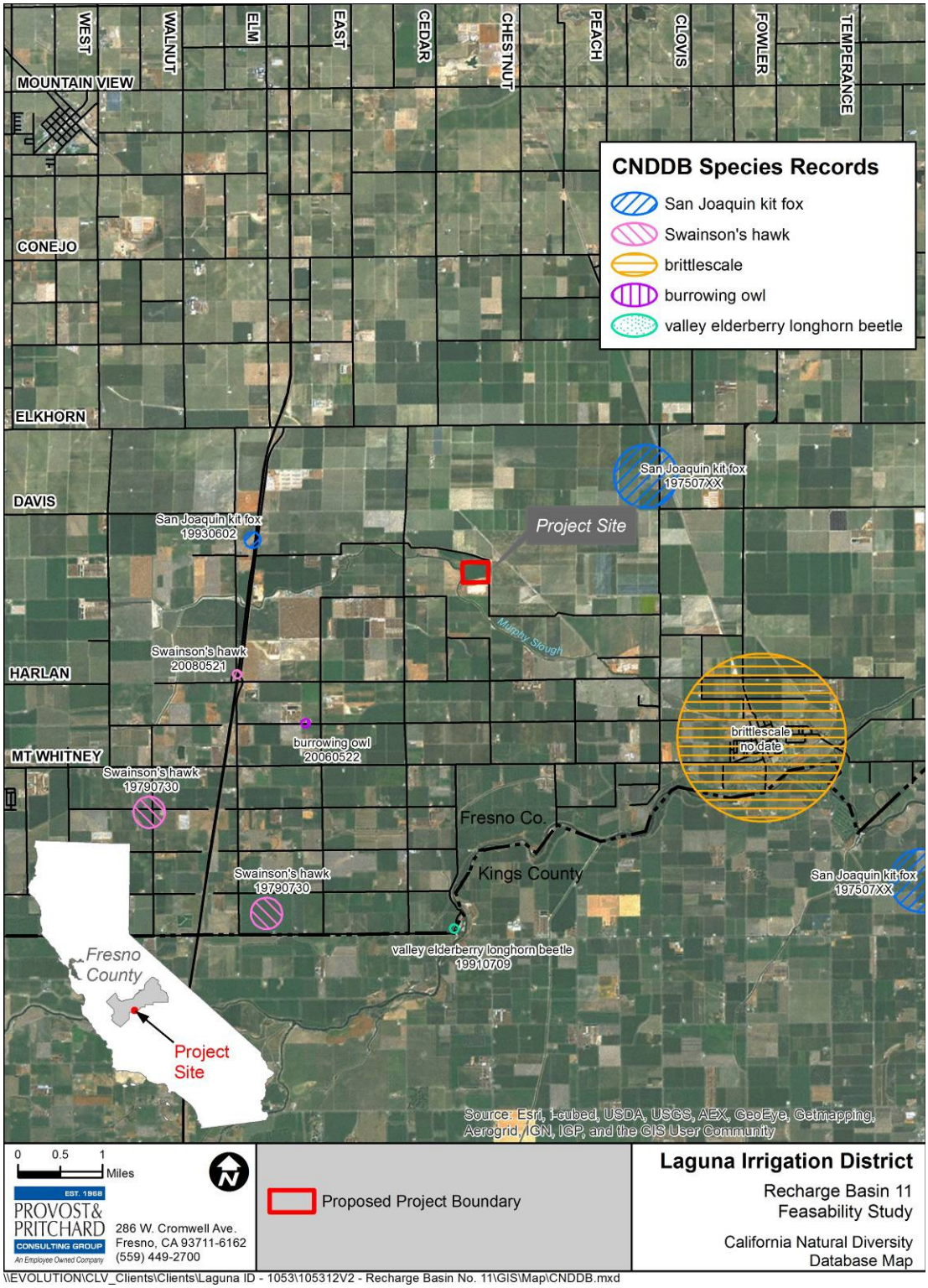

Figure 8.1 – Records of Special Status Species in Project Vicinity

8.2 - Cultural Resources

A historical and cultural resources records search was performed for the project site and surrounding area by the Southern San Joaquin Valley Information Center. The results are presented in a letter dated January 7, 2013 (see **Appendix H**). According to the Information Center, there has been one previous cultural resource study conducted in the project area. There are no recorded cultural, historical or archeological resources within the project area or within a one-half mile radius, and it is not known if any exist there. In addition, there are no known resources within a one-half mile radius of the project that are listed in the National Register of Historic Places, the California Register, California Inventory of Historical Resources, California Points of Historical Interest, or the California State Historic Landmarks. It is recommended that a professional archeologist perform a reconnaissance-level site review prior to verify these findings.

8.3 - Contaminated Materials

The California State Water Resources Control Board maintains a database called Geotracker that includes records of known contamination sites. This database was used to look for present or past contamination on or near the project site. **Figure 8.3** shows that no known contamination exists within one-half miles of the site. Geotracker records show a gasoline tank about 0.6 miles southeast of the project, but the case was closed in 2008, so it is assumed to no longer present a risk. Before the site is purchased, it is recommended that an environmental scientist perform a Phase I site assessment of the property to identify potential contamination not shown on the Geotracker Website. It is also recommended that newly installed monitoring wells be tested for contaminants to establish baseline data.

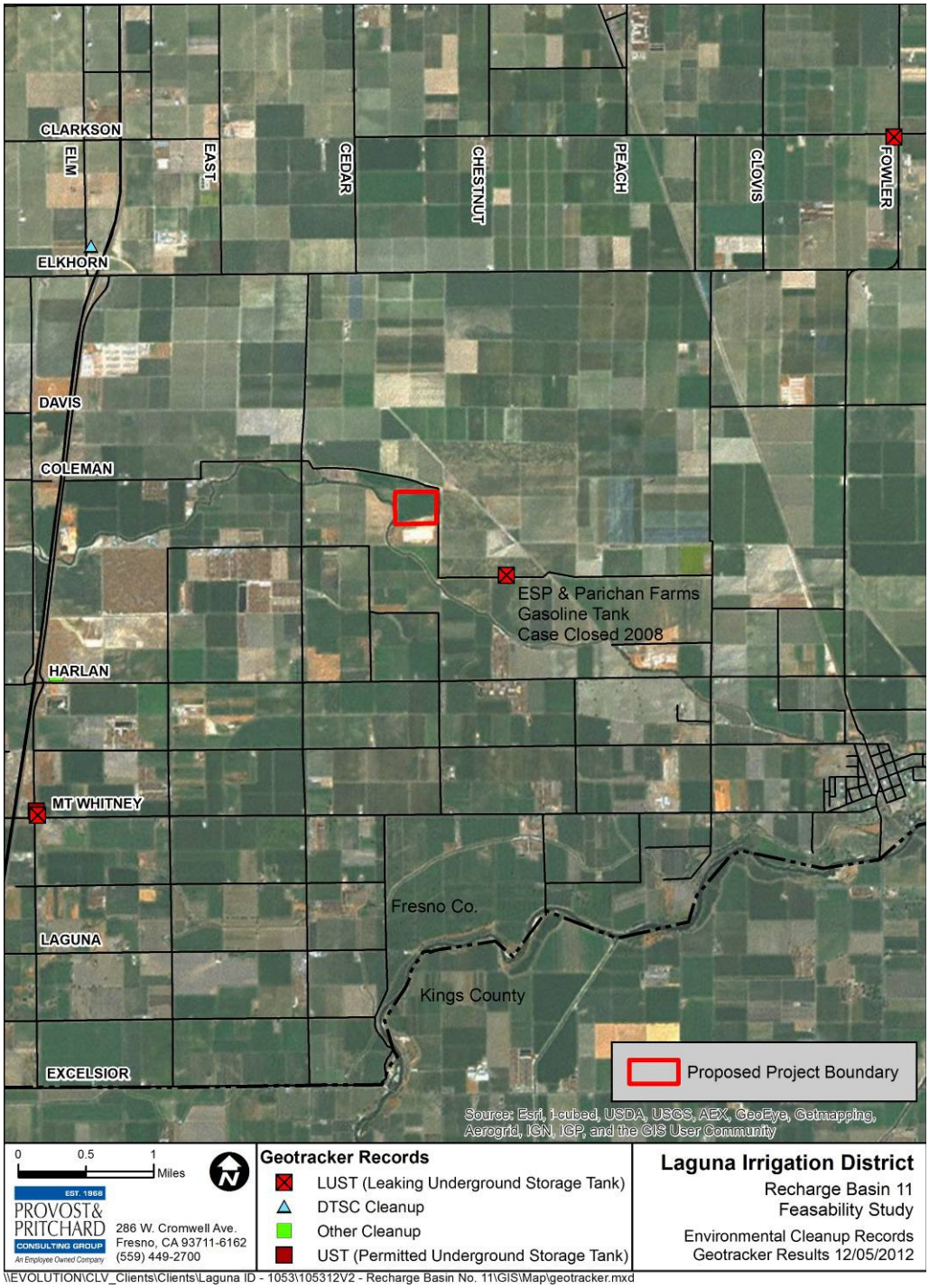

Figure 8.3 – Known Contamination Sites in Project Vicinity

9 - COST ESTIMATE AND FINANCIAL ANALYSIS

9.1 - Cost Estimate

A feasibility-level cost estimate was prepared for the design and construction of the project. The estimate is in 2012 dollars and includes a 15% contingency. This contingency is considered appropriate for the feasibility-level design and accounts for uncertainty in dimensions, uncertainty in design, allowance for neglected items, and uncertainty in regulatory requirements. It is assumed that Laguna ID staff will perform the construction, except for the monitoring wells which will be installed by an experienced well driller. Unit prices were developed from historical values on similar projects and judgment of constructability factors. The total estimated cost of the project is $1,096,000. This includes estimated land purchase costs of $371,000. A detailed breakdown of the costs is provided in **Appendix E**.

9.2 - Financial Analysis

Value of Benefit

The primary benefits of the project include recharge, energy conservation and flood damage reduction.

The value of the recharged water is based on the cost to purchase Kings River water in the local area. Data was available on two local transfers and are summarized in **Table 9.1**.

Table 9.1 – Recent Sales Data for Kings River Water

Year	Price ($/AF)	Cost after Losses	Volume
2009	$50	67	5,000 AF
2012	$100	133	5,000 AF
	Average	$100	

Notes
1 - The prices are for water at Pine Flat Dam. It is assumed that 25% losses occur between the Dam and water user.
2 - The agencies selling and receiving the water were agricultural water contractors. They did not grant permission for their names to be provided

The estimated value of $100/AF was used in the financial analysis. The value for Kings River water could be even higher in a critically dry year. The value of energy conserved from raising groundwater levels is estimated to be $11,000/year. The value of flood damage reduction was not monetized, since it is not possible to know where and when the benefits would be realized.

Operation and Maintenance Costs

Operation and maintenance will include operating the valves, recording flowmeters, maintaining levees, monitoring wells, and disking and ripping the basin interior each year to loosen soils and maintain a good recharge rate. Most of these tasks will require minimal effort, and be performed as part of the regular duties of district staff. The primary costs will be levee maintenance and basin disking/ripping, which are estimated to cost $5,000/year, based on data provided by Laguna ID. The water supply would come from Kings River floodwater, which is free to members of the Kings River Water Association.

Replacement Costs

Replacement costs will be needed for mechanical equipment (gates, valves, and flowmeters) and monitoring wells. All these items have assumed replacement periods of 25 years, based on typical design lives. These items are estimated to cost $84,000. By the designated replacement period, the items will either be obsolete or have decreasing output, and high enough maintenance costs to warrant replacement. These items were assumed to have no salvage value. Other project features such as the pipelines, levees, and check structure are assumed to have life expectancies of 50 years, so no replacement costs were included in the analysis.

Cost Analysis

A financial analysis was performed over a 50-year period using a six percent discount rate. The costs (initial, maintenance and replacement) and benefits (recharged water and energy conservation) were calculated over a 50-year period. The project benefit cost ratio is provided below:

$$\frac{\text{Project Benefits}}{\text{Project Costs}} = \frac{\$4{,}619{,}600}{\$1{,}488{,}400} = \mathbf{3.1}$$

Details of the financial analysis are provided in **Appendix E**.

10 - PROJECT SCHEDULE

A Gantt chart schedule for the project is included as **Appendix F**. The schedule shows the major tasks needed to complete the project and linkages between each task. The schedule assumes that Laguna ID applies for an Integrated Regional Water Management Implementation Grant. These grant funds will probably be awarded in September 2013. The first task will include purchasing the land. The design and construction will require approximately 9 months. Canal work will have to be performed outside of the irrigation season so it does not interfere with normal water deliveries. Basin work could be performed any time of year, but may be best in the winter or spring when the soils have some residual moisture to assist with levee compaction. The District will perform most of the construction work and only the monitoring wells will be competitively bid. No major delays due to environmental documentation or permitting are anticipated.

11 - PUBLIC OUTREACH

Laguna ID performed extensive public outreach to educate the local community about the project, solicit their comments, and gain their support. The public outreach efforts are described below. Proof of some public outreach efforts is found in **Appendix G**.

City of Lemoore
In April 2012, the Laguna ID General Manager presented the project to the Lemoore City Manager and Finance Manager. Additional project information has been sent to Lemoore since then.

Liberty Canal Company
The LID General Manager gave a presentation on the project to the Liberty Canal Company Board of Directors in August 2012. A copy of draft minutes from the meeting is included in **Appendix F**. The Canal Company has since supported the project and agreed to let LID use the Liberty Canal to convey water to the proposed recharge project.

Liberty Water District
The LID General Manager presented the project to District Engineer for the neighboring Liberty Water District in September 2012.

North Fork Group
The North Fork Group is an informal subdivision the Kings River Conservation District. The group includes eight local irrigation districts and canal companies located in the North Fork of the Kings River. The group performed the 2007 study that identified the proposed site as the most promising recharge site in the area (Provost & Pritchard, 2007). The LID Manager and LID Consulting Engineer gave a presentation to the group on November 8, 2012 to describe the project, solicit support, and explain the grant application process. The members showed widespread support for the project. Copies of the meeting agenda, list of attendees, and presentation are included in **Appendix G**.

Riverdale Public Utilities District
The LID General Manager and LID consulting engineer gave a presentation on the project to the Riverdale Public Utilities District (PUD) on December 4, 2012. The project was described including the potential benefits to the Riverdale Area. The PUD members voted to endorse the project and agreed to write a letter of support. An agenda for the meeting is provided in **Appendix G**.

12 - CONCLUSIONS AND RECOMENDATIONS

Favorable Project Characteristics

The project has many favorable characteristics for a groundwater recharge project including:

1. Favorable soils. The soils have a high sand content. Some clay and silt layers were found, but they do not appear to be laterally continuous and will not be the primary control of infiltration.
2. Better land use. The property is marginal farmland due to its sandy soils. The land is not cropped every year since it has a high water demand due to high infiltration rates. Some of the farmland is designated 'Unique Farmland', which is defined by the California Department of Conservation as "*Farmland of lesser quality soils*". A recharge basin is considered a better use of the land.
3. Liberty Canal. The project is located adjacent to Liberty Canal which can deliver water directly to the site.
4. Murphy Slough. The project is also located adjacent to Murphy Slough. Murphy slough has an invert below the ground level and can be used for overflow spills, or to collect water that is temporarily stored in the basin for delivery to irrigators.
5. Topographic depression. The site is located in an excavated depression that allows water to be delivered by gravity, and will reduce the height of levees needed to develop the project. Groundwater mounding in adjacent areas is a small concern since the water will be percolated below the natural ground surface.
6. Area not served by surface water. The project will recharge water in an area of Laguna ID that does not receive surface water (see **Figure 4.2**).
7. Groundwater Recharge Study. In a 2007 study the site was identified as the best of sixteen potential sites in the area, and was the only sited rated as having 'Excellent' potential for groundwater recharge.
8. Local and regional support. The project has widespread support from local and regional agencies including neighboring landowners, neighboring districts, nearby cities, the Kings River Conservation District, and all of the agencies in the North Fork Group.
9. Multi-agency collaboration. The project was identified through a collaborative multi-agency effort when the North Fork Group performed a regional groundwater recharge study in 2007.

Project Benefits

The project will provide the following benefits:

Groundwater Recharge. A simulation of historical Kings River floodwater shows that an average of 2,650 AF/year could be recharged in the basin. Total recharge may be higher if Kings River entitlement water and San Joaquin River water are also recharged.

This recharged water will help to raise groundwater levels, lower pumping costs, and provide a dry-year water supply.

Regulation reservoir. The project could also be used as a temporary regulation reservoir. The reservoir could temporarily store 144 AF of water, and deliver it to Murphy Slough for delivery to irrigators.

Floodwater. The project will have the capacity to divert up to 70 cfs of floodwater. Average annual floodwater diversions are estimated to be 2,650 AF. In very wet years, such as 1968-1969, 1979-1980 and 1982-1983, flood water was available for over 180 days each year. With six months of floodwater, diversions could be as high as 11,000 AF/year. This will reduce water levels and peak flows on the Kings River during flood periods, and thereby potentially reduce flood damage.

Habitat creation. The project will create temporary habitat for waterfowl and a water supply for terrestrial creatures when it is filled with water.

Water quality improvement. The project will recharge high quality Kings River water in an area with known water quality problems including elevated levels of nitrates and arsenic.

Disadvantaged Communities. The project will have secondary benefits to disadvantaged Communities including the Camden Mobile Home Park and Community of Riverdale. The recharged water will eventually flow to these communities and help to improve their water quality and raise groundwater levels.

Increased Conveyance Capacity. The project will include increasing the capacity of Liberty Canal (from 60 cfs to 110 cfs) for 1.5 miles along a 3.5 mile reach. This will allow delivery to the recharge basin, while meeting full irrigation demands. This increased conveyance capacity will provide other benefits, especially if infrastructure is ever built to deliver surface water to the northern portion of Laguna ID that does not currently receive surface water.

13 - REFERENCES

California Department of Water Resources, San Joaquin District, *Lines of Equal Elevation of Water in Wells, Groundwater Contour Maps of Unconfined Water Table, Unconfined and Semiconfined Aquifers*, Spring 2010 to 2000.

Davis, G. H., Lofgren, B. E., and Mack, S., *Use of Ground-Water Reserviors for Storage of Surface Water in the San Joaquin Valley, California,* United States Geological Survey Water Supply Paper 1618, 1964.

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WRIME, Inc., *Groundwater Recharge Feasibility Study: Prepared for Raisin City Water District*, August 2012.

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX A

INVESTIGATION OF GROUNDWATER RECHARGE POTENTIAL IN THE NORTH FORK AREA OF THE KINGS RIVER (2007)

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX B

PRELIMINARY DESIGN DRAWINGS

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

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KINGS RIVER FLOODWATER AVAILABILITY

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

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LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

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LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

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LAGUNA IRRIGATION DISTRICT

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APPENDIX G

PUBLIC OUTREACH DOCUMENTATION

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX H

CULTURAL RESOURCES RECORDS SEARCH

INVESTIGATION OF GROUNDWATER RECHARGE POTENTIAL IN THE NORTH FORK AREA OF THE KINGS RIVER

FOR

KINGS RIVER CONSERVATION DISTRICT
NORTH FORK GROUP

SUBMITTED TO

DEPARTMENT OF WATER RESOURCES, STATE OF CALIFORNIA

FUNDED UNDER

Local Groundwater Management Assistance Act of 2000
(Grant No. 4600004078)

May 2007

Prepared by:

Provost and Pritchard
Engineering Group, Inc.

Kings River
Conservation District

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EXECUTIVE SUMMARY

The Kings River Conservation District (KRCD) was awarded a grant from the Local Groundwater Management Assistance Act of 2000 (Grant No. 4600004078) to identify and evaluate potential groundwater recharge sites in the North Fork area of the Kings River. The North Fork Conjunctive Management Group (North Fork Group) consists of six water agencies in western Fresno and Kings Counties that work collectively to advance water management projects in their area. This study was limited to the area served by the North Fork Group member agencies. The motive for this study is the groundwater overdraft condition in the North Fork area. This report includes the data, findings, and conclusions from the study.

The *original* goals of the study included the following: 1) Characterize the local geology through a literature review; 2) Identify potential sites for future development of recharge basins; 3) Develop and implement a subsurface exploration program to evaluate promising sites; 4) Evaluate and rank the prospective sites according to their potential for groundwater recharge; 5) Install piezometers in exploratory holes and new monitoring wells near existing groundwater recharge basins; and 6) Engage stakeholders throughout the project.

Sixteen potential sites were identified by local growers and water agencies (see **Figure ES-1**). Each site was evaluated through site visits, discussions with landowners, and an evaluation of physical characteristics, regional geology and local geology. Nine of these sites were identified as promising, and seven of the landowners agreed to allow subsurface investigations. Subsurface investigations were subsequently performed at Site No.'s 1, 2, 3, 4, 5, 11 and 16. The piezometer and monitoring well installations were eliminated to allow subsurface investigations in greater detail and at a greater number of sites. The exploration program included 2,523 feet of hollow-stem auger drilling, 1,904 feet of cone penetration tests, 51 laboratory grain size analysis tests, and 45 laboratory permeability tests.

Important information gained from subsurface investigations included lithology, soil permeability, soil grain sizes, and groundwater levels. The subsurface investigations also allowed for the general correlation and identification of fine-grained sedimentary sequences that could potentially impede groundwater recharge. Although numerous fine-grained sequences were found, few, if any, appear to be laterally extensive, and hence they only present a minor or moderate barrier to groundwater recharge.

The following conclusions and recommendations are provided for each of the seven sites:

Site No. 1: Recharge potential appears good but the site has limited room for groundwater recharge basins. The existing stormwater basin could be used for

groundwater recharge through the installation of a small pipe connecting the basin to Liberty Canal. A small feasibility study is recommended to evaluate this option.

Site No. 2: Site No. 2, also called Zonneveld Pond, is an existing groundwater recharge basin. The site appears fair for recharge, but infiltration could be improved by excavating a fine grained layer at a depth of 5 to 18 feet below ground surface (bgs).

Site No. 3: Site No. 3, also called Dias Pond, is an existing borrow pit. The pit is currently 18 feet deep and will be excavated as long as sandy sediments prevail, which is probably to a depth of 25 feet. The site has good potential for groundwater recharge, particularly through lateral infiltration at the edges of the excavated pit. If practical, excavation of a clay lens at about 35-40 feet bgs could help to improve vertical recharge.

Site No. 4: This site has only fair potential for groundwater recharge, but could be an excellent site for development of wetlands next to an existing slough.

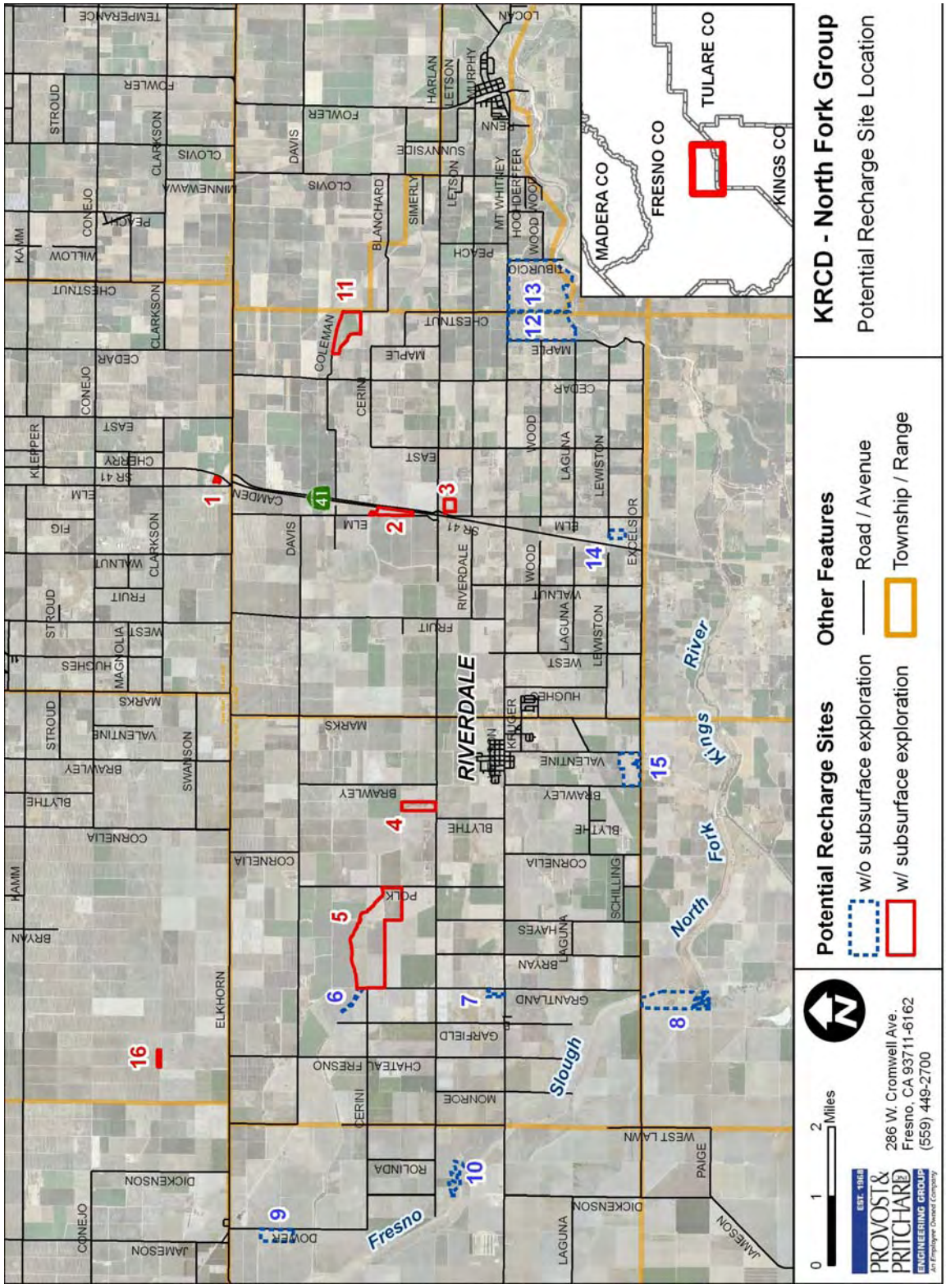
Site No. 5: This site is not suitable for groundwater recharge and no actions are proposed.

Site No. 11: This site appears good to excellent for groundwater recharge and a comprehensive groundwater-recharge feasibility study is recommended.

Site No. 16: This site appears good for groundwater recharge although groundwater recharge may be limited to minor or moderate amounts to prevent groundwater mounding. A comprehensive groundwater-recharge feasibility study is recommended for this site.

As a consequence of this study, KRCD has a greater understanding of the local geology and suitability of specific sites for groundwater recharge. It is recommended that KRCD and the North Fork Group investigate alternatives to fund feasibility studies for Site No.'s 11 and 16.

Figure ES-1: Potential Recharge Site Location Map



1 - INTRODUCTION

The Kings River Conservation District (KRCD) was awarded a grant (Grant No. 4600004078) in June 2005 from the Local Groundwater Management Assistance Act of 2000 to perform a groundwater recharge study. KRCD submitted the grant proposal on behalf of the North Fork Conjunctive Management Project Group (North Fork Group), a subdivision of KRCD comprised of water agencies that work collectively to manage the regional water resources in western Fresno and Kings Counties, California. The North Fork Group members include: Murphy Slough Association, Crescent Canal Company, Stinson Canal and Irrigation Company, Burrel Ditch Company, Liberty Canal Company, and Laguna Irrigation District. This study was limited to the area served by the North Fork Group member agencies (see Base Map in **Appendix A**).

KRCD is responsible for regional groundwater management within their District. As part of these efforts, KRCD initiated this study to help address groundwater overdraft problems in the study area. The general goals of this study are to identify and investigate sites for their groundwater recharge potential, and ultimately recommend the best sites for comprehensive groundwater-recharge feasibility studies.

This report documents findings from five phases of the study: 1) hydrogeologic literature review; 2) preliminary evaluation of sixteen prospective sites; 3) development of a recommended drilling and exploration program; 4) drilling and exploration at seven sites; and 5) evaluation of the results of the exploration program and the suitability of each site for groundwater recharge. This report does not include a comprehensive groundwater-recharge feasibility study; rather the study includes subsurface investigations and a reconnaissance-level evaluation of physical site conditions.

2 - HYDROGEOLOGY OF THE NORTH FORK KINGS RIVER AREA

A literature review was conducted to analyze the feasibility of using 16 preliminary sites for intentional groundwater recharge in the North Fork Kings River Area based on the geologic and hydrogeologic conditions. The information presented herein is from various published reports from the United States Geological Survey, California Department of Water Resources, Kings River Conservation District, and several other agencies. The relationship between water bearing formations and the various confining clay beds of the Tulare Formation is shown in two new geologic cross sections. Refer to **Appendix A** for the cross sections (A-A' and B-B'), and a map showing the locations of the cross sections in the study area. The new cross sections were developed from cross-sectional material in Page (1986) and Croft (1972), and where practical correlated with Well Completion Reports from the area. Successful intentional recharge in the area will be dependent on the location of the proposed sites in relation to the widespread clay beds and the recharge capabilities of the upper approximately 100 feet of soil.

Geology/Hydrogeology

Regional Geology and Hydrogeology

The Central Valley—comprised of the Sacramento Valley to the north and the San Joaquin Valley to the south—is a large, northwestward-trending, asymmetric structural trough. The project area is within the San Joaquin Valley portion of the Central Valley and lies roughly atop the axis of the trough. Continental and marine deposits are up to 6 miles thick in the area and overlie granitic, metamorphic, mafic, and ultra-mafic crystalline basement rocks of the Sierra-Nevada and Coast Ranges. For the purpose of this study, only the near surface Quaternary deposits and the extensive lacustrine clay deposits are examined.

The asymmetric structural trough is the principle feature that controls the movement and occurrence of groundwater in the area. Along the flanks of the valley, which are the flanks of the trough, deposits are much thinner than those underlying the topographic axis of the trough (spatially, roughly equal to the Fresno Slough). In general, because the flanks of the valley are higher than the axis, recharge is primarily along the flanks of the valley with groundwater flowing towards the axis of the trough. Historically, the preferential movement of groundwater towards the axis of the trough caused groundwater to be confined under the extensive clay beds of the area, especially the A-clay and E-clay. In recent times, pumping of groundwater has caused a marked decrease in head in the aquifer between the A-clay and E-clay resulting in decreased confined conditions there. In addition, large pumping depressions have caused local changes in groundwater gradients, resulting in local groundwater movements that differ from the regional west-southwest gradient.

Quaternary Units

Near surface deposits in the study area include flood-basin deposits (Qb), river deposits (Qr), lacustrine and marsh deposits (Qti), and continental rocks and deposits (Qtcd) (descriptions after Page, 1986). Flood-basin deposits are composed of clay, silt, and some fine sand. In the project area, the flood-basin deposits crop out as a narrow belt along the Fresno Slough Bypass. In the subsurface, the flood-basin deposits overlie and probably grade into the A-clay. Because of their fine-grained nature, the flood-basin deposits would not yield much water to wells and would impede the vertical movement of water (Page, 1986). River deposits are composed of gravel, sand, silt, and minor amounts of clay. The river deposits, including channel and flood plain deposits, are considered the most permeable deposits in the valley and recharge sites located in them will likely be the most successful. Lacustrine and marsh deposits are composed of clay, silt, and some sand; this unit includes the widespread A-E clays. The continental rocks and deposits are a heterogeneous mix of unconsolidated clay, silt, sand, and gravels; and consolidated beds of claystone, siltstone, and conglomerate.

Lacustrine and Marsh Deposits (Confining Clays)

The lacustrine and marsh deposits (Qti), especially the A-clay and E-clay, are of major significance to potential recharge in the North Fork Kings River Area (see cross sections in **Appendix A**). A description of the lacustrine clays is excluded here, but they are discussed at length in Page (1986) and Croft (1972). In the subsurface, at various depths, the edge of these deposits trend roughly northwest to southeast across the study area and they cover the southwestern 2/3 of it. The lowest deposit of concern is the E-clay, which underlies the area at depths between 200 to 650 feet below the ground surface (bgs), in general deepening southwestward. Several sources indicate that the northeastern extent of the E-clay is roughly contiguous with the northeastern edge of the A- and C-clays. However, Page (1986) extends the northeastern boundary of the E-clay approximately 5.5 miles northeasterly, which could have significant ramifications to recharge operations at several of the proposed recharge locations (Sites 1, 2, 3, 11, 12, and 13, discussed below). At this location, approximately 2.5 miles northeast of Laton, the E-clay, as mapped by Page (1986), is approximately 200 feet bgs. If the E-clay extends further northeast than previously thought, then recharged water from potential Sites 1, 2, 3, 11, 12, and 13 would most likely be recharged into the existing aquifer between the A-clay and E-clay. This scenario would be a major benefit to users in this area, as the aquifer between the A- and E-clays contains water of high quality and is tapped by numerous domestic, municipal, and agricultural wells. In addition to the E-clay, the C-clay is a potential concern to recharge operations in the area, but it is not as laterally extensive as the E-clay, pinching out to the northwest in the central portion of T. 16S, R. 18E and to the northeast at approximately the same location as the A-clay. The C-clay is not discussed further here.

The A-clay underlies the southwestern 2/3 of the study area at depths between 30 to 90 feet bgs. There is some uncertainty as to the depth to the top of the A-clay, as the

shallow depths were based on Well Completion Reports, however, Page and Leblanc (1969) give a similar depth in this area. In general, the A-clay parallels the land surface, and deepens southwestward. A concern for intentional recharge above the A-clay is that the water quality in some locations has been negatively impacted by various land-use practices. Another concern for recharge on top of the A-clay is the possibility of inducing a water table that could encroach into the root zone of the surrounding crops. In addition, recharge operations could become less efficient over time, if the relatively shallow zone between the top of the A-clay and the local ground surface becomes saturated. However, Page and Leblanc (1969) indicate that because of the large quantities of water being pumped today from above and below the A-clay and the general decline of water levels, waterlogging conditions would probably not occur for some time. At present in the study area, only Riverdale Irrigation District is operating limited recharge facilities atop the A-clay. The efficiency of recharge and affect of these facilities on local groundwater conditions is not known.

Recharge and Cyclic Storage

Areas underlain by coarse-grained material of moderate to high permeability and specific yield are favorable for recharge and cyclic storage of groundwater. Highly permeable materials permit relatively rapid recharge and high specific yield ensures adequate storage capacity. Locally, such areas are underlain by the d, e, and f facies of the older alluvium as defined by Page and Leblanc (1969). A composite map of surface (USDA-SCS soils) and subsurface materials (from Page and Leblanc, 1969) favorable for recharge compiled by the Kings River Conservation District (Exhibit 3 in Ground Water Recharge Study, 1979) shows that conditions favorable for recharge are limited to a swath of land in T. 16S, R. 20E, which is located just northwest of the study area. The linear nature of the composite surface indicates that conditions favorable for recharge are located in an area of old stream or wind-laid deposits.

Geology/Hydrology of Proposed Recharge Sites

The geology and hydrogeology of the proposed recharge sites falls into two main categories, 1) sites with a high recharge potential, and 2) sites with low or unknown recharge potential. Sites with high recharge potential include those that fall outside of the areal extent of the A-clay. Within this category, Sites 1, 4, 5, 12, and 13 are within the facies considered favorable for recharge by Page and Leblanc (1969). From Page and Leblanc's facies, sites 2, 3, and 11 are not in areas considered favorable for recharge, while the recharge potential of Site 6 is unknown based on the Page and LeBlanc facies. However, none of these sites falls within the boundary of sites considered favorable for recharge based on the composite surface compiled by Kings River Conservation District, which is based on surface and subsurface materials.

Based on the literature review, the remaining sites have low or unknown recharge potential. These sites lie atop the A-clay and the recharge potential based on Page and Leblanc facies is unknown (with the exception of sites 14 and 15). Sites 14 and 15 are both located in areas underline by Page and Leblanc d-facies, making them—at least

surficially—acceptable for recharge. In addition to sites 14 and 15, sites 7 and 9 may also have high recharge potential--as they lie outside of the area containing flood-basin deposits. However, sites 8 and 10, while atop the flood-basin deposits, could be acceptable locations, if the underlying recent deposits of the North Fork of the Kings River are permeable.

3 - EVALUATION OF POTENTIAL RECHARGE SITES

Members of the North Fork Group identified 16 sites for evaluation and possible future development as groundwater recharge basins (see **Figure 1**). Data was collected on each of these sites through a literature review (see Section 2) and site visits. This chapter presents the criteria used to evaluate and compare the sites, specific information on each site, and a list of the sites considered the most promising and recommended for subsurface explorations.

3.1 - Criteria for Site Selection

The following set of criteria were developed to rank potential groundwater recharge sites in the North Fork Kings River area. These criteria are comprised of pertinent information about the land, site location, hydrogeologic setting, existing facilities, and environmental issues. The following is a description and explanation of each criterion.

Land

Approximate Potential Wetted Area: This is the area that would be covered by water when the recharge basin is in operation. A larger wetted area equates to more recharge potential. The 'potential wetted area' was calculated as the area of the parcel(s) minus the area of permanent facilities (houses, barns, etc.) and the area needed for boundary setbacks and recharge basin levees. These areas are approximate, and pending review by landowners they may change.

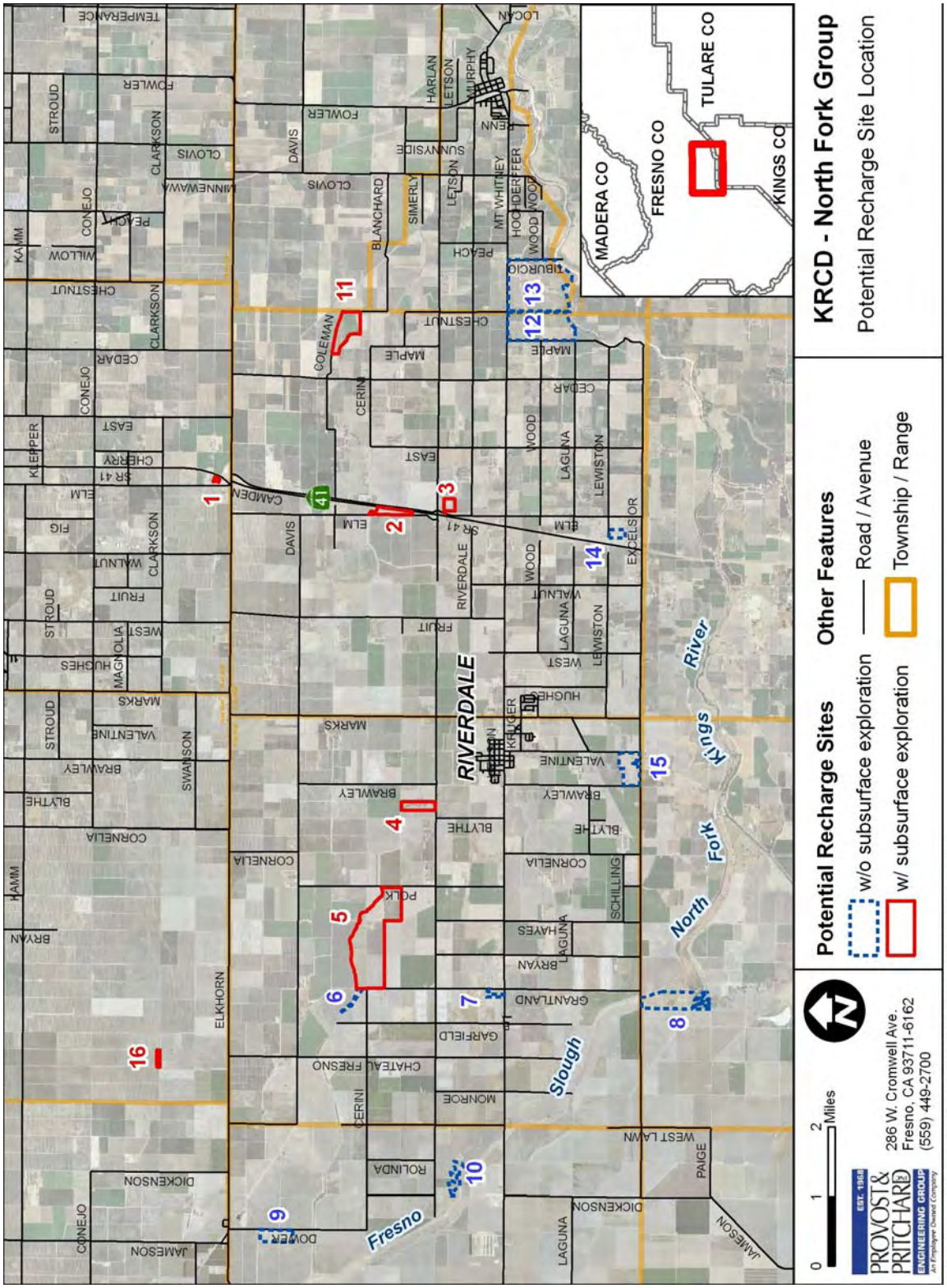
Shape: The shape of a site has an affect on its recharge capabilities. In general, an elongated site results in a larger perimeter to area ratio. This results in more outflow from the basin than could be obtained from a more compact shape of the same acreage. More outflow equates to less mounding effects and higher recharge potential. This effect is magnified if the long axis of the site is perpendicular to the local groundwater flow direction and may be negated if the long axis is parallel to the local groundwater flow direction.

Number of Landowners: Sites with fewer landowners will be easier to develop and operate since each landowner would have their own individual issues, concerns, negotiations, and contract.

Current Land Use: The current land use will have an affect on the cost of site development. If a site is currently planted with orchards then tree removal could be cost prohibitive. On the other hand, if the site is not actively farmed or is planted to row crops, site-clearing costs will be minimal. In addition, if a site is currently used as a borrow pit, it will need less excavation, thereby reducing construction cost.

Accessibility: Sites that have paved roads for the ingress and egress of large earth moving equipment will be easier to develop. Well-packed dirt or aggregate roads will

Figure 1: Potential Recharge Site Location Map



work for this purpose in dry conditions but may become problematic in wet conditions. In addition, sites that are accessible from County roads will be easier to develop because permission from private landowners will not be needed to gain access during construction and operation.

Favorable for Gravity Flow: Sites that can be filled with water under the influence of gravity are favorable to sites that would require new excavation to permit gravity deliveries, or require the construction and operation of pumping facilities to fill a recharge basin. Existing sites can be favorable for gravity flow if they are already excavated, fed by an above-grade canal, or are located downgradient from the water source based on the current topography.

Proximity to Standing Water Bodies: Water bodies in close proximity to a site can possibly reduce the infiltration potential and volume of water that can be recharged. If the body of water has been there for an extended period, the potential for a high water table is increased, and thus the unsaturated zone available for recharge could be smaller. In addition, a standing water body could indicate an impervious stratum that could hinder the vertical migration of recharged water.

Hydrogeology

Topsoils: Surface materials with a high permeability and porosity are favorable for recharge. If the surface materials are fine silts and clays, which are generally unfavorable for recharge, they may need to be excavated before the site efficiently recharges groundwater. In addition, some soils have hardpans that greatly reduce the vertical movement of groundwater. Costs for deep ripping or removal of the hardpan will add to the cost of site development. However, if the upper soil layer contains clay, this material can be used to construct the basin levees, reducing the cost of importing soils appropriate for basin-levee construction. A topsoil map of the project area can be found in **Appendix A**.

Geologic Facies: Page and Leblanc (1969) generated a map of subsurface materials to depths of 300 feet. The geologic materials were classified as different facies that are either favorable or unfavorable for groundwater recharge. Not all of the prospective sites are covered by Page and Leblanc's map. See Section 2 for more discussion on these facies.

Lacustrine Clay Layers: The project area is partially underlain by a laterally extensive clay layer (A-clay) that can have a potential negative affect on groundwater recharge. Water recharged atop the A-clay has an increased possibility of creating mounded conditions and/or a water table that encroaches into the root zone of the local crops. In addition, some of the waters in the upper aquifer (above the A-clay) have poor quality, and, even when mixed with recharged water, may be unsuitable for extraction and use.

Groundwater Levels: The depth to groundwater has significant implications on recharge operations. The area between the bottom of the recharge basin and the water table (called the unsaturated zone) can be used for groundwater storage. A larger unsaturated zone will provide more storage potential and also reduce the possibility of groundwater mounding problems.

Potential for Groundwater Outflow: Groundwater in the study area generally flows to the southwest. Water that is recharged in the southwestern portion of the study area—especially near the boundary—will likely flow along the regional gradient and be lost to project participants. Conversely, a site located upgradient from the project area will make water available to down gradient users, i.e. North Fork Group members. This criterion is based on the regional flow direction of groundwater. It should be noted that local flow directions may vary. Therefore, groundwater contour maps should be prepared for the area surrounding sites that are being seriously considered for development.

Facilities

Proximity to Conveyance Facilities: Sites that are in close proximity to existing canals or other conveyance facilities will have a lower construction cost. Development of these sites can avoid the time and costs for permitting, right-of way access, land acquisition, and design and construction of new conveyance facilities.

Capacity of Nearby Conveyance Facilities: The capacity of nearby conveyance facilities is an important factor in site selection. The canals, rivers, sloughs, or pipelines used to deliver surface water to the site will need to have a sufficient capacity to fill the recharge basin and still be able to supply water to downstream users. If the conveyance facilities are undersized, the cost of expansion will need to be included in the price of site development.

Existing Infrastructure: The use of existing on-site infrastructure can reduce the cost of initial site development. If canals, turnouts, basins, etc. have to be built then costs will escalate accordingly.

Relocations Needed for Development: Facilities that are located on the footprint of a new recharge basin will need to be relocated or abandoned. This will add to the cost of site development. These facilities could include powerlines, small structures, wells, roads, etc.

Underground Utilities: Underground utilities can be very costly to relocate and gaining location information from the utility companies can be time consuming. Sites that are located in an area with fewer underground utilities will be less expensive to develop.

Regulatory Issues

Environmental Issues: Environmental reviews for this study only included an evaluation of surficial features that might indicate potential soil and groundwater contamination. Sites that are in close proximity to known contamination sites—especially down gradient from the source of contamination—may not be viable for development.

Proximity to Dairies: Sites that are in close proximity to dairies may experience degraded water quality due to leakage from dairy lagoons or improper application of manure water to crops. If a potential recharge site is located near a dairy then a more detailed environmental assessment may be necessary.

3.2 - Description of Prospective Sites

The Kings River Conservation District solicited input from local water agencies and landowners on prospective groundwater recharge sites. Sixteen sites were recommended for evaluation (see **Figure 1**). These initial recommendations were based primarily on visual observations and anecdotal evidence. Each location was visited to collect information on the site characteristics (see **Attachment B-1** in **Appendix B**), take photographs, and identify any potential fatal flaws. Some general features of the sixteen sites are described below:

- 15 of the sites are in Fresno County and 1 site is in Kings County
- The sites range in size from 5 to 400 acres
- The average area of the sites is about 65 acres
- Current land uses include the cultivation of annual crops, abandoned vineyards, borrow pits, groundwater recharge, terminal reservoirs and flood control basins
- All of the sites are easily accessible
- Soils in the area are generally loamy (see Soils map in **Appendix A**)
- Groundwater depth varies but averages approximately 100 to 120 feet
- Numerous dairies are located throughout the project area, particularly in the northeast
- Most of the prospective sites are located adjacent to operating conveyance facilities

3.3 - Sites Recommended for Subsurface Exploration

The prospective recharge sites were evaluated and ranked based on the literature review (Section 2) and the summary of site characteristics (see **Attachment B-1** in **Appendix B**). All of these criteria were used to rank the prospective sites, but the location of the sites in relation to the A-clay was the most important factor. Consequently, all of the recommended sites are located outside the boundary of the A-clay. These sites are located in the northeast part of the study area. With regional groundwater flow to the southwest, these sites also have the lowest potential for groundwater outflow from the study area. Lastly, the northeast area generally has coarser soils and canals with higher capacities than the remainder of the study area. A

total of 9 sites were initially recommended for subsurface geologic exploration and are described below.

Site No. 1. Site No. 1 is a 37-acre bus yard owned by Southwest Education Support Center. A small stormwater basin covering about 0.5 acres is located in the southwest corner of the site and adjacent to Liberty Canal. Southwest Transportation staff have observed rapid infiltration in the basin. The landowner also identified a 0.3-acre area just north of the stormwater basin where it could be expanded for groundwater recharge.

Site No. 2. Site No. 2 is a 25-acre parcel currently used as a terminal reservoir and groundwater recharge basin. The site is owned by Laguna Irrigation District, a North Fork Group member. Laguna Irrigation District has named the site Zonneveld Pond. Murphy Slough borders the northern end of the site and an irrigation canal terminates near the southern end. A surficial clay layer was excavated in the northern 8 acres (northern 1/3 of site) of the site. The clay layer was about 5-8 feet thick, according to Laguna Irrigation District staff. Infiltration rates were observed to increase dramatically after removal of the clay layer. Caltrans is expected to expand Highway 41, which will remove an 80-100 feet strip of land from the eastern end the site within the next few years.

Site No. 3. Site No. 3, called Dias Pond, is a 19-acre terminal reservoir/groundwater recharge basin owned by Laguna Irrigation District. The site was being used as a borrow pit during the exploration program. As of March 2007, the site was excavated to a depth of 18 feet, and Laguna Irrigation District planned to continue excavation to a depth of 20 feet. Water is delivered to the site from the Little B Ditch/Pipeline.

Site No. 4. Site No. 4 covers 35 acres and is privately owned. The land is used for periodic grazing. A meandering slough bisects the site. The slough is in a quasi-natural state with riparian vegetation and wildlife and is in sharp contrast to the canals connected to the northern and southern ends of the slough. Both the landowner and California Department of Fish and Game have expressed interest in habitat enhancement in and around the slough, possibly in combination with groundwater recharge basins.

Site No. 5. Site No. 5 includes seven privately owned parcels covering 447 acres. Murphy Slough borders the northern end of the site. Active and abandoned oil and gas wells, pipelines and storage tanks are scattered throughout the site. The remainder of the land is used to grow row crops.

Site No. 11. Site No. 11 is privately owned and covers 91 acres. Most of the land is used to grow field crops and a portion on the southern end is a borrow pit. Liberty Canal borders the northern end and Murphy Slough borders the western end. Most of

the site is several feet below the Liberty Canal and therefore can easily be served water under gravity flow.

Site No.'s 12 and 13. Site No.'s 12 and 13 are privately owned agricultural land covering 464 acres. The sites include a dairy, but most of the land is used to grow field crops. The Kings River borders the southern end of the site, and Grant Canal traverses both sites. However, no subsurface investigations were performed since the landowners were not interested in participating.

Site No. 16. Site No. 16 is a privately-owned abandoned vineyard. The landowners plan to plant new crops, but identified a 6-acre area on the southern end of the parcel that they could reserve for groundwater recharge. Liberty/Mill Race Canal is located just south of the site.

4 - SUBSURFACE EXPLORATION PROGRAM

The subsurface exploration program included a combination of hollow-stem auger drilling, cone penetration testing, and laboratory soils testing at seven different sites. This chapter provides a brief description of each investigation methods. The technical specifications for the subsurface investigations are provided in **Appendix D**, and Section 5 includes an interpretation of the results.

The following conventions were used for naming the exploratory holes:

Hollow-stem auger soil borings: The soil borings are named as 'Site Number' B - 'Hole Number'. For instance, the third soil boring at Site No. 4 would be called 4B-3.

Cone Penetration Tests: The cone penetration tests are named as CPT 'Site Number'-'Hole Number'. For instance, the second CPT at Site No. 3 would be CPT3-2.

4.1 - Planning for Subsurface Explorations

The original scope of work included construction of two monitoring wells and two piezometers, and exploration using deep mud-rotary holes, borehole geophysics, and cone penetration tests. After prospective sites were identified the initial exploration program was re-evaluated and several changes were proposed to be more compatible with the physical site conditions. The monitoring wells and piezometers were removed from the program and replaced with exploratory holes in greater detail and at a greater number of sites, which were determined to be a greater value to the North Fork Group participants. Borehole geophysics was eliminated since the method provides questionable results in the unsaturated zone, which is the primary zone of interest. The deep mud-rotary holes were replaced with hollow-stem auger drilling, which could reach the desired hole depths (100 to 150 feet) at a lower cost. The revised scope of work was approved by KRCD, the North Fork Group members, and the California Department of Water Resources.

Drilling locations were generally selected in an attempt to achieve a uniform spatial distribution across each site. However, some areas could not be accessed due to poor road conditions, saturated soils, buried utilities, or low power lines. As a result, the spatial distribution of exploratory holes is not uniform or ideal at several of the sites.

Permits were obtained from the Fresno County Health Department to drill soil borings and CPTs. The holes were also backfilled according to Fresno County guidelines. Utility maps were obtained prior to subsurface explorations, and soil borings and CPTs were placed at least 20 feet away from any buried utilities. Underground Service Alert (USA) was also contacted just prior to drilling to verify the locations of underground utilities.

4.2 - Cone Penetration Tests

Cone penetration tests (CPT) involve the advancement of standard piezocones into the ground under a known load while measuring the tip resistance and sleeve friction. Background information on the CPT method can be found in **Appendix E**. The CPT provides a rapid and fairly reliable means of determining subsurface stratigraphic and hydrogeologic information. The CPTs were performed by Gregg Drilling and Testing, Inc. of Signal Hill, California. **Table 4.1** summarizes the quantity of cone penetration testing that was performed.

Table 4.1 – Cone Penetration Test Quantities

Description	Value
No. Sites Investigated	6
No. Holes Drilled	15
Total Lineal Footage	1,904 ft
Average Depth/Hole	127 ft

Piezocones were advanced to the groundwater table in each CPT hole. At various depths pore pressure dissipation tests were performed to determine the potentiometric surface. CPTs were performed at six of the seven sites; they could not be performed at Site 16 since the site was volunteered by a landowner towards the end of the exploratory program after the CPT rig had demobilized. CPT logs can be found in **Appendices F-L** for the seven sites. The CPT logs were used in conjunction with the hollow-stem auger logs to characterize the subsurface geology.

The CPT provides a continuous log, which is only possible with a hollow-stem auger if a relatively slow process is used. For the exploratory holes drilled on this project, the CPTs were about 25% less expensive than continuously sampled soil borings. The higher costs for soil borings are primarily from the need to have a full time geologist on-site to log soils and later type a boring log. CPT logs, on the other hand, are automatically generated.

A disadvantage of CPTs is potential problems and delays with finding an available CPT rig. The rigs are not common and only a few are in operation in California. They may have to mobilize from far away and often have a backlog of several months.

4.3 - Hollow-Stem Auger Drilling

A hollow-stem auger rotates as it drills into the ground and a series of flights lift the soil up and out of the borehole along the outside of the auger. Hollow-stem auger drilling also allows for the collection of relatively undisturbed samples using a split-spoon sampler. The hollow-stem auger method is generally simpler, faster and cleaner than

the mud rotary method for shallow holes. **Table 4.2** summarizes the quantity of hollow stem auger drilling that was performed.

Table 4.2 – Hollow-Stem Auger Drilling Quantities

Description	Value
No. Sites Investigated	7
No. Holes Drilled	23
Total Lineal Footage	2,523 ft
Average Depth/Hole	110 ft

The holes were drilled to a few feet below the groundwater table; however it was difficult to discern the groundwater table in some holes. Soils were logged at 5-foot intervals at 20 holes and continuous logging was performed at 3 holes. The boreholes were drilled by Technicon Engineering Services, Inc. of Fresno, California. Soil boring logs for each hole are provided in **Appendices F-L** for the seven sites.

4.4 - Laboratory Soils Testing

Laboratory soils testing included permeability and grain size distribution tests (sieve analysis and/or hydrometer tests). Samples were collected with split-spoon samplers during the hollow-stem auger drilling. All samples were collected at the discretion of a field geologist with the goal of characterizing the variety of conditions at each site. The number of samples collected at each boring varied due to differences in boring depth and heterogeneity. However, on average about two grain-size analysis and two permeability samples were collected at each soil boring. **Table 4.3** summarizes the number of laboratory tests that were performed.

Table 4.3 - Soil Laboratory Testing Quantities

Description	No.
Grain Size Analysis Tests	51
Laboratory Permeability Tests	51

The soil testing was performed by Technicon Engineering Services, Inc. of Fresno, California. The results of the tests are found in **Appendices F-L** for the seven sites. An interpretation of the test results is presented in Section 5.

Laboratory permeability tests were primarily performed on fine-grained layers that could impede recharge. Therefore, the permeability tests for a specific site or soil boring are not indicative of average permeabilities, but rather represent some of the lower permeability values that are locally present.

Some additional permeability values were calculated using the Hazen method (**Attachment B-5** in **Appendix B**).

Hazen Method

The Hazen Method provides an approximate permeability for coarse grained soils. The formula is provided below:

Permeability (cm/sec) = C x $(D_{10})^2$

The coefficient C is a constant and is based on the grain size and sorting. The coefficient is not dimensionless and has the units of 1/(length x time). D_{10} is the effective grain size and represents the size corresponding to the 10% passing line on a grain-size distribution curve. To use the Hazen method, D_{10} must be between 0.1 and 3.0 mm, so the formula can only be used for samples consisting primarily of sand. Only five of the grain size samples met this criterion. Refer to **Attachment B-5** in **Appendix B** for the permeability calculations using the Hazen method. This formula is empirical and therefore the results are considered approximate at best.

5 - SITE EVALUATIONS BASED ON SUBSURFACE EXPLORATION

This section describes the results of the subsurface investigations performed at the seven sites (No.'s 1, 2, 3, 4, 5, 11 and 16). Details of the subsurface investigations can be found in **Appendices F-L**. Each appendix contains the results for one site including: a summary of the subsurface investigations, map of drilling locations, soil boring logs, permeability tests, grain size analysis tests, and cone penetration test logs. Below is an evaluation of the results from each site, followed by some general observations.

The evaluations provided below are general and the sites were evaluated relative to each other. In addition, the evaluations looked at each site as a whole, without detailed scrutiny of different parts of each site. If feasibility studies or design are eventually pursued, then the information in the appendices can be used to identify the best location(s) on a site to place recharge basins.

5.1 - Site No. 1: Southwest Education Support Center Stormwater Basin

Site No. 1 is a bus yard owned by Southwest Education Support Center. The site includes a small 0.5 acre stormwater basin that may be available for recharging groundwater. It is located north of Elkhorn Ave and west of Highway 41 in Fresno County. The following table summarizes the subsurface explorations at the site:

Table 5.1 - Summary of Subsurface Explorations (Site No. 1)

Method	No.
Soil Borings	2
Cone Penetration Tests	2
Grain Size Analysis	4
Permeability Tests	4

Refer to **Appendix F** for copies of the soil boring logs, CPT logs, and soil testing results for Site No. 1.

Permeability. The following table summarizes the permeability tests for Site No. 1:

Table 5.2 - Summary of Permeability Tests (Site No. 1)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
1B-1	36	Sandy clay	1.40E-05	Low
1B-1	96	Sandy clay	1.10E-06	Very low
1B-2	30	Sandy clay	5.30E-07	Very low
1B-2	40	Sandy clay	6.70E-07	Very low
1B-2	60	Poorly graded sand	7.29E-02[2]	Medium

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.
2 – Permeability calculated with the Hazen Method.

Stratigraphy. The subsurface at Site No. 1 is characterized by sands, silts, clays and mixtures of these three components. CPT1-1 met refusal at 35 feet below ground surface (bgs) due to dense and possibly cemented sands, thus below this depth, Site No. 1 is characterized using the two boreholes and CPT1-2.

<u>0-50 feet</u>
This interval is dominated by sands and silty sands with minor amounts of clay. Several dense, possibly cemented sand and silty sand lenses are prominent at a depth of 30 to 40 feet bgs, and silt and clay are found between 40 and 50 feet. These layers are probably laterally continuous over the area investigated and probably would reduce groundwater recharge.

<u>50-100 feet</u>
This interval is mostly sand but has appreciable quantities of silt and clay. Sands and silty sands dominate down to 75 feet bgs and interbedded silt, clay and fine sand mixtures from 75 to 100 feet bgs. The interval from 75 to 100 feet bgs, being dominated by dense and hard, very fine-grained materials would probably be a recharge barrier.

<u>100+ feet</u>
Sands and silty/clayey sands are abundant over this interval. Some clay layers and stiff, hard, fine-grained deposits occur in this interval, but their lateral continuity is unknown.

Groundwater Levels. Site No. 1 has variable groundwater levels ranging from 76 to 115 feet bgs. Groundwater levels are higher on the south side of the site near the Liberty Canal and progressively deeper away from the canal. This is probably caused by canal seepage.

Other Factors. The limiting factor at this site is space to expand the existing storm water detention basin. The existing basin is about 0.5 acres and only about 0.3 acres is available to expand the basin.

Suitability for Groundwater Recharge. High percentages of sand would indicate that Site No. 1 is fair to good for recharge, but the above mentioned low permeability intervals could form a recharge barrier beginning at a depth of about 30 feet. The owner of the property noted that the existing basin readily percolates water, indicating that the sands in the upper approximately 30 ft probably have high horizontal permeability.

5.2 - Site No. 2: Zonneveld Pond

Site No. 2 is a terminal reservoir/recharge basin for Laguna Irrigation District called Zonneveld Pond. It is located between Highway 41 and Elm Avenue about one-eight of a mile north of Harlan Avenue in Fresno County. The site is bounded to the north by Murphy Slough. The following table summarizes the subsurface explorations at the site:

Table 5.3 - Summary of Subsurface Explorations (Site No. 2)

Method	No.
Soil Borings	3
Cone Penetration Tests	2
Grain Size Analysis	7
Permeability Tests	5

Refer to **Appendix G** for copies of the soil boring logs, CPT logs and soil testing results for Site No. 2.

Permeability. The following table summarizes the permeability tests for Site No. 2:

Table 5.4 - Summary of Permeability Tests (Site No. 2)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
2B-1	46	Clay with sand	7.80E-06	Very low
2B-1	66	Sand	2.52E-03	Medium
2B-2	41	Sandy clay	4.50E-07	Very low
2B-2	116	Silty sand	1.00E-05	Low
2B-3	16	Silty sand	3.60E-06	Very low
2B-3	91	Clay with sand	8.00E-07	Very low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.

Stratigraphy. The subsurface at Site No. 2 is characterized by sands, silts, clays and mixtures of these three components.

0-50 feet

This interval is dominated by silty sands, sands, and silts, with minor quantities of clay. A silt/silty sand layer is evident under the site at approximately 5 to 18 feet bgs. This

unit could likely form a near-surface recharge barrier. Moist to saturated cuttings above this layer at 2B-2 suggests that, at least locally, water perches on this fine-grained material. A low permeability layer is found in most of the exploratory holes at a depth of about 45 to 55 feet bgs.

50-100 feet
This interval is similar in composition to the 0-50 feet interval. A low permeability layer is found in most of the holes from about 50 to 60 feet bgs.

100+ feet
This interval has a prominent sand lens from approximately 100 to 110 feet bgs. Below this lens, the site is dominated by finer grained and possibly cemented materials that could be a recharge barrier. However, waters recharged to this depth would likely be at or near the groundwater table.

Groundwater Levels. Groundwater levels at Site No. 2 are consistent at around 100 feet bgs. They vary from 96 feet to 109 feet bgs. At the time of exploration, there did not appear to be any residual affect on the local groundwater gradient from waters being recharged on site or from Murphy Slough to the north of the site.

Other Factors. Site No. 2 has potentially two sources of water: Murphy Slough and the current ditch that delivers water to the existing basins. As this site is already partially developed excavation and full development could be relatively inexpensive.

Suitability for Groundwater Recharge.
The manager of Laguna Irrigation District noted that water is slow to percolate in the existing basin, but some recent shallow excavation helped to notably improve percolation. The rate of recharge would probably be increased with the excavation of the near-surface fine-grained material in the 5 to 17 bgs interval. The affect of the deeper low permeability layers could be ascertained after the above fine-grained material was excavated. In its current state, the site is only fair for recharge, but excavation, as mentioned above, could increase the recharge capabilities.

5.3 - Site No. 3: Dias Pond
Site No. 3 is a borrow pit and terminal reservoir/recharge basin called Dias Pond and is owned by Laguna Irrigation District. The site is located south of Harlan Avenue and east of State Highway 41 in Fresno County. The site is currently excavated to a depth of about 18 feet. The following table summarizes the subsurface explorations at the site:

Table 5.5 - Summary of Subsurface Explorations (Site No. 3)

Method	No.
Soil Borings	1
Cone Penetration Tests	1
Grain Size Analysis	2
Permeability Tests	2

Refer to **Appendix H** for copies of the soil boring logs, CPT logs, and soil testing results for Site No. 3.

Permeability. The following table summarizes the permeability tests for Site No. 3:

Table 5.6 - Summary of Permeability Tests (Site No. 3)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
3B-1	40	Silty sand with clay	1.09E-05	Low
3B-1	60	Poorly graded sand	4.00E-02[2]	Medium
3B-1	75	Sandy silt	1.30E-07	Very low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.
2 – Permeability calculated with the Hazen Method.

Stratigraphy. The subsurface at Site No. 3 is characterized by mixtures of sands, silts, and clays that vary with depth and between the two exploratory holes.

The intervals below are based on depth from the point of drilling. The soil boring and CPT were both performed inside the borrow pit at about 5 feet below the adjacent ground surface.

<u>0-50 feet</u>
This interval is dominated by silt, silty sand, and sand with minor amounts of clay. The upper 25 feet is predominantly sand. The CPT log shows a clayey layer from 30-40 feet deep. This layer was not encountered in the soil boring so it is probably an isolated lens.

<u>50-100 feet</u>
The results of the soil boring log and CPT log vary considerably in this interval. The soil boring shows high sand content (67%) and the remaining sediments as silty sands and silt, but no clay. The CPT log shows a fairly even mixture of sand, silt and clay.

<u>100+ feet</u>
This interval is only characterized with the CPT3-1. Silts are the dominant material with lower amounts of sand and silty sand. Of note is the relatively high percent of clay at

24%. The CPT log shows several dense, cemented, sand lenses within the interval. These dense sands in conjunction with high amounts of silt and clay could be a recharge barrier.

Groundwater Levels. Groundwater levels at the site were consistent at 98 feet bgs. Numerous perched water zones indicate the presences of low permeable layers at approximately 40, 60 and 85 feet bgs.

Suitability for Groundwater Recharge. After excavation is complete, the site will have a high potential for lateral recharge due to the high percentage of sand in the upper 20 to 30 feet. Vertical infiltration is probably only fair, but could be enhanced by excavating a clay lens found at a depth of about 35 to 45 feet below ground surface.

5.4 - Site No. 4: Murphy Slough

Site No. 4 includes two north-south trending parcels bisected from the north to south by Murphy Slough. It is located north of Harlan Avenue, midway between south Brawley Avenue and the south Blythe alignment. The following table summarizes the subsurface explorations at the site:

Table 5.7 - Summary of Subsurface Explorations (Site No. 4)

Method	No.
Soil Borings	5
Cone Penetration Tests	2
Grain Size Analysis	11
Permeability Tests	12

Refer to **Appendix I** for copies of the soil boring logs, CPT logs, and soil testing results for Site No. 4.

Permeability. The following table summarizes the permeability tests from Site No. 4:

Table 5.8 - Summary of Permeability Tests (Site No. 4)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
4B-1	46	Clay	2.10E-07	Very low
4B-1	71	Silty sand	2.70E-06	Very low
4B-2	3	Sandy silt	9.20E-07	Very low
4B-2	71	Clayey silt	5.50E-06	Very low
4B-3	50	Clayey silt	4.20E-06	Very low
4B-3	55	Poorly graded sand	1.69E-02[2]	Medium
4B-3	115	Clayey silt	1.10E-07	Very low
4B-4	16	Silt	3.09E-03	Medium
4B-4	111	Sand with silt and clay	7.10E-07	Very low
4B-5	11	Silty clay	1.6E-06	Very low
4B-5	26	Sand	3.94E-03	Medium
4B-5	41	Sand	2.35E-02	Medium
4B-5	51	Sandy silt	4.80E-06	Very low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.
2 – Permeability calculated with the Hazen Method

Stratigraphy. The subsurface at Site No. 4 is characterized by sands, silts, clays and mixtures of these three components.

<u>0-50 feet</u>
This interval is comprised mainly of sand and sandy silt/silty sand, with smaller quantities of silt and clay. The upper 20 feet generally has the most permeable materials. Some low permeability layers are present, but they do not appear to be laterally continuous.

<u>50-100 feet</u>
This interval is similar in composition to the 0-50 feet interval. Some low permeability layers are present, especially between 60 and 70 feet bgs, but their laterally continuity is uncertain.

<u>100-150 feet</u>
This interval is also similar in composition to the 0-50 and 50-100 feet intervals. The CPT logs indicate the presence of numerous cemented sand layers from 100 to 110 feet bgs, however the boring logs indicate that these sands are dense to very dense sands with no cementation. Based on the CPT logs, fine-grained materials increase in percentage from approximately 130 feet to 160 feet bgs.

Groundwater Levels. Groundwater levels at this site range from 106 to 120 feet bgs. Perched groundwater was encountered in each boring, but at differing depths. This might indicate that the perched water lenses are not continuous.

Other Factors. This site has a limited amount of area to develop into a traditional recharge basin. However, with Murphy Slough traversing it, development of a recharge facility with an enhanced wetland component could be an efficient use for this site. The affects of the dairy immediately to east on the local water quality will need to be ascertained.

Suitability for Groundwater Recharge. The relatively high percentages of coarse-grained materials in the upper 20 to 30 of the site, plus the apparent lack of continuity between sequences of fine-grained deposits would indicate that this site is fair to good for recharge. However, there are a fair number of silt and clay layers, with clay content in some intervals as high 30%. Overall, this site is considered to have fair to good potential for groundwater recharge. If the area is developed for wetlands habitat, the low permeability soils might be acceptable or even beneficial.

5.5 - Site No. 5: Monteiro Dairy

Site No. 5 is located one-half mile north of Harlan Avenue and is bounded to the north by Murphy Slough, to the east by Polk Avenue and to the west by the Grantland Avenue alignment. Oil and gas wells, pipelines, and storage tanks are on the site. The following table summarizes the subsurface explorations at the site:

Table 5.9 - Summary of Subsurface Explorations (Site No. 5)

Method	No.
Soil Borings	3
Cone Penetration Tests	4
Grain Size Analysis	5
Permeability Tests	6

Refer to **Appendix J** for copies of the soil boring logs, CPT logs, and soil testing results for Site No. 5.

Permeability. The following table summarizes the permeability tests for Site No. 5:

Table 5.10 - Summary of Permeability Tests (Site No. 5)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
5B-1	25	Silty sand	1.4E-06	Very low
5B-1	120	Silty clayey sand	5.2E-07	Very low
5B-2	31	Silty clayey sand	2.70E-07	Very low
5B-2	121	Clayey sand	1.20E-07	Very low
5B-3	6	Silty sand	6.88E-04	Low
5B-3	36	Sandy silt	2.40E-05	Low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.

Stratigraphy. The subsurface at Site No. 5 is characterized by a mixture of sand, silt and clay, with silt and sandy silt comprising most of the sediment.

<u>0-50 feet</u>
This interval is composed primarily of sand, silt and mixtures of these, with minor amounts of clay. Some low permeability layers were encountered, but they don't appear to be laterally continuous.

<u>50-100 feet</u>
This interval is composed primarily of sandy silt and silt, with smaller quantities of sand and clay. Low permeability layers were found in most of the holes at a depth of about 60 to 70 feet bgs.

<u>100-150 feet</u>
This interval is comprised of roughly equal amounts of sand, silt and clay. The clay content is considerably higher than the 50-100 feet interval. Several low permeable layers were identified, but they don't appear to be laterally continuous.

Groundwater Levels. Groundwater levels are between 120 feet to 147 feet bgs. There does not appear to be any influence from Murphy Slough on the local groundwater gradient.

Other Factors. This site is adjacent to and below grade from Murphy Slough making for efficient delivery of water. In addition, there is a large amount of area available to develop into a recharge facility. However, placing groundwater recharge facilities near the existing oil and gas facilities could present permitting and technical challenges, as well as possible expensive, time consuming efforts to decommission any abandoned equipment.

Suitability for Groundwater Recharge. This site appears fair for groundwater recharge. The near surface materials do have a considerable quantity of sand, but the percentage of fines increases rapidly with depth.

5.6 - Site No. 11: Silva Farm

Site No. 11 is a privately owned farm used to grow field crops. The site covers 91 acres and is located near Coleman Avenue and Chestnut Avenue in Fresno county. The following table summarizes the subsurface explorations at the site:

Table 5.11 - Summary of Subsurface Explorations (Site No. 11)

Method	No.
Soil Boring	6
Cone Penetration Tests	4
Grain Size Analysis	6
Permeability Tests	6

Refer to **Appendix K** for copies of the soil boring logs, CPT logs, and soil testing results for Site No. 11.

Permeability. The following table summarizes the permeability tests from Site No. 11:

Table 5.12 - Summary of Permeability Tests (Site No. 11)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
11B-1	21	Poorly graded sand	2.25E-02[2]	Medium
11B-1	31	Silt	2.45E-04	Low
11B-1	51	Sand	1.14E-02	Medium
11B-2	31	Sandy silt	3.92E-04	Low
11B-2	46	Poorly graded sand w/ silt	1.58E-02[2]	Medium
11B-2	61	Sand	3.94E-02	Medium
11B-3	26	Sandy silt	1.50E-06	Very low
11B-3	36	Silty clayey sand	1.34E-04	Low
11B-4	76	Silty sand	2.80E-05	Low
11B-5	41	Clay	9.50E-09	Practically impermeable
11B-5	56	Sand	1.99E-03	Medium
11B-6	2.5	Clayey sand/sandy clay	1.30E-06	Very low
11B-6	4	Silty clayey sand	1.90E-07	Very low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.
2 – Permeability calculated with the Hazen Method

Stratigraphy. The subsurface at Site No. 11 is primarily sand with lesser quantities of silt and minor quantities of clay.

<u>0-50 feet</u>

This interval consists mainly of sand, silt, clay and mixtures of these. Sand was the most common sediment type and comprised about 50% of the materials. The soil borings show several silt layers between 20 and about 40 feet bgs, although the CPT logs primarily show sand, silty sand and sandy silt at this depth. The silt layers do not appear to be laterally continuous.

50-100 feet
This interval consists mainly of sand, silt, clay and mixtures of these. Sand represents the largest group and comprises about 45-50% of the sediment. Some low permeability layers are present but they do not appear to be laterally continuous.

100+ feet
This interval contains roughly even quantities of sand, silt and clay, but this varies widely between the three CPT holes that penetrated below 100 feet.

Groundwater Levels. Groundwater depths ranged from 70 feet to 94 feet bgs. This site had the shallowest groundwater of all the sites investigated.

Suitability for Groundwater Recharge. This site appears good for groundwater recharge based on the high sand content, low clay content, and possible absence of laterally continuous low permeability layers.

5.7 - Site No. 16: Batth Farm

Site No. 16 is privately owned agricultural land located on Clarkson Avenue, in between Chateau Fresno and West Lawn alignments in Fresno County. The site covers 6-acres and is currently an abandoned vineyard. The following table summarizes the subsurface explorations at Site No. 16.

Table 5.13 - Summary of Subsurface Explorations (Site No. 16)

Method	No.
Soil Borings	3
Cone Penetration Tests	0
Grain Size Analysis	8
Permeability Tests	6

No CPTs could be performed because the site was not identified until late in the exploratory program after the CPT rig had demobilized. Refer to **Appendix L** for copies of the soil boring logs and soil testing results for Site No. 16.

Permeability. The following table summarizes the permeability tests for Site No. 16.

Table 5.14 - Summary of Permeability Tests (Site No. 16)

Boring Number	Sample Depth (ft)	Soil Description	Permeability[1] (cm/s)	Rating
16B-1	11	Sandy silt	2.60E-05	Low
16B-1	106	Silty sand	5.50E-06	Very low
16B-2	11	Silty sand	5.60E-04	Low
16B-2	31	Sand	1.22E-01	Medium
16B-2	46	Sandy silt/clay	4.50E-06	Very low
16B-2	71	Silty sand	4.87E-04	Low
16B-3	3	Sandy silt	1.40E-04	Low

1 – Permeability samples are not representative of average stratigraphy but were focused on the confining layers with only a few samples from the coarse grained layers.

Stratigraphy. Site No. 16 consists mostly of sand and silt with smaller quantities of clay.

<u>0-50 feet</u>
This interval is comprised of sand, silt and sandy silt/silty sand. Very little clay was encountered. A low permeability layer was found in all three soil borings at a depth of about 50 feet.

<u>50-100 feet</u>
This interval includes mixtures of sand, silt, and clay, and has more clay than the 0-50 feet interval. The upper portion of the interval (about 50 to 65 feet) is comprised of clay and silt and could be a recharge barrier. This layer appears to be continuous over the small 6-acre area designated for groundwater recharge.

<u>100+ feet</u>
This interval has a fairly even mixture of sand, silt and clay, with clay over 30% in all three soil borings. Several layers that probably have low permeability were identified. These layers could be laterally continuous.

Groundwater Levels. Groundwater was not encountered in any of the three soil borings which extended to depths of 120 to 150 feet. Based on regional groundwater contour maps, the groundwater level should be in the vicinity of 150 feet bgs.

Suitability for Groundwater Recharge. The first 50 feet of the site would be fair to good for recharge. However, below 50 feet the clay content increases and there are numerous low permeability layers that are possibly continuous over the 6-acre area. Recharge would be feasible only if lateral groundwater flow in the first 50 feet bgs is sufficient to prevent mounding.

<u>5.8 - General Observations</u>

General observations on the subsurface investigation results are provided below.

Groundwater Depth

Groundwater depths at each soil boring and CPT are summarized in **Attachment B-3** in **Appendix B**. Groundwater depths ranged from 70 feet to greater than 150 feet, and generally increase in a southwest direction. Site No. 11, the most northeasterly site, had groundwater depths averaging about 75 feet, while Site No. 5, the most southwesterly site, had some depths greater than 150 feet. These values are consistent with groundwater depths shown on regional groundwater contour maps. The soil boring groundwater depths represent first encountered groundwater. In some cases, the groundwater level rose after the initial reading indicating that the potentiometric surface was higher than the first encountered groundwater. The CPT groundwater depths were calculated from pore-pressure dissipation tests. This method is approximate and is more representative of the potentiometric surface.

Groundwater storage is limited to the unsaturated (vadose) zone, which extends from the ground surface to the groundwater table. However, the ability to recharge and store groundwater is also based on the ability of the water to spread out laterally. Horizontal hydraulic conductivity is generally an order of magnitude greater than vertical hydraulic conductivity. During recharge, groundwater levels would probably not be allowed to rise higher than 20 feet below ground surface to prevent waterlogging of crops. In fact, waterlogging does not occur until groundwater levels are less than 10 feet from the surface, but 20 feet would provide a comfortable buffer zone. Consequently, at least 50 feet of soil profile would be available for storing groundwater at each of the sites. Site 11, while probably the best site for infiltration potential, has the smallest space for groundwater storage. Groundwater mounding can restrict groundwater recharge, so the ability of the recharged water to flow laterally will be important when determining the water volume that can be recharged.

Permeability

The permeability of the soils was determined through laboratory tests as well as calculations using the Hazen Method (see Section 4.4 for more details). A summary of all the permeability tests at all of the sites is included in **Attachment B-1** in **Appendix B**. These tests are not intended to provide average results for any one site or soil boring, because they were focused on fine-grained layers, with a lesser number of tests performed in coarse grained layers. The tests, however, do provide a range of permeabilities for the different soil types encountered. Sediments that comprise a mixture of sand and silt or sand and clay generally have fairly low permeabilities. Therefore, it is believed that the recharge potential is largely dependent on the percentage of sediments classified as sand.

Lateral Continuity of Low Permeability Layers

All of the sites include some fine-grained low permeability layers. Only a few of the low permeability layers appear to be laterally continuous across a single site. This is not unexpected considering the depositional environment (primarily fluvial and floodplain

deposits), which would have created isolated pockets of coarse and fine grained materials. When the layers are not continuous groundwater can flow around them and they would only be a minor or moderate impediment to groundwater recharge.

Accuracy of Cone Penetration Test Results

The CPT method is considered slightly less reliable than hollow-stem auger soil borings for characterizing the lithology. The CPT method estimates lithology from physical parameters such as sleeve friction and tip resistance, whereas the soil boring logs are based on physical observations of the geologic materials. Geologists naturally place greater trust in samples that they have physically seen.

Two hollow-stem auger soil borings were drilled within 20 feet of two CPT holes to help calibrate the CPT logs (4B-2 versus CPT 4-1, and 11B-6 versus CPT 11-4). A comparison of these logs shows that they are fairly similar. The minor discrepancies could be attributed to variations in geology, which may be notable in the 20 feet gap between the exploratory holes being compared. In summary, the CPTs were found to give a reasonable description of the subsurface geology.

Blow Counts

Blow counts are the number of blows, caused by dropping a specific weight a specific height, to advance a soil sampler a specific distance. The blow counts measure the relative density in coarse-grained sediments, and relative consistency in fine-grained sediments. Blow counts were recorded for most of the soil borings by advancing a California sampler. Blow counts could not be recorded for the three soil borings that were sampled continuously, since the sampler was advanced under hydraulic pressure instead of by hammer blows. Estimated blow counts were also shown on the CPT logs. These were estimated from the resistance encountered while advancing the piezocone and are reported as Standard Penetration Test (SPT) blow counts. The California and SPT methods use a different size sampler, therefore the blow count values are interpreted differently.

The range of blow counts for each exploratory hole (minimum, average and maximum) are provided in the summary tables at the beginning of **Appendices F-L**. These results provide little insight into the lithology, except that the density and consistency vary widely in almost every hole. To be useful, the blow count information should be reviewed on the individual soil boring and CPT logs with respect to its variation with depth.

6 - CONCLUSIONS AND RECOMMENDATIONS

The conclusions from the study and specific recommendations for each of the seven sites are provided below. The recommendations are based on the results of the subsurface investigations and the criteria described in Section 2.

Site No. 1: Southwest Education Support Center Stormwater Basin. Site No. 1 is considered fair to good for groundwater recharge based on the geology. The site is conveniently located next to Liberty Canal, and an existing stormwater basin could be used or expanded to accept water for recharge. In addition, the landowner has expressed interest in allowing groundwater recharge, partly so they can develop a positive relationship with neighboring entities, including local water agencies. However, the existing stormwater basin is only about 0.5 acres and there is only an additional 0.3 acres of land for expansion of the basin. The volume of water that could be recharged may be small, even if the basin is expanded. Furthermore, without expansion, water could only be delivered when the basin is not needed for stormwater retention. Nevertheless, a pipe and valve could be installed to deliver water to the existing stormwater basin for little cost. Therefore, a small study is recommended to explore this option.

Site No. 2: Zonneveld Pond. Site No. 2 is currently used as a terminal reservoir and groundwater recharge basin by Laguna Irrigation District (LID). LID observed very low infiltration rates in the basin and subsequently excavated some near-surface fine-grained layers in a portion of the site. This was found to substantially improve infiltration. Subsurface investigations were performed to determine if further shallow excavation would help improve infiltration. The investigations were also performed to characterize the suitability of deeper sediments for infiltration. The deep soils are only fair for groundwater recharge. However, the site is already developed, and excavation of a fine grained layer at about 5 to 18 feet bgs could help to improve groundwater recharge. The depth and extent of the fine grained layer varies and would need to be determined from the exploratory program results and during actual excavation.

Site No. 3: Dias Pond. Site No. 3 is a borrow pit and terminal reservoir owned by LID. The site was being actively excavated during the subsurface exploration program. The purpose of investigating this site was to determine if any additional excavation (to remove fine-grained layers) would be beneficial to promote recharge. The current depth of the pit is about 18 feet, and LID plans to excavate the pit as long as they can retrieve substantial quantities of sand. The soil boring log and CPT log indicate sandy sediments to a depth of about 25 feet, with underlying materials comprised of sandy silt and silty sand. If the excavation is pursued to a greater depth, then excavation of a clay lens at a depth of about 35-45 feet bgs could help to improve vertical infiltration. The pit will have considerable ability to recharge water laterally due to the preponderance of sand in the upper 25 feet of the soil profile.

Site No. 4: Murphy Slough. The geology at Site No. 4 consists of mixtures of sand and clay and is considered only fair for groundwater recharge. This site is located next to a ½-mile reach of slough that is still in a quasi-natural state. The slough serves as an irrigation water conveyance facility, and on its north and south ends the slough is connected to channelized sections. As a result, the slough is in sharp contrast to the surrounding area, and is the only portion of the slough resembling a natural feature in the local area. The landowner and California Department of Fish and Game have expressed interest in developing additional wildlife habitat along the slough, possibly in combination with groundwater recharge basins. The low permeability layers that would restrict groundwater recharge could be acceptable or even beneficial for wetlands habitat. It is recommended that discussions be held with the Department of Fish and Game and other agencies, such as Ducks Unlimited or the United States Department of Agriculture, that could fund a wetland enhancement project.

Site No. 5: Monteiro Dairy. The geology at Site No. 5 includes mixtures of clay, silt and sand. The clay and silt contents are high enough to substantially impede groundwater recharge. In addition, existing and abandoned oilfield facilities on the site could present problems with permitting and developing a groundwater recharge site. As a result, it is recommended that groundwater recharge not be pursued at this site.

Site No. 11: Silva Farm. Several years ago, Site No. 11 was identified by KRCD as a potentially promising site for groundwater recharge. Subsurface investigations also show this site to have good potential for groundwater recharge. This site has the most favorable geology of all seven sites investigated. Furthermore, this site has the added advantage of being adjacent to two conveyance facilities, Murphy Slough and Liberty Canal. Much of the site is lower than the flow line in Liberty Canal and water could be delivered to recharge basins by gravity. In conclusion, a comprehensive groundwater-recharge feasibility study is recommended at this site. The feasibility study should include the following topics: surface water sources, water rights, conceptual layout and design, groundwater mounding, land acquisition, community interest, permitting and regulations, environmental issues, capital and operation and maintenance costs, and a financial analysis. In addition, construction of a pilot basin should be considered.

Site No. 16: Batth Farm.
Site No. 16 is favorable for groundwater recharge in the upper 50 feet of the soil profile. Below about 50 feet fine-grained sediments increase substantially, which would likely impede groundwater recharge. Groundwater recharge could be feasible if lateral groundwater flow is sufficient to prevent a groundwater mound from forming. As a result, it is possible that only small to moderate quantities of water could be recharged. Site No. 16 is only a few miles east of the A-clay boundary. Water that is recharged may flow laterally to the west and deposit on top of the A-Clay where it would mix with poor quality perched groundwater. Nevertheless, this site has many favorable characteristics and a comprehensive groundwater-recharge feasibility study is

recommended. The feasibility study should include the following topics: surface water sources, water rights, conceptual layout and design, groundwater mounding, land acquisition, community interest, permitting and regulations, environmental issues, capital and operation and maintenance costs, and a financial analysis. In addition, construction of a pilot basin should be considered.

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KINGS RIVER CONSERVATION DISTRICT

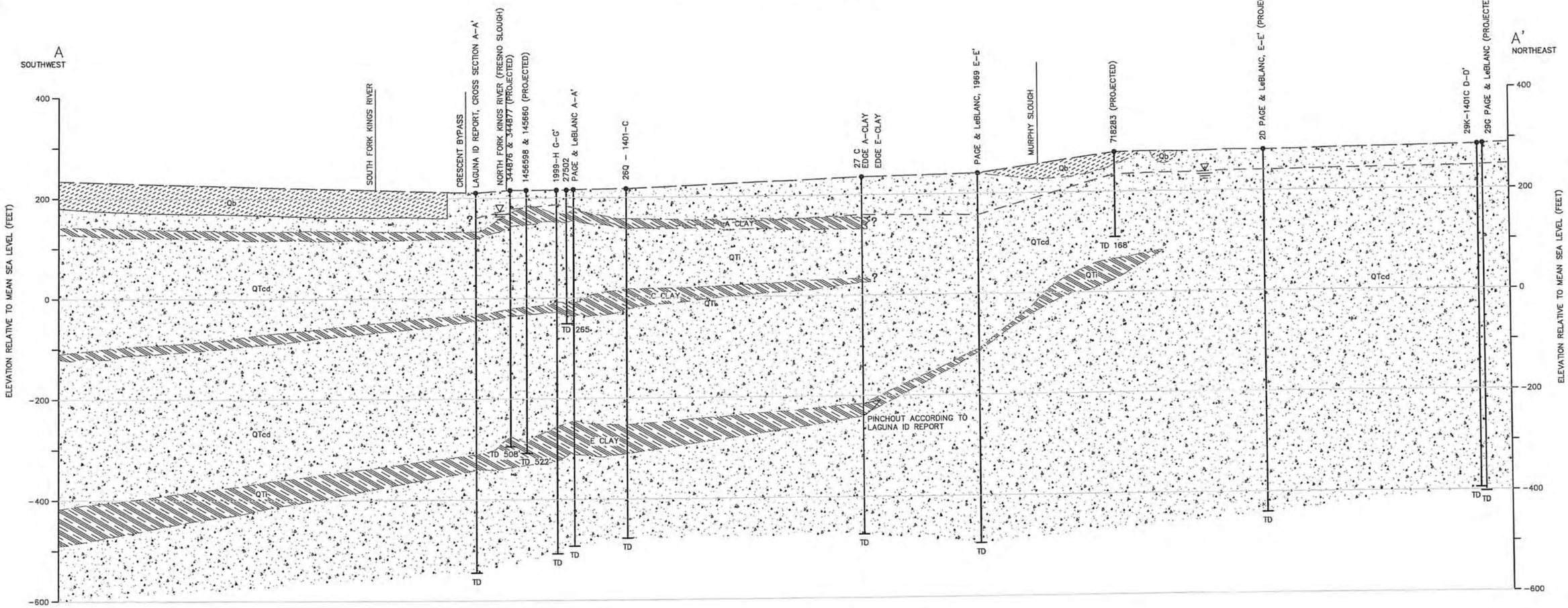
INVESTIGATION OF GROUNDWATER RECHARGE POTENTIAL

IN THE NORTH FORK AREA OF THE KINGS RIVER

APPENDIX A

Regional Soils and Geology

KINGS RIVER CONSERVATION DISTRICT
NORTH FORK GROUP
AB 303 GROUNDWATER STUDY



SUBSURFACE GEOLOGIC CROSS SECTION A–A'

EXPLANATION

Qb – FLOOD BASIN DEPOSITS (HOLOCENE) CLAY, SILT, AND SOME SAND

QTcd – CONTINENTAL ROCKS AND DEPOSITS (OLIGOCENE AND HOLOCENE) HETEROGENOUS MIX OF GENERALLY POORLY SORTED CLAY, SILT, SAND, AND GRAVEL, SOME BEDS OF CLAYSTONE, SILTSTONE, SANDSTONE, AND CONGLOMERATE

QTi – LACUSTRINE AND MARSH DEPOSITS (PLIOCENE TO HOLOCENE) CLAY, SILT, AND SOME SAND; IN SUBSURFACE INCLUDES THREE WIDESPREAD CLAYS: A CLAY (PLEISTOCENE TO HOLOCENE?), C CLAY (PLEISTOCENE), E CLAY (PLEISTOCENE) INCLUDES THE CORCORAN CLAY MEMBER OF THE TULARE FORMATION

344876 — CROSS SECTION/ WELL IDENTIFICATION

TD 508' — TOTAL DEPTH (FEET)

SPRING 2003 GROUNDWATER ELEVATION

HORIZONTAL SCALE IN MILES
0 1.0 2.0

NOTES

SUBSURFACE GEOLOGY BASED ON

1) USGS PROFESSIONAL PAPER 1401–C, CROSS SECTION D–D'

2) GROUNDWATER ELEVATIONS FROM KINGS RIVER CONSERVATION DISTRICT –2003 ANNUAL GROUNDWATER REPORT

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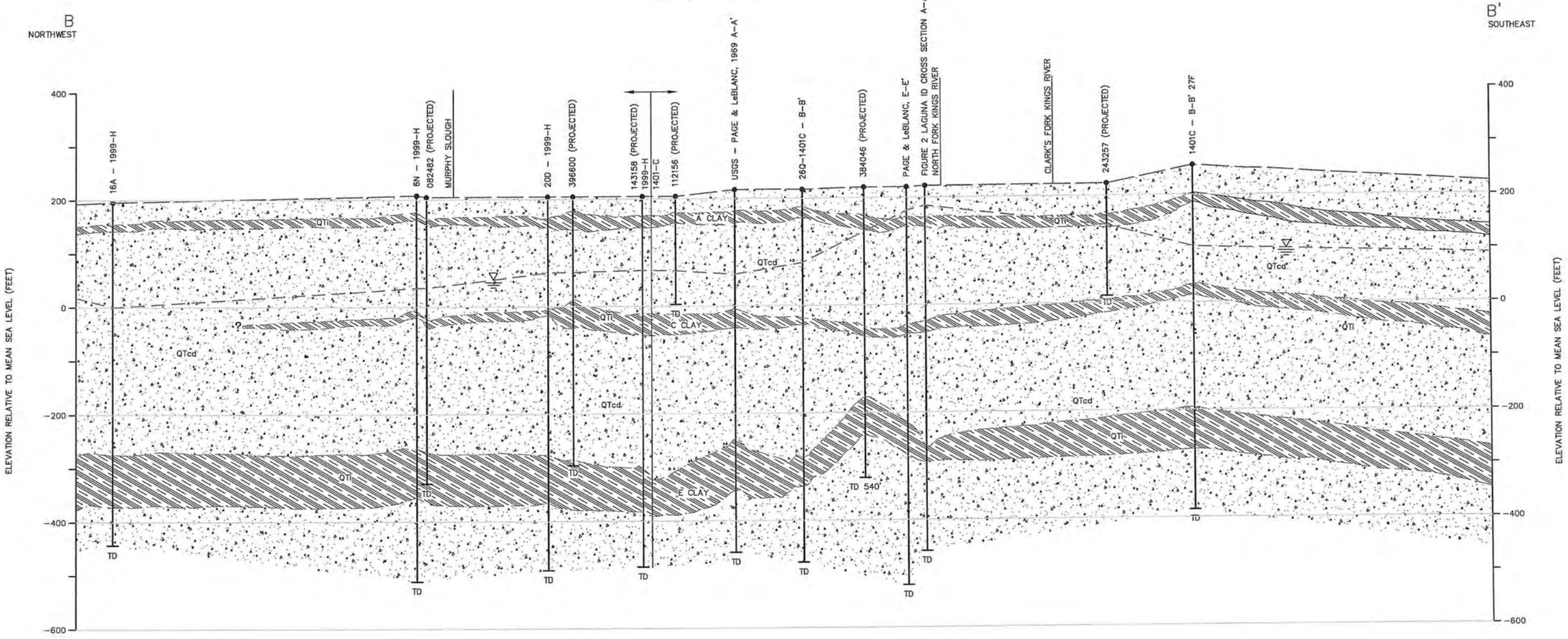
KINGS RIVER CONSERVATION DISTRICT
NORTH FORK GROUP
AB 303 GROUNDWATER STUDY



SUBSURFACE GEOLOGIC CROSS SECTION B-B'

EXPLANATION

QTcd – CONTINENTAL ROCKS AND DEPOSITS (OLIGOCENE AND HOLOCENE) HETEROGENOUS MIX OF GENERALLY POORLY SORTED CLAY, SILT, SAND, AND GRAVEL, SOME BEDS OF CLAYSTONE, SILTSTONE, SANDSTONE, AND CONGLOMERATE

QTi – LACUSTRINE AND MARSH DEPOSITS (PLIOCENE TO HOLOCENE) CLAY, SILT, AND SOME SAND; IN SUBSURFACE INCLUDES THREE WIDESPREAD CLAYS: A CLAY (PLEISTOCENE TO HOLOCENE?), C CLAY (PLEISTOCENE), E CLAY (PLEISTOCENE) INCLUDES THE CORCORAN CLAY MEMBER OF THE TULARE FORMATION

HORIZONTAL SCALE IN MILES
0 1.0 2.0

384046 — CROSS SECTION/ WELL IDENTIFICATION

TD 540' — TOTAL DEPTH (FEET)

SPRING 2003 GROUNDWATER ELEVATION

NOTES

SUBSURFACE GEOLOGY BASED ON

1) USGS PROFESSIONAL PAPER 1401-C, CROSS SECTION B-B'

2) USGS WATER SUPPLY PAPER 1999-H, CROSS SECTION G-G'

3) GROUNDWATER ELEVATIONS FROM KINGS RIVER CONSERVATION DISTRICT -2003 ANNUAL GROUNDWATER REPORT

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KINGS RIVER CONSERVATION DISTRICT

INVESTIGATION OF GROUNDWATER RECHARGE POTENTIAL

IN THE NORTH FORK AREA OF THE KINGS RIVER

APPENDIX B

Summary Tables

Attachment B-1

Kings River Conservation District
North Fork Group AB303 Project

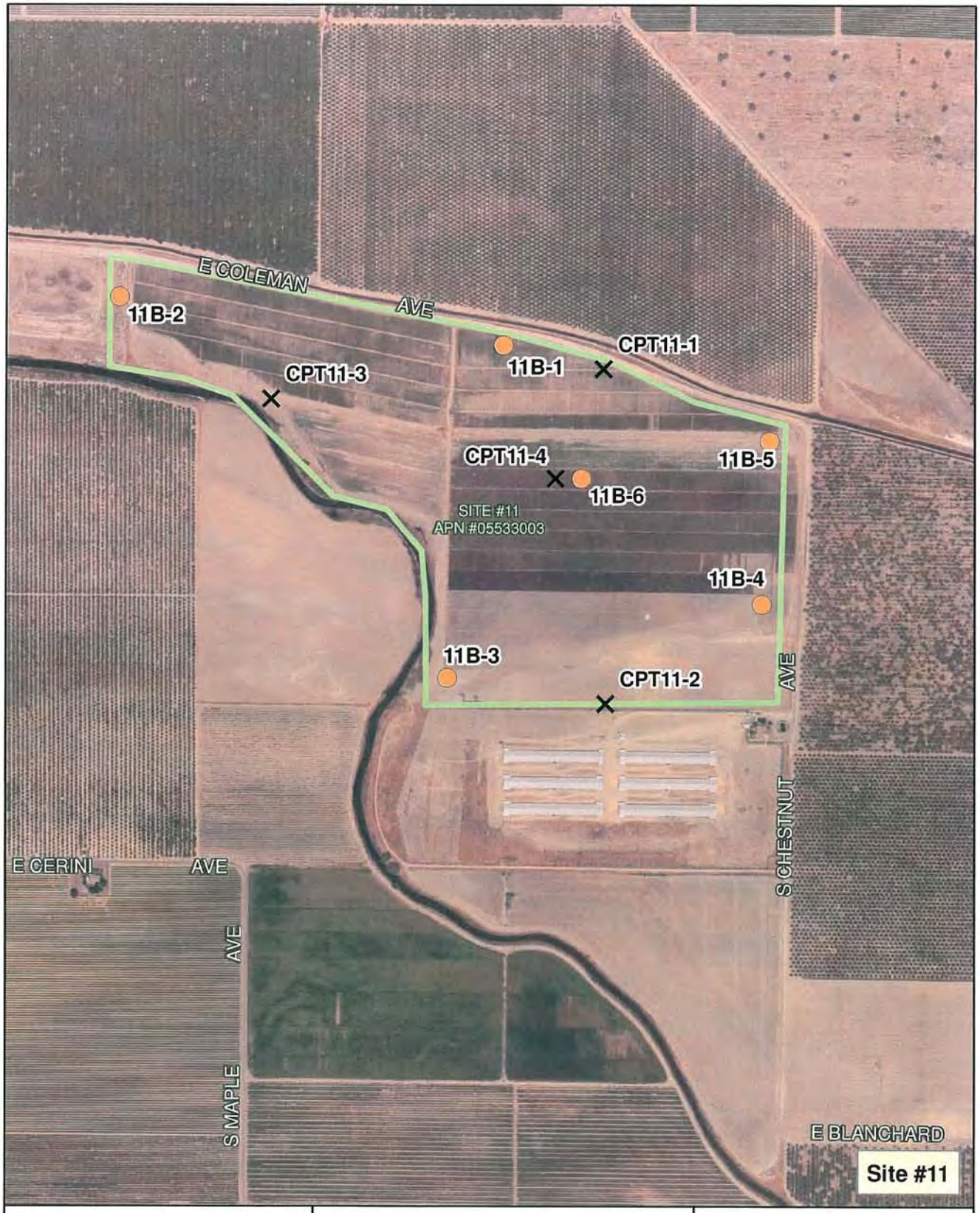
Summary of Potential Recharge Sites

	Description	Site Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Location	Cross Streets	Elkhorn & Hwy 41	Cerini & Elm	Harlan & Elm	Harlan & Brawley	Cerini & Polk	Cerini & Grantland	Mt Whitney & Grantland	Excelsior & 26 1/4 Ave	Dower & South of Elkhorn	Harlan & Dickenson	Coleman & Chestnut	Mt Whitney & Maple	Mt Whitney & Chestnut	Lewiston & Elm (HWY 41)	Excelsior & Brawley	On Clarkson, between Chatsau Fresno & West Lawn
	County	Fresno	Fresno	Fresno	Fresno	Fresno	Fresno	Fresno	Kings	Fresno	Fresno	Fresno	Fresno	Fresno	Fresno	Fresno	Fresno
	District	Liberty W.D.	Laguna I.D.	Laguna I.D.	Riverdale I.D.	Riverdale I.D.	Riverdale I.D.	Riverdale I.D.	KRCD	None	Riverdale I.D.	Laguna I.D.	Laguna I.D.	Laguna I.D.	Laguna I.D.	Laguna I.D.	Murphy Slough Association Service Area
	Township/Range/Section	T16S R20E SEC 34	T17S R20E SEC 15	T17S R20E SEC 22	T17S R19E SEC 14	T17S R19E SEC 15, T17S R19E SEC 9&10	T17S R19E SEC 8	T17S R19E SEC 20	T18S R19E SEC 5	T17S R18E SEC 2	T17S R18E SEC 24	T17S R20E SEC 12	T17S R20E SEC 25	T17S R21E SEC 30	T17S R20E SEC 33	T17S R19E SEC 36	T16S R19E SEC 30
Land	Parcel Areas (acres)	36.86	25.13	19.04	35	447	10.9	5.81	148.24	49.87	24.4	91.13	260.9	402.73	20	83.56	640.35
	Approximate Potential Wetted Area (acres)	0.5	19	16	22	200	5	2	133	44	20	83	248	325	15	75	6
	Shape	square	narrow, triangular	square	narrow and sinuous	oblong	narrow, sinuous	rectangular, L-shape	oblong	long rectangular	irregular, sinuous	square	rectangular	rectangular	rectangular	rectangular, irregular	rectangular
	No. Landowners	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
	Parcel Numbers	04204350ST	05522033ST	05535017ST	05319010S, 05319011S,	seven parcels (see map)	05305030S	5324053	40100090	05018103S, 05018105S	05027013ST, 05027015T	05533003	05509027s	05705044s	05518009	05311095	04122001S
	Current Land Use	Bus parking and maintence, fallow, storm water detention	borrow pit, recharge	recharge, terminal reservior	fallow, dairy, grains	hay, grains	fallow, hay	fallow	flood control facility	plowed	slough, wetlands	fallow, alfafa	plowed, dairy	plowed, dairy	fallow, excavated pit	grains, fallow	abandoned vineyards
	Accessibility	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible	accessible
	Favorable for Gravity Flow	down slope, excavated	down slope, excavated	down slope?, excavated	not excavated, Murphy Slough onsite	not excavated, Murphy Slough onsite	Murphy Slough onsite & downslope	downslope	excavated, downslope	not excavated, downslope	excavted, downslope	partially excavated	not excavated, downslope	not excavated, partial downslope	partially excavated, downslope	not excavated, downslope	Unknown
	Proximity to Standing Water Bodies	onsite	onsite	dairy ~ 0.5mi SE	dairies onsite & dairy ~ 0.25mi W	dairy ~0.5mi SE	dairy ~0.6mi N	none	onsite	recharge basin adjacent to N	onsite	none	dairy onsite	dairy onsite	Vaz Pond~0.5 mi W	dairy ~ 0.5mi N, small domestic pond	None?
Hydro-geology	Topsoils	loamy sand, sandy loam, fine sandy loam	fine sandy loam, loamy sand	fine sandy loam	loam	loam	clay loam	loam	loam	sandy loam, loam	clay loam	fine sandy loam, loamy coarse sand, loamy sand, sandy loam,	fine sandy loam, sandy substrate, sandy loam, loamy sand	fine sandy loam, sandy substrate, hard substrate, riverwash, sand	sandy loam	fine sandy loam, loam	Sandy loam
	Subsurface Geology: Facies from Page and Leblanc (see below)	e,d	c	c	c,d	d	N/A	N/A	N/A	N/A	N/A	c	d,c	d	d	d?	c
	Lacustrine Clay Layers	outside A&E*	outside A&E*	outside A&E*	outside A & over E	outside A & over E	outside A & over E	over A & over E	over A & over E	over A & over E	over A & over E	outside A&E*	outside A&E*	outside A&E*	over A & over E	over A & over E	Over A
	Depth to Groundwater/Spring 2003	~100 ft	80 - 100 ft	~80 - 100 ft	~140 - 160 ft	~140 - 160 ft	~140 - 160 ft	~140 ft	~180 ft	~170 ft	~170-180 ft	~ 80 - 90 ft	~ 70 ft	~ 70 ft	~20 ft	~40 ft	~130 feet?
	Potential for Groundwater Outflow from Project Area	low	low	low	low	low	low	low	high	moderate	moderate	low	low/moderate	low/moderate	low	low	high
Facilities	Proximity to Conveyance Facilities	adjacent to Liberty Canal, S	adjacent to Murphy Slough, N	canal terminates at site	canals, S & Murphy Slough thru middle	Murphy Slough, N	Murphy Slough, N	Canal ~0.2mi N	adjacent to Kings River	adjacent to canal, N	slough, wetlands	adjacent to Liberty Ditch, W&N, & Murphy Slough, S&W	canal thru center, Kings River, S	canal thru center, Kings River, S	canal ~ 0.25mi, N, Adjacent to Cama Loma Pipe line?	adjacent to canal, N&S	adjacent to canal at south end
	Estimated Capacity of Nearby Conveyance Facilities	~25 cfs	~300 cfs ??	TBD	N. Turner Ditch ~ 75 cfs, Murphy Slough ~ 300 cfs??	Murphy Slough ~ 300cfs	Murphy Slough ~ 300cfs	Turner Ditch ~ 50cfs	Cresent Canal ~ 200cfs + Kings River	TBD	Kings River	Liberty Ditch ~ 60 cfs, Murphy Slough ~ 300 cfs	300 cfs	300 cfs	~150 cfs	~30 cfs	70 cfs
	Existing Infrastructure	Detention basin	flow meter, excavated	excavated	Murphy Slough and N. Turner Ditch	Murphy Slough	Murphy Slough	none	inlet for flood waters	none	inlet for flood waters	excavated	none	none	excavated, pipe line	none	none
	Relocations Needed for Development	fence, underground waterlines	none?	none?	none?	none?	none?	none?/probable	none?	gas lines	none?	none?	none?	none?	pipeline	none?	none
	Underground Utilities	signed gas line	unknown	unknown	utilites for house?	unknown but probable	unknown	unknown/probable	unknown	gas lines	unknown	unknwn	unknown	unknown	pipeline	unknown	waterline on site
Regulatory Issues	Environmental Issues	unknown/TBD	unknown/TBD	riparian veg.	Murphy Slough as wetlands	Murphy Slough as wetlands	unknown	unknown	floodplain, wetlands	unknown	slough, wetlands	unknown	unknown	unknown	unknown	unknown	unknown
	Proximity to Dairies	no	1 mi NE	~0.5 mi SE	onsite	0.5 mi SE	0.6 mi N	no	no	1 mi N	~ 1mi N	~1 mi SW	onsite	onsite	no	~0.5 mi N	no
Geologic Recharge Potential		Fair to Good	Fair	Fair to Good	Fair	Fair	Unknown	Unknown	Unknown	Unknown	Unknown	Good	Unknown	Unknown	Unknown	Unknown	Fair to Good
Overall Suitability for Groundwater Recharge		**Good**	**Fair**	**Good**	**Fair**	**Poor**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Excellent**	**Unknown**	**Unknown**	**Unknown**	**Unknown**	**Good**

Notes
1) Facies from Page and Leblanc, 1969 - facies d, e, & f are considered favorable for recharge, facies a, b, & c are considered unfavorable for recharge
2) *Above the E-clay based on the aerial extent from USGS Professional Paper 1401-C
3) Other topics that can be evaluted in a future feasibility study include: availability of the land for lease or sale, land value, land-use restrictions, groundwater quality, and water rights issues.

Kings River Conservation District
Potential Recharge Site Exploration
Summary of Exploratory Hole Depths

Site	Hole	Hole Depth (ft)
1	1B-1	120
	1B-2	80
	CPT 1-01	35
	CPT 1-02	122
2	2B-1	100
	2B-2	127
	2B-3	105
	CPT 2-01	130
	CPT 2-02	120
3	3B-1	100
	CPT 3-01	134
4	4B-1	115
	4B-2	90
	4B-3	115
	4B-4	125
	4B-5	141
	CPT 4-01	147
	CPT 4-02	160
5	5B-1	135
	5B-2	150
	5B-3	105
	CPT 5-01	155
	CPT 5-02	140
	CPT 5-03	150
	CPT 5-04	165
11	11B-1	80
	11B-2	75
	11B-3	85
	11B-4	85
	11B-5	100
	11B-6	75
	CPT 11-01	105
	CPT 11-02	121
	CPT 11-03	126
	CPT 11-04	94
16	16B-1	145
	16B-2	150
	16B-3	120
Average		117



0 365 730 Feet

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✕ Core Penetration Test
Soil Boring
Proposed Basin Parcel

KRCD North Fork Group

Potential Recharge Site Exploration

SITE MAPS

1/4/2007
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The hole locations shown are approximate and were determined with a measuring wheel.

Kings River Conservation District
North Fork Group Potential Recharge Site Exploration
Summary of Subsurface Explorations - Site 11

		Soil Borings						Cone Penetration Tests			
Description		**11B-1**	**11B-2**	**11B-3**	**11B-4**	**11B-5**	**11B-6 (continuous)**	**CPT 11-1**	**CPT 11-2**	**CPT 11-3**	**CPT 11-4**
Total Depth (ft)		80	75	85	85	100	75	105	121	126	94
Depth to GW (ft)		Not encountered	70	71	71	71	71	84	77	95	74
Soil Types (0-50 feet)	SW/SP	34%	59%	44%	51%	21%	60%	51%	69%	51%	49%
	SM	36%	23%	14%	14%	55%	10%	30%	18%	22%	24%
	ML	15%	18%	31%	20%	14%	12%	12%	11%	16%	27%
	SC			10%	5%		12%				
	CL	15%		1%	10%	10%	6%	7%	2%	11%	
Soil Types (51-100 feet)	SW/SP	75%	60%	19%	49%	50%	70%	42%	16%	44%	7%
	SM	17%	40%	30%	35%	10%	4%	30%	30%	20%	34%
	ML	8%		32%	13%	15%	11%	20%	36%	36%	48%
	SC			15%		5%	4%				
	CL			4%	3%	20%	11%	8%	18%		11%
Soil Types (100+ feet)	SW/SP							40%	19%	4%	
	SM							40%	38%	12%	
	ML							20%	29%	40%	
	SC										
	CL								14%	44%	
Perched Aquifers (depth in feet)		None	41-46	41	31, 41, 45	36, 75	65	-	-	-	-
Low Permeability Layers (depth in feet)		20, 30-35, 45, 71	30-35, ~48?	15, 20-35	26, 76	16-23, 41, 65-70, 80-85, 90-99	3, 7, 36-42, 43, 69-72	77	58, 102	45	None
Dry Layers (depth in feet)		65	6, 25	None	None	70	None	-	-	-	-
Blow Counts (min-avg-max)		12 - 40 - 77	12 - 46 - 85	11 - 35 - 74	12 - 38 - 79	15 - 52 - 184	NA (continuous sampling)	22 - 45 - 100+	15 - 58 - 100+	18 - 39 - 100+	15 - 45 - 100+
Density/Consistency		loose to dense, soft to hard	loose to dense, soft to stiff	loose to dense, firm to hard	loose to dense, firm to hard	loose to very dense, firm to hard	NA (continuous sampling)	medium dense to very dense / very stiff to hard	medium dense to very dense / hard	medium dense to very dense / very stiff to hard	medium dense to very dense / very stiff to hard
Permeability (cm/sec at depth)		2.3E-02 (21') 2.5E-04 (31') 1.1E-02 (51')	3.9E-04 (31') 1.6E-02 (46') 3.9E-02 (61')	1.5E-06 (26') 1.3E-04 (36')	8.9E-06 (26') 2.8E-05 (76')	9.5E-09 (41') 2.0E-03 (56')	1.3E-06 (2.5') 1.9E-07 (4')	-	-	-	-
Notes		Boring is located on upper terrace and is approximately 10' higher than 11B 3-6	Boring is located on upper terrace and is approximately 10' higher than 11B 3-6	Terminate boring @75 feet due to heaving sands	Terminate boring @ 85 feet due to heaving sands	Clay layer @90-99' is probably a confining layer based on a waterlevel of 71'	-	-	-	-	-
Localized Suitability for Groundwater Recharge		Good	Very Good	Good	Fair to Good	Fair	Good	Good	Fair to Good	Good	Fair to Good
Overall Suitability for Groundwater Recharge		Good									

Notes:
1) Groundwater levels in the soil borings represent first encountered water
2) Groundwater depths in CPT holes were calculated from pore pressure dissipation test results
3) Density/consistency based on blow counts for soil borings and Standard Penetration Tests for CPT
4) Low permeability layers based on density/consistency, boring logs, CPT logs, and laboratory results

Kings River Conservation District
North Fork Group Potential Recharge Site Exploration
Summary of Subsurface Explorations - Site 11

		Soil Borings						Cone Penetration Tests			
Description		**11B-1**	**11B-2**	**11B-3**	**11B-4**	**11B-5**	**11B-6 (continuous)**	**CPT 11-1**	**CPT 11-2**	**CPT 11-3**	**CPT 11-4**
Total Depth (ft)		80	75	85	85	100	75	105	121	126	94
Depth to GW (ft)		Not encountered	70	71	71	71	71	84	77	95	74
Soil Types (0-50 feet)	**SW/SP**	34%	59%	44%	51%	21%	60%	51%	69%	51%	49%
	SM	36%	23%	14%	14%	55%	10%	30%	18%	22%	24%
	ML	15%	18%	31%	20%	14%	12%	12%	11%	16%	27%
	SC			10%	5%		12%				
	CL	15%		1%	10%	10%	6%	7%	2%	11%	
Soil Types (51-100 feet)	**SW/SP**	75%	60%	19%	49%	50%	70%	42%	16%	44%	7%
	SM	17%	40%	30%	35%	10%	4%	30%	30%	20%	34%
	ML	8%		32%	13%	15%	11%	20%	36%	36%	48%
	SC			15%		5%	4%				
	CL			4%	3%	20%	11%	8%	18%		11%
Soil Types (100+ feet)	**SW/SP**							40%	19%	4%	
	SM							40%	38%	12%	
	ML							20%	29%	40%	
	SC										
	CL								14%	44%	
Perched Aquifers (depth in feet)		None	41-46	41	31, 41, 45	36, 75	65	-	-	-	-
Low Permeability Layers (depth in feet)		20, 30-35, 45, 71	30-35, ~48?	15, 20-35	26, 76	16-23, 41, 65-70, 80-85, 90-99	3, 7, 36-42, 43, 69-72	77	58, 102	45	None
Dry Layers (depth in feet)		65	6, 25	None	None	70	None	-	-	-	-
Blow Counts (min-avg-max)		12 - 40 - 77	12 - 46 - 85	11 - 35 - 74	12 - 38 - 79	15 - 52 - 184	NA (continuous sampling)	22 - 45 - 100+	15 - 58 - 100+	18 - 39 - 100+	15 - 45 - 100+
Density/Consistency		loose to dense, soft to hard	loose to dense, soft to stiff	loose to dense, firm to hard	loose to dense, firm to hard	loose to very dense, firm to hard	NA (continuous sampling)	medium dense to very dense / very stiff to hard	medium dense to very dense / hard	medium dense to very dense / very stiff to hard	medium dense to very dense / very stiff to hard
Permeability (cm/sec at depth)		2.3E-02cm/sec (21') 2.5E-04cm/sec (31') 1.1E-02cm/sec (51')	3.9E-04cm/sec (31') 1.6E-02cm/sec (46') 3.9E-02cm/sec (61')	1.5E-06cm/sec (26') 1.3E-04cm/sec (36')	8.9E-06cm/sec (26') 2.8E-05cm/sec (76')	9.5E-09cm/sec (41') 2.0E-03cm/sec (56')	1.3E-06cm/sec (2.5') 1.9E-07cm/sec (4')	-	-	-	-
Notes		Boring is located on upper terrace and is approximately 10' higher than 11B 3-6	Boring is located on upper terrace and is approximately 10' higher than 11B 3-6	Terminate boring @75 feet due to heaving sands	Terminate boring @ 85 feet due to heaving sands	Clay layer @90-99' is probably a confining layer based on a waterlevel of 71'	-	-	-	-	-
Localized Suitability for Groundwater Recharge		Good	Very Good	Good	Fair to Good	Fair	Good	Good	Fair to Good	Good	Fair to Good
Overall Suitability for Groundwater Recharge		Good									

Notes:
1) Groundwater levels in the soil borings represent first encountered water
2) Groundwater depths in CPT holes were calculated from pore pressure dissipation test results
3) Density/consistency based on blow counts for soil borings and Standard Penetration Tests for CPT
4) Low permeability layers based on density/consistency, boring logs, CPT logs, and laboratory results

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-1

Soil Boring Summary Sheet
Hole No. 11B-1

Project Name	North Fork Group Potential Recharge Site Exploration
Project Number	1364 05V2
Feature	Soil Boring
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co
Hole Location	SW corner of site 11, 11B3.....160' E. of powerpole @N/S Rd
	in center of site 11, on the berm bordering alfalfa field. South side of Coleman.
Drilling Contractor	Technicon
Driller	
Drill Rig Type	CME 55
Drilling Started	11/30/2006
Drilling Completed	11/30/2006
Total Depth	80'
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B1-21	11/30/2006	Cal	grain size
11B1-31	11/30/2006	Cal	permeability
11B1-41	11/30/2006	Cal	grain size
11B1-51	11/30/2006	Cal	permeability

Groundwater Levels

Date	Time	Depth (bgs)
not encountered		

Remarks: terminate boring @ 80' due to heaving sands

SOIL BORING LOG
HOLE NO. 11B-1

Hole No. 11B-1 Date: 11-30-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: Southwest corner of site 11

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM		surface = silty sand, light grey, medium grained, dry
1				
2				
3		SM		silty sand, brown, medium to fine grained, slightly moist, loose
4				
5		SM		silty sand - as above
6		SP	14	sand with trace of silt, light grey, very fine grained, loose, slightly moist
7				
8				
9				
10		SM		silty sand, light brown, fine grained, loose, slightly moist
11		SP	19	sand, light grey, very fine grained, medium dense, slightly moist
12				
13				
14				
15		SM		sand, grey, very fine, medium dense, moist
16		SP	31	sand with trace of silt, light grey, very fine grained, medium dense, slightly moist
17				
18				
19				
20	11B1-21, gs	ML		sandy silt, grey brown, very fine sand, soft, slightly moist
21		SP	29	sand, light grey, fine to medium grained, medium dense, slightly moist
22				
23				
24				
25		ML		sandy silt, light grey/brown, very fine sand, medium soft, slightly moist
26		SP	41	sand, grey, fine to medium grained, medium dense, slightly moist
27				
28				
29				
30		C		silty clay, brown, soft, slightly moist, slightly plastic
31	11B1-31,p	ML	47	silt, light brown/grey, hard, slightly most
32				
33				
34				
35		C		silty clay, brown, soft, moist
36		SM		silty sand, brown, soft, moist
37		SP	22	sand, grey/brown, fine grained, medium dense, moist
38				
39				
40				
41	11B1-41, gs	SM	12	silty sand, yellow/brown, fine grained, loose, moist
42				
43				
44				
45		C		clay, yellow/grey with oxidation mottling, hard, moist
46		SM	77	silty sand yellow/brown, very fine grained, medium dense, moist
47				
48				
49				
50				
51	11B1-51, p	SP	49	sand, orange/grey, fine grained, medium dense, moist
52				
53				
54				
55				

SOIL BORING LOG
HOLE NO. 11B-1

Hole No. 11B-1

Date: 11-30-06

Project Name: North Fork Group AB303

Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: Southwest corner of site 11

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
56		SP	48	sand as above, slightly moist
57				
58				
59				
60				
61		SP	59	sand as above, dense
62				
63				
64				
65		SM		silty sand, grey/brown, stiff, dry
66		SP	66	sand as above
67				
68				
69				interbedded silty sand, sand as above
70		SM		silty sand, dark brown, medium grained, loose, moist
71		ML	41	sandy silt, yellow brown, hard, moist
72				
73				
74				
75				
76		SP	41	sand, light grey/orange, fine grained, medium dense, very moist
77				
78				
79				
80				Terminate at 80' due to heaving sand

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Wiess
Sampled:	11/30/2006	Date:	12/8/2006
TES#:	16725.003	Sample No.:	\\ B-1@21'
		Remarks:	Poorly Graded SAND (SP)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.	200	Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	194.3	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash	194.3	1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	191.6	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.	0	0.0	0.0	100.0	
#4	0.0	0.0	0.0	100.0	
#8	0.0	0.0	0.0	100.0	
#16	0.2	0.1	0.1	99.9	
#30	14.8	7.6	7.7	92.3	
#50	80.6	41.5	49.2	50.8	
#100	73.0	37.5	86.7	13.3	
#200	21.8	11.2	97.9	2.1	
Pan					

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	EZ
		Date:	12/8/2006
TES#:	16725.003	Sample No.:	B-1@41'
Lab #:		Remarks:	Silty SAND (SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.	200	Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	178.0	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash	178.0	1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	101.2	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.	0	0.0	0.0	100.0	
#4	0.0	0.0	0.0	100.0	
#8	0.0	0.0	0.0	100.0	
#16	0.4	0.2	0.2	99.8	
#30	9.0	5.1	5.3	94.7	
#50	26.6	14.9	20.2	79.8	
#100	29.0	16.3	36.5	63.5	
#200	32.2	18.1	54.6	45.4	
Pan					

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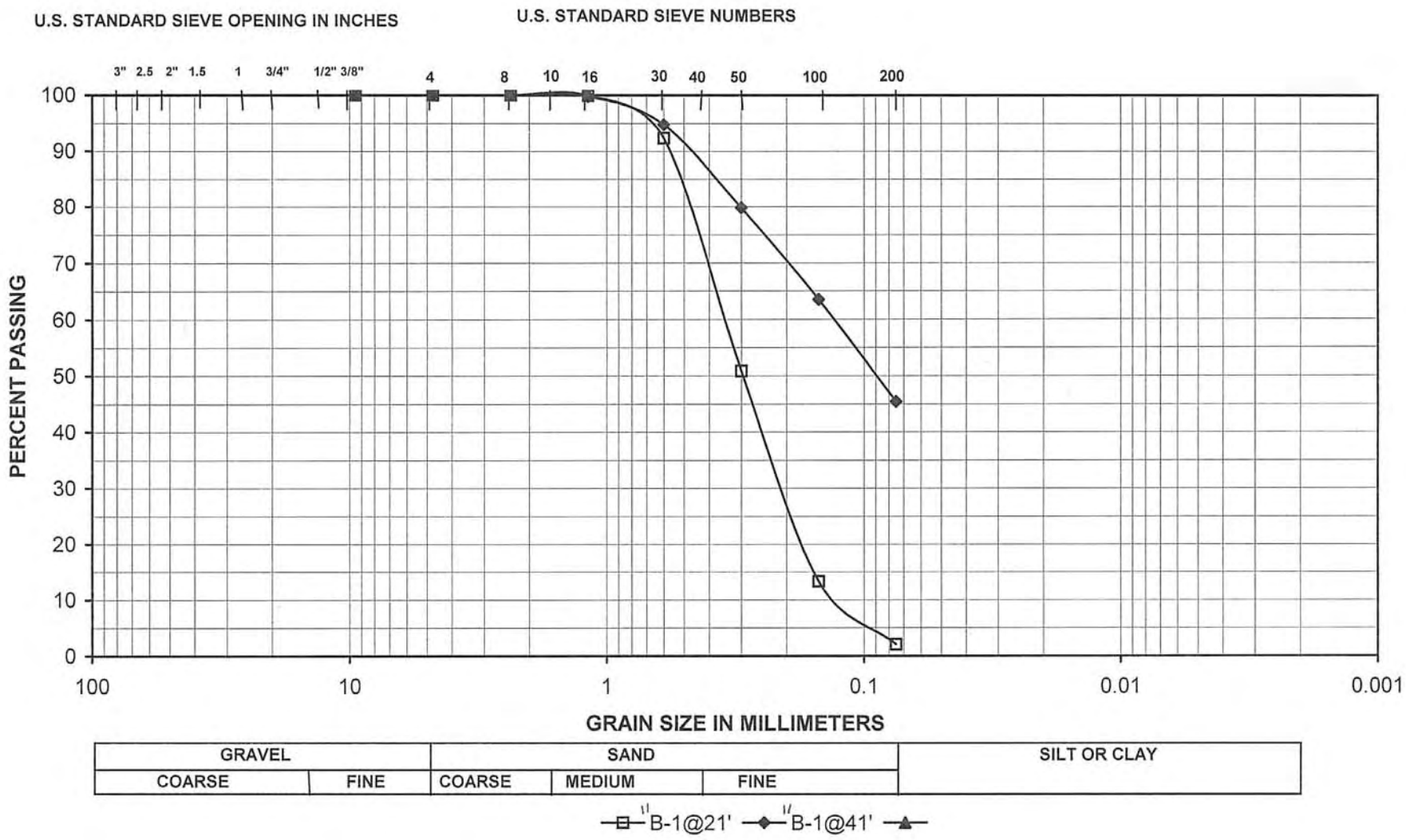

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI	Project:	KRCD North Fork Group
B-1@21'	Poorly Graded SAND (SP)	0	97.9	2.1	2.9				Sampled:	11/30/2006
B-1@41'	Silty SAND (SM)	0	54.6	45.4	12.4				TES#:	16725.003
									Tested:	12/8/2006

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD North Fork Group	Sampled:	11/30/2006
Project Number:	16725.003	Tested:	12/21/2006
Sample Location:	| | B-1 @ 31'	Technician:	M. Connell

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	554.67
Area Of Sample(A):	4.60	Weight Of Tube:	100.8
Length Of Sample(L):	3.01	Weight Of Sample:	453.87

Permeability (K)

2.45E-04 cm/sec

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/21/2006	11:12:00	11:33:15	1.00	9.50	2.0	
12/21/2006	11:33:15	11:56:30	9.50	18.00	2.0	
12/21/2006	11:57:00	12:15:15	1.00	9.50	2.0	
12/21/2006	12:16:00	12:42:52	1.00	12.50	2.0	
12/21/2006	12:43:40	13:03:15	1.00	9.50	2.0	
12/21/2006	13:03:45	13:22:15	1.00	9.50	2.0	

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD North Fork Group	Sampled:	11/30/2006
Project Number:	16725.003	Tested:	12/14/2006
Sample Location:	|| B-1 @ 51'	Technician:	M. Connell

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	554.67
Area Of Sample(A):	4.60	Weight Of Tube:	100.8
Length Of Sample(L):	3.01	Weight Of Sample:	453.87

Permeability (K)

1.14E-02 cm/sec

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/14/2006	12:32:00	12:32:30	1.00	10.90	0.0	
12/14/2006	12:33:30	12:34:00	1.00	11.60	0.0	
12/14/2006	12:34:30	12:35:00	1.00	11.70	0.0	
12/14/2006	12:35:30	12:36:00	1.00	11.60	0.0	
12/14/2006	12:36:30	12:37:00	1.00	11.60	0.0	
12/14/2006	12:37:30	12:38:00	1.00	11.60	0.0	
12/14/2006	12:38:30	12:39:00	1.00	11.60	0.0	
12/14/2006	12:39:30	12:40:00	1.00	11.60	0.0	

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-2

Soil Boring Summary Sheet
Hole No. 11B-2

Project Name	North Fork Group Potential Recharge Site Exploration
Project Number	1364 05V2
Feature	Soil Boring
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co
Hole Location	SW corner of site 11, 11B3.....192' S. of edge of Rd. West side of property
Drilling Contractor	Technicon
Driller	NA
Drill Rig Type	CME 55
Drilling Started	12/1/2006
Drilling Completed	12/1/2006
Total Depth	75'
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B2-31	12/1/2006	Cal	permeability
11B2-46	12/1/2006	Cal	grain size
11B2-61	12/1/2006	Cal	permeability
11B2-66	12/1/2006	Cal	grain size

Groundwater Levels

Date	Time	Depth (bgs)
12/1/2006	12:15 PM	69.5'

Remarks: terminate boring at 75' due to heaving sands

SOIL BORING LOG
HOLE NO. 11B-2

Hole No. 2B-1 Date: 12-01-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: west side site 11, 11B2

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM		Surface - silty sand, light grey/light brown, fine to medium grained, loose
1				
2				
3				
4				
5		SM		silty sand, light grey, fine to medium grained, dry, loose
6		SP	13	sand, yellow/grey, fine grained, loose, dry
7				
8				
9				
10		SP		sand, brown/orange, fine grained, loose, moist
11		SP	12	sand, grey/yellow, medium grained, loose, moist
12				
13				
14				
15				
16		SP	18	sand, grey, medium grained, loose, moist
17				
18				
19				
20		SM		silty sand, yellow/brown, fine grained, loose, moist
21		SP	24	sand, grey, medium grained, medium dense, moist
22				
23				
24				
25		SM		silty sand, yellow/brown, fine grained, stiff, dry
26		SP	38	sand, grey, medium grained, medium dense, moist
27				
28				
29				
30		ML	32	sandy silt, grey/brown, stiff, moist
31	11B2-31, p			
32				
33				
34				
35		ML		clayey silt, grey, soft, very moist
36		SP	36	sand, yellow/orange, fine grained, medium dense, moist
37		ML		sandy silt, grey/brown, stiff, moist
38				
39				
40				
41		SP	53	sand, grey with oxidation mottling, medium grained, medium dense, saturated.
42				
43				
44				interbedded sand / silty sand, saturated
45		SP		sand, grey, medium grained, dense, saturated
46	11B2-46, gs		76	Poorly graded sand w/ silt, grey/brn with purple mottling, med. grained, dense, sat'd
47				
48				
49				
50		SP		sand, yellow, fine grained, dense, very moist
51			68	sand with silt, orange/brown, fine grained, dense, moist
52				
53				
54				
55		SP	62	sand, grey/yellow, medium grained, dense, moist

SOIL BORING LOG
HOLE NO. 11B-2

Hole No. 2B-1

Date: 12-01-06

Project Name: North Fork Group AB303

Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: west side site 11, 11B2

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
56		SP		
57				
58				
59				
60		SP	85	sand, grey, fine grained, dense, moist
61	11B2-61, p			
62				
63				
64				
65		SM	39	Silty sand, yellow/orange, fine to medium grained, medium dense, moist
66	11B2-66, gs			
67				
68				
69				water at 69.5 bgs @ 12:15
70		SM		
71			70	silty sand, orange/grey, very fine to fine, hard, dense, very moist
72				
73				
74				
75		SP	71	sand, grey, fine grained, dense, very moist to saturated
76				terminate boring @ 75' due to heaving sand

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Requested Test	☐
Sample Prepared	☒
Test Completed	☒

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: KRCD North Fork Group Project #: 16725-V44

Requested By: Shay Overton / Provo & Pritchard Date: 12-01-06 Due By: ASAP #1 Priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / B2 / 31												X					
11 / B2 / 46							Maybe	X	X	X							Run 200 wash first
11 / B2 / 61												X					if soil is sandy run
11 / B2 / 66								X									Fine sieve, if silt run
11 / B3 / 31										X	X						Hydrometer.
11 / B3 / 26													X				

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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Sieve Analysis for Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/8/2006
TES#:	16725.004	Sample No.:	Site 11; B-2 @ 46'
Lab #:		Remarks:	Poorly Graded SAND w/ Silt (SP-SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	188.1	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	178	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.	0	0.0	0.0	100.0	
#4	0.0	0.0	0.0	100.0	
#8	0.0	0.0	0.0	100.0	
#16	0.4	0.2	0.2	99.8	
#30	24.0	12.8	13.0	87.0	
#50	74.1	39.4	52.4	47.6	
#100	64.8	34.4	86.8	13.2	
#200	13.1	7.0	93.8	6.2	
Pan	1.6	0.850611377			

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/8/2007
TES#:	16725.004	Sample No.:	Site 11; B-2 @ 66'
Lab #:		Remarks:	Silty SAND (SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	169.8	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	123.1	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.	0	0.0	0.0	100.0	
#4	0.2	0.1	0.1	99.9	
#8	0.0	0.0	0.1	99.9	
#16	0.1	0.1	0.2	99.8	
#30	6.9	4.1	4.3	95.7	
#50	37.5	22.1	26.4	73.6	
#100	41.4	24.4	50.7	49.3	
#200	32.3	19.0	69.8	30.2	
Pan	4.5	2.650176678			

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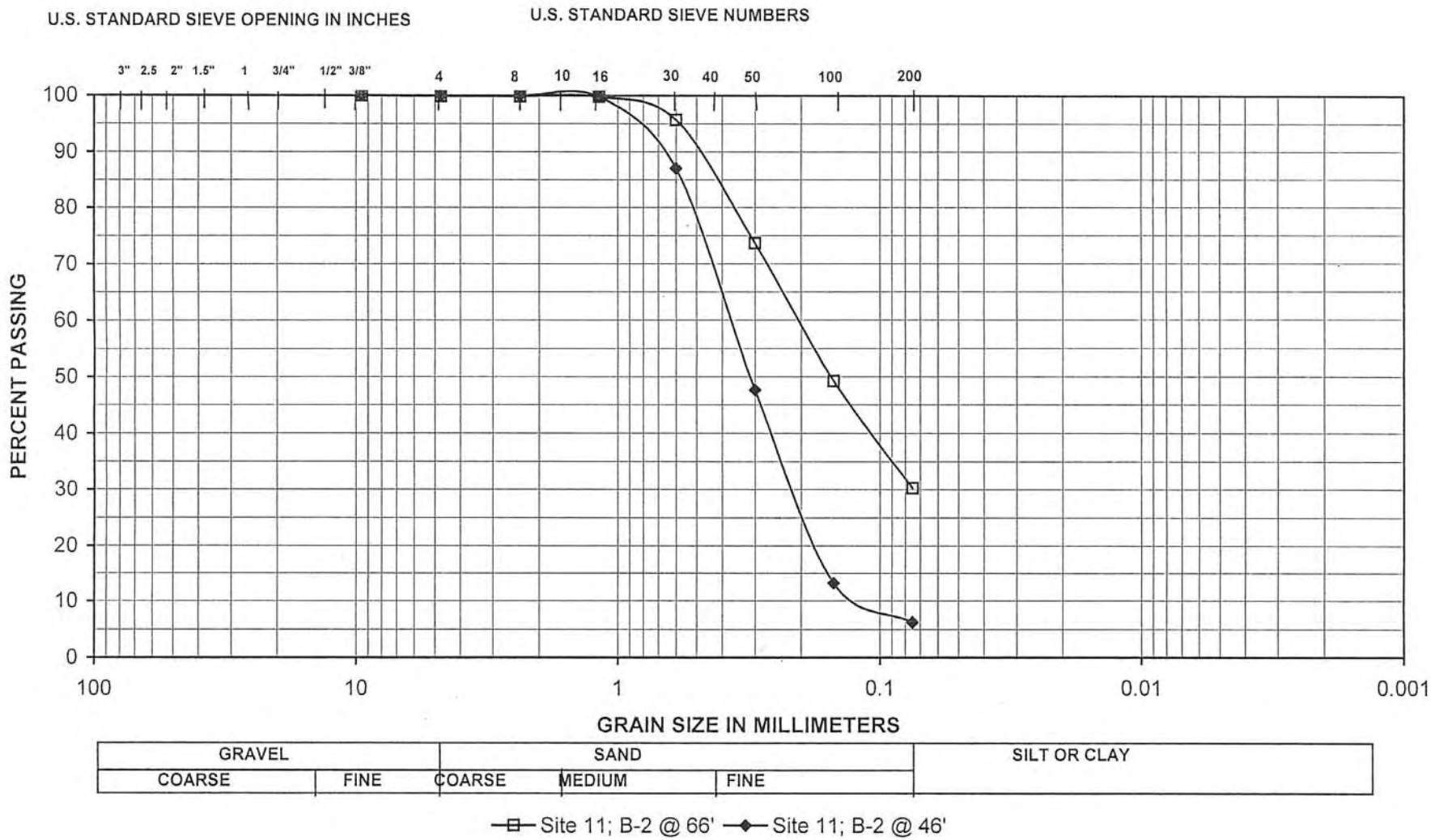

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI
Site 11; B-2 @ 66'	Silty SAND (SM)	0.1	69.6	30.2	17.8			
Site 11; B-2 @ 46'	Poorly Graded SAND w/ Silt (SP-SM)	0	93.8	6.2	6.3			

Project:	KRCD North Fork Group
TES#:	16725.004
Date:	12/8/2006 Date Sampled: 12/1/2006

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD	Samp. By:	Shay Overton
Project Number:	16725.004	Samp. Date:	12/1/2006
Sample Location:	Site 11; B-2 @ 31'	Tested By:	MC

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	0
Area Of Sample(A):	4.60	Weight Of Tube:	0
Length Of Sample(L):	6	Weight Of Sample:	0

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/19/2006	10:17:00	11:12:00	1.00	13.10	5.5	
12/19/2006	11:13:30	12:15:30	1.00	14.50	5.5	
12/19/2006	12:16:00	13:33:00	1.00	17.20	5.5	
12/19/2006	13:33:30	14:12:30	1.00	9.50	5.5	
12/19/2006	14:12:30	14:54:30	1.00	18.20	5.5	
12/19/2006	14:56:30	15:58:00	1.00	14.50	5.5	
12/19/2006	15:58:30	16:36:30	1.00	9.50	5.5	

Permeability (K) = aL/AL = **3.92E-04 cm/sec**

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD	Samp. By:	Shay Overton
Project Number:	16725.004	Samp. Date:	12/1/2006
Sample Location:	Site 11; B-2 @ 61'	Tested By:	MC

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	0
Area Of Sample(A):	4.60	Weight Of Tube:	0
Length Of Sample(L):	6	Weight Of Sample:	0

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/14/2006	12:41:30	12:42:00	1.00	15.80	0.0	
12/14/2006	12:43:00	12:43:30	1.00	15.80	0.0	
12/14/2006	12:44:00	12:44:30	1.00	15.80	0.0	
12/14/2006	12:45:00	12:45:30	1.00	15.80	0.0	
12/14/2006	12:46:00	12:46:30	1.00	15.80	0.0	
12/14/2006	12:47:00	12:47:30	1.00	15.80	0.0	
12/14/2006	12:48:00	12:48:30	1.00	15.80	0.0	
12/14/2006	12:49:00	12:49:30	1.00	15.80	0.0	

Permeability (K) = aL/AL = **3.94E-02 cm/sec**

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-3

Soil Boring Summary Sheet
Hole No. 11B-3

Project Name	North Fork Group AB303 Groundwater Study
Project Number	1364 05V2
Feature	Soil Boring
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co
Hole Location	South east corner of Site 11, ~120' north of southern access road and ~165' west of Chestnut 105' N and 35' W of North west corner of fence that boarders site 11 on south side and 100' east of east bank
Drilling Contractor	Technicon
Driller	NA
Drill Rig Type	CME 55
Drilling Started	12/1/2006
Drilling Completed	12/4/2006
Total Depth	85'
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B3-26	12/1/2006	California	permeability
11B3-31	12/1/2006	California	grain size
11B3-36	12/9/2006	California	permeability
11B3-76	12/4/2006	California	grain size

Groundwater Levels

Date	Time	Depth (bgs)
12/4/2006	11:25am	71'

Remarks: terminated boring due to hearing sands

SOIL BORING LOG
HOLE NO. 11B-3

Hole No. 2B-1 Date: 12-01-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: South east corner of Site 11, ~120' north of southern access road and ~165' west of Chestnut

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM		surface, silty sand, light brown, fine to medium grained, dry, loose
1				
2				silty sand, brown, fine to medium grained, loose, moist
3		SP		sand, grey, fine grained, dry, loose
4		SP		silty sand, brown, fine to medium grained, loose, moist
5		SM		silty sand, light brown, slightly moist, loose, fine
6		SP	21	sand, grey/orange, fine grained, medium dense, slightly moist
7				
8				
9				
10				sand, brown/grey, fine grained, loose, moist
11		SP	11	sand, grey with orange mottling, fine to medium grained, loose, moist
12				
13				
14				
15		ML		clayey silt, grey/black, soft, moist
16		SP	13	sand, grey with evident oxidized mottling, medium grained, loose, moist
17				
18				
19				
20		SP		sand, grey, medium grained, loose, moist
21		ML	16	silt, grey, firm, moist
22				
23				
24				
25				
26	11B3-26, p	ML	16	silt, grey, firm, moist
27				
28				
29				
30				
31	11B3-31, gs	C		Sandy clayey silt, light brown/orange, moist
32		ML	30	sandy clayey silt, grey/brown with oxidized streaks, stiff, moist
33				
34				
35				
36	11B3-36, p	SC	74	silty/clayey sand, yellow brown, dense, moist, partially cemented
37				
38				
39				
40				
41		SW	30	sand with some silt, yellow/brown, very fine to fine grained, medium dense, saturated
42				
43				
44				
45				
46		SP	48	sand, light grey, medium grained, medium dense, very moist
47				
48				
49				
50		SM		silty sand, yellow/brown, fine to medium grained, medium dense, very moist
51		SP	47	sand, grey, medium grained, medium dense, moist
52				
53				
54				

SOIL BORING LOG
HOLE NO. 11B-3

Hole No. 2B-1 Date: 12-01-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: South east corner of Site 11, ~120' north of southern access road and ~165' west of Chestnut

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
55		SM		silty sand, yellow/brown, fine to medium grained, medium loose, moist
56		SP	32	sand, grey, medium dense, moist
57		ML		silt, yellow/grey, medium soft, moist
58				
59				
60		ML		silt, grey/yellow, soft, moist
61		SP	45	sand with silt, yellow/grey, fine grained, medium dense, moist
62				
63				
64				
65		SM	32	silty sand, grey/yellow, very fine grained, stiff, very moist
66		ML		grades into pure, yellow, oxidized silt
67				
68				
69				
70		SC		
71			11	clayey sand, yellow/brown, very fine grained, loose, very moist
72				
73				
74				
75		ML		
76	11B3-76, gs		73	sandy silt, yellow, hard, very fine sand, moist
77				
78				
79				
80				
81		SP	54	silty sand, grey/brown, very fine grained, dense, moist
82		SP		
83				
84				
85				terminate boring @ 85' due to heaving sands
86				water level = 71' @ 11:25 am

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.004

Requested Test	╱
Sample Prepared	╳
Test Completed	☒

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: KRCD North Fork Group Project #: 16725-V44

Requested By: Shay Overton / Provo & Pritchard Date: 12-01-06 Due By: ASAP #1 Priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / B2 / 31												X					
11 / B2 / 46							Maybe	X	X	X							
11 / B2 / 61												X					
11 / B2 / 66								X									
11 / B3 / 31										X	X						
11 / B3 / 26													X				

Run 200 wash FIRST
If soil is sandy run
Fine sieve, if silt run
Hydrometer.

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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-005

Requested Test	⧄
Sample Prepared	⧅
Test Completed	⧅

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: NF6 / KRCD Project #: NF6 16725-V44

Requested By: Shay Overton / Provo. & Pritch. Date: 12-04-06 Due By: ASAP # 1 priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / B3 / 36												X					
11 / B3 / 76										X	X						
11 / B4 / 26													X	VECTOR			
11 / B4 / 46									X	X	X						If over 50% passing #200 run hydrometer. If over 50% run Fine sieve.
11 / B4 / 66									X	X	X						
11 / B4 / 76													X	VECTOR			

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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Sieve Analysis for Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/8/2006
TES#:	16725.004	Sample No.:	Site 11; B-3 @ 31'
Lab #:		Remarks:	Sandy Clayey SILT (ML)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	166.0	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	10.1	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16		0.0	0.0	100.0	
#30		0.0	0.0	100.0	
#50		0.0	0.0	100.0	
#100		0.0	0.0	100.0	
#200	10.1	6.1	6.1	93.9	
Pan	155.9	93.9			

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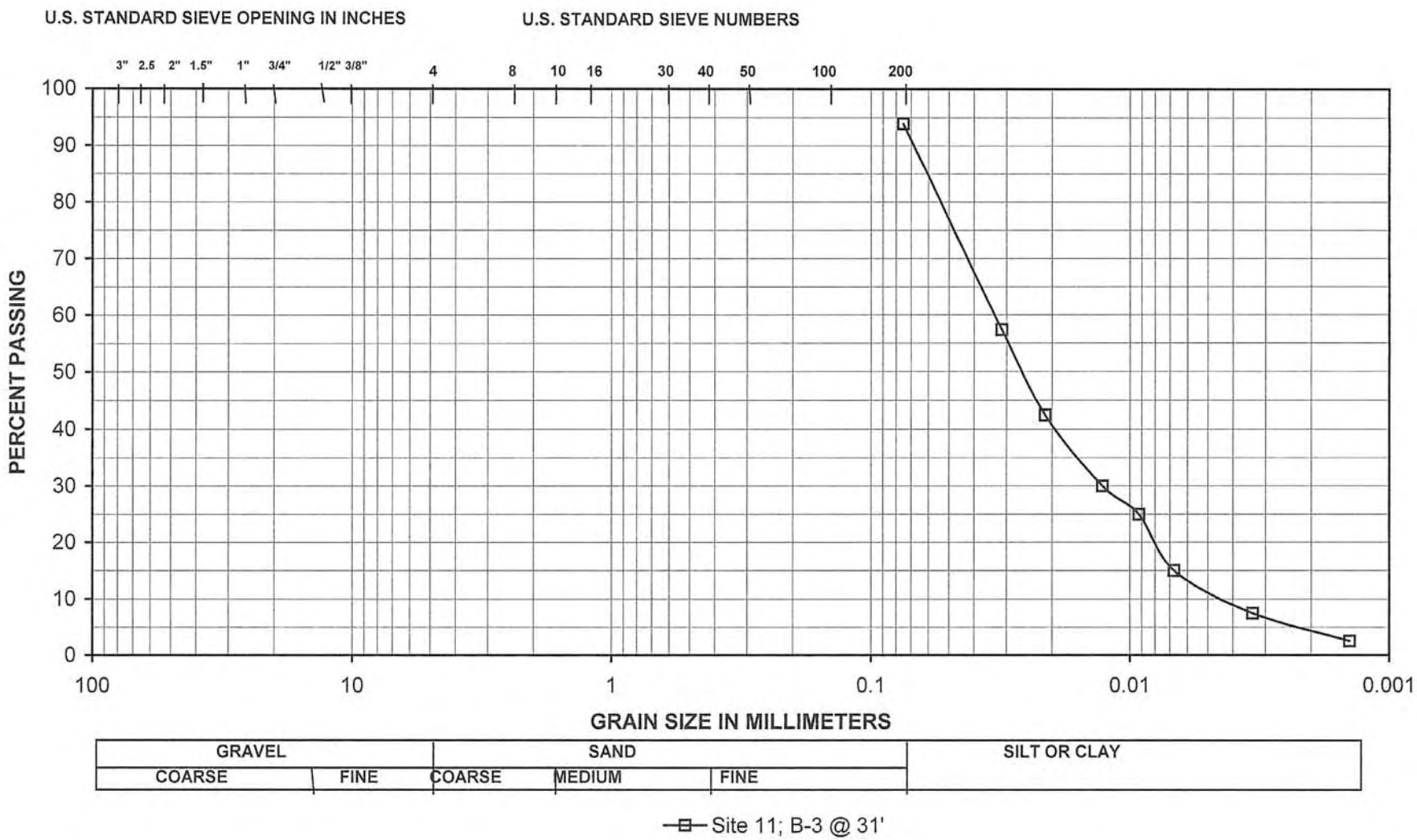
HYDROMETER TEST DATA SUMMARY
ASTM D 422-63

H_2O

PROJECT:	KRCD North Fork Group		TES # : 16725.004
Boring Number	Site 11; B-3 @ 31'	TESTED BY: MW	DATE: 12/11/2006
Sample Depth, ft			

Mass of Test Sample, g	75.00	"air-dried"	Hydrometer Type	151H
Mass of Hygroscopic Sample, g	15.00	"air-dried"		
Mass of Hygroscopic Sample, g	12.10	"oven-dried"	Specific Gravity of Test Material	2.650
Mass of Test Sample, g	60.50	"oven-dried"	Specific Gravity of Test Solution	1.0000

Time (min.)	Hydrometer Reading	Corrected Reading	Temperature Degrees C	Effective Depth Table 2 (cm)	Constant, K Table 3	Diameter, D (mm)	Amt. Suspended, P (%)
2	1.0230	1.0230	19	10.2	0.01382	0.0312	57.3
5	1.0170	1.0170	19	11.8	0.01382	0.0212	42.4
15	1.0120	1.0120	20	13.1	0.01365	0.0128	29.9
30	1.0100	1.0100	20	13.7	0.01365	0.0092	24.9
60	1.0060	1.0060	20	14.7	0.01365	0.0068	15.0
250	1.0030	1.0030	21	15.5	0.01348	0.0034	7.5
1440	1.0010	1.0010	21	16.0	0.01348	0.0014	2.5



Sample #	Classification	% Gravel	% Sand	% Silt	% Clay*	% Moist.	LL	PL	PI
Site 11; B-3 @ 31'	Sandy Clayey SILT (ML)	0.0	6.1	83.4	10.5	20.5			

Project:	KRCD North Fork Group	
TES#:	16725.004	
Date:	12/8/2006	Date Sampled: 12/1/2006

* 5 Micron

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M Weiss
		Date:	12/6/2006
TES#:	16725.005	Sample No.:	Site 11; B-3 @ 76'
Lab #:		Remarks:	Sandy SILT(ML)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	164.6	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	70.7	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16		0.0	0.0	100.0	
#30		0.0	0.0	100.0	
#50		0.0	0.0	100.0	
#100		0.0	0.0	100.0	
#200	70.7	43.0	43.0	57.0	
Pan	93.9	57.0			

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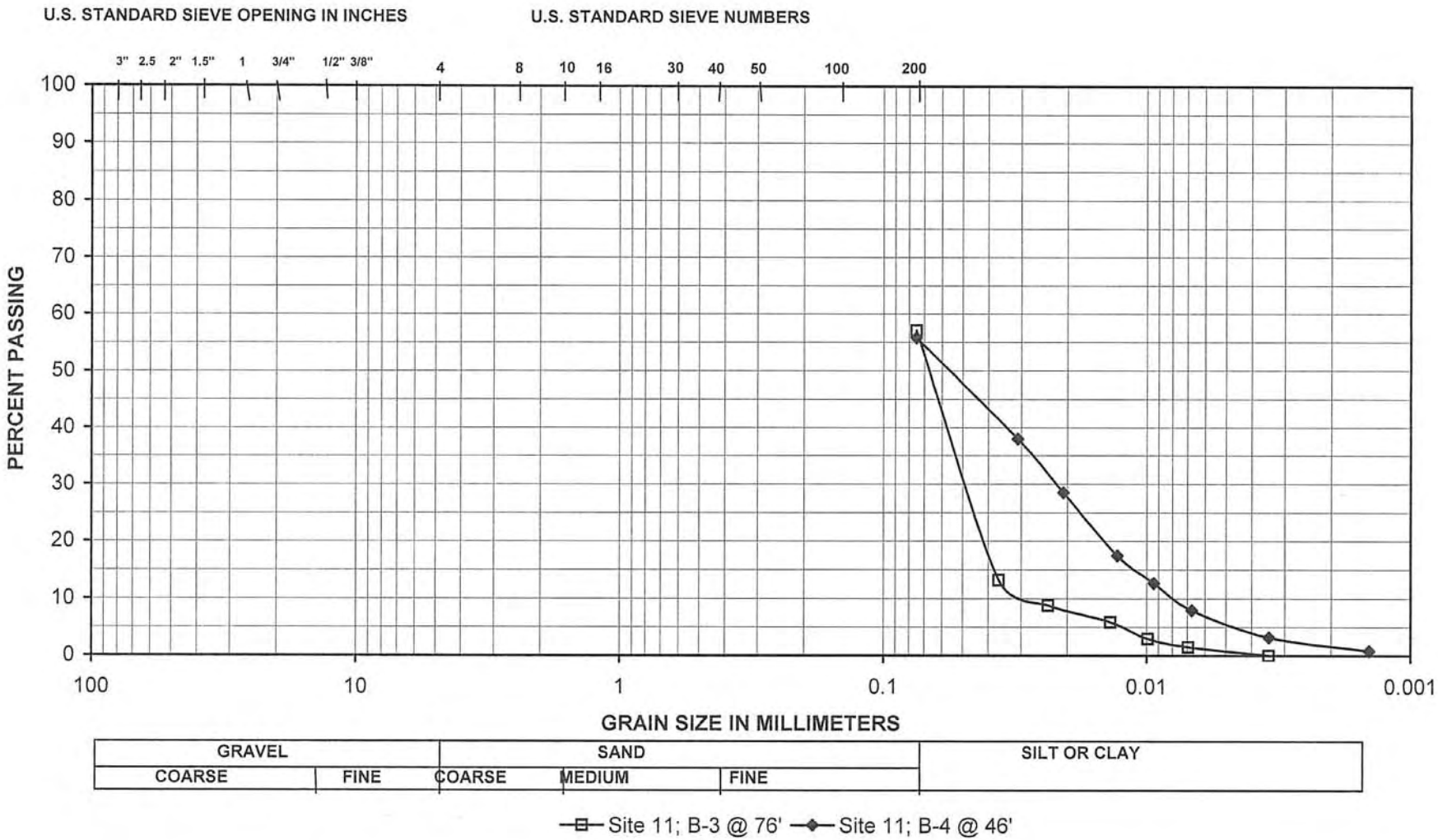
HYDROMETER TEST DATA SUMMARY
ASTM D 422-63

H_2O

PROJECT:	KRCD North Fork Group		TES # : 16725.005
Boring Number	Site 11; B-3 @ 76'	TESTED BY: MW	DATE: 12/11/2006
Sample Depth, ft			

Mass of Test Sample, g	75.00	"air-dried"	Hydrometer Type	151H
Mass of Hygroscopic Sample, g	15.00	"air-dried"		
Mass of Hygroscopic Sample, g	12.52	"oven-dried"	Specific Gravity of Test Material	2.650
Mass of Test Sample, g	62.60	"oven-dried"	Specific Gravity of Test Solution	1.0000

Time (min.)	Hydrometer Reading	Corrected Reading	Temperature Degrees C	Effective Depth Table 2 (cm)	Constant, K Table 3	Diameter, D (mm)	Amt. Suspended, P (%)
2	1.0090	1.0090	19	13.9	0.01382	0.0364	13.2
5	1.0060	1.0060	19	14.7	0.01382	0.0237	8.8
15	1.0040	1.0040	20	15.2	0.01365	0.0137	5.9
30	1.0020	1.0020	20	15.8	0.01365	0.0099	2.9
60	1.0010	1.0010	21	16.0	0.01348	0.0070	1.5
250	1.0000	1.0000	21	16.3	0.01348	0.0034	0.0
1440	1.0000	1.0000	21	16.3	0.01348	0.0014	0.0



Sample #	Classification	% Gravel	% Sand	% Silt	% Clay*	% Moist.	LL	PL	PI
Site 11; B-3 @ 76'	Sandy SILT(ML)	0.0	43.0	56.0	1.0	21.5			
Site 11; B-4 @ 46'	Clayey Sandy SILT (ML)	0.0	44.2	50.8	5.0	18.0			

Project:	KRCD North Fork Group	
TES#:	16725.005	
Date:	12/11/2006	Date Sampled: 12/4/2006

* 5 Micron

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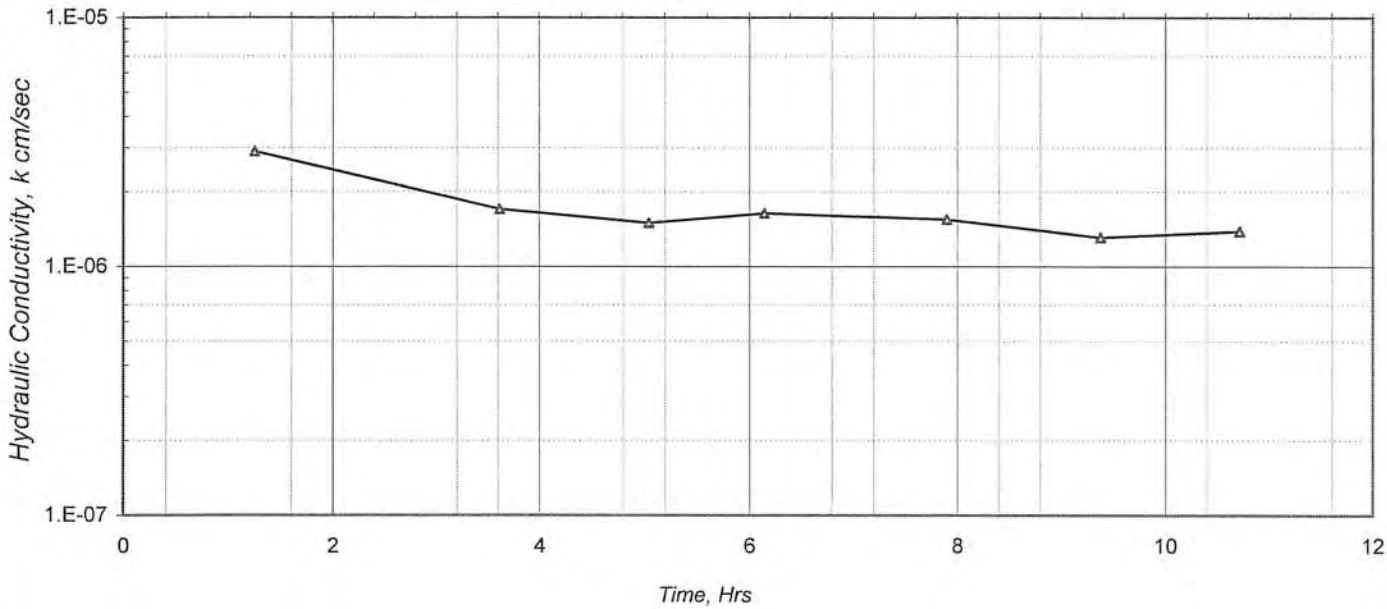
HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
KRCD	**16725.004**	

Sample ID:	Sample Date:
Site 11; B 3 @ 26'	**December 20, 2006**

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	**Site 11; B 3 @ 26'**	
DESCRIPTION:	Sandy SILT (ML)	
	INITIAL	FINAL
HEIGHT, in.	6.0	6.0
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	n/a	n/a
DRY DENSITY, pcf	n/a	n/a
SATURATION, %	n/a	n/a
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf	n/a	
OPTIMUM WATER CONTENT, %	n/a	
SPECIFIED COMPACTION, %	n/a	
ACHEIVED COMPACTION, %	n/a	

COMMENTS:
Tap water used as permeant

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	5 - 6
IN / OUT RATIO:	0.96
"B" PARAMETER:	0.95

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
1	1.3	2.9E-06
2	3.6	1.7E-06
6	9.4	1.3E-06

AVERAGE LAST 4 : **1.5E-06**
SPECIFICATION : **1.0E-06**
PASS

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of **TECHNICON** Engineering Services, Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of **TECHNICON** Engineering Services, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmless**TECHNICON** from and against all liability in excess of the aforementioned limit.

Reviewed By:

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD	Samp. By:	Shay Overton
Project Number:	16725.005	Samp. Date:	12/4/2006
Sample Location:	Site 11; B-3 @ 36'	Tested By:	MC

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	0
Area Of Sample(A):	4.60	Weight Of Tube:	0
Length Of Sample(L):	6	Weight Of Sample:	0

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/26/2006	14:52:00	15:48:30	1.00	1.70	6.0	
12/27/2006	15:48:30	8:57:37	1.70	13.80	6.0	
12/27/2006	8:58:30	11:50:30	1.00	3.00	6.0	
12/27/2006	11:50:30	11:52:00	1.00	17.70	6.0	
12/28/2006	8:13:00	12:17:00	1.00	4.50	6.0	
12/28/2006	12:17:00	14:15:00	4.50	6.30	6.0	
12/28/2006	14:15:30	15:41:30	1.00	2.30	6.0	

Permeability (K) = aL/AL = **1.34E-04 cm/sec**

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-4

Soil Boring Summary Sheet
Hole No. 11B-4

Project Name	North Fork Group Potential Recharge Site Exploration
Project Number	1364 05V2
Feature	Soil Boring
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co.
Hole Location	SE corner site 11 ~ 120' North of southern access road ~ 165' west of Chestnut
Drilling Contractor	Technicon
Driller	NA
Drill Rig Type	CME 55
Drilling Started	12/4/2006
Drilling Completed	12/5/2006
Total Depth	85 feet
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B4-26	12/4/2006	Cal	permeability
11B4-46	12/4/2006	Cal	grain size
11B4-66	12/4/2006	Cal	grain size
11B4-76	12/4/2006	Cal	permeability

Groundwater Levels

Date	Time	Depth (bgs)
12/5/2006	9:31am	70.7'
12/5/2006	9:45am	70.7'

Remarks: Terminate boring due to heaving sands @ 85'

SOIL BORING LOG
HOLE NO. 11B-4

Hole No. 11B-4 Date: 12-04-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: SE corner site 11 ~ 120' North of southern access road ~ 165' west of Chestnut

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM		surface - silty sand, light brown/grey, fine to medium, loose, dry
1				silty sand, loose, brown, dry
2				
3		SP		sand, grey, medium grained, loose, dry
4				
5		SP	12	sand, light grey, medium grained, loose, moist
6				
7				
8				
9		SP		sand with trace of silt, brown/grey, fine to medium grained, loose, moist
10			14	sand, light grey, medium grained, medium dense, moist
11				
12				
13				
14				
15		SP	25	sand as above
16				
17				
18				
19				
20				
21		SP	19	sand with some silt, grey with black streaks, very fine grained, medium dense, moist
22				
23				
24				
25		SP		silty sand, grey, fine grained, medium soft, moist
26	11B4-26, p	ML	32	silt, grey, hard, slightly moist
27				
28				
29				
30		SP		
31			23	sand with trace of silt, grey, medium grained, medium dense, saturated
32				grading into pure sand
33				
34				
35		ML	15	silt, grey, firm, very moist
36				
37				
38				
39				
40		SC		clayey sand, grey, fine grained, stiff, moist
41		C	35	sandy clay, grey, medium grained, stiff, medium dense, saturated
42				
43				
44				
45		C		silty clay, grey with oxidation mottling, soft, saturated
46	11B4-46, gs	ML	29	clayey sandy silt, yellow orange, fine grained, medium dense, very moist
47				
48				
49				
50		SC		clayey sand, grey with oxidation mottling, fine grained, medium dense, moist
51		SP	35	sand, grey/orange, medium grained, medium dense, moist
52				
53				
54				

SOIL BORING LOG
HOLE NO. 11B-4

Hole No. 11B-4 Date: 12-04-06

Project Name: North Fork Group AB303 Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: SE corner site 11 ~ 120' North of southern access road ~ 165' west of Chestnut

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
55		SM		silty sand, light brown with white mottling, fine grained, friable, dense, slightly moist
56		SP	54	sand, grey/orange, medium grained, dense, moist
57				
58				
59		SM		silty sand, as above
60		SP	54	sand as above
61				
62				
63				
64				
65				interbedded sand and silty sand in lenses up to 6 inches thick
66	11B4-66, gs	SM	59	silty sand, yellow/grey, medium grained, dense, moist
67		SP		sand, grey, medium grained, dense, moist
68				
69				
70				
71		??	41	no sample retrieved
72				
73				
74				
75		SP		sand, grey/orange, fine to very fine grained, dense, very moist
76	11B4-76, p	ML	74	sandy silt, grey with oxidized mottle, hard, moist
77				
78				
79				
80		ML		silt, grey with oxidized sand stringers, moist
81		SM	79	silty sand, grey, very fine grained, dense, moist
82				
83				
84				
85		SP		sand, grey, fine grained, loose, saturated, disturbed
86				terminate boring @ 85' due to heaving sands up to ~82'
87				water level = 70.7' bgs @ 9:31 am
88				water level = 70.7' bgs @ 9:45 am

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-005

Requested Test	⧄
Sample Prepared	⧅
Test Completed	⧅

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: NF6 / KRCD Project #: NF6 16725-V44

Requested By: Shay Overton / Provo. & Pritch. Date: 12-04-06 Due By: ASAP # 1 priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / B3 / 36												X					
11 / B3 / 76										X	X						
11 / B4 / 26													X	VECTOR			
11 / B4 / 46									X	X	X						If over 50% passing #200 run hydrometer. If over 50% run Fine sieve.
11 / B4 / 66									X	X	X						
11 / B4 / 76													X	VECTOR			

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	MC
		Date:	12/6/2006
TES#:	16725.005	Sample No.:	Site 11; B-4 @ 46'
Lab #:		Remarks:	Clayey Sandy SILT (ML)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	169.5	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	75	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16		0.0	0.0	100.0	
#30		0.0	0.0	100.0	
#50		0.0	0.0	100.0	
#100		0.0	0.0	100.0	
#200	75.0	44.2	44.2	55.8	
Pan	94.5	55.8			

4539 N. Brawley Avenue, #108, Fresno, CA 93722
Phone (559) 276-9311 Fax (559) 276-9344

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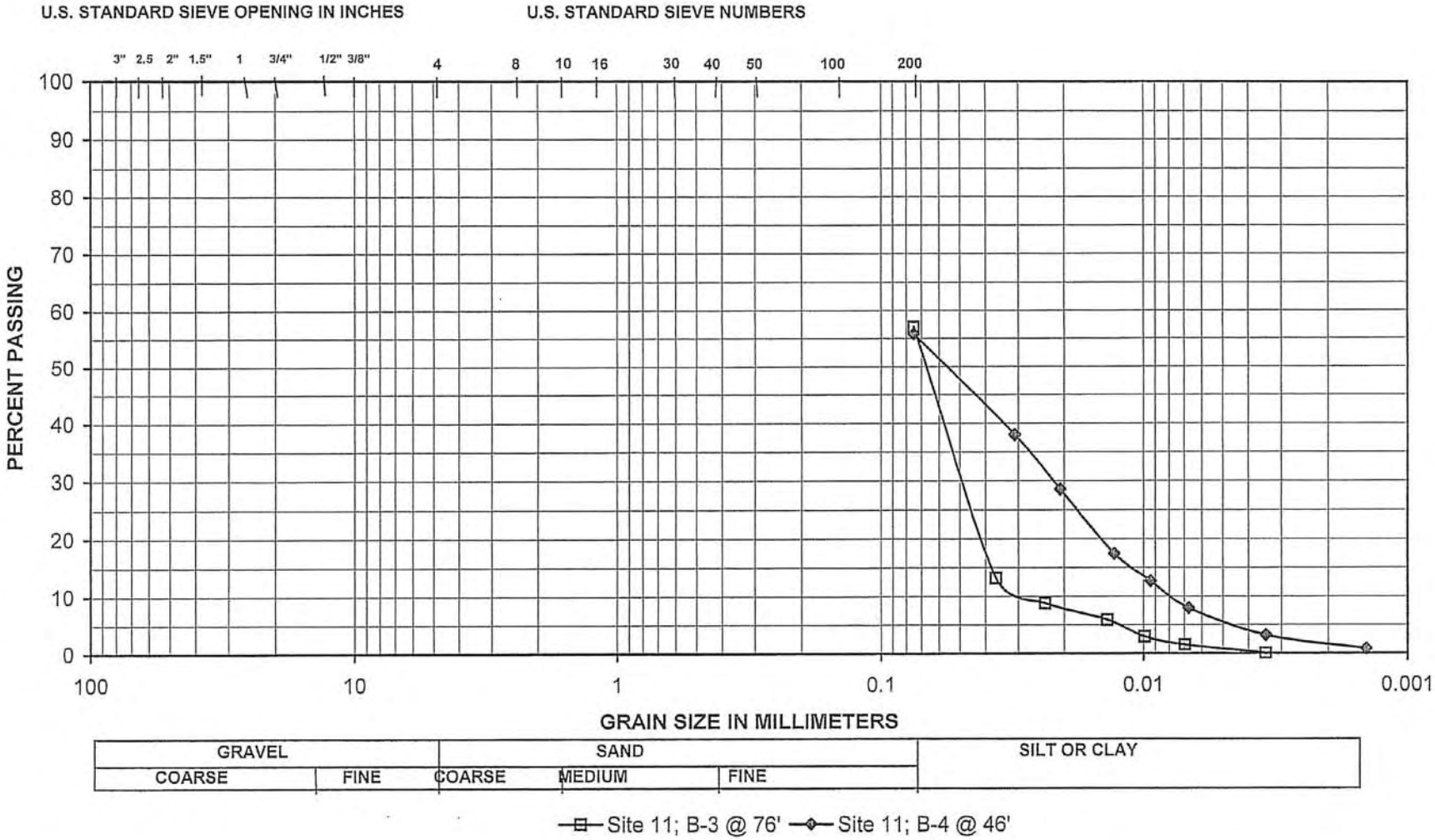
HYDROMETER TEST DATA SUMMARY
ASTM D 422-63

H_2O

PROJECT:	KRCD North Fork Group		TES # : 16725.005
Boring Number	Site 11; B-4 @ 46'	TESTED BY: MW	DATE: 12/11/2006
Sample Depth, ft			

Mass of Test Sample, g	75.00	"air-dried"	Hydrometer Type	151H
Mass of Hygroscopic Sample, g	15.00	"air-dried"		
Mass of Hygroscopic Sample, g	11.86	"oven-dried"	Specific Gravity of Test Material	2.650
Mass of Test Sample, g	59.30	"oven-dried"	Specific Gravity of Test Solution	1.0000

Time (min.)	Hydrometer Reading	Corrected Reading	Temperature Degrees C	Effective Depth Table 2 (cm)	Constant, K Table 3	Diameter, D (mm)	Amt. Suspended, P (%)
2	1.0240	1.0240	19	10.0	0.01382	0.0309	38.0
5	1.0180	1.0180	20	11.5	0.01365	0.0207	28.5
15	1.0110	1.0110	20	13.4	0.01365	0.0129	17.4
30	1.0080	1.0080	20	14.2	0.01365	0.0094	12.7
60	1.0050	1.0050	21	15.0	0.01348	0.0067	7.9
250	1.0020	1.0020	20	15.8	0.01365	0.0034	3.2
1440	1.0005	1.0005	21	16.3	0.01348	0.0014	0.8



Sample #	Classification	% Gravel	% Sand	% Silt	% Clay*	% Moist.	LL	PL	PI
Site 11; B-3 @ 76'	Sandy SILT(ML)	0.0	43.0	56.0	1.0	21.5			
Site 11; B-4 @ 46'	Clayey Sandy SILT (ML)	0.0	44.2	50.8	5.0	18.0			

Project:	KRCD North Fork Group	
TES#:	16725.005	
Date:	12/11/2006	Date Sampled: 12/4/2006

* 5 Micron

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Sieve Analysis for Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/6/2006
TES#:	16725.005	Sample No.:	Site 11; B-4 @ 66'
Lab #:		Remarks:	Silty SAND (SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	168.8	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	94.5	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.	0	0.0	0.0	100.0	
#4	0.0	0.0	0.0	100.0	
#8	0.4	0.2	0.2	99.8	
#16	1.0	0.6	0.8	99.2	
#30	3.2	1.9	2.7	97.3	
#50	29.0	17.2	19.9	80.1	
#100	27.7	16.4	36.3	63.7	
#200	29.5	17.5	53.8	46.2	
Pan	3.6	2.1			

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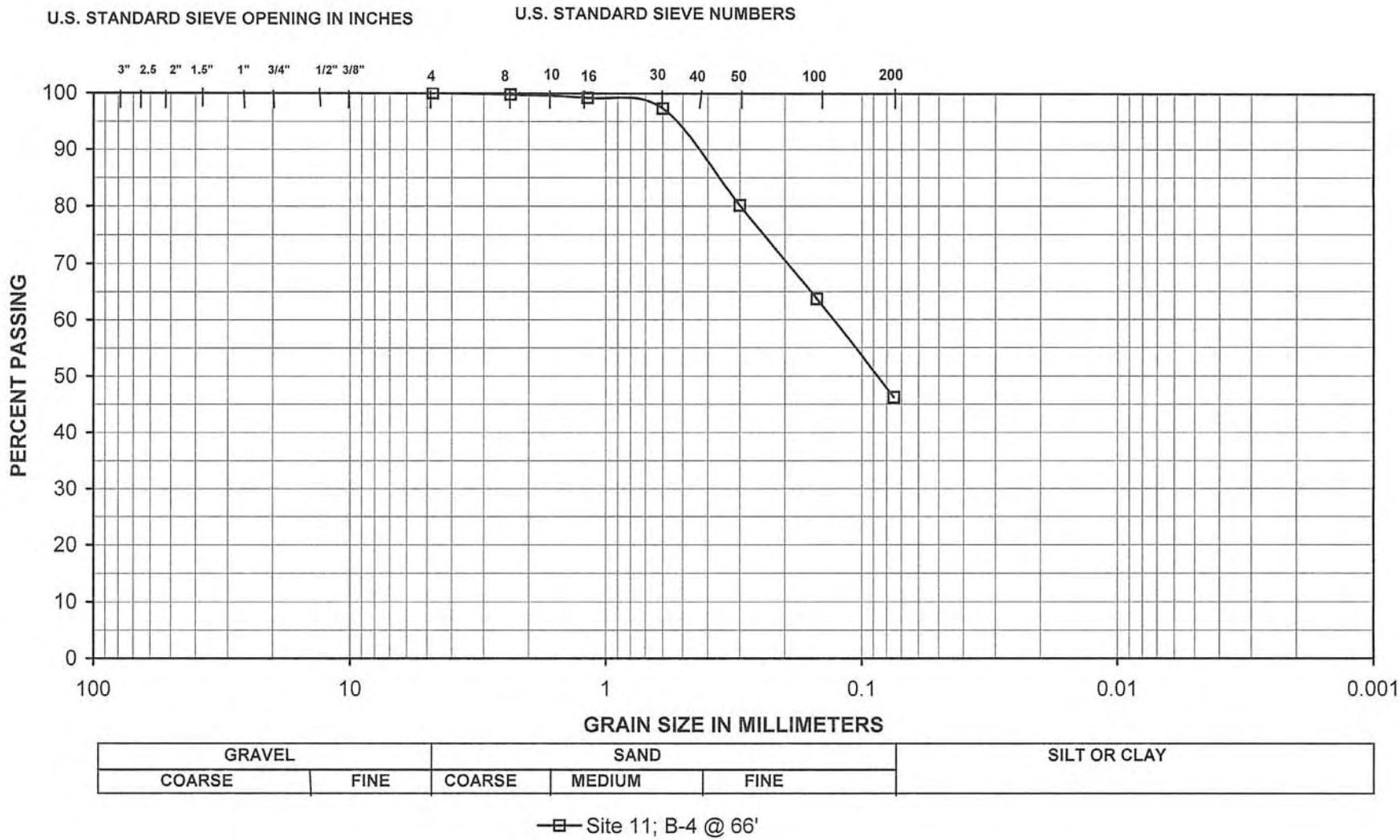

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI	Project:	KRCD North Fork Group	
Site 11; B-4 @ 66'	Silty SAND (SM)	0	53.8	46.2	18.5						
									TES#:	16725.005	
									Date:	12/11/2006	Date Sampled: 12/4/2006

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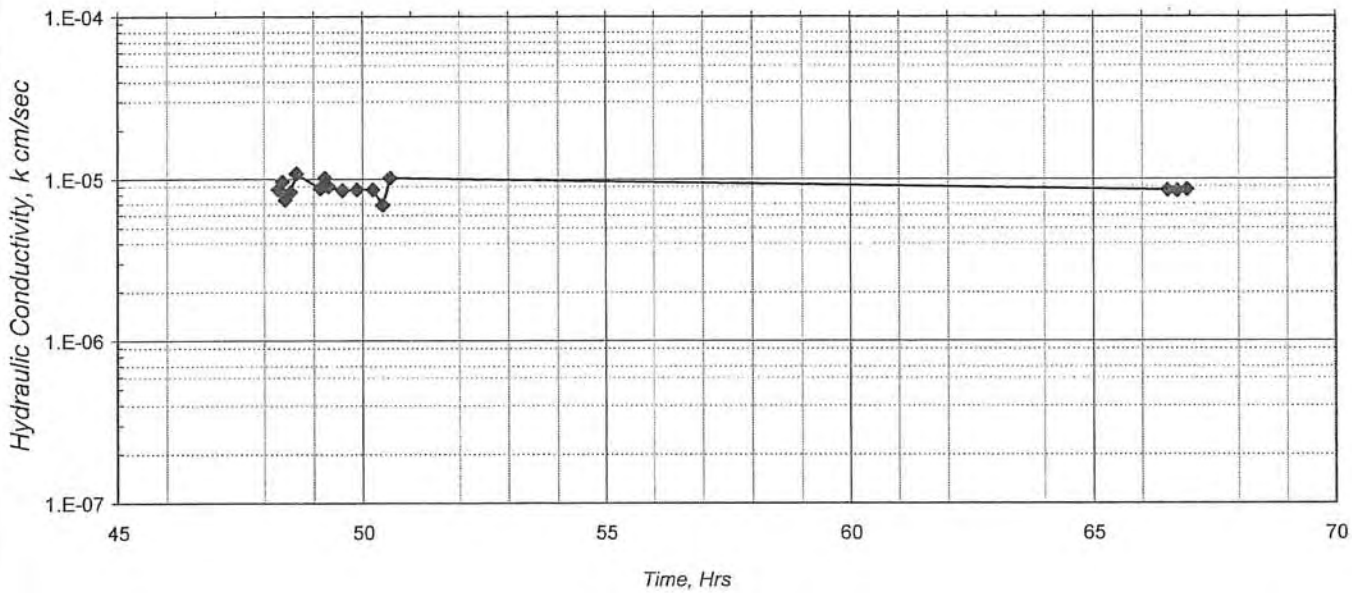
HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
Technicon Engineering Inc. / KRCD #16725-V44	941707.03	2078A

Sample ID:	Report Date:
B-4 26'	January 17, 2007

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	B-4 26'	
DESCRIPTION:	Gray Brown Silty Sand	
	INITIAL	FINAL
HEIGHT, in.	3.8	3.8
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	21.4	21.7
DRY DENSITY, pcf	104	106
SATURATION, %	93	100
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf		
OPTIMUM WATER CONTENT, %		
SPECIFIED COMPACTION, %		
ACHIEVED COMPACTION, %		

COMMENTS:
Tap water used as permeant.

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	1 - 4
IN / OUT RATIO:	0.95
"B" PARAMETER:	0.99

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
10	49.9	8.6E-06
11	50.2	8.6E-06
12	50.4	6.9E-06
13	50.6	1.0E-05
14	66.5	8.5E-06
15	66.7	8.5E-06
16	66.9	8.6E-06
AVERAGE LAST 4 :		**8.9E-06**

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of Vector Engineering, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmless Vector from and against all liability in excess of the aforementioned limit.

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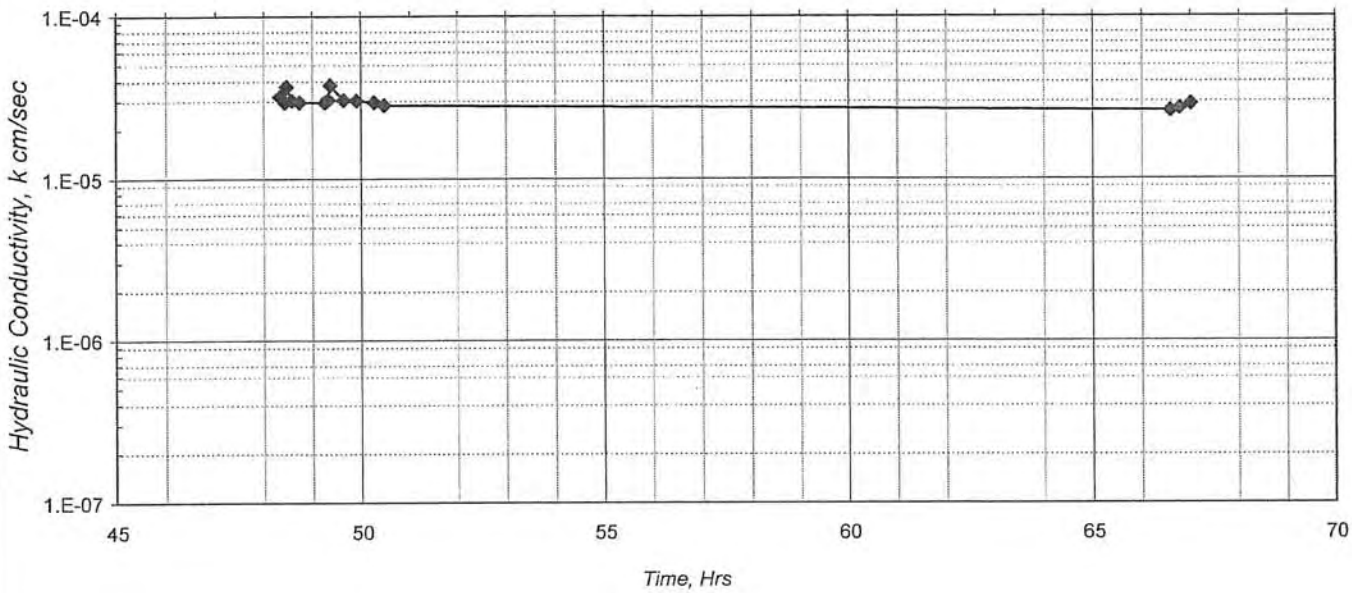
HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
Technicon Engineering Inc. / KRCD #16725-V44	941707.03	2078B

Sample ID:	Report Date:
B-4 76'	January 17, 2007

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	B-4 76'	
DESCRIPTION:	Gray Silty Sand	
	INITIAL	FINAL
HEIGHT, in.	3.5	3.5
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	22.0	23.8
DRY DENSITY, pcf	101	102
SATURATION, %	88	99
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf		
OPTIMUM WATER CONTENT, %		
SPECIFIED COMPACTION, %		
ACHIEVED COMPACTION, %		

COMMENTS:
Tap water used as permeant.

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	0 - 4
IN / OUT RATIO:	0.98
"B" PARAMETER:	0.99

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
9	49.7	3.1E-05
10	49.9	3.0E-05
11	50.3	3.0E-05
12	50.5	2.8E-05
13	66.6	2.6E-05
14	66.8	2.7E-05
15	67.0	2.9E-05
AVERAGE LAST 4 :		**2.8E-05**

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By accepting the data and results represented on this page, client agrees to limit the liability of Vector Engineering, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmless Vector from and against all liability in excess of the aforementioned limit.

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-5

Soil Boring Summary Sheet
Hole No. 11B-5

Project Name	North Fork Group Potential Recharge Site Exploration
Project Number	1364 05V2
Feature	Soil Boring
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co.
Hole Location	NE corner Site 11 ~ 100' W and 120' S of street sign for Chestnut / Coleman
Drilling Contractor	Technicon
Driller	NA
Drill Rig Type	CME 55
Drilling Started	12/5/2006
Drilling Completed	12/6/2006
Total Depth	100'
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B5-21	12/5/2006	Cal	grain size
11B5-41	12/5/2006	Cal	permeability
11B5-56	12/5/2006	Cal	permeability
11B5-81	12/6/2006	Cal	grain size

Groundwater Levels

Date	Time	Depth (bgs)
12/6/2006	10:50am	71.1'

Remarks: Terminate hole @ 100' due to 20' of heaving sands probably a confined aquifer

SOIL BORING LOG
HOLE NO. 11B-5

Hole No. 11B-5

Date: 12-05-06

Project Name: North Fork Group AB303

Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: NE corner Site 11 ~ 100' W and 120' S of street sign for Chestnut / Coleman

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM		surface: silty sand, light brown/grey, fine to medium grained, loose, dry
1				
2		SP		sand, brown/grey, medium grained, loose, moist
3				
4		SP		sand, brown, fine to medium grained, loose, moist
5		SM		silty sand, light grey, fine grained, loose, dry
6		SP	18	sand, grey, medium grained, loose, moist
7				
8				
9				interbedded medium sand and silty sand in lenses up to 6 inches thick
10		SP		sand, light grey, medium grained, loose, moist
11		SM	16	silty sand, brown with black oxidized stringers, loose, dry
12				
13				
14				interbedded sand and silt
15		SP		sand, grey, fine grained, medium dense, moist
16		ML	29	silt, grey, hard, moist
17				
18				
19				
20		SM		
21	11B5-21, gs		25	silty sand, grey, very fine grained, stiff, slightly moist
22				
23				
24				
25				
26		SM	26	silty sand, grey with oxidized stringers, very fine grained, medium dense, moist
27				
28				
29				
30		ML		
31			30	silt with trace of very fine sand, grey, stiff, moist
32				
33				
34				
35				
36		SP	15	sand, brown/grey, medium grained, loose, saturated
37				
38				
39				
40		C		clay with trace of fine sand, grey with trace of oxidation, high plasticity, moist
41	11B5-41, p		26	silty clay, grey with trace of oxidation, stiff, moist
42				
43				
44				
45		SM		
46			34	silty sand, yellow/brown with oxidation mottling, fine grained, medium dense, moist
47				
48				
49				
50		SM		silty sand, yellow/brown with oxidation mottling, medium grained, medium dense, moist
51		SP	48	sand, grey, medium grained, medium dense, moist
52				
53				
54				

SOIL BORING LOG
HOLE NO. 11B-5

Hole No. 11B-5

Date: 12-05-06

Project Name: North Fork Group AB303

Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: NE corner Site 11 ~ 100' W and 120' S of street sign for Chestnut / Coleman

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
55	11B-56, p	SP		sand, grey, medium grained, dense, slightly moist
56			76	2 to 3 lenses < 1inch thick of partially cemented silty sand
57				
58				
59				
60		SP		sand, grey, medium grained, dense, as above, with lenses of
61			73	partially cemented silty sand in lenses < 0.5 inches thick, moist
62				
63				
64		ML		
65			76	clayey silt, grey with oxidation mottling, hard, medium plasticity, moist
66				
67				
68				
69				
70		ML		silt, white/grey, hard, partially cemented, dry
71		SP	100	sand, light grey, medium grained, very dense, moist
72				
73				
74				
75		SP		sand, grey, medium grained, medium dense, saturated
76			45	sand with silt, grey with oxidation mottling mottle, fine grained, medium dense, moist
77				
78				
79				
80		SC		
81	11B5-81, gs		184	clayey silty sand, brown/grey, fine grained, very dense, very moist
82				
83				
84				
85		SM		silty sand, yellow/brown, fine to medium grained, very dense, very moist
86		SP	90	sand, yellow/brown, medium grained, very dense, partially cemented, moist
87				
88				
89				
90				
91		C		sandy clay, yellow/brown, stiff, very fine sand, low plasticity, moist
92			24	clay with sand, grey with oxidation mottling, stiff, moist
93				
94				
95				
96		C		clay, grey/brown, hard, high plasticity, moist
97			53	sandy clay, yellow/brown, medium to high plasticity, fine sand, hard, moist
98				terminate at 100' due to ~ 20' of heaving sands
99				Water Level. 71.1 ft bgs @ 10:50 am
100		SP		sand, assumed do to heaving

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.006

Requested Test	/
Sample Prepared	X
Test Completed	X

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: NF 6/KRCD Project #: 16725-V49

Requested By: Shay Overton/Prov. & Pritch. Date: 12-5-06 Due By: ASAP #1 Priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / B5 / 21									X	X							If over 50% passing #200 run hydrometer if not over 50% run fine sive.
11 / B5 / 41													X	VECTOR			
11 / B5 / 56												X					
~~8X~~																	

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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.007

Requested Test	☐
Sample Prepared	☒
Test Completed	☒

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: NF6/KRCD

Project #: 16725-V44

Requested By: Shay Overton / PEP

Date: 12-6-06

Due By: ASAP # 1 priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 B5 8'									☒	☒	☒						If over 50% passing #200 sieve run hydrometer if not run fine sieve

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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Sieve Analysis for Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/6/2006
TES#:	16725.006	Sample No.:	Site 11; B-5 @ 21'
Lab #:		Remarks:	Silty SAND(SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	183.6	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	152.1	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16		0.0	0.0	100.0	
#30	0.1	0.1	0.1	99.9	
#50	3.9	2.1	2.2	97.8	
#100	75.6	41.2	43.4	56.6	
#200	64.7	35.2	78.6	21.4	
Pan	7.8	4.2			

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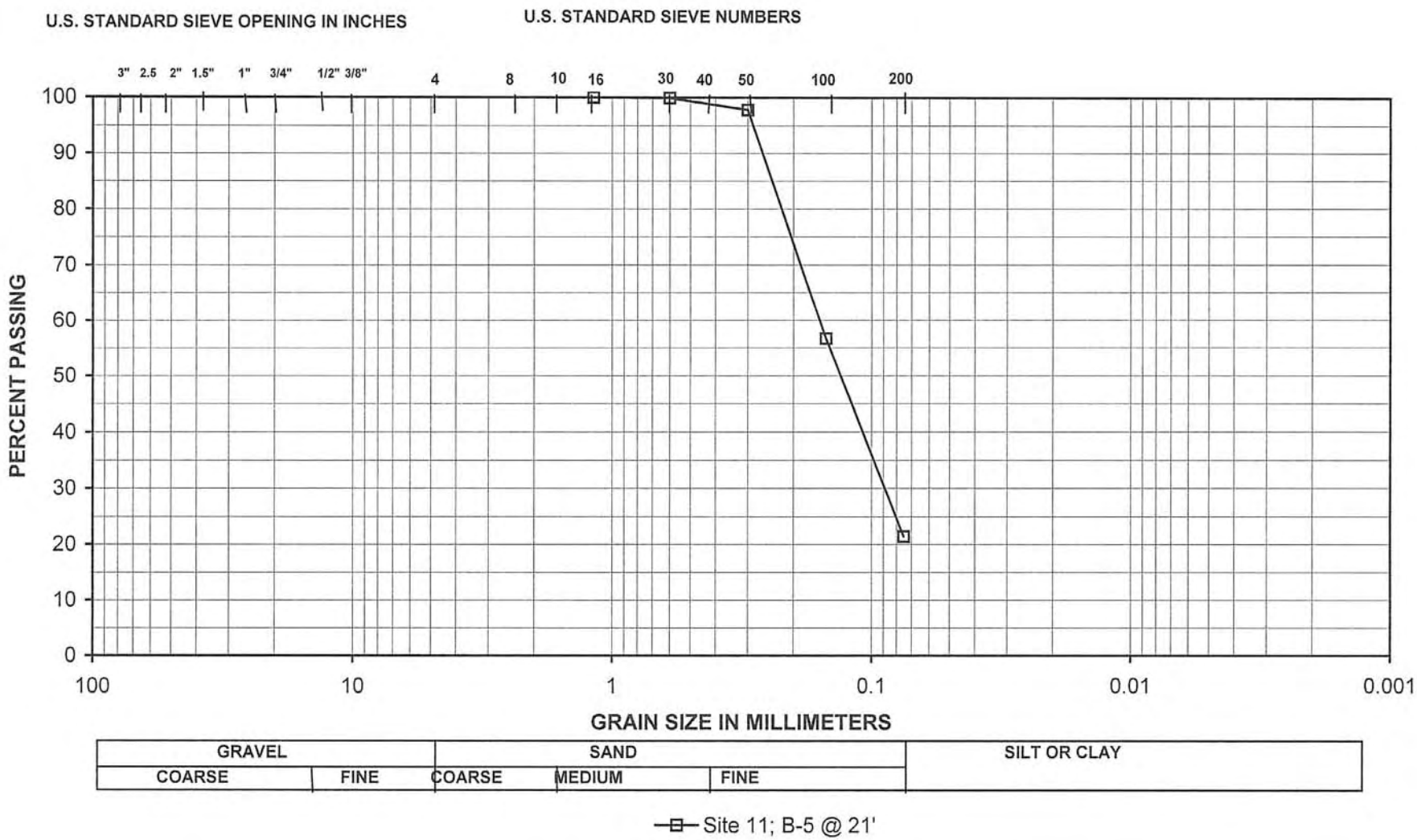

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI
Site 11; B-5 @ 21'	Silty SAND(SM)	0.0	78.6	21.4	8.9			

Project:	KRCD North Fork Group		
TES#:	16725.006		
Date:	12/6/2006	Date Sampled:	12/5/2006

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/17/2006
TES#:	16725-007	Sample No.:	Site 11; B-5 @ 81'
Lab #:		Remarks:	Clayey Silty SAND (SC-SM)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	172.0	1/2"	4.0 (2.0)
Initial Weight Fine Aggregate Before Wash		3/4"	11.0 (5.0)
		1"	22.0 (10.0)
Final Weight Fine Aggregate After Wash	91.1	1 1/2"	33.0 (15.0)
		2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16	0.1	0.1	0.1	99.9	
#30	0.9	0.5	0.6	99.4	
#50	5.9	3.4	4.0	96.0	
#100	52.2	30.3	34.4	65.6	
#200	30.6	17.8	52.2	47.8	
Pan	1.4	0.813953488			

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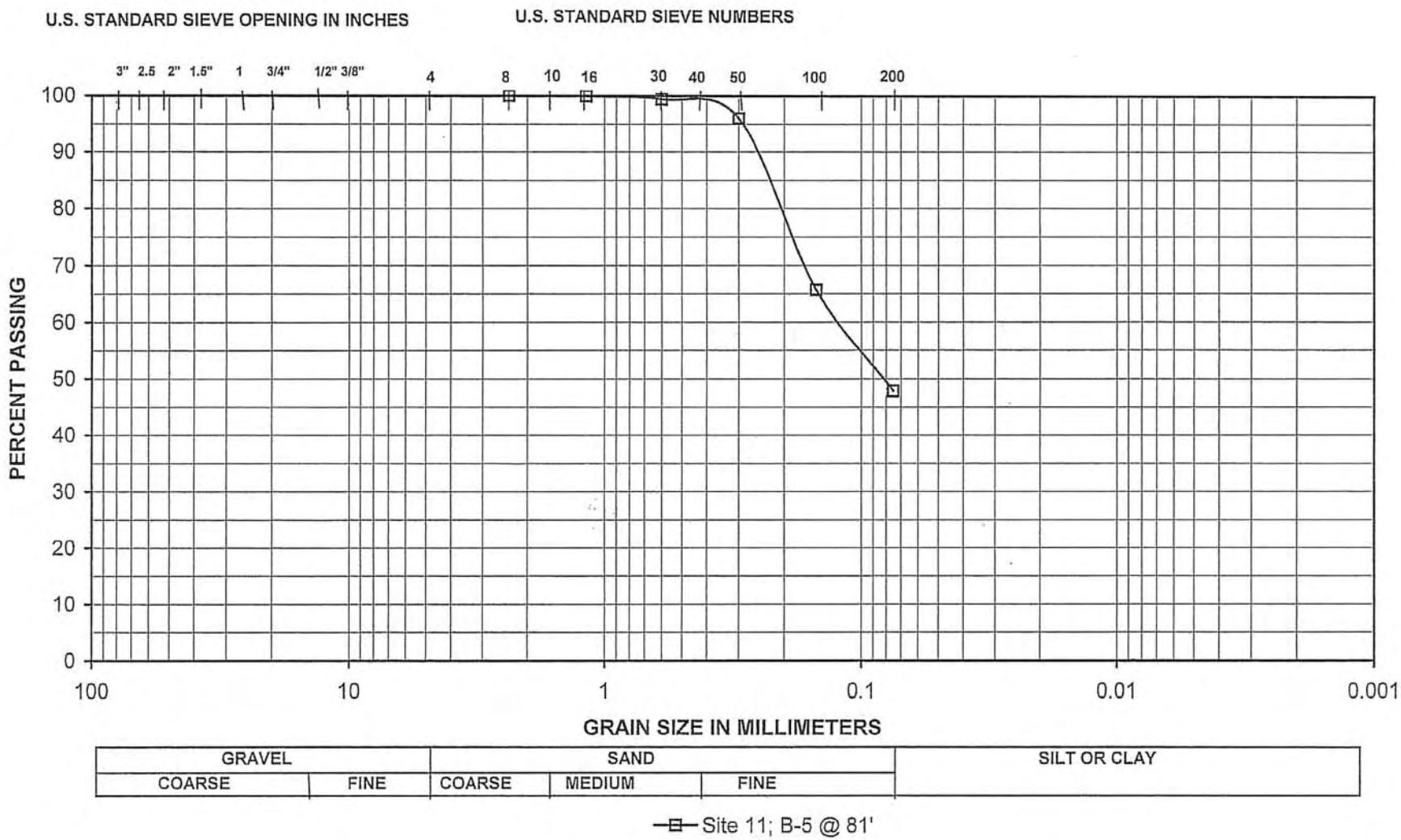

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI
Site 11; B-5 @ 81'	Clayey Silty SAND (SC-SM)	0.0	52.2	47.8	16.3			

Project:	KRCD North Fork Group	
TES#:	16725-007	
Date:	12/17/2006	Date Sampled: 12/6/2006

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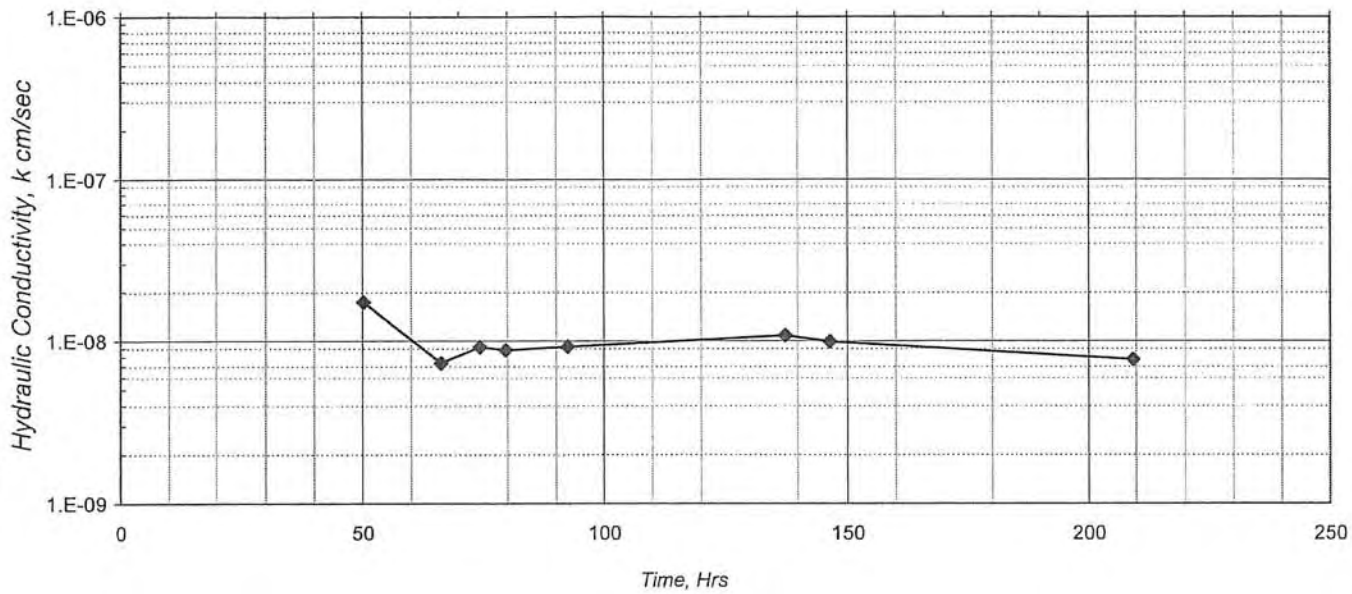
HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
Technicon Engineering Inc. / KRCD #16725-V44	941707.03	2078C

Sample ID:	Report Date:
B-5 41'	January 16, 2007

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	B-5 41'	
DESCRIPTION:	Gray Clay	
	INITIAL	FINAL
HEIGHT, in.	4.0	4.0
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	19.8	20.1
DRY DENSITY, pcf	108	109
SATURATION, %	96	100
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf		
OPTIMUM WATER CONTENT, %		
SPECIFIED COMPACTION, %		
ACHIEVED COMPACTION, %		

COMMENTS:
Tap water used as permeant.

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	4 - 10
IN / OUT RATIO:	1.09
"B" PARAMETER:	0.99

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
2	66.2	7.3E-09
3	74.3	9.2E-09
4	79.6	8.8E-09
5	92.4	9.3E-09
6	137.5	1.1E-08
7	146.5	1.0E-08
8	209.3	7.7E-09
AVERAGE LAST 4 :		**9.5E-09**

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of Vector Engineering, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmless Vector from and against all liability in excess of the aforementioned limit.

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RIGID WALL PERMEABILITY TEST DATA SHEET (ASTM D-5084)

Project Information:

Project Name:	KRCD	Samp. By:	Shay Overton
Project Number:	16725.006	Samp. Date:	12/4/2006
Sample Location:	Site 11; B-5 @ 56'	Tested By:	MC

Sample Information:

Test Cell No.		Area Of Burette(a):	0.906
Diameter Of Sample:	2.42	Weight Of Sample & Tube:	0
Area Of Sample(A):	4.60	Weight Of Tube:	0
Length Of Sample(L):	6	Weight Of Sample:	0

Test Information:

Time			Height			
Date	Begin Test (h:m:s)	End Test (h:m:s)	Initial Reading (H_i)	Final Reading (H_f)	Pressure (psi)	Comments
12/19/2006	14:08:30	14:13:00	1.00	9.50	4.5	
12/19/2006	14:13:00	14:20:00	9.50	21.30	4.5	
12/19/2006	14:21:00	14:31:00	1.00	18.10	4.5	
12/19/2006	14:32:00	14:36:35	1.00	9.50	4.5	
12/19/2006	14:36:35	14:42:00	9.50	19.10	4.5	
12/19/2006	14:43:00	14:52:30	1.00	17.80	4.5	
12/19/2006	14:53:30	15:04:00	1.00	19.00	4.5	

Permeability (K) = aL/AL = **1.99E-03 cm/sec**

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

Site No. 11
11B-6

Soil Boring Summary Sheet
Hole No. 11B-6

Project Name	North Fork Group Potential Recharge Site Exploration
Project Number	1364 05V2
Feature	Soil boring - continuous sampling
Logged by	Shay Overton
Ground Elevation	NA
Property Owner	Jesse P Silva Trustee
Address	SW of the intersection of S Chestnut Ave and E Coleman Ave in Fresno Co.
Hole Location	Middle of site 11, ~1200' west and 300' south of Chestnut and Coleman intersection
Drilling Contractor	Technicon
Driller	Billy
Drill Rig Type	CME 55
Drilling Started	12/12/2006
Drilling Completed	12/12/2006
Total Depth	75'
Hole Size	3 1/4" Auger
Drilling Method	Hollow Stem Auger
Sampling Methods	California Sampler
Drilling Fluids	None

Laboratory Samples

Sample No.	Date	Type of Sample	Lab Tests
11B6-2.5	12/12/2006	Cal	permeability
11B6-4	12/12/2006	Cal	permeability
11B6-6	12/12/2006	barrel	grain size
11B6-43	12/12/2006	barrel	grain size

Groundwater Levels

Date	Time	Depth (bgs)
12/12/2006	3:15pm	71.4'

Remarks: possible issue with advancing barrel sampler below 75' and in sands.

SOIL BORING LOG
HOLE NO. 11B-6 Continuous

Hole No. 11B-6 Date: 12-12-06

Project Name: North Fork Group AB30: Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: Middle of site 11, ~1200' west and 300' south of Chestnut and Coleman intersection

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
0		SM	13	0 - 1.5' silty sand, brown, fine to medium grained, loose, moist
1				
2	11B6-2.5, p		14	1.5 - 3.0' silty sand, brown, fine to medium grained, medium loose
3		C		clay, grey, medium soft, moist
4	11B6-4, p	SM	25	3.0 - 3.5' silty sand, dark brown, medium, stiff, moist
5		ML		3.5 - 4.0' clay, grey, medium firm, with organic black oxidation, moist
6	11B6-6, gs			4.0 - 5.0' silt with some sand, light brown/yellow, very tight, firm, moist
7		SC		clayey sand, green, medium grained, tight, moist, grades into pure sand
8		SP		sand, grey with oxidation mottling, medium grained, loose, slightly moist
9				
10				
11				
12				sand, grey with some oxidation, fine grained, loose, moist
13				
14				
15				sand, grey, medium, loose, moist, lower 3" is oxidation accumulating on clay below
16				2-3 inch lens of clay, grey/green, firm, moist
17				sand, dark grey, medium grained, dense, loose, moist, contact gradational
18				
19		ML		silt, grey/green, firm, medium plasticity, moist, grades into sand
20		SP		sand, grey/green, medium grained, loose, moist
21				
22				
23		SM		silty sand/sandy silt, blue/green, very fine grained, medium loose, moist
24		SP		sand, grey, fine grained, loose, moist
25				
26		ML		silt, grey/green, firm, moist, grades into sand over 4 inches
27				
28		SP		sand, grey/yellow with oxidation mottling, medium grained, loose, moist
29				grades into fine sand @ 29.5'
30				sand, green/grey, medium, loose, moist
31		ML		silt with some sand, green/grey with oxidation mottling, firm, moist
32		SP		sand, grey, with some black and orange oxidation, medium grained, loose, moist
33				
34				
35				
36		C		clay, greyish green, medium plasticity, moist
37		SC		clayey sand, yellow brown, partially cemented, slightly moist
38				
39				
40				
41				
42		SW		sand with clay, yellow/orange, firm, moist
43	11B6-43, gs	ML		sandy clayey silt, orange/brown, firm, slightly moist, grades into
44				sandy silt, yellow/orange, medium firm, moist
45				sand, orange, medium grained, loose, moist
46				
47				sand as above, orange/grey, coarsens downward
48				

SOIL BORING LOG
HOLE NO. 11B-6 Continuous

Hole No. 11B-6 Date: 12-12-06

Project Name: North Fork Group AB30: Drilling Equipment: CME 55

Logged by: Shay Overton

Hole Location: Middle of site 11, ~1200' west and 300' south of Chestnut and Coleman intersection

Depth (ft)	Sample	Soil Classification	Blows per foot	Soil Description
49				
50				
51				sand as above, orange/yellow, medium grained, grades into
52				grey sand @ 53'
53				
54				
55		SP		
56				
57				
58				sand, grey, medium grained, loose, moist, as above
59				
60				
61				sand as above, with ~ 10% cemented particles up to 1 inch diameter
62				
63				
64				
65				sand, as above, medium to coarse, very moist, grades into
66		ML		silt, blue/grey with oxidation mottling, firm, moist, grades into
67		SP		interbedded sand and silt as above
68		ML		
69				clay with trace of fine sand, brown/orange, firm, slightly moist
70		C		
71				
72		SC		clayey sand, orange, soft, saturated, grades into
73		SP		sand, orange/grey, medium grained, loose, saturated, grades into
74		ML		silt, grey/orange, firm, slightly moist
75		SP		sand with trace of silt, pink/orange, fine to medium grained, loose, saturated
76		SM	58	silty sand, brown/orange, very fine grained, dense, saturated
77				water level = 71.4 bgs @ 3:15pm
78				Terminate boring @ 75'

1

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.011

Requested Test	☐
Sample Prepared	☒
Test Completed	☒

LABORATORY SCHEDULE OF TESTS: SOILS & MISC. MATERIALS

Project: KRCD / NF6 Project #: 16725-V44

Requested By: Shay Overton Provost & Pritchard Date: 12-12-06 Due By: ASAP #1 priority

Site No. / Boring No. / Depth	Water Content and Dry Density	Atterberg Limits	Expansion Index	Compaction Curve ASTM D1557	Collapse Potential	Consolidation	Direct Shear	Coarse & Fine Sieve	Fine Sieve	#200 Wash	Hydrometer Analysis	Rigid Wall Permeability (Coarse)	Flex Wall Permeability (Fine)	pH/Minimum Resistivity	R-Value	Sulfate Content/Chloride Content	REMARKS
11 / 6 / 2.5-3.0													X				
11 / 6 / 4.0-4.5													X				
11 / 6 / 6								X		X	X						if coarse due Sieve, else due hydro
11 / 6 / 43										X	X						

Laboratory Technician: Before beginning work give a copy of the laboratory schedule to the laboratory manager.

Laboratory Manager: Scan and E-Mail a copy of the laboratory schedule to Owen Kubit with Provost & Pritchard @ okubit@ppeng.com

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Sieve Analysis for Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Weiss
		Date:	12/12/2006
TES#:	16725.011	Sample No.:	Site 11; B-6 @ 6'
Lab #:		Remarks:	Clayey SAND (SC)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	179.1	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	123.3	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4		0.0	0.0	100.0	
#8		0.0	0.0	100.0	
#16	0.5	0.3	0.3	99.7	
#30	33.7	18.8	19.1	80.9	
#50	60.2	33.6	52.7	47.3	
#100	21.1	11.8	64.5	35.5	
#200	6.9	3.9	68.3	31.7	
Pan	0.8	0.446677834			

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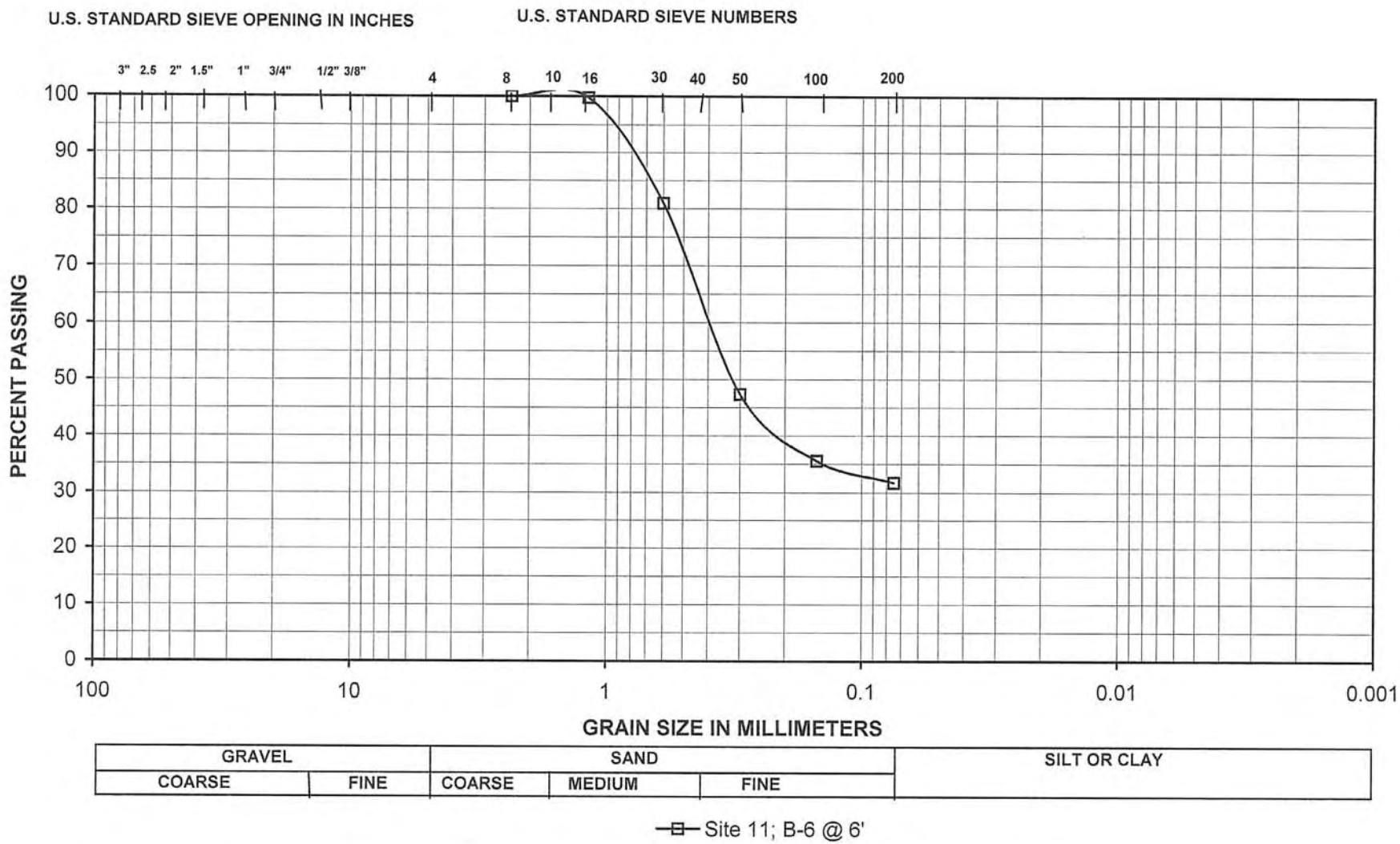

Sample #	Classification	% Gravel	% Sand	% Fines	% Moist.	LL	PL	PI	Project:	KRCD North Fork Group	
Site 11; B-6 @ 6'	Clayey SAND (SC)	0.0	68.3	31.7	11.7						
									TES#:	16725.011	
									Date:	12/12/2006	Date Sampled: 12/12/2006

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Sieve Analysis
for
Coarse and Fine Aggregate

Project:	KRCD North Fork Group	Technician:	M. Wiess
		Date:	12/20/2006
TES#:	16725.011	Sample No.:	Site 11; B-6 @ 43'
Lab #:		Remarks:	Sandy Clayey SILT (ML)

	Weight (lbs. or grams)	Maximum Sieve Size	Minimum Weight of Test Specimen, lbs. (kg)
Total Dry Sample + Tare Wt.		Sand	1.0 (0.5)
Tare Weight		3/8"	2.0 (1.0)
Total Dry Sample Wt.	162.7	1/2"	4.0 (2.0)
Initial Weight Fine		3/4"	11.0 (5.0)
Aggregate Before Wash		1"	22.0 (10.0)
Final Weight Fine		1 1/2"	33.0 (15.0)
Aggregate After Wash	39.4	2"	44.0 (20.0)

Sieve Size	Individual Weight Retained	Individual % Retained	Cumulative % Retained	Cumulative % Passing	Specs.
3 in.		0.0	0.0	100.0	
2 1/2 in.		0.0	0.0	100.0	
2 in.		0.0	0.0	100.0	
1 1/2 in.		0.0	0.0	100.0	
1 in.		0.0	0.0	100.0	
3/4 in.		0.0	0.0	100.0	
1/2 in.		0.0	0.0	100.0	
3/8 in.		0.0	0.0	100.0	
#4	0.0	0.0	0.0	100.0	
#8	0.0	0.0	0.0	100.0	
#16	0.0	0.0	0.0	100.0	
#30	0.0	0.0	0.0	100.0	
#50	0.0	0.0	0.0	100.0	
#100	0.0	0.0	0.0	100.0	
#200	39.4	24.2	24.2	75.8	
Pan	0	0			

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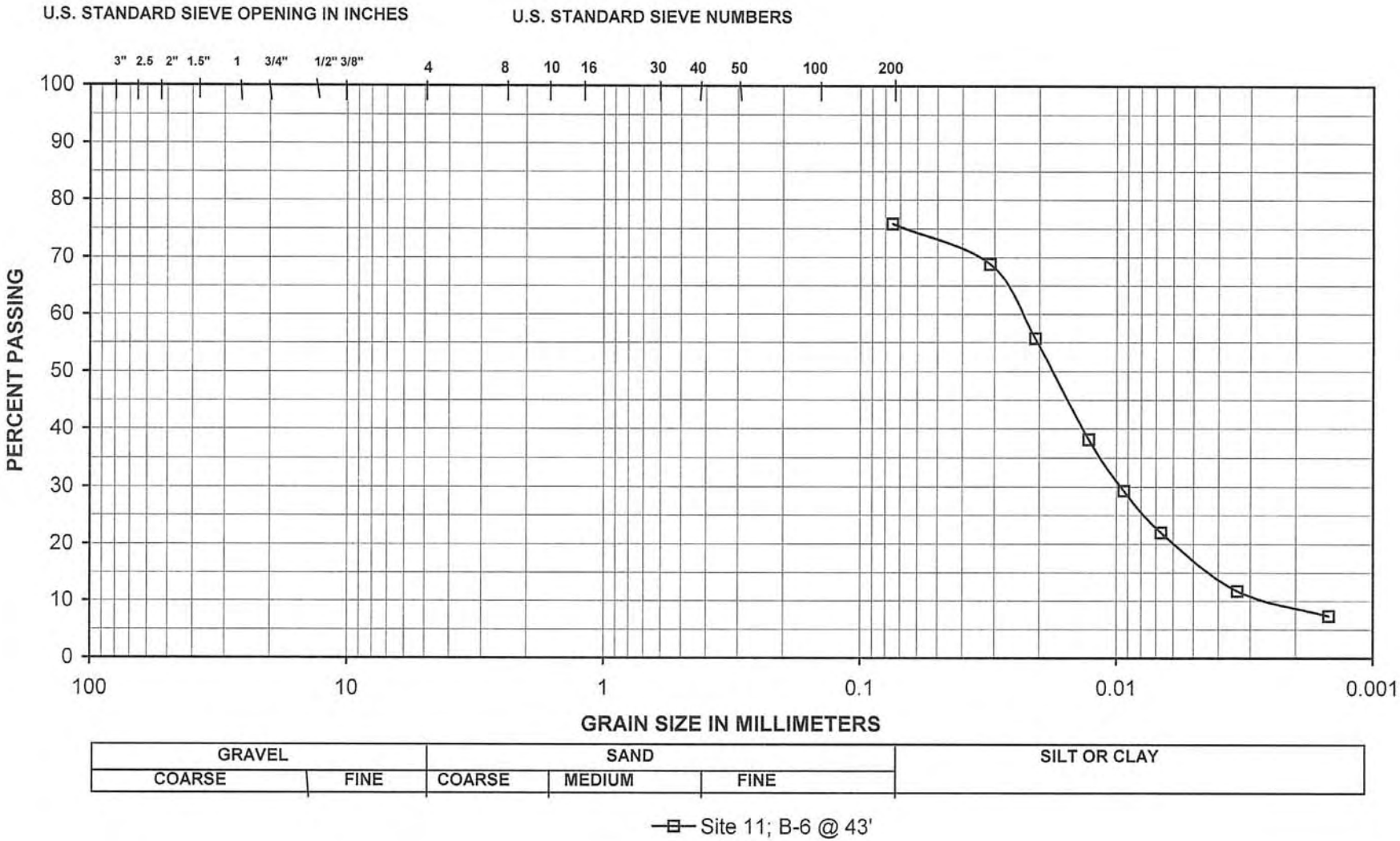
HYDROMETER TEST DATA SUMMARY
ASTM D 422-63

H_2O

PROJECT:	KRCD North Fork Group		TES # : 16725.011
Boring Number	Site 11; B-6 @ 43'	TESTED BY: E. Sinco	DATE: 12/27/2006
Sample Depth, ft			

Mass of Test Sample, g	50.00	"air-dried"	Hydrometer Type	151H
Mass of Hygroscopic Sample, g	15.00	"air-dried"		
Mass of Hygroscopic Sample, g	12.47	"oven-dried"	Specific Gravity of Test Material	2.650
Mass of Test Sample, g	41.57	"oven-dried"	Specific Gravity of Test Solution	1.0000

Time (min.)	Hydrometer Reading	Corrected Reading	Temperature Degrees C	Effective Depth Table 2 (cm)	Constant, K Table 3	Diameter, D (mm)	Amt. Suspended, P (%)
2	1.0235	1.0235	19	10.2	0.01382	0.0312	68.8
5	1.0190	1.0190	19	11.3	0.01382	0.0208	55.6
15	1.0130	1.0130	19	12.9	0.01382	0.0128	38.1
30	1.0100	1.0100	19	13.7	0.01382	0.0093	29.3
60	1.0075	1.0075	20	14.4	0.01365	0.0067	22.0
250	1.0040	1.0040	20	15.2	0.01365	0.0034	11.7
1440	1.0025	1.0025	17	15.8	0.01417	0.0015	7.3



Sample #	Classification	% Gravel	% Sand	% Silt	% Clay*	% Moist.	LL	PL	PI
Site 11; B-6 @ 43'	Sandy Clayey SILT (ML)	0.0	24.2	58.3	17.5	22.9			

Project:	KRCD North Fork Group	
TES#:	16725.011	
Date:	12/20/2006	Date Sampled: 12/12/2006

* 5 Micron

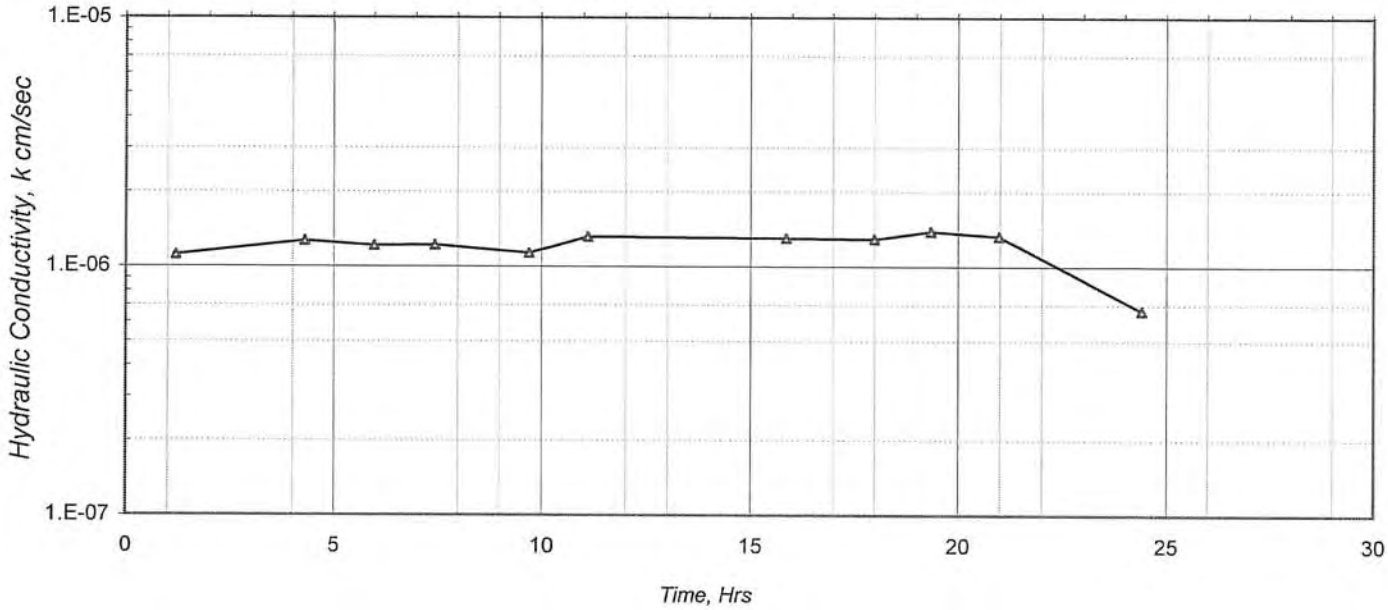
TECHNICON
ENGINEERING SERVICES, Inc.

HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
KRCD North Fork Group	**16725-011**	

Sample ID:	Sample Date:
Site 11; B-6 @ 2.5'	**December 12, 2006**

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	**Site 11; B-6 @ 2.5'**	
DESCRIPTION:	Clayey SAND (SC) / Sandy CLAY (CL)	
	INITIAL	FINAL
HEIGHT, in.	3.8	3.8
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	n/a	n/a
DRY DENSITY, pcf	n/a	n/a
SATURATION, %	n/a	n/a
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf	n/a	
OPTIMUM WATER CONTENT, %	n/a	
SPECIFIED COMPACTION, %	n/a	
ACHEIVED COMPACTION, %	n/a	

COMMENTS:
Tap water used as permeant

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	7 - 9
IN / OUT RATIO:	0.99
"B" PARAMETER:	0.95

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
1	1.2	1.1E-06
3	6.0	1.2E-06
8	18.0	1.3E-06

AVERAGE : **1.3E-06**
SPECIFICATION : **1.0E-06**
PASS

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of TECHNICON Engineering Services, Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of TECHNICON Engineering Services, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmlessTECHNICON from and against all liability in excess of the aforementioned limit.

Reviewed By:

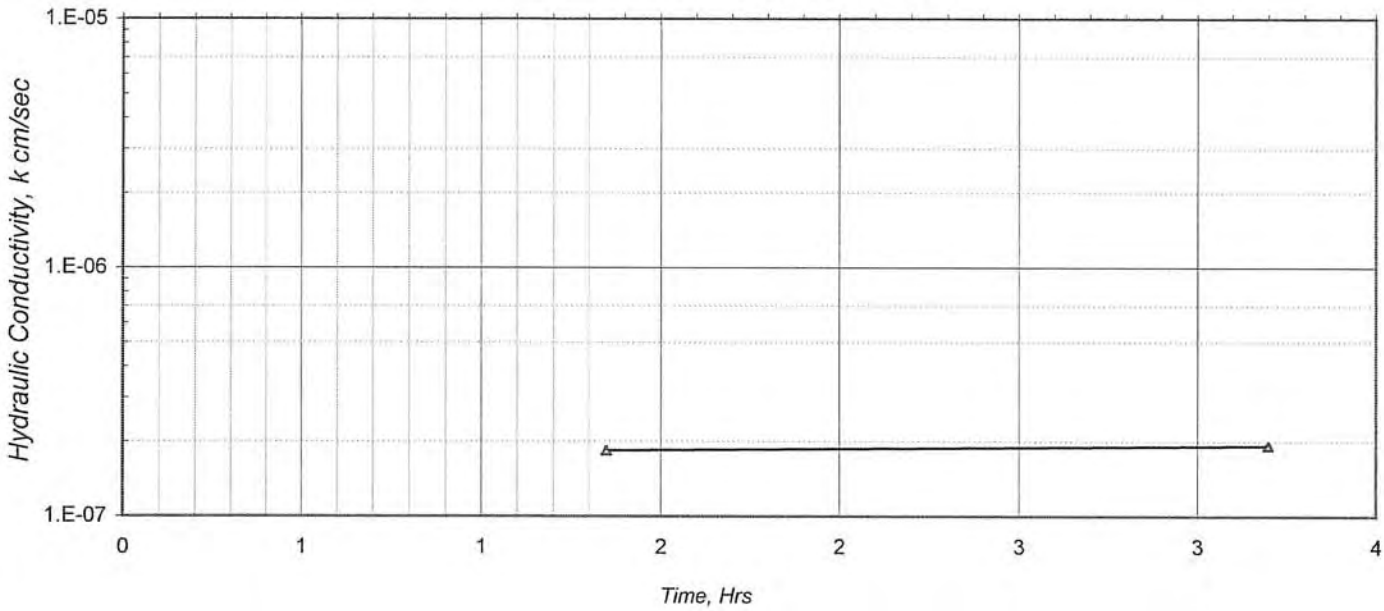
TECHNICON
ENGINEERING SERVICES, Inc.

HYDRAULIC CONDUCTIVITY REPORT

Client / Project Name:	Project No:	Lab Sample Number:
KRCD North Fork Group	**16725-011**	

Sample ID:	Sample Date:
Site 11; B-6 @ 4.0'	**December 12, 2006**

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	**Site 11; B-6 @ 4.0'**	
DESCRIPTION:	Silty Clayey SAND (SM-SC)	
	INITIAL	FINAL
HEIGHT, in.	5.8	5.8
DIAMETER, in.	3.4	3.4
WATER CONTENT, %	n/a	n/a
DRY DENSITY, pcf	n/a	n/a
SATURATION, %	n/a	n/a
(Specific Gravity assumed as 2.7)		
MAXIMUM DRY DENSITY, pcf	n/a	
OPTIMUM WATER CONTENT, %	n/a	
SPECIFIED COMPACTION, %	n/a	
ACHEIVED COMPACTION, %	n/a	

COMMENTS:
Tap water used as permeant

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	5 - 6
IN / OUT RATIO:	1.08
"B" PARAMETER:	0.95

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY cm / sec
1	1.4	1.8E-07
2	3.2	1.9E-07

AVERAGE : **1.9E-07**
SPECIFICATION : **1.0E-06**
FAIL

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of TECHNICON Engineering Services, Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of TECHNICON Engineering Services, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmlessTECHNICON from and against all liability in excess of the aforementioned limit.

Reviewed By:

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

Subsurface Explorations Data

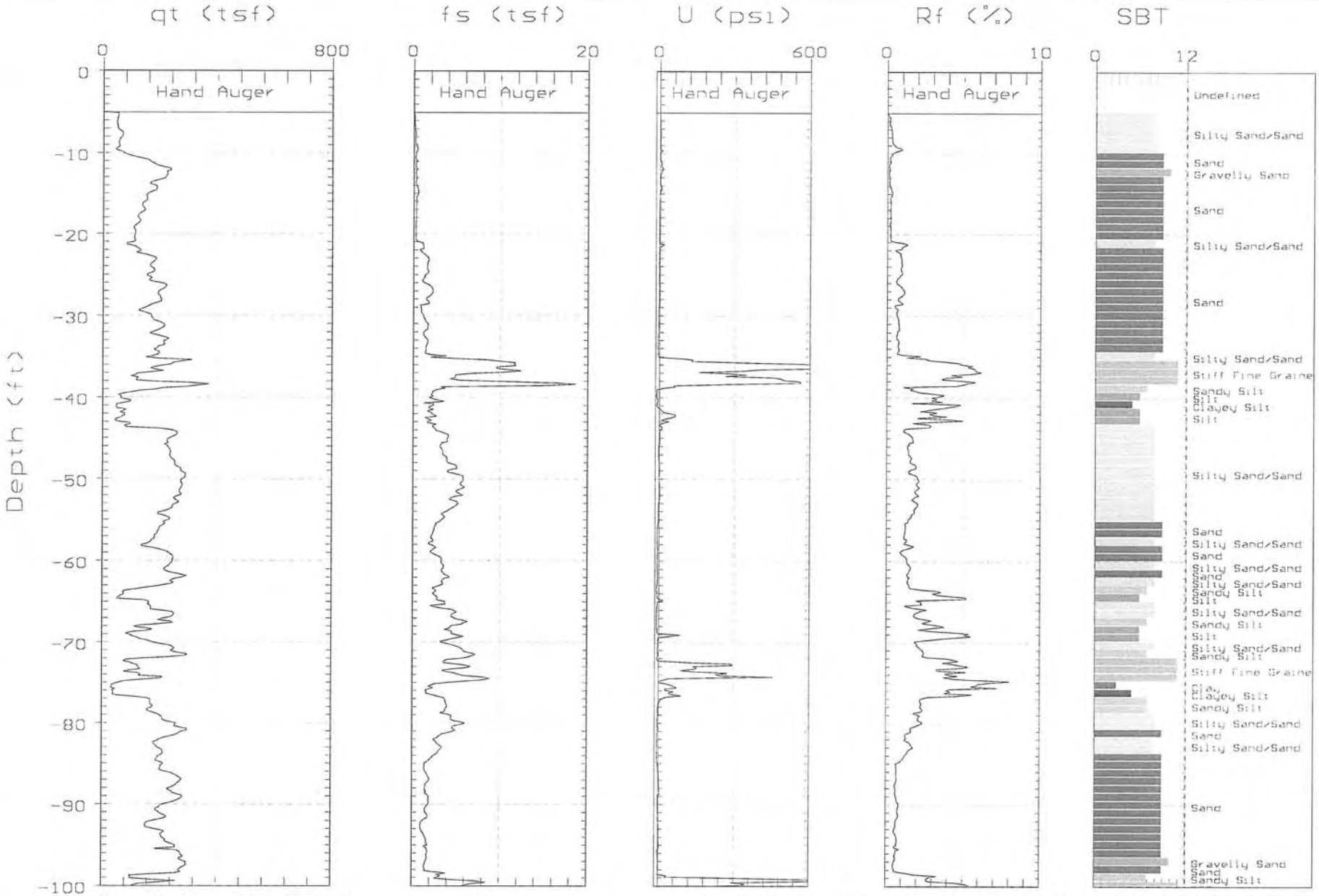
Site No. 11
CPT 11-01

GRL

TECHNICON

Site: NFG S_E #11
Location: CPT11-01

Geologist: A.JONES
Date: 11:29:06 15:08



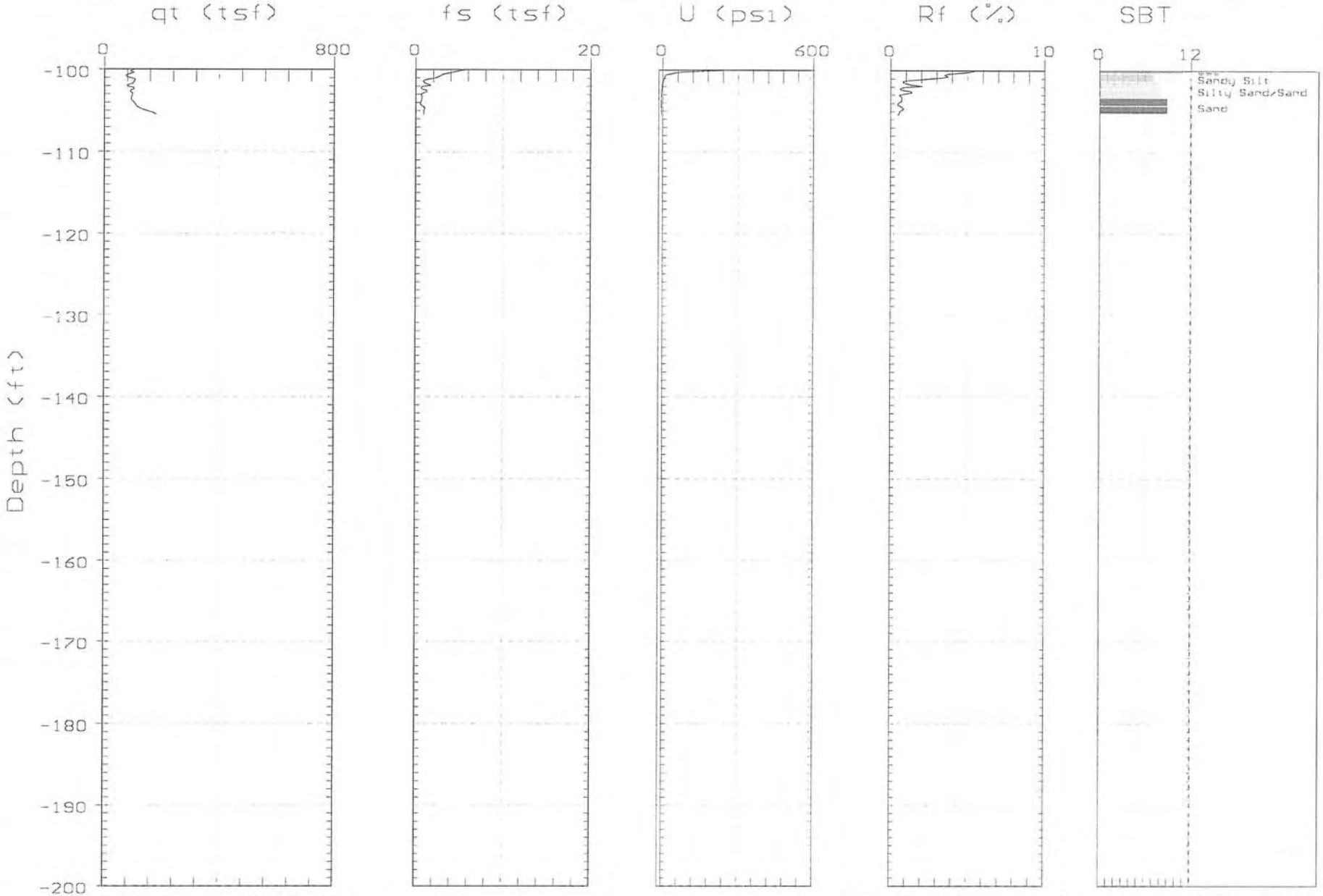
Max. Depth: 105.48 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG SITE #11
Location: CPT11-01

Geologist: A.JONES
Date: 11:29:06 15:08



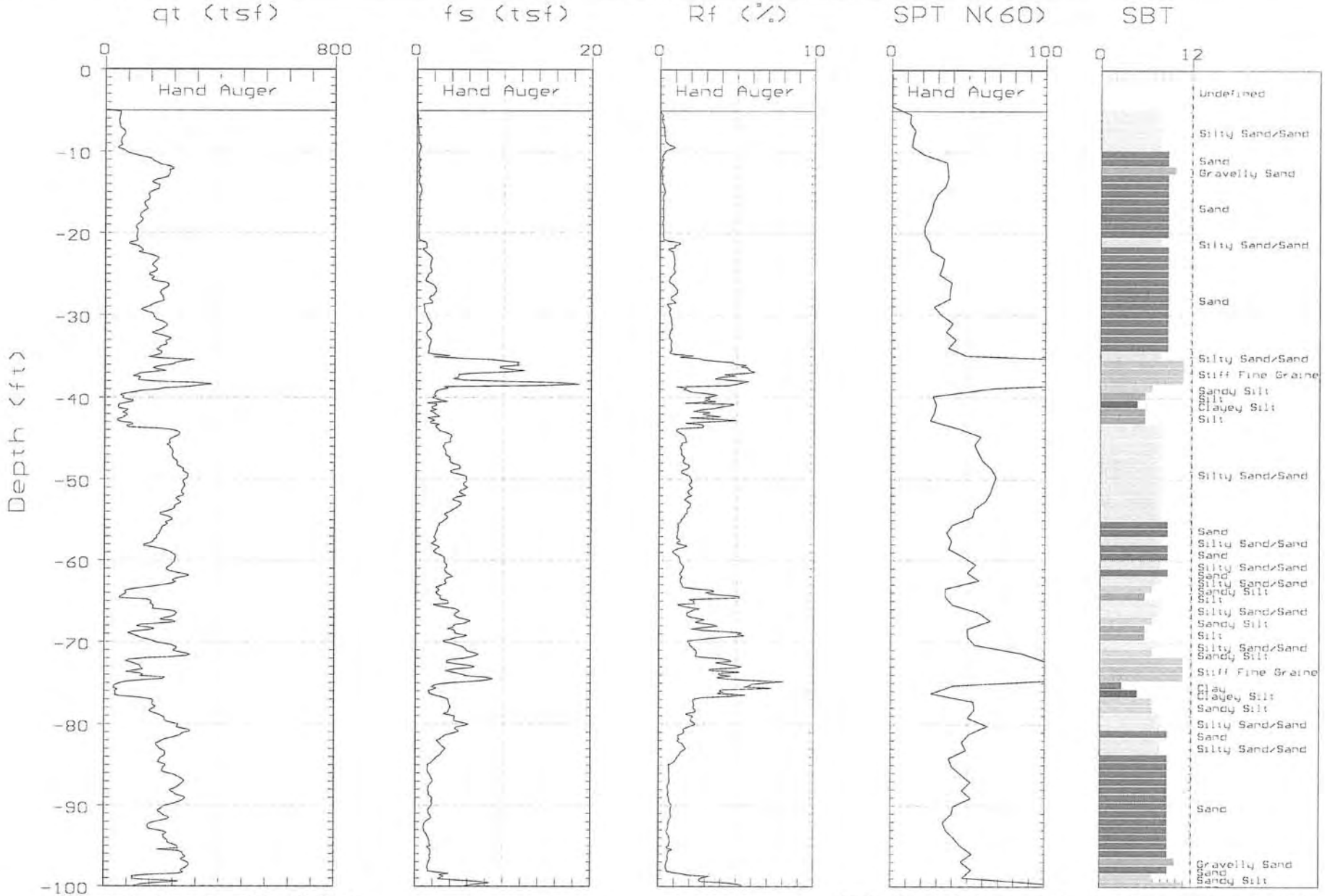
Max. Depth: 105.48 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG SITE #11
Location: CPT11-01

Geologist: A. JONES
Date: 11:29:06 15:08



Max. Depth: 105.48 (ft)
Depth Inc.: 0.164 (ft)

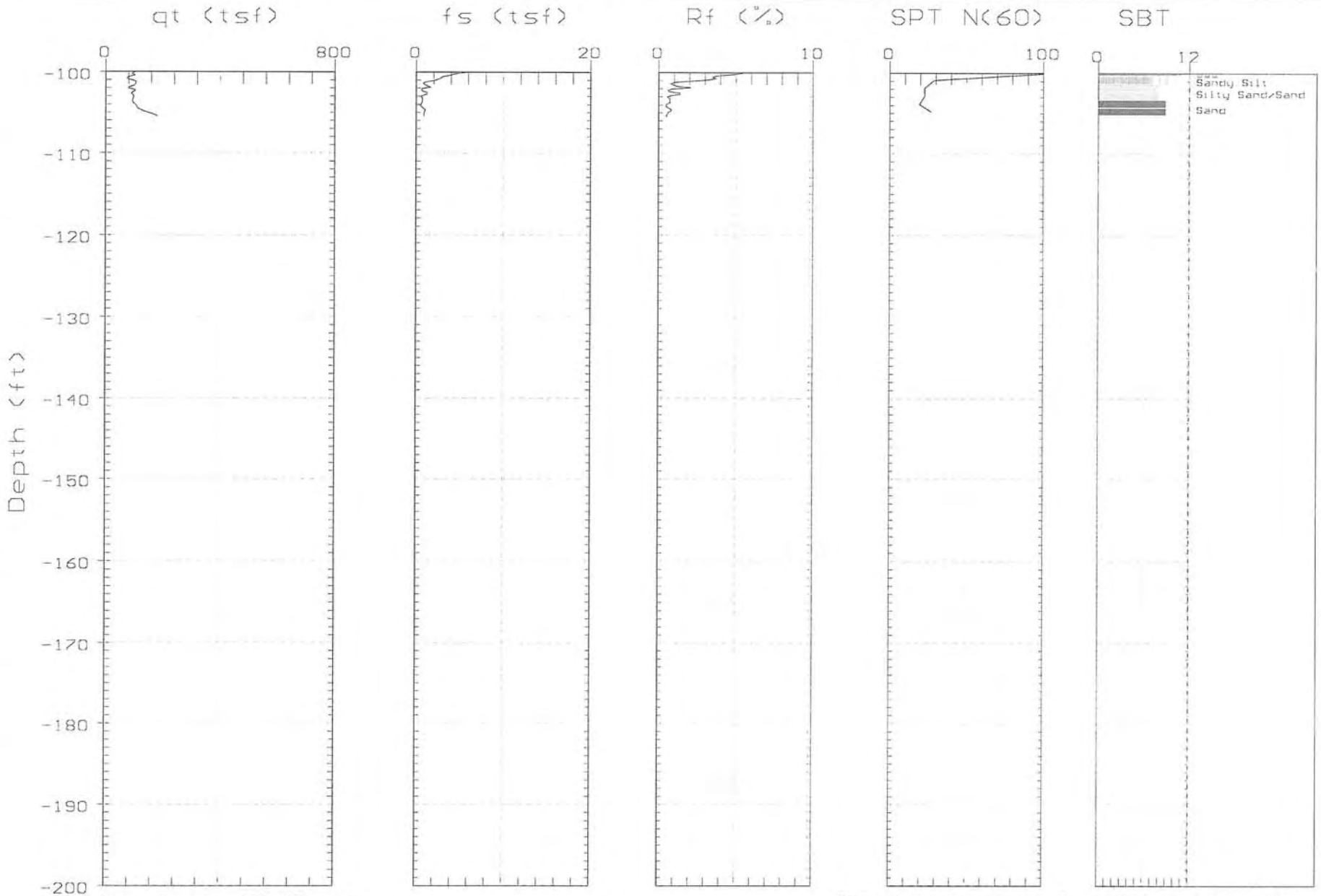
SBT: Soil Behavior Type (Robertson 1990)

GRL

TECHNICON

Site: NFG SITE #11
Location: CPT11-01

Geologist: A. JONES
Date: 11:29:06 15:08



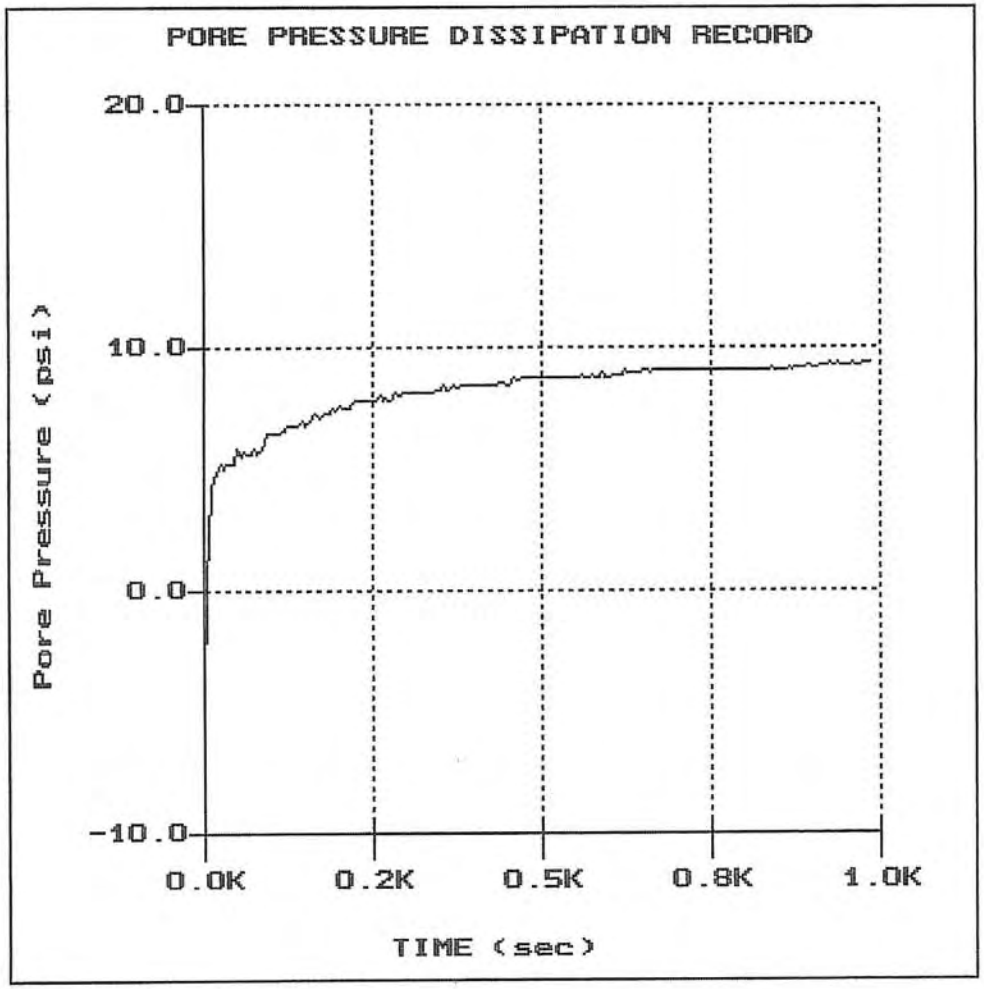
Max. Depth: 105.48 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site:NFG SITE #11
Location:CPT11-01

Oversite:A.JONES
Date:11:29:06 15:08



File: 247C1101.PPC
Depth (m): 32.15
(ft): 105.48
Duration : 985.0s
U-min: -4.58 0.0s
U-max: 9.40 985.0s

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

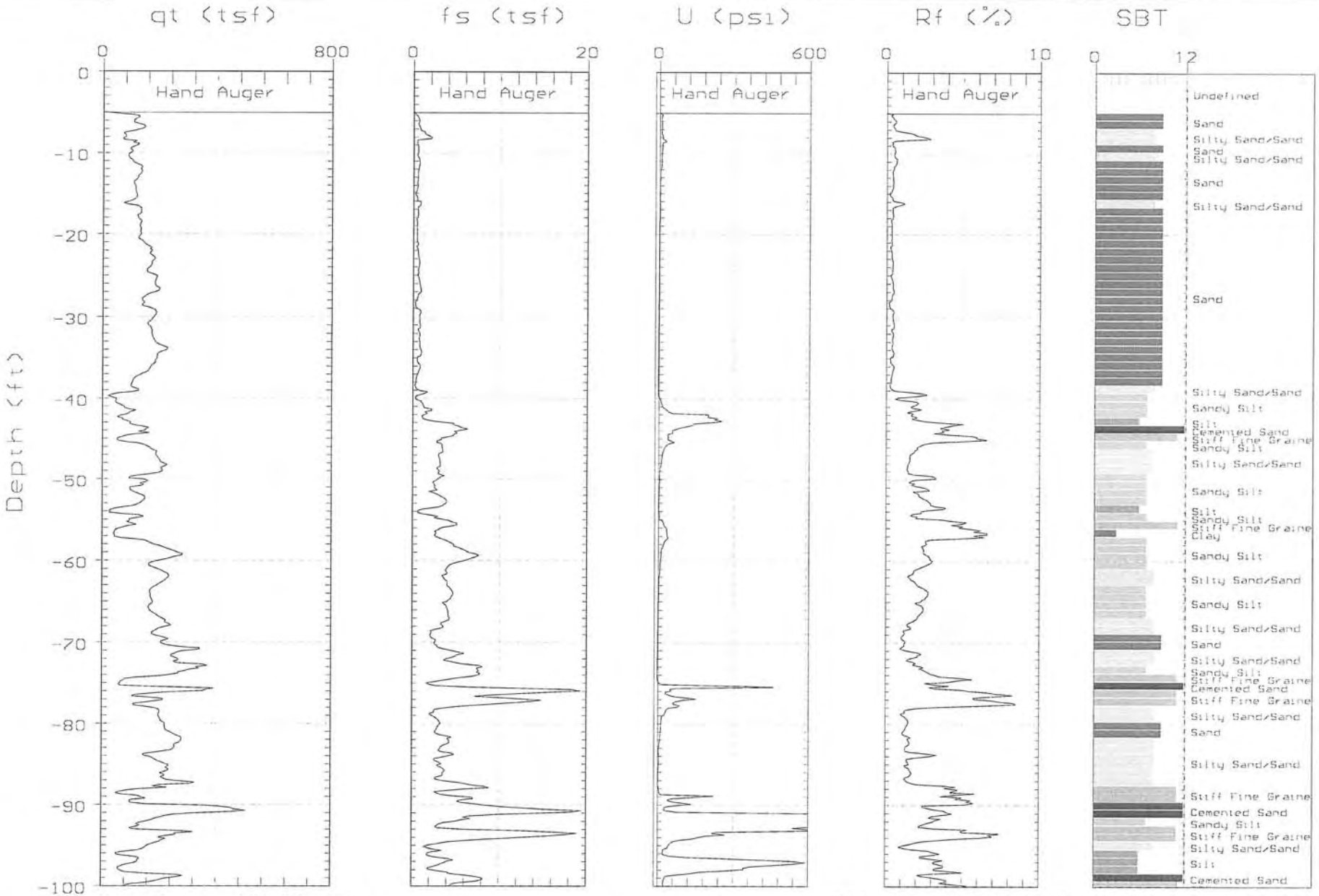
Subsurface Explorations Data

Site No. 11
CPT 11-02

TECHNICON

Site: NFG SITE #11
Location: CPT11-02

Geologist: A.JONES
Date: 11:29:06 16:28



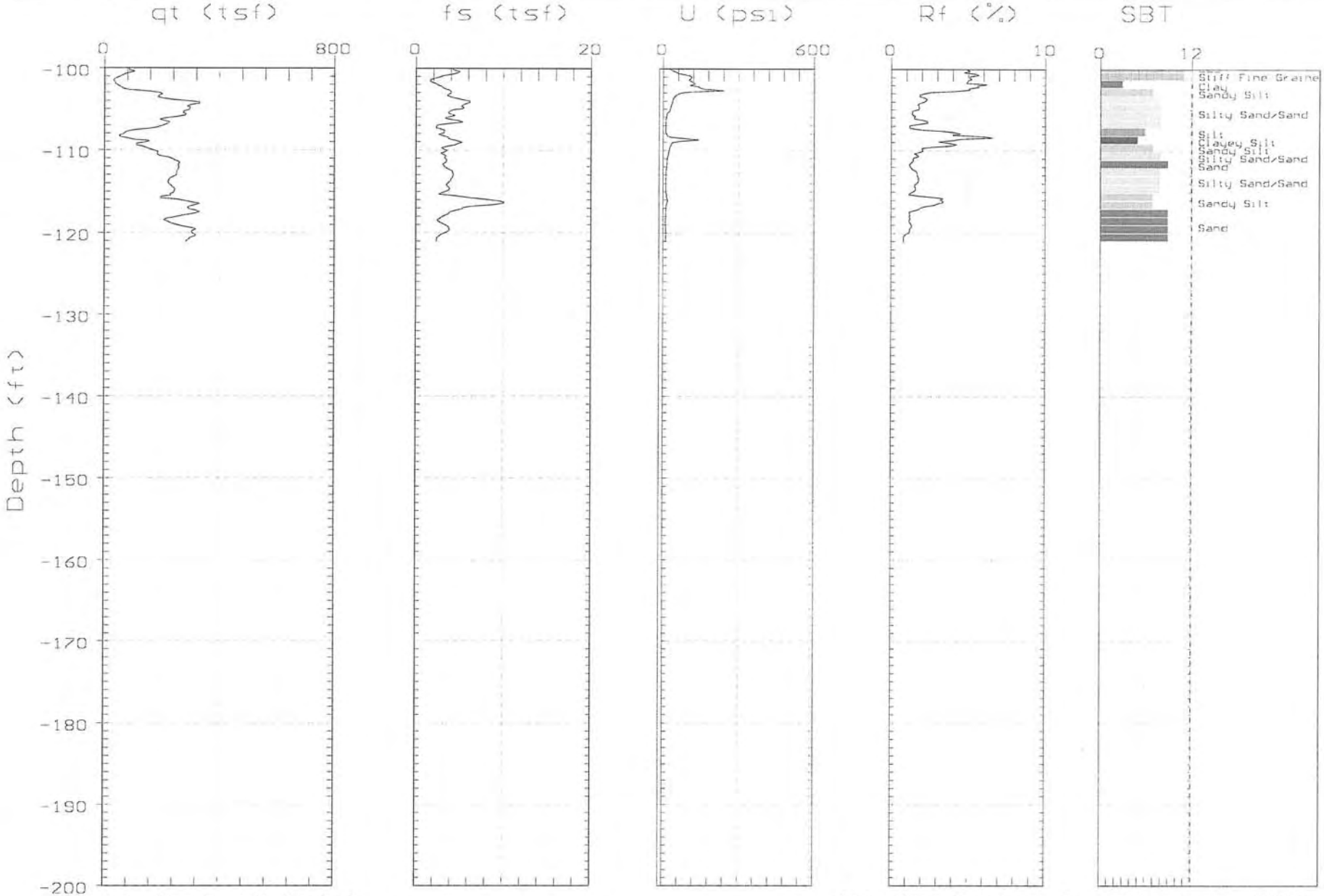
Max. Depth: 121.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG SITE #11
Location: CPT11-02

Geologist: A.JONES
Date: 11:29:06 16:28



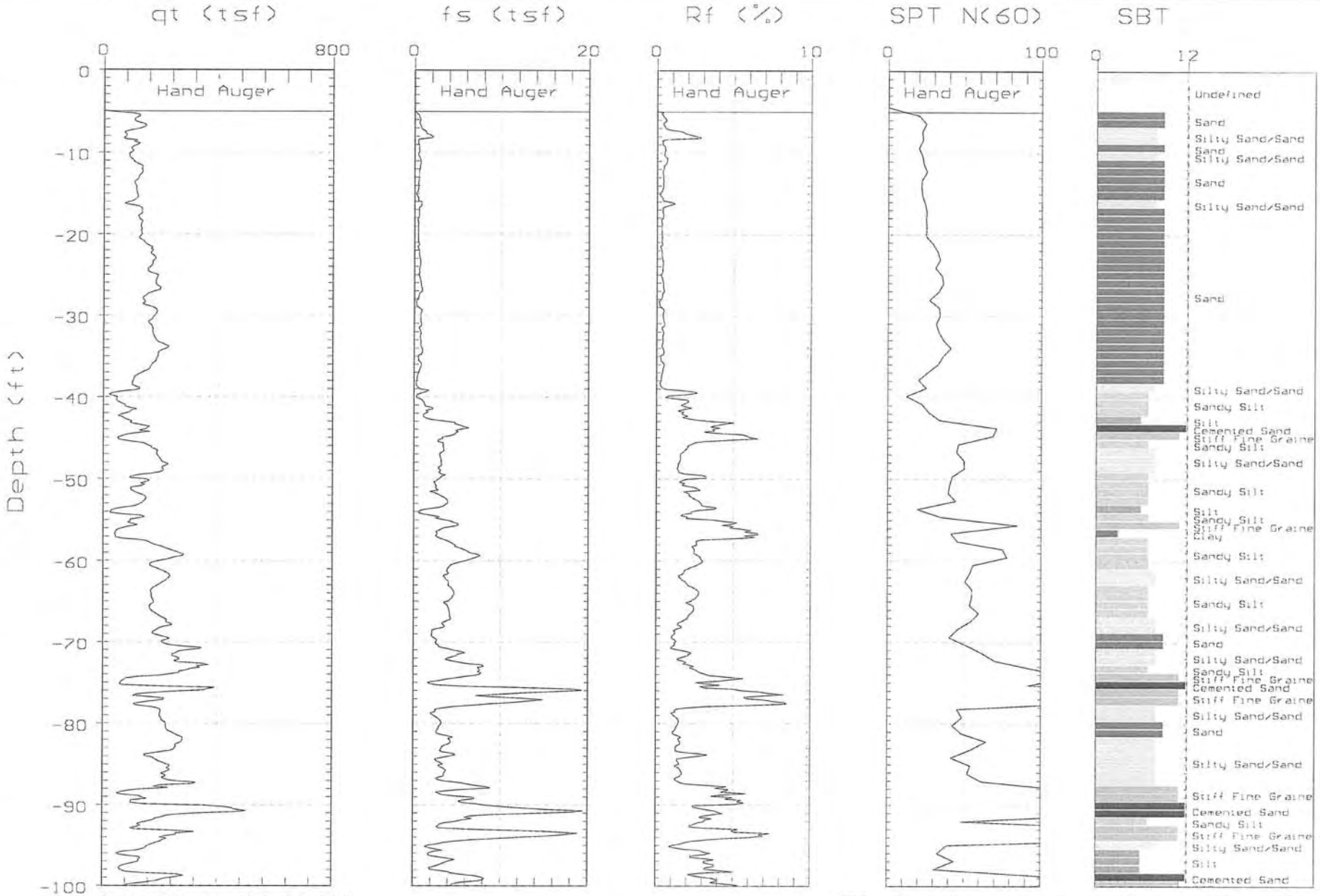
Max. Depth: 121.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG S-E #11
Location: CPT11-02

Geologist: A.JONES
Date: 11:29:06 16:28



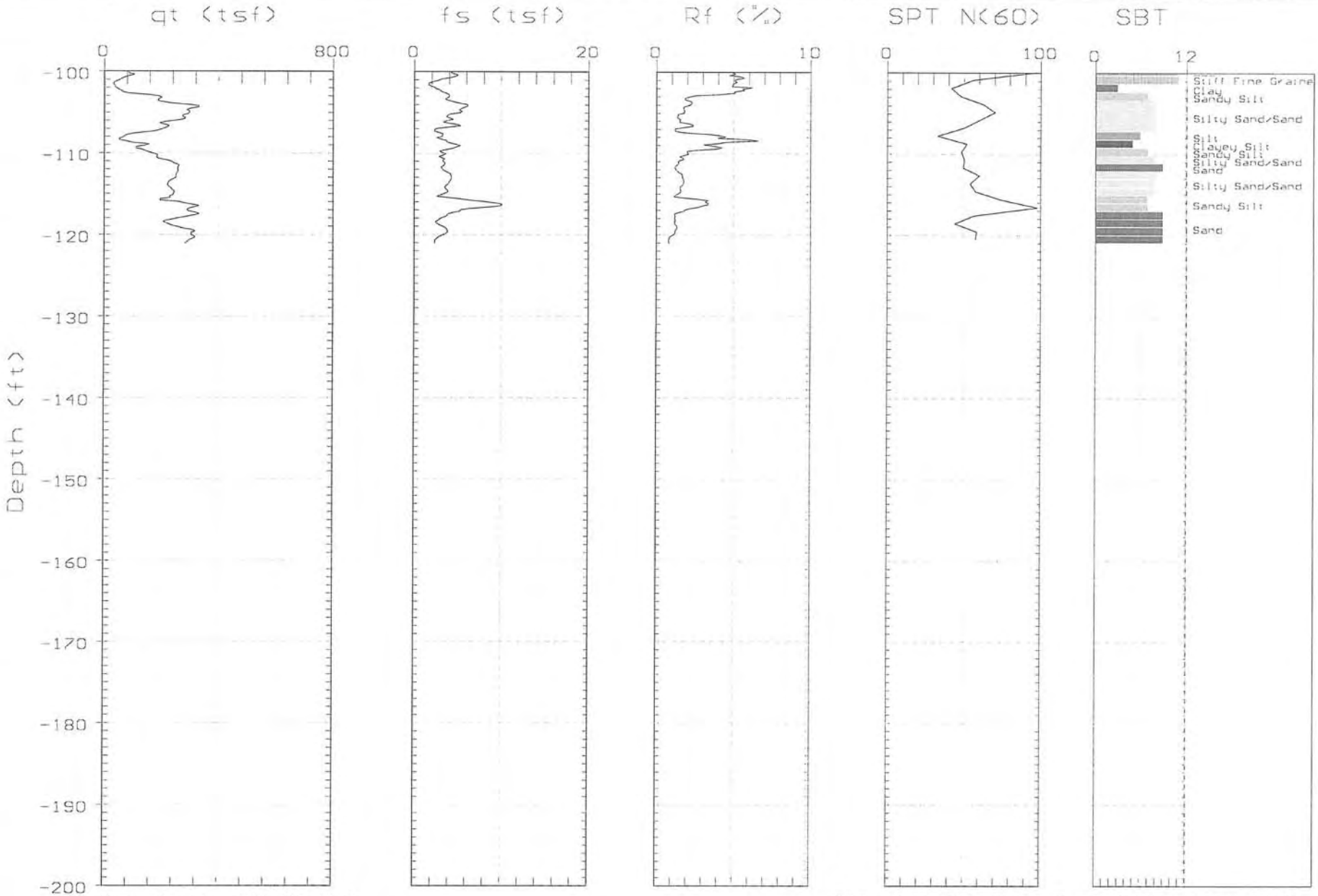
Max. Depth: 121.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG S[illegible]E #11
Location: CPT11-02

Geologist: A.JONES
Date: 11:29:06 16:28



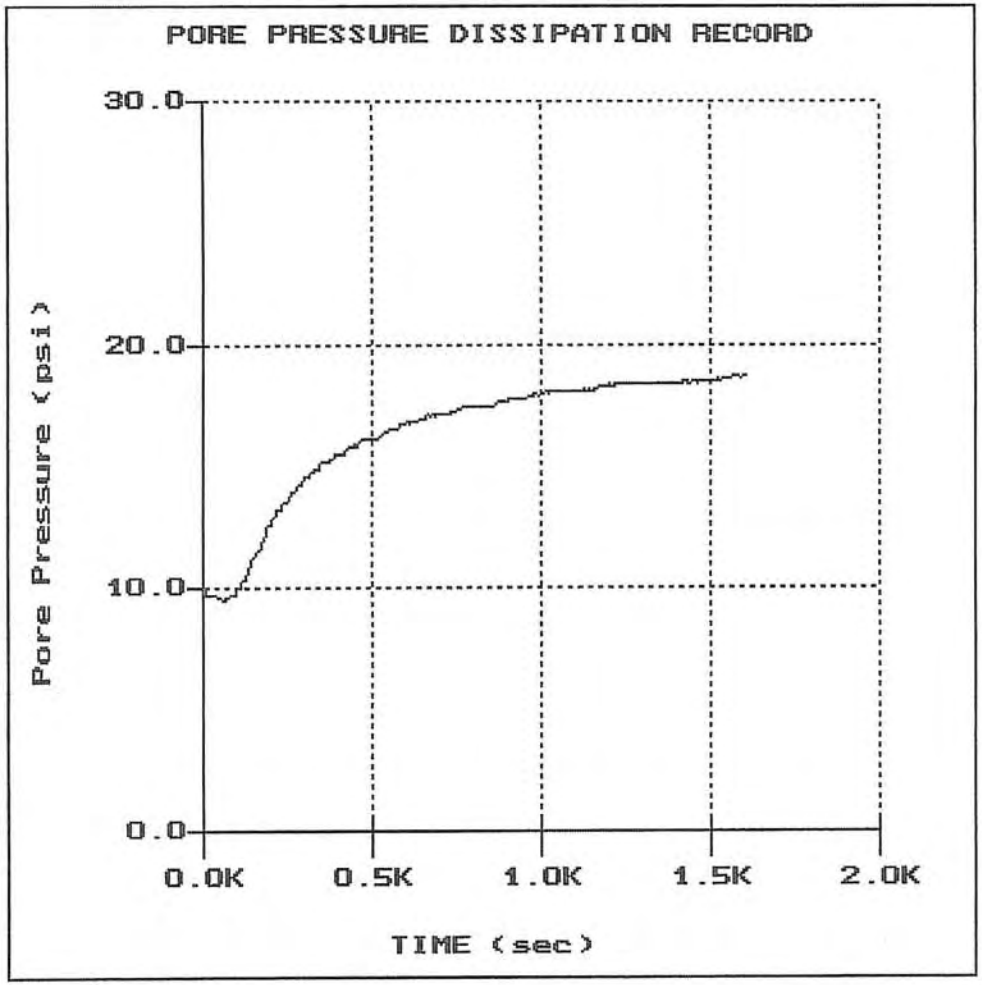
Max. Depth: 121.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site:NFG SITE #11
Location:CPT11-02

Oversite:A.JONES
Date:11:29:06 16:28



File: 247C1102.PPC
Depth (m): 36.90
(ft): 121.06
Duration : 1605.0s
U-min: 9.52 65.0s
U-max: 18.76 1605.0s

Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

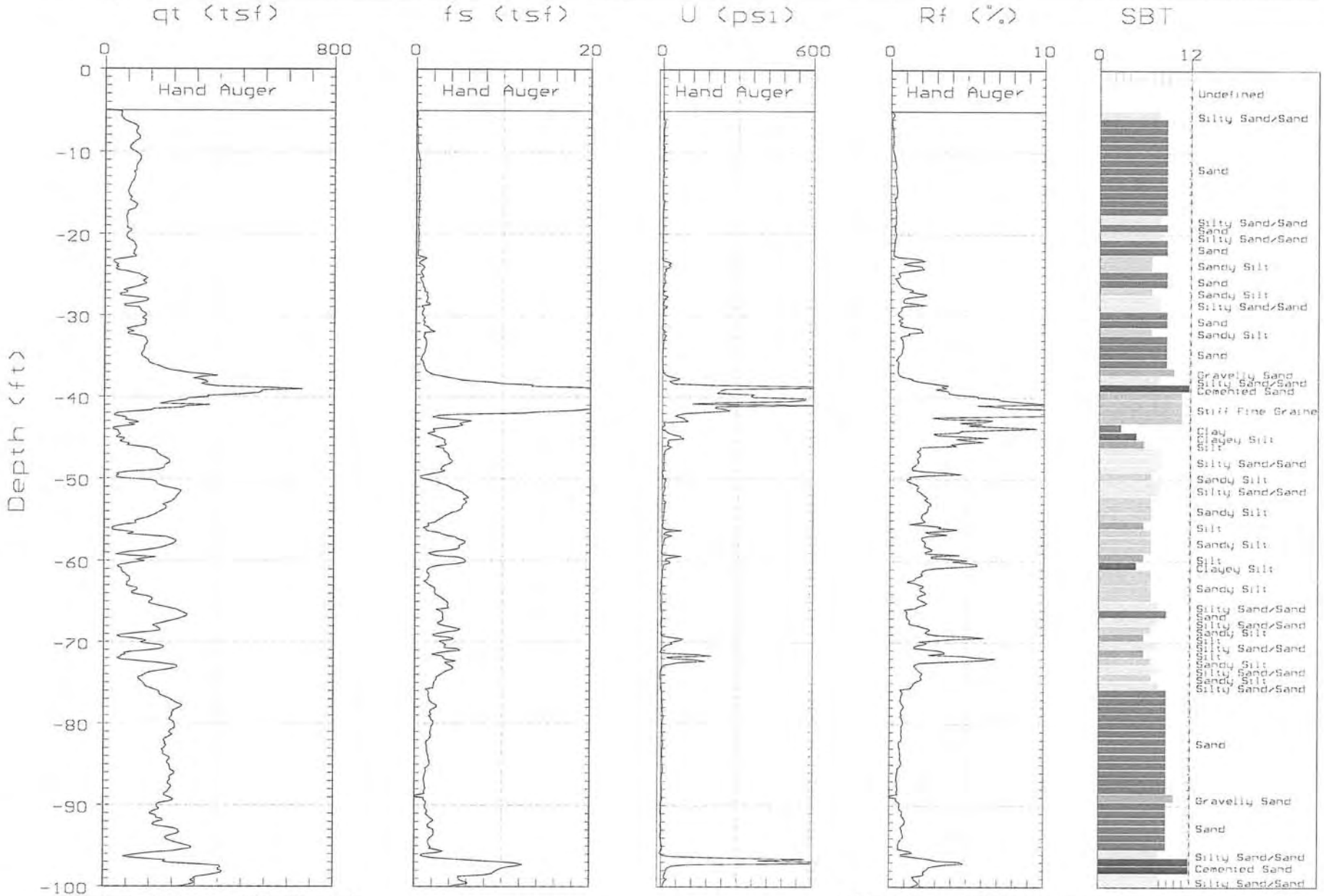
Subsurface Explorations Data

Site No. 11
CPT 11-03

TECHNICON

Site: NFG SITE #11
Location: CPT11-03

Geologist: A.JONES
Date: 11:30:06 08:10



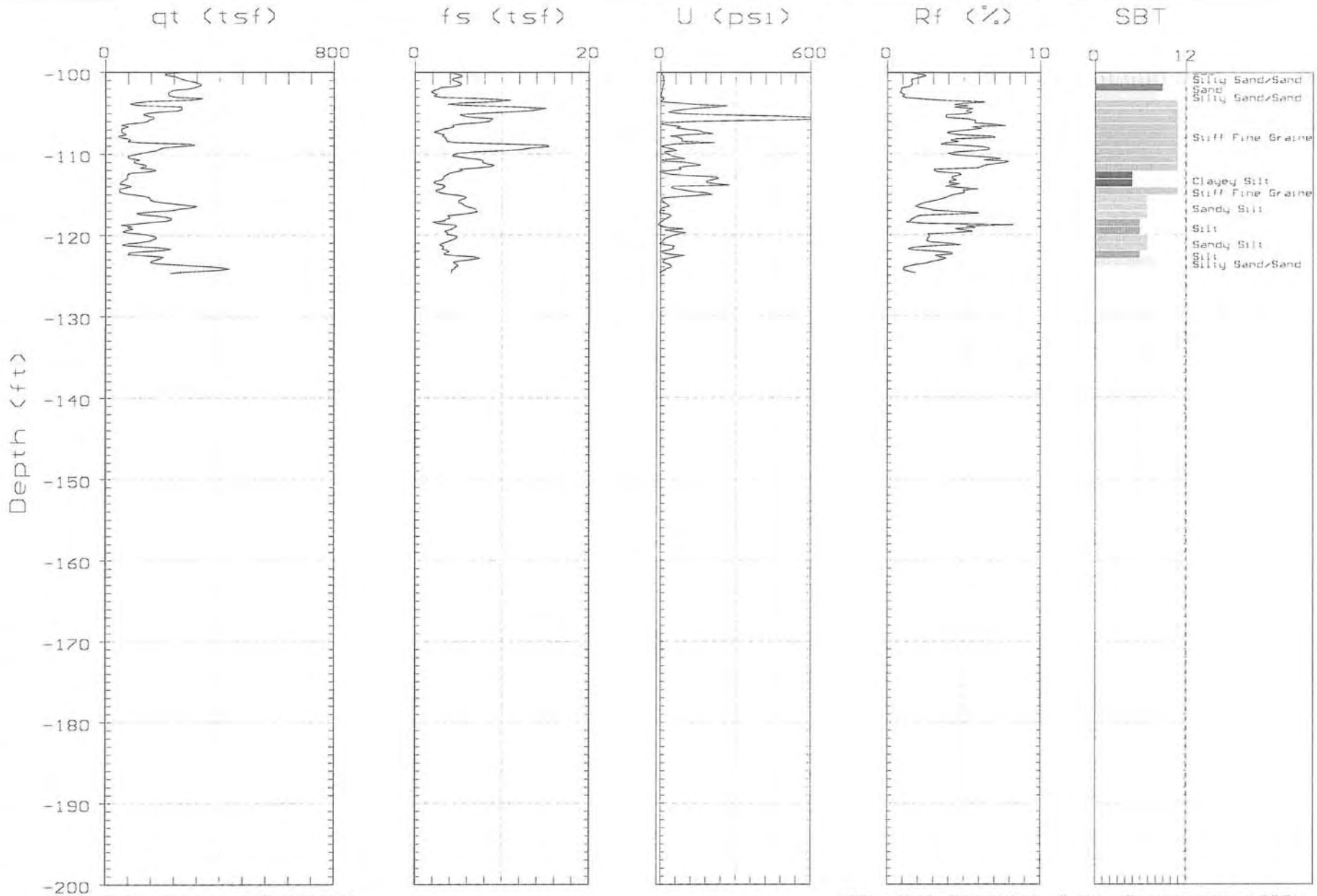
Max. Depth: 124.67 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG S[illegible]E #11
Location: CPT11-03

Geologist: A.JONES
Date: 11:30:06 08:10



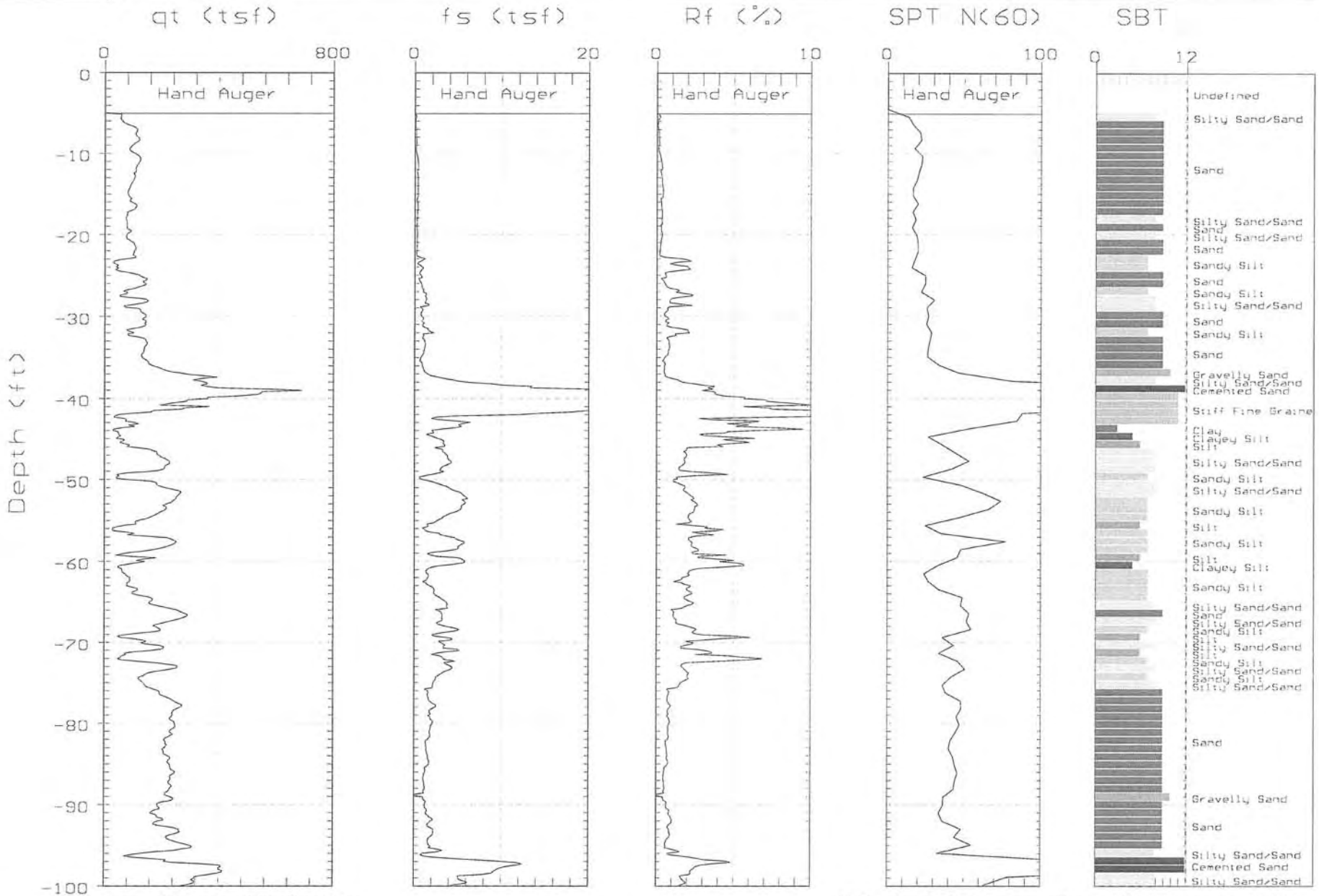
Max. Depth: 124.67 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG [illegible]E #11
Location: CPT11-03

Geologist: A. JONES
Date: 11:30:06 08:10



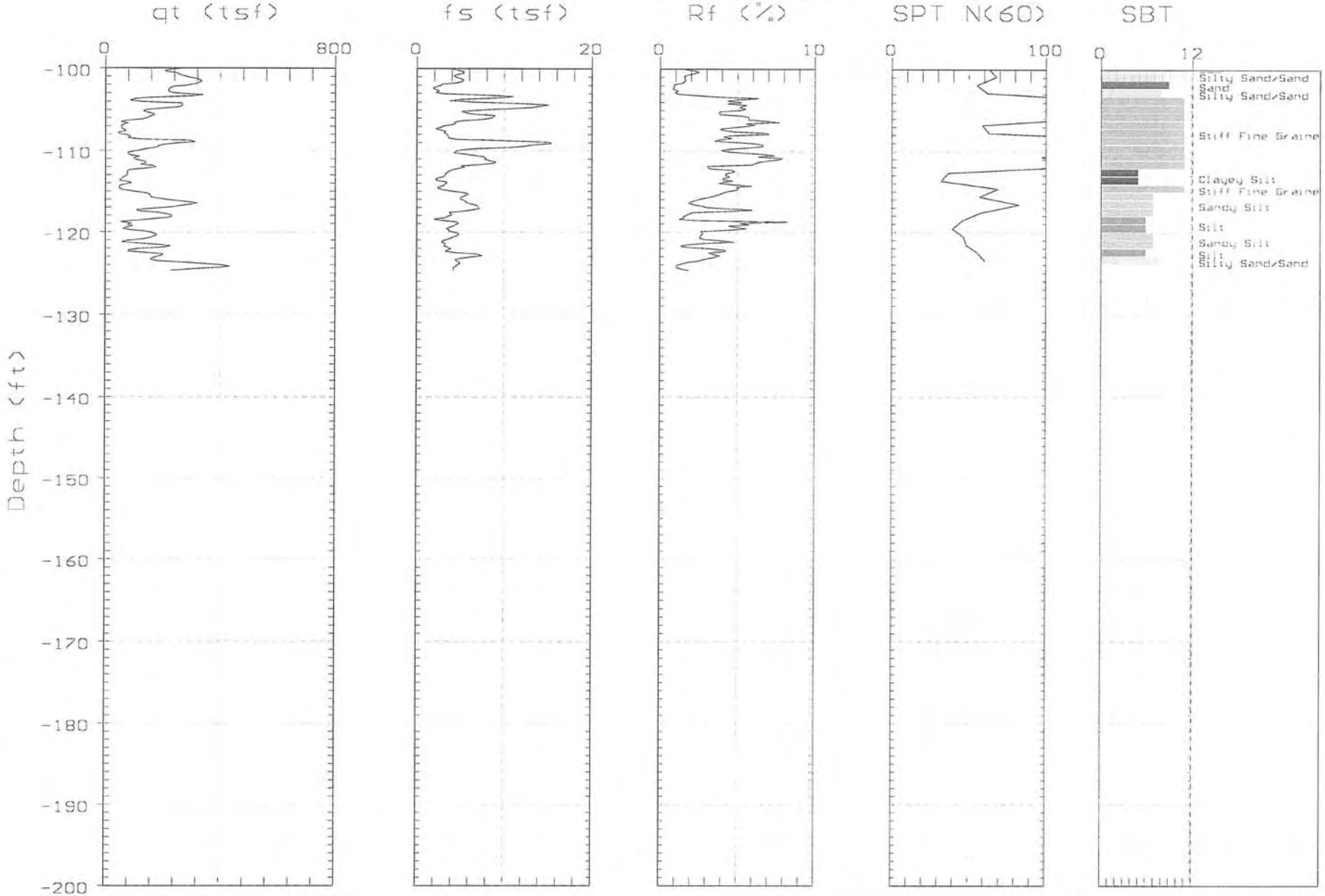
Max. Depth: 124.67 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG S-E #11
Location: CPT11-03

Geologist: A.JONES
Date: 11:30:06 08:10



Max. Depth: 124.67 (ft)
Depth Inc.: 0.164 (ft)

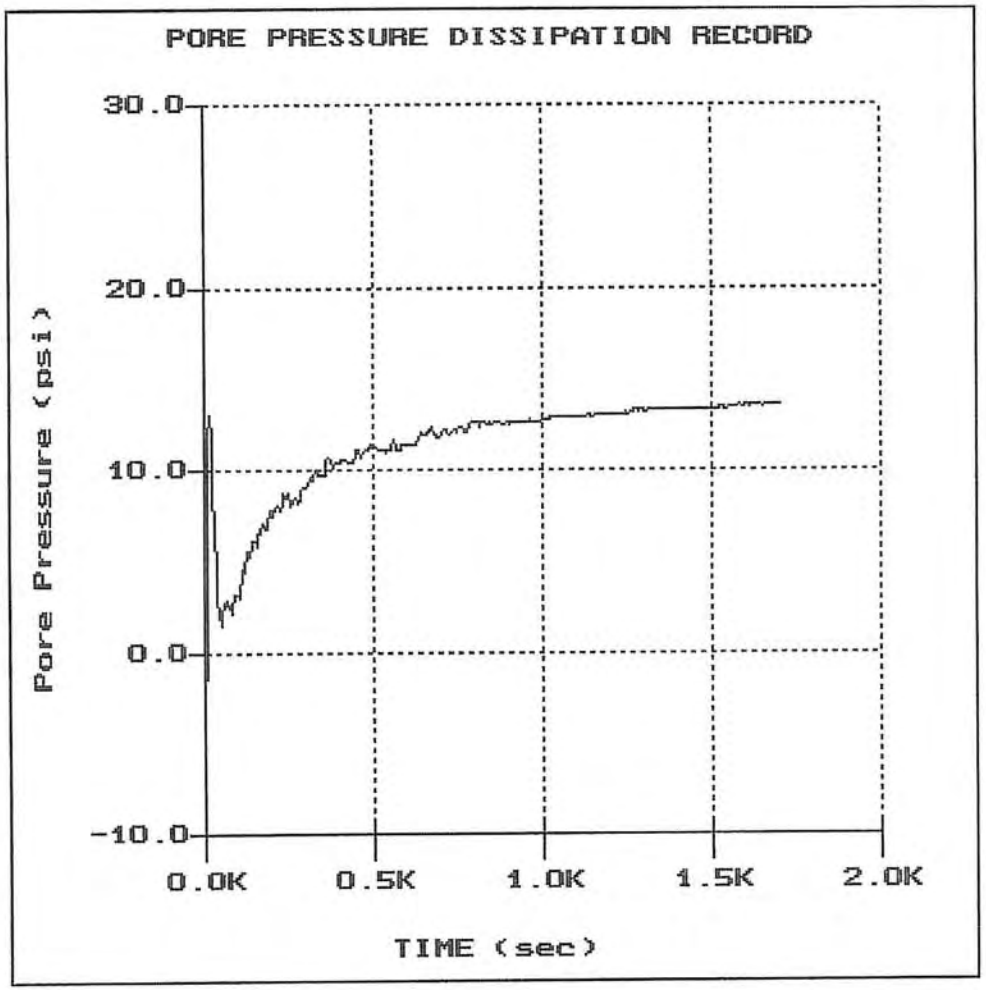
SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site:NFG SITE #11
Location:CPT11-03

Oversite:A.JONES
Date:11:30:06 08:10

File: 247C1103.PPC
Depth (m): 38.65
(ft): 126.80
Duration : 1705.0s
U-min: -3.54 0.0s
U-max: 13.65 1705.0s



Kings River Conservation District

Investigation of Groundwater Recharge Potential in the North Fork Area of the Kings River

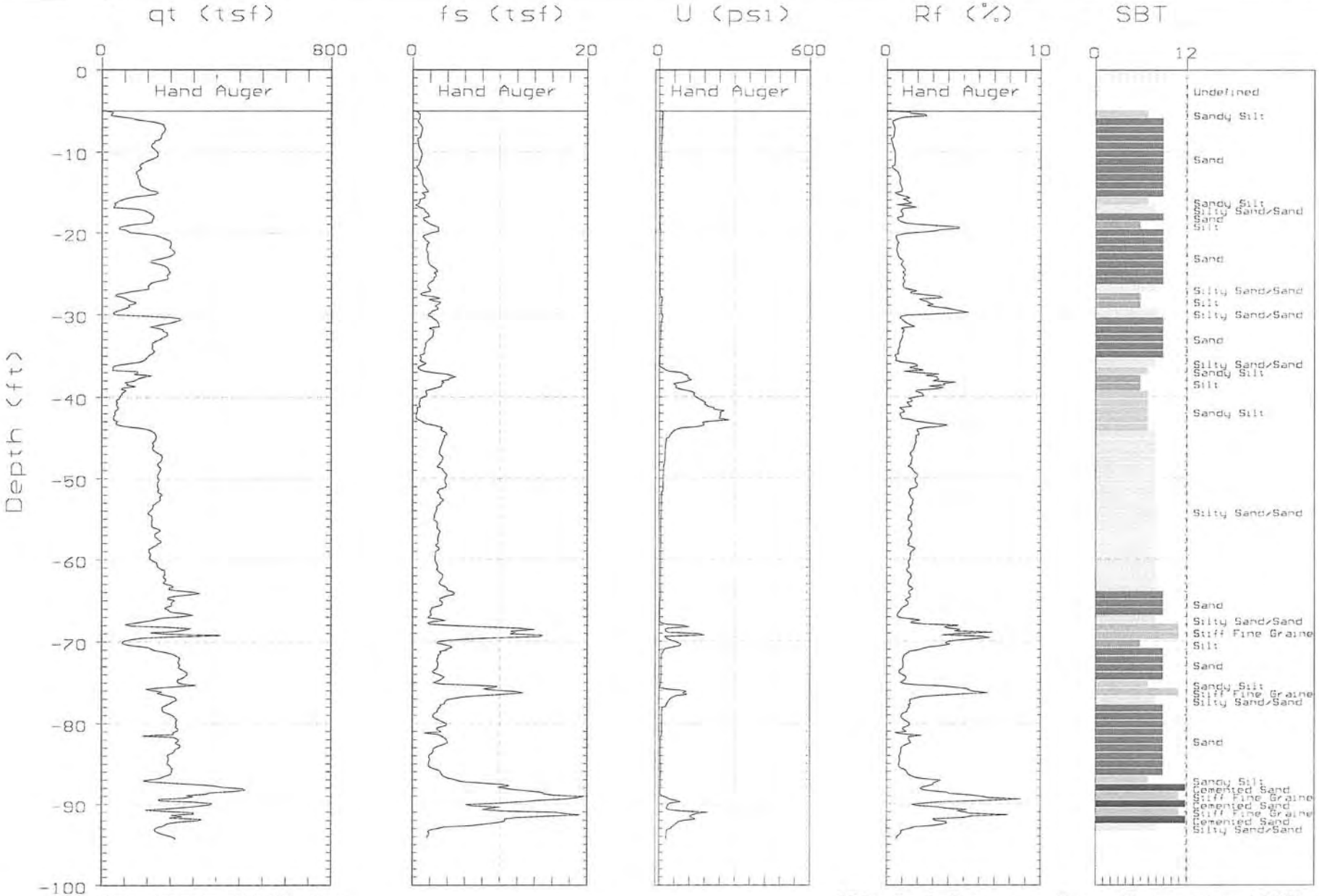
Subsurface Explorations Data

Site No. 11
CPT 11-04

TECHNICON

Site: NFG S_E #11
Location: CPT11-04

Geologist: A.JONES
Date: 11:30:06 10:30



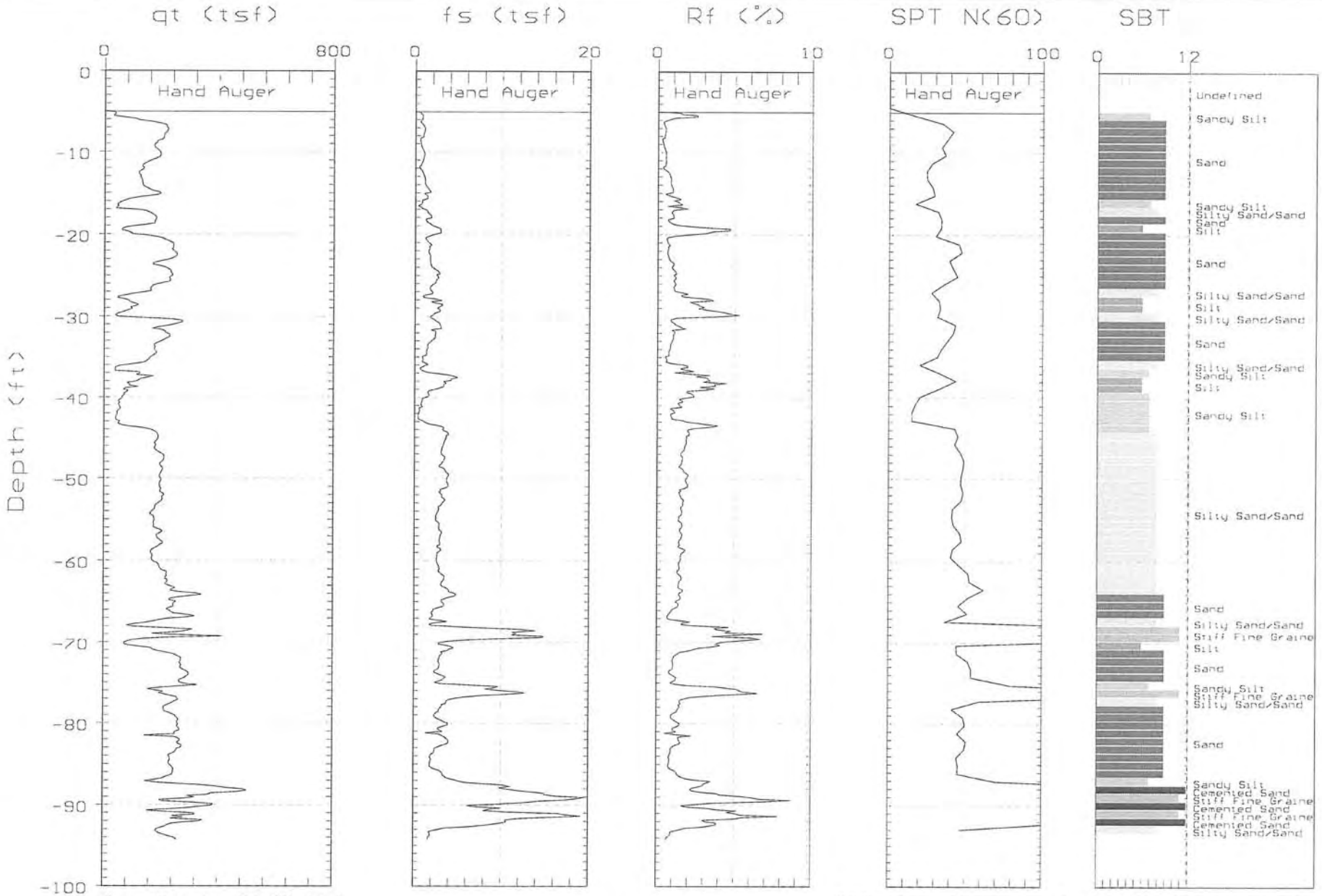
Max. Depth: 94.32 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site: NFG S[illegible]E #11
Location: CPT11-04

Geologist: A.JONES
Date: 11:30:06 10:30



Max. Depth: 94.32 (ft)
Depth Inc.: 0.164 (ft)

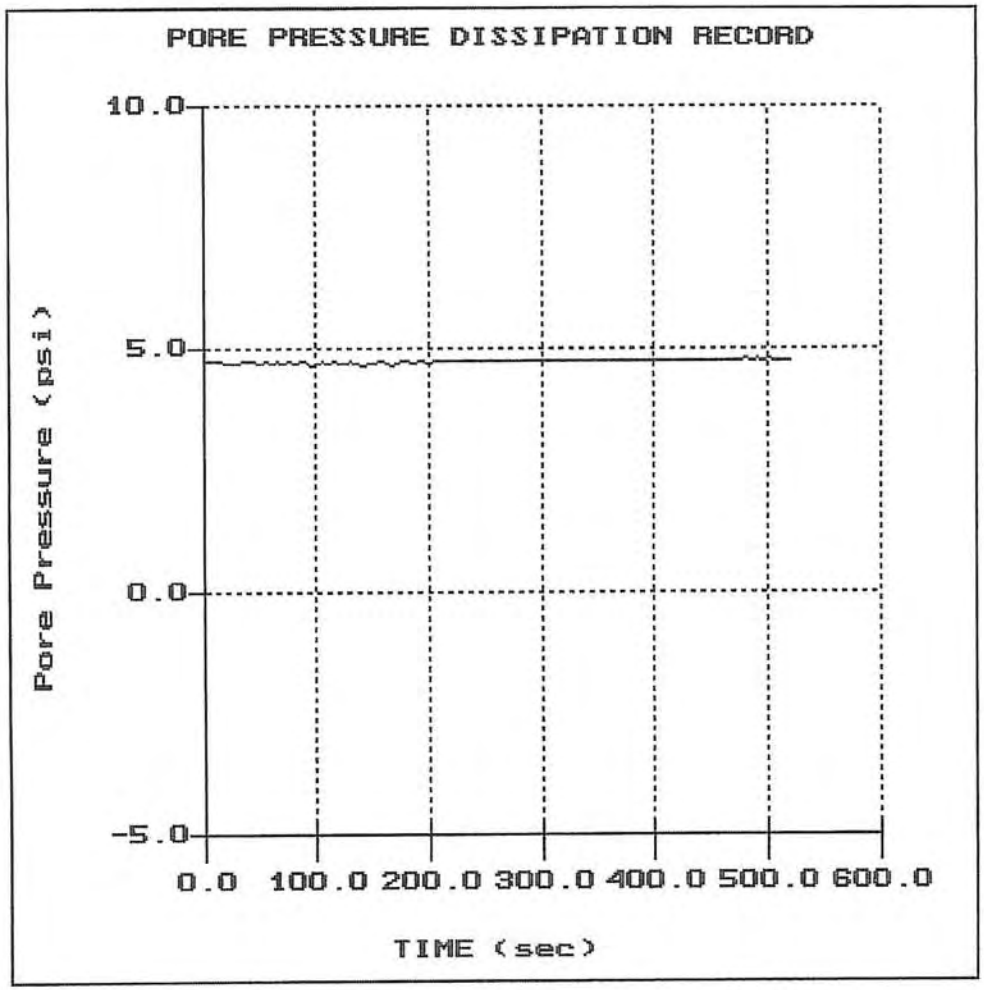
SBT: Soil Behavior Type (Robertson 1990)

TECHNICON

Site:NFG SITE #11
Location:CPT11-04

Oversite:A.JONES
Date:11:30:06 10:30

File: 247C1104.PPC
Depth (m): 24.85
(ft): 81.53
Duration : 520.0s
U-min: 4.66 165.0s
U-max: 4.80 490.0s

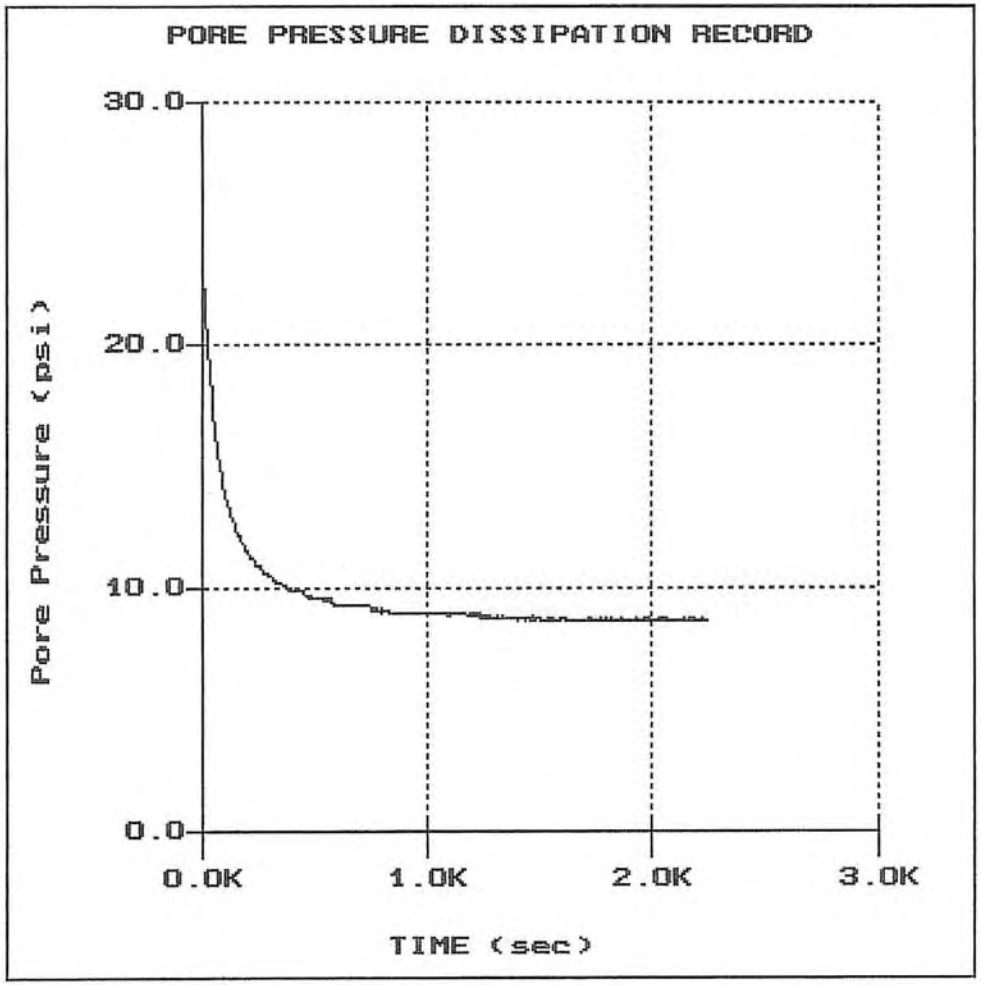


TECHNICON

Site:NFG SITE #11
Location:CPT11-04

Oversite:A.JONES
Date:11:30:06 10:30

File: 247C1104.PPC
Depth (m): 28.75
(ft): 94.32
Duration : 2235.0s
U-min: 8.63 2195.0s
U-max: 26.55 0.0s



LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX B

PRELIMINARY DESIGN DRAWINGS

Know what's **below.**
Call before you dig.

WARNING
POWER LINES
OVERHEAD

LAGUNA IRRIGATION DISTRICT

FRESNO COUNTY

RECHARGE BASIN NO. 11

VICINITY MAP

N

SPECIAL NOTE

WHERE UNDERGROUND AND SURFACE STRUCTURES ARE SHOWN ON THE PLANS, THE LOCATIONS, DEPTH AND DIMENSIONS OF STRUCTURES ARE BELIEVED TO BE REASONABLY CORRECT, BUT ARE NOT GUARANTEED. SUCH STRUCTURES ARE SHOWN FOR THE INFORMATION OF THE CONTRACTOR, BUT INFORMATION SO GIVEN IS NOT TO BE CONSTRUED AS A REPRESENTATION THAT SUCH STRUCTURES WILL, IN ALL CASES, BE FOUND WHERE SHOWN, OR THAT THEY REPRESENT ALL OF THE STRUCTURES WHICH MAY BE ENCOUNTERED.

SITE SAFETY AND PROTECTION NOTES

THE DUTY OF THE ENGINEER, OWNER OR ITS AGENTS TO CONDUCT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE AND THE UNDERTAKING OF INSPECTIONS OR THE GIVING OF INSTRUCTIONS AS AUTHORIZED HEREIN IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON, OR NEAR THE CONSTRUCTION SITE AND SHALL NOT BE CONSTRUED AS SUPERVISION OF THE ACTUAL CONSTRUCTION NOR MAKE THE ENGINEER, OWNER OR ITS AGENTS RESPONSIBLE FOR PROVIDING A SAFE PLACE FOR THE PERFORMANCE OF WORK BY THE CONTRACTOR, SUBCONTRACTORS, OR SUPPLIERS, OR FOR ACCESS, VISITS, USE, WORK, TRAVEL OR OCCUPANCY BY ANY PERSON.

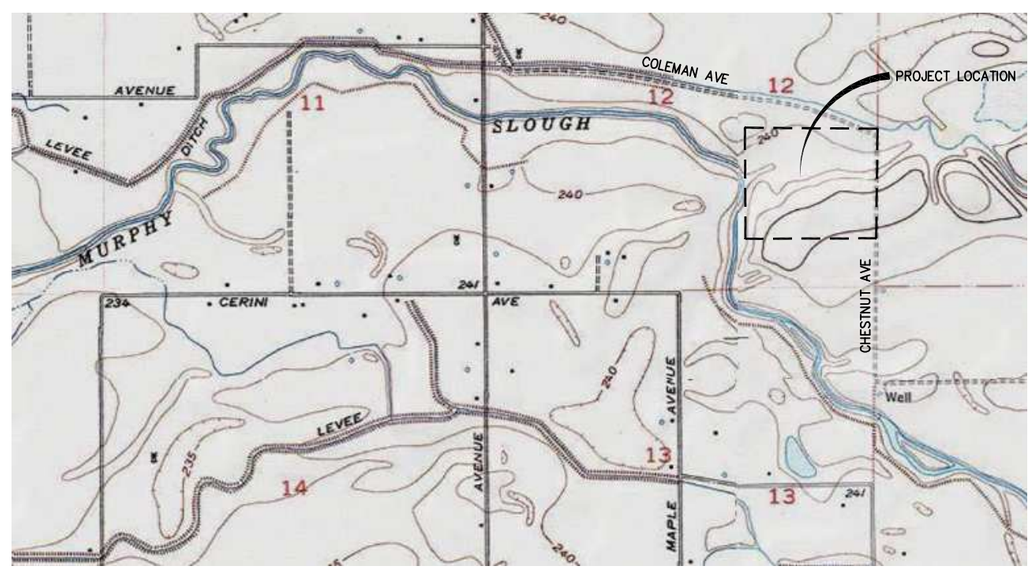
THE CONTRACTOR SHALL HAVE AT THE WORK SITE, COPIES OR SUITABLE EXTRACTS OF CONSTRUCTION SAFETY ORDERS, ISSUED BY CAL-OSHA. CONTRACTOR SHALL COMPLY WITH PROVISIONS OF THESE AND ALL OTHER APPLICABLE LAWS, ORDINANCES AND REGULATIONS. THE CONTRACTOR MUST COMPLY WITH PROVISIONS OF THE SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION, PROMULGATED BY THE SECRETARY OF LABOR UNDER SECTION 107 OF THE CONTRACT WORK HOURS AND SAFETY STANDARDS ACT, AS SET FORTH IN TITLE 29 C.F.R.

TO PROTECT THE LIVES AND HEALTH OF CONTRACTOR'S EMPLOYEES UNDER THE CONTRACT, THE CONTRACTOR SHALL COMPLY WITH ALL PERTINENT PROVISIONS OF THE "MANUAL OF ACCIDENT PREVENTION IN CONSTRUCTION" ISSUED BY THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC., AND SHALL MAINTAIN AN ACCURATE RECORD OF ALL CASES OF DEATH, OCCUPATIONAL DISEASE, AND INJURY REQUIRING MEDICAL ATTENTION OR CAUSING LOSS OF TIME FROM WORK, ARISING OUT OF AND IN THE COURSE OF EMPLOYMENT OR WORK UNDER THE CONTRACT.

THE CONTRACTOR ALONE SHALL BE RESPONSIBLE FOR THE SAFETY, EFFICIENCY, AND ADEQUACY OF CONTRACTOR'S FACILITIES, APPLIANCES, AND METHODS AND FOR ANY DAMAGE, WHICH MAY RESULT FROM THEIR FAILURE OR THEIR IMPROPER CONSTRUCTION, MAINTENANCE OR OPERATION.

THE CONTRACTOR AGREES THAT IT SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER, PROVOST & PRITCHARD CONSULTING GROUP, AND THEIR RESPECTIVE AGENTS HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF OWNER, ENGINEER, OR THEIR RESPECTIVE AGENTS.

THE OWNER AND ITS AGENTS' SITE RESPONSIBILITIES ARE LIMITED SOLELY TO THE ACTIVITIES OF THEIR EMPLOYEES ON SITE. THESE RESPONSIBILITIES SHALL NOT BE INFERRED BY ANY PARTY TO MEAN THAT THE OWNER OR ITS AGENTS HAVE RESPONSIBILITY FOR SITE SAFETY. SAFETY IN, ON, OR ABOUT THE SITE IS THE SOLE AND EXCLUSIVE RESPONSIBILITY OF THE CONTRACTOR ALONE. THE CONTRACTOR'S METHODS OF WORK PERFORMANCE, SUPERINTENDENCE AND THE CONTRACTOR'S EMPLOYEES, AND SEQUENCING OF CONSTRUCTION ARE ALSO THE SOLE AND EXCLUSIVE RESPONSIBILITIES OF THE CONTRACTOR ALONE.



SITE MAP

GENERAL NOTES

1. LAGUNA IRRIGATION DISTRICT (DISTRICT) (XXX-XXX-XXXX) SHALL BE CONTACTED AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF WORK ON OR NEAR EXISTING DISTRICT FACILITIES.
2. USED MATERIAL, REJECTS, MISFITS, OR SECONDS, ETC. ARE NOT ACCEPTABLE FOR USE ON DISTRICT FACILITIES.
3. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH THESE PLANS, PROJECT SPECIFICATIONS.
4. CONTRACTOR SHALL FIELD VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING FACILITIES PRIOR TO COMMENCING WORK. CALL UNDERGROUND SERVICE ALERT (USA) AT 8-1-1. CONTRACTOR SHALL MAKE ENGINEER AWARE OF ANY DISCREPANCIES.
5. ALL CAST-IN-PLACE CONCRETE STRUCTURES SHALL BE FORMED INSIDE AND OUT AND CONCRETE VIBRATED SUFFICIENTLY TO PROVIDE FOR SMOOTH SURFACED WALLS/FLOORS WITHOUT VOIDS AND HONEYCOMBS.
6. DISTRICT SHALL INSPECT ALL WORK PHASES ON IRRIGATION FACILITIES FOR CONFORMANCE TO PROJECT SPECIFICATIONS. REINFORCING SHALL NOT BE ENCASED IN CONCRETE WITHOUT PRIOR DISTRICT INSPECTIONS. LIKEWISE, CONCRETE SHALL NOT BE COVERED WITH EARTH PRIOR TO DISTRICT INSPECTION.
7. CONCRETE DESIGN MIX SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL. ALL CONCRETE SHALL HAVE A 28-DAY MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI UNLESS OTHERWISE SPECIFIED.
8. ALL STEEL PIPE AND FITTINGS SHALL BE FURNISHED WITH A SHOP APPLIED HIGH SOLIDS EPOXY COATING ON THE INTERIOR AND EXTERIOR, UNLESS OTHERWISE INDICATED. ALL OTHER EXPOSED STEEL SHALL BE PAINTED WITH A PRE-TREATMENT PRIMER, AN UNDERCOAT AND A FINAL COAT OF PAINT IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
9. ALL NUTS, BOLTS, AND WASHERS USED TO SECURE UNDERGROUND FITTINGS SHALL BE STAINLESS STEEL. AFTER INSTALLATION, ALL STEEL HARDWARE SHALL BE COATED WITH A RUST PREVENTATIVE, WRAPPED WITH 4 MIL POLYETHYLENE SHEETING, AND SECURE WITH PVC TAPE.
10. THRUST RESTRAINTS TO BE PROVIDED AT ALL PIPELINE BENDS, WHETHER OR NOT SHOWN ON THE PLANS.
11. ALL CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE HEALTH AND SAFETY LAWS OF THE STATE OF CALIFORNIA AND CAL/OSHA STANDARDS.
12. TRENCH BACKFILL AND RESERVOIR EMBANKMENTS SHALL BE COMPACTED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
13. CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR OF ALL PIPELINE CRACKS, WHICH DEVELOP DURING CONSTRUCTION OF IMPROVEMENTS AFFECTING EXISTING FACILITIES.
14. CONCRETE VAULTS AND BOXES MAY BE PURCHASED FROM A PRECAST MANUFACTURER OR CONTRACTOR MAY CONSTRUCT THE STRUCTURES IF STRUCTURAL CALCULATIONS AND DESIGN IS APPROVED BY THE DISTRICT AND THE ENGINEER.
16. ALL EXCESS MATERIAL AND/OR DEBRIS SHALL BE REMOVED UPON COMPLETION OF INSTALLATION.
17. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE DUST CONTROL AT ALL TIMES.

TOPOGRAPHY NOTE

TOPOGRAPHY SHOWN IS SURVEY DATA PROVIDED BY PROVOST AND PRITCHARD 12-06-2012.

PROJECT TEMPORARY BENCHMARK

CONTROL POINT #101 EL=245.63, A SET ¾" IRON PIPE WITH PLASTIC "SURVEY CONTROL" CAP SET FLUSH IN ORIGINAL GROUND. BASE COORDINATES AND ALL RELATIVE DATA WERE ADJUSTED BASED ON OBSERVATION OS HPGN D CA 06 MG

PROJECT BENCHMARK

HPGN D CA 06 MG

HORIZONTAL DATA

BASE & MERIDIAN	: MDB&M
DATUM	: NAD 83(2011)
COORDINATE TYPE	: TRUNCATED GROUND
COORDINATE SYSTEM	: CCS83 ZONE 4
BENCH MARK	: HPGN D CA 06 MG
BENCH MARK EPOCH	: 2010
APPLIED SCALE FACTOR	: 0.99993814153
APPLIED TRUNCATION	: N: -2000000 E: -6300000

VERTICAL DATA

DATUM	: NAVD 88
BENCH MARK	: HPGN D CA 06 MG
APPLIED GEOID MODEL	: GEOID 03

Sheet List Table

Sheet Number	Sheet Title
1	COVER SHEET
2	SITEPLAN
3	SECTIONS
4	STRUCTURES

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No.	REVISION	BY	DATE

PRELIMINARY
NOT FOR CONSTRUCTION
12-27-12

RECHARGE BASIN NO. 11
LAGUNA IRRIGATION DISTRICT
FRESNO COUNTY

COVER SHEET

PROVOST & PRITCHARD
CONSULTING GROUP
FCE 21603
747 Emerald Vista Drive, Suite 100
CLOVIS, CALIFORNIA 93611-9166
559/326-1100 FAX 559/326-1090
www.ppeng.com

DESIGN ENGINEER: P&P
LICENSE NO: ----
DRAFTED BY: ACC
CHECKED BY: ----
SCALE: AS SHOWN
DATE: 12-27-12
JOB NO: 105312V2
DWG. NO:
SHEET 1 OF 4

12/27/2012 2:11 PM G:\Clients\Laguna ID - 105312V2 - Recharge Basin No. 11\DWG\SHEET1.dwg\Layout1 - Alex Collins

811 Know what's below. Call before you dig.

WARNING
POWER LINES OVERHEAD

COLEMAN AVENUE

(E) PUMP, MOTOR, STANDPIPE AND OVERHEAD ELECTRIC TO REMAIN

ACCESS RAMP

F&I RIP RAP

FLOW

NEW LEVEE

SETTLING CHANNEL
S=0.0075%

LIBERTY CANAL CHECK STRUCTURE AND TURNOUT (- / 4)

LIBERTY CANAL

C / 3

B / 3

CONSTRUCT BASIN STAFF GAGE

SLOPE TO DRAIN

239.9 EG

239.8 EG

239.6 EG

NEW LEVEE

239.7 EG

239.5 EG

A / 3

BASIN
(~ 41 ACRES)
FLOOR AREA

NEW LEVEE

(E) STAND PIPE TO BE REMOVED

(E) IRRIGATION LINE AND ALFALFA VALVES TO BE REMOVED. APPROX 1,300 LF PIPE.

CONSTRUCT MURPHY SLOUGH DRAIN

C / 4

CONSTRUCT BASIN STAFF GAGE

240.1 EG

MURPHY SLOUGH FLOW

EXISTING BORROW PILE

CHESTNUT AVENUE

ACCESS RAMP

SCALE IN FEET
0 50 100 200

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No.	REVISION	BY	DATE

PRELIMINARY
NOT FOR CONSTRUCTION
12-27-12

RECHARGE BASIN NO. 11
LAGUNA IRRIGATION DISTRICT
FRESNO COUNTY

SITEPLAN

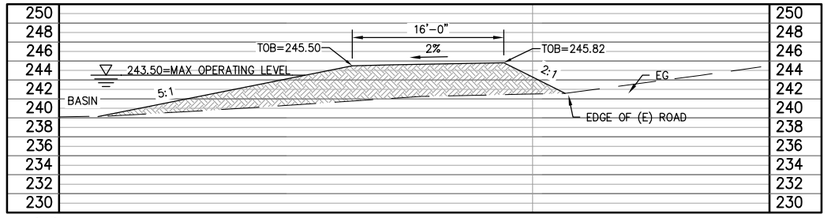
EST. 1963
PROVOST & PRITCHARD
CONSULTING GROUP
147 Employee Owned Company
2020 CLOVIS AVENUE
CLOVIS, CALIFORNIA 93611-9166
559/326-1100 FAX 559/326-1090
www.ppeng.com

DESIGN ENGINEER: P&P
LICENSE NO: ----
DRAFTED BY: ACC
CHECKED BY: ----
SCALE: AS SHOWN
DATE: 12-27-12
JOB NO: 105312V2
DWG. NO:
SHEET 2 OF 4

12/27/2012 2:11 PM G:\Clients\Laguna ID - 105312V2 - Recharge Basin No. 11\DWG\SHEET1\105312V2-GN-SITEPLAN.dwg -Alex Collins

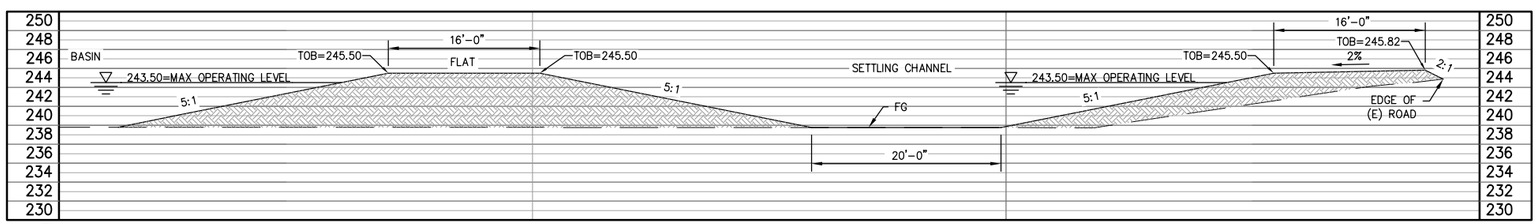
811 Know what's below. Call before you dig.

WARNING
POWER LINES OVERHEAD



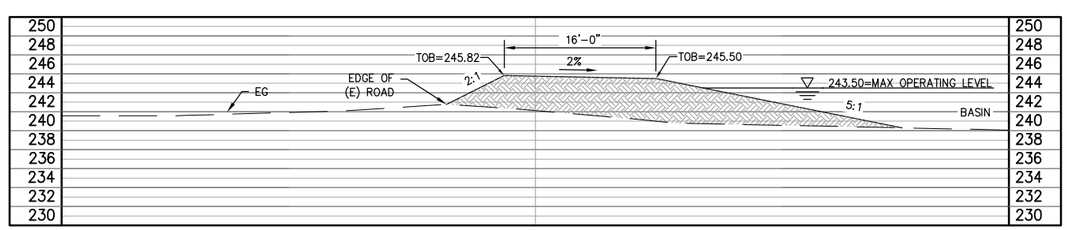
A / 3

SECTION A



B / 3

SECTION B



C / 3

SECTION C

SCALE IN FEET

VERTICAL 0 4 8 16

HORIZONTAL 0 4 8 16

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PRELIMINARY
NOT FOR CONSTRUCTION
12-27-12

No.	REVISION	BY	DATE

RECHARGE BASIN NO. 11

LAGUNA IRRIGATION DISTRICT
FRESNO COUNTY

SECTIONS

EST. 1953
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company
2505 ALLUVIAL AVENUE
CLOVIS, CALIFORNIA 93611-9166
559/326-1100 FAX 559/326-1090
www.ppeng.com

DESIGN ENGINEER: P&P
LICENSE NO: ----
DRAFTED BY: ACC
CHECKED BY: ----
SCALE: AS SHOWN
DATE: 12-27-12
JOB NO: 105312V2
DWG. NO:
SHEET 3 OF 4

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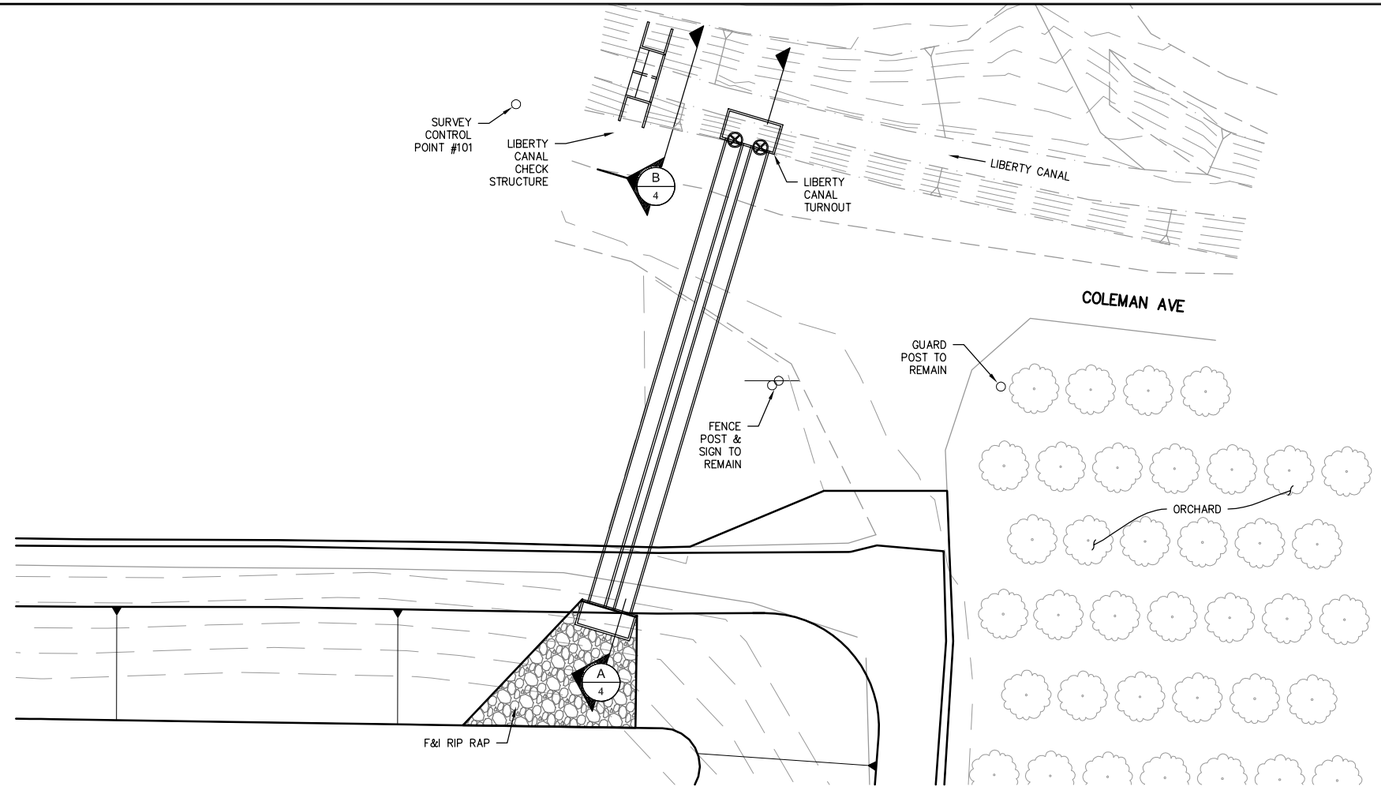
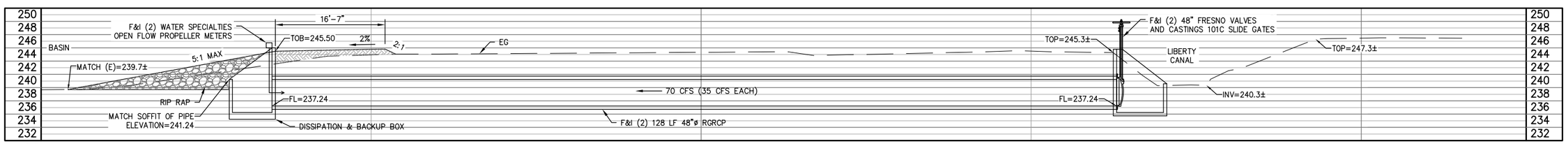
811 Know what's below. Call before you dig.

WARNING POWER LINES OVERHEAD

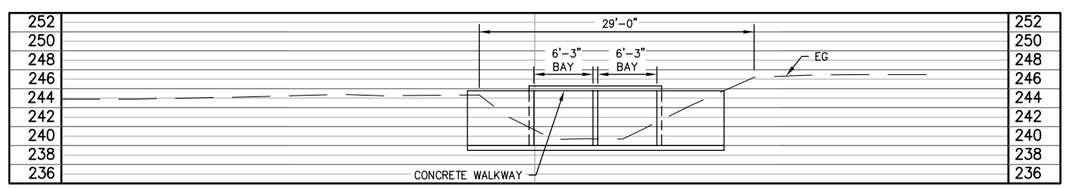


SCALE IN FEET
0 10 20 40



A 4

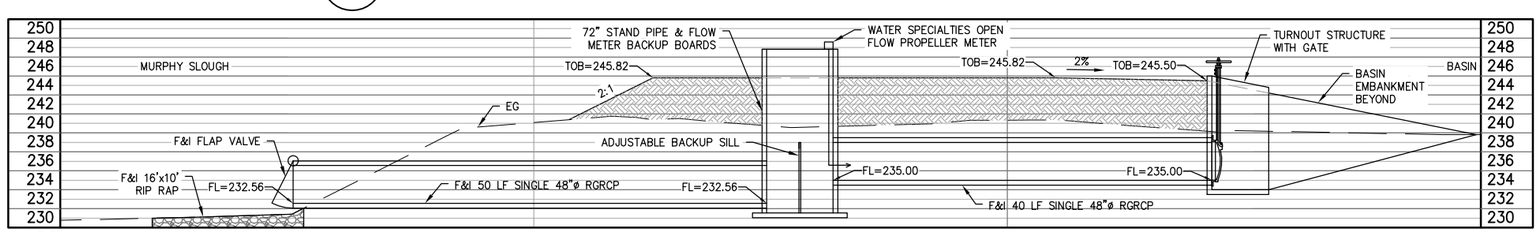
LIBERTY CANAL TURNOUT



B 4

LIBERTY CANAL CHECK STRUCTURE

SCALE IN FEET
VERTICAL 0 4 8 16
HORIZONTAL 0 4 8 16



C 4

MURPHY SLOUGH DRAIN

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PRELIMINARY
NOT FOR CONSTRUCTION
12-27-12

No.	REVISION	BY	DATE

RECHARGE BASIN NO. 11

LAGUNA IRRIGATION DISTRICT
FRESNO COUNTY

STRUCTURES

EST. 1956
PROVOST & PRITCHARD
CONSULTING ENGINEERS
A Professional Corporation
2505 ALLUVIAL AVENUE
CLOVIS, CALIFORNIA 93611-9166
559/326-1100 FAX 559/326-1090
www.ppeng.com

DESIGN ENGINEER: P&P	
LICENSE NO: ----	
DRAFTED BY: ACC	CHECKED BY: ----
SCALE: AS SHOWN	
DATE: 12-27-12	
JOB NO: 105312V2	
DWG. NO:	
SHEET 4 OF 4	

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Kings River Flood Release to San Joaquin River

Monthly Discharge in Acre-Feet at James Bypass Gaging Station

Data from annual KRWA Watermaster Reports

Water Year	Water Year % of Avg.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	TOTAL
1954 - 1955	66%	0	0	0	0	0	0	0	0	0	0	0	0	0
1955 - 1956	153%	0	0	3,681	468	57,672	29,384	0	0	0	0	0	0	91,205
1956 - 1957	74%	0	0	0	0	0	0	0	0	0	0	0	0	0
1957 - 1958	150%	0	0	0	0	0	958	27,241	93,363	90,610	625	0	0	212,797
1958 - 1959	48%	0	0	0	0	0	0	0	0	0	0	0	0	0
1959 - 1960	42%	0	0	0	0	0	0	0	0	0	0	0	0	0
1960 - 1961	34%	0	0	0	0	0	0	0	0	0	0	0	0	0
1961 - 1962	112%	0	0	0	0	0	0	0	0	0	0	0	0	0
1962 - 1963	114%	0	0	0	0	0	0	0	0	0	0	0	0	0
1963 - 1964	54%	0	0	0	0	0	0	0	0	0	0	0	0	0
1964 - 1965	118%	0	0	0	0	0	0	0	0	0	0	0	0	0
1965 - 1966	71%	0	0	0	0	0	0	0	0	0	0	0	0	0
1966 - 1967	198%	0	0	2,884	0	0	0	48,657	194,665	149,853	88,811	0	0	484,870
1967 - 1968	50%	0	0	0	0	0	0	0	0	0	0	0	0	0
1968 - 1969	258%	0	0	0	38,510	184,090	285,920	278,860	302,640	318,170	132,580	10,570	0	1,551,340
1969 - 1970	78%	0	0	1,370	53,320	4,780	2,700	0	0	0	0	0	0	62,170
1970 - 1971	69%	0	0	0	0	0	0	0	0	0	0	0	0	0
1971 - 1972	51%	0	0	0	0	0	0	0	0	0	0	0	0	0
1972 - 1973	125%	0	0	0	0	0	0	0	0	139	0	0	0	139
1973 - 1974	123%	0	0	0	93	0	0	18,340	19,940	47,980	0	0	0	86,353
1974 - 1975	93%	0	0	0	0	0	0	0	0	0	0	0	0	0
1975 - 1976	32%	0	0	0	0	0	0	0	0	0	0	0	0	0
1976 - 1977	23%	0	0	0	0	0	0	0	0	0	0	0	0	0
1977 - 1978	203%	0	0	0	0	6,670	94,810	198,670	202,040	48,820	176	0	0	551,186
1978 - 1979	102%	0	0	0	0	397	218	640	9,430	730	337	0	0	11,752
1979 - 1980	179%	0	0	0	57,150	86,990	252,370	77,650	70,020	12,230	23,170	0	0	579,580
1980 - 1981	61%	0	0	0	0	0	0	0	0	0	0	0	0	0
1981 - 1982	183%	0	0	0	0	0	0	157,860	213,240	62,480	19,160	8	0	452,748
1982 - 1983	263%	0	91,790	224,340	218,320	260,350	319,270	301,490	303,280	292,440	183,520	66,190	48,290	2,309,280
1983 - 1984	116%	105,920	140,620	135,320	185,000	900	650	200	0	0	0	0	0	568,610
1984 - 1985	74%	0	0	0	0	0	0	0	0	0	0	0	0	0
1985 - 1986	192%	0	0	0	0	10,584	211,518	215,285	139,539	90,824	0	0	0	667,750
1986 - 1987	46%	0	0	0	1,347	0	0	0	0	0	0	0	0	1,347
1987 - 1988	49%	0	0	0	0	0	0	0	0	0	0	0	0	0
1988 - 1989	53%	0	0	0	0	0	0	0	0	0	0	0	0	0
1989 - 1990	40%	0	0	0	0	0	0	0	0	0	0	0	0	0
1990 - 1991	63%	0	0	0	0	0	0	0	0	0	0	0	0	0
1991 - 1992	41%	0	0	0	0	0	0	0	0	0	0	0	0	0
1992 - 1993	150%	0	0	0	0	0	0	0	0	0	0	0	0	0
1993 - 1994	51%	0	0	0	0	0	0	0	0	0	0	0	0	0
1994 - 1995	203%	0	0	0	0	0	32,644	158,918	228,382	87,044	77,364	2,158	0	586,510
1995 - 1996	123%	0	0	0	0	0	6,637	0	67,441	464	0	0	0	74,542
1996 - 1997	156%	0	0	5,080	169,558	223,588	38,887	0	0	0	0	0	0	437,113
1997 - 1998	182%	0	0	0	494	6,179	65,325	212,350	278,273	266,025	157,807	0	0	986,453
1998 - 1999	74%	0	3,501	16,542	0	0	0	0	0	0	0	0	0	20,043
1999 - 2000	90%	0	0	0	0	0	0	0	0	0	0	0	0	0
2000 - 2001	59%	0	0	0	0	0	0	0	0	0	0	0	0	0
2001 - 2002	67%	0	0	0	0	0	0	0	0	0	0	0	0	0

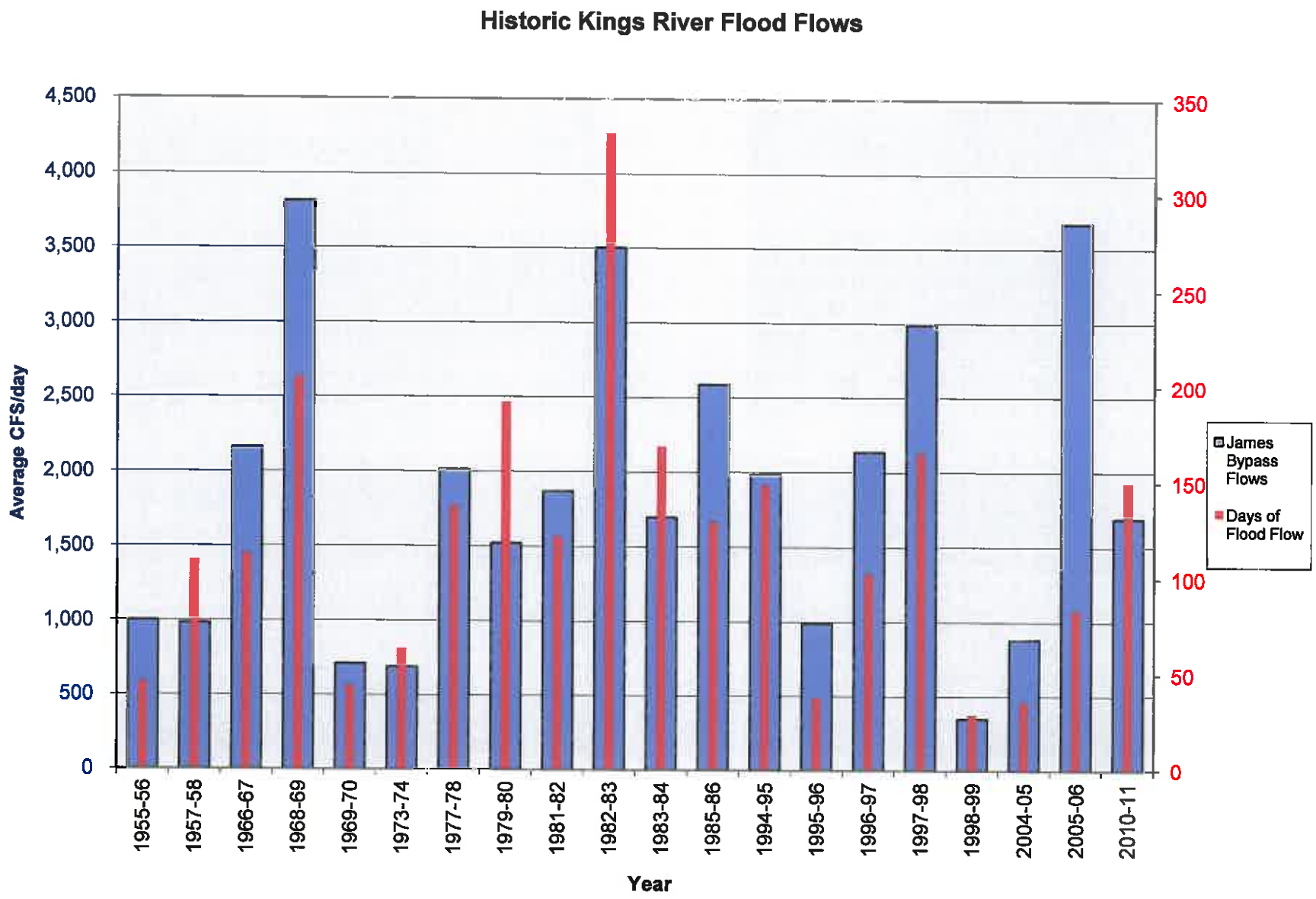
Kings River Flood Release to San Joaquin River

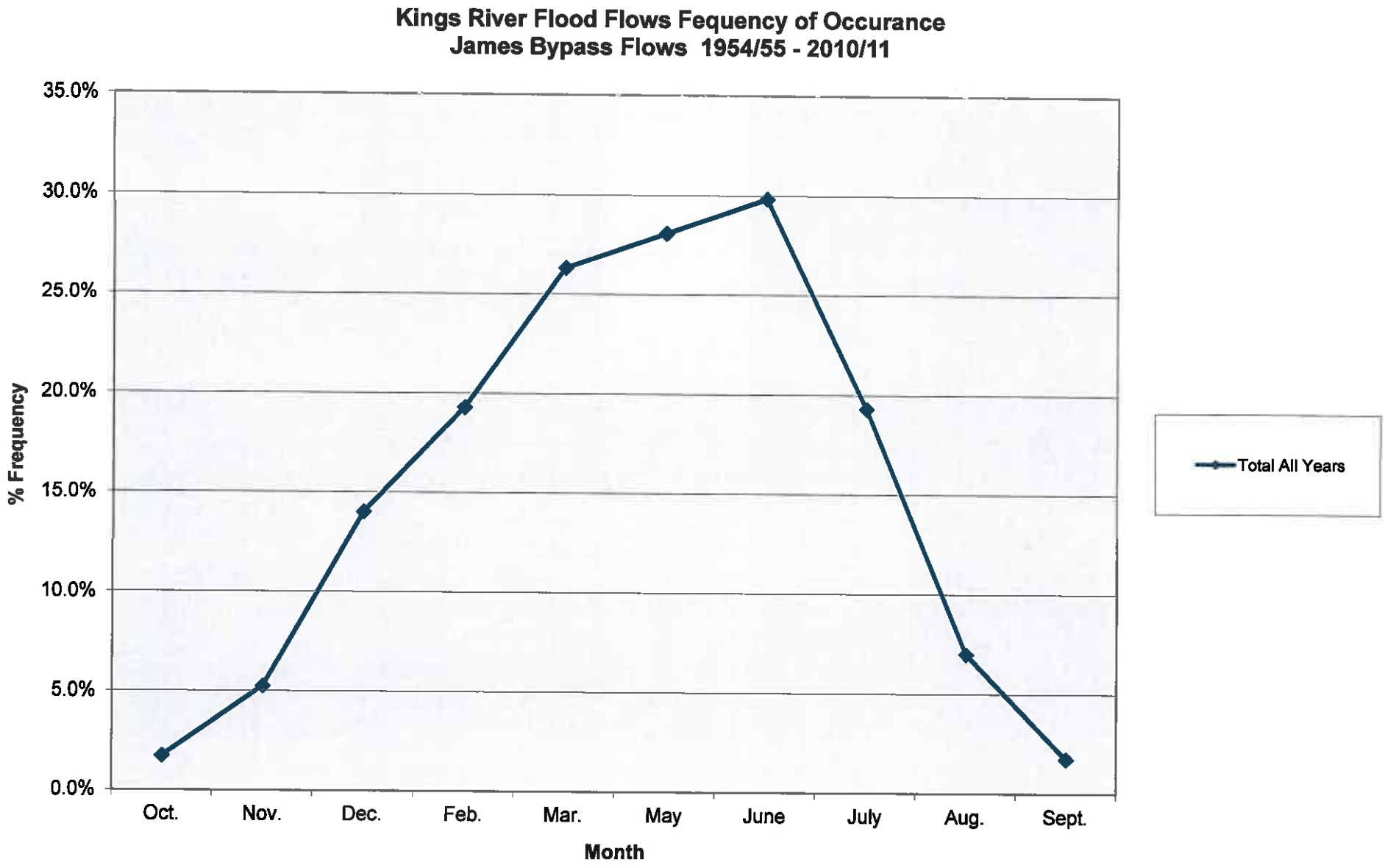
Monthly Discharge in Acre-Feet at James Bypass Gaging Station

Data from annual KRWA Watermaster Reports

Water Year	Water Year % of Avg.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	TOTAL
2002 - 2003	84%	0	0	0	0	0	0	0	0	0	0	0	0	0
2003 - 2004	62%	0	0	0	0	0	0	0	0	0	0	0	0	0
2004 - 2005	149%	0	0	0	0	0	0	0	48,545	14,648	0	0	0	63,193
2005 - 2006	173%	0	0	0	0	0	0	186,228	256,443	169,468	0	0	0	612,139
2006 - 2007	40%	0	0	0	0	0	0	0	0	0	0	0	0	0
2007 - 2008	71%	0	0	0	0	0	0	0	0	0	0	0	0	0
2008 - 2009	79%	0	0	0	0	0	0	0	0	0	0	0	0	0
2009 - 2010	121%	0	0	0	0	0	0	0	0	0	0	0	0	0
2010 - 2011	195%	0	0	1,845	18,597	0	27,689	216,926	78,823	101,332	58,247	0	0	503,459
Total - AF		105,920	235,911	391,062	742,857	842,200	1,368,980	2,099,315	2,506,064	1,753,257	741,797	78,926	48,290	10,914,579
Average - AF	104%	1,858	4,139	6,861	13,033	14,775	24,017	36,830	43,966	30,759	13,014	1,385	847	191,484

Years when flood occurred	1	3	8	11	11	15	15	16	17	11	4	1	23
Years of record	57	57	57	57	57	57	57	57	57	57	57	57	57
Occurrance percentage	1.8%	5.3%	14.0%	19.3%	19.3%	26.3%	26.3%	28.1%	29.8%	19.3%	7.0%	1.8%	40.4%
Years with zero flood flows	56	54	49	46	46	42	42	41	40	46	53	56	34


Historic Kings River Flood Flows
Average CFS/day
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
350
300
250
200
150
100
50
0
1955-56
1957-58
1966-67
1968-69
1969-70
1973-74
1977-78
1979-80
1981-82
1982-83
1983-84
1985-86
1994-95
1995-96
1996-97
1997-98
1998-99
2004-05
2005-06
2010-11
Year
James Bypass Flows
Days of Flood Flow


Kings River Flood Flows Fequency of Occurance
James Bypass Flows 1954/55 - 2010/11
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
% Frequency
Oct.
Nov.
Dec.
Feb.
Mar.
May
June
July
Aug.
Sept.
Month
Total All Years

Kings River Flood Release to San Joaquin River
Floodwater discharge in Acre-Feet at James Bypass Gaging Station

Year	Total Volume (Acre-feet)	Days of Flood Releases	Average Flow (CFS)
1955-56	91,205	46	1,000
1957-58	212,797	109	984
1966-67	484,870	113	2,163
1968-69	1,551,340	205	3,815
1969-70	62,170	44	712
1973-74	86,353	63	691
1977-78	551,186	138	2,014
1979-80	579,580	192	1,522
1981-82	452,748	122	1,871
1982-83	2,309,280	332	3,507
1983-84	568,610	169	1,696
1985-86	667,750	130	2,590
1994-95	586,510	149	1,985
1995-96	74,542	38	989
1996-97	437,113	103	2,140
1997-98	986,453	166	2,996
1998-99	20,043	29	348
2004-05	63,193	36	885
2005-06	612,139	84	3,674
2010-11	503,459	150	1,692
	Average	121	

Percent of years with flood flows	35%
Historical average days of flood flows/year (flood years only)	121
Historical average days of flood flows/year (all years, 1954 - 2011)	42

Notes:
1) Floodwater was also released in water years 1972-1973, 1978-1979 and 1986-1987, but average flows were below 200 cfs and were considered unavailable to the District
2) Data from Kings River Water Association Annual Watermaster Reports
3) Flow releases vary throughout each flood release, so the average flow is not based on the

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX D

LIBERTY CANAL CAPACITY ANALYSIS

LAGUNA IRRIGATION DISTRICT
RECHARGE BASIN 11 FEASIBILITY STUDY
LIBERTY CANAL HYDRAULICS

Laguna ID Liberty Canal Hydraulics										
STA (Mi)	Elevation (ft)	Width Top 1' Down (ft)	Width Bottom (ft)	Ave. Depth (ft)	Area (ft^2)	W.P. (ft)	R (ft)	Q (cfs)	Sides (ft)	Slope (ft/ft)
0.0	245.63	23	9	4.0	64.0	26.80	2.39	204	7.0	0.000701
0.1	245.26	22	15	3.0	55.5	33.81	1.64	126	3.5	0.000587
0.2	245.57	21	7	2.5	35.0	22.30	1.57	292	7.0	0.008352
0.3	249.98	31	15	4.0	92.0	38.00	2.42	460	8.0	0.001686
Xing1								218		
0.4	249.09	29	12	4.0	82.0	33.41	2.45	646	8.5	0.004110
0.5	246.92	26	15	3.0	61.5	34.95	1.76	156	5.5	0.000663
0.6	246.57	23	13	2.5	45.0	30.36	1.48	129	5.0	0.001061
0.7	247.13	22	15	3.0	55.5	33.81	1.64	119	3.5	0.000521
Xing2								297		
0.8	246.86	15	6	2.5	26.3	17.50	1.50	113	4.5	0.002358
0.9	248.10	18	7	3.3	41.7	21.14	1.97	36	5.5	0.000066
1.0	248.14	20	9	3.3	47.5	23.86	1.99	157	5.8	0.000956
1.1	248.64	20	9	3.2	45.9	24.26	1.89	252	5.5	0.002822
1.2	250.13	18	8	4.0	51.0	22.31	2.29	221	5.3	0.001364
1.3	249.41	24	6	6.0	90.0	27.63	3.26	82	9.0	0.000038
1.4	249.39	20	9	4.0	57.0	24.52	2.32	166	5.8	0.000606
1.5	249.71	18	7	3.6	44.2	21.08	2.10	149	5.7	0.000928
1.6	250.20	19	6	4.0	50.0	21.69	2.31	289	6.5	0.002405
1.7	248.93	17	7	2.7	32.0	19.87	1.61	72	5.0	0.000587
1.8	249.24	16	7	2.7	30.7	19.31	1.59	41	4.5	0.000208
1.9	249.13	16	8	2.7	32.0	20.56	1.56	36	4.0	0.000152
2.0	249.21	14	6	2.5	24.8	16.74	1.48	170	4.1	0.006117
2.1	252.44	20	14	5.5	93.5	34.14	2.74	434	3.0	0.001231
Clovis					80.0	26.00	3.08	401		
2.2	251.79	19	7	4.2	54.2	22.61	2.40	107	6.0	0.000265
2.3	251.93	18	7	4.0	50.0	21.80	2.29	173	5.5	0.000871
2.4	251.47	18	7	3.5	43.8	21.30	2.05	88	5.5	0.000341
2.5	251.29	16	6	3.3	36.7	18.95	1.93	84	5.0	0.000473
2.6	251.54	17	6	3.5	40.3	19.78	2.04	151	5.5	0.001193
R.R.					96.0	28.00	3.43	2065		
2.7	252.17	20	6	3.5	45.5	21.94	2.07	212	7.0	0.001799
2.8	251.22	16	6	2.7	29.3	18.29	1.60	103	5.0	0.001439
2.9	251.98	16	7	3.3	38.3	19.98	1.92	101	4.5	0.000644
3.0	252.32	16	6	3.5	38.5	19.12	2.01	169	5.0	0.001667
Fowler					62.3	22.42	2.78	339		
3.1	253.20	29	12	3.7	75.2	33.08	2.27	232	8.5	0.000701
3.2	252.83	19	6	3.7	45.8	21.36	2.15	50	6.5	0.000095
3.3	252.88	18	7	3.5	43.8	21.30	2.05	161	5.5	0.001136
3.4	253.48	19	7	3.8	49.8	22.27	2.24	83	6.0	0.000208
3.5	253.59	21	10	3.7	56.8	26.49	2.15	180	5.5	0.000795
3.6	253.17									
3.7	253.27									
3.8	254.00									
3.9	254.06									
4.0	253.31									
4.1	254.94									
4.2	255.53									
Harlan					121.0	44.17	2.74	616		
4.3	254.75									
4.4	256.17									
4.5	257.41									
4.6	255.55									
4.7	256.95									
4.8	257.69									
4.9	259.37									

Notes: 1) Survey and hydraulic calculations performed by Laguna ID December 2012.
2) Station 0.0 is the hub set at the northeast location of the proposed recharge basin site.

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX E

COST ESTIMATE AND FINANCIAL ANALYSIS

PROVOST& PRITCHARD
An Employee Owned Company

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

LAGUNA IRRIGATION DISTRICT
RECHARGE BASIN NO. 11

PRELIMINARY 12-21-12

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
	Land Purchase/Easement				
1	Purchase of Property	53	AC	$11,000	$583,000
2	Mobilization/demobilization, bonds & insurance, worker protection, miscellaneous facilities and operations	Lump Sum	LS	$43,000	$43,000
	Canal Improvements (Upstream of Site) (1)				
3	Structure Replacements in Liberty Canal	1	EA	$20,000	$20,000
4	Earthwork Improvements in Liberty Canal	8,000	LF	$6	$50,000
5	Vine Removal	1	EA	$5,000	$5,000
	Basin Earthwork				
6	Irrigation and Standpipe Removal	1	EA	$5,000	$5,000
7	Basin Earthwork (2)	30,000	CY	$3.50	$105,000
8	Levee Keyways/Overexcavation	4,100	LF	$4	$16,400
9	Basin Staff Gages	2	EA	$800	$1,600
10	Initial Disking & Ripping Basin Floor	1	EA	$3,000	$3,000
	Liberty Canal Structures				
11	Check Structure	1	EA	$20,000	$20,000
12	F&I 2 48" Dia Concrete Pipe Turnouts	320	LF	$170	$54,400
13	Concrete Inlet Turnout	1	EA	$15,000	$15,000
14	Concrete Outlet Turnout	1	EA	$15,000	$15,000
15	Open Flow Propeller Meters	2	EA	$4,000	$8,000
16	Canal Gates	2	EA	$7,000	$14,000
17	Outlet Rip Rap	1	EA	$2,000	$2,000
	Murphy Slough Drain				
18	Drain Inlet Structure	1	EA	$8,000	$8,000
19	48" Dia Concrete Pipe Drain	140	LF	$170	$23,800
20	72" Measurement Stand Pipe	1	EA	$8,000	$8,000
21	Canal Gate	1	EA	$7,000	$7,000
22	Open Flow Propeller Meter	1	EA	$4,000	$4,000
23	F&I Flap Valve	1	EA	$4,000	$4,000
24	Outlet Rip Rap	1	EA	$2,000	$2,000

PROVOST& PRITCHARD
An Employee Owned Company

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

LAGUNA IRRIGATION DISTRICT
RECHARGE BASIN NO. 11

PRELIMINARY 12-21-12

Item No.	Item Description	Estimated Quantity	Unit	Unit Price	Amount
	Monitoring Wells				
25	Monitoring Wells (4 x 100 FT)	400	LF	$85	$34,000
	Contingency			15%	$70,200
	Construction		SUBTOTAL:		$1,121,400
	Engineering, environmental, surveying, legal, admin., construction staking, construction management				$173,000
			PRELIMINARY COST ESTIMATE:		$1,294,400

NOTE(S):

1) Canal improvements upstream of the project site were surveyed and determined by District
2) Earthwork is assumed to come from basin floor

Annual Benefit (Recharge)

(All benefits should be in 2012 dollars)

Project: Laguna Irrigation District Recharge Basin 1?

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Recharge	Acre-feet	0	2,650	2,650	100	265,000	1.000	$265,000
2013	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.943	$249,895
2014	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.890	$235,850
2015	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.840	$222,600
2016	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.792	$209,880
2017	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.747	$197,955
2018	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.705	$186,825
2019	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.665	$176,225
2020	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.627	$166,155
2021	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.592	$156,880
2022	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.558	$147,870
2023	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.527	$139,655
2024	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.497	$131,705
2025	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.469	$124,285
2026	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.442	$117,130
2027	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.417	$110,505
2028	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.394	$104,410
2029	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.371	$98,315
2030	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.350	$92,750
2031	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.331	$87,715
2032	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.312	$82,680
2033	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.294	$77,910
2034	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.278	$73,670
2035	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.262	$69,430
2036	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.247	$65,455
2037	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.233	$61,745
2038	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.220	$58,300
2039	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.207	$54,855
2040	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.196	$51,940
2041	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.185	$49,025
2042	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.174	$46,110
2043	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.164	$43,460
2044	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.155	$41,075
2045	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.146	$38,690
2046	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.138	$36,570
2047	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.130	$34,450
2048	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.123	$32,595
2049	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.116	$30,740
2050	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.109	$28,885
2051	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.109	$28,885
2052	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.097	$25,705
2053	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.092	$24,380
2054	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.087	$23,055
2055	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.082	$21,730
2056	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.077	$20,405
2057	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.073	$19,345
2058	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.069	$18,285
2059	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.065	$17,225
2060	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.061	$16,165
2061	Recharge	Acre-feet	0	2,650	2,650	100	265,000	0.058	$15,370
Last Year of Project Life								...	
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$4,429,740

Comments:

(1) Complete these columns if dollar value is being claimed for the benefit.

Annual Benefit (Energy Conservation)

(All benefits should be in 2012 dollars)

Project: Laguna Irrigation District Recharge Basin 11

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (1) (f) x (g)	(i) Discount Factor (1)	(j) Discounted Benefits (1) (h) x (i)
2012	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	1.000	$11,360
2013	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.943	$10,712
2014	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.890	$10,110
2015	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.840	$9,542
2016	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.792	$8,997
2017	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.747	$8,486
2018	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.705	$8,009
2019	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.665	$7,554
2020	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.627	$7,123
2021	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.592	$6,725
2022	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.558	$6,339
2023	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.527	$5,987
2024	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.497	$5,646
2025	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.469	$5,328
2026	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.442	$5,021
2027	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.417	$4,737
2028	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.394	$4,476
2029	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.371	$4,215
2030	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.350	$3,976
2031	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.331	$3,760
2032	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.312	$3,544
2033	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.294	$3,340
2034	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.278	$3,158
2035	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.262	$2,976
2036	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.247	$2,806
2037	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.233	$2,647
2038	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.220	$2,499
2039	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.207	$2,352
2040	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.196	$2,227
2041	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.185	$2,102
2042	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.174	$1,977
2043	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.164	$1,863
2044	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.155	$1,761
2045	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.146	$1,659
2046	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.138	$1,568
2047	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.130	$1,477
2048	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.123	$1,397
2049	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.116	$1,318
2050	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.109	$1,238
2051	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.109	$1,238
2052	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.097	$1,102
2053	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.092	$1,045
2054	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.087	$988
2055	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.082	$932
2056	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.077	$875
2057	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.073	$829
2058	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.069	$784
2059	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.065	$738
2060	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.061	$693
2061	Energy Conserved	killowatt-hours	0	113,600	113,600	0.10	11,360	0.058	$659
Last Year of Project Life								...	
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$189,894

Comments:

(1) Complete these columns if dollar value is being claimed for the benefit.

Annual Costs of Project

(All costs should be in 2012 Dollars)

Project: Laguna Irrigation District Recharge Basin #1

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs[2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	1,294,400				5,000			1,390,200	1.000	$1,390,200
2013					5,000			5,000	0.943	$4,715
2014					5,000			5,000	0.890	$4,450
2015					5,000			5,000	0.840	$4,200
2016					5,000			5,000	0.792	$3,960
2017					5,000			5,000	0.747	$3,735
2018					5,000			5,000	0.705	$3,525
2019					5,000			5,000	0.665	$3,325
2020					5,000			5,000	0.627	$3,135
2021					5,000			5,000	0.592	$2,960
2022					5,000			5,000	0.558	$2,790
2023					5,000			5,000	0.527	$2,635
2024					5,000			5,000	0.497	$2,485
2025					5,000			5,000	0.469	$2,345
2026					5,000			5,000	0.442	$2,210
2027					5,000			5,000	0.417	$2,085
2028					5,000			5,000	0.394	$1,970
2029					5,000			5,000	0.371	$1,855
2030					5,000			5,000	0.350	$1,750
2031					5,000			5,000	0.331	$1,655
2032					5,000			5,000	0.312	$1,560
2033					5,000			5,000	0.294	$1,470
2034					5,000			5,000	0.278	$1,390
2035					5,000			5,000	0.262	$1,310
2036					5,000			5,000	0.247	$1,235
2037					5,000	84,000		89,000	0.233	$20,737
2038					5,000			5,000	0.220	$1,100
2039					5,000			5,000	0.207	$1,035
2040					5,000			5,000	0.196	$980
2041					5,000			5,000	0.185	$925
2042					5,000			5,000	0.174	$870
2043					5,000			5,000	0.164	$820
2044					5,000			5,000	0.155	$775
2045					5,000			5,000	0.146	$730
2046					5,000			5,000	0.138	$690
2047					5,000			5,000	0.130	$650
2048					5,000			5,000	0.123	$615
2049					5,000			5,000	0.116	$580
2050					5,000			5,000	0.109	$545
2051					5,000			5,000	0.109	$545
2052					5,000			5,000	0.097	$485
2053					5,000			5,000	0.092	$460
2054					5,000			5,000	0.087	$435
2055					5,000			5,000	0.082	$410
2056					5,000			5,000	0.077	$385
2057					5,000			5,000	0.073	$365
2058					5,000			5,000	0.069	$345
2059					5,000			5,000	0.065	$325
2060					5,000			5,000	0.061	$305
2061					5,000			5,000	0.058	$290
								Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		$1,488,352

Comments:

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

LAGUNA IRRIGATION DISTRICT

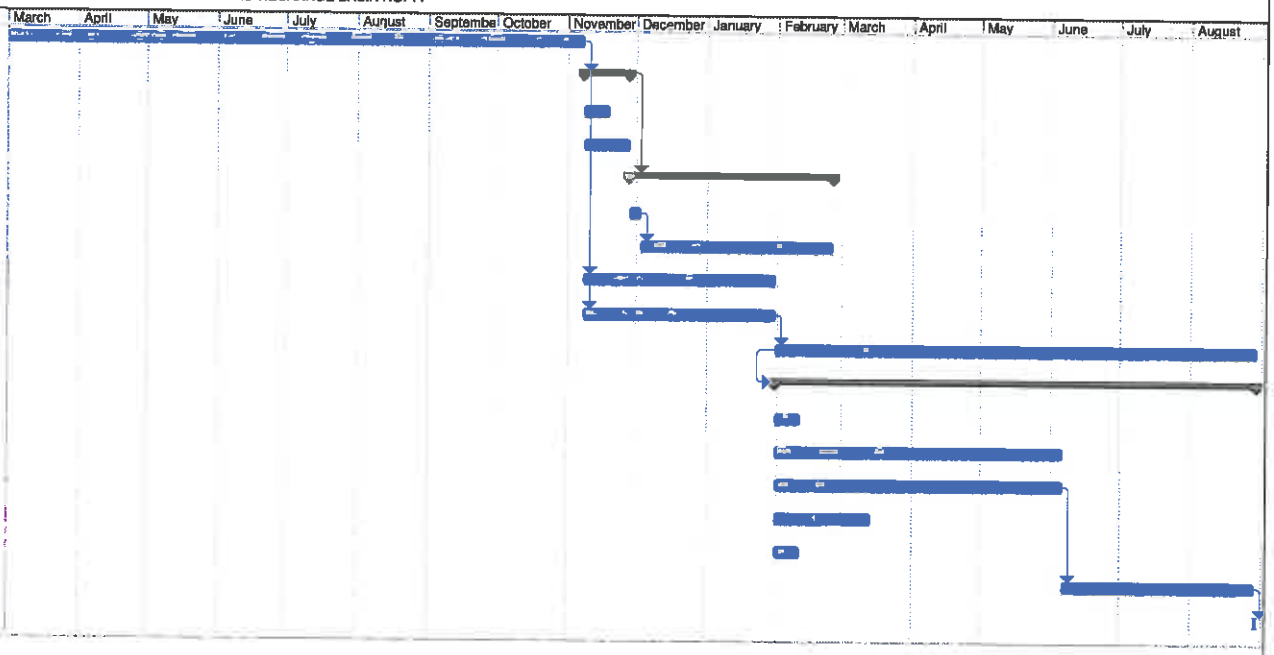
RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX F

PROJECT SCHEDULE

LAGUNA ID RECHARGE BASIN NO. 11

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Land Purchase/Easement**	180 days	Fri 3/1/13	Thu 11/7/13	
2	**Assessment and Evaluation**	**14 days**	**Fri 11/8/13**	**Wed 11/27/13**	**1**
3	Canal Hydraulic Study	7 days	Fri 11/8/13	Mon 11/18/13	
4	Establish Monitoring Plan	14 days	Fri 11/8/13	Wed 11/27/13	
5	**Final Design**	**63 days**	**Thu 11/28/13**	**Mon 2/24/14**	**2**
6	Surveying	3 days	Thu 11/28/13	Mon 12/2/13	
7	Design	60 days	Tue 12/3/13	Mon 2/24/14	6
8	**Environmental Documentation**	60 days	Fri 11/8/13	Thu 1/30/14	1
9	**Permitting**	60 days	Fri 11/8/13	Thu 1/30/14	1
10	**Construction Management**	151 days	Fri 1/31/14	Fri 8/29/14	9
11	**Construction**	**151 days**	**Fri 1/31/14**	**Fri 8/29/14**	**10SS**
12	Mobilization/Demobilization	7 days	Fri 1/31/14	Mon 2/10/14	
13	Canal Improvements	90 days	Fri 1/31/14	Thu 6/5/14	
14	Basin Earthwork	90 days	Fri 1/31/14	Thu 6/5/14	
15	Liberty Canal Structures	30 days	Fri 1/31/14	Thu 3/13/14	
16	Murphy Slough Drain	7 days	Fri 1/31/14	Mon 2/10/14	
17	Monitoring Wells	60 days	Fri 6/6/14	Thu 8/28/14	14
18	Performance Testing	1 day	Fri 8/29/14	Fri 8/29/14	17



Project: Laguna ID Pond 11 Prelimina
Date: Mon 12/31/12

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX G

PUBLIC OUTREACH DOCUMENTATION

Unapproved Copy

LIBERTY CANAL COMPANY

MEETING CALLED TO ORDER

September 13, 2012

The Board of Directors of the Liberty Canal Company met on September 13, 2012 in the office of the Riverdale Irrigation District. Directors present were John Coelho –President, Buddy Mendes, and Jerry Coelho was present for a portion of the meeting. Directors absent were Tony Campos and Andrew Ormonde.

President Coelho called the meeting to order at 10:10 a.m.

Minutes

The Secretary mailed the Directors a copy of the minutes of the April 18, 2012 meeting. After discussion, Director Mendes made a motion, seconded by Director Coelho and unanimously carried to approve the minutes as mailed.

Treasurer's Report

The Treasurer presented a list of bills that were paid with the discretion of the President and Secretary between April 25, 2012 and September 6, 2012. The bank balance as of today is $2,345.52. After discussion, a motion was made by Director Mendes, seconded by Director Coelho and unanimously carried to ratify the action of the President and Secretary in payment of the bills listed as paid. A copy of the list of bills is attached hereto and made a part hereof.

The Treasurer handed out a list of remaining bills due in September and estimated bills for October, November and December and discussed the need to levy an assessment. After discussion, a motion was made by Director Mendes, seconded by Director Coelho and unanimously carried to levy Assessment #144 for $250.00 per share on the Capital Stock of the Corporation. The Assessment will be dated September 13, 2012 and will be due and payable on or before October 31, 2012.

Ditch Maintenance

Scott Sills reported the ditch was sprayed on August 10, 2012 and asked the Board what additional maintenance is needed. After discussion, it was the consensus of the Board that the decisions to mow, grade and winter spraying will be made at a later date; Scott Sills is to talk to President John Coelho for authorization.

Old Business

Scott Sills reported that all the Liberty Canal Co. water was run in the Murphy Slough this year and everything went well.

New Business

Irrigated Lands Program:

Scott Sills gave a report on a meeting regarding the Irrigated Lands Regulatory Program that was held in Tulare on August 21, 2012. After discussion, the Board took no action.

High Speed Rail Project:

Scott Sills reported that he met with the Calif. High Speed Rail Authority, CHSRA, on August 30, 2012 to discuss reimbursement to the canal operators for review of documents and design work. The Reimbursement Agreement would be between Liberty Canal Co. and the CHSRA to cover costs incurred by the L.C.Co. for staff, legal and engineering review and consultation. Scott asked to be authorized by the Board to

Unapproved Copy

complete the documents with the assistance of Attorney Nordstrom. After discussion, a motion to authorize Scott Sills and Attorney Nordstrom to complete the Reimbursement Agreement was made by Director Mendes, seconded by Director Coelho and unanimously carried.

Scott Sills then stated that the Company needs to respond to the Environmental Impact Report, EIR, before October 19, 2012. He reported that the West Alignment of the High Speed Rail Project would affect Liberty Canal in the following several ways: (1) It would create an island where no access would exist to the canal west of the current B.N.S.F. railway alignment north of Laton. This would require the CHSRA to obtain access through other landowners for Company personnel to maintain and operate the canal. (2) The construction of embankments to elevate the new high speed rail alignment would change the flood plain in the area of Liberty Canal and Murphy Slough. (3) It would cause additional response time by staff due to the need to drive several miles to get around the new rail project. (4) It would cause additional wear and tear of vehicles and equipment as well as additional pollution due to extra mileage required to access the canal.

Scott asked the Board to consider allowing him to work with Attorney Nordstrom to respond to the EIR within the comment period. Attorney Nordstrom is working with some of the Kings County Units of the KRWA to respond to the EIR on their behalf. Scott also asked to incorporate the comments with Laguna I.D. and the Murphy Slough Association. Director Mendes asked that the response not be tied to the Kings County unit's comments, but exclusively with Murphy Slough and Laguna. After discussion, a motion was made by Director Mendes, seconded by Director Coelho and unanimously carried to authorize Scott Sills and Attorney Nordstrom to respond to the High Speed Rail EIR in coordination with the Murphy Slough Association and Laguna Irrigation District exclusively.

Other Business

Proposal for Grant for Recharge Project:

Scott Sills reported that the Kings Basin Water Authority had asked for submittal of new projects in the middle Kings River for prop 50 funding. Scott said that a 92-acre parcel that had been previously studied and determined to be a very good candidate for recharge was submitted by Laguna I. D. to the Authority for possible funding. The parcel is in the general area of Liberty Canal and Chestnut Avenue. The project would be used in years where excess Kings River water was available, (i.e. flood release). If the proposal is approved and for the project to work, Liberty Canal would be the preferred conveyance and would need to be improved from the start of the canal to the project area. Director Coelho asked if the use of Liberty Canal for the project would reduce deliveries to Liberty stockholders. Scott reported that the improvements would be in the form of increasing channel capacity to a minimum of 100 c.f.s., at least to the proposed project, and by doing so would not affect deliveries. This report is informational only at this point in time and no action was taken. A map of the proposed site it attached hereto.

There being no further business, a motion was made by Director Mendes, seconded by Director Coelho and unanimously carried to adjourn the meeting at 11:05 a.m.

Kim Mayfield, Secretary

Kings River North Fork Conjunctive Management Group

Announcement and Agenda

Thursday, November 8, 2012

1:30 PM

Riverdale Community Center
3160 W. Mt. Whitney Avenue
Riverdale, CA 93656

1. Call Meeting To Order
2. Welcome and Introductions
3. Review of Potential Recharge Site
4. Prop. 84 Grant Funding
5. Next Step
6. New Business
7. Old Business
8. Adjournment

Kings River Conservation District
Burrel Ditch CompanyCompany
Crescent Canal Company
Laguna Irrigation District
Liberty Canal Company

Liberty Mill Race Company
Reed Ditch Company
Riverdale Irrigation District
Stinson Canal and Irrigation Company
California Department of Water Resources

Kings River North Fork Conjunctive Management Group

Meeting

Date: Thursday, November 8, 2012

Time: 1:30 PM

Location: **Riverdale Community Center**
3160 W. Mt. Whitney Avenue
Riverdale, CA 93656

Attendees:

Rick Hoelzel - Kings River Conservation District

John Maddox - Burrel Ditch Company and Liberty Mill Race Company

Mark McKean - Crescent Canal Company and Reed Ditch Company

Frank Zonneveld - Laguna Irrigation District

Scott Sills - Laguna Irrigation District

John Coelho - Liberty Canal Company

Leonard Acquistapace - Riverdale Irrigation District and Murphy Slough Association

Jerry Gragnani - Stinson Canal and Irrigation Company

Dane Mathis --California Department of Water Resources

Owen Kubit – Provost and Pritchard Engineering

RECHARGE BASIN SITE 11

SITE CHARACTERISTICS AND FUNDING OPPORTUNITIES

Presented to the North Fork Group

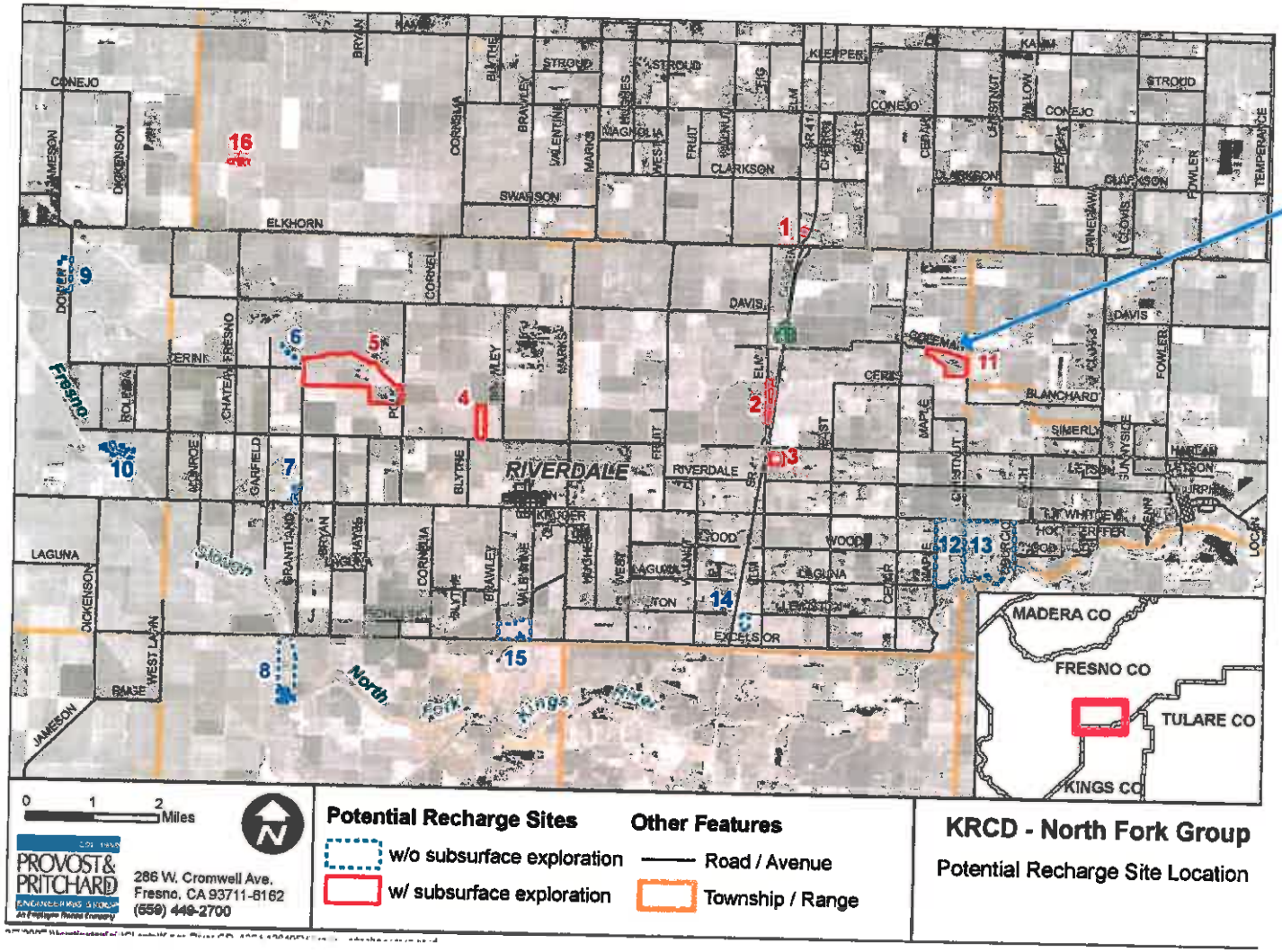
November 8, 2012

EST 1968
PROVOST & PRITCHARD
CONSULTING GROUP
An Employee Owned Company

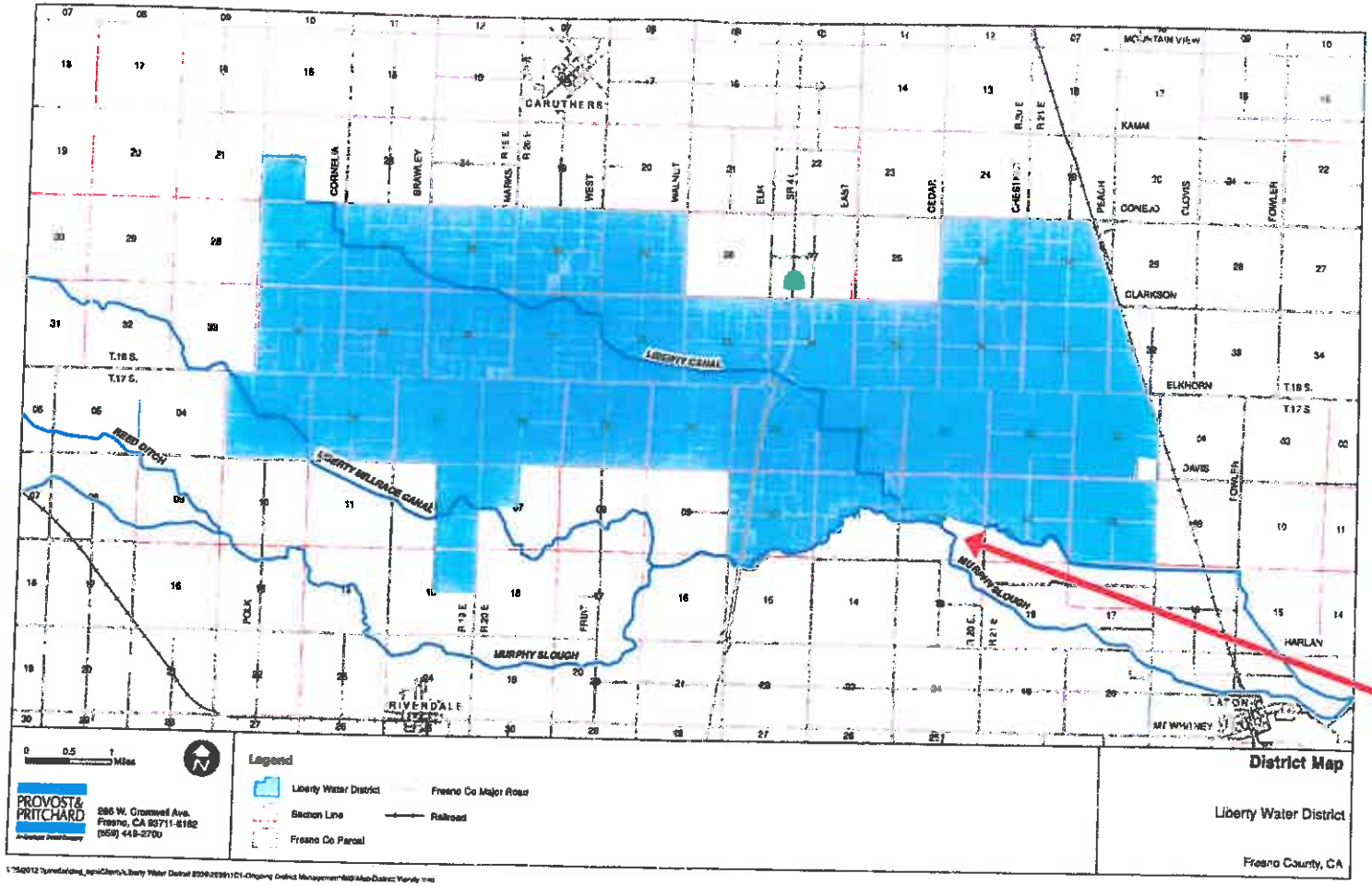
OVERVIEW

1. Description of Project
2. Why project is worth pursuing
3. Additional studies needed
4. Grant application process

PROJECT LOCATION MAP

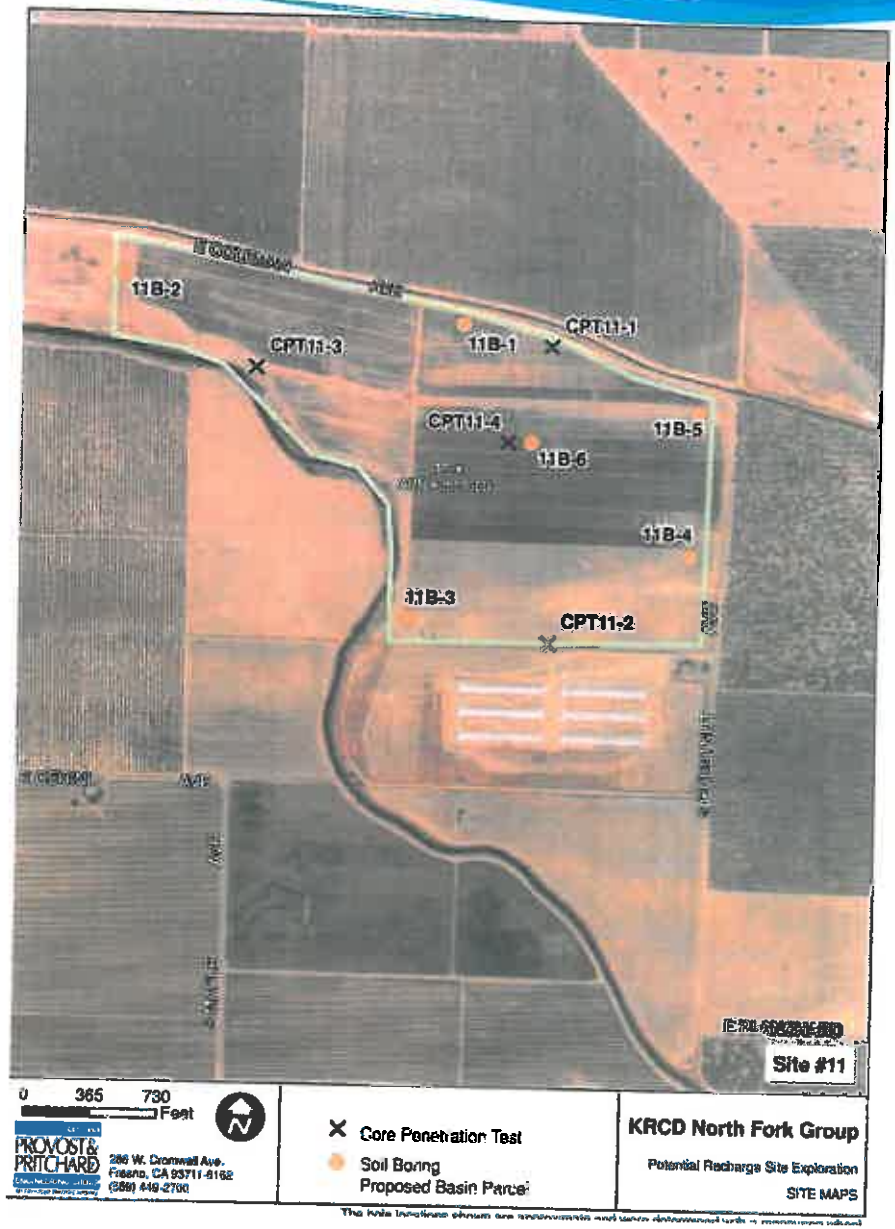


PROJECT LOCATION MAP



Project Site

PROJECT SITE MAP



2007 RECHARGE BASIN STUDY

- $250,000 Funded by Department of Water Resources
- Performed by KRCD, North Fork Group and P&P
- Investigated sites in North Fork area for recharge potential
- Scope of Work included:
  - Site identification
  - Landowner contact
  - Subsurface investigations
  - Laboratory soils investigations

2007 STUDY RESULTS

- 16 sites identified
- 7 best sites evaluated in detail
  - Subsurface investigations
  - Practical factors (gravity delivery, relocations needed, proximity to canals, regional geology, etc.)
- Overall Suitability for Recharge
  - 1 site rated POOR
  - 2 sites rated FAIR
  - 3 sites rated GOOD
  - **1 site rated Excellent (Site No. 11!)**

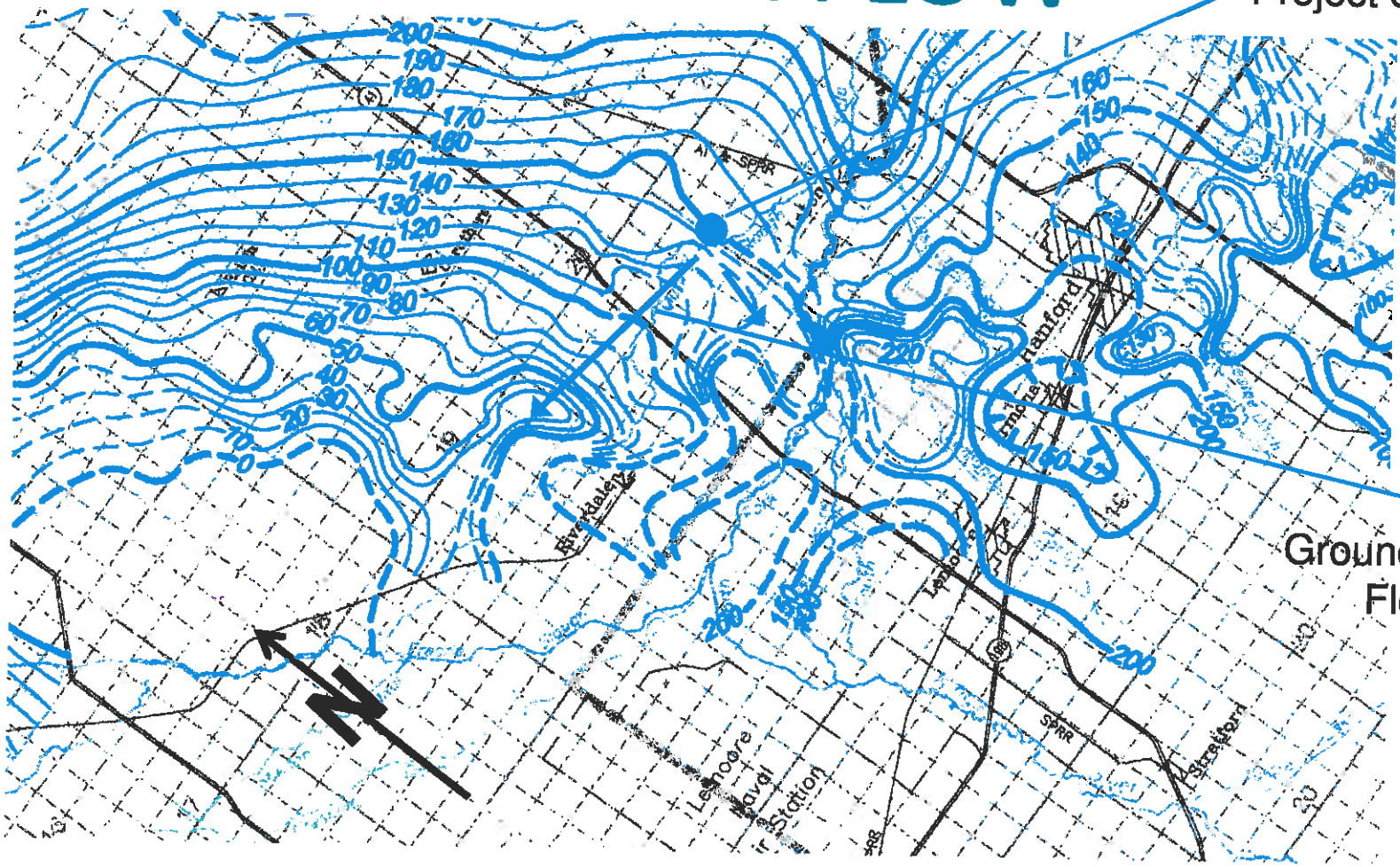
SITE CHARACTERISTICS

- 90 acres total
- Sandy soils
- Adjacent to conveyance facilities
  - Liberty Canal
  - Murphy Slough
- Existing depression (gravity delivery possible)
- Occasionally farmed (soils too sandy)
- Owner interested in selling 50 to 60 acres

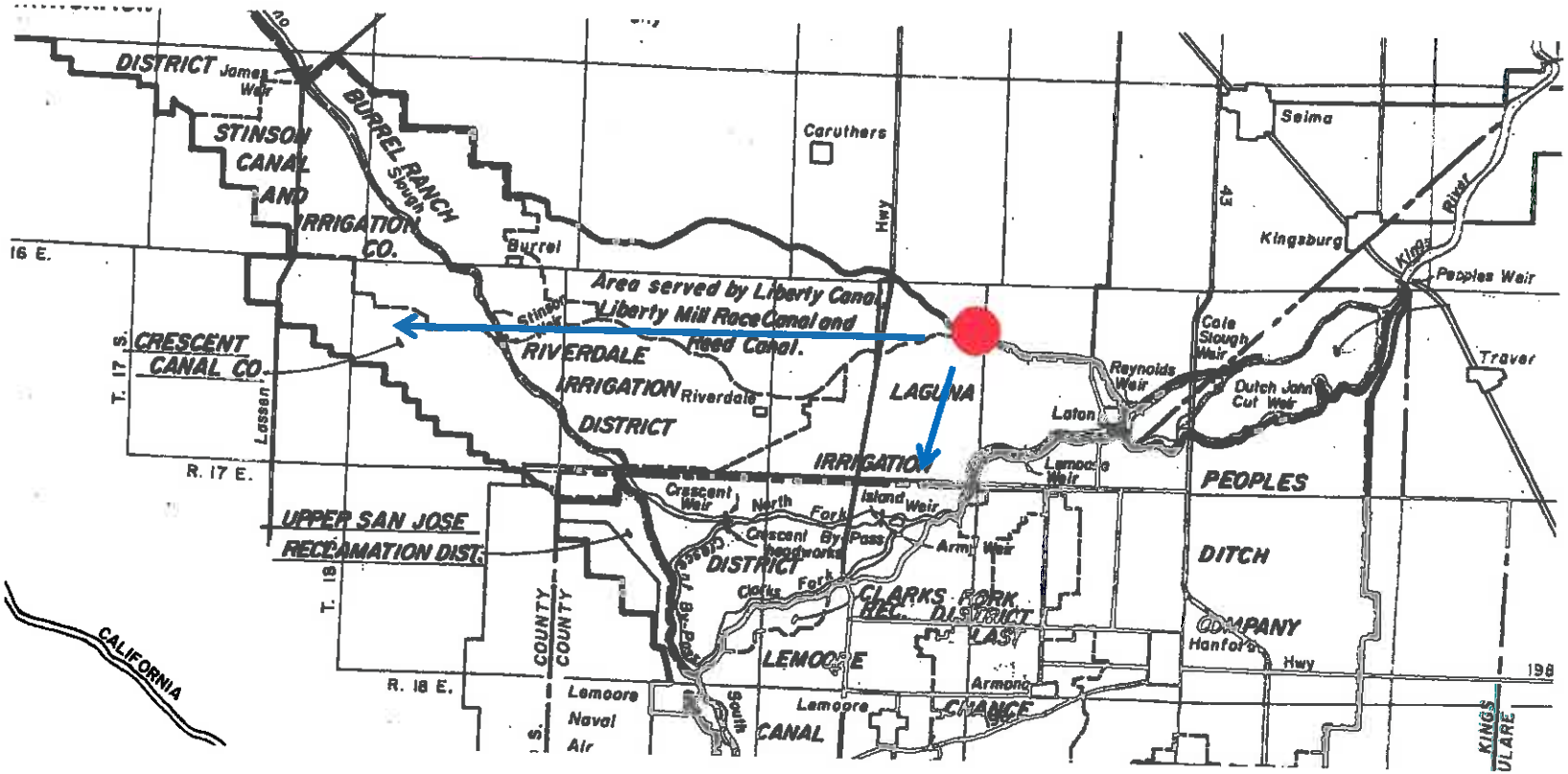
PROJECT DEVELOPMENT

- Final design
- Purchase land
- Increase capacity in Liberty Canal
- Construct turnouts
- Construct levees??
- Install monitoring equipment (monitoring wells, staff gauges, flow meters)

GROUNDWATER FLOW



GROUNDWATER FLOW



IRWMP FUNDING

- Construction funding available through DWR Integrated Regional Water Management Grant Program
- Applications due in March 2013
- Member or Interested Party of Kings Basin Water Authority (KBWA) can apply
- Interested party needs member to sponsor them
- KBWA selects best projects to include in joint application
- Not all proposed projects are included in application

PROPOSED FEASIBILITY STUDY

- 2007 study provides good justification for project.
- However, info still insufficient to complete grant application
- Additional studies needed:
  - Topographic surveying
  - Canal capacity analysis
  - Project yield study (Kings River floodwater)
  - Preliminary design
  - Environmental issues
  - Cost estimate
- Cost of Feasibility Study = $19,000
- Feasibility study **minimum** work needed to make project ready for funding

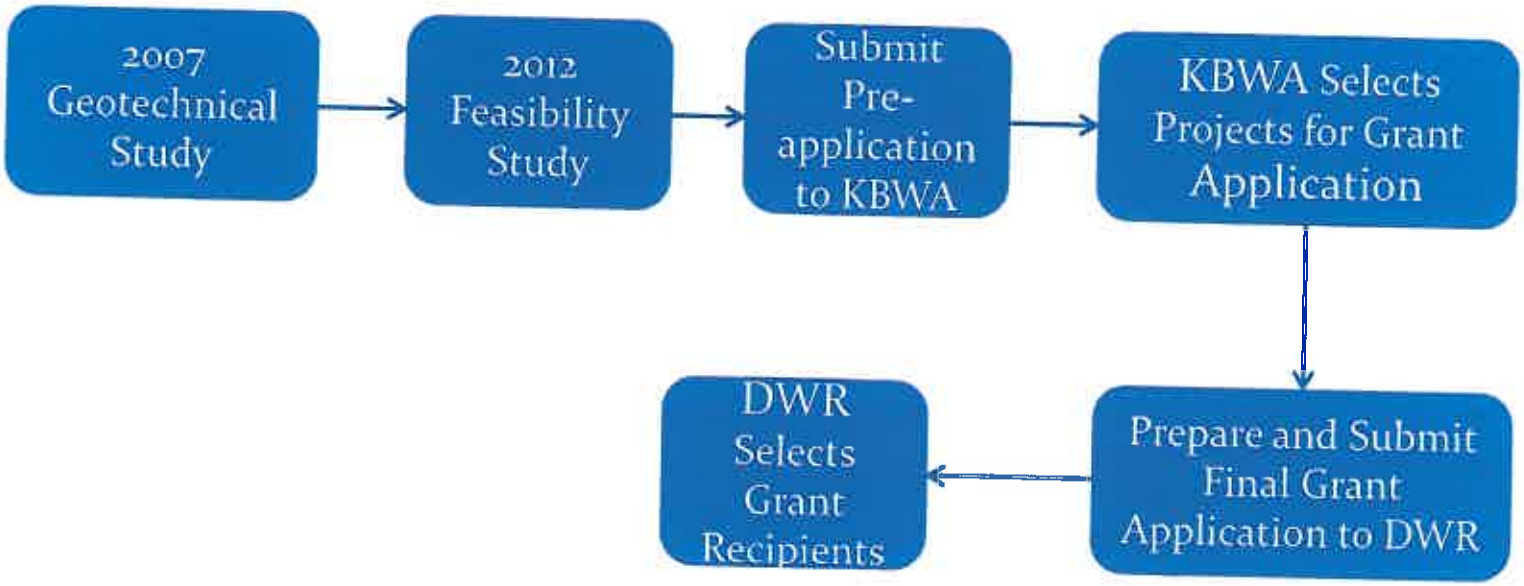
IRWMP PRE-APPLICATION

- KBWA will solicit 'pre-applications' in December 2012
- KBWA will identify most viable projects to include in a grant application
- 'Readiness to proceed' and 'Previous work' important considerations.
- Feasibility study needed to answer questions in pre-application

IRWMP FINAL APPLICATION

- Implementation grant application due in March 2013
- Funds awarded in late 2013
- 25% cost share required
  - District construct facilities
  - District manager time
  - Monetary contributions

OVERALL PROCESS



QUESTIONS OR COMMENTS

RIVERDALE PUBLIC UTILITY DISTRICT
NOTICE OF BOARD MEETING
AND PUBLIC HEARING

December 4, 2012
4:00 P.M.
Meeting Location:
Fire Station Annex

AMENDED AGENDA

District Office
20896 Malsbary
Riverdale, CA.
559 867-3838

- **ROLL CALL**
  - **ESTABLISHMENT OF QUORUM**
  - **MINUTES OF PREVIOUS GENERAL MEETING (November 6, 2012)**
  - **PUBLIC COMMENT**

    Any member of the public may address the Board and ask questions relating to any matter within the Board's jurisdiction. This need not be related to any item on the Agenda but the presentation should normally be limited to five (5) minutes. If the matter should appropriately be included within an item that is listed on the Agenda, the presentation to the Board should be made at the time that the particular item is taken up by the Board.
  - **SUPERINTENDENT'S REPORT (GENERAL/SAFETY/FIRE)**
  - **POTENTIAL CONFLICTS OF INTEREST**

    Any Board Member who has a potential conflict of interest may now identify the item And recuse themselves from discussing and voting on the matter. FPPC #87105

- **OLD BUSINESS**
  - **WELL #5 & #6 WATER TREATMENTS PLANTS -ARSENIC LEVEL COMPLIANCE MANDATE. DISCUSSION / ACTION**
  - **WELL #2 REPLACEMENT/ WELL #6 PROGRESS REPORT/USDA FUNDING. DISCUSSION / ACTION**
  - **MAIN SEWER LIFT STATION UPGRADE: DISCUSSION / ACTION**

- **NEW BUSINESS**
  - **LAGUNA IRRIGATION DISTRICT PRESENTATION – SCOTT SILLS: DISCUSSION / ACTION**
  - **UPPER KINGS BASIN INTEGRATED REGIONAL WATER MANAGEMENT AUTHORITY – UPPER KINGS BASIN DISADVANTAGED COMMUNITY PILOT STUDY (MATT KEMP): DISCUSSION / ACTION**

LAGUNA IRRIGATION DISTRICT

RECHARGE BASIN 11 FEASIBILITY STUDY

APPENDIX H

CULTURAL RESOURCES RECORDS SEARCH

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

FRESNO
KERN
KINGS
MADERA
TULARE

Southern San Joaquin Valley Information Center
California State University, Bakersfield
Mail Stop: 46 MEC
9001 Stockdale Highway
Bakersfield, California 93311-1022
(661) 654-2289 FAX (661) 654-2415
E-mail: ssjvic@csub.edu

TO: Jason Thomas
Provost & Pritchard Consulting Group
130 N. Garden Street
Visalia, CA 93291

(RS# 13-001)

DATE: January 7, 2013

RE: Job No. 1053-12V2-PRE: Recharge Basin Feasibility Study - Laguna Irrigation District

County: Fresno

Map(s): Laton & Riverdale 7.5's

The Southern San Joaquin Valley Information Center is under contract to the State Office of Historic Preservation and is responsible for the local management of the California Historical Resources Inventories. The Center is funded by research fees and a grant from the State Office of Historic Preservation. The Information Center does not conduct fieldwork and is not affiliated with any archaeological consultants who conduct fieldwork.

CULTURAL RESOURCES RECORDS SEARCH

The Information Center files include known and recorded archaeological and historic sites, inventory and excavation reports filed with this office, and properties listed on the National Register of Historic Places (4/5/12), California Register, the California Historical Landmarks, the California Inventory of Historic Resources, and the California Points of Historical Interest. The following summarizes the known historical resources information currently available for this subject property based in part on the sources outlined above.

PRIOR CULTURAL RESOURCE INVENTORIES WITHIN THE PROJECT AREA AND A ONE-HALF MILE RADIUS

According to the information in our files, there has been one (1) previous cultural resource study conducted within the project area, FR-01568. There have been no additional studies conducted within a one-half mile radius.

(RS # 13-001)

RECORDED CULTURAL RESOURCES WITHIN THE PROJECT AREA AND A ONE-HALF MILE RADIUS

There are no recorded cultural resources within the project area or within a one-half mile radius and it is not known if any exist there.

There are no known cultural resources within the project area or a one-half mile radius that are listed in the National Register of Historic Places, the California Register, California Inventory of Historic Resources, California Points of Historic Interest, or the California State Historic Landmarks.

COMMENTS/RECOMMENDATIONS

We understand this project consists of the creation of a basin to recharge the local groundwater. Additionally, we understand this project area and surrounding vicinity have historically and are currently used for farming. Please note that farming does not destroy sub-surface cultural resources but can disturb resources within the plow zone only. Many sites have been located well beneath the plow zone and have proven quite significant in providing valuable information about the prehistory of the region. Further, the study conducted on a portion of the project area was done more than 15 years ago. Given the improvements in field methods, etc. the Information Center routinely recommends a new survey be conducted when a previous survey was done more than 5-7 years ago. As such, we recommend a qualified, professional archaeologist conduct a field survey of the area, prior to ground disturbance activities, to determine if cultural resources are present. A referral list of is available at www.chrisinfo.org. If you have any questions or comments, or need any additional information, please don't hesitate to contact our office at (661) 654-2289.

By Michael A. Glassow for

Brian E. Hemphill, Ph. D.
Coordinator

Date: January 7, 2013

Fee: $225.00/hr. (Priority Service)

Please note that invoices for Information Center services will be sent under separate cover from the California State University, Bakersfield Accounting Office.

OPTION AGREEMENT

This Option Agreement (the "Agreement") is entered into effective the 21st day of March, 2013, (the "Effective Date) by and between **The Jessie P. Silva Trust**, ("Trust") and the **Laguna Irrigation District**, a California Irrigation District duly organized and existing under Division 11 of the California Water Code ("District"). Trust and District shall sometimes be referred to herein collectively as the "Parties" or individually as a "Party."

WHEREAS, Trust is the owner of certain real property located in Fresno County, California, comprising approximately fifty-four (54) acres (the "Property"), which Property is more particularly described in **Exhibit A**, attached hereto and incorporated herein;

WHEREAS, District owns operates a public water project for the benefit of the District and its landowners (the "Project"), which Project includes recharge basins designed for direct recharge of the aquifer situated beneath the District; and

WHEREAS, District is attempting to secure from the State of California certain grant funds available pursuant to Proposition 84 (the "Grant Funds"); and

WHEREAS, District intends to use the Grant Funds to acquire the Property and construct a recharge basin on the Property; and

WHEREAS, District wishes to acquire from Trust and Trust wishes to grant to Buyer an option to purchase the Property subject to the District's timely receipt of the Grant Funds;

NOW, THEREFORE, in consideration of the mutual covenants set forth in this Agreement and for other valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Trust hereby grants to District an exclusive and irrevocable option (the "Option") to purchase the Property from the Trust for the Purchase Price (defined below) and, if District exercises the Option, agrees to sell the Property to District (i) subject to and upon the terms, covenants and conditions set forth herein, and (ii) in accordance with escrow instructions to be agreed upon by the Parties. The Purchase Price shall be equivalent to the value assigned to the Property pursuant to an appraisal performed by a licensed appraiser agreed upon and retained by both Parties; provided that if one Party objects to said appraisal the Parties shall have a subsequent appraisal performed by a different licensed appraiser agreed up and retained by both Parties, which subsequent appraisal shall be done at the objecting Party's sole cost and expense.

2. The term of the Option shall commence on the Effective Date and shall expire on the date that is twelve (12) months from the Effective Date (the "Initial Option Term"). If District has not received the Grant Funds prior to the expiration of the Initial Option Term, District may extend the term of the Option for one (1) additional twelve-month term (the "Extended Option Term") by notifying the Trust in writing prior to the expiration of the Initial Option Term. The Trust may make such use of the Property during the Initial Option Term and Extended Option Term as the Trust deems appropriate, provided that the Trust shall not take any action to sell the Property to a third-party purchaser or do anything that compromises the ability of the District to construct and operate a recharge basin on the Property following District's exercise of the Option.

3. District may exercise the Option by providing written notice to Trust of its election to do so ("Option Notice") prior to the conclusion of the Initial Option Term or Extended Option Term, as applicable. The Option Notice shall specify (i) District's intention to exercise the Option and purchase the Property, and (ii) the Purchase Price. Such Option Notice shall be transmitted by certified mail, return receipt requested, or by a nationally recognized overnight delivery service. Upon the Trust's receipt of District's Option Notice, District shall purchase the Property in fee simple from the Trust, pursuant to a grant deed executed by the Trust, on the terms and conditions set forth herein.

4. The Trust shall indemnify, defend and hold District, its directors, officers, employees, agents and volunteers harmless from and against any and all liability, claims, injuries, damages, losses, deficiencies, costs, expenses (including, but not limited to, investigation, clean-up, abatement and remedial expenses incurred with regard to contamination of the soil or water) and attorney's fees arising in any manner whatsoever as a result of (i) any breach of its warranties or obligations hereunder or failure to perform any of its covenants or obligations hereunder; or (ii) any violation or claimed violation by the Trust in connection with the Property of any federal, state or local law, ordinance, or regulation relating to environmental conditions on, under, or about the Property.

5. The Trust warrants that: (i) it is the sole owner of the Property and holds good and marketable title to the Property; and (ii) the Trust has not granted any option or right of first refusal or first opportunity to any party to acquire any fee or leasehold interest in any portion of the Property.

6. If District exercises the Option and purchases the Property, District acknowledges that, except as expressly provided for otherwise in this Agreement, it shall do so on as "**As-Is With All Faults**" basis with any and all patent and latent defects, and, except as expressly provided for elsewhere in this Agreement, is not relying on any representations or warranties, express or implied, of any kind whatsoever from the Trust.

7. This Agreement supersedes all prior discussions and agreements between the Parties with respect to the subject matter hereof and contains the sole and entire agreement between the Parties with respect to the subject matter hereof.

8. This Agreement may be amended, modified, or supplemented only by written instrument duly executed by both Parties hereto.

9. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original and all of which shall constitute the same Agreement.

10. This Agreement shall be governed by and construed in accordance with the laws of the State of California without giving effect to conflicts of laws principles. All claims and controversies arising out of or related to this Agreement shall be resolved in Kern County Superior Court.

11. If any action at law or in equity is necessary to enforce or interpret this Agreement, the prevailing Party will be entitled to reasonable attorneys' fees, costs, and discovery or investigation expenses in addition to any other relief to which that Party may be entitled.

[Signatures Follow on Next Page]

IN WITNESS WHEREOF, District and Trust have executed this Agreement to be effective as of the Effective Date.

TRUST:

By: Jesse P. Silva

Print Name: JESSE P. SILVA

Title: Jesse Silva Dairy

DISTRICT:

By: [illegible]

Print Name: Scott Sills

Title: General Manager

EXHIBIT A

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF FRESNO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

The southern 1,750 feet of Fresno County APN 055-330-03, approximately 54 acres.

Section 12, Township 17 South, Range 20 East, Mount Diablo Base and Meridian of the Laguna DeTache Grant, portions of lots 11, 12, 16 and 17.

LAGUNA IRRIGATION DISTRICT
RECHARGE BASIN 11 FEASIBILITY STUDY
LIBERTY CANAL HYDRAULICS

Laguna ID Liberty Canal Hydraulics										
STA (Mi)	Elevation (ft)	Width Top 1' Down (ft)	Width Bottom (ft)	Ave. Depth (ft)	Area (ft^2)	W.P. (ft)	R (ft)	Q (cfs)	Sides (ft)	Slope (ft/ft)
0.0	245.63	23	9	4.0	64.0	26.80	2.39	204	7.0	0.000701
0.1	245.26	22	15	3.0	55.5	33.81	1.64	126	3.5	0.000587
0.2	245.57	21	7	2.5	35.0	22.30	1.57	292	7.0	0.008352
0.3	249.98	31	15	4.0	92.0	38.00	2.42	460	8.0	0.001686
Xing1								218		
0.4	249.09	29	12	4.0	82.0	33.41	2.45	646	8.5	0.004110
0.5	246.92	26	15	3.0	61.5	34.95	1.76	156	5.5	0.000663
0.6	246.57	23	13	2.5	45.0	30.36	1.48	129	5.0	0.001061
0.7	247.13	22	15	3.0	55.5	33.81	1.64	119	3.5	0.000521
Xing2								297		
0.8	246.86	15	6	2.5	26.3	17.50	1.50	113	4.5	0.002358
0.9	248.10	18	7	3.3	41.7	21.14	1.97	36	5.5	0.000066
1.0	248.14	20	9	3.3	47.5	23.86	1.99	157	5.8	0.000956
1.1	248.64	20	9	3.2	45.9	24.26	1.89	252	5.5	0.002822
1.2	250.13	18	8	4.0	51.0	22.31	2.29	221	5.3	0.001364
1.3	249.41	24	6	6.0	90.0	27.63	3.26	82	9.0	0.000038
1.4	249.39	20	9	4.0	57.0	24.52	2.32	166	5.8	0.000606
1.5	249.71	18	7	3.6	44.2	21.08	2.10	149	5.7	0.000928
1.6	250.20	19	6	4.0	50.0	21.69	2.31	289	6.5	0.002405
1.7	248.93	17	7	2.7	32.0	19.87	1.61	72	5.0	0.000587
1.8	249.24	16	7	2.7	30.7	19.31	1.59	41	4.5	0.000208
1.9	249.13	16	8	2.7	32.0	20.56	1.56	36	4.0	0.000152
2.0	249.21	14	6	2.5	24.8	16.74	1.48	170	4.1	0.006117
2.1	252.44	20	14	5.5	93.5	34.14	2.74	434	3.0	0.001231
Clovis					80.0	26.00	3.08	401		
2.2	251.79	19	7	4.2	54.2	22.61	2.40	107	6.0	0.000265
2.3	251.93	18	7	4.0	50.0	21.80	2.29	173	5.5	0.000871
2.4	251.47	18	7	3.5	43.8	21.30	2.05	88	5.5	0.000341
2.5	251.29	16	6	3.3	36.7	18.95	1.93	84	5.0	0.000473
2.6	251.54	17	6	3.5	40.3	19.78	2.04	151	5.5	0.001193
R.R.					96.0	28.00	3.43	2065		
2.7	252.17	20	6	3.5	45.5	21.94	2.07	212	7.0	0.001799
2.8	251.22	16	6	2.7	29.3	18.29	1.60	103	5.0	0.001439
2.9	251.98	16	7	3.3	38.3	19.98	1.92	101	4.5	0.000644
3.0	252.32	16	6	3.5	38.5	19.12	2.01	169	5.0	0.001667
Fowler					62.3	22.42	2.78	339		
3.1	253.20	29	12	3.7	75.2	33.08	2.27	232	8.5	0.000701
3.2	252.83	19	6	3.7	45.8	21.36	2.15	50	6.5	0.000095
3.3	252.88	18	7	3.5	43.8	21.30	2.05	161	5.5	0.001136
3.4	253.48	19	7	3.8	49.8	22.27	2.24	83	6.0	0.000208
3.5	253.59	21	10	3.7	56.8	26.49	2.15	180	5.5	0.000795
3.6	253.17									
3.7	253.27									
3.8	254.00									
3.9	254.06									
4.0	253.31									
4.1	254.94									
4.2	255.53									
Harlan					121.0	44.17	2.74	616		
4.3	254.75									
4.4	256.17									
4.5	257.41									
4.6	255.55									
4.7	256.95									
4.8	257.69									
4.9	259.37									

Notes: 1) Survey and hydraulic calculations performed by Laguna ID December 2012.
2) Station 0.0 is the hub set at the northeast location of the proposed recharge basin site.

SUMMARY APPRAISAL REPORT

APPROXIMATELY 52 ACRES BEING ACQUIRED
FROM A LARGER 91.13 ASSESSED ACRE LAND PARCEL
OF IRRIGATED FIELDCROP LAND,
WITH THE PURPOSE OF DEVELOPING A
GROUNDWATER RECHARGE BASIN FOR
OWNERSHIP AND USE BY LAGUNA IRRIGATION DISTRICT
SOUTHWEST CORNER OF EAST COLEMAN AND SOUTH CHESTNUT AVENUES
LATON, FRESNO COUNTY, CALIFORNIA 93242
ASSESSOR PARCEL NUMBER: 055-330-03

Effective Date Of Valuation:
March 15, 2013

Owner Of Record:
Jesse P. Silva, Trustee Of The Survivor's Trust Created
Under The Jesse and Mary Silva Living Trust Dated
February 12, 1991, as Amended.

Intended User/Client:
Mr. Scott Sills
General Manager
Laguna Irrigation District
5065 19½ Avenue
Riverdale, California 93656

Prepared By:
Mr. Rick P. Smith, MAI, ASA, SR/WA
State Of California Certified General
Real Estate Appraiser No. AG005172

SUBJECT PROPERTY
APPROXIMATELY 52 ACRES BEING ACQUIRED
FROM A LARGER 91.13 ASSESSED ACRE LAND PARCEL
OF IRRIGATED FIELDCROP LAND,
WITH THE PURPOSE OF DEVELOPING A
GROUNDWATER RECHARGE BASIN FOR
OWNERSHIP AND USE BY LAGUNA IRRIGATION DISTRICT
SOUTHWEST CORNER OF EAST COLEMAN AND SOUTH CHESTNUT
AVENUES, LATON, FRESNO COUNTY, CALIFORNIA 93242
ASSESSOR PARCEL NUMBER: 055-330-03

AARON
REALTY GROUP

7638 NORTH INGRAM AVENUE, SUITE 201 • FRESNO, CALIFORNIA 93711 • PHONE 559.435.6077 • FAX 559.435.6079

March 25, 2013

Mr. Scott Sills
General Manager
Laguna Irrigation District
5065 19½ Avenue
Riverdale, California 93656

RE: ***APPROXIMATELY 52 ACRES BEING ACQUIRED FROM A LARGER 91.13 ASSESSED ACRE LAND PARCELOF IRRIGATED FIELDCROP LAND, WITH THE PURPOSE OF DEVELOPING A GROUNDWATER RECHARGE BASIN FOR OWNERSHIP AND USE BY LAGUNA IRRIGATION DISTRICT/SOUTHWEST CORNER OF EAST COLEMAN AND SOUTH CHESTNUT AVENUES LATON, FRESNO COUNTY, CALIFORNIA 93242/ASSESSOR PARCEL NUMBER: 055-330-03/SILVA TRUST***

Dear Mr. Sills:

In accordance with your written authorization of February 15, 2013, I have conducted an appraisal and completed an appraisal report on the above referenced property. The purpose of the appraisal is to determine fair market value as herein defined. I have determined the value of the fee simple estate, with an effective valuation date of October 1, 2012. I have been engaged by yourself, on behalf of yourself, Laguna Irrigation District and Provost & Pritchard Consulting Group and the report has been prepared for the sole benefit of the same. As per the *Uniform Standards Of Professional Appraisal Practice*, the Laguna Irrigation District, Provost & Pritchard Consulting Group, and the California Department Of Water Resources are the itended users, for the stated herein use.

This report has been prepared in conformance with *the Uniform Standards Of Professional Appraisal Practice* (USPAP). As per USPAP, this meets the requirements of a Summary Appraisal Report.

The report has been prepared subject to all the conditions set forth in the Contingent and Limiting Conditions section of this report, as well as all specific conditions (USPAP hypothetical conditions and or extraordinary assumptions) which have been summarized in the Scope Of The Appraisal section of the report. I am a State Of California Certified General Real Estate Appraiser and meet the requirements of the Competency Rule to complete the assignment at hand.

Based on the conclusions and analyses contained in this report, in addition to reasonable and professional judgment which I have exercised in the valuation approaches, it is my opinion the subject property has an as proposed fair market value of the fee simple estate, on March 15, 2012, as follows:

USPAP HYPOTHETICAL CONDITION FAIR MARKET VALUE
OF PROPOSED SUBJECT SITE OF 52 ACRES:
$450,000
FOUR HUNDRED FIFTY THOUSAND DOLLARS

AS WILL BE LATER DETAILED, THE VALUATION REPORTED HEREIN IS PREPARED UNDER A UNIFORM STANDARDS OF PROFESSIONAL APPRAISAL PRACTICE (USPAP) HYPOTHETICAL CONDITION. THIS IS UNDER THE PREMISE THAT, AS OF THE APPRAISAL DATE, THE SUBJECT IS A 91.13 ACRE LAND PARCEL AND IS NOT A LEGALLY DEFINED PARCEL OF 52 ACRES. UPON COMPLETION OF A PROPOSED LOT LINE ADJUSTMENT (NOT YET FILED OR RECORDED), THE 52 ACRE LAND PARCEL AS DISCUSSED IN THIS ANALYSIS WILL BE FORMED, RESULTING IN OWNERSHIP BY THE LAGUNA IRRIGATION DISTRICT AND A REMAINING LAND PARCEL OF 39.13 RETAINED BY THE CURRENT OWNERSHIP (SILVA TRUST).

Please direct your attention to the accompanying report which is the communicated basis of my opinions. Additionally, please give particular attention to the Special Conditions and Assumptions contained in the Scope Of The Appraisal section of this report. Thank you for the opportunity to be of service. If I may be of further assistance, please don't hesitate to call.

Respectfully submitted,

Rick P. Smith, MAI, ASA, SR/WA
State Of California Certified General
Real Estate Appraiser No. AG005172
Principal, Aaron Realty Group
reffevalue@att.net

CERTIFICATION

I, Rick P. Smith, Certify:

- That I did personally inspect the property and have reviewed the analyses, conclusions and opinions concerning the real estate contained in this appraisal report and fully concur with the final value estimates herein expressed.
- That I am a Member of the Appraisal Institute (MAI). The Appraisal Institute conducts a voluntary continuing education program for members. I am currently certified under this program.
- That I am an Accredited Senior Appraiser (ASA) Member of the American Society of Appraisers. The American Society of Appraisers conducts a voluntary continuing education program for members. I am currently certified under this program.
- That all market data pertaining to the final value estimate has been accumulated from various sources and, where possible, personally examined and verified as to details, motivation and validity.
- The statements of fact contained in this report are true and correct.
- The reported analyses, opinions and conclusions are limited only by the reported General Assumptions and Limiting Conditions and, where applicable, the Special Assumptions and Limiting Conditions, and are our personal, impartial and unbiased professional analyses, opinions and conclusions.
- I have no present or prospective interest in the property that is the subject of this report, and I have no personal interest or bias with respect to the parties involved.
- I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.
- My engagement in this assignment was not contingent upon developing or reporting predetermined results.
- My compensation is not contingent upon the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value estimate, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.
- My analyses, opinions and conclusions were developed, and this report has been prepared in conformity with the requirements of the Code of Professional Ethics and the Standards of Professional Appraisal Practice of the Appraisal Institute and the American Society Of Appraisers.
- This appraisal assignment was not based on a requested minimum valuation, a specific valuation, or the approval of a loan.
- The use of this report is subject to the requirements of the Appraisal Institute and American Society Of Appraisers relating to review by their duly authorized representative.
- Landon Nordstrom provided significant professional assistance to the persons signing this report.
- I have complied with the Appraisal Standards of the Uniform Standards Of Professional Appraisal Practice (USPAP) and the Appraisal Institute in conducting the research and analysis, and in formulating the value conclusion contained in this report.
- I have never provided appraisal, brokerage, property management, review, consulting or any other real estate related services or any other professional services pertaining to the property which is the subject of this report..

Rick P. Smith, MAI, ASA, SR/WA
State Of California Certified General
Real Estate Appraiser No. AG005172

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INTRODUCTION

DEFINITION OF FAIR MARKET VALUE

The purpose of this appraisal report is to estimate market value, defined as follows:

The fair market value of the property taken is the highest price on the date of valuation that would be agreed to by a seller, being willing to sell but under no particular or urgent necessity for so doing, nor obliged to sell, and a buyer, being ready, willing, and able to buy but under no particular necessity for so doing, each dealing with the other with full knowledge of all the uses and purposes for which the property is reasonably adaptable and available.

Source: California Eminent Domain-Condemnation (Code Of Civil Procedure Section 1263-320a)

market value is similar in concept and is also included in consideration of how the valuation was determined.

The most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller, each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition is the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:

1. *Buyer and seller are typically motivated;*
2. *Both parties are well informed or well advised, and acting in what they consider their best interests;*
3. *A reasonable time is allowed for exposure in the open market;*
4. *Payment is made in terms of cash in United States dollars or in terms of financial arrangements comparable thereto; and*
5. *The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale.*

(The Uniform Standards Of Professional Appraisal Practice-USPAP)

CONTINGENT AND LIMITING CONDITIONS

1. The report may not be relied upon by any other person other than the client, for any purpose whatsoever. The client, in disclosing the contents of the report, makes no representation or warranty, express or implied, as to the contents of the report and none may be assumed or implied by persons or entities other than the client.

2. The report contains conclusions and opinions which are the result of the training, experience and judgment of the appraisers in the particular circumstances under which the report was prepared. No representation or warranty is made and none may be assumed or implied as to whether any other appraiser, working in the same or different circumstances, would agree with the conclusions or opinions contained in the report.
3. The appraisal report itself may contain limiting conditions, qualifications and disclaimers beyond those contained herein.

4. No warranty, expressed or implied, is made or may be assumed concerning any statements or observations in the report concerning the safety, fitness for use, soundness, design or marketability to the land or any of the improvements in, on or under the land. Moreover, no investigation or effort has been made to discover potential or actual defects or other conditions, unless expressly stated in the report.

5. The date of the value to which the conclusions and opinions expressed in this report apply, is set forth in the transmittal letter. Further, the dollar amount of any value opinion in the appraisal report is based upon the purchasing power of the American dollar existing on that date.

6. The appraisers assume no responsibility for economy or physical factors which may affect the opinions in the appraisal report which occur after the date of the letter transmitting the report.

7. The information furnished by others is assumed to be reliable. Therefore, no representation or warranty is made for its truth or accuracy.

8. The appraisers reserve the right to make such adjustments to the analyses, opinions and conclusions set forth in the appraisal report as may be required by the consideration of additional data or more reliable data that may become available.

9. No opinion as to the condition of the title is rendered. Title is assumed to be marketable and free and clear of liens, encumbrances, easements and restrictions except those specifically discussed in the report. The property is appraised assuming it to be under responsible ownership and competent management, and available for its highest and best use.

10. The appraisers assume no responsibility for hidden or unapparent conditions of the property, subsoil, or structures that render it more or less valuable.

11. The property is appraised assuming it to be in full compliance with all applicable federal, state and local environmental regulations and laws, unless otherwise stated.

12. The property is appraised assuming that all applicable zoning and use regulations and restrictions have been complied with, unless otherwise stated.

13. The property is appraised assuming that all required licenses, certificates or occupancy consents, or other legislative or administrative authority from any local, state, or national government or private entity or organization have been or can be obtained or renewed for any use on which the value estimate contained in this report is based, unless otherwise stated.

14. No engineering survey has been made by the appraisers. Except as specifically stated, data relative to size and area was taken from sources considered reliable and no encroachment on real property improvements is considered to exist.

15. No opinion is expressed as to the value of subsurface oil, gas or mineral rights or whether the property is subject to surface entry for the exploration, or removal of such materials except as expressly stated.

16. Maps, plats and exhibits included in the report are for illustration only as an aid in visualizing matters discussed within the report. They should not be considered as surveys or relied upon for any other purpose, nor should they be removed or reproduced, or used apart from the report.

17. No opinion is intended to be expressed for matters which require legal expertise or specified investigation or knowledge beyond that customarily employed by real estate appraisers.

18. The distribution, if any, of the total valuation in this report between land and improvements applies only under the stated program of utilization. The separate allocations for land and buildings may not be used in conjunction with any other appraisal and are invalid if so used.

19. Possession of this report, or any copy of it, does not carry with it the right of publication. It may not be used for any purpose other than the party to whom it is addressed without written consent of the appraisers, and in any event only with proper written qualification and only in its entirety.

20. At the request of the client, for whom the report was prepared, the content of the appraisal report has been limited to the data set forth. As such, it may represent something less than a full and complete appraisal report. However, the substance of the appraisal investigation meets all of the requirements of a full and complete appraisal assignment and a complete memorandum of all analyses and conclusions leading to the stated value opinion has been retained in the appraiser's files. The appraisers' files are confidential to the appraisers and their employer/client and no waiver of confidentiality or privacy of those files may be assumed or implied.

21. Testimony or attendance in court or at any other hearing shall not be required by reason of rendering the appraisal, unless arrangements satisfactory to the appraisers are made in writing a reasonable time in advance.

22. Testimony or attendance in court by reason of the appraisal is not required unless further authorization to fully appraise the property involved is granted the appraisers at a fee to be determined prior to commencement of such additional work as may be required.

23. Because the date of the value to be used may be the date of trial, the appraisers reserve the right to consider and evaluate such additional data as becomes available between the date of the report and said date of trial and to make such adjustments, if any, to the stated value opinions as may be required by analysis of such additional data.

24. Unless otherwise stated in the report, no consideration has been given in the appraisal as to the value of the property located on the premises considered to be personal property, nor have the appraisers given consideration to the cost of moving or relocating such personal property; only the real property has been considered.

25. Neither all nor any part of the contents of this report, particularly as to the valuation conclusions, the identity of the appraisers, or the firm the appraisers are associated with shall be disseminated to the public through the media, public relations media, or the news media.

26. On all appraisals subject to satisfactory completion, repairs or alterations, the appraisal report and value conclusions are contingent upon completion of the improvements in a workmanlike manner, and according to plans, specifications and contracts provided.

27. In this appraisal assignment, the existence of potentially hazardous materials used in the construction

or maintenance of the building such as lead based paint, aluminum wiring or the presence of urea formaldehyde formula insulation or asbestos, or the existence of toxic waste and/or radon gas which, may or may not be present on the property, was not known or observed. Also, the existence of any soil contaminants, ground water or drinking water contamination and/or land subsidence or failure was not known or observed. The effect, if any, of exposure to electromagnetic energy from high tension electrical power lines is also not known to the appraisers. The appraisers are not qualified to detect such substances or conditions. The existence of any hazardous material or any other soil condition may have an effect on the value of the property. We urge the client to retain an expert in the field if so desired.

28. The Americans with Disabilities Act (ADA) became effective January 26, 1992. The appraisers have not made a specific compliance survey and analysis of this property to determine whether or not it is in conformity with various detailed requirements of the ADA. It is possible that a compliance survey of the property, together with a detailed analysis of the requirements of the ADA, could reveal that the property is not in compliance with one or more of the requirements of the Act. If so, this fact could have a negative effect upon the value of the property. Since the appraisers have no direct evidence relating to this issue, they did not consider possible noncompliance with the requirements of ADA in estimating the value of the property.

29. The appraisers are not qualified to determine the cause of mold, if any, the type of mold or whether the mold might pose any risk to the property or its inhabitants. Additional inspection by a qualified professional is recommended. The appraisers are not building or environmental inspectors. The appraisers provide an opinion of value. The appraisal does not guarantee that the property is free of defects or environmental problems. The appraisers perform an inspection of visible and accessible areas (in most cases) only. Mold may be present in areas that appraisers cannot see. A professional building inspection or environmental inspection is recommended.

SCOPE OF APPRAISAL

The scope of the appraisal is intended to provide the client with a summary of the extent of the process in which data are collected, confirmed and reported. Essentially, it describes what the assignment entails, what resources were utilized and what special conditions are placed on the appraisal.

The appraiser has been engaged by Scott Sills, General Manager, Laguna Irrigation District, to conduct an appraisal and to provide a Summary Appraisal Report. The subject property is 52 acres which will be formed by means of a legal lot line adjustment from a larger 91.13 acre assessed parcel. This is in unincorporated Laton in southernmost Fresno County. Specifically, the subject is at the southwest corner of South Chestnut and East Coleman Avenue. More specifically, historically, the parcel has been used for alfalfa production by the current ownership which operates a proximate dairy; he purchased the property some eight years ago. The property has no building improvements. The property is in the Laguna Irrigation District. However, the ownership has not historically primarily utilized district water, but ground water provided by a well system of unknown specifications. There is, no less, a subsurface pipeline system which is capable of distributing irrigation district water; well water; and dairy wastewater. The property is zoned AE-20 which is Exclusive Agriculture, 20 Acre Minimum Parcel. As irrigated fieldcrop land, used for alfalfa production, the subject is legally conforming to the classification. Moreover, upon division of the property by the lot line adjustment, the resulting two parcels of 52 acres (part being acquired by the LID); and 39.13 acres (part being retained by current ownership) will be conforming as they will be for agriculture purposes and meet the size requirements of being at least 20 acres. The property does have some undulating topography nuances, with a large portion of the property being below street grade and not laser level which is commonly practiced for commercial agriculture crop production.

More particularly, the 52 acres which will constitute the subject property will be severed from the current irrigation pipeline source and formed as a legally defined parcel which will be owned and used by the Laguna Irrigation District. The district is acquiring the property by means of negotiations with the property owner; it is not an eminent domain action. The acquisition is being funded by grant monies from the California Department Of Water Resources.

My client, Mr. Scott Sills, General Manager, Laguna Irrigation District, has instructed me to value the property under one scenario, namely the as is (or as proposed as a 52 acre land tract being purchased) fair market value. This is of the fee simple estate and is in consideration of an exposure period upwards of three to twelve months.

During the course of the appraisal assignment, the appraiser and or staff conducted interviews with several individuals to include Mr. Scott Sills, General Manager, Laguna Irrigation District; Owen Kubit, Civil Engineer/Registered Professional Engineer, Provost & Pritchard Consulting Group; Mr. Jesse P. Silva, Trustee/owner of the subject property; County of Fresno Planner's Office; County of Fresno Assessor's Office; etc. The appraiser extensively relied upon several resources for this assignment; namely, Kings Multiple Listing Service, Fresno Multiple Listing Services, MetroScan, LoopNet, etc. Landon Nordstrom conducted a field inspection of the property on or about March 11, 2013; and Rick P. Smith conducted a field inspection of the property on or about March 15, 2013.

The appraisal process entailed a personal inspection of the property, with analyses made of accessibility, topography, orientation, visibility, exposure, identity, etc. The process then extended to surrounding land use considerations, district and market area trends, study of the general Fresno and Kings Counties irrigated fieldcrop market, with particular attention given to sales and listings of irrigated fieldcrop land in the Laguna Irrigation District, as well as neighboring Consolidated Irrigation District.

In developing the scope of the appraisal assignment, the appraiser and client agreed the appraiser would employ and utilize only the Sales Comparison Approach in the valuation of the subject. I have agreed with the client, given the type of property being appraised, the transaction at hand, current market trends and considerations, etc., this would produce a credible conclusion of market value. The client, along those lines, was of the opinion this would meet their analysis and negotiation considerations. Consequently, the scope of the appraisal has been limited to my employment of the Sales Comparison Approach only, with no utilization of the Cost or Income Approaches. (For an agriculture parcel as the subject, neither the Cost or Income Approaches would typically have any application in the appraisal of such a property).

The client has requested I report my appraisal within a Summary Appraisal Report format. This is defined as:

Summary Appraisal Report
A written report prepared under Standards Rule 2-2 (b) of an Appraisal performed under Standard One.

This is essentially a report which is abbreviated when compared to a Self Contained Appraisal Report. In most categories and subsections of the report, the level of detail which has been presented is condensed, primarily to satisfy the requirements and regulations of USPAP Standard Rule 2-2 (b) and to meet the needs of the client. This report should not be construed as exhaustive in nature and will be particularly less than a Self-Contained Report in the Regional/ Area Analysis, as well as the Highest And Best Use Analysis and Valuation sections. It is expected that the client understands that they are obtaining a report which is less than an exhaustive, Self-Contained Appraisal Report. In all, the report is significantly abbreviated in it's format, and should not be construed as Self-Contained in nature.

In addition to the aforementioned assumptions and limiting conditions, the appraiser has recognized extraordinary assumptions, conditions and limitations specific to this appraisal assignment:

1. The appraiser is not an environmental engineer/expert and cannot assess property, building materials, etc. for conditions such as lead paint, asbestos, underground fuel tanks, toxicity associated with previous site use, etc. The appraiser has not reviewed an engineer prepared, Phase One Environmental Report. It is recommended that a professional be retained to analyze such to the degree it is warranted given the context of this assignment. The appraiser reserves all rights to modify the value conclusion for any disclosed adverse environmental matters provided by a qualified engineering firm.

2. I have prepared my appraisal under an extraordinary assumption. The *Uniform Standards of Professional Appraisal Practice* 2012-2013 defines *Extraordinary Assumption* as: ***An assumption, directly related to a specific assignment, which, if found to be false, could alter the appraiser's opinions or conclusions.*** The extraordinary assumption relative to this assignment is the fact I have not reviewed a preliminary title report during this appraisal assignment. The property appears to be encumbered by typical matters of record and is not (apparently) unduly or adversely influenced regarding any easements, encroachments, etc. During the course of the field inspection, there were no observed adverse easements or encroachments. In the event the property is found to be encumbered by any adverse matters of record which impact the use or marketability of the property and is otherwise than what has been presented by public records, I reserve the right to modify the appraisal.

3. My appraisal is prepared under another Extraordinary Assumption. My appraisal analysis does not take into account any cost to cure liability associated with the severing of the current underground pipeline. In other words, I have been told the property, upon formation of the 52 acre parcel by means of the lot line adjustment, will be removed from any source of irrigation water which presently serves the balance of the property (the part which will be retained by the current ownership). I am appraising the property under the extraordinary assumption the cost of severing the existing pipeline will be relatively negligible and will be incurred as a cost of acquisition by the district. If this is being performed or arranged otherwise, I reserve the right to modify my appraised value stated herein. Similarly, I have not recognized any costs or liabilities associated with the lot line adjustment, legal, engineering or title fees, etc. My analysis is solely in consideration of the real property being appraised.

4. The appraisal is being conducted under a *Uniform Standards of Professional Appraisal Practice* hypothetical condition. The 2012-2013 edition of the *Uniform Standards of Professional Appraisal Practice,* page U-3, defines *Hypothetical Condition* as: ***A condition, directly related to a specific assignment, which is contrary to what is known by the appraiser to exist on the effective date of the assignment results, but is used for the purpose of analysis. (Hypothetical conditions are contrary to known facts about physical, legal, or economic characteristics of the subject property; or about conditions external to the property, such as market conditions or trends; or about the integrity of data used in an analysis).*** As of current, the subject of this report is 52 acres which is proposed to be acquired from a larger assessed parcel of approximately 91.13 acres. I am valuing a land tract of about 52 acres which will be formed by a lot line adjustment; therefore, the remainder being retained by the current owner of the entirety is 39.13 acres. After recordation of the lot line adjustment, a legally defined parcel, entirely capable of being conveyed and transferred to different ownership will be created. The basis of my understanding what is to be appraised is detailed and set forth in a document submitted by the client's engineering firm entitled, *Feasibility Study For Recharge Basin No. 11*. Factually, both legally and physically, the subject is a larger land tract. However, my analysis is prepared under the Hypothetical Condition that what will be valued is a 52 acre land tract identified by the preceding exhibit. In the event this is not accurate, my valuation will be subject to modification.

INTENDED USE AND USER/PURPOSE AND FUNCTION OF APPRAISAL

The purpose of the appraisal is to determine fair market value as defined in this appraisal report. The function of the appraisal report is to provide the Laguna Irrigation District, an adequate description and value opinion of a portion of the subject property which is proposed for acquisition by the client for use as a recharge basin. The appraisal report has been prepared for the sole benefit of Laguna Irrigation District; their retained engineering firm, Provost & Pritchard Consulting Group; and the California Department Of Water Resources. As per the *Uniform Standards Of Professional Appraisal Practice* (USPAP), Laguna Irrigation District; their retained engineering firm, Provost & Pritchard Consulting Group; and the California Department Of Water Resources are the intended users of this appraisal report, for the stated herein use. No other use of the appraisal is valid and is considered entirely invalid, inappropriate and unauthorized.

PROPERTY RIGHTS APPRAISED

The property rights being valued are those of the **Fee Simple Estate.** This is defined, per ***The Dictionary Of Real Estate Appraisal***, 4th Edition, as:

Absolute ownership unencumbered by any other interest or estate, subject only to the limitations imposed by the governmental powers of taxation, eminent domain, police power, and escheat.

DATES OF VALUATION

Property Visitation/Effective Date Of Value:	March 15, 2013
Date Of Report/Signature Date:	March 25, 2013

PROPERTY HISTORY

There have been no known matters of public record relative to the subject property in the prior five years. The most recent known matter of public record pertaining to the subject property was the conveyance of the subject property from Nader and Avila, on May 27, 2005. This was to the current ownership, Jesse P Silva, Trustee of the Survivor's Trust created under the Jesse and Mary Silva Living Trust Dated February 12, 1991, as Amended. This is evidenced by County of Fresno Grant Deed, document number 118101. This was a full value transfer for the amount of $460,880 (or approximately $4,465 per acre).

The purchaser, since acquisition, has utilize the property, primarily, for alfalfa production relative to a dairy operation he has proximate to the subject property. Since that time, the property has not known to have been offered for sale or lease.

The transaction at hand entails the purchase of a 52 acre portion of the subject, located at the southeastern most sector of the existing 91.13 acres. It is our understanding a formal offer has not been tendered to the current owner. However, the parties (owner and agency/prospective buyer) have been in discussions and have agreed, in concept, to the sale of the property to the Laguna Irrigation District. The district will utilize the property for a groundwater recharge basin. This is subject to a grant for acquisition and development of the property; this will be from the California Water Resources Board. At present, application is being made to the state.

There are no other known matters of property history over the recent years pertaining to the subject property.

ESTIMATED EXPOSURE AND MARKETING TIME

Exposure time is the consideration of how long it would take a property to sell in the open marketplace under conditions requisite of market value, immediately preceding the effective appraisal date. Conversely, marketing time is the estimated period which it will take to achieve a sale given current market conditions; it is an anticipated period to produce a sale.

With respect to the subject property, it is a 91.13 acre assessed parcel which located in the area of Laton in unincorporated southern Fresno County. This is within the Laguna Irrigation District and the district is acquiring the southeasternmost 52 acres of the subject property. This is for the purpose of developing a groundwater recharge basin. As we will later discuss, irrigated fieldcrop land is in strong demand at this time. There are some exceptions to this, particularly those which are not benefitted by irrigation district water and or have soils which are not suitable for permanent crop (vineyards, fruit and nut trees, etc.) purposes. Nonetheless, the market for open agriculture land is exceptionally strong at this time, with few properties being offered for sale at this time.

In thought of exposure and marketing time issues, I have considered several sources. First, I have spoken with numerous market participants in this area over the past year relative to properties of this nature. This has included, but is not limited to agriculture brokers, banks which extend credit to agriculture land, investors in agriculture land, growers, agriculture appraisers, etc. All concur, this is a very strong market as it pertains to irrigated fieldcrop land, with most agreeing if the land is in a defined district; has favorable soils for permanent crop use; has secondary irrigation sources (on site wells); etc., the supply is nearly non-existent. In more secondary areas where soils are marginal and or water sources are not as durable, demand is not as strong, however, is still very strong. If properly marketed and offered, the sense is these type of properties will and can sell within a couple of month period.

Secondly, within the scope of my analysis, I have reviewed some 15 irrigated fieldcrop land sales and listings in the area of southern Fresno County and northern Kings County. More particularly, the vast majority of these were in the Laguna Irrigation District or neighboring Consolidated Irrigation District. These were from about ten to 150 acres in area, were zoned agriculture, and had a variety of soil types. They ranged from having had no formal exposure to the market (buyer approaching seller), to those which with professional brokerage and marketing efforts, remain on the market after about a year of marketing efforts. They cluster in the one to two month period of days on market and time to secure a prospect.

Based on the preceding and in consideration of current market events, the expected exposure time for the subject would be upwards of three to twelve months. In that current market trends parallel those of the recent year with respect to these type of properties, the marketing time is deemed similar to the exposure time: upwards of three to twelve months. This gives consideration to the probable time line for securing a qualified buyer, financing, etc. This estimation is under the assumption that the property be professionally marketed by a qualified brokerage firm in the central San Joaquin Valley, experienced in the sale of irrigated fieldcrop land in southern Fresno County.

PROPERTY IDENTIFICATION

ADDRESS & LOCATION

The property under appraisal is irrigated fieldcrop land, absent of any building improvements. Consequently, it is not identified with any common street address. Generally speaking, the subject is at the southwest corner of East Coleman and South Chestnut Avenues, Laton, Fresno County, California 93242. This is within unincorporated, southern Fresno County, proximate to northern Kings County. Alternatively, the property is at the northeast quadrant of South Cedar and East Cerini Avenue. This is south of the Liberty Canal and lying east of the Murphy Slough. This area is strongly characterized by agriculture land uses. It is about 40 miles east of Interstate Highway 5; 15 miles west of State Highway 99; about 2.50 miles east of State Highway 41; and five miles west of State Highway 43. This is also about three miles northwest of the unincorporated town of Laton; and some five miles northeast of the unincorporated town of Riverdale.

ASSESSOR'S PARCEL NUMBER

The subject is being formed from a larger parcel identified as assessor's parcel number 055-330-03; and is identified as a portion thereof. Upon recording of the lot line adjustment, the parcel will assigned a new assessor's parcel number by the County of Fresno Assessor's Office.

LEGAL DESCRIPTION

Please see accompanying Grant Deed contained as an exhibit in the Addenda of report for the current legal description. Upon recordation of the lot line adjustment, the subject will be identified by a newly formed legal description; the appraiser is not in receipt of this as of the writing of the appraisal report.

CENSUS TRACT

0074.00, County Of Fresno 2010 Census

ZONING

According to the County of Fresno Planner's Office, the subject is designated with the AE-20 zone designation. This is defined as *Exclusive Agriculture, 20 Acre Minimum Parcel Size*. "This is intended to be an exclusive district for agriculture and for those uses which are necessary and an integral part of the agriculture operation. This district is intended to protect the general welfare of the agriculture community from encroachments of non-related agriculture uses which by their nature would be injurious to the physical and economic well being of the agriculture district". This would include livestock raising, breeding and grazing; dairy uses (with appropriate permitting); permanent crops (to include vineyards, fruit and nut trees, citrus groves, orchards, etc.); field crops (table vegetables, livestock feed and forage, etc.); dry farming (wheat, oats, etc.); agriculture facilities (cold storage, dry storage, packing houses, gins, wineries, etc.); support services (blacksmiths, tractor repairs, well companies, irrigation districts and companies, etc.); and farm labor facilities and housing (single family residences, mobile homes, dormitories, etc.). In addition, a variety of non-farming related uses are permitted such as houses of worship, power substations and communication towers, public schools, etc.) In short a host of agriculture related uses consistent with the region of Fresno County are legally permitted on the parcel. The property, for several decades, has been used for irrigated field crop purposes. This is a legal use of the property.

Upon recording of the lot line adjustment, both the part being acquired (52 acres), as well as the remainder (39.13 acres) will be in conformance to the AE-20 Acre

This is a legal utilization of the property under the current zone designation.

FEMA FLOOD DATA

As per County of Fresno Federal Emergency Management Agency (FEMA) FIRM Panel 06019C 2900H, dated February 18, 2009, the subject site is located in a Special Flood Hazard Zone X. This is a zone of moderate food hazard risk; insurance is not mandatory for federally related loan transactions.

AD VALOREM TAXATION

The County Of Fresno Tax Collector and Assessor's Offices have assigned the following assessments and taxes:

APN: 055-330-03

2012-2013 Assessed Valuation	
Land:	$136,206.00
Improvement:	$ 35,509.00
Total Assessed Value:	***$171,715.00***
2012-2013 Taxes	$1,733.16
Special Assessments	$ 0.00
Total 2012-2013 Taxes	***$1,733.16***

According to the County of Fresno Tax Collector's Office, the subject parcel is located in Tax Rate Area 125-004, and is taxed at a rate of $1.009358 per $100 of assessed value. In addition, the parcel is subject to any special assessments regarding bond or district encumbrances. Any encumbrances of record would be detailed in a title report.

NOTE: All parcels within this county, and the State of California, are assessed at 100% of full cash value as determined by staff appraisal of the County Assessor's Office. Full cash value is defined as market value at the time of property transfer or the 1975-76 assessed values modified at the maximum compounded rate of 2% per annum.

With the passage of Proposition 13 in California, or the Jarvis-Gann Initiative, in the event of a transfer or improvement of the property, a reassessment will be triggered. Generally, the Assessor will reassess the property at the current market value. In the event of the transfer, a full reassessment would occur. In the event of an improvement, only the improved portion of the subject would be reassessed, with the unimproved portion carrying the prior year's tax base. If no transfers or improvements occur within the tax year, the assessment is subject to a statutory two percent maximum increase.

The current assessment is materially lower than the determined as is market value (as herein defined). The subject is under an agriculture preserve contract by means of the provisions of the Williamson Act. Therefore, the assessment and taxation are based on the agriculture utilization of the property as opposed to the market

value of the property as described herein. Upon division of the property by means of the lot line adjustment, the two, new resulting assessed parcels will be separately and individually assessed. Each property will, hence, be assessed accordingly. Under the basis the subject will be utilized as a groundwater recharge basin, owned and operated by a California Irrigation District, it is likely agriculture preserve status will be maintained and the property will be valued and taxed at a level below the full cash value (as defined by the State Board of Equalization).

OWNER OF RECORD

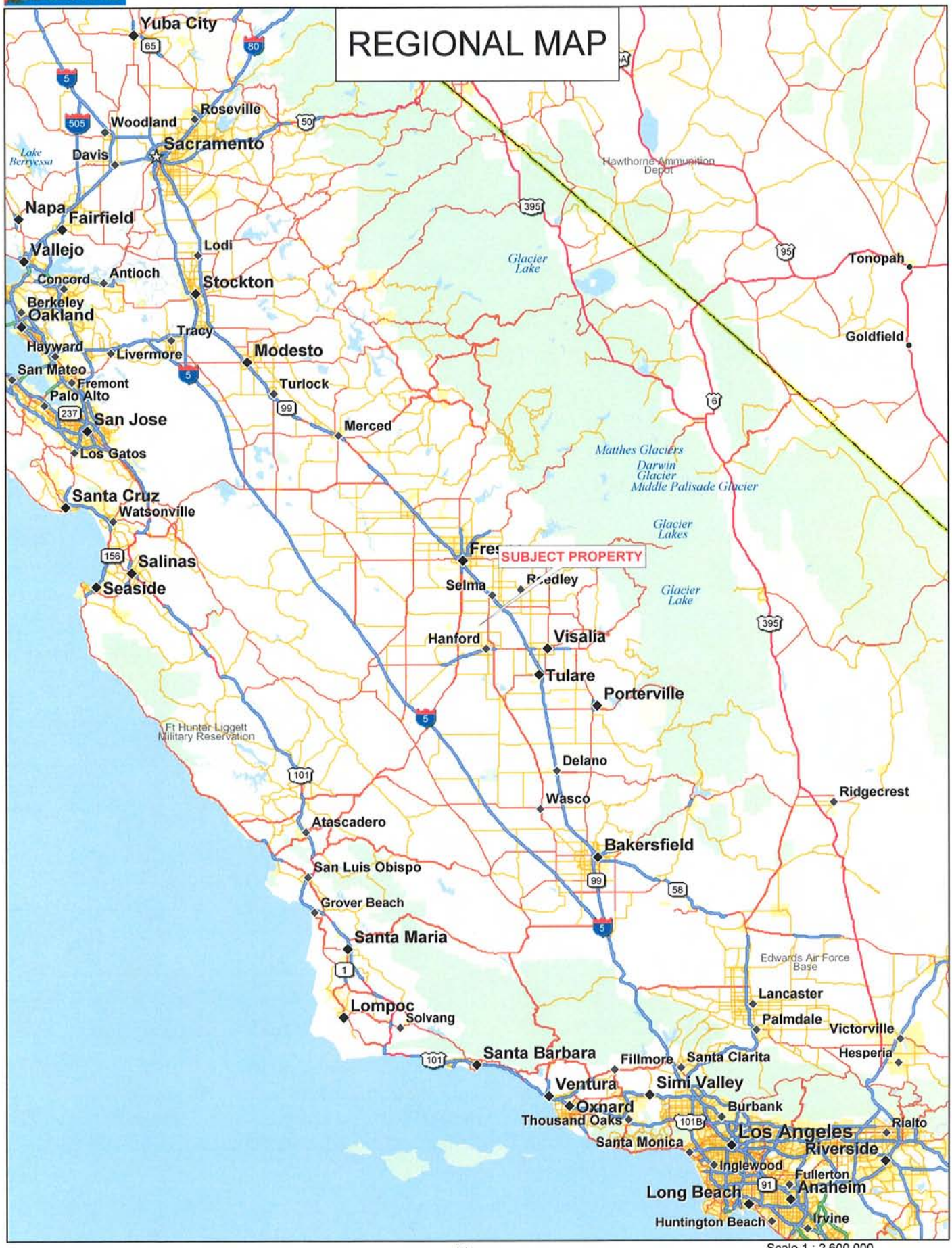
Public records of the County Of Fresno Recorder's Office indicate the subject property is vested in the name of:

Jesse P. Silva, Trustee Of The Survivor's Trust Created
Under The Jesse and Mary Silva Living Trust Dated
February 12, 1991, as Amended.

Upon acquisition, the property will be vested in the name of:

Laguna Irrigation District
A California Irrigation District.

REGIONAL MAP



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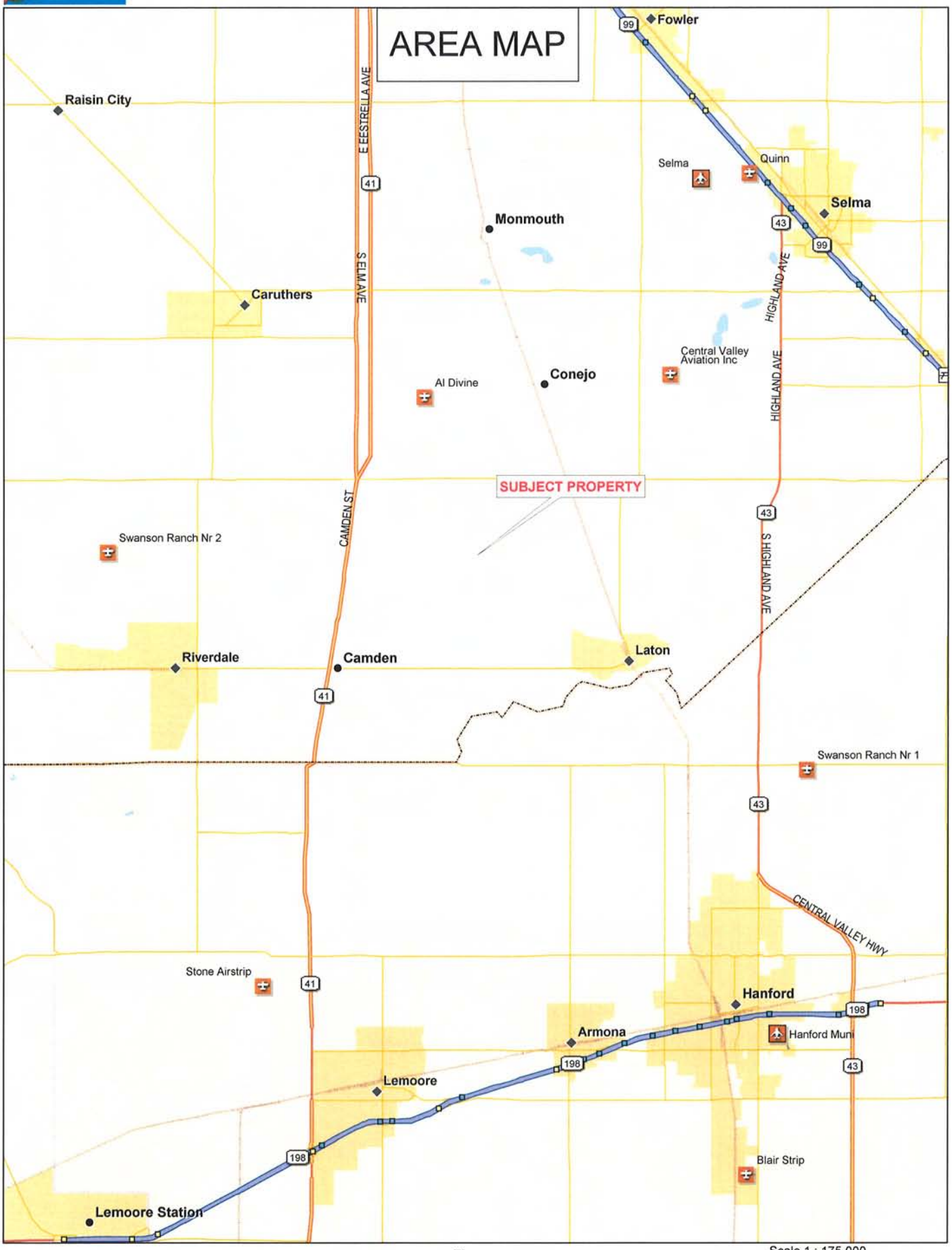
TN
MN (13.2°E)

Scale 1 : 2,600,000
1" = 41.04 mi
Data Zoom 6-3

AREA MAP



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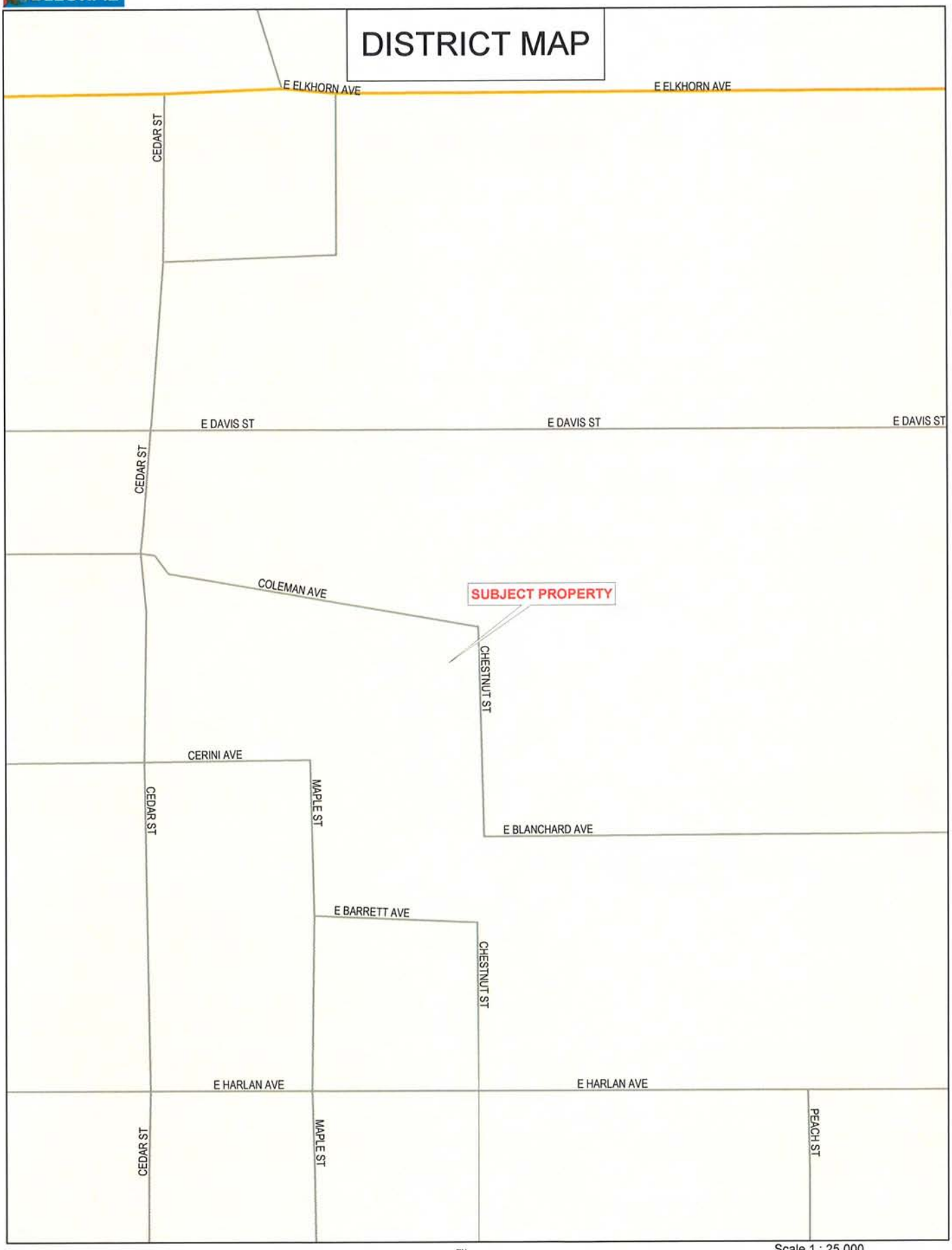
TN
MN (13.2°E)

Scale 1 : 175,000
1" = 2.76 mi
Data Zoom 10-2

DISTRICT MAP



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TN
MN (13.2°E)

Scale 1 : 25,000
0 600 1200 1800 2400 3000 ft
0 200 400 600 800 1000 m
1" = 2,083.3 ft
Data Zoom 13-0

SITE DESCRIPTION AND DISCUSSION

At present, the subject property is comprised of a single assessed parcel, located at the southwest corner of South Chestnut and East Coleman Avenues in unincorporated southern Fresno County. It contains 91.13 acres; this is about 3,969,623 square feet. The proposal at hand is a legal division of the property through a lot line adjustment, thereby creating two new, legally formed parcels. The smallest of the new parcels will be retained by current ownership and will contain about 39.13 acres. The portion being acquired will be by the Laguna Irrigation District by which the southeasternmost 52 acres will be developed to a groundwater recharge basin. Thus, the remainder parcel of 39.13 acres will be about 1,704,503 square feet; and the part being acquired will be 2,265,120 square feet.

The property is not laser leveled and has extreme slopes, largely due to the historical excavation of a portion of the property which has resulted in a sub-street level "canyon" in some and undulation of the property in others. In all, topography is a considerable issue with the property and restricts normal farming practices of the property. Public utilities are basically not at the property, but are proximate, nonetheless, minimal. These include electricity and base telephone service. There are no public forms of water, sewer or natural gas which will serve the property. While the two roads which front the subject are public right of ways, they are not asphalt paved and cannot handle most licensed street vehicles during rainy weather. Surrounding and proximate properties include agriculture facilities, permanent crops and irrigated fieldcrops.

Of the 91.13 acres, about 47 acres are being actively farmed with alfalfa. The majority of such is within the area being retained by the owners.

Critical to successful farming operations in the San Joaquin Valley is the durable supply of water for irrigation purposes. Meteorologic and geographic attributes dictate the region is marginally a desert and necessitates augmentation of precipitation from other water sources for most commercial crop production. In this regard, the subject is served by two irrigation water sources; with each source being having severe limitation and conditions. First, the subject is served by Laguna Irrigation District and enjoys the associated benefits of this legally formed district. Laguna Irrigation District was formed in 1920 and has some 35,197,000 acres under management with approximately 30,000 acres receiving surface water. There are 867 landowners in the district. The primary water source is the Kings River flowing from Pine Flat Reservoir. The water is delivered to the growers through miles of open canals and pipelines. Water toll rates vary based upon the location (service areas of the district) of the parcel and each parcel in the district will have a special assessment and stand by charge for all land in the service area. The district has four rates of assessment: Irrigated Rate; Pump Rate; Pasture Rate; and Exempt. The subject is categorized as "Irrigation Rate" (receiving ditch/surface water). With this, they are eligible to receive irrigation water from district facilities. However, the ownership has relied upon pumped well water from his own on site system which is distributed by a private pipeline he has serving several properties he owns. This pipeline is reportedly capable of transporting private well system water; district water; and livestock waste water. We do not know the specifications of the well system to include the outflow, depth, year, type of gearhead, source of power, size of the pipeline, etc. We are told, upon division of the property by a lot line adjustment, the irrigation source to the 52 acres being acquired will be severed. We are also advised the 39.13 acres being retained will continued to be served by the irrigation system and will be flood irrigated by means of underground concrete pipelines at the property which run north and south.

Another important element of the property are the soils. In the San Joaquin Valley, there are hundreds of different soil types. How a property is farmed and the expected outcome in terms of the viability of commercial agriculture production pertains to the soil composition. The reader is directed to the accompanying Soils Map provided by the *National Cooperative Soil Survey* published by the Natural Resources Conservation Service of the United States Department of Agriculture. As it pertains to the subject, there are three different soil types that account for 96.30 percent of the entire property. Soil viability is measured by several metrics, but the most inclusive consideration is the "rating" in terms of capability class. This scale ranges from "I to VIII", with I having few limitations which restrict their use; whereas class VIII soils have limitations which are severe and preclude commercial plant production and can essentially only be used for recreational purposes, wildlife habitat, watershed, or esthetic purposes. The subject soils are from II to IV in classification. Of the three categories which comprise the subject, one is class II; this is defined as *soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices*. These comprise 45.60 percent of the entire acreage. The second subject category of which the subject is comprised is class III; this is defined as *soils have severe limitations that reduce the choice of plants or that require special conservation practices*, or both. These comprise 21.50 percent of the entire acreage. Lastly, the remaining 29.20 percent of the subject soil is class IV; this is defined *as soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.* The three soil categories are (in descending order) Traver Fine Sandy Loam, (45.60 percent); Fresno Fine Sandy Loam, shallow (29.20 percent); and Delhi Loamy Sand, 3 to 9 percent slopes (21.50 percent). As mentioned, the Class II soils amount to about 45.60 percent of the entire property, with the remaining in Class II and IV. In all, the majority of the site has soil attributes with moderate to severe limitations restricting the use on type of crop grown. Once again, soils associated with the subject will be a consideration in the valuation of the subject.

The appraiser has not reviewed a Preliminary Title Report during this appraisal assignment. During the course of the appraisal assignment, no adverse easements or encroachments were observed. It would appear, based on visual inspection, the property is encumbered by normal matters of record such as right of way and public utility easements, etc. Again, the appraisal has been prepared under the critical premise it is absent of any matters of record. In the event any are disclosed or discovered subsequent to the submission of this appraisal, the appraiser reserves the right to modify the value conclusion stated herein.

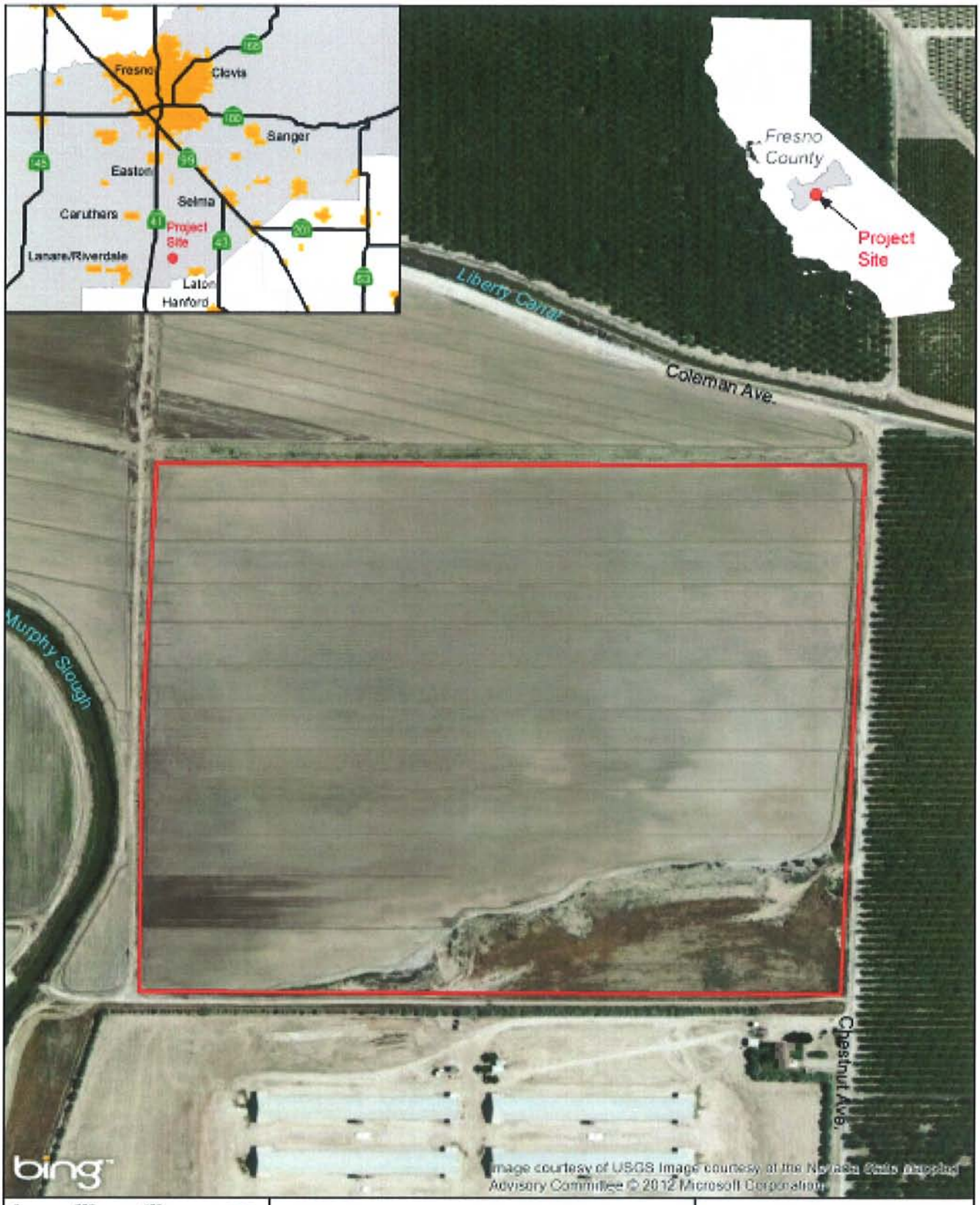
During the course of the field inspection, no evident environmental hazards were observed by the appraiser. As previously discussed within the Scope of the Appraisal subsection of this report, the appraisers are not in receipt of a Phase One Environmental Report. The appraiser is not qualified to discuss subsurface matters, latent problems from previous and/or adjacent land uses, etc. The client is strongly advised to retain the services of an engineering firm to prepare a Phase One Report to the degree it is deemed necessary in their policy and procedures. The appraisal has been prepared under the critical premise it is absent of any adverse environmental influences. In the event any are disclosed or discovered subsequent to the submission of this appraisal, the appraiser reserves the right to modify the value conclusion stated herein. There are no known historical, archeological, scientific, cultural, wetland, etc., factors which impact the subject site. The town of Laton/County of Fresno (in this area) are not in an identified Seismic Hazard Zone.

In summary, the subject is comprised of an irregular shaped parcel of about 91.13 assessed acres, situated at the southwest corner of South Chestnut and East Coleman Avenues in southern unincorporated Fresno County, proximate to Laton and Riverdale and between Highways 41 and 43. This area is characteristically agriculture, including facilities, irrigated field crop and permanent plantings. The site suffers from marginal soils and below grade topography. The proposal at hand entails the division of the subject by a lot line adjustment. With this, there will be the formation of two new parcels: one of 52 acres at the southeasternmost portion of the property; and the balance, about 39.13 acres which will be retained by the current ownership. The acreage being retained will be of an irregular shape and continue to be farmed with alfalfa. Likewise, it will remain on the existing irrigation system, to include private well and underground, private pipeline. The portion being acquired will be rectangular in shape, however, it will be severed of all irrigation water systems and infrastructure. The proposed use for such is a groundwater recharge basin. Outside of the topography and soils, there are no known deficiencies or problems associated with the subject property (on a before or after basis). The parcel appears to be encumbered by typical right of way, utility, etc. types of easements, with no known encroachments or matters of record which would restrict the proposed uses.

IMPROVEMENT DESCRIPTION AND DISCUSSION

As of the effective date of valuation, the subject property consists of irrigated fieldcrop land; there are no building improvements associated with the larger parcel comprised of 92.13 acres. (There is a subsurface/underground pipeline on the parcel; this will be severed in the formation of the new parcel, resulting in no irrigation water supply-district or privately pumped well water from the remainder parcel-to the newly formed parcel. I have made no cost to cure analysis for the process of abandoning the existing pipeline system within the scope of the appraisal).

AERIAL VIEW



0 200 400 Feet

PROVOST& PRITCHARD
CONSULTING GROUP

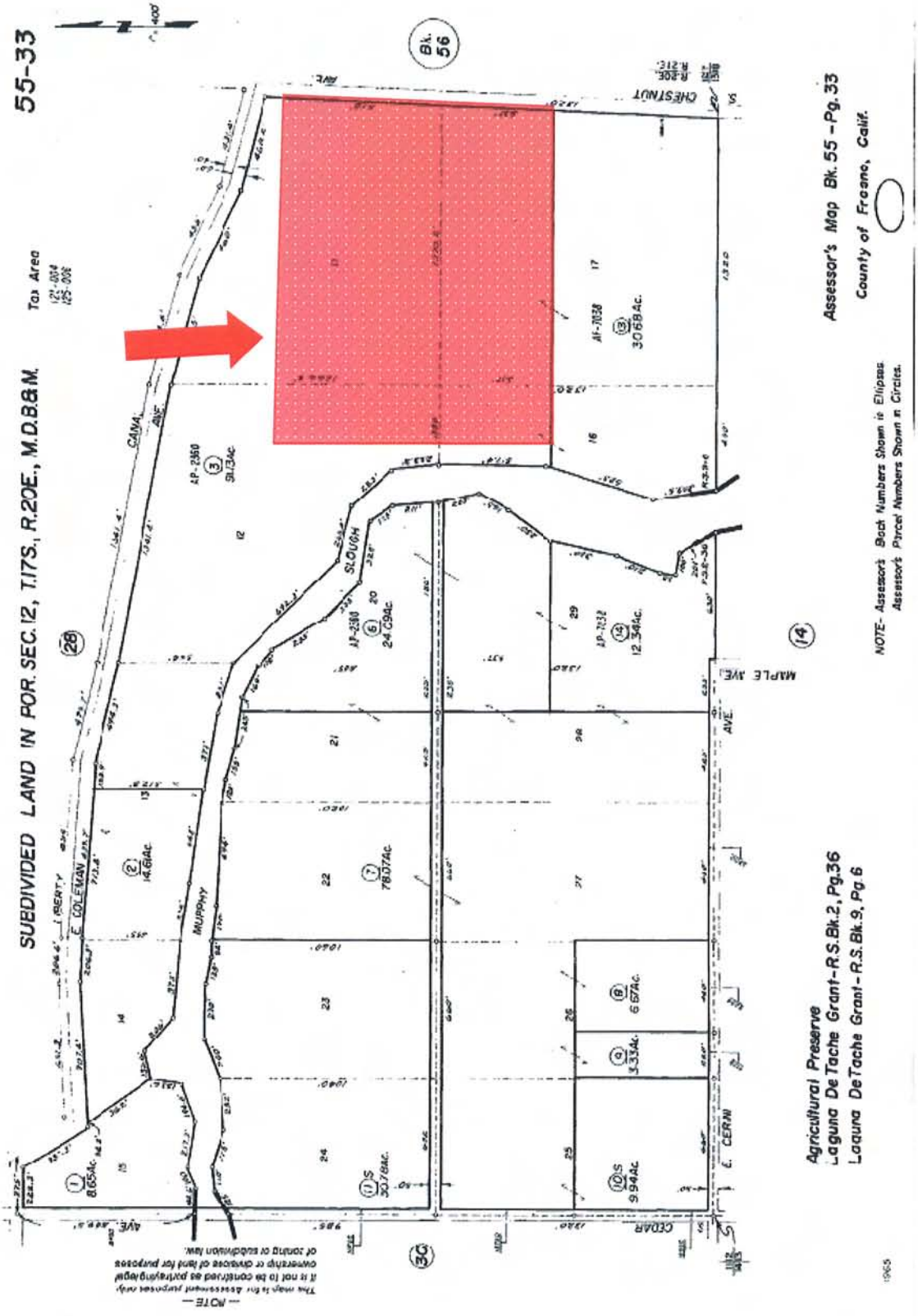
286 W. Cromwell Ave
Fresno, CA 93711-6162
(559) 449-2700

Laguna Irrigation District

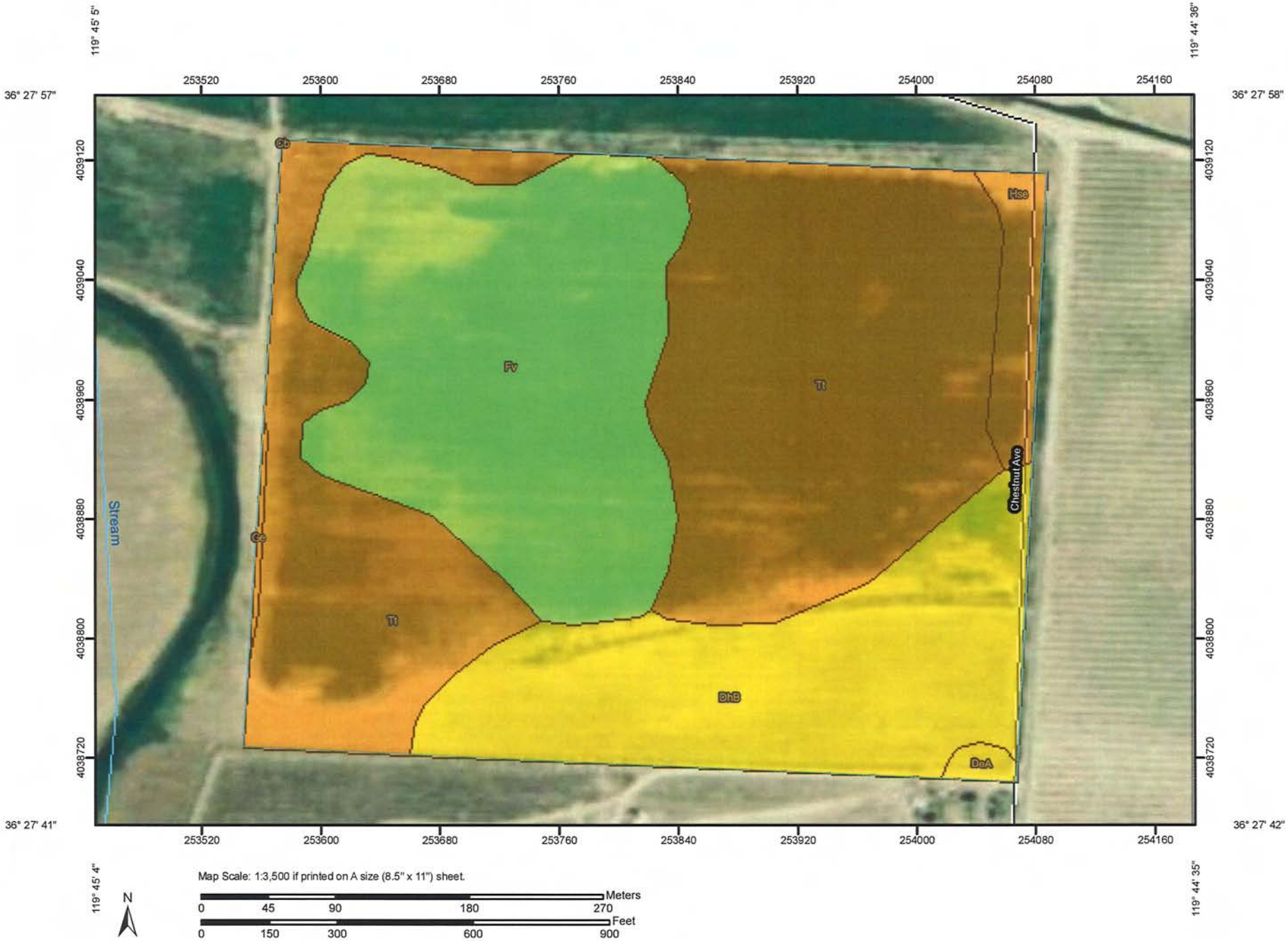
Recharge Basin 11

Project Location Map

ASSESSOR'S PARCEL MAP
PORTION OF APN: 055-330-03



Irrigated Capability Class—Eastern Fresno Area, California



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

Capability Class - I

Capability Class - II

Capability Class - III

Capability Class - IV

Capability Class - V

Capability Class - VI

Capability Class - VII

Capability Class - VIII

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:3,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eastern Fresno Area, California
Survey Area Data: Version 5, Sep 26, 2008

Date(s) aerial images were photographed: 6/11/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Irrigated Capability Class

Irrigated Capability Class— Summary by Map Unit — Eastern Fresno Area, California (CA654)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Cb	Cajon loamy coarse sand, saline-alkali	3	0.0	0.0%
DeA	Delhi sand, 0 to 3 percent slopes	3	0.3	0.5%
DhB	Delhi loamy sand, 3 to 9 percent slopes	3	11.2	21.5%
Fv	Fresno fine sandy loam, shallow	4	15.2	29.2%
Ge	Grangeville sandy loam, sandy substratum	2	0.1	0.3%
Hse	Hesperia sandy loam, saline-alkali	2	1.5	2.9%
Tt	Traver fine sandy loam	2	23.7	45.6%
Totals for Area of Interest			**52.0**	**100.0%**

Description

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

California Revised Storie Index Rating (CA)

The Storie Index is a soil rating based on soil properties that govern a soil's potential for cultivated agriculture in California.

The Storie Index asseses the productivity of a soil from the following four characteristics: Factor A, degree of soil profile development; factor B, texture of the surface layer; factor C, slope; and factor X, manageable features, including drainage, microrelief, fertility, acidity, erosion, and salt content. A score ranging from 0 to 100 percent is determined for each factor, and the scores are mukltiplied together to derive an index rating.

For simplification, Storie Index ratings have been combined into six grades classes as follows: Grade 1 (excellent), 100 to 80; grade 2 (good), 79 to 60; grade 3 (fair), 59 to 40; grade 4 (poor), 39 to 20; grade 5 (very poor), 19 to 10; and grade 6 (nonagricultural), less than 10.

Report—California Revised Storie Index Rating (CA)

The Storie Index is a soil rating based on soil properties that govern a soil map unit component's potential for cultivated agriculture. [Absence of an entry indicates that a Storie Index rating is not applicable or was not estimated]. For simplification, Storie Index ratings have been combined into six grades as follows: Grade 1 (Excellent): Soils that rate between 80 and 100 and which are suitable for a wide range of crops. Grade 2 (Good) Soils that rate between 60 and 79 and which are suitable for a wide range of crops. Grade 3 (Fair): Soils that range between 40 and 59. Soils in this grade may give good results with certain specialized crops. Grade 4 (Poor): Soils that rate between 20 and 39 and which have a narrow range in their agricultural potential. Grade 5 (Very Poor): Soil that rate between 10 and 19 and are of very limited agricultural use except for pasture because of adverse soil conditions. Grade 6 (Nonagricultural): Soils that rate less than 10. [The numbers in the "Limiting feature value" column range from 0.01 to 1.00. Soils with a smaller the value have a lower potential for cultivated agriculture. The table shows each of the sub-factors used to generate the Storie Index rating for each soil component].

California Revised Storie Index Rating (CA)– Eastern Fresno Area, California				
Map symbol and soil name	Pct. of map unit	California Revised Storie Index (CA)		
		Storie index rating	Storie index grade and limiting features	Limiting feature value
Cb—Cajon loamy coarse sand, saline-alkali				
Cajon	85	0	NOT RATED - Missing Data Somewhere!!	
			Rated Soil Order	1.00
			Profile Group	1.00
			Toxicity	0.99
			Nearly level to gently sloping	0.98
			Wetness, flooding, ponding, drainage, erosion	0.85

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

PETE WILSON, Governor

DEPARTMENT OF HEALTH SERVICES
OFFICE OF DRINKING WATER
5545 EAST SHIELDS AVENUE
FRESNO, CA 93727
(209) 445-5321

January 23, 1992

System No. 10-001

Mr. Richard Bakman
Bakman Water Company
P.O. Box 7965
Fresno, CA 93747

Dear Mr. Bakman:

Blending Treatment of Wells 8 and 8A for Nitrate Removal

The purpose of this letter is to summarize the discussion you had with Betsy Lichti, of my staff, on January 16, 1992, regarding your proposal to blend the waters from Wells 8 and 8A to meet the nitrate primary drinking water standard.

Well 8A, just recently completed but not on line, has a current nitrate concentration of 4.3 mg/l. Well 8 has not been sampled recently, but has a historical nitrate concentration ranging from 24 mg/l to 63.6 mg/l, as is summarized below:

Nitrate (mg/l)

Date	Well 8	Well 8A
10/77	61.8	
11/77	27	
12/85	63.6	
1/86	57	
5/87	58	
6/89	24	
9/91	--	4.3

Your proposal, presented to the Office of Drinking Water (ODW) by letter dated January 3, 1992, is to blend 400 gpm from Well 8 with 300 gpm from Well 8A in a 10,000 gallon pressure tank. The resulting nitrate concentration of the

blended water, based on a nitrate concentration of 58 mg/l in Well 8, would be 35 mg/l.

The amount of nitrate data from Well 8 is limited and no recent data is available. Therefore, current monitoring of the nitrate concentration must be conducted, and shall consist of 6 weekly samples. In addition, State Regulations require that Bakman Water Company apply for a domestic water supply permit to allow this treatment process. Enclosed with this letter is a blank permit application form. The suggested wording is .."to continue to operate the existing water supply system and to provide treatment of the water from Well 8 by blending with water from Well 8A."

The permit which will be issued by ODW will include both design and monitoring requirements of the blending process. The requirements are needed to assure that the customers do not receive water that exceeds the nitrate MCL. The design and monitoring parameter <u>under consideration</u> include:

<u>Design Parameters</u>

1. Ability to vary flow from Well 8A to vary dilution if necessary.

2. Flow measuring devices on raw water lines from Well 8 and Well 8A into the blending facility.

3. Blending facilities (already available at Well 8).

4. Electrical controls to assure that Well 8 <u>cannot</u> be operated without Well 8A on line.

5. Sample taps located to enable compliance with water quality monitoring requirements (see below).

<u>Monitoring Requirements</u>

1. Daily flow measurement from each raw water line <u>into</u> the blending tank.

2. Monthly raw water nitrate sample from Well 8 and Well 8A.

3. Monthly nitrate sample from blended flow.

You expressed some concern regarding several of the above requirements during the meeting with Ms. Lichti. The ODW

must assure that the blended water consistently and reliably meets drinking water standards. We have developed the above requirements for that reason. Therefore, I recommend that you contact our office to arrange another meeting to discuss your proposal. Please contact Ms. Lichti at 445-5941 to arrange the meeting.

Sincerely,

Richard L. Haberman, P.E.
Senior Sanitary Engineer
OFFICE OF DRINKING WATER

RLH
BSL/jw

Attachment

cc: Fresno County Environmental Health Department

L16BL2.DOC

4886 East Jensen Avenue
Fresno, CA 93725
phone: (559) 237-5567
fax: (559) 237-5560
www.kingsbasinauthority.org

KINGS BASIN
Water Authority

March 25, 2013

TO: Kings Basin Water Authority Board Members and Alternates

FROM: Authorized Representatives for City of San Joaquin, Bakman Water Company and City of Kerman Water Metering Projects

SUBJECT: Letter of Intent for Partnering and Collaborating with Procurement and Public Outreach Processes for Water Meter Implementation

LETTER OF INTENT

The City of San Joaquin, Bakman Water Company, and City of Kerman ("We") are in the process of securing Proposition 84, Round 2 Implementation Grant funding for water meters in their respective service areas. We wish to partner with each other as each of our agencies moves forward with the procurement process and the public outreach process for water metering. It is believed that by partnering and collaborating, we will eliminate duplication of efforts and create efficiencies in order to better conserve public resources and staff time.

For these reasons, we shall endeavor to commit as follows:

1. To support each other to encourage cost efficiencies.
2. To consult with each other to encourage cost efficiencies.
3. To collaborate with each other in marketing and outreach efforts.
4. To explore ways to purchase water meters that will result in cost savings and meets legal requirements.
5. To collaborate with each other in sharing of information and research to promote sound water projects both fiscally and environmentally.

The undersigned will present this Letter of Intent to our respective boards for consideration and approval.

Authorized Representative Signature — Bakman Water Co 3/26/13
Primary Project Organization — Date

Authorized Representative Signature — City of Kerman 3/26/13
Primary Project Organization — Date

Authorized Representative Signature — City of San Joaquin 3/26/13
Primary Project Organization — Date

BAKMAN WATER COMPANY
Schedule No. 1
GENERAL METERED SERVICE

APPLICABILITY

Applicable to all metered water service.

TERRITORY

This schedule is applicable within the entire territory served by the utility. (T)

RATES

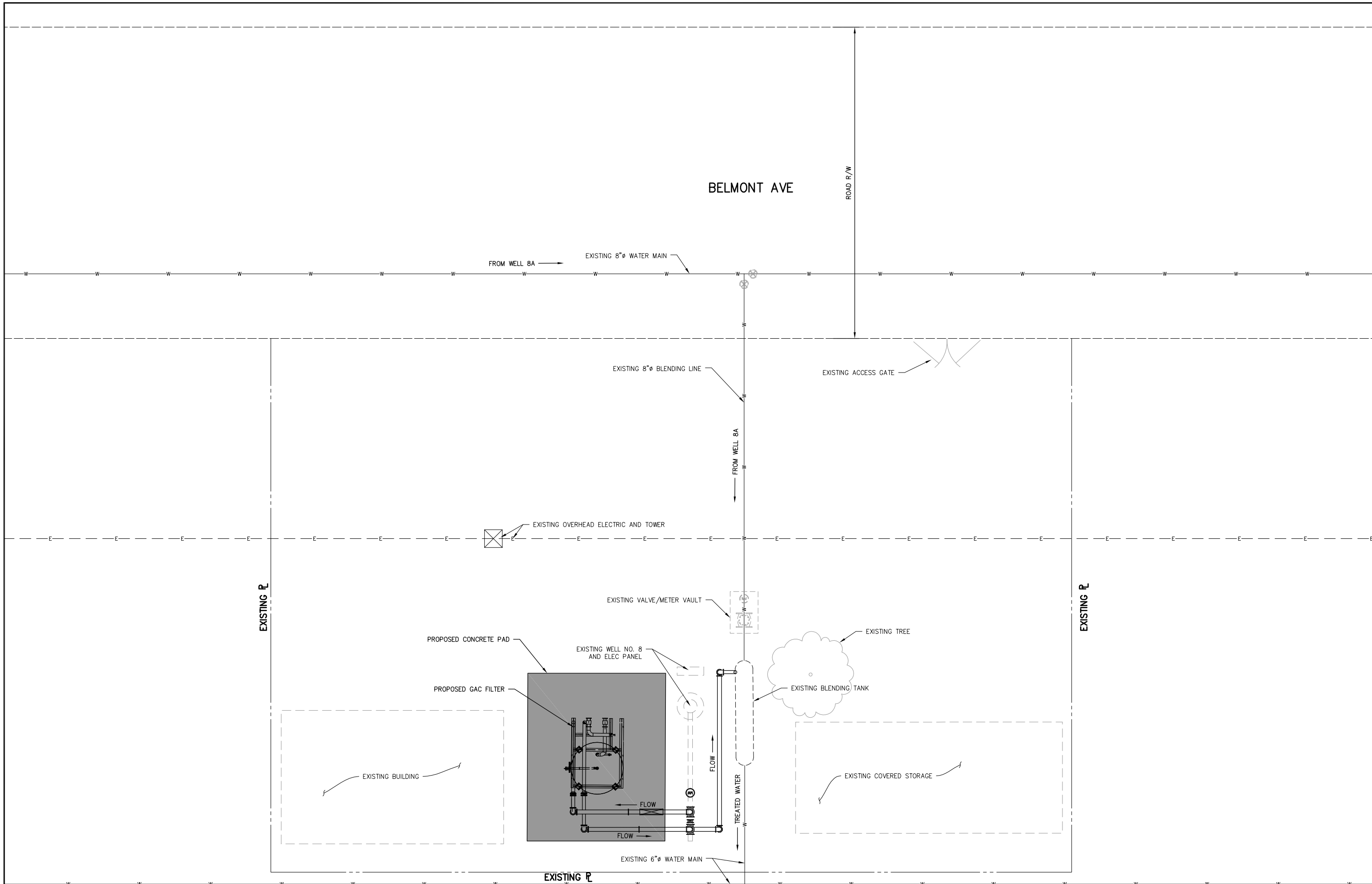
Quantity Rates

All water, per 100 cu. ft.	$	0.97	(I)

Service Charge:		Per Meter Per Year	
For 5/8 x 3/4 -inch meter	$	8.98	(I)(D)
For 3/4 -inch meter	$	8.98	|
For 1 -inch meter	$	13.45	|
For 1-1/2 -inch meter	$	19.29	|
For 2 -inch meter	$	26.90	|
For 3 -inch meter	$	53.80	|
For 4 -inch meter	$	80.79	|
For 6 -inch meter	$	143.72	|
For 8 -inch meter	$	224.52	|
For 10 -inch meter	$	448.93	(I)(D)

The Service Charge is a readiness-to-serve charge which is applicable to all metered service and to which is to be added the charge computed at the Quantity Rate.

(continued)



BAKMAN WELL 8 – MAINTENANCE YARD

SCALE: NOT TO SCALE –SCHEMATIC

DESIGN ENGINEER: ####	
LICENSE NO: ####	
DRAFTED BY: ####	CHECKED BY: ####
DATE: ####	
JOB NO: ####	

0 1

ORIGINAL SCALE SHOWN IS IN INCHES. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET #### OF ####

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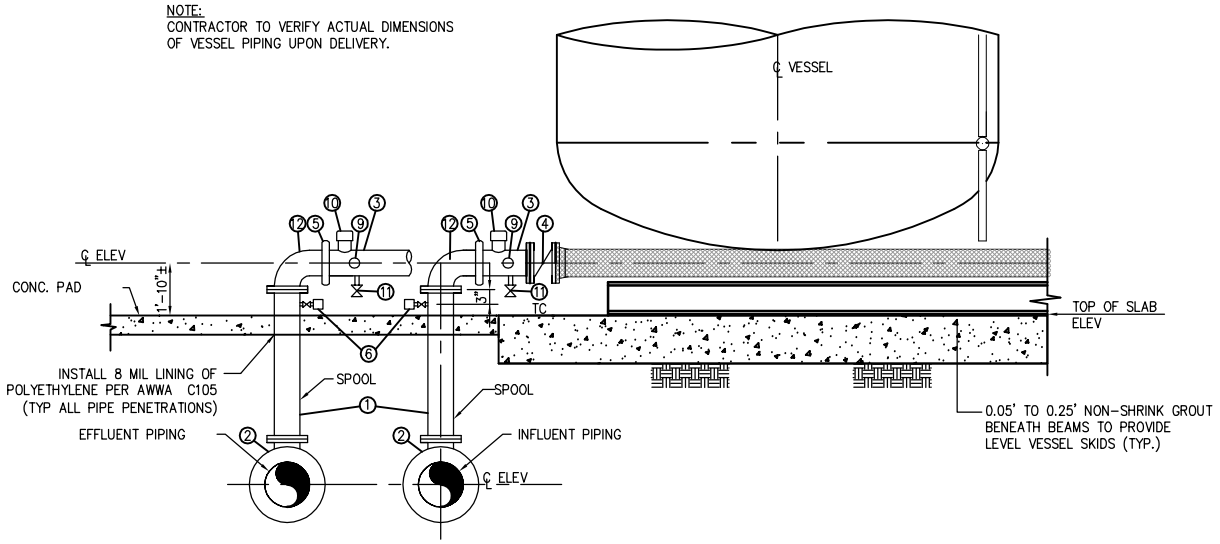
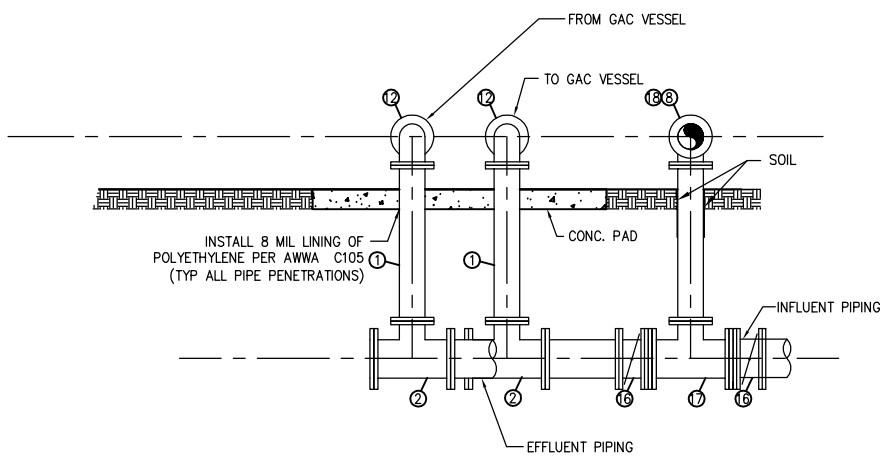
NOTE:
CONTRACTOR TO VERIFY ACTUAL DIMENSIONS OF VESSEL PIPING UPON DELIVERY.



VESSEL ELEVATION
SCALE: NOT TO SCALE

MATERIALS LIST

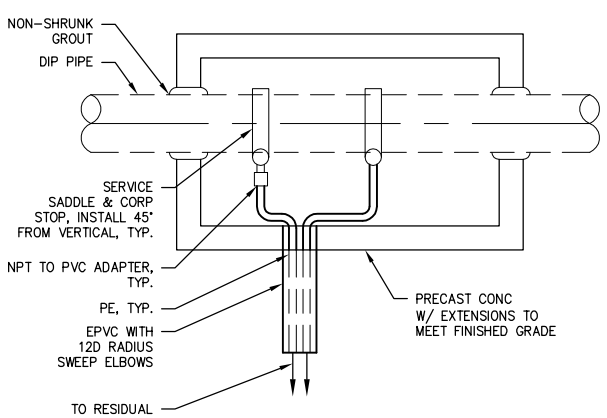
1. DIP SPOOL, FLG x FLG
2. DIP TEE, FLG (TYP.)
3. STEEL SPOOL, FLG x GROOVED END
4. BUTTERFLY VALVE (TYPE 20), 3 REQ'D
5. GROOVED END COUPLING
6. 1" TAP W/BALL VALVE, TYPE 30, 2 REQ'D (BY CONTRACTOR),
7. DIP 90° BEND, FLG
8. ALUMINUM CAM-LOCK FITTING-MALE
9. THREADED OUTLET W/ GATE VALVE (TYPE 1)
10. STEEL THREADED OUTLET W/ THREADED CAP
11. 1/2" DRAIN COCK ON 1" OUTLET WITH NYLON BUSHING
12. STEEL SR ELBOW, FLG x GROOVED END
13. DIP 90° ELBOW, FLG x FLG
14. NOT USED
15. REDUCER
16. BUTTERFLY VALVE
17. DIP TEE, FLG
18. BUTTERFLY VALVE



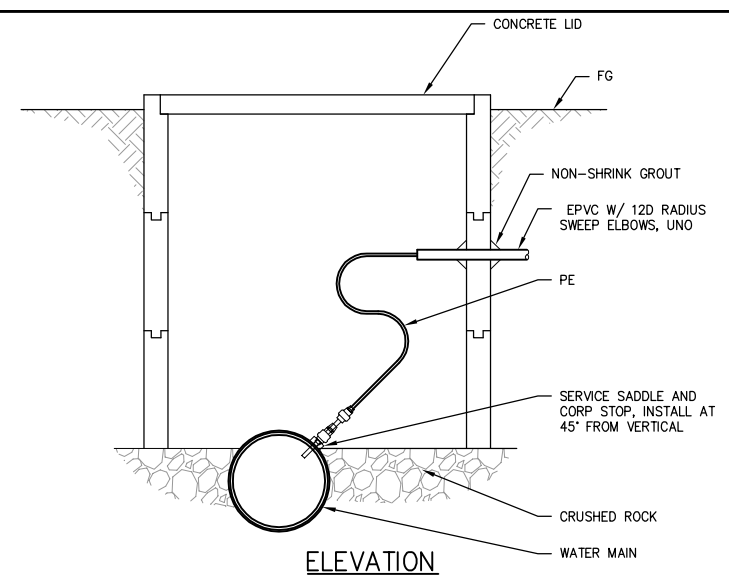
PIPING SECTION
SCALE: NOT TO SCALE

NOTES:

1. ALL STEEL PIPE SHALL BE STANDARD WEIGHT PER SPECS. FLANGES WHERE SHOWN SHALL BE CLASS "D" PER SPECS. PAINT ALL EXPOSED STEEL PIPE, VALVES AND APPURTENANCES PER SPECS., SECTION 09900, SYSTEM 15.
2. PIPING TO BE SUPPLIED BY THE VESSEL MANUFACTURER.

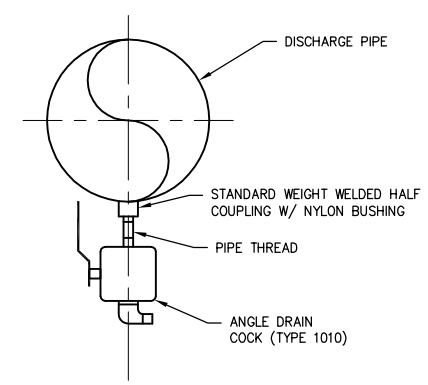


PLAN

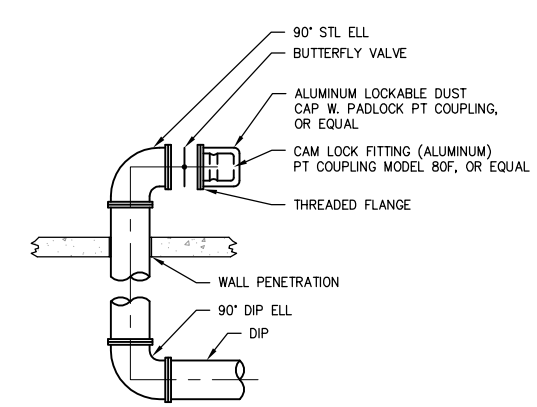


ELEVATION

SAMPLE BOX
NOT TO SCALE



DRAIN CONNECTION
NOT TO SCALE



BACKWASH RISER
NOT TO SCALE

DESIGN ENGINEER:
LICENSE NO:
DRAFTED BY: CHECKED BY:
DATE: 3/26/2013
JOB NO:
0 1
ORIGINAL SCALE SHOWN IS IN INCHES. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.
SHEET OF

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Recordall® Cold Water Bronze Disc Meter

Size 1" (DN 25mm)

NSF/ANSI Standard 61 Certified, Annex G

DESCRIPTION

Badger Meter offers the Recordall Disc meter in Cast Bronze and a Lead-Free Alloy. The Lead-Free Alloy (Trade designation: M55-LL) version has been certified to comply with NSF/ANSI Standard 61, Annex G and carries the NSF-61 Mark on the housing. All components of the Lead-Free Alloy meter, i.e., disc, chamber, housing, seals, etc. comprise the certified system.

APPLICATIONS: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

OPERATION: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register dial face.

OPERATING PERFORMANCE: The Badger Meter Recordall Disc meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated by AWWA Standard C700.

CONSTRUCTION: Badger Meter Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: meter housing, measuring chamber, and permanently sealed register. The water meter is available in bronze and Lead-Free Alloy with externally-threaded spuds. A corrosion-resistant engineered polymer material is used for the measuring chamber.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters also minimizes spare parts inventory investment.

MAGNETIC DRIVE: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading, remote or automatic meter reading options.

SEALED REGISTER: The standard register consists of a straight-reading odometer-type totalization display, 360° test circle with center sweep hand and flow finder to detect leaks. Register gearing consists of self-lubricating engineered polymer gears to minimize friction and provides long life. Permanently sealed; dirt, moisture, tampering and lens fogging problems are eliminated. Multi-position register simplifies meter installation and reading. Automatic meter reading systems are available for all Recordall Disc meters. See the back of this sheet for additional information. All reading options are removable from the meter without disrupting water service.

TAMPER-PROOF FEATURES: Customer removal of the register to obtain free water can be prevented when the optional tamper detection seal wire screw or TORX® tamper resistant seal screw is added to the meter. Both can be installed at the meter site or at the factory.

MAINTENANCE: Badger Meter Recordall Disc meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location. As an alternative to repair by the utility, Badger Meter offers various maintenance and meter component exchange programs to fit the needs of the utility.

CONNECTIONS: Tailpieces/Unions for installations of meters on various pipe types and sizes, including misaligned pipes, are available as an option.

Model 55

SPECIFICATIONS

Typical Operating Range (100% ± 1.5%)	1-55 GPM (.23 to 12.5 m³/hr)
Low Flow (Min. 95%)	1/2 GPM (.11 m³/hr)
Maximum Continuous Operation	40 GPM (9.1 m³/hr)
Pressure Loss at Maximum Continuous Operation	3.4 PSI at 40 GPM (.23 bar at 9.1 m³/hr)
Maximum Operating Temperature	80°F (26°C)
Maximum Operating Pressure	150 PSI (10 bar)
Measuring Element	Nutating disc, positive displacement
Register Type	Straight reading, sealed magnetic drive standard. Remote reading or Automatic Meter Reading units optional.
Register Capacity	10,000,000 Gallons, 1,000,000 Cubic Feet, 100,000 m³. 6 odometer wheels.
Meter Connections	Available in bronze and engineered polymer to fit 1" (DN 25mm) spud thread bore diameter sizes. See table below.

METER SPUD AND CONNECTION SIZES

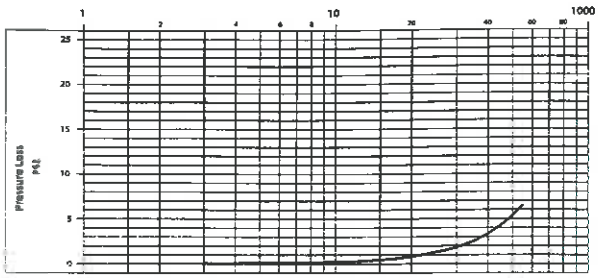
Size Designation	x	"L" Laying Length	"B" Bore Dia.	Coupling Nut and Spud Thread	Tailpiece Pipe Thread (NPT)
1"	x	10 3/4"	1"	1 1/4" (1")	1"

MATERIALS

Meter Housing	Cast Bronze, Lead-Free Alloy
Housing Bottom Plates	Bronze, Cast Iron, Lead-Free Alloy
Measuring Chamber	Engineered Polymer
Disc	Engineered Polymer
Trim	Stainless Steel, Bronze
Strainer	Engineered Polymer
Disc Spindle	Engineered Polymer
Magnet	Polymer Bonded
Magnet Spindle	Engineered Polymer
Register Lid and Shroud	Engineered Polymer, Bronze
Generator Housing	Engineered Polymer

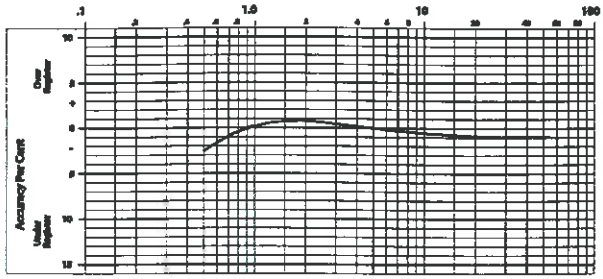
PRESSURE LOSS CHART

Rate of Flow, in Gallons per Minute



ACCURACY CHART

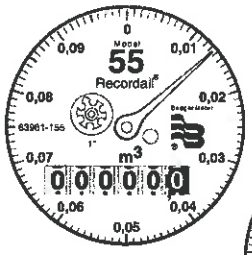
Rate of Flow, in Gallons per Minute

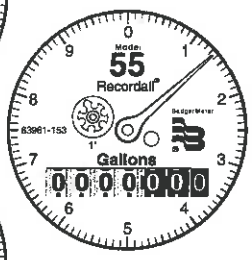


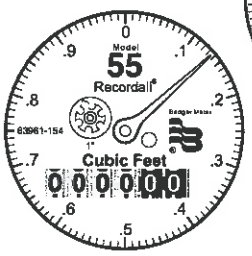
METER SIZE	METER MODEL	A LAYING LENGTH	B HEIGHT REG./RTR	B HEIGHT TO ADE	C HEIGHT GEN.	D CENTERLINE TO BASE	WIDTH	METER WEIGHT
1" (25mm)	55	10 3/4" (273mm)	6" (152mm)	6 1/2" (165mm)	7 3/8" (187mm)	2 1/32" (52mm)	6 1/4" (159mm)	8.75 lbs.

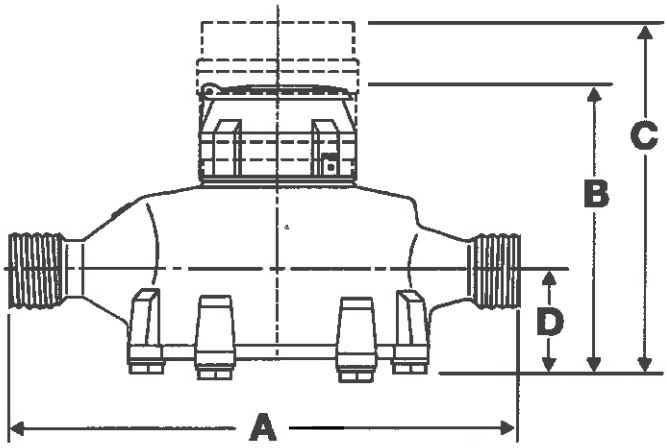
Sweep Hand Registration

MODEL	GALLON	CU.FT.	CU. METER
M55	10	1	.1









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Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.

Badger Meter | P.O. Box 245036, Milwaukee, Wisconsin 53224-9536
800-876-3837 | infocentral@badgermeter.com | www.badgermeter.com

Recordall® Cold Water Top Load Bronze Disc Meter
Size 2" (DN 50mm)
NSF/ANSI Standard 61 Certified, Annex G

DESCRIPTION

Badger Meter offers the Recordall Disc meter in Cast Bronze and a Lead-Free Alloy. The Lead-Free Alloy (Trade designation: M170-LL) version has been certified to comply with NSF/ANSI Standard 61, Annex G and carries the NSF-61 Mark on the housing. All components of the Lead-Free Alloy meter, i.e., disc, chamber, housing, seals, etc. comprise the certified system.

APPLICATIONS: For use in measurement of potable cold water in residential, commercial and industrial services where flow is in one direction only.

OPERATION: Water flows through the meter's strainer and into the measuring chamber where it causes the disc to nutate. The disc, which moves freely, nutates on its own ball, guided by a thrust roller. A drive magnet transmits the motion of the disc to a follower magnet located within the permanently-sealed register. The follower magnet is connected to the register gear train. The gear train reduces the disc nutations into volume totalization units displayed on the register dial face.

OPERATING PERFORMANCE: The Badger Meter Recordall Disc meters meet or exceed registration accuracy for the low flow rates (95%), normal operating flow rates (100 ± 1.5%), and maximum continuous operation flow rates as specifically stated by AWWA Standard C700.

CONSTRUCTION: Badger Meter Recordall Disc meter construction, which complies with ANSI/AWWA standard C700, consists of three basic components: bronze meter housing, measuring chamber, and permanently, sealed register. A corrosion-resistant engineered polymer material is used for the measuring chamber.

To simplify maintenance, the register, measuring chamber, and strainer can be replaced without removing the meter housing from the installation. No change gears are required for accuracy calibration. Interchangeability of parts among like-sized meters also minimizes spare parts inventory investment. The built-in strainer has an effective straining area of twice the inlet size.

MAGNETIC DRIVE: Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling for straight-reading, remote or automatic meter reading options.

SEALED REGISTER: The standard register consists of a straight-reading, odometer-type totalization display, 360° test circle with center sweep hand and flow finder to detect leaks. Register gearing consists of self-lubricating engineered polymer gears to minimize friction and provides long life. Permanently sealed; dirt, moisture, tampering and lens fogging problems are eliminated. Multi-position register simplifies meter installation and reading. Automatic meter reading systems are available for all Recordall Disc meters. All reading options are removable from the meter without disrupting water service.

TAMPER-PROOF FEATURES: Customer removal of the register to obtain free water can be prevented when the optional tamper detection seal wire screw/or Torx® tamper seal resistant screw is added to the meter. Both can be installed at the meter site or at the factory.

MAINTENANCE: Badger Meter Recordall Disc meters are designed and manufactured to provide long-term service with minimal maintenance. When maintenance is required, it can be performed easily either at the meter installation or at any other convenient location. As an alternative to repair by the utility, Badger Meter offers various maintenance and meter component exchange programs to fit the needs of the utility.

CONNECTIONS: Tailpieces/Flanges for installations of meters on various pipe types and sizes, including misaligned pipes, are available as an option.

Model 170 shown with optional 1" Test Plug

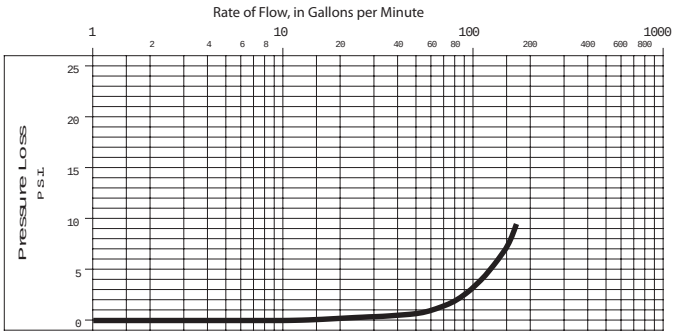
SPECIFICATIONS

Typical Operating Range (100% ± 1.5%)	2 1/2 -170 GPM (.57 to 39 m^3/hr)
Low Flow (Min. 95%)	1 1/2 GPM (.34 m^3/hr)
Maximum Continuous Operation	100 GPM (23 m^3/hr)
Pressure Loss at Maximum Continuous Operation	3.3 PSI at 100 GPM (.23 bar at 23 m^3/hr)
Maximum Operating Temperature	80°F (26°C)
Maximum Operating Pressure	150 PSI (10 bar)
Measuring Element	Nutating disc, positive displacement
Register Type	Straight reading, permanently sealed magnetic drive standard. Remote reading or Automatic Meter Reading units optional.
Registration	100 Gallons, 10 Cubic Feet, 1 m^3
Register Capacity	100,000,000 Gallons, 10,000,000 Cubic Feet, 1,000,000 m^3. 6 odometer wheels.
Meter Connections	2" AWWA two bolt elliptical flange, drilled, or 2" - 11 1/2 NPT internal pipe threads.
Optional Test Plug	1" NPT test plug (TP) available on elliptical long and short versions.

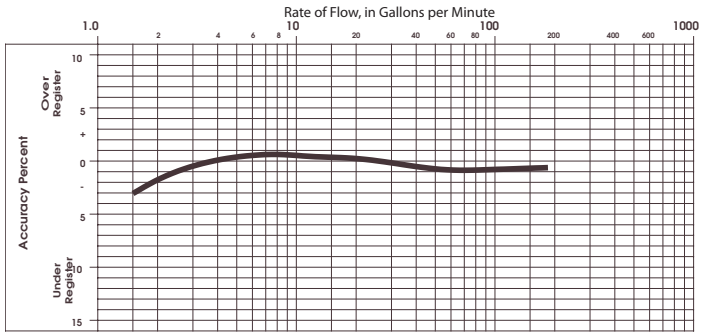
MATERIALS

Meter Housing	Cast Bronze, Lead-Free Alloy
Housing Top Plates	Bronze, Lead-Free Alloy
Measuring Chamber	Engineered Polymer
Disc	Engineered Polymer
Trim	Stainless Steel/Bronze
Strainer	Engineered Polymer
Disc Spindle	Stainless Steel
Magnet	Ceramic
Magnet Spindle	Stainless Steel
Register Lid and Box	Engineered Polymer or Bronze
Generator Housing	Engineered Polymer

PRESSURE LOSS CHART



ACCURACY CHART

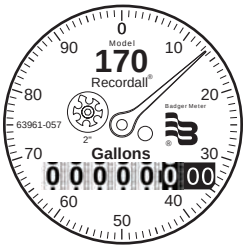


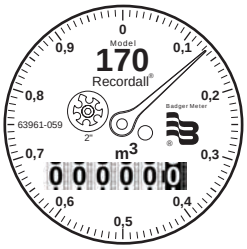
METER SIZE	METER MODEL	A LAYING LENGTH	B HEIGHT REG./RTR	C HEIGHT GEN.	D CENTERLINE BASE	WIDTH	APPROX. SHIPPING WEIGHT
2" (50mm)	170 EL, Hex. 170 EL, TP	$15^1/_4$" (387mm)	8" (203mm)	$9^3/_8$" (238mm)	$2^7/_8$" (73mm)	$9^1/_2$" (241mm)	30 lb. (13.6kg)
2" (50mm)	170 ELL, 170 ELL, TP	17" (432mm)	8" (203mm)	$9^3/_8$" (238mm)	$2^7/_8$" (73mm)	$9^1/_2$" (241mm)	30 lb. (13.6kg)

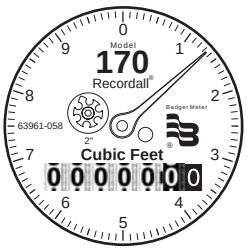
EL = Elliptical ELL = Elliptical Long Hex = Hexagon, 2" - $11^1/_2$ NPT Thread TP=Test Plug 1"

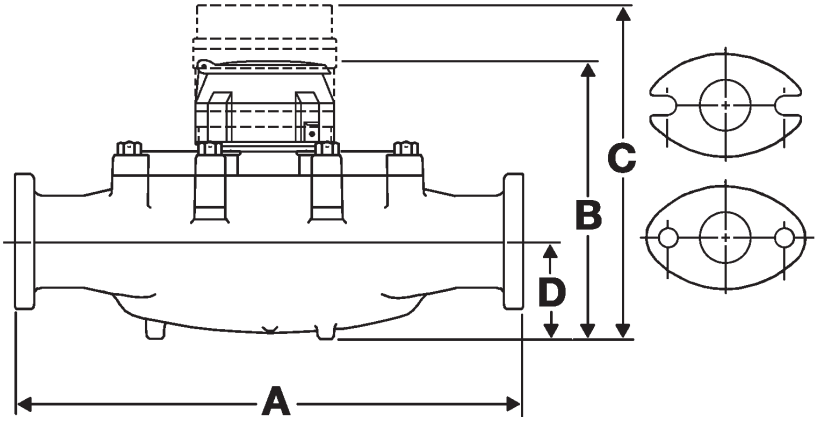
Sweep Hand Registration

MODEL	GALLON	CU.FT.	CU. METER
M170	100	10	1









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800-876-3837 | infocentral@badgermeter.com | www.badgermeter.com

Well #8

6/21/04	DBCP - EDB	0.67 ug/L
7/18/05	DBCP - EDB	0.89 ug/L
	1 HRS.	0.89 ug/L
	4 HRS.	1.01 ug/L
	8 HRS.	0.99 ug/L
	24 HRS	1.11 ug/L
3/30/2006	NO_3	43.4 mg/L
11/20/2006	DBCP - EDB	1.08 ug/L

ENVIRONMENTAL X

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : December 19, 2006
Laboratory Name: **FGL Environmental**
Sampled On : 11/20/2006-15:10
Received On : 11/21/2006-11:00
Completed On : 11/30/2006

Sample ID : VI 642395-09
Lab Director :
Sampler : ~~Steve Pickens~~ / Neil
Employed By: Bakman Water Compa EDT

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 - STANDBY

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 6 1 1 2 0 1 5 1 0
Y Y M M D D T T T T

Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-392-2000

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	1.08	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

2006
4TH QTR
ANNUAL
EDB
&
4TH QTR DBCP.
Pump # 8 (Standby)

Corporate Offices & Laboratory
P.O. Box 272 / 853 Corporation Street
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Visalia, California
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Mobile: (559) 737-2399

FGL ENVIRONMENTAL

ANALYTICAL CHEMISTS

INORGANIC CHEMICAL ANALYSIS

Date of Report : April 20, 2006
Laboratory Name: FGL Environmental
Sampled On : 03/30/2006-00:00
Received On : 04/01/2006-10:00
Completed On : 04/19/2006

Sample ID : VI 640466-01
Lab Director :
Sampler : Steve Pickens
Employed By : EDT

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 - STANDBY Influent (Before Blend w/8N)

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 6 0 3 3 0 0 0 0 0
Y Y M M D D T T T T
Laboratory Code: 5 8 6 7

Submitted By: FGL Environmental Phone # (805)-392-2000

GENERAL MINERAL & PHYSICAL CHEMICALS

MCL	UNITS	CHEMICAL	ENTRY	RESULT	DLR
45	mg/L	Nitrate (NO_3)	71850	43.4	0.8

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

2006
1ST QTR

ANNUAL
NITRATE (NO_3)
TEST

PUMP # 8 Influent (Before Blend w/8) Standby

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ENVIRONMENTAL

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : July 21, 2005
Laboratory Name: **FGL Environmental**
Sampled On : 07/19/2005-08:30
Received On : 07/20/2005-11:00
Completed On : 07/21/2005

Sample ID : VI 541271-04
Lab Director :
Sampler :
Employed By : **EDT**

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 5 0 7 1 9 0 8 3 0
Y Y M M D D T T T T
Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-659-0910

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	1.11	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

24 hrs

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ENVIRONMENTAL

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : July 21, 2005
Laboratory Name: **FGL Environmental**
Sampled On : 07/18/2005-16:30
Received On : 07/20/2005-11:00
Completed On : 07/21/2005

Sample ID : VI 541271-01
Lab Director
Sampler :
Employed By : **EDT**

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 5 0 7 1 8 1 6 3 0 (Y Y M M D D T T T T) Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-659-0910

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	0.99	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

2005
3RD QTR ANNUAL
DBCP & EDB
(8 hr & 24 hr)
Not Used or Pumped
INTO System

Pump #8 (RAW)
Before Blend

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ENVIRONMENTAL

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : July 21, 2005
Laboratory Name: **FGL Environmental**
Sampled On : 07/18/2005-12:30
Received On : 07/20/2005-11:00
Completed On : 07/20/2005

Sample ID : VI 541270-07
Lab Director : _____
Sampler : Jared Mott
Employed By : **EDT**

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID:AGE Station Number :1010001-008

Date/Time of Sample: 0 5 0 7 1 8 1 2 3 0
Y Y M M D D T T T T

Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-659-0910

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	1.01	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

4 hrs.

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ENVIRONMENTAL

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : July 21, 2005
Laboratory Name: **FGL Environmental**
Sampled On : 07/18/2005-09:30
Received On : 07/20/2005-11:00
Completed On : 07/20/2005

Sample ID : VI 541270-03
Lab Director :
Sampler : Jared Mott
Employed By : **EDT**

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 5 0 7 1 8 0 9 3 0
Y Y M M D D T T T T
Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-659-0910

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	0.89	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

1 hr.

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ENVIRONMENTAL

ANALYTICAL CHEMISTS

ORGANIC CHEMICAL ANALYSIS

Date of Report : July 21, 2005
Laboratory Name: **FGL Environmental**
Sampled On : 07/18/2005-08:30
Received On : 07/20/2005-11:00
Completed On : 07/20/2005

Sample ID : VI 541270-01
Lab Director :
Sampler : Jared Mott
Employed By : **EDT**

System Name: BAKMAN WATER COMPANY Number: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID:AGE Station Number :1010001-007

Date/Time of Sample: 0 5 0 7 1 8 0 8 3 0
Y Y M M D D T T T T

Laboratory Code: 5 8 6 7

Submitted By: **FGL Environmental** Phone # (805)-659-0910

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	0.89	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminate Level, DLR - Detection Limit for Reporting Purposes, ND - Not Detected at/or above DLR

2005
3RD QTR ANNUAL - INITIAL
DBCP & EDB
(INITIAL, 1 hr, 4 hr)
NOT USED OR PUMPED
INTO SYSTEM

PUMP #8 (RAW)
Before Blend

Corporate Offices & Laboratory
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BSK LABORATORIES
1414 Stanislaus St.
Fresno, CA 93706

EDT

ORGANIC CHEMICAL ANALYSIS (03/03)

Date of Report: 04/06/28
Laboratory Name: BSK ANALYTICAL LABORATORIES

Sample ID No.2004061324-462406

Authorized Signature: Cynthia Hamel

Name of Sampler: Steve Pickens

Employed By: Bakman Water Company

Date/Time Sample Collected: 04/06/21/0815

Date/Time Sample Received:04/06/21/0955

Date Analyses Completed: 04|06|24

System Name: BAKMAN WATER COMPANY

System #: 1010001

Name or Number of Sample Source: WELL 08 (RAW) Before Blend

User ID: AGE

Date/Time of Sample: 04|06|21|0815|

Station Number: 1010001-007

Laboratory Code: 5810

Date Analysis Completed: 04|06|24

Submitted by: _____

Phone #: _____

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED µg/L	ENTRY #	ANALYSES RESULTS	MCL µg/L	DLR µg/L
EPA 504.1	**Dibromochloropropane (DBCP)**	**38761**	**0.67**	**.2**	**0.01**
EPA 504.1	Ethylene Dibromide (EDB)	77651	ND	.05	0.02

2004
Annual

DBCP & EDB
Test

Pump # 8 (RAW)
Before Blend

Note: MTBE's primary MCL is 13 µg/L; the secondary MCL is 5 µg/L
MCL for Total THM was lowered to 80 µg/L, effective 1/1/04

BSK ANALYTICAL LABORATORIES

04061324.res

Well #8A

5/11/2004	DBCP - EDB	ND
6/14/2011	DBCP - EDB	0.01 ug/L
10/21/2011	NO_3	25 mg/L

INORGANIC CHEMICALS ANALYSIS

Date of Report	: November 02, 2011	Sample ID	: VI 1142632-001
Laboratory Name	: **FGL Environmental**	Approved By	**Kelly A. Dunnahoo, B.S.** Digitally signed by Kelly A. Dunnahoo, B.S. Title: Laboratory Director Date: 2011-11-02
Sampled On	: 10/21/2011-09:20		
Received On	: 10/25/2011-09:30	Sampler	: Steve Pickens
Completed On	: 10/25/2011	Employed By	: Bakman Water Company

System Name : BAKMAN WATER COMPANY Number : 1010001 **EDT**

Name Or Number of Sample Source : WELL 08A

User ID	: E	Station Number	: 1010001-008
Date/Time of Sample	: 1110210920 YYMMDDTTTT	Laboratory Code	: 5 8 6 7
Submitted By	: **FGL Environmental**	Phone #	: (805) 392-2000

GENERAL MINERAL & PHYSICAL

MCL	UNITS	CHEMICALS	ENTRY	RESULT	DLR
45	mg/L	Nitrate (NO3)	71850	25.0	0.4

MCL - Maximum Contaminant Level, DLR -Detection Limit for Reporting Purpose, ND - Not Detected at or above DLR

2011
4TH QTR
NITRATE(NO_3) TEST
Well #8A

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ORGANIC CHEMICALS ANALYSIS

Date of Report	: July 01, 2011	Sample ID	: VI 1141322-001
Laboratory Name	: **FGL Environmental**	Approved By **Kelly A. Dunnahoo, B.S.**	Digitally signed by Kelly A. Dunnahoo, B.S. Title: Laboratory Director Date: 2011-07-01
Sampled On	: 06/14/2011-16:00		
Received On	: 06/21/2011-11:00	Sampler	: Steve Pickens
Completed On	: 06/22/2011	Employed By	: Bakman Water Company

System Name : BAKMAN WATER COMPANY Number : 1010001 **EDT**

Name Or Number of Sample Source : WELL 08A

User ID	: E	Station Number	: 1010001-008
Date/Time of Sample	: 1106141600 YYMMDDTTTT	Laboratory Code	: 5 8 6 7
Submitted By	: **FGL Environmental**	Phone #	: (805) 392-2000

REGULATED ORGANICS CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504.1	Dibromochloropropane (DBCP)	38761	0.01	0.2	0.01
504.1	Ethylene Dibromide (EDB)	77651	ND	0.05	0.02

MCL - Maximum Contaminant Level, DLR -Detection Limit for Reporting Purpose, ND - Not Detected at or above DLR

2011
2ND QTR
ANNUAL
DBCP & EDB
Well #8A

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ENVIRONMENTAL /

ACCREDITED IN ACCORDANCE WITH nelac

ANALYTICAL CHEMISTS

June 4, 2004

Bakman Water Company
Steve Pickens
P.O. Box 7965
Fresno, CA 93747

Description : Pump #8A
Project

Lab ID : VI 440876-02
Customer ID: 4-14282

Sampled On : May 11, 2004-08:35
Sampled By : Steve Pickens
Received On: May 12, 2004-10:00
Matrix : Drinking Water

Sample Results - Organic

Constituents	Results	PQL	Units	MCL	Preparation Method	Preparation Date/ID	Analysis Date/ID
EPA 504.1 VOA:1							
1,3-Dibromopropane-Surrogate	106	70-130	% Rec		504.1	05/18/04:A203	05/18/2004:B02
DBCP	ND	0.01	ug/L	0.2	504.1	05/18/04:A203	05/18/2004:B02
EDB	ND	0.02	ug/L	0.05	504.1	05/18/04:A203	05/18/2004:B02
EPA 507 AGT:1							
Triphenylphosphate-Surrogate	80.4	70-130	% Rec		507	05/18/04:A205	06/04/2004:A00
Alachlor	ND	1	ug/L		507	05/18/04:A205	06/04/2004:A00
Atrazine	ND	0.5	ug/L	1	507	05/18/04:A205	06/04/2004:A00
Bromacil	ND	2	ug/L		507	05/18/04:A205	06/04/2004:A00
Butachlor	ND	1	ug/L		507	05/18/04:A205	06/04/2004:A00
Diazinon	ND	2	ug/L		507	05/18/04:A205	06/04/2004:A00
Dimethoate	ND	2	ug/L		507	05/18/04:A205	06/04/2004:A00
Metolachlor	ND	1	ug/L		507	05/18/04:A205	06/04/2004:A00
Metribuzin	ND	0.5	ug/L		507	05/18/04:A205	06/04/2004:A00
Molinate	ND	2	ug/L	20	507	05/18/04:A205	06/04/2004:A00
Prometryne	ND	2	ug/L		507	05/18/04:A205	06/04/2004:A00
Propachlor	ND	1	ug/L		507	05/18/04:A205	06/04/2004:A00
Simazine	ND	1	ug/L	4	507	05/18/04:A205	06/04/2004:A00
Thiobencarb	ND	1	ug/L	70[2]	507	05/18/04:A205	06/04/2004:A00

ND=Non-Detect. PQL=Practical Quantitation Limit. ♦ PQL adjusted for dilutions, concentrations, dry weight reporting, or limited sample.
MCL = Maximium Contaminat Level. [2] - Secondary Standard.
Containers: (VOA) VOA, (AGT) Amber Glass TFE-Cap Preservatives: (1) Cool 4°C

2004
ANNUAL

DBCP & EDB
Test

Pump #8A

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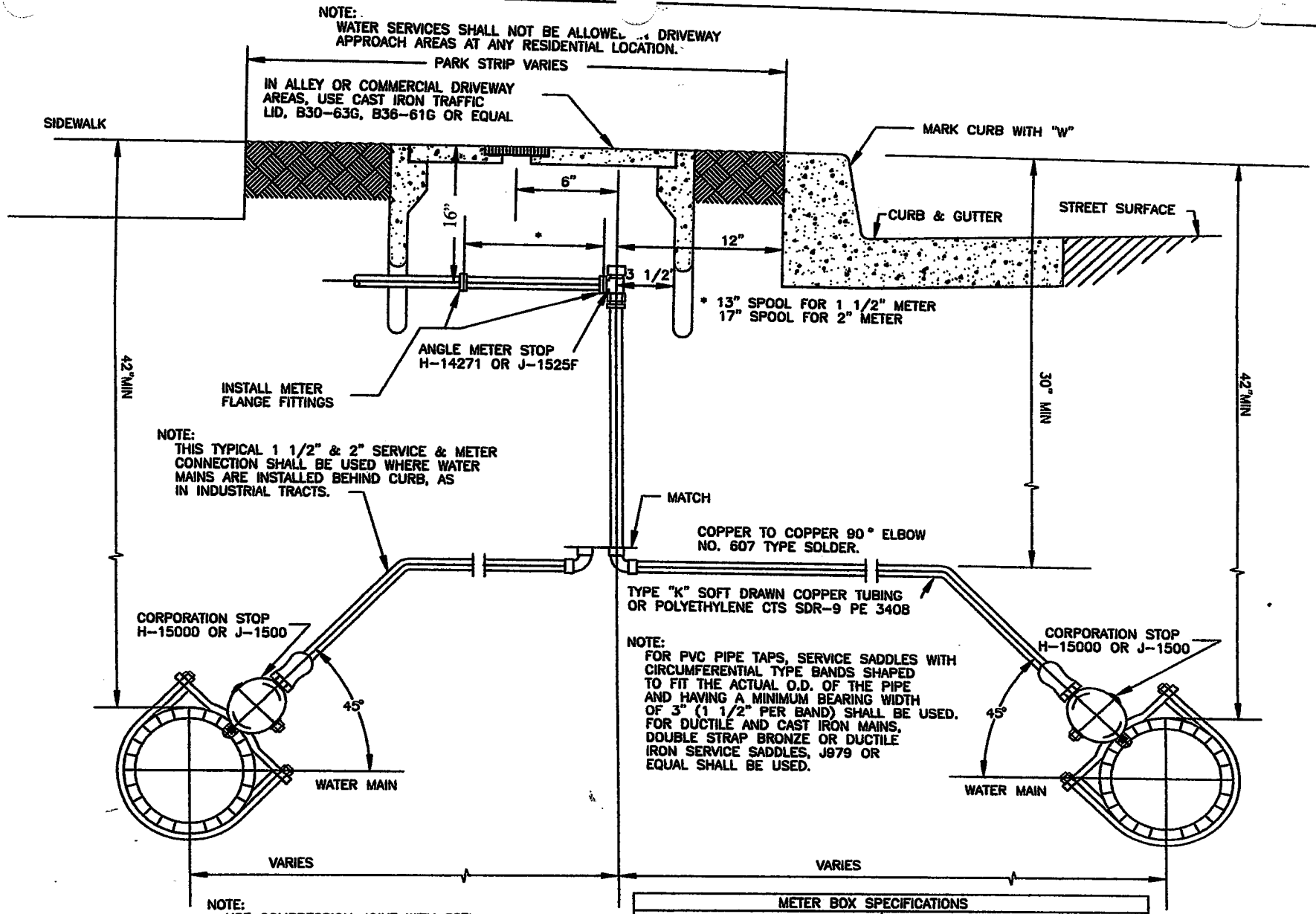
1 1/2" & 2" SERVICE CONNECTION & METER BOX INSTALLATION

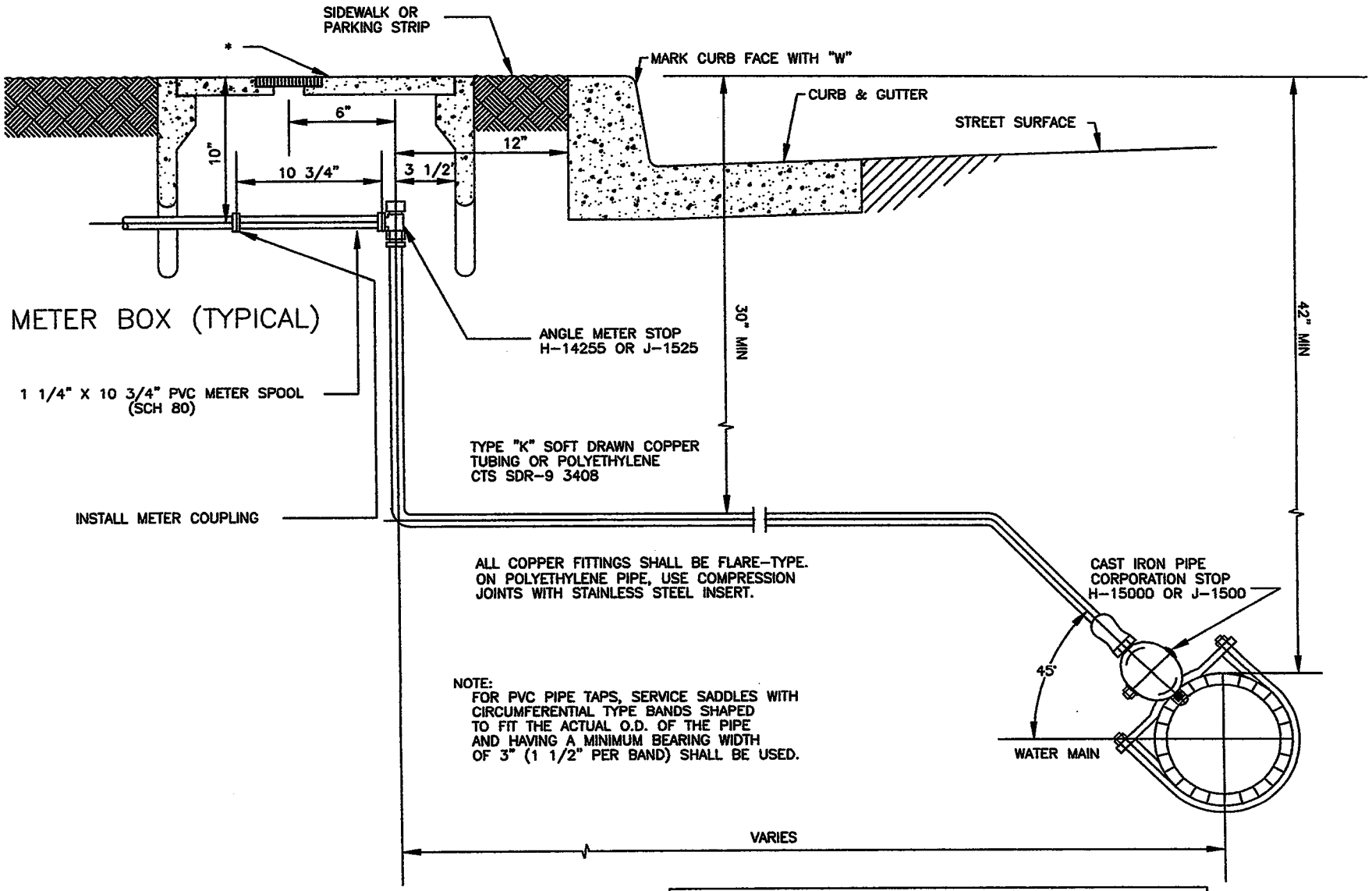


NOTE:
USE COMPRESSION JOINT WITH SSTL INSERT ON PE PIPE.

METER BOX SPECIFICATIONS		
CRISTY (FORNI DIV.)		BROOKS
1 1/2" B30 WITH E-45' LID	OR	1 1/2" NO. 38 WITH NO. 38 "H" COVER & CAST IRON LID.
2" B36 WITH E70 LID FB IN DIRT AREAS ONLY	OR	2" NO. 65 WITH NO. 65 "S" COVER & NO. 65 "S" LID.

WW — 1

1" SERVICE CONNECTION & METER BOX INSTALLATION



NOTE:
FOR PVC PIPE TAPS, SERVICE SADDLES WITH CIRCUMFERENTIAL TYPE BANDS SHAPED TO FIT THE ACTUAL O.D. OF THE PIPE AND HAVING A MINIMUM BEARING WIDTH OF 3" (1 1/2" PER BAND) SHALL BE USED.

NOTE:
WATER SERVICES SHALL NOT BE ALLOWED IN DRIVEWAY APPROACH AREAS AT ANY RESIDENTIAL LOCATION.

* NO. 37 "T" CAST IRON TRAFFIC COVER TO BE USED WHEN METER IS LOCATED IN ALLEYS OR DRIVEWAY AREAS.

METER BOX SPECIFICATIONS		
CRISTY (FORNI DIV.) B16 WITH G3D LID	OR	BROOKS NO. 37 WITH NO. 37 "H" COVER & CAST IRON LID.

W-2

California Department of Public Health
MEMORANDUM

DATE: June 14, 2011

TO: Betsy Lichti, P.E.
Senior Sanitary Engineer
DWFOB- Fresno District

FROM: Sudarshan Poudyal, P.E.
Sanitary Engineer
DWFOB- Fresno District

SUBJECT: Sanitary Survey Report
City of San Joaquin
System No. 1010034

PURPOSE OF REPORT

On April 25, 2011, I conducted an inspection of the City of San Joaquin water system (Water System) with Jeff Viau, Public Works Director. The Water System was last inspected by California Department of Public Health (Department) in January 2005 for issuing permit amendment for Well No. 5. The Water System currently operates the system under domestic water supply permit No. 78-065 issued on October 13, 1978 which has been amended one time as follows:

Table 1. Permit Summary

Permit Amendment No.	Date of Issue	Reason
03-12-05PA-005	10/04/2005	Addition of Well No.5

The purpose of this inspection report is to document the recently completed inspection of the Water System, to describe the facilities and operational practices as they exist today, provide a status of corrective actions from the last inspection and specify corrective actions required.

ENFORCEMENT HISTORY

- A Citation No. 03-23-10C-087 was issued to the Water System on December 7, 2010 for failure to comply with the total coliform MCL at Well No. 4. *The Department did not receive proof of public notification as required in the citation.*
- A Compliance Order No. 03-23-10O-009 was issued to the Water System on October 19, 2010, requiring a plan to eliminate the use of Well No. 4, which had a history of total coliform and E.coli contamination. *The Water System abandoned the well and is planning to construct a new well and has applied for the United States Department of Agriculture (USDA) grant funding.*

POPULATION SERVED

The City of San Joaquin is located approximately 25 miles southwest of the city of Fresno, south of Hwy 180 and west of Hwy 145, in Fresno County. The Water System is classified as a

community water system and serves a year-round population of approximately 4,060 through a total of 960 service connections, 48 of which are commercial. The service connections are not metered except for nine (9) commercial connections. The unmetered service connections are billed on a flat rate.

SOURCES OF SUPPLY

The Water System is currently served by two active wells: Well No. 3 and Well No. 5. Well No. 3 is the lead well, which typically is operated to meet the average and maximum day demands and the Well No. 5 typically is operated to meet the peak demands. Well No. 2 was inactivated in 2001 due to sanding issues. Well No. 4 was abandoned since September 2010 due to sporadic detection of total coliform, E.coli and pseudomonas bacteria in the well.

The Water System is planning to construct a new well to replace Well No. 4 and has applied for the United States Department of Agriculture (USDA) Rural Utility Services (RUS) grant funding. Plans and specifications need to be submitted to our office for approval prior to drilling a new well. Upon completion of the construction of new well, the City shall properly destroy the existing inactive Well No. 4. Permitting requirement for approval of the new well will be provided to the City in a separate correspondence.

Well No. 3 and 5 are secured by locked fences. Both the wells are equipped with Vertical Turbine Pumps with above ground electric motors. They are equipped with Water Specialties Propeller Flow Meter with a measurement accuracy of ±2 percent. Pump at Well No. 3 operates based on pressure switch controls from the hydropneumatic tank and Pump at Well No. 5 operates based on pressure transducer located on the well discharge. A simplified schematic diagram of the Water System is presented in Figure 1.

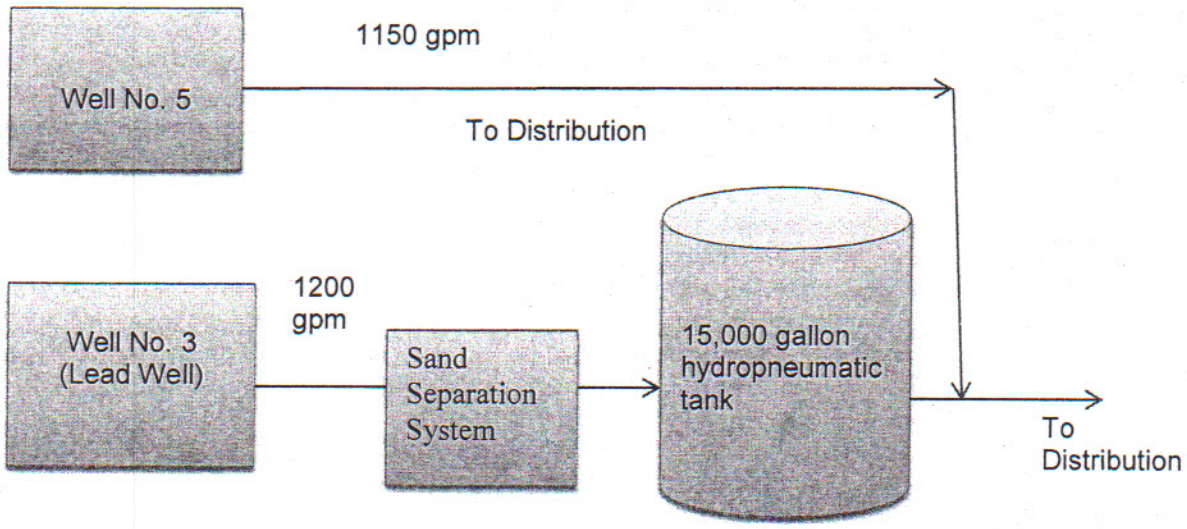


Figure 1. City's existing water system schematic

Well No. 3 (Active)

Well No. 3 is located at City Corporation yard approximately 250 feet southeast of Main Street along West Railroad Avenue as shown in Figure 2. This well site is secured by a locked fence. It is the lead well and was drilled in 1968 to a depth of 589 feet. The method of drilling is not recorded in the well data sheet available in our record. The well contains a 16-inch diameter steel casing from 0 to 510 feet. The casing is perforated from 210 to 510 feet. The well is gravel packed and has an annular seal to a depth of 56 feet. The material of the annular seal is unknown. The well is equipped with a casing vent, sounding tube, check valve, flow control valve, flowmeter and a raw water sample tap. It includes a 75 HP motor that powers a water lubricated vertical turbine pump manufactured by Fairbanks Morse. The rated capacity of the pump is 1200 gpm. The well discharges into a 15,000 gallon hydropneumatic tank through a Lakos sand separator. The hydropneumatic tank pressurizes the system between 40 to 60 psi. The well site consists of a backup 99KW/135 HP diesel generator manufactured by Deutz Diesel Corporation. *The Water System exercises the generator once a month.*

Figure 2. Location of Active and Inactive Wells.

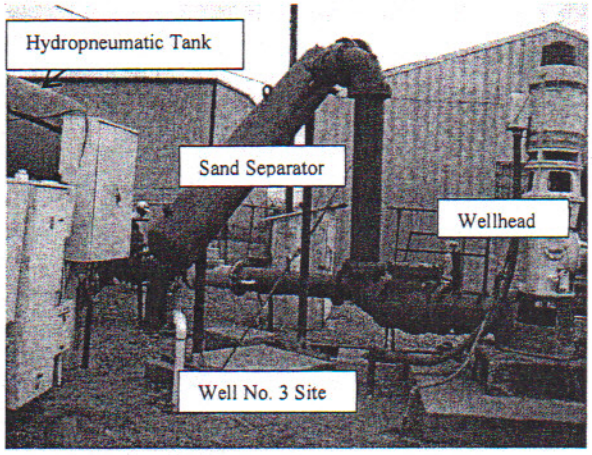
The well is continuously chlorinated with a 12.5% Sierra Sani Chlor Sodium Hypochlorite (NaOCl) and metering equipment located in a wooden enclosure. The chemical feed pump is activated with the well pump. The NaOCl is stored in a 30 gallon tote and is injected to the water supply by an LMI Milton Roy metering pump with a maximum capacity of 2.5 GPH. During the inspection, the pump speed and stroke were set at 80 and 90 percent respectively. The Water

System has redundant chemical storage and metering pump on site. California Water Services (CWS) also maintain a supply of spare storage and equipment at their offices. A 30 gallon NaOCl typically last for a week or two. The chemical and feed pump is NSF 60 and 61 certified respectively.

A source water assessment for the well was completed in August 2001. The well was deemed to be vulnerable to automobile gas station, metal plating and fabricating activities. However, no related contaminants have been detected.

During the inspection, following deficiencies were observed at the well site:

- The wellhead was not regularly cleaned.
  - ✓ We recommend regularly cleaning of the wellhead surface and concrete pads to maintain the visual appearance of the system and to avoid any potential contamination.
- A watertight seal (gasket) was not installed between the pump motor base and concrete slab.
  - ✓ We recommend placing a gasket to prevent any potential contamination. The Water System can temporarily apply silicon seal around the pump motor base until a gasket is placed.
- A casing vent (or may be a gravel chute) was capped.
  - ✓ We recommend verifying if it is a casing vent or not by introducing a sounding tube. If it is a casing vent, it should be extended at least three (3) feet above the well pad, downturned and screened. The vent shall be at least 3-inches in diameter. The City shall refer to the DWR Water Well Standards for proper construction of the casing vent. It is available at http://wwwdpla.water.ca.gov/sd/groundwater/california_well_standards/well_standards_content.html.

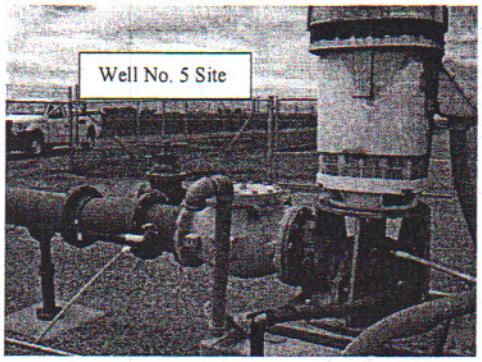


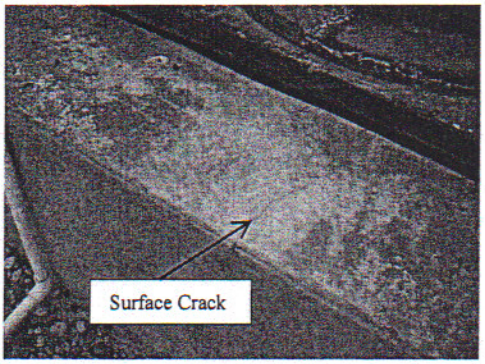
Well No. 5 (Active)

Well No. 5 is located at 21926 W. Cherry Lane south of W. Manning Avenue and east of S. Colusa Avenue (see Figure 2). Based on well data sheet available, this well was drilled to a depth of 500 feet by the rotary method in July 2003. The well features a 16-inch diameter steel casing from 0 to 495 feet. Perforated casing is installed from 300 to 480 feet. The well is gravel packed from 380 feet to 500 feet and has a cement annular seal to a depth of 275 feet and a bentonite seal to a depth of 380 feet. Well No. 5 is equipped with a 150 HP motor that powers a water lubricated vertical turbine Flowserve pump. The maximum capacity of the pump is 1150 gpm. The well is equipped with a screened casing vent, sounding tube, check valve, flow control

valve, flowmeter and a raw water sample tap. The well is controlled by a pressure transducer located downstream of well discharge check valve and discharges directly into the distribution system.

Well No. 5 is continuously chlorinated with a 12.5% Sani Chlor Sodium Hypochlorite (NaOCl) and metering equipment located in a wooden enclosure. The chlorine feed pump is activated with the well pump. The NaOCl is stored in a 30 gallon tote and is injected into the water supply by an LMI Milton Roy metering pump with a maximum capacity of 2.5 GPH. During the inspection, the pump speed and stroke settings were 20 and 100 percent respectively. A 30 gallon NaOCl typically last for a week or two. The chemical and feed pump is NSF 60 and 61 certified respectively. During the inspection, no sanitary deficiencies were observed except that the concrete pad had minor visible surface cracks. The Water System should monitor the crack and seal it if the crack starts expanding below the surface.





A source assessment for the well has not been completed. The Water System completed a Potential Contamination Activities (PCA) checklist in January 2005 and submitted to the Department.

INACTIVE WELLS

Well No. 2 and 4 are the inactive wells. Well No. 2 was inactivated in 2001 due to sanding issues. Well No. 4 was inactivated at the end of 2010 due to bacteriological contamination. The following table presents the well construction information for inactive wells.

Table 2. Inactive wells

Well No.	Date Drilled	Well Depth (ft)	Casing Depth (ft)	Annular Seal Depth (ft)	Casing Size (inches)
2	1954	570	570	225	12
4	1978	518	500	50	16

PRODUCTION DATA

Three years of production and population data from the Annual Reports to the Drinking Water Program (ARDWP), which are on file at the Department's Fresno District office were reviewed and determined that the Water System may have been incorrectly reporting the flow data. Therefore, monthly and annual flow data for 2009 and 2010 were requested from the City Engineer which are accurate and presented below.

Table 2. Number of Service Connections and Water Usage

Year	Population	Service Conn. (SC)	Annual Production (MG)	Max. Month (MG)
2010	4060	953	245	33.1 (June)
2009	4060	953	257	31.7 (July)

The following table presents the average day, maximum day and peak hour demand for the Water System based for 2009 and 2010 flow data. The flow data were calculated by the City Engineer and the Department concurs with it. The average day demand is calculated from the total annual demand by dividing with 365 days. The maximum day demand was calculated by multiplying average day demand with a factor of 2.0 and a peak hour demand was calculated by multiplying maximum day demand with a peak factor of 3.5 to represent the actual condition of the usage.

Table 3. Water Demand (gpm) for the District

Demand	2009	2010
Average Day (gpm)	489	466
Maximum Day (gpm)	979	862
Peak Hour (gpm)	1,713	1,630

SOURCE CAPACITY ASSESSMENT

The Water System currently has a maximum day and a peak hour demand of 979 gpm and 1,713 gpm respectively based on Table 3 data. The existing active wells, Well No. 3 (1200 gpm) and Well No. 5 (1150 gpm) have a total production capacity of 2,350 gpm. So, each well is individually capable of meeting the maximum day demand and collectively capable of meeting the peak hour demand. The Water System should typically be capable of meeting the peak hour demand or the maximum day demand plus fireflow, whichever is higher. Assuming a fire flow requirement of 2000 gpm, as identified in Preliminary Engineering Report for USDA application, the Water System should be capable of producing (2000+979) gpm = 2979 gpm to comply with the California Fire Code. The Water System is currently unable to meet this requirement.

The Water System has applied for USDA RUS funding to construct a new well to replace the abandoned Well No. 4. The construction of this well will help Water System meet the fire flow requirements and also meet the peak hour demand when one of the well is down for maintenance.

TREATMENT FACILITIES

Currently, the Water System does not provide any specific treatment except for continuous disinfection at Well No. 3 and 5 and sand separation at Well No. 3. The disinfection system is described in pages 3 through 5 of the report.

STORAGE AND DISTRIBUTION FACILITIES

Water from Well No. 3 is pumped into a 15,000 gallon horizontal hydropneumatic tank, where it is pressurized at 40-60 psi before discharging into the distribution system. Water from Well No. 5 is pumped directly into the distribution system. All of the distribution system is looped with pipe sizes ranging from 4 to 12 inches. Based on the available records, the distribution system is composed of asbestos cement and cast iron pipes. The City mentioned that they have only installed PVC pipe for the last fifteen (15) years. The distribution system contains 145 valves of different sizes, six (6) dead-ends, 47 backflow prevention devices and approximately 90 Fire Hydrants.

The Water System typically installs new distribution pipelines in conformance with the California Waterworks Standards, §64570 - Material and Installation, and §64572 - Water Main Separation. The District shall seek the approval from the Department for any variance from this requirement.

RECORDS

The Water System has contracted out the operation and maintenance to California Water Services and its recording practice is adequate. However, the Water System should also maintain the records related to water quality monitoring, maintenance and correspondences with the Department.

WATER QUALITY MONITORING

GROUNDWATER

Source Monitoring

For the purpose of assessing source water quality monitoring requirements, Well Nos. 3 and 5 were assigned a source class code of CMGA (Community, Medium, Groundwater, and Agricultural). Based on population of greater than 3,300, the Department has revised the source class code to CLGA (Community, Large, Groundwater, and Agricultural). This change requires increased monitoring for VOCs discussed under applicable section below. The Department will notify the Water System in a separate correspondence when this change is reflected in the database. A copy of the analysis results from the Department's water quality database is attached in Appendix A and a list of last sample date and next due date is listed in Appendix B. The Water System is not current with its source water monitoring. The monitoring results should be submitted electronically by the analyzing laboratory to the following Primary Station (PS) Codes:

Table 4. Assigned Source Class Code and PSCodes

Source Name	Source Class	PSCodes
Well No. 3	CLGA	1010034-003
Well No. 5	CLGA	1010034-005

General Mineral, General Physical, and Inorganic Chemical

General Mineral, General Physical, and Inorganic Chemical monitoring should be conducted every three (3) years. The monitoring results were last obtained for Well No. 3 and 5 in December 2007. The 2010 data has not been reported to the Department. The water quality report in State's database reveals that both the wells (Well No. 3 and 5) have produced water that exceeds the MCL for color. The samples collected in December 2007 from Well No. 3 and the sample collected in December 2004 from Well No. 4 resulted in color concentration of 20 and 25 units respectively. The water samples collected from 1998 through 2007 show that both the wells have exceeded the manganese MCL ranging from 63.8 to 227 µg/L. The water samples collected from Well No. 3 from 1998 through 2007 resulted in arsenic concentration ranging from 5.3 to 7 µg/L and a sample collected from Well No. 4 in 2007 resulted in arsenic concentration of 6 µg/L, which complies with the arsenic MCL of 10 µg/L. The Water System completed the initial perchlorate monitoring at both the wells in 2007/2008. All the samples tested were below the detection level.

Both the wells are able to comply with all the primary drinking water standards. Currently, arsenic is being monitored every three (3) years at both the wells. Since the Water System exceeds the secondary MCL for manganese, it should initiate quarterly manganese monitoring starting with 2011 third quarter (July- September) to determine variability in water.

Volatile Organic Chemicals (VOCs) & Synthetic Organic Chemicals (SOCs)

Monitoring for VOCs and SOCs is required from both wells. VOC monitoring is required every six (3) years and SOC monitoring is required every nine (9) years except for Dibromochloropropane (DBCP) and Ethylene Dibromide (EDB), which requires triennial monitoring. The most recent VOCs and SOCs samples collected in December 2007 from both wells were reported as non-detected. The next VOC samples are overdue due to recent change in source class code. The VOC samples shall be collected by July 29, 2011. The SOC samples are due in December 2013/2016.

Radiological

The Water System completed the initial gross alpha monitoring that consisted of four quarterly samples for Gross Alpha from both the wells. The Water System has initiated the quarterly Radium 228 monitoring at both the wells and completed two (2) quarters of monitoring. Both results were less than the DLR of 1.0 pCi/L for both wells. Therefore, the remaining two quarters of monitoring for Radium 228 are hereby waived. The following table summarizes the average results for all the radiological constituents.

Table 5. Radiological Data

Average of Results				
Source	**Sampling Period**	**Gross Alpha Particle Activity (pCi/L)**	**Uranium Activity (pCi/L)**	**Ra-228 (pCi/L)**
Well No. 3	most recent four quarter(2006-2009)	**6.77**	**5.7**	**<1.0**
Well No. 5	most recent four quarter (2006- 2009)	**4.55**	**NT***	**<1.0**

**NT – Not Taken*

Based on the above results, the district is required to sample for Gross Alpha every six (6) years from both the wells. The next gross alpha sample is due in 2015.

SOURCE BACTERIOLOGICAL MONITORING

The Water System provides continuous chlorination at Well No. 3 and 5 and is required to collect monthly source bacteriological samples from both of the wells. Well No. 4 was abandoned since September 2010 due to ongoing bacteriological problems. A summary of the past results from 2007 to date from all the wells can be found in Appendix C. Well No. 3 tested positive for total coliform only one time in May 2010.

As required under the federal Groundwater Rule, effective December 2009, the Water System shall collect a bacteriological sample from the operating well as a part of the repeat sampling following any detection of total coliform in the distribution system. This is also applicable for the well which currently provides chlorination treatment. To waive this requirement, the Water System must demonstrate its ability to achieve 4- log virus inactivation by free chlorine.

DISTRIBUTION BACTERIOLOGICAL MONITORING

The District is required to collect four (4) routine bacteriological samples per month in accordance to the Bacteriological Sample Siting Plan (BSSP). The Department does not have a copy of BSSP on file. The Water System should prepare a BSSP and submit to the Department for review by **July 29, 2011**. A guideline is provided in Appendix D. Upon review of the bacteriological data from 2007 to date, the Water System has occasional presence of total coliform in the distribution system. A summary of the distribution system bacteriological sampling from January 2007 to present is provided in Appendix E.

The Water System should continue to report chlorine residual for each distribution bacteriological samples. The chlorine residual ranged from 0.2 to 2.4 mg/L since January 2010 to present.

DISTRIBUTION LEAD AND COPPER MONITORING

The Water System is on triennial monitoring for lead and copper and is required to take twenty (20) samples per sampling period. The last sample taken in October 2010 resulted in a 90th percentile lead and copper concentration of <0.005 and 0.059 mg/L, respectively, which are below the lead and copper action levels. The next round of sampling is to be collected during the summer of 2013 (between June and September). A summary of past results can be found in Appendix F.

ASBESTOS MONITORING

Regulation requires monitoring of systems vulnerable to asbestos contamination within the distribution system at a tap served by asbestos-cement pipe. Distribution system monitoring for asbestos is required if asbestos-cement pipe is used and the water produced by the sources exhibits an aggressive index less than 11.5. The aggressive index is an indicator of the corrosivity, and correlates reasonably well with the release of asbestos fibers caused by dissolution of the cement matrix. The aggressive index (AI) is calculated using the following equation.

$$AI = pH + \log (A*H)$$

pH = measured pH of the water
A = alkalinity, mg/L as $CaCO_3$
H = calcium hardness, mg/L as $CaCO_3$

The aggressive index for each well is displayed in Table 6 based on most recent data collected in December 2011. Well 05 yields aggressive index of 10.6 units and therefore the Water System is required to monitor asbestos every nine (9) years from the distribution system. The Water System may take the asbestos sampling from one of the lead and copper sample site. The first asbestos sample should be collected by **July 29, 2011.**

Table 6: Aggressive Index

Source	Sample Date	pH	A	H	AI
Well No. 3	12/10/2007	7.74	159	56.2	11.69
Well No. 5	12/10/2007	7.16	114	25	10.6

STAGE 1 DISINFECTANTS/DISINFECTION BY PRODUCT (D/DBP) RULE

The Water System currently provides disinfection; therefore, it is required to conduct this monitoring. The groundwater systems with population less than 10,000 are required to conduct annual monitoring. The monitoring is reduced to one sample every three (3) year if TTHM ≤ 0.020 mg/L and HAA5 ≤ 0.015 mg/L for <u>one year.</u>

The Department does not have a copy of D/DBP Monitoring Plan on file. The Water System should submit the plan to the Department by **July 29, 2011**. A DBP Monitoring form can be found in Appendix G. Based on the monitoring data from 2004 through 2009, the TTHM and HAA5 data ranged from 0 to 6 µg/L and 0 to <6 µg/L respectively. The Water System may reduce the monitoring requirement to triennial. The last sample was collected in September 2009. The next sample shall be collected in summer of 2012 (June through September).

STAGE 2 DISINFECTANTS/DISINFECTION BY PRODUCT (D/DBP) RULE

A letter was sent to the Water System on February 21, 2008 which indicated that the Water System will be impacted by the Stage 2 D/DBP Rule. Based on initial review in 2008, it was determined that the water system was eligible for a 40/30 certification due to its ability to meet the following criteria:

- Collected all of the required Stage 1 D/DBP samples.
- All TTHM and HAA5 did not exceed 0.040 and 0.030 mg/L, respectively.
- No TTHM or HAA5 monitoring violations occurred within a 2 year period.

A signed 40/30 certification is not on file with the Department. It is required to satisfy the Initial Distribution System Evaluation (IDSE) requirements for the Stage 2 D/DBP Rule. The Water System should continue with Stage 1 D/DBP Rule until Stage 2 D/DBP Rule comes into effect. Compliance with the Stage 2 D/DBP Rule routine monitoring for the Water System will begin on October 1, 2013. Additional information will be provided prior to this date.

OPERATION AND MAINTENANCE

Cross-Connection Control Program

The Water System will be required to maintain an approved Cross- Connection Control Program which shall include the following elements (as applied from Title 17, California Code of Regulations, Section 7584), and as outlined in Appendix H.

a) The conducting of surveys to identify water user premises or locations where cross-connections are likely to occur,
b) The provisions of backflow protection by the Water user at the user's connection or within the user's premises or both,
c) The provision of at least one person trained in cross-connection control to carry out the cross- connection program,
d) The establishment of a procedure or system for annual testing of backflow preventers, and
e) The maintenance of records of locations, tests, and repairs of backflow preventers.

The Water System does not have cross-connection control plan on file. It is recommended that the Water System hire a cross-connection specialist for conducting the survey. A list of cross-connection control specialist in our database is attached in Appendix I for your reference.

The 2009 ARDWP specifies that there are 47 backflow prevention (BFP) devices installed. Six (6) of the BFP devices failed and were repaired in 2009. All backflow prevention devices must be tested annually by a certified backflow prevention device tester. A copy of the test report should be provided to the Department every year.

Complaints

The Annual Reports submitted to the Department indicates two (2) complains were received in 2009, one of which was related to color and other is unknown. All complaints are recorded, responded and resolved satisfactorily whenever possible. Flushing is usually effective in eliminating the water quality complaints.

Operator Certification

The Water System is classified as a community system and is required to have a certified D2 distribution operator. California Water Services is currently operating and maintaining the

system and satisfies this requirement. **The Water System does not have an operation plan on file.** The Water System should develop an operation plan based on guidelines attached in Appendix J. The operation plan will provide the Water System operator with a tool to operate and maintain the plant effectively and efficiently.

Consumer Confidence Report (CCR)

As a community water system, the Water System is required to complete a CCR on an annual basis. The Department has received the 2009 CCR and certification form. The CCR is to provide, as minimum, specific information on concentration of microbiological contaminants, minerals, physical agents, inorganic chemicals, organic chemicals, and radioactivity that are present in the water supply. The 2010 CCR shall be distributed to customers and a copy provided to the Department by July 1, 2011. Additional information and updated form can be found at:

http://www.cdph.ca.gov/certlic/drinkingwater/Pages/CCR.aspx

Emergency Notification Plan

The Water System shall maintain an up to date Emergency Notification Plan (ENP) identifying how customers will be notified in the event of a water quality emergency. The Water System shall refer to the ENP for phone numbers to contact the Department after normal business hours in the event of a water quality emergency. The Department does not have an updated ENP on file for the Water System. The Water System must fill and submit the attached ENP (Appendix K) and submit to the Department by **July 29, 2011.**

Valve Maintenance and Flushing Program

The District has 145 valves in the distribution system that is exercised annually. The District has six (6) dead-ends in the system, which are flushed at least two times a year and as required based on consumer complaints. However, the Water System does not have a formal documentation of valve maintenance and flushing program.

SYSTEM APPRAISAL

The Water System serving the City has been able to adequately meet the water demands to date. The City's staff visits each active well site every day for regular check-ups and flow recordings. The water quality monitoring is contracted out to CWS. There is no storage provided in the system. The system has limited source reliability and failure of either well in the summer could result in a water outage or low pressure problem. Well No. 3 is equipped with auxiliary power. The City is planning to develop a San Joaquin Sports Park with an intention to provide an additional open space to the community. To improve the system's source reliability, the Water System is pursuing the construction of a new well to replace the abandoned Well No. 4. It has applied for USDA RUS grant and is awaiting approval.

STATUS OF 1993 INSPECTION CORRECTION ACTIONS

The Water System was thoroughly inspected in 1993 and various corrective actions were requested at that time. Since it has been a long time, most of the general corrective actions are of no significance. However, the corrective actions that are still applicable have been discussed above in the applicable sections and presented below.

CORRECTION ACTIONS REQUIRED

The following corrective actions must be taken by the Water System following the receipt of the inspection report.

1. The Water System shall collect the overdue source water quality samples (Appendix C) by **July 29, 2011**. If the overdue samples have already been collected in the past, the results should be electronically transmitted by the testing laboratory to the State's database using the assigned PSCodes.

2. The Water System should initiate asbestos monitoring from the distribution system. The first asbestos sample should be collected by **July 29, 2011**.

3. The Water System should initiate quarterly manganese monitoring to determine variability in water. The first quarterly manganese sample shall be collected between **July and September, 2011.**

4. The Water System has abandoned Well No. 4 since September 2010 but has not formally requested the Department for a status change from active to inactive. The Department has inactivated the well in the database to exempt it from monitoring requirement.

5. The Department does not have a copy of BSSP on file. The Water System should prepare a BSSP and submit to the Department for review by **July 29, 2011** (Appendix D).

6. The Department does not have a copy of D/DBP Monitoring Plan on file. The Water System should submit the D/DBP plan to the Department by **July 29, 2011** (Appendix G).

7. The Water System should submit a 40/30 certification form (Attachment L), which is required to satisfy the Initial Distribution System Evaluation (IDSE) requirements for the Stage 2 D/DBP Rule.

8. The Water System shall maintain an approved Cross- Connection Control Program which shall include the following elements (as applied from Title 17, California Code of Regulations, Section 7584), and as outlined in Appendix H.
   - The conducting of surveys to identify water user premises or locations where cross-connections are likely to occur,
   - The provisions of backflow protection by the Water user at the user's connection or within the user's premises or both,
   - The provision of at least one person trained in cross-connection control to carry out the cross- connection program,
   - The establishment of a procedure or system for annual testing of backflow preventers, and
   - The maintenance of records of locations, tests, and repairs of backflow preventers.

   It is recommended that the Water System hire a cross-connection specialist for conducting the survey. A list of cross-connection control specialist in our database is attached in Appendix I for your reference.

9. All backflow prevention devices must be tested annually by a certified backflow prevention device tester. A copy of the test report should be provided to the Department.

10. The Water System does not have an operation plan on file. The Water System shall develop an operation plan based on guidelines attached in Appendix J by **August 31, 2011**.

11. The Department does not have an updated Emergency Notification Plan (ENP) on file for the Water System. The Water System must fill and submit the attached ENP (Appendix K) and submit to the Department by **July 29, 2011.**

12. Correct the deficiencies at Well No. 3 as discussed in this report. Photo documentation should be provided to the department by **August 31, 2011,** showing each correction.

Appendices:

Appendix A:	Source Chemical Monitoring Database
Appendix B:	Last Sample and Due Summary
Appendix C:	Source Bacteriological Monitoring
Appendix D:	BSSP Guidance and Form
Appendix E:	Distribution Bacteriological Monitoring
Appendix F:	Lead and Copper Monitoring
Appendix G:	D/DBP Form
Appendix H:	Cross-Connection Control Survey Guidelines
Appendix I:	Reference List of Cross Connection Specialist
Appendix J:	Operation Plan Guidelines
Appendix K:	Emergency Notification Plan Form and sample
Appendix L:	40/30 Certification Form

Notice of Exemption

E201310000025 *Appendix E*

To: ☑ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

☑ County Clerk
County of Fresno
2221 Kern Street
Fresno, CA 93721-2600

From: (Public Agency) City of San Joaquin
21900 West Colorado Avenue
San Joaquin, CA 93660
(Address)

FILED
JAN 31 2013
FRESNO COUNTY CLERK
By DEPUTY

Project Title: City of San Joaquin Water Meter Project

Project Location - Specific: The proposed project will be within and/or adjacent to the City of San Joaquin.

Project Location - City: San Joaquin **Project Location - County:** Fresno County

Description of Nature, Purpose, and Beneficiaries of Project:
The City will install water meters on various water customers throughout the City. The water meter project will allow the City to charge customers a volumetric rate for water. The project will benefit all customers by encouraging water conservation and reducing water waste.

Name of Public Agency Approving Project: City of San Joaquin

Name of Person or Agency Carrying Out Project: Cruz Ramos, City Manager

Exempt Status: (*check one*)

- ☐ Ministerial (Sec. 21080(b)(1); 15268);
- ☐ Declared Emergency (Sec. 21080(b)(3); 15269(a));
- ☐ Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
- ☑ Categorical Exemption. State type and section number: 15301 Existing Facilities; 15302 Replacement
- ☐ Statutory Exemptions. State code number:

Reasons why project is exempt: Title 14, Section 15301, Class 1: Minor alteration of existing facilities to provide public utility (water) services. Section 15302, Class 2: Replacement or reconstruction of existing utility systems.

Lead Agency Contact Person: Cruz Ramos, City Manager Area Code/Telephone/Extension: 559/693-4311

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? ☐ Yes ☐ No

Signature: Amarpreet Dhaliwal Date: 1/30/13 Title: Mayor

☑ Signed by Lead Agency Date received for filing at OPR:

☐ Signed by Applicant

Revised October 1989

E201310000025

Final Report

Water and Sewer Rate Study

May 2010

HDR

ONE COMPANY | *Many Solutions*®

May 25, 2010

Mr. Tim Przybyla, Finance Director
City of Kerman
850 South Madera Avenue
Kerman, CA 93630

RE: Final Report – Water and Sewer Rate Study

Dear Mr. Przybyla:

This final report summarizes the results of the water and sewer rate analysis HDR prepared for the City of Kerman (City). In addition to preparing cost-of-service based rates, this study addressed the transitioning of the City's water system from a partially-metered to a completely-metered system and the City's water conservation objectives.

Due to Proposition 218 requirements, we have proposed several changes to the current rates, including eliminating subsidies to senior residential and school district accounts, eliminating lot size factors, reducing water and sewer rates for multi-family customers, and providing new commercial sewer rates that reflect effluent strength characteristics.

We have also outlined a longer-term approach to accommodate the eventual metering of all customers, including the need to review both revenue requirements and consumption data on an annual basis, followed by the adoption of inclining block rates for single-family residential customers once fully metered consumption levels have been verified.

We appreciate the opportunity to work with you on this significant change to the City's water and sewer rates, as well as all the assistance you and your staff have provided during this study. If you have any questions about this report, please call me at (916) 817-4873. We look forward to working with you again in the future.

Sincerely,

Gregory C. Clumpner
Project Manager

GCC:pk/451529-130987-141

HDR Engineering, Inc.

2365 Iron Point Road, Suite 300
Folsom, CA 95630

Phone (916) 817-4700
Fax (916) 817-4747
www.hdrinc.com

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SECTION 1 - INTRODUCTION

Overview of the Rate Analyses

The City of Kerman (City) retained HDR Engineering, Inc. (HDR) to prepare rate studies for the City's water and sewer utilities. As a part of these rate studies, HDR evaluated projected revenues and expenditures, developed net revenue requirements, performed cost-of-service rate analyses, and recommended new water and sewer rates. The water rate analysis also reviewed current customer classes and rate structure alternatives with the intent of improving the efficiency and equity of the water rates. This report presents an overview of the results of these rate studies.

Rate Design Criteria and Considerations

Several criteria should be considered in setting rates and developing sound rate structures. The fundamentals of this process have been documented in a number of rate-setting manuals; although, the foundation for evaluating rate structures is generally credited to James C. Bonbright in the *Principles of Public Utility Rates*.[1] This manual outlines pricing policies, theories, and economic concepts, along with various rate designs. A simplified list of the attributes of a sound rate structure, which apply to both water and sewer rates, is provided below:

- Rates should be easy to understand from the customer's perspective.
- Rates should be easy to administer from the utility's perspective.
- Rates should promote the efficient allocation of the resource.
- Rate should be equitable and non-discriminating (i.e., cost based).
- There should be continuity in the rate-making philosophy over time.
- Other utility policies should be considered (e.g., encouraging conservation, economic development, etc.).
- Rates should consider the customer's ability to pay.
- Rates should provide revenue stability from month to month and year to year.

Many rate economists and regulatory agencies, including HDR, feel the cost-based attribute should be of primary importance in guiding utilities on rate structure and policy issues. For a number of reasons (i.e., drought, population growth, and infrastructure deficiencies), the California Water Conservation Plan encourages water utilities to emphasize water conservation and reducing their average long-term per-capita usage (i.e., 20 percent by year 2020).

[1] James C. Bonbright, Albert L. Danielsen, and David R. Kamerschen, *Principles of Public Utility Rates*, (Arlington, VA: Public Utilities Report, Inc., Second Edition, 1988), p. 383-384.

It is important for water utilities to send proper price signals to its customers about the actual cost of their water usage, and likewise sewer costs. This objective may be approached through both the magnitude and structure of the rates. In other words, both the amount of revenue collected (i.e., $10 million per year) and the way in which the revenue is collected from the customers are important.

Key Study Objectives

The City is in the process of installing water meters on all single-family residential (SFR) accounts and converting these customers from flat rates, which do not reflect individual water use, to a fully-metered system where monthly charges for all SFR users reflect their actual consumption. In light of this transition, some of the City's key objectives for this study are:

- Completing this transitioning of residential customers to a fully-metered system and volumetric rates.
- Achieving revenues that are sufficient and stable during this transition.
- Adequately funding capital improvement projects.
- Maintaining adequate financial reserves, meeting debt service coverage ratios, and observing appropriate financial management policies.
- Reducing peak summer time and total annual water consumption, with the intent of reducing annual system costs and the average customer cost for water service.

HDR believes this study and our recommendations meet these key objectives.

Proposition 218

Proposition 218, which was adopted in 1996 and dubbed the "citizen's right to vote on new taxes," provides the opportunity for the public to vote on changes to any "property-related fees." Following passage of this law, various court decisions have defined water and sewer service charges to be property-related fees.[2] Proposition 218 essentially requires a utility to provide public notification of proposed rate changes, inform property owners/customers of the protest mechanism and the time frame for response, and provide a public hearing on the proposed rates. The public hearing must be held "not less than 45 days after the mailing of the notice." The City should consult their legal counsel regarding the details of their notification, protest ballots, and public hearing process.

Rate Structure Terminology

Some basic terminology related to rate structures and rate designs is helpful in understanding this rate study. Although other water utilities across California and the United States use a wide

[2] For example, Bighorn-Desert View Water Agency v. Verjil (2006), Richmond v. Shasta Community Services District (2004), and Apartment Association of Los Angeles County, Inc. v. City of Los Angeles (2001).

variety of structures today, in reality, they are all based upon a few basic rate design concepts. A brief discussion of these basic rate design concepts is provided below.

> ***"Although other water utilities across California and the U.S. use a wide variety of structures today, in reality, they are all based upon a few basic rate design concepts."***

The starting point in considering rate structures is the relationship between fixed costs and variable costs. Most rate structures contain a fixed or minimum charge, and a volumetric charge.

Fixed Charges

Fixed charges can be called base charges, minimum charges, customer charges, meter charges, etc., and typically do not vary with the amount of water produced or the amount of effluent handled by a sewer system. Debt service is an example of a fixed cost.

Although fixed charges are typically a significant percentage of the utility's overall cost structure, utilities rarely collect 100% of their fixed costs through fixed charges; customers generally prefer to be charged on a volumetric basis.

A 2007 survey conducted by the California-Nevada Section of the American Water Works Association (AWWA)[3] indicated that 96% of the water utilities surveyed had some form of fixed charge. At a minimum, most fixed charges reflect the cost of meter reading, billing/accounting, and collection costs.

Fixed charges for water utilities typically increase by meter size. For example, a customer with a 2" meter may have a fixed meter charge that is eight times greater than the 5/8" or 3/4" meter charges based on the meter's safe operating capacity.[4] Because a large portion of water utilities' costs are typically related to meeting capacity requirements, reflecting individual demands for capacity are important in establishing rates for customers.

The City's fixed monthly charges for water are a combination of administrative costs (e.g., meter reading and billing) plus capacity-related costs that increase with meter size. Fixed charges for SFR sewer customers (and non-metered SFR water customers) include essentially all their costs rolled into a monthly "flat rate," whereas non-residential sewer customers are charged a much smaller fixed charge for a minimal level of administrative costs.

Variable (Consumption) Charges

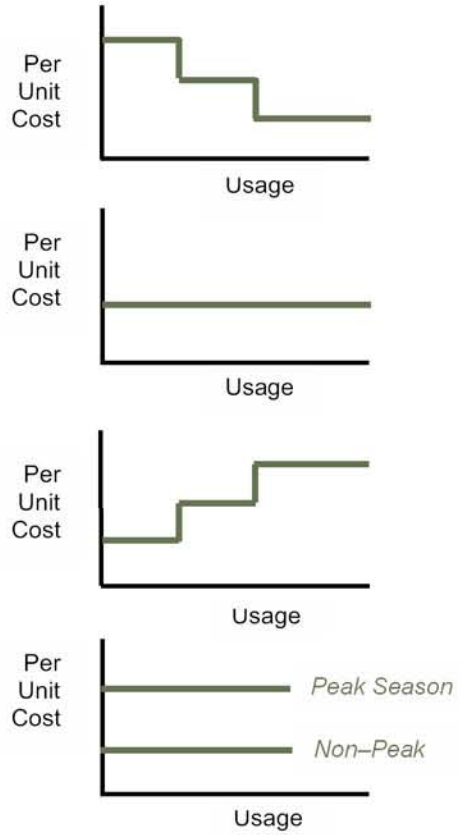
In contrast, variable costs tend to change with the quantity of water produced (or effluent handled), such as the cost of chemicals and electricity. For a water utility, variable charges are generally based on metered consumption and charged on a dollar-per-unit cost (one-thousand

[3] California-Nevada AWWA and Raftelis Financial Consultants, Inc., California-Nevada Water Rate Survey, (2007).

[4] American Water Works Association, Principles of Water Rates, Fees and Charges – M1 Manual, p. 202.

gallons in the City's case). They are generally one of four basic rate structures: ■ a declining block charge; ■ a uniform charge; ■ an inverted (increasing) block charge; and ■ seasonal charges, as seen in Figure 1.

Figure 1 – Overview of Variable Charge Water Rate Structures



DECLINING BLOCK RATE STRUCTURE
The cost per unit of consumption under a declining block rate structure decreases with additional units of consumption.

UNIFORM RATE STRUCTURE
The cost per unit of consumption under a uniform rate structure does not increase or decrease with additional units of consumption.

INCREASING BLOCK RATE STRUCTURE
The cost per unit of consumption under an inverted block rate structure increases with additional units of consumption.

SEASONAL RATE STRUCTURE
The cost per unit of consumption under a seasonal rate structure changes with time periods. The peak is the most expensive time period.

Figure 1 also illustrates the significant variation in the basic philosophy of each of these variable charge rate structures. Under a uniform rate structure, the cost per unit does not change with consumption, and provides a simple and straightforward approach from the perspective of customer understanding and rate administration/billing.

In contrast, the declining block rate structure is more complex, since both the number of blocks (e.g., three stepped blocks) and size of the blocks (e.g., 0 to 10,000 gallons) can vary.[5] However, the number of blocks should be reasonable (i.e., two to five blocks) for both of simplicity and ease of administration. A declining block rate structure implies there are certain economies of scale with additional consumption, and do not necessarily entail a "volume discount."

[5] "Blocks" or "Consumption Blocks" is used in a declining block or inverted block rate structure and refers to the amount of consumption allowed before the price changes to a succeeding price block. The initial block refers to the first price block (e.g., 0 to 5,000 gallons).

An inverted (or inclining) tiered block rate structure attempts to send a price signal to consumers that their consumption costs more as more water is consumed. Finally, a seasonal rate structure is a form of a time-differentiated rate structure in which water consumed in the summer is priced higher than winter water consumption. This structure typically reflects the higher costs associated with peak period usage when water supplies may be constrained.

Figure 2 provides a comparison of the volumetric rate structures, as surveyed by the California-Nevada AWWA 2007 Water Rate Survey.

Figure 2 - Summary of Volumetric Water Rate Structure Survey

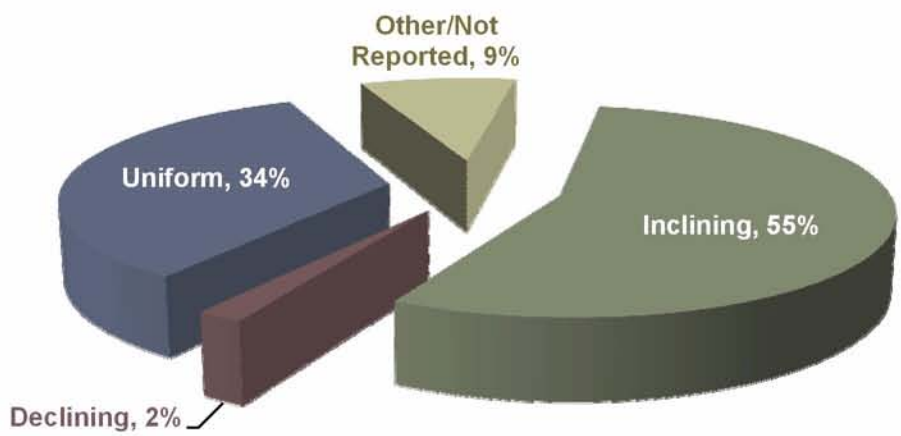


Figure 2 indicates that inclining block rate structures are the most predominate, followed by the uniform rate structure. However, across the U.S., volumetric rate structures are roughly split equally among inclining, declining, and uniform rate structures. The predominance of inclining block rate structures in California reflects water resource constraints and California's focus on conservation and efficient use.

The rate structures noted above may be combined to form different rate structures. As an example, a seasonal inverted block rate structure combines the seasonal rate structure concept with the inverted block rate structure. A more recent innovation in water rate design is the concept of a water budget rate structure, which is a form of an inverted block structure where the block sizes are tailored for each individual customer. The water budget allocation may be based upon one or several of the following:

- Lot size or size of landscaped area.
- Number of occupants.
- Type and size of business.
- The type of land use (i.e., residential, landscape, and commercial).
- Evapotranspiration rate for the billing period.

It should be noted that water budgets have had limited implementation within the water utility industry to date, primarily because of the administrative complexity and billing system software issues.[6] Because of this, City staff and HDR have not considered water budgets.

Current Industry Thinking and Trends

The California Urban Water Conservation Council (CUWCC) was created to increase efficient water use across California. CUWCC's goal is to integrate urban water conservation Best Management Practices (BMPs) into the planning and management of California's water agencies/utilities.

> ***"The CUWCC was created to increase efficient water use across California. CUWCC's goal is to integrate urban water conservation BMPs into the planning and management of California's water agencies/utilities."***

CUWCC notes that there currently is no industry benchmark to determine whether or not a water utility's rate structure is conservation-oriented. However, CUWCC's best management practices on pricing (BMP 11) define a conservation-based rate structure as one that "…provides economic incentives (a price signal) to customers to use water efficiently." It also notes the following volumetric rate designs are potentially consistent with this definition:

- **Uniform Rates** – in which the volumetric rate is constant regardless of the quantity consumed.
- **Seasonal Rates** – in which the volumetric rate reflects seasonal variation in water delivery costs.
- **Tiered Rates** – in which the volumetric rate increases as the quantity used increases.
- **Allocation-Based (Water Budget) Rates** – in which consumption tiers and respective volumetric rates are based on water use norms for *each individual customer,* as well as water delivery costs established by the utility.

In essence, the CUWCC recommends using "A quantifiable performance target of 70% that defines a minimum percentage of water sales revenue from volumetric rates."[7]

We note that HDR is not recommending using this target of 70% of revenue from volumetric rates for two reasons: ■ the City does not yet have complete data on the water consumption patterns of its largest customer class (SFR users); and ■ revenue stability needs to be established (and take priority at this time) under the new fully-metered system until sufficient data is available so that the City could reliably implement a more aggressive conservation-oriented water rate structure.

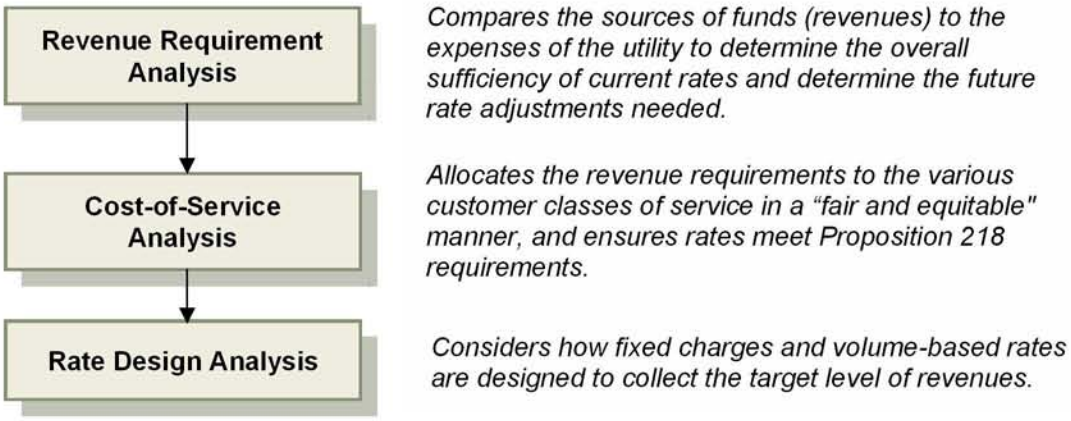
[6] For example, while the Irvine Ranch Water District has had water budget rates since 1991, only a handful of other municipalities in California have adopted this rate structure since then.

[7] *Revising BMP 11 (Conservation Pricing),* Memo to All Signatories to the MOU, from CUWCC Executive Director, April 9, 2007.

SECTION 2 - SEWER RATE STUDY

As background to this analysis, we note that any comprehensive utility rate study typically analyzes the three components shown in Figure 3: ■ the overall revenue requirements of the utility; ■ the cost to serve each customer class; and, finally, ■ the appropriateness of the rate structure design.

Figure 3 – Overview of Rate Study Components



This sewer rate analysis provides these three components, but note that the design of the sewer rates incorporated additional factors, such as an overall rate philosophy that emphasizes revenue stability and equity among different types of customers. The following are some of the basic components included in this analysis:

- **Unit Costs:** The revenue requirements were "functionalized" into customer service costs and flow-related costs. Unit costs for these functions were determined based on water consumption and the estimated effluent received at the City's treatment facility.
- **Revenue Requirements by Customer Class:** The total revenue collected from each customer class was determined using the unit costs times the total units, such as water use and number of accounts (or dwelling units) used by each class.
- **Fixed vs. Variable Costs and Rates:** The revenue requirements for each customer class are collected through a combination of fixed monthly charges and variable rates; although, the revenues from SFR customers are rolled into a single monthly flat rate. In contrast, commercial revenue requirements are collected through fixed monthly charges and a volume-based rate tied to their water consumption.

The fixed and volume-based charges were calculated based on the net revenue requirements, number of customer accounts, water consumption, and other City-provided information. Figure 4 on the following page summarizes the recommended water rates resulting from this cost-of-service rate analysis.

Figure 4 - Summary of Proposed Sewer Rates

Residential (Metered and Non-Metered)	Proposed Monthly Rate		
	Customer Cost ($/Account/Month)	Flow, BOD, and TSS Costs	Total Flat Rate
Single-Family Residential	$5.53	$18.48	$24.01 per SFR Unit
Multi-Family Residential	$5.53 ($0.15 per unit)	$14.20 per unit	$14.35 per MFR Unit
Other Customers	**Proposed Monthly Rate**		
Fixed Account Charge	$5.53		
Volume-Based Rate	Volume Charge($/1,000 gallons)		
School District	$1.18		
Commercial			
Low Strength	$0.91		
Medium Strength	$1.18		
High Strength	$2.26		

Revenue Requirements – Sewer Utility

To provide for the City's long-term financial needs, HDR has developed a financial plan extending through June 30, 2016. This financial plan projects sewer revenues and expenditures, including reserves, based on discussions with City staff and data provided by the City. Figure 5 on the following page presents a summary of this five-year financial plan, showing revenue requirements, revenue sources (including rate revenue), and necessary rate increases.

Rate increases are required for three aspects of the sewer utility's financial health:

- **Meeting Operations Costs:** The sewer utility must generate enough revenue to cover the expenses of sewer operations, including administration and accounting, collections operations, and the wastewater treatment plant operations. For Fiscal Year (FY) 2010/2011, the net revenue requirement (total annual expenses, including debt service, less non-rate revenues) is estimated to be $1,098,414.
- **Maintaining Adequate Bond Coverage:** The City is legally required to maintain a debt service coverage ratio of at least 1.20. However, HDR recommends a target coverage ratio of 1.40, which better supports the City's credit rating, may lower the cost of future long-term debt, and better supports the overall financial health of the City's sewer utility.

Figure 5 - Summary of the Revenue Requirements for Sewer Rate Study

	Budget	Projected Budgets and Rate Increases					
	FY 09/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16
Operations and Maintenance (O&M) Expense							
Sewer Administration and Accounting	$ 333,030	$ 340,000	$ 347,000	$ 354,000	$ 361,000	$ 368,000	$ 375,000
Sewer Collections Operations							
Utilities	$ 2,300	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 2,000
Salaries/Benefits	$ 201,510	$ 204,000	$ 236,000	$ 238,000	$ 240,000	$ 242,000	$ 244,000
Miscellaneous	$ 50,293	$ 51,000	$ 52,000	$ 53,000	$ 54,000	$ 55,000	$ 56,000
Sewer Wastewater Treatment Plant Operations							
Utilities	$ 81,000	$ 83,000	$ 150,000	$ 155,000	$ 160,000	$ 165,000	$ 170,000
Salaries/Benefits	$ 134,864	$ 136,000	$ 167,000	$ 169,000	$ 171,000	$ 173,000	$ 175,000
Miscellaneous	$ 96,158	$ 98,000	$ 100,000	$ 102,000	$ 104,000	$ 106,000	$ 108,000
Total Expenses	$ 899,155	$ 914,000	$ 1,054,000	$ 1,073,000	$ 1,092,000	$ 1,111,000	$ 1,130,000
Annual Debt Service	$ 217,414	$ 215,414	$ 109,622	$ 148,580	$ 146,330	$ 149,080	$ 146,580
Total Revenue Requirement	$ 1,116,569	$ 1,129,414	$ 1,163,622	$ 1,221,580	$ 1,238,330	$ 1,260,080	$ 1,276,580
Less: Non-Rate Revenues	$ 84,000	$ 31,000	$ 81,000	$ 81,405	$ 81,812	$ 82,630	$ 83,456
Net Revenue Requirement	**$ 1,032,569**	**$ 1,098,414**	**$ 1,082,622**	**$ 1,140,175**	**$ 1,156,518**	**$ 1,177,450**	**$ 1,193,124**
Less: Current Rate Revenues	$ 1,074,286	$ 1,074,286	$ 1,074,286	$ 1,079,657	$ 1,085,056	$ 1,095,906	$ 1,106,865
Surplus/(Deficiency) of Rate Revenue ($)	$ 41,717	$ (24,128)	$ (8,336)	$ (60,518)	$ (71,462)	$ (81,544)	$ (86,258)
Deficiency as a Percent of Rate Revenue	*N.A.*	*2.2%*	*0.8%*	*5.6%*	*6.6%*	*7.4%*	*7.8%*
Proposed Rate Adjustment	**0.0%**	**6.0%**	**4.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**
Additional Rate Revenue from Increase	$ -	$ 64,457	$ 110,007	$ 134,361	$ 159,435	$ 186,168	$ 139,166
Surplus/(Deficiency), Adjusted	$ 41,717	$ 40,329	$ 101,671	$ 73,843	$ 87,972	$ 104,624	$ 52,907
Revenue After Rate Increase		**$ 1,138,743**	**$ 1,184,293**	**$ 1,214,019**	**$ 1,244,491**	**$ 1,282,074**	**$ 1,246,031**
Ending Operating Reserve Balance	**$ 498,943**	**$ 228,500**	**$ 263,500**	**$ 268,250**	**$ 273,000**	**$ 277,750**	**$ 282,500**
Minimum 25% of Annual Operating Budget	*$ 224,789*	*$ 228,500*	*$ 263,500*	*$ 268,250*	*$ 273,000*	*$ 277,750*	*$ 282,500*
Ending CIP Reserve Balance	**$ 874,829**	**$ 1,379,937**	**$ 1,152,951**	**$ 1,365,095**	**$ 1,625,508**	**$ 1,673,356**	**$ 1,678,082**
Ending Balance - All Reserves	$ 1,373,772	$ 1,608,437	$ 1,416,451	$ 1,633,345	$ 1,898,508	$ 1,951,106	$ 1,960,582
Debt Service Coverage Ratio							
Before Rate Adjustment	1.2	0.9	0.9	0.6	0.5	0.5	0.4
After Proposed Rate Adjustment	1.2	1.2	1.9	1.5	1.6	1.7	1.4

- **Sustaining Reserve Funds:** The utility should maintain operating and capital improvement reserve funds. The operating reserve acts as a rate stabilization fund in which excess/surplus funds from rate revenues are transferred. Good management practice is to keep the balance at a minimum of three months (25%) of the operating budget. For FY 2010/11, this target amount is $228,500. Funds in excess of the 25% target amount can be transferred into the capital improvement reserve, which must be built up to fund future capital improvements and repair and replacement (R&R) costs.

In light of these requirements and recommended practices, HDR proposes the City adopt an increase in the sewer utility rate of 6% for FY 2010/11, 4% for FY 2011/12, and 2% each year for years FY 2012/13 through FY 2015/16, respectively.

HDR proposes the City adopt an increase in the sewer utility rate of 6% for FY 2010/11, 4% for FY 2011/12, and 2% each year for years FY 2012/13 through FY 2015/16, respectively.

Cost-of-Service Sewer Rate Analysis

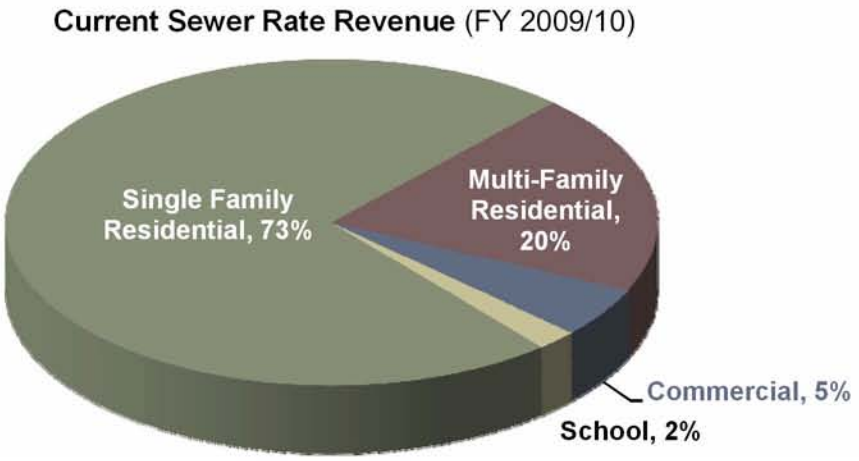
The overall methodologies used in this analysis follow generally-accepted industry standards and methodologies (i.e., Water Environment Federation [WEF]) with the intent of equitably allocating costs to the various functional categories related to the sewer utility (e.g., customer costs, fixed costs, and flow- and strength-related costs). The fixed and volume-based charges were calculated based on the net revenue requirements, the number of customer accounts, water consumption, and other information provided by the City. In light of these generally-accepted practices, several specific changes in the sewer rate design should be noted:

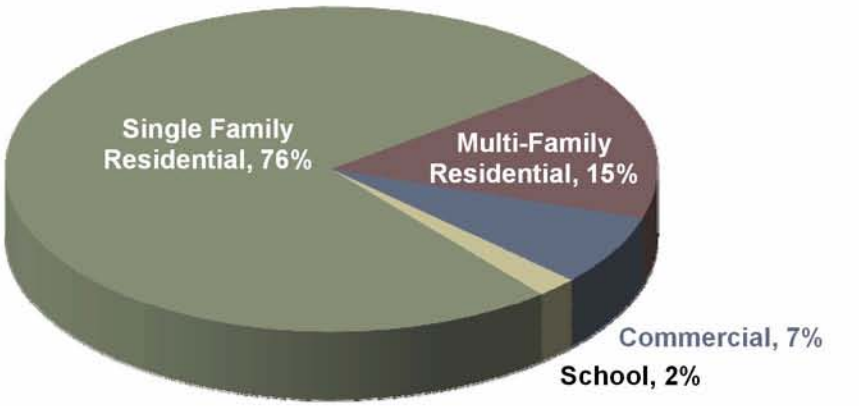
- **Lot-Size Factors are Eliminated:** Current rates assign "service units" based on lot size (for both water and sewer rates). These factors have little justification in a cost-of-service analysis and were therefore eliminated. In other words, there is no data supporting the practice of assigning higher costs to customers based on lot size.
- **School Discount Rates are Eliminated:** The City's current rate structure includes a discount of 20% for Tier 2 water consumption and 50% for Tier 3 consumption. This discount is eliminated as well.
- **Multi-Family Rates are Reduced:** As a result of the cost-of-service analysis, the estimated effluent generation for multi-family residential (MFR) customers was less than previously reflected in MFR rates. Current rates, which were 84% of SFR rates were reduced to 60% of SFR rates. This change is now more in line with cost-of-service principles.
- **Commercial Rates Now Reflect Effluent Strength:** Current rates do not attempt to allocate a higher share of costs to commercial customers that generate higher levels of biochemical oxygen demand (BOD) and total suspended solids (TSS). However, since those components cost more to treat, HDR assigned higher volume-based rates to higher strength customers, such as restaurants, and lower costs to lower strength customers such as car washes and professional offices.

Comparison of Current and Proposed Sewer Rate Structures

A summary of the recommended sewer rates resulting from the cost-of-service rate analysis were presented above in Figure 4. The current and proposed amounts of revenue collected from each customer class are shown in Figure 6 on the following page.

Figure 6 - Current and Proposed Revenue Collected from Sewer Customers





In the rate study workshop with the City Council, the council asked about the number of accounts by customer class.[8] Therefore, we have provided this information in Figure 7 on the following page along with the current rates by customer class. The projected rates for FY 2011/12 and FY 2012/13 assume across-the-board rate increases based on the recommended four percent (4%) and two percent (2%) increases, respectively.[9]

[8] This was the May 19, 2010 rate study workshop at 5:30 PM in Council Chambers.

[9] As shown in Figure 5 on the line "Proposed Rate Adjustment".

Residential (Metered and Non-Metered)	Customer Accounts	Current Flat Rates
Single-Family Residential	2,997	$23.50
Multi-Family Residential (per unit)	1,016	$19.64
Multi-Family Residential (accounts)	24	

Commercial Customers	Customer Accounts	Current Minimum Monthly Bill	Current Volume Charges		
Volume-Based Rate (based on water use)			<200,000 gallons	200,000 to 2 million gallons (MG)	>2 MG
School Districts (reflects total monthly bill)	19	$23.50	$23.50	$18.80	$11.75
Commercial					
Low Strength	81	$23.50	$23.50	$23.50	$23.50
Medium Strength	24	$23.50	$23.50	$23.50	$23.50
High Strength	22	$23.50	$23.50	$23.50	$23.50

Figure 7 - Current Sewer Customer Accounts and Rates

Single-Family Residential

The City currently charges a monthly flat rate of $23.50 per SFR account, and gives seniors a discounted rate of $19.65 per month. HDR recommends a fixed monthly sewer charge of $24.01 for all SFR customers (eliminating the senior discount).

HDR recommends a fixed monthly sewer charge of $24.01 for all SFR sewer customers.

Figures 8 and 9 on the following page show the City's current and proposed monthly SFR sewer bills compared to sewer bills of selected surrounding communities.

As noted earlier, the discount for seniors was eliminated since it conflicts with Proposition 218 requirements. The basis of the proposed charge is an assumed average monthly consumption of 19,000 gallons of water per SFR customer. When the City's metering implementation is complete (anticipated end of FY 2011/12), actual consumption can be tracked and analyzed to update this value.

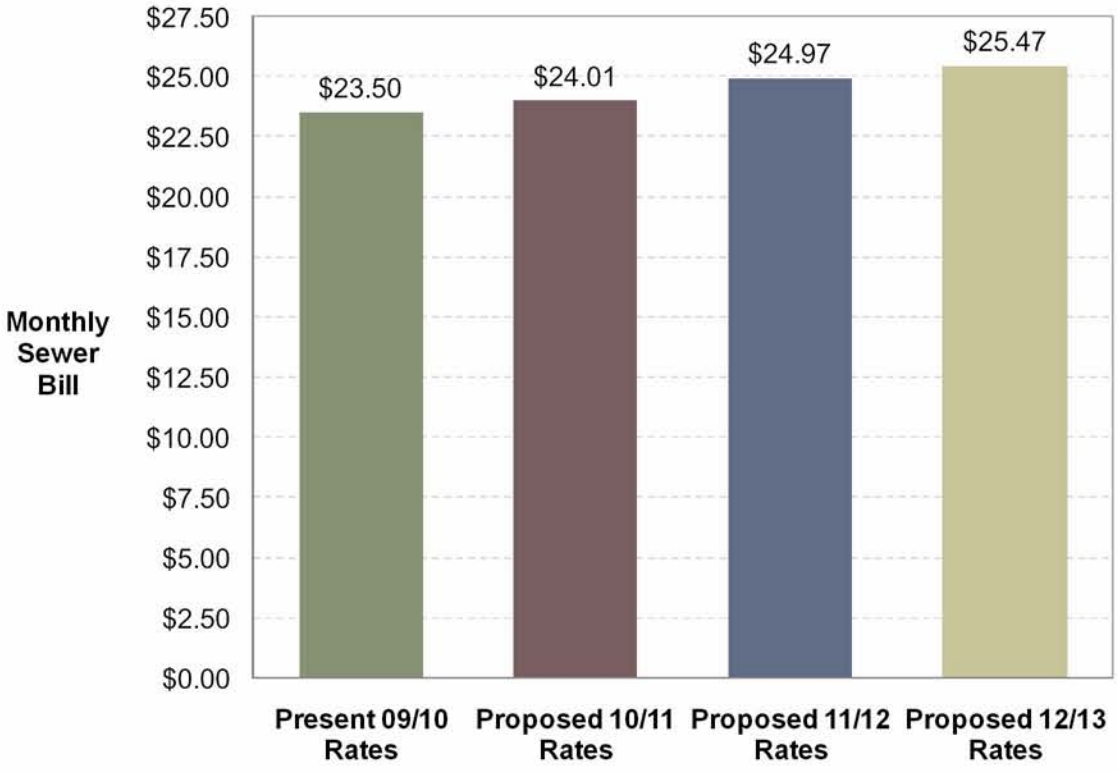


Figure 8 - Monthly Sewer Bill Comparison for SFR Customers

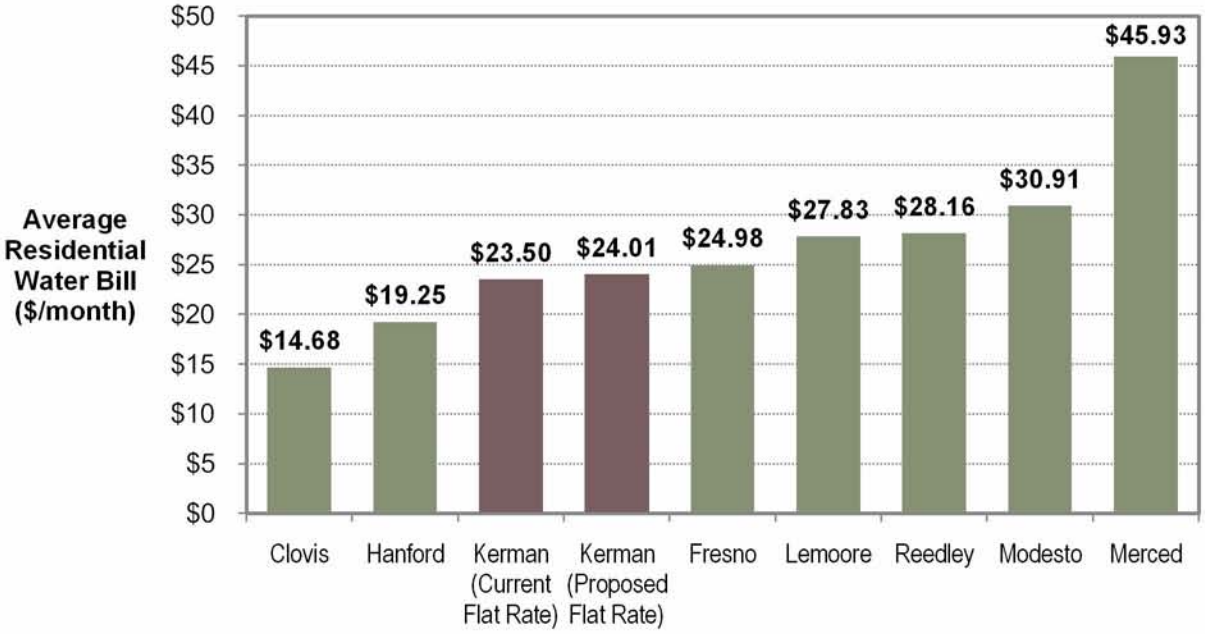


Figure 9 - Monthly SFR Sewer Bills of Surrounding Communities

Multi-Family Residential

The City currently charges metered and non-metered MFR accounts differently:

- **Non-metered accounts** are charged 75% of the SFR rate, currently $17.63 per unit.
- **Metered accounts** are charged $24.55 per 20,000 gallons of water consumed, with a minimum of $19.64 per unit.

Figure 10 compares current and recommended monthly sewer bills for MFR customers.

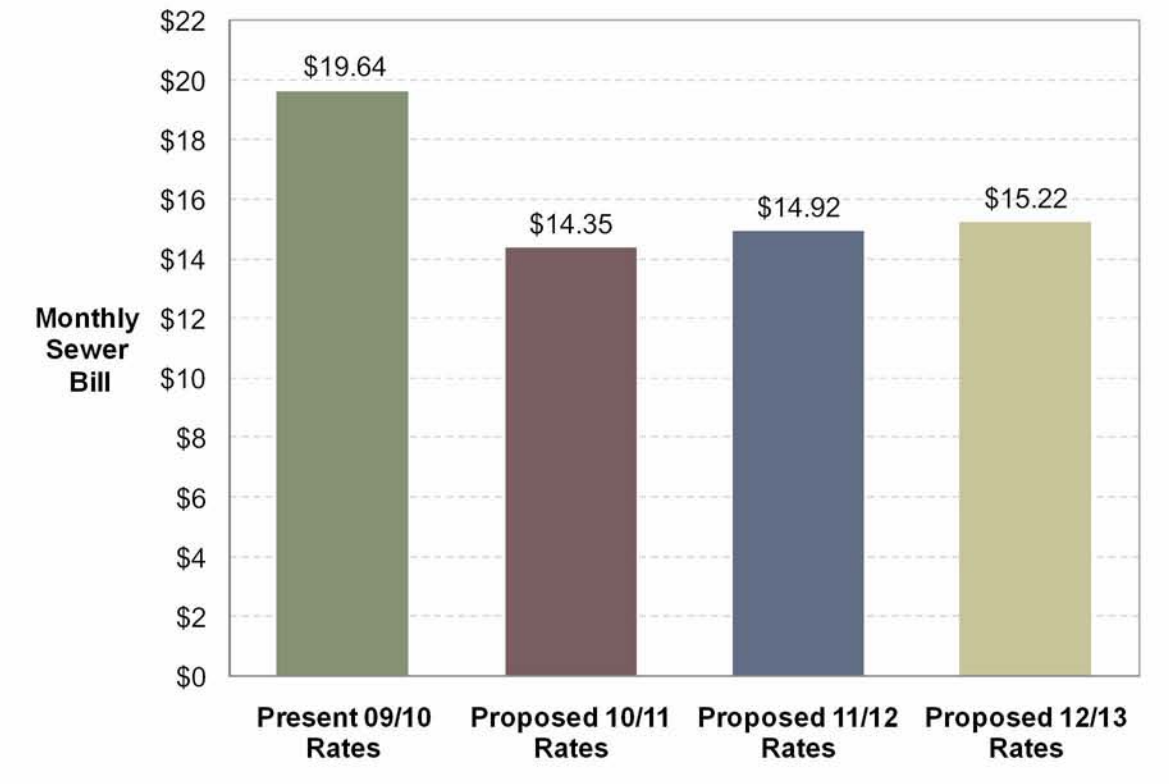


Figure 10 - Monthly Sewer Bill Comparison for MFR Customers

HDR proposes a fixed monthly sewer charge of $14.35 per apartment unit for all accounts, metered or non-metered.

HDR proposes a fixed monthly sewer charge of $14.35 per apartment unit for all accounts, metered or non-metered. The basis of this charge includes a fixed customer cost of $5.53 per account (this averages out across all MFR customers to be $0.15 per MFR unit), as well as the proportional costs associated with flow, BOD, and TSS, which total $14.20 per MFR unit. This is based on an assumed average monthly consumption of approximately 12,000 gallons of water per MFR unit and state guidelines for typical strength factors (i.e., BOD and TSS) contributed into wastewater influent. When the City's metering implementation is complete (anticipated FY 2011/12), actual consumption can be tracked to update this assumed water use and the recommended rates.

Commercial

The City bills commercial customers based on a two-tier, declining block consumption basis. Customers are charged a base monthly fee of $24.55, which includes water consumption up to 20,000 gallons plus $24.55 per additional 20,000 gallons water consumed, up to 200,000 gallons of water, and then $23.50 per 20,000 gallons of water consumed in excess of 200,000 gallons. Figure 11 shows the monthly bill comparison for sewer commercial customers.

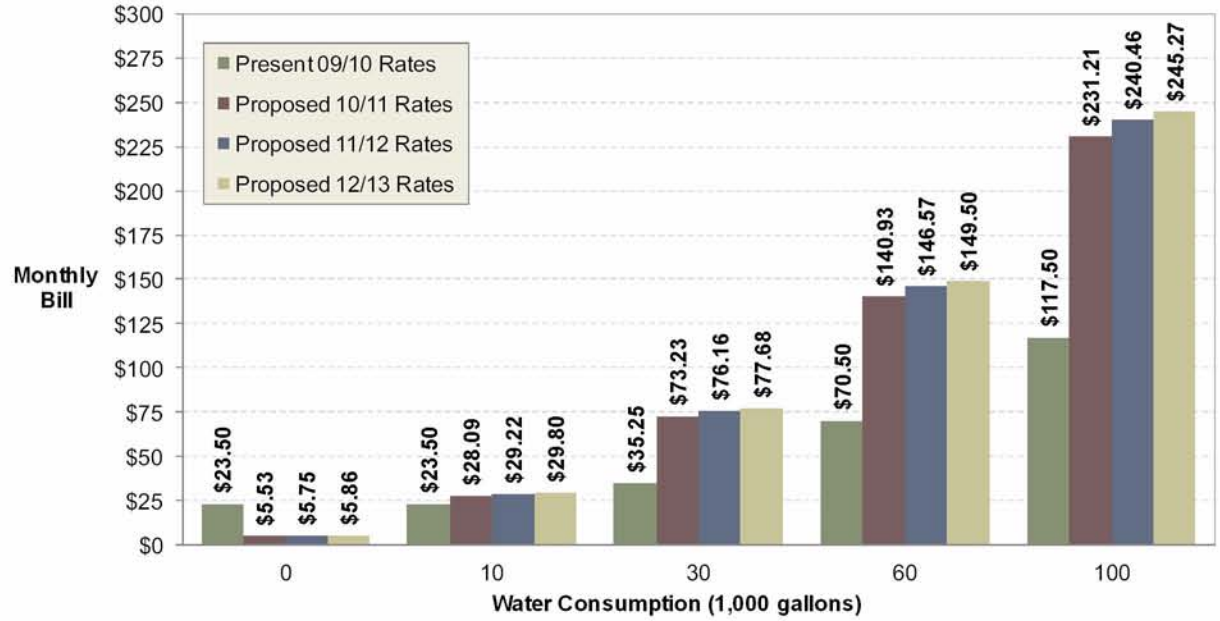


Figure 11 - Monthly Sewer Bill Comparison for Commercial Customers

HDR proposes to charge fixed customer cost of $5.53 per month, plus a variable charge based on water consumption, and recommends classifying each commercial account as a "high-," "medium-," or "low-" strength customer, which will be identified from anticipated loadings to the wastewater treatment plant. The proposed volume charges for high-, medium-, and low-strength customers are $2.26, $1.18, and $0.91 per 1,000 gallons, respectively.

HDR proposes to charge fixed sewer customers a cost of $5.53 per month, plus a variable charge based on water consumption, and recommends classifying each customer account, and a high-, medium-, or low-strength customer.

School District Sites

The City currently bills school districts on a three-tier, declining block consumption basis: ■ $24.55 per 20,000 gallons up to 200,000 gallons; ■ $19.64 (80% of the first tier) per 20,000 gallons between 200,000 and 2,000,000 gallons; ■ $12.28 (50% of the first tier) per 20,000 gallons over 2,000,000 gallons of water used. This is essentially a subsidy under Proposition 218.

HDR proposes a fixed school district sewer customer cost charge of $5.53 per account (or facility billed), plus a variable charge of $1.18 per 1,000 gallons consumed.

The proposed rates are a fixed customer cost charge of $5.53 per account (or facility billed), plus a variable charge of $1.18 per 1,000 gallons consumed. Figure 12 shows the monthly bill comparisons for a 350-student school at various consumption levels.

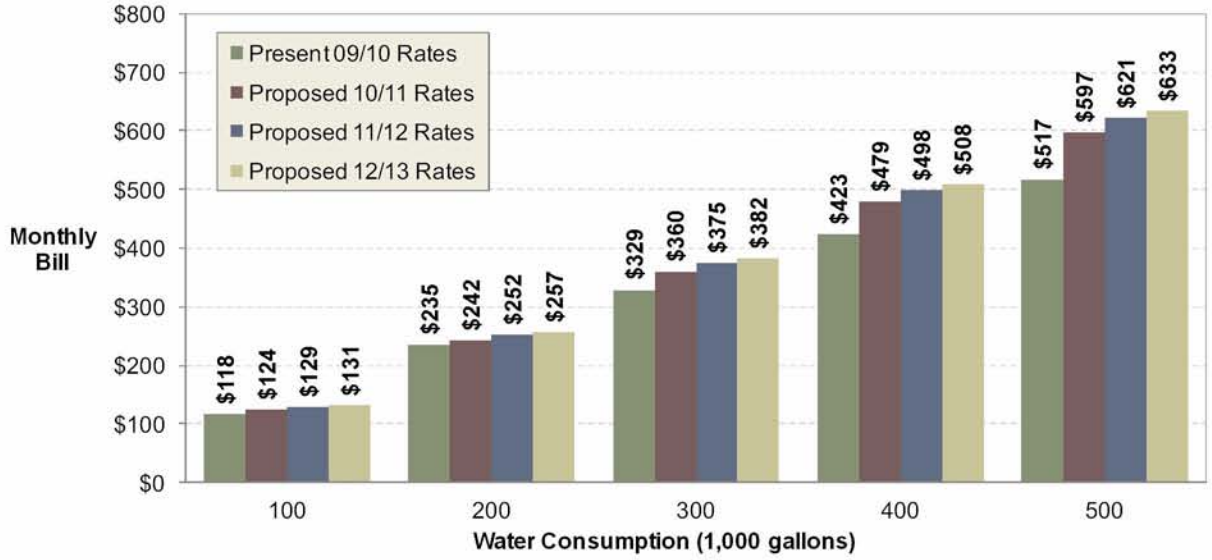


Figure 12 – Monthly Sewer Bill Comparison for a 350-Student School

HDR also considered establishing rates for school district accounts based on average daily attendance (ADA) for students, faculty, and staff at each school district site, as well as the state guidelines of effluent generation per student (10 gallons per day per student). Rates using this method will include the fixed customer cost charge of $5.53 per account (or facility billed) plus a charge of $0.79 per ADA. A bill comparison using the ADA method is presented in Figure 13 on the following page and reflects the bill of a school with 350 ADA.

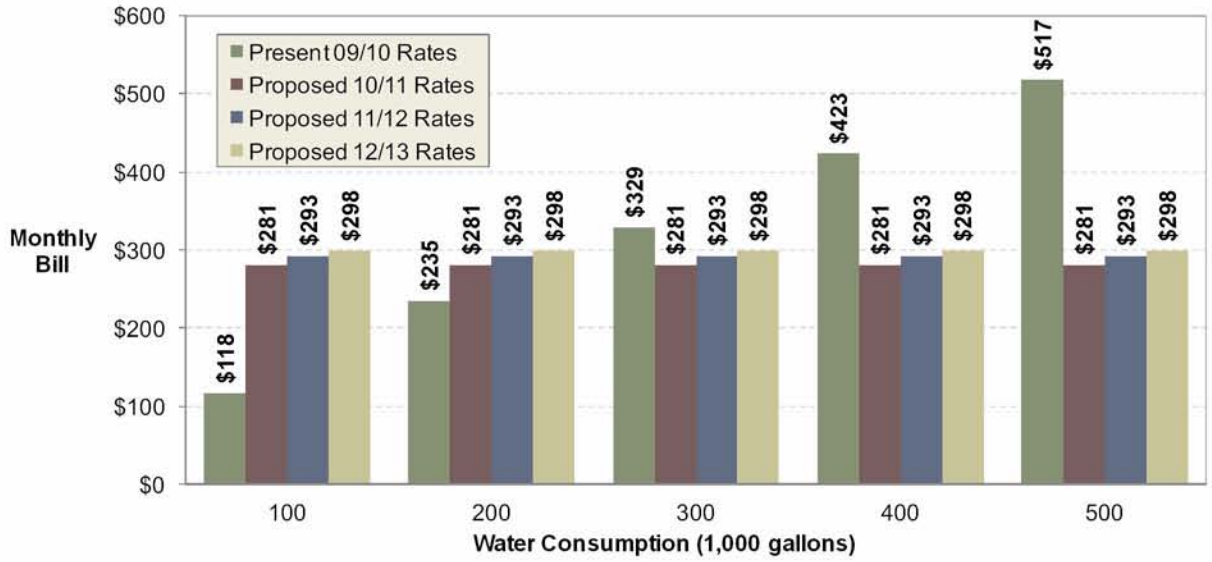


Figure 13 - Monthly Sewer Bill Comparison for 350-Student School Using Average Daily Attendance Method

The City has been negotiating with the school district regarding the new sewer (and water) rate structure. Whatever the City and schools ultimately agree upon, the new rate structure for schools should:

- Be based on cost-of-service principles consistent with this rate analysis.
- Encourage a greater level of conservation, which would also be consistent with the overall objectives of new rates for other customer classes.
- Comply with Proposition 218 requirements regarding subsidies.

Actual monthly bills for schools will obviously be determined by either their metered consumption or number of ADA, depending on what the City council chooses.

SECTION 3 - WATER RATE STUDY

This section outlines the water rate analysis and discusses how proposed rates were developed.

As previously noted (in Figure 3), the three things a comprehensive rate study typically analyzes, which are addressed in this study, are: ■ the overall financial requirements of the utility; ■ the cost to serve each customer class; and ■ the appropriateness of the rate structure.

The proposed City rates were developed by evaluating specific components, including:

- **Unit Costs:** The water revenue requirements were "functionalized" into three categories, including customer service costs, fixed capacity costs, and variable (or volume-based) costs. Unit costs for each of these functions were determined based on allocations to functional areas, water consumption, and number of accounts by meter size and customer class.[10]
- **Revenue Requirements by Customer Class:** The total revenue that should be collected from each customer class was determined using the unit costs and the total units that each class uses. For example, customer costs are allocated based on number of accounts, while volume-related costs are allocated based on the water consumption for each class by meter size.
- **Fixed vs. Variable Costs and Rates:** The revenue requirements for each customer class are collected through a combination of fixed monthly charges and variable rates. Fixed costs, such as customer service, billing, and general administrative costs, are typically collected through a fixed monthly charge, while pumping costs and water supply are typically collected through volume charges. However, more aggressive water conservation goals would necessitate a higher percentage of costs being allocated to variable (volume-based) charges.

The fixed and volume-based charges were calculated based on the net revenue requirements, number of customer accounts, water consumption, and other City-provided information. Figure 14 on the following page summarizes the recommended water rates resulting from this cost-of-service rate analysis.[11]

As shown in Figure 14, all metered accounts, regardless of customer class, are charged a fixed rate (based on meter size), plus a variable (volume-based) rate. Projected rates after FY 2010/11 assume an across-the-board rate increase based on the recommended percent increases.

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[10] The CUWCC recommends recovering 70% of rate revenue through volume-based rates. However, water utilities generally develop their own policy and conservation objectives.

[11] The percent increases in FY 2010/11 indicate the changes from current rates, and reflect the combination of administrative costs (e.g., meter reading and billing) and the hydraulic capacity of each meter size, whereas FY 2011/12 and 2012/13 are "across-the-board" increases of the previous year's rates.

Figure 14 – Summary of Proposed Water Rates

Customer Class	Proposed Rates
Non-Metered Customers	
Single-Family Residential (19,000 gallons/month)	$26.22/customer
Multi-Family Residential	$16.28/dwelling unit
Commercial	$44.31/account
Metered Customers	
Average Metered Customer	
Single-Family Residential (16,000 gallons/month)	$24.97/customer
Multi-Family Residential	$14.03/unit
Meter Charges (Fixed Monthly Charges)	
3/4" Meter	$17.77
1" Meter	$28.21
1.5" Meter	$54.28
2" Meter	$127.30
3" Meter	$236.83
4" Meter	$393.30
6" Meter	$784.46
Volume Charge (per 1,000 gallons)	**$0.45**

Revenue Requirements – Water Utility

Figure 15 on the following page presents a summary of the proposed water utility financial plan and shows revenue requirements, the introduction of a rate stabilization fund, revenue sources, and necessary rate increases.

As described in Section 2, rate increases are governed by meeting operating costs, maintaining adequate debt coverage, and sustaining appropriate reserve funds. The City's water utility current state, with regards to these three aspects, is summarized below:

- **Meeting Operating Costs:** For FY 2010/11, the net revenue requirement (total annual expenses, including debt service, less non-rate revenues) is estimated to be $1,356,260.
- **Maintaining Adequate Debt Coverage:** The City is legally required to maintain a debt service coverage ratio of at least 1.20. To be conservative, it is recommended to have a coverage ratio of 1.40, which better supports the City's credit rating, may lower the cost of future long-term debt, and better supports the overall financial health of the City's water utility. Not increasing rates in FY 2010/11 will result in a ratio of 0.72.

Figure 15 - Summary of the Revenue Requirements for Water Rate Study

	Budget	Projected Budgets and Rate Increases					
	FY 09/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16
Operating Expenses							
Water Administration and Accounting	$385,024	$388,874	$392,763	$396,691	$400,658	$404,664	$408,711
Water Operations							
Utilities	272,000	280,160	288,565	297,222	306,138	315,323	324,782
Salaries/Benefits	330,099	333,400	366,000	369,660	373,357	377,090	380,861
Miscellaneous	175,204	176,956	178,726	180,513	182,318	184,141	185,983
Debt Service	203,870	203,870	203,870	203,870	203,870	165,000	165,000
Total Expenses	1,366,197	1,383,260	1,429,923	1,447,955	1,466,340	1,446,218	1,465,337
Less: Miscellaneous Revenues	57,000	27,000	27,000	27,135	27,271	27,543	27,819
Net Revenue Requirement	$ 1,309,197	$ 1,356,260	$ 1,402,923	$ 1,420,820	$ 1,439,070	$ 1,418,675	$ 1,437,518
Less: Current Rate Revenues	$ 1,300,000	$ 1,300,000	$ 1,300,000	$ 1,306,500	$ 1,313,033	$ 1,326,163	$ 1,339,424
Surplus/(Deficiency) of Rate Revenue ($)	$ (9,197)	$ (56,260)	$ (102,923)	$ (114,320)	$ (126,037)	$ (92,512)	$ (98,093)
Deciciency as a Percent of Rate Revenue	*0.7%*	*4.3%*	*7.9%*	*8.8%*	*9.6%*	*7.0%*	*7.3%*
Proposed Rate Adjustment	**0%**	**8.0%**	**5.0%**	**2.0%**	**2.0%**	**2.0%**	**2.0%**
Additional Rate Revenue from Increase	$ -	$ 104,000	$ 174,200	$ 204,702	$ 236,101	$ 269,755	$ 182,903
Surplus/(Deficiency), Adjusted	$ (9,197)	$ 47,740	$ 71,277	$ 90,382	$ 110,064	$ 177,243	$ 84,810
Proposed Adjusted Net Revenue	**–**	**$1,404,000**	**$1,474,200**	**$1,511,202**	**$1,549,134**	**$1,595,917**	**$1,522,328**
Ending Rate Stab. Reserve Balance	**$ 195,000**	**$ 211,000**	**$ 221,000**	**$ 227,000**	**$ 232,000**	**$ 239,000**	**$ 228,000**
Minimum 15% of Rate Revenue	*$ 195,000*	*$ 211,000*	*$ 221,000*	*$ 227,000*	*$ 232,000*	*$ 239,000*	*$ 228,000*
Ending Operating Reserve Balance	**$ 1,269,367**	**$ 294,848**	**$ 306,513**	**$ 311,021**	**$ 315,618**	**$ 320,304**	**$ 325,084**
Minimum 25% of Annual Operating Budget	*$ 290,582*	*$ 294,848*	*$ 306,513*	*$ 311,021*	*$ 315,618*	*$ 320,304*	*$ 325,084*
Ending CIP Reserve Balance	**$ 558,562**	**$ 992,123**	**$ (124,144)**	**$ 83,619**	**$ 261,010**	**$ 282,683**	**$ 236,373**
Ending Balance - All Reserves	**$ 2,022,929**	**$ 1,497,971**	**$ 403,370**	**$ 621,641**	**$ 808,628**	**$ 841,988**	**$ 789,457**
Debt Service Coverage Ratio							
Before Rate Adjustment	0.95	0.72	0.50	0.44	0.38	0.44	0.41
After Proposed Rate Adjustment	0.95	1.23	1.35	1.44	1.54	2.07	1.51

- **Sustaining Reserve Funds:** The water utility should maintain rate stabilization, operating, and capital improvement reserve funds. The rate stabilization reserve has been introduced to help cover operating costs when the City experiences lower-than-anticipated rate revenues. This is especially important in the water utility because much of the revenue is based on water consumption, which can vary significantly from month to month. HDR proposes a one time transfer of $215,000 from the capital improvement reserve to initiate this fund. Good management practice is to keep this balance at a minimum of 15% of anticipated water rate revenue. Excess/surplus funds from operations will be transferred to/from the operating reserve, which targets to have a balance of at least three months (25%) of the operating budget. Excess of this target can be transferred into the capital improvement reserve, which must be built up to fund future capital improvements and R&R costs.

In light of these requirements and recommended practices, HDR proposes the City adopt an increase in the water utility rate of 8% for FY 2010/11, 5% for FY 2011/12, and 2% in FY 2012/13 through FY 2015/16.

HDR proposes the City adopt an increase in the water utility rate of 8% for FY 2010/11, 5% for FY 2011/12, and 2% in FY 2012/13 through FY 2015/16

Cost-of-Service Water Rate Analysis

As previously discussed in the sewer rate analysis, a comprehensive rate study is typically used for three purposes: ■ to evaluate the overall financial requirements of the utility; ■ to analyze the cost to serve each customer class; and, finally, ■ to evaluate the appropriateness of the rate structure.

The overall methodologies used in this analysis follow generally-accepted industry standards and methodologies (i.e., WEF) and are intended to equitably allocate the City's costs to the various functional categories related to the water utility. However, in light of generally-accepted practices, several specific changes in the proposed water rates should be noted:

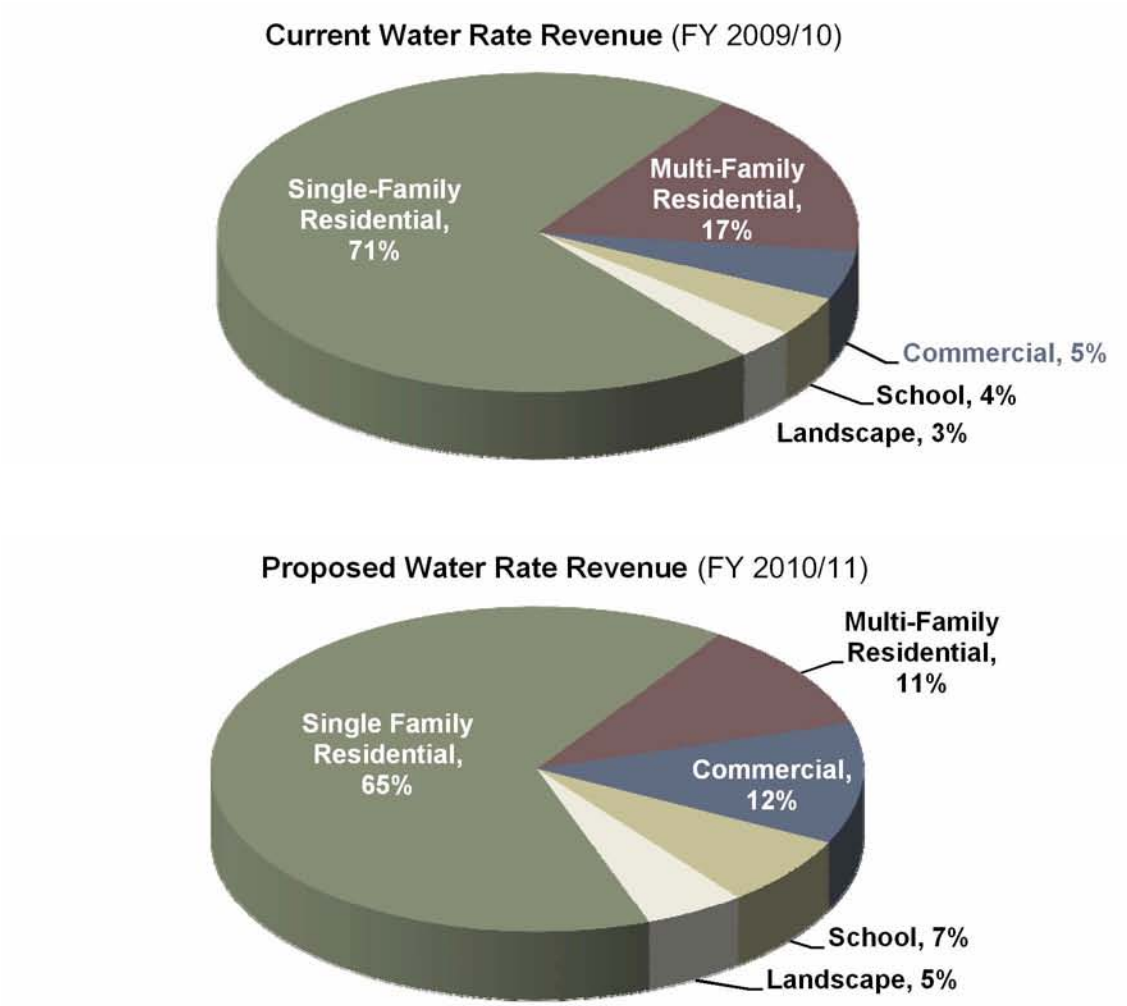
- **Lot Size Factors Were Eliminated:** Current water rates assign "service units" based on lot size. These factors were eliminated because they are unnecessary once metered consumption is available, and they have little justification based on actual data. In other words, there is no data supporting the practice of assigning higher costs to customers based on lot size.
- **Meter-Size Factors Were Added:** The City's current water rates do not appropriately reflect the cost of providing capacity in the system in that fixed costs are the same regardless of meter size. However, because larger meters impose a larger "demand" on the system, and the costs of meeting larger demand is higher, we have incorporated fixed charges that increase with meter size. This is a more equitable, and industry standard, for allocating fixed capacity costs.
- **Senior Discount Rates Are Eliminated: Current Rates include a 20% discount for seniors.** Proposition 218 does not allow a subsidy of one customer class at the expense of other customers. Therefore, seniors are now treated exactly the same as other SFR customers.
- **School Discount Rates are Eliminated:** The City's current rate structure includes a discount of 20% for Tier 2 water consumption and 50% for Tier 3 consumption. This discount, which is another form of a subsidy, is eliminated for similar reasons.
- **Multi-Family Rates Are Reduced:** As a result of the cost-of-service analysis, the estimated water consumption for MFR customers was lower than currently reflected in MFR rates, which are75% to 80% of SFR rates.[12] The proposed MFR rates are 62% of the SFR unmetered rate and 56% of the SFR metered rate (see Figure 14 above).

[12] Minimum MFR rates ($19.64/unit) is 80% of the SFR rate while Unmetered MFR rates ($18.41) is 75% of SFR.

Comparison of Current and Proposed Water Rate Structures

Figure 16 provides a comparison of the revenue collected from each customer class under the current versus proposed water rates, and indicates there were some adjustments to the amount of rate revenue collected from customer classes based on the cost-of-service analysis.

Figure 16 - Current and Proposed Revenue Collected from Water Customers



In response to City Council inquiries about the number of customers by class and meter size, we have summarized this data in Figure 17 on the following page. As this figure indicates, the vast majority (over 90 percent) of customers are single-family residential, although in terms of meter size, all meters larger than one-inch are in non-single family accounts.

Figure 17 – Number of Water Accounts by Meter Size

Customer Classes	Meter Size							Total
	3/4"	1"	1.5"	2"	3"	4"	6"	
SFR Accounts (Non-Metered)	1,357	-	-	-	-	-	-	1,357
SFR Accounts (Metered)	1,622	18	-	-	-	-	-	1,640
MFR Accounts (Non-Metered)	-	9	4	13	-	4	-	30
MFR Meters	2	5	3	11	-	4	1	26
Commercial Accounts (Non-Metered)	-	66	-	-	-	-	-	66
Commercial Accounts (metered)	26	41	20	33	1	7	-	128
Landscape Accounts	-	9	2	16	1	2	-	30
School Accounts	7	1	2	2	1	8	2	23

Single-Family Residential

The City currently charges a monthly flat rate of $24.55 and $19.65 for unmetered SFR and senior accounts, respectively. Metered customers are charged on a declining two-tier block - $24.55 per 20,000 gallons up to 200,000 gallons, and $23.50 per additional 20,000 gallons. Figure 18 shows the monthly water bill comparison for SFR customers, which include unmetered flat rates and average metered rates.[13]

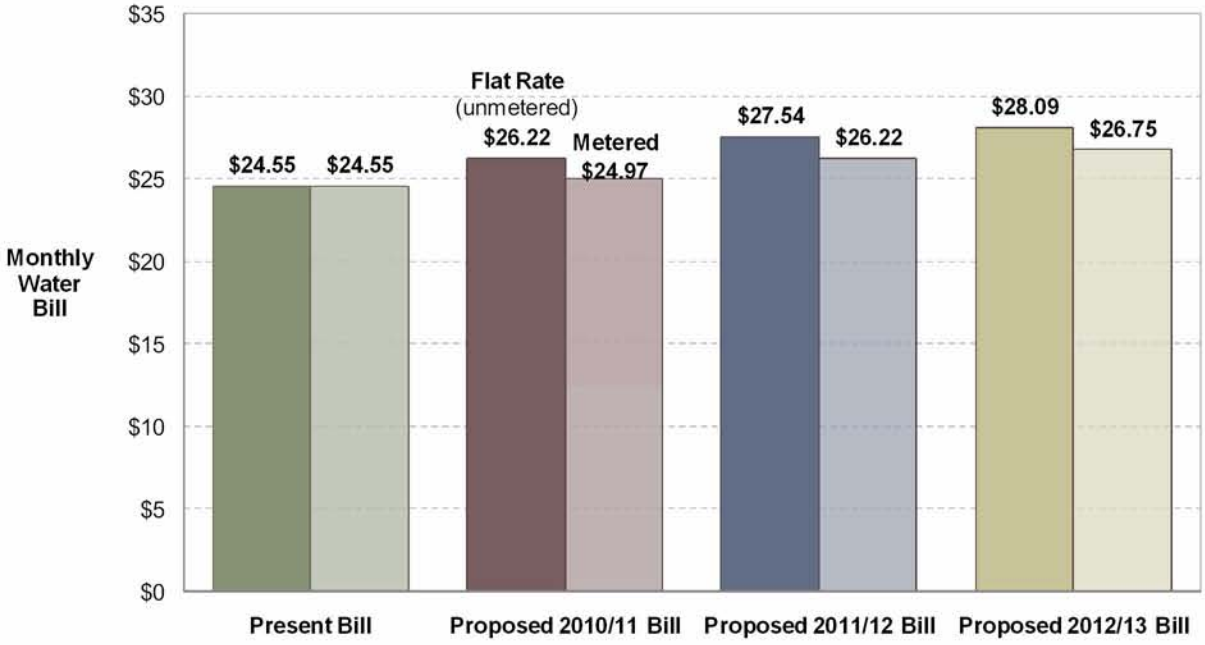


Figure 18 - Monthly Water Bill Comparison for SFR Customers

[13] Until all SFR customers are metered, the City will continue billing unmetered accounts using a flat monthly rate. Monthly bills for metered SFR accounts will be higher or lower than the average shown here based on their actual consumption.

HDR recommends a flat monthly rate of $26.22 for non-metered SFR customers. Metered customers will be charge per the rate schedule previously shown in Figure 14, with the average SFR customer having a monthly bill of $24.97 (assuming a ¾-inch meter). The difference in bills is due to anticipated additional conservation of metered customers.

HDR recommends a flat monthly rate of $26.22 for non-metered SFR water customers.

Figure 19 shows the monthly SFR water bills in surrounding communities.

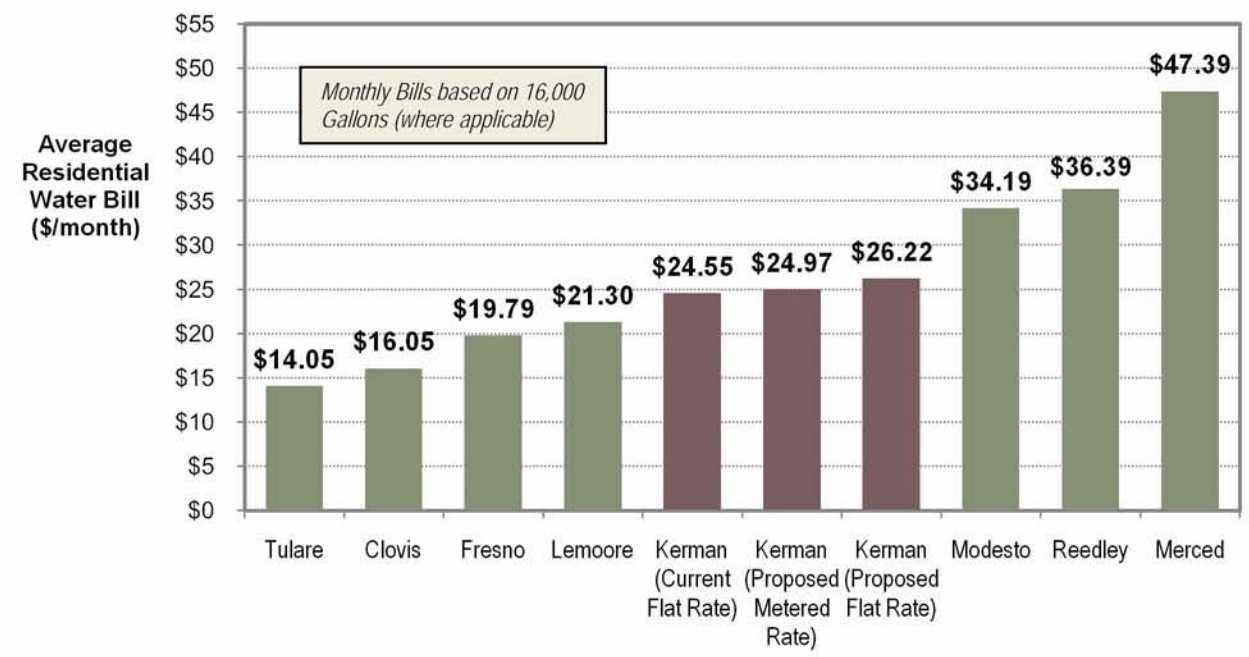


Figure 19 - Monthly SFR Water Bills in Surrounding Communities

As noted earlier, the discount for seniors was eliminated because it is inconsistent with Proposition 218 requirements. The basis of the proposed un-metered charge is an assumed average monthly consumption of 19,000 gallons of water per non-metered SFR customer.[14]

Once the City's metering implementation program is completed (this is anticipated by the end of FY 2011/12), actual consumption will be used to track consumption and all residents will be billed on actual water usage. We expect the rates will need to be adjusted once this occurs to more accurately reflect residential consumption patterns.

[14] Based on HDR's review of the City's water system, average single-family consumption is expected to be approximately 20,000 gallons/month. However, due to expected conservation and a response of residents to higher water rates (referred to as the "price elasticity of demand"), an averaged consumption of about 19,000 gallons for unmetered residents and closer to 16,000 gallons for metered customers was estimated.

Multi-Family Residential

The City currently charges metered and non-metered MFR accounts differently:

- **Non-metered** accounts are charged per apartment unit at 75% of the SFR rate, currently $18.41 per unit.
- **Metered accounts** are charged $24.55 per 20,000 gallons of water consumed or at least the minimum of $19.64 per unit.

Figure 20 shows the monthly water bill comparison for MFR customers, which include unmetered flat rates and average metered rates.

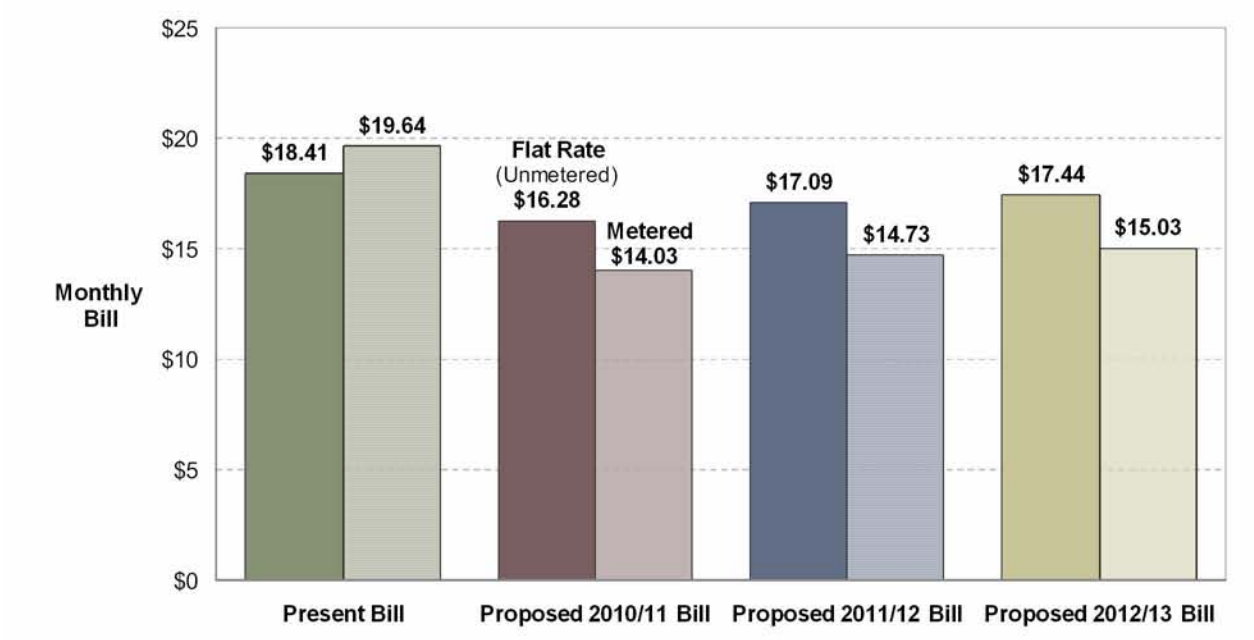


Figure 20 - Monthly Water Bill Comparison for MFR Customers

HDR proposes a fixed monthly water charge of $16.28 per apartment unit for unmetered accounts. However, a typical monthly water bill per metered MFR dwelling unit can range from $9.34 and $16.41, depending on the size of apartment complex and the number of meters it has installed. The average metered MFR unit monthly bill is estimated to be closer to $14.03. The basis of this charge includes the assumption that MFR units use an average monthly consumption of approximately 12,000 gallons of water per MFR unit. As with SFR customers, once the City's metering implementation is completed and better consumption data is available, this estimated consumption and rates should be re-evaluated.

HDR proposes a fixed monthly water charge of $16.28 per apartment unit for unmetered MFR accounts.

Commercial

The City currently bills commercial customers based on a two-tier, declining block consumption basis. Customers are charged a base monthly fee of $24.55, which includes water consumption up to 20,000 gallons, plus $24.55 for every additional 20,000 gallons of water consumed up to 200,000 gallons of water, and then $23.50 per 20,000 gallons of water consumed in excess of 200,000 gallons. Figure 21 shows a monthly water bill comparison for commercial customers.

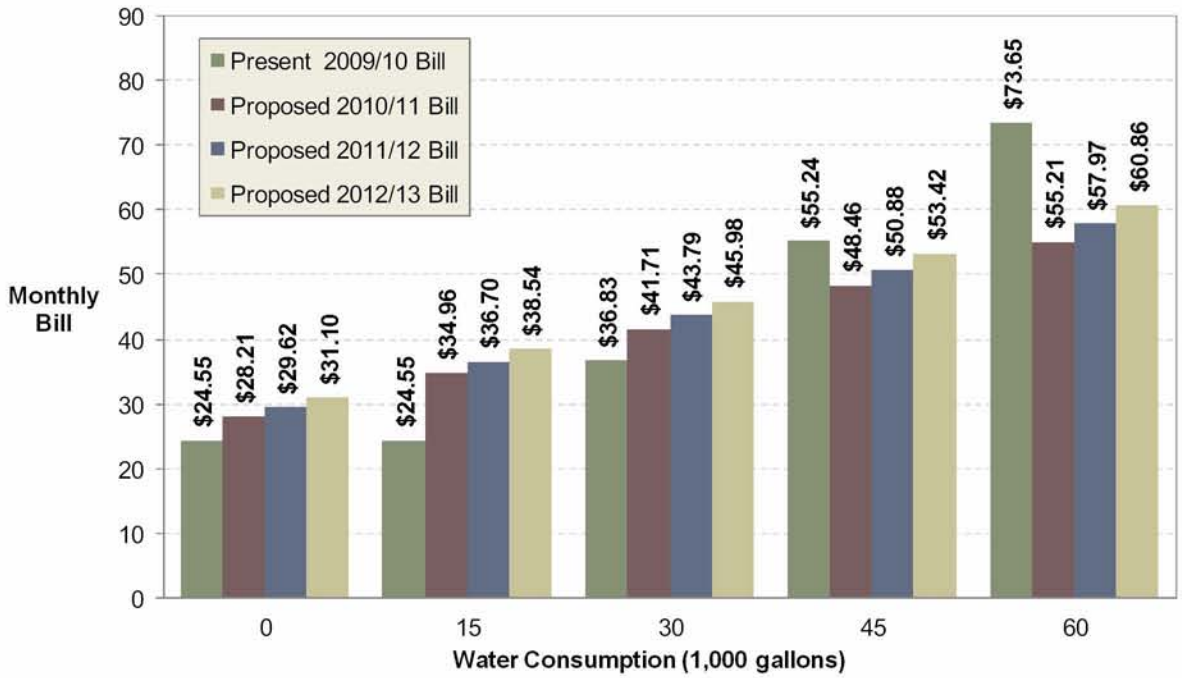


Figure 21 - Monthly Water Bill Comparison for Commercial Customers

HDR proposes the same commercial rates as presented previously in Figure 14: a fixed charge based on meter size, plus a consumption charge of $0.45 per 1,000 gallons of water consumed. A typical commercial bill for a 1" meter and consumption of 36,000 gallons will be $44.50.

A typical commercial bill, assuming a 1" meter and consumption of 36,000 gallons, will be $44.50.

Landscape

The City bills landscape accounts based on a two-tier, declining block consumption basis. Accounts are charged a base monthly fee of $24.55, which includes water consumption up to 20,000 gallons, plus $24.55 for every additional 20,000 gallons of water consumed up to 200,000 gallons of water, and then $23.50 per 20,000 gallons of water consumed in excess of 200,000 gallons. Figure 22 on the following page shows a monthly water bill comparison for landscape accounts based on 2" meter.

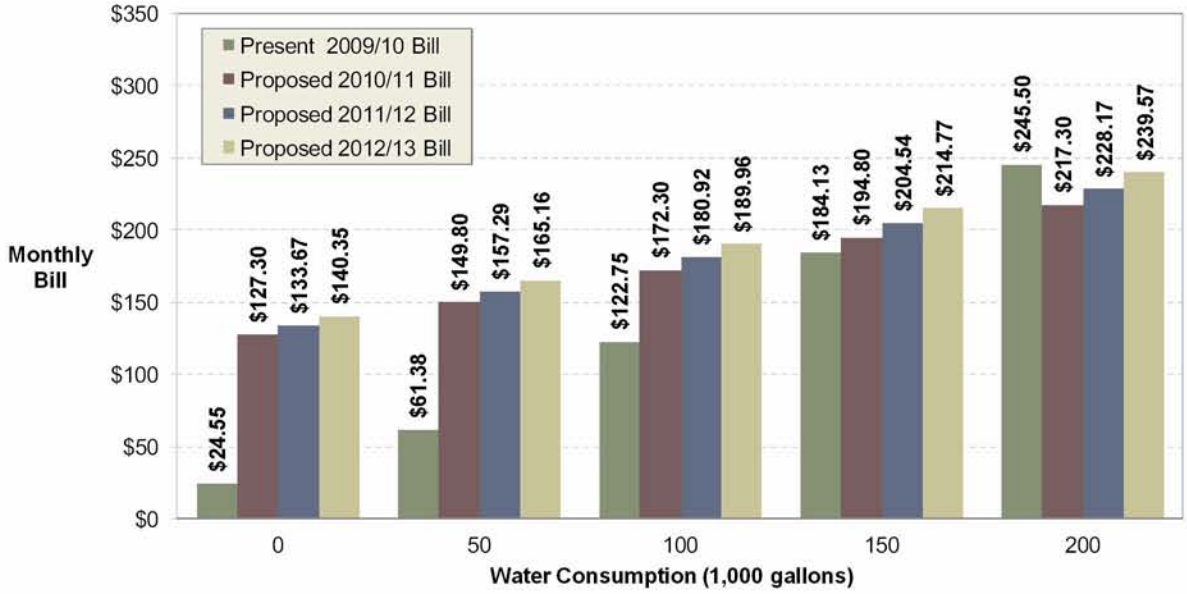


Figure 22 - Monthly Water Bill Comparison for Landscape Accounts (2" Meter)

HDR proposes to charge landscape accounts on the fixed monthly and volume charges presented previously in Figure 14. Based on a fixed meter charge plus a consumption charge of $0.45 per 1,000 gallons, a typical landscape bill will be about $172, assuming a 2" meter and consumption of 100,000 gallons.

A typical landscape bill, assuming a 2" meter and consumption of 100,000 gallons, will be $172.17.

School District Sites

The City currently bills school districts using a three-tier, declining block consumption rate structure that reflects a subsidy not offered other customers:

- $24.55 per 20,000 gallons up to 200,000 gallons.
- $19.64 (80% of the first tier) per 20,000 gallons between 200,000 and 2,000,000 gallons.
- $12.28 (50% of the first tier) per 20,000 gallons over 2,000,000 gallons.

Figure 23 on the following page shows a monthly water bill comparison for school district accounts based on 2" meter.

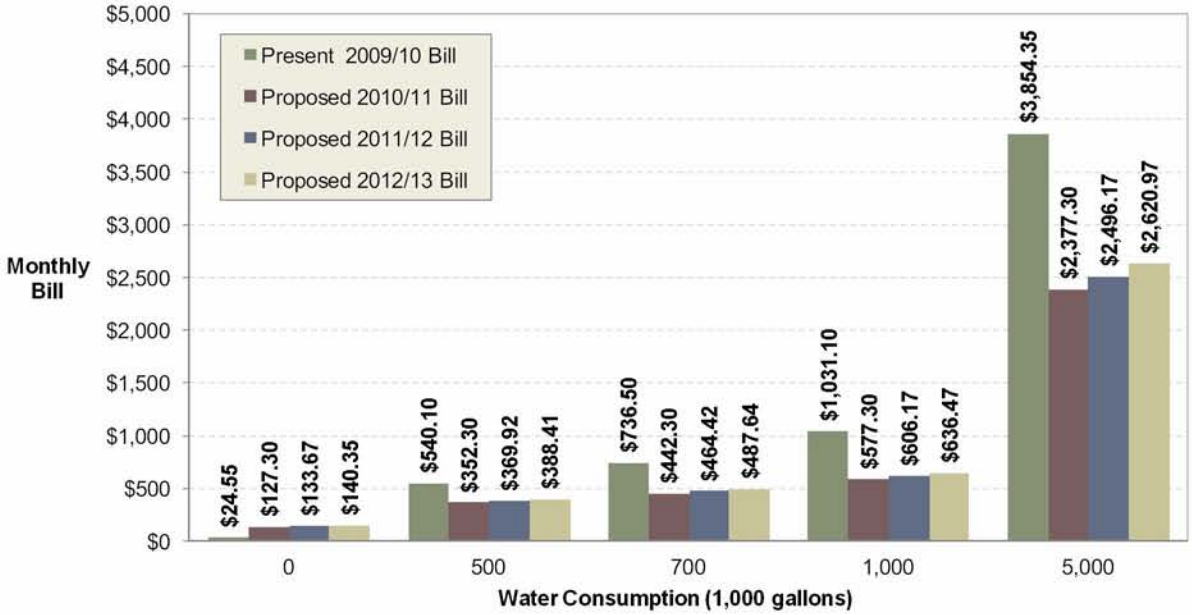


Figure 23 - Monthly Water Bill Comparison for School District Accounts

A typical school bill, assuming a 2" meter and consumption of 300,000 gallons, will be about $248.

HDR proposes to charge schools on the same rate schedule as presented above in Figure 14: a fixed charge based on meter size plus a consumption charge of $0.45 per 1,000 gallons. A typical school bill, assuming a 2" meter and consumption of 300,000 gallons, will be about $248.

SECTION 4 - RECOMMENDATIONS

HDR proposes the City take the following actions:

- **City Council Presentation and Review**: Both utilities' rate study and proposed rates should be thoroughly reviewed by the City staff and Council.
- **Adopt Recommended Rates and Study Report:** Based on the water and sewer rate analysis provided, the City Council should select, adopt and implement the recommended rate structures.
- **Complete Public Hearing and Proposition 218 Noticing:** To move ahead with adoption of the proposed rates, the City will need to meet the public noticing requirements and hold a public hearing in compliance with Proposition 218.
- **Transition to More Conservation-Oriented Water Rates:** After implementing the proposed rates and completing the City's metering program, the City should begin planning on phasing in more conservation-oriented water rates once new metered consumption data has been monitored for a year or two.
- **Review Rates and Revenue Annually:** Any time a utility adopts new rates or rate structures, the utility should closely monitor annual rate revenue generated to ensure sufficient revenues are being generated. Changing economic and water consumption patterns underscore this concept, as well as potential changing revenue requirements, particularly those related to capital improvements and R&R costs. Additionally, since the City is in the process of completing its metering program, both water and sewer rates will need to be reevaluated once this metering is complete and more comprehensive data is available.

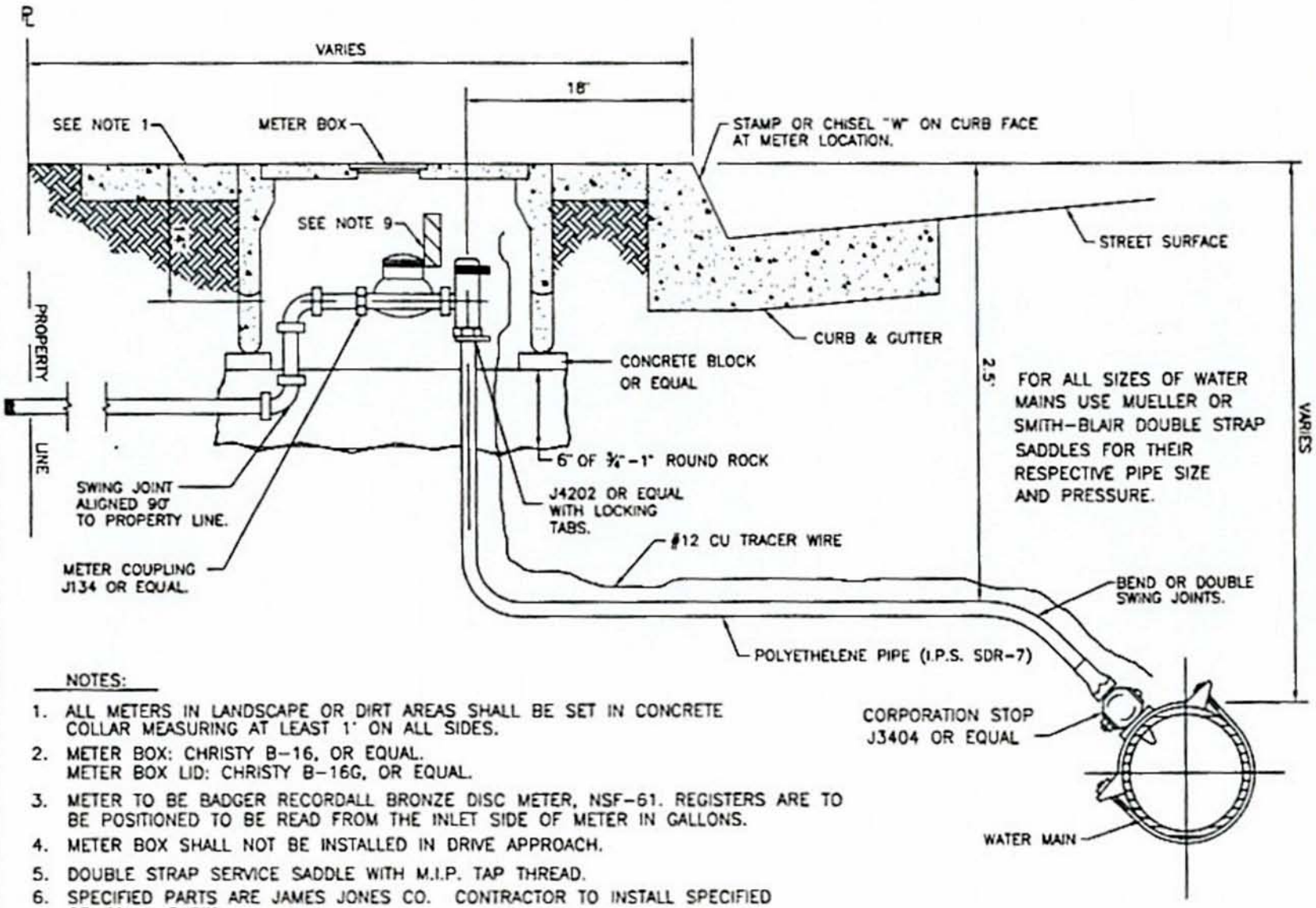
Principal Assumptions and Considerations

In preparing this report and opinions and recommendations included herein, HDR has relied on a number of principal assumptions and considerations with regard to financial matters, conditions, and events that may occur in the future. This information and assumptions, including the City's budgets and information from City staff, were provided by sources we believe to be reliable.

While we believe HDR's use of such information and assumptions is reasonable for the purpose of this report, some assumptions will invariably not materialize as stated herein, and may vary significantly due to unanticipated events and circumstances. Therefore, the actual results can be expected to vary from those projected to the extent that actual future conditions differ from those assumed by us or provided to us by others.

Exhibit 7

1" SERVICE CONNECTION



NOTES:

1. ALL METERS IN LANDSCAPE OR DIRT AREAS SHALL BE SET IN CONCRETE COLLAR MEASURING AT LEAST 1' ON ALL SIDES.
2. METER BOX: CHRISTY B-16, OR EQUAL.
   METER BOX LID: CHRISTY B-16G, OR EQUAL.
3. METER TO BE BADGER RECORDALL BRONZE DISC METER, NSF-61. REGISTERS ARE TO BE POSITIONED TO BE READ FROM THE INLET SIDE OF METER IN GALLONS.
4. METER BOX SHALL NOT BE INSTALLED IN DRIVE APPROACH.
5. DOUBLE STRAP SERVICE SADDLE WITH M.I.P. TAP THREAD.
6. SPECIFIED PARTS ARE JAMES JONES CO. CONTRACTOR TO INSTALL SPECIFIED OR EQUAL PARTS.
7. ALL COMPRESSION JOINT FITTINGS TO USE STAINLESS STEEL INSERTS.
8. METER & REGISTER NUMBER MUST MATCH.
9. ORION RTR & INTEGRAL PIT TRANSMITTER.
10. FOR NON-FIRE SPRINKLERED DWELLINGS USE 3\4" X 9" METER.
    FOR FIRE SPRINKLERED DWELLINGS USE 1" X 10-3\4" METER.

REVISIONS 09-22-11

CITY OF KERMAN

STD NO. W-2

CITY OF KERMAN

REQUEST FOR PROPOSALS FOR PROCUREMENT AND INSTALLATION OF AUTOMATED METER READING SYSTEM EQUIPMENT, SOFTWARE AND RELATED SUPPORT SERVICES

THE KERMAN COMMUNITY AND WATER SYSTEM

The City of Kerman provides water service to approximately 3,000 residential and commercial connections. The majority of these connections are 1-inch services. For approximately three and a half years, the City has been installing meter-setters with no meters, in new residential construction. These meter-setters are located in meter boxes in the alley adjacent to the residences or in the sidewalk in front of the residences.

The City wishes to generate monthly bills, detect leaks in a timely manner and enhance water conservation potential. Currently, certain water usage data collected by Public Works Department staff is entered into the City's billing software by Finance Department staff. The City wishes to eliminate manual data entry and streamline the billing process by moving to an automated meter-reading system (AMRS).

The City of Kerman is seeking proposals from qualified firms interested in contracting with the City of Kerman to provide procurement and installation services for 500 water meters and related equipment with AMRS capability that will improve the efficiency of the City's water meter reading and utility billing practices. After this first phase of 500 meters is completed and the AMRS has been tested, the City of Kerman will schedule future meter installation and retro-fitting phases.

Proposals for meters, radio-read equipment, software and billing interfaces will be rated based on criteria developed by the City and will include equipment, software and installation services that meet the needs of the City of Kerman.

Qualified firms shall have extensive experience in the manufacture and implementation of AMRS. The successful candidate will supply all equipment necessary to install the preferred system, as well as act as system implementation specialists. Installation shall be performed by a qualified contractor. Tasks shall include coordination of all aspects of the system integration with the City's utility billing system, pre-testing and troubleshooting of the system during the field installation process, and all training of both field and office personnel.

The City is also seeking proposals for financing of the project as part of this qualifications package.

This proposal includes a project description, scope of work, submission requirements, selection process and criteria, insurance requirements, and Professional Services Agreement. Prospective firms are encouraged to carefully read this Request for Proposals in its entirety.

The City of Kerman reserves the right to reject any or all Proposals, to waive any irregularities or informalities not affected by law, to evaluate the Proposals submitted and to award the contract according to the proposal which best serves the interests of the City of Kerman. The City of Kerman also reserves the right to change or limit the scope of this project at anytime.

SCOPE OF WORK

This contract would consist of the following tasks:

This scope of work consists of several parts: 1) procurement of meters, registers and radio transmitters, and 2) installation of meters and AMR equipment, 3) software system integration, testing, and 4) start-up training and on-going support.

At least 500 electronic registers and radio transmitters may need to be purchased by the City to partially upgrade the manual read system to an automated radio read system. An unknown number of the City meters will also need to be replaced in phases subsequent to this project. The number of replacement meters will depend on the approach presented by the successful team. Information on the type, size and approximate age of the existing meters will be available upon request at a later date.

The City is requesting that all devices be powered independently. The existing meter pits do not have access to a power source, fiber optic cable or telephone line, so each unit must be independently powered and have the ability to communicate without a hard line connection to a reading location or device. Water usage data must be transferred remotely without cost prohibitive installation of fiber or copper wire.

While the primary function shall be to provide accurate and timely meter reading data for billing purposes, the system shall also furnish consumption and other pertinent data to facilitate enhanced operation and management of the total water distribution system. The AMRS must be capable of providing an easy, effective way of detecting water leaks between reads.

Meter Details

The quantity of water meters to be installed in this initial phase is 500 1-inch AMR-equipped water meters. Future meter replacements and installations will be handled separately.

All new meters shall meet or exceed all current City of Kerman and AWWA standards for cold water meters. The proposal will include a submittal of an electronic copy of the proposed specifications for the water meters and the AMR system, as well as specifications for installation in the field.

Automatic Meter Reading System

The Automatic Meter Reading System shall be a one-way radio frequency system. The system shall use an FCC non-licensed radio frequency band to communicate water usage data to a fixed-base receiver and/or a vehicle-based mobile receiver. A transmitter located at the meter will be used to transmit readings and alarm signals to the receiver. The system shall be capable of storing and processing the information in a portable or fixed-base database format.

The AMR shall record usage through the meter to the closest one gallon increment on residential meters. The AMR shall record to the nearest ten gallons for 1.5-inch meters and larger. Leak detection capability shall be available at all times. The equipment and system

shall have the capacity to be connected to an individual meter monitor allowing the customer to read their own meter remotely and alert the customer of potential leaks.

The automated meter reading system shall include a receiver that will receive data from the meter reads and transmitters that will transfer data to the receiver. This data shall, at a minimum, include the meter ID, meter location, the water usage reading, tamper alerts and leak detection status. The system shall maintain records of unread meters during and after the read.

The City of Kerman is seeking a fixed base automated meter reading system that has been tested and proven to be fully-functional in other cities. However, the City of Kerman may be willing to consider portable drive-by AMRS's if it can be demonstrated that such a system would be more reliable and effective than existing fixed-base systems and the meters would be readily convertible to a fixed base AMRS once a dependable fixed-base system becomes available.

Any proposed portable drive-by AMRS's shall include a laptop computer and receiver that are portable and adaptable to any vehicle with a 12VDC cigarette lighter. The speed of the read shall be limited only by the speed of the vehicle transporting the receiver. Any handheld radio read equipment must be of rugged design and be fully-capable of receiving and recording all data sent from the transmitters. The handheld display shall provide a minimum of eight rows of twenty characters each, and be powered by a long life lithium-ion battery.

Data shall be transferred between devices via USB, serial connections and recordable CDs.

Software

The route management software and the billing software shall communicate with each other via an interface program. This interface software shall have the capacity to be easily upgraded to conform to the needs of the billing software and changes in the billing software.

The Proposer shall own all right, title or license, and interest in and to: (i) any and all computer hardware, equipment, and other physical assets used by Proposer in performing the work; (ii) any and all software, software configurations, source code, databases, and database schema used by Proposer to perform the work or to otherwise create, modify, host, serve, and/or maintain the interface program and other software programs, whether or not created before or in the course of providing the work; and (iii) and any and all intellectual property rights in any of the foregoing.

Furthermore, Proposer shall grant to City a non-exclusive, worldwide, non-transferable, royalty free license under all of Proposer's intellectual property rights to use, or permit a third party to use or modify, any software, designs, configurations, databases, and database schema developed and used by Proposer for the City's AMR operations, solely for the purpose of maintaining, upgrading or replacing the procured software systems. The City and a temporarily-licensed third party shall maintain the confidentiality of the Proposer's software code and applications, and shall not use such information for the purpose of redistribution or sale."

Installation Coordination

The proposal shall contain information on how the firm shall provide on-site construction coordination during all AMR installation activities. Coordination with the City shall occur throughout the installation and implementation of the AMR system. No delay in the water service billing schedule shall occur.

The City is currently using a utility billing system with a current customer data base. The proposal shall provide a methodology for trouble-free integration of existing customer data. The successful bidder will need to coordinate with the Finance Department to ensure a smooth transition of the new meter reading and billing system with the City's utility billing system. The City is requesting a proposal that has an option of the consultant inputting data into the City's utility billing system during the meter change-out and radio upgrade.

The proposal shall include full-system commissioning and testing of meters, implementation and trouble-shooting of data collecting/management systems and interface with billing systems until the system is fully-operational and produces accurate readings and invoices for all customers provided with AMR meters.

The project will commence during budget year 08/09, which started July 1, 2008. The proposed installation schedule is approximately 200 meters per week. The proposal shall state that all meters and AMR equipment will be available to meet the proposed schedule. The City will provide an actual meter installation schedule at a later time. The manufacturer, supplier and installation contractors must state that they can support the 200 meter per week plan.

All materials shall be covered under a minimum full 10-year warranty by the manufacturer and supported locally by the manufacturer's representative.

QUALIFICATIONS SUBMISSION REQUIREMENTS

Each submittal shall consist of two separate parts, **each in a sealed envelope**: 1) Statement of Qualifications; and 2) Statement of Compensation.

Statements of Qualifications should be as concise as possible, at a minimum shall contain the information presented below, and should not exceed 25 pages in length (printed on one side of the sheet). Information should address how the successful candidate will address the City's needs as identified in the scope of work and the criteria listed under "Selection Process."

Additional materials, including detailed resumes and brochures may be submitted as an attached appendix to the proposal. Brochures and marketing materials not directly related to specific experience with the proposed scope of work shall not be submitted as part of this proposal.

<u>Statement of Qualifications shall include the following:</u>

1. An introductory letter, addressed to the Finance Director, shall contain mailing address, telephone number, fax number, type of ownership, and the name of the person to contact regarding the qualifications. The letter should also provide a statement of any manufacturer's or vendor's interest in the work and clearly identify any sub-contractors, including the installation firm(s).

2. Scope of Work; A statement of understanding of the City's needs as stated in the RFP.

3. The proposal should explain how the AMR system operates, how it is read automatically, and how it has performed in other locations. The proposal should also include the information about how the products will be installed and maintained, including an approach or approaches for retrofit and replacement of existing meters.

4. Information about necessary software and/or hardware for the reading, collection, collation,

computation and storage of billing data. The system must have a compatible interface with the City's existing AVR utility billing platform.

5. A description of the proposed approach to meeting the City's needs, including meeting and exceeding standards for laying length, operating accuracy, normal flow range, accuracy at low flow, maximum continuous flow, nutations/oscillations per gallon, pressure loss at AWWA maximum flow rate, water resistance of electronic components, high visibility (no fog) of registers, high availability of replacement parts including batteries, compatibility with existing meters to remain in operation, easy availability of replacement parts, and ability for manufacturer to supply combo-type meters.

6. A description of the proposed automated meter reading system detailing the automated meter reading system capacity for leak detection, reverse flow sensing capacity, GIS system interface, ability to upgrade to future technology, speed and accuracy during collection of information, flexibility to use both hand-held and lap top-based receivers, maneuverability of placement of the transmitter inside the meter box, the ability to recharge the hand-held in the field, power to transmit and receive long distances (extent of coverage), ability to transmit without outside interference and/or through solid and metal objects (lids, RVs, walls), compatibility and ease of interface with the City billing system.

7. Approach to evaluation and repair/retrofit of existing improvements, including meters, meter boxes, and appurtenances.

8. Approach to delivery of a turn-key project.

9. Approach to training (initial and on-going) for public works and finance department staff.

10. Approach to providing prompt service during the warrantee period and ability of the manufacturer to supply equipment within the time limitations of the construction project and in the future.

11. Actual warrantees of equipment, and software. All labor shall be warranteed for a minimum of one year.

12. Relevant Experience, References, and Key Personnel Qualifications: References and experience of key individuals with similar projects, including installation, including a brief narrative of the experience and resources of the proposing company, ownership, history, primary contact, information relating to financial viability, etc. Identification and role of key personnel to be assigned to all phases of the project and their background and experience. Be specific in identifying the nature and the extent of each subconsultant's participation, and provide a project team organization chart. The proposal shall include a minimum of three references for which the consultant has provided similar work during the previous ten years. If the project team includes subcontractors, please clearly state which manufacturer was responsible for each specific project reference, and identify any previous projects that were jointly completed.

13. Work Schedule: A statement of the contractor's ability to perform services within the required time of completion, along with a preliminary schedule of work.

14. A statement that all parties involved have or will have the necessary insurance coverage noted in the attached Insurance Requirements for Consultants. The statement should also address the acceptability of the Professional Services Agreement. Any proposed deviations or modifications to the agreement should be noted, with reasons given.

The Statement of Compensation shall include the following:

Budget and Schedule of Charges

Note the requirement to submit this information separate from the proposal. One sealed copy of the Statement of Compensation shall be provided in the manner prescribed herein, with 'Statement of Compensation', and the consultant name and project name clearly shown on the front of the envelope.

1. Provide a "Not to Exceed" amount and a list of Personnel Rates, Equipment Charges, Travel Reimbursement Costs, and Job Descriptions for Personnel. Provide an itemized budget to complete the work as identified in the Scope of Work. A statement of a not-to-exceed total cost shall be indicated with the itemized budget. Please be aware that prevailing wage rates apply to preconstruction work, such as inspection and land surveying, for public works projects. The itemized budget shall be good for 120 days from the proposal due date.

2. The successful proposal will provide a unit price for the procurement and installation of new meters and automated meter reading equipment. Mobilization, coordination and training during installation, and system implementation shall be included in the unit price proposal. Also, the proposal shall include a separate unit price for providing a new meter box for those installations that require upgrading to allow a successful installation at the existing location, and a unit price for meter and/or meter box replacement to be relocated within the property boundary.

3. A statement of hourly billing rates for each classification of personnel to be assigned to the project, plus any related direct project expenses, including photocopies, telephone, travel, office expenses, and overhead markups.

4. At the proposer's option, prospective vendors may also submit project financing information. The City is willing to contemplate a two to ten year amortization schedule for this project. Vendors interested in submitting this additional information must include both a lump sum fee assuming no financing is needed by the City as well as a second fee proposal and amortization schedule with the proposed financing method and terms.

5. Insurance: The individual or firm receiving the contract shall procure and maintain for the duration of the contract, insurance against claims for injuries to persons or damages to property that may arise from or in connection with the performance of the work hereunder by the Consultant, his agents, representatives, employees or subcontracts as set forth in Exhibit "A" which is attached hereto and incorporated by reference herein. The cost of such insurance shall be included in the consultant's proposal.

6. Consultant Agreement: The City's standard consultant services agreement is attached as Exhibit "B". Please identify if your firm would have any issues with the provisions of the City's standard consulting services agreement.

Additional Efforts

If, in the professional judgment of the qualifying manufacturer, additional work over and above that presented in the Scope of Services is necessary, indicate this in a separate section of the qualifications.

PROPOSAL SUBMITTAL REQUIREMENTS

1. Proposers should send four (4) copies of the completed proposals and cost bid so that it is received by the City no later than 4:00 p.m. on August 8, 2008 to:

   City of Kerman
   Attention: Renee Holdcroft, City Clerk
   850 S Madera Ave.
   Kerman, CA 93630

2. Format: Proposal should be 8 ½ x 11 inches, printed two-sided on recyclable paper with removable bindings, bound in a single document and organized in sections following the order specified under contents.

3. Proposer's Proprietary Information: The proposals received shall become the property of the City of Kerman and are subject to public disclosure. Proposers are to indicate any restrictions on the use of data contained in their responses. Materials must be clearly identified and the Proposer must include a brief statement that sets out the reasons for confidentiality. Those parts of a proposal which are defined by the Proposer as confidential, proprietary or, business or trade secrets, as that term is defined in California Government Code, Section 6254.7, and are determined by the City to be reasonably marked as "Trade Secrets", "Confidential" or "Proprietary" shall only be disclosed to the public if such disclosure is required or permitted under the California Public Records Act or otherwise by law. Marking the entire proposal as proprietary will neither be accepted nor honored. Failure by Proposer to label materials as proprietary shall be deemed a waiver by the Proposer of any claim against the City of Kerman for release of said materials.

4. Maintenance of Confidential City/Ratepayer Information: All Proposers shall sign the attached Exhibit "C"-Confidentiality Agreement before receiving confidential and sensitive statistical, personal or financial data from the City. Confidential or sensitive information shall be so marked by the City.

SELECTION PROCESS

The Selection Committee will evaluate each Statement of Qualifications based upon the criteria listed below:

Responsiveness to the City's requirements for meter accuracy, low head loss, water resistance of electronic components, visibility of (no fog) registers, availability of replacement parts including batteries, compatibility with existing meters to remain in operation, availability of replacement parts, ability to supply combo-type meters,	**20**
Automated meter reading system capacity for leak detection, reverse flow sensing capacity, ability to upgrade to future technology, speed and accuracy during collection of information, capability to transmit and receive long distances (coverage), ability to transmit without outside interference and through solid and metal objects (lids, RVs, walls), compatibility and ease of interface with City billing system and maneuverability of placement of transmitter inside meter box. Portable AMRS proposals (if any) must demonstrate flexibility to use both hand-held and lap top-based receivers and the ability to recharge hand-held in the field.	**20**
Ability to deliver a turn-key project, provide training initial and on-going for public works and finance department staff, provide prompt service during the warrantee period and ability of the manufacturer to supply equipment within the time limitations.	**20**
Warrantees of equipment, software and labor	**10**
References; experience and competence of key individuals with similar projects	**20**
Approach to evaluation and repair of existing improvements, including meter boxes, meters and appurtenances.	**10**
Total	**100**

The above selection criteria are provided to assist proposers and are not meant to limit other considerations that may become apparent during the course of the selection process.

A Selection Committee will evaluate and rank all complete Statements of Qualifications on the above criteria. ***Interviews <u>may</u> be scheduled with up to four of the highest scoring manufacturers, and information derived therefore shall be treated on a confidential basis.***

The sealed Statement of Compensation envelopes of the highest-rated proposals shall be opened and evaluated. Final selection will be made based on the lowest responsive cost quotation between the selected highest-rated proposals.

The selected firm will be asked to enter into negotiations for the services and equipment to be contracted. If negotiations are successful, the manufacturer will be requested to enter into an agreement with the City of Kerman for the proposed services. The required insurance must also be procured and maintained for the duration of the contract. A contract will be considered in effect only after approval by the City Council and execution by both parties.

Proposals will be reviewed and evaluated by the City of Kerman and a recommendation for award of contract will be presented to the Kerman City Council.

OTHER CONSIDERATIONS

The City of Kerman reserves the right to reject any and all proposals. This Request for Proposals does not commit the City to award contract, pay any costs incurred in the preparation of proposals, or to procure or contract for supplies or services.

The City of Kerman reserves the right to negotiate with any qualified source or to cancel, in part of or in its entirety, this Request for Proposals, if it is in the best interest of the City to do so. The City may require the selected consultant to participate in negotiations, and submit such price, technical or other revisions of the proposal that may result from negotiations.

QUESTIONS

Questions should be directed to:

Tim Przybyla, Finance Director
City of Kerman
850 S. Madera Ave.
Kerman, CA 93630
(559) 846-9382
tprzybyla@cityofkerman.org

CITY OF SAN JOAQUIN

UTILITY RATE UPDATE STUDY

EXECUTIVE SUMMARY

JUNE 2009

PREPARED BY

YAMABE & HORN ENGINEERING, INC.
2985 N. BURL AVENUE, SUITE 101
FRESNO, CA 93727

CITY OF SAN JOAQUIN

EXECUTIVE SUMMARY

The purpose of this report is to analyze updates to the existing sewer and water utility service rates in the City of San Joaquin. The existing rates were established by City Council Resolution 02-02 in March 2002.

The City's Wastewater Treatment Plant (WWTP) has a capacity of 0.252 million gallons per day (mgd). Monitoring of the wastewater flows to the WWTP as early as 2000 showed that the average daily flows were exceeding the WWTP's operating capacity, and were measured as high as 0.376 mgd in 2007. On June 7, 2002 (shortly after the last utility rate increase adoption), the Central Valley Regional Water Quality Control Board (Regional Water Board) issued waste discharge requirements (WDR) for the City's Wastewater Treatment Facility by adopting Order No. R5-2002-0103. The Regional Water Board also adopted Cease and Desist Order (CDO) No. R5-2002-0104 requiring the City to: 1) Cease and desist discharges of waste in violation of the new WDR limits, and 2) Develop a wastewater treatment facility expansion in accordance with the time schedule specified in the CDO. If the requirements of the CDO are not met, the City faces stiff fines from the Regional Water Board.

The City has contracted Carollo Engineers to prepare the construction contract documents for the WWTP expansion project, which will include construction of an oxidation ditch, new clarifiers, rehabilitation of an existing sewer lift station, and expansion of the current disposal pond facilities by purchasing 23 acres of adjacent property to provide for current and future wastewater storage demand. No upgrades have been made to the WWTP since 1990, due to lack of funding. The proposed improvements will expand the capacity of the Plant to 0.50 mgd, which will provide adequate operating capacity for another 15-20 years. This capacity is vital, not just to prevent hazardous sanitary sewer overflows, but also to accommodate city growth and development and provide for business expansion and attraction.

The City has filed applications with several Federal and State agencies including the United States Department of Agriculture (USDA), the California State Water Resources Control Board (SWRCB), Economic Development Administration (EDA), and others to receive grants and low interest loans to construct the facility expansion. These upgrades are planned to cost approximately $8.1 million. The USDA is expected to provide a $2,000,000 grant and a $331,022 loan, with an interest rate of 4.375% and a term of 40 years. The SWRCB has approved a $2,000,000 Small Communities Wastewater Grant and the Department of Housing and Urban Development (HUD) has established a Community Development Block Grant (CDBG) in the amount of $1,000,000. EDA and the Environmental Protection Agency (EPA) are currently reviewing application information for grants totaling $2,100,000 and $485,000, respectively. The feedback from both agencies has been very favorable relative to the prospects of award to the City. The project funding summary is shown below:

Funding Source		Amount
USDA Rural Development Grant	$	2,000,000
USDA Rural Development Loan	$	331,022
SWRCB Small Communities Wastewater Grant	$	2,000,000
Community Development Block Grant	$	1,000,000
EDA Grant	$	2,100,000
EPA Grant	$	485,000
City Funds	$	183,978
TOTAL	**$**	**8,100,000**

The City's contribution will come from the Sewer Major Facilities Impact Fee fund which was set up to pay for major capital expenditures, such as this project. Although the expansion project will result in a large capital outlay, the vast majority of the funds will come through grants, as described above. Additionally, the project will help to control future energy costs, due to the construction of newer, more energy efficient machinery and equipment. Lastly, the project will have a strong environmental benefit, as the quality of the treatment plant effluent will be greatly improved.

There are no current improvements planned to the City water system, but recent accounting reviews show the City of San Joaquin operating in a deficit in the Water Fund. Therefore, the existing water rates were analyzed, in addition to the existing sewer rates, against historical, budgeted and projected expenditures from each of the Funds. These expenditures are shown for the Sewer and Water Funds in Table 1 and 2, respectively. The analysis, based on financial planning criteria, shows that rate increases for both utility services will be required. The criteria include debt service requirements for the proposed USDA loan, including principal and interest (P&I) payments, a debt service reserve (equal to 10% of the annual P&I payment), and a depreciation reserve for short-lived assets. Additionally, the target fund balances over the next 5 years were established to develop a $50,000 capital reserve, as well as to sufficiently cover 90 days of operations and maintenance expenses. Finally, the revenue was analyzed to project a balanced budget for each fund in the last year of the study period (Fiscal Year (FY) 13/14). Based on these criteria, annual adjustments in service revenues have been prepared for multiple alternatives for each of the Utility Funds, as follows:

- **Alternative 1**: A one-time increase to utility rates, effective immediately.
- **Alternative 1A**: A one-time increase to utility rates, effective immediately (as in Alternative 1, but with a partial subsidy from the General Fund to offset the initial burden to the rate-payers, which decreases annually, and phases out in FY 11/12.
- **Alternative 2:** A stepped increase, effective immediately, which increases annually through FY 11/12.
- **Alternative 3:** A stepped increase, effective in the second half of FY 09/10, which increases every 6 months thereafter through FY 11/12.

The proposed increases to each of the Utility Funds are presented below, as well as the new rates for average residential users as of the effective date shown.

ALTERNATIVE 1

	Effective Date	% Increase	Prior Rate	New Rate
Sewer Utility	August 1, 2009	80%	$ 20.50	$ 36.90
Water Utility	August 1, 2009	72%	$ 26.00	$ 44.72

The Flow of Funds calculations and informational graph for Alternative 1 in the Sewer Fund are shown in Tables 3 and 4, respectively. The same information for the Water Fund is represented in Tables 5 and 6, respectively.

ALTERNATIVE 1A

As mentioned above, this alternative proposes a subsidy from the City of San Joaquin's General Fund to help offset the initial cost of the rate increases to the ratepayers. Based on this scenario, the rate paid into the Sewer Fund will be as shown above in Alternative 1, but the monthly contributions per average residential account will be broken down as follows between Fiscal Years 09/10 and 11/12:

	Effective Date	New Rate	Gen. Fund	Residents
Sewer Utility	August 1, 2009	$ 36.90	$ 10.90	$ 26.00
	June 1, 2010		$ 5.00	$ 31.50
	June 1, 2011		$ 0	$ 36.90
Water Utility	August 1, 2009	$ 44.72	$ 12.47	$ 32.25
	June 1, 2010		$ 6.22	$ 38.50
	June 1, 2011		$ 0	$ 44.72

The Flow of Funds calculations and informational graph for Alternative 1A is the same as Alternative 1 and can be seen in the tables discussed above.

ALTERNATIVE 2

	Effective Date	% Increase	Prior Rate	New Rate
Sewer Utility	August 1, 2009	25%	$ 20.50	$ 25.63
	June 1, 2010	22.5%	$ 25.63	$ 31.40
	June 1, 2011	20%	$ 31.40	$ 37.68
Water Utility	August 1, 2009	20%	$ 26.00	$ 31.20
	June 1, 2010	20%	$ 31.20	$ 37.44
	June 1, 2011	20%	$ 37.44	$ 44.93

The Flow of Funds calculations and informational graph for Alternative 2 in the Sewer Fund are shown in Tables 7 and 8, respectively. The same information for the Water Fund is represented in Tables 9 and 10, respectively.

ALTERNATIVE 3

	Effective Date	% Increase	Prior Rate	New Rate
Sewer Utility	December 1, 2009	25%	$ 20.50	$ 25.63
	June 1, 2010	20%	$ 25.63	$ 30.75
	December 1, 2010	10%	$ 30.75	$ 33.83
	June 1, 2011	5%	$ 33.83	$ 35.52
	December 1, 2011	5%	$ 35.52	$ 37.29
Water Utility	December 1, 2009	15%	$ 26.00	$ 29.90
	June 1, 2010	15%	$ 29.90	$ 34.39
	December 1, 2010	10%	$ 34.39	$ 37.82
	June 1, 2011	10%	$ 37.82	$ 41.61
	December 1, 2011	7.5%	$ 41.61	$ 44.73

The Flow of Funds calculations and informational graph for Alternative 3 in the Sewer Fund are shown in Tables 11 and 12, respectively. The same information for the Water Fund is represented in Tables 13 and 14, respectively.

The effective dates are determined using an expected one-month billing lag between rate increase and fee collection. Rate increases are planned to be incorporated within the same current rate structure.

Affordability of utility service rates is a very important criterion to consider when analyzing any increase. A key benchmark for this analysis is suggested by the EPA, which uses 2% of the median household income (MHI) for the City for each utility, or 4% combined for both utilities. Based on the 2000 Census MHI information for the City of San Joaquin, the maximum monthly bill for either water or sewer service would be $41.56, or $83.12 for both bills combined. Under any alternative, the ultimate water rate will exceed this threshold, while the sewer rate will remain below it. The combined maximum ultimate bill under any alternative is $82.61, which would be considered affordable, although very close to exceeding the affordability standard.

Comparison of the average single family residential sewer and water rates for other similar communities in the area are shown in Tables 15 and 16, respectively. The tables indicate that the ultimate proposed sewer rate would be second-highest of any of the other communities listed (under any alternative), and that the proposed water rate would be the fourth-highest (under any alternative). Please note that all calculations and comparisons of utility rates for the basis of this study are made using residential rates. When an alternative is selected, all user rate classifications will be increased by the same percentage as the residential rates.

Table 1
City of San Joaquin
Sewer Utility
Historical and Projected Expenditures

Line No.	Description	2004-05*	2005-06*	2006-07*	2007-08**	2008-09**	2009-10***	2010-11***	2011-12***	2012-13***	2013-14***
1	Salaries	$ 62,445	$ 72,564	$ 77,185	$ 122,558	$ 122,616	$ 137,616	$ 144,497	$ 151,722	$ 159,308	$ 167,273
2	Employee Benefits	$ 17,490	$ 30,694	$ 18,441	$ 33,591	$ 38,915	$ 43,915	$ 48,307	$ 53,137	$ 58,451	$ 64,296
	Total Personnel Cost	$ 79,935	$ 103,258	$ 95,606	$ 156,149	$ 161,531	$ 181,531	$ 192,803	$ 204,859	$ 217,759	$ 231,569
3	Accounting Fees	$ 4,250	$ 4,649	$ 3,968	$ 5,000	$ 4,000	$ 4,120	$ 4,244	$ 4,371	$ 4,502	$ 4,637
4	Advertising & Promotions	$ -	$ -	$ -	$ 50	$ 50	$ 52	$ 53	$ 55	$ 56	$ 58
5	Continuing Education	$ 474	$ 1,316	$ 1,418	$ 2,000	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
6	Contract Services	250	$ 9,320	$ 7,825	$ 10,000	$ 9,500	$ 19,322	$ 22,731	$ 26,743	$ 31,463	$ 37,014
7	Depreciation	$ 34,631	$ 31,472	$ 31,304	$ 34,000	$ 31,000	$ 31,930	$ 32,888	$ 33,875	$ 34,891	$ 35,937
8	Dues & Subscriptions	$ 340	$ 277	$ 52	$ 250	$ 250	$ 5,000	$ 5,150	$ 5,305	$ 5,464	$ 5,628
9	Engineering Fee	$ 3,002	$ 709	$ 185	$ 10,000	$ 10,000	$ 10,300	$ 10,609	$ 10,927	$ 11,255	$ 11,593
10	Equipment Rental	$ -	$ -	$ -	$ 500	$ 500	$ 515	$ 530	$ 546	$ 563	$ 580
11	Food	$ 42	$ 100	$ 179	$ 100	$ 100	$ 103	$ 106	$ 109	$ 113	$ 116
12	Gas, Lube & Oil	$ 3,323	$ 4,541	$ 4,725	$ 7,000	$ 7,800	$ 8,034	$ 8,275	$ 8,523	$ 8,779	$ 9,042
13	Insurance	$ 8,879	$ 10,459	$ 10,550	$ 12,000	$ 14,000	$ 14,420	$ 14,853	$ 15,298	$ 15,757	$ 16,230
14	Interest Expense	$ 17,874	$ 11,919	$ 10,727	$ 21,572	$ 21,572	$ -	$ -	$ -	$ -	$ -
15	Janitorial	$ 569	$ 2,669	$ 555	$ 2,500	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
16	Lease Payments	$ 315	$ 236	$ 414	$ 350	$ 450	$ 464	$ 477	$ 492	$ 506	$ 522
17	Legal Fees	$ -	$ -	$ 412	$ -	$ 2,000	$ 2,060	$ 2,122	$ 2,185	$ 2,251	$ 2,319
18	Miscellaneous	$ 167	$ -	$ 5	$ -	$ 100	$ 103	$ 106	$ 109	$ 113	$ 116
19	Office Supplies	$ 1,397	$ 1,682	$ 1,240	$ 1,500	$ 2,000	$ 2,060	$ 2,122	$ 2,185	$ 2,251	$ 2,319
20	Other Professional Fees	$ 466	$ 8,229	$ 1,609	$ 3,000	$ 2,000	$ 2,060	$ 2,122	$ 2,185	$ 2,251	$ 2,319
21	Rents	$ 2,371	$ 2,454	$ 3,055	$ 2,500	$ 2,500	$ 2,575	$ 2,652	$ 2,732	$ 2,814	$ 2,898
22	Repairs & Maintenance	$ 6,786	$ 14,259	$ 24,360	$ 15,000	$ 20,000	$ 20,600	$ 21,218	$ 21,855	$ 22,510	$ 23,185
23	Supplies	$ 11,119	$ 9,431	$ 9,346	$ 12,000	$ 13,000	$ 13,390	$ 13,792	$ 14,205	$ 14,632	$ 15,071
24	Telephone	$ 4,606	$ 4,145	$ 4,106	$ 4,500	$ 4,500	$ 4,635	$ 4,774	$ 4,917	$ 5,065	$ 5,217
25	Travel	$ -	$ 632	$ -	$ 2,000	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
26	Utilities	$ 15,520	$ 16,243	$ 16,679	$ 20,000	$ 17,000	$ 18,700	$ 43,700	$ 48,070	$ 52,877	$ 58,165
27	Improvements	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -
	Total Other Cost	$ 116,381	$ 134,742	$ 132,714	$ 170,822	$ 165,322	$ 163,532	$ 195,706	$ 207,967	$ 221,488	$ 236,441
28	Machinery & Equipment	$ -	$ 1,200	$ -	$ 7,900	$ 3,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
	Total Expenditures	$ 196,316	$ 239,200	$ 228,320	$ 334,871	$ 329,853	$ 353,063	$ 396,510	$ 420,825	$ 447,247	$ 476,010

* Actual
** Budgeted
*** Projected

Notes:
1) Salaries inflated at 5% annually
2) Benefits inflated at 10% annually
3) Utilities costs inflated at 10% annually
4) All other costs inflated at 3% annually
5) Contract Services estimated by current provider. City is examining possibility of providing these services with City staff at some time within study period.

Table 2
City of San Joaquin
Water Utility
Historical and Projected Expenditures

Line No.	Description	2004-05*	2005-06*	2006-07*	2007-08**	2008-09**	2009-10***	2010-11***	2011-12***	2012-13***	2013-14***
1	Salaries	$ 66,158	$ 76,747	$ 78,700	$ 122,558	$ 122,616	$ 137,616	$ 144,497	$ 151,722	$ 159,308	$ 167,273
2	Employee Benefits	$ 18,939	$ 30,966	$ 18,676	$ 33,591	$ 38,915	$ 43,915	$ 48,307	$ 53,137	$ 58,451	$ 64,296
	Total Personnel Cost	$ 85,097	$ 107,713	$ 97,376	$ 156,149	$ 161,531	$ 181,531	$ 192,803	$ 204,859	$ 217,759	$ 231,569
3	Accounting Fees	$ 4,250	$ 4,649	$ 3,968	$ 5,000	$ 4,000	$ 4,120	$ 4,244	$ 4,371	$ 4,502	$ 4,637
4	Advertising & Promotions	$ 825	$ -	$ -	$ 650	$ 650	$ 670	$ 690	$ 710	$ 732	$ 754
5	Bank Charges	$ 720	$ 5	$ 35	$ 100	$ 100	$ 103	$ 106	$ 109	$ 113	$ 116
6	Continuing Education	$ 194	$ 1,839	$ 1,496	$ 1,500	$ 1,500	$ 1,545	$ 1,591	$ 1,639	$ 1,688	$ 1,739
7	Contract Services	$ 16,509	$ 7,359	$ 5,950	$ 10,000	$ 8,500	$ 19,322	$ 22,731	$ 26,743	$ 31,463	$ 37,014
8	Depreciation	$ 14,403	$ 11,218	$ 12,283	$ 10,000	$ 10,000	$ 10,300	$ 10,609	$ 10,927	$ 11,255	$ 11,593
9	Dues & Subscriptions	$ 278	$ 2,501	$ 1,705	$ 1,800	$ 2,100	$ 7,500	$ 7,725	$ 7,957	$ 8,195	$ 8,441
10	Engineering Fee	$ 8,707	$ 2,097	$ 35	$ 7,000	$ 3,000	$ 3,090	$ 3,183	$ 3,278	$ 3,377	$ 3,478
11	Equipment Rental	$ 1,189	$ -	$ 1,250	$ 1,000	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
12	Food	$ 41	$ 238	$ 179	$ 300	$ 300	$ 309	$ 318	$ 328	$ 338	$ 348
13	Gas, Lube & Oil	$ 3,324	$ 3,925	$ 4,636	$ 6,000	$ 7,000	$ 7,210	$ 7,426	$ 7,649	$ 7,879	$ 8,115
14	Insurance	$ 8,879	$ 10,459	$ 10,550	$ 12,000	$ 13,000	$ 13,390	$ 13,792	$ 14,205	$ 14,632	$ 15,071
15	Interest Expense	$ 20,802	$ 14,861	$ 12,304	$ 25,000	$ 25,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000
16	Janitorial	$ 569	$ 2,714	$ 865	$ 2,200	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
17	Lease Payments	$ 315	$ 236	$ 414	$ 350	$ 350	$ 361	$ 371	$ 382	$ 394	$ 406
18	Legal Feees	$ -	$ -	$ 412	$ -	$ 2,000	$ 2,060	$ 2,122	$ 2,185	$ 2,251	$ 2,319
19	Miscellaneous	$ 170	$ 10,421	$ 105	$ 2,000	$ 1,000	$ 1,030	$ 1,061	$ 1,093	$ 1,126	$ 1,159
20	Office Supplies	$ 1,397	$ 1,683	$ 1,330	$ 1,600	$ 1,800	$ 1,854	$ 1,910	$ 1,967	$ 2,026	$ 2,087
21	Other Professional Fees	$ 7,980	$ 2,337	$ 8,078	$ 8,000	$ 5,000	$ 5,150	$ 5,305	$ 5,464	$ 5,628	$ 5,796
22	Rents	$ 2,524	$ 2,454	$ 3,055	$ 3,000	$ 3,000	$ 3,090	$ 3,183	$ 3,278	$ 3,377	$ 3,478
23	Repairs & Maintenance	$ 65,823	$ 44,736	$ 18,860	$ 35,000	$ 25,000	$ 35,000	$ 36,050	$ 37,132	$ 38,245	$ 39,393
24	Supplies	$ 14,819	$ 16,120	$ 15,693	$ 15,000	$ 18,000	$ 18,540	$ 19,096	$ 19,669	$ 20,259	$ 20,867
25	Telephone	$ 4,643	$ 4,172	$ 4,148	$ 4,000	$ 4,000	$ 4,120	$ 4,244	$ 4,371	$ 4,502	$ 4,637
26	Travel	$ -	$ 82	$ 200	$ 300	$ 300	$ 309	$ 318	$ 328	$ 338	$ 348
27	Utilities	$ 50,850	$ 51,644	$ 70,104	$ 65,000	$ 65,000	$ 71,500	$ 78,650	$ 86,515	$ 95,167	$ 104,683
28	Improvements	$ -	$ -	$ -	$ 18,000	$ -	$ 15,000	$ -	$ -	$ -	$ -
29	Machinery & Equipment	$ -	$ 1,200	$ -	$ 5,000	$ 2,500	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 8,000
	Total Other Cost	$ 229,211	$ 196,950	$ 177,655	$ 239,800	$ 205,100	$ 255,632	$ 254,845	$ 270,486	$ 287,735	$ 306,795
	Total Expenditures	$ 314,308	$ 304,663	$ 275,031	$ 395,949	$ 366,631	$ 437,163	$ 447,649	$ 475,345	$ 505,493	$ 538,364

* Actual
** Budgeted
*** Projected

Notes: 1) Salaries inflated at 5% annually
2) Benefits inflated at 10% annually
3) Utilities costs inflated at 10% annually
4) All other costs inflated at 3% annually
5) Contract Services estimated by current provider. City is examining possibility of providing these services with City staff at some time within study period.

Table 3
City of San Joaquin

Sewer Utility
Flow of Funds
Alternative 1 and 1A

Line No.	Description			Fiscal Year 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
1	Sewer Service Operating Income			$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000		
	Changes to Service Charges Required:										
	Fiscal Year	% Increase									
2	2008-09	0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	80			$ 174,000	* $ 232,000	$ 232,000	$ 232,000	$ 232,000		
4	2010-11	0				$ -	$ -	$ -	$ -		
5	2011-12	0					$ -	$ -	$ -		
6	2012-13	0						$ -	$ -		
7	Total Change in Service Charge Revenue			$ -	$ 174,000	$ 232,000	$ 232,000	$ 232,000	$ 232,000		
8	**Total Sewer Service Operating Income**			$ 290,000	$ 464,000	$ 522,000	$ 522,000	$ 522,000	$ 522,000		
9	Impact/Connection Fee Income			$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**			$ 290,000	$ 464,000	$ 522,000	$ 522,000	$ 522,000	$ 522,000		
	Revenue Requirements										
11	Operation and Maintenance Expenses			$ (143,750)	$ (163,532)	$ (195,706)	$ (207,967)	$ (221,488)	$ (236,441)		
12	Existing Debt Service			$ (21,572)	$ -	$ -	$ -	$ -	$ -		
13	Employee Services			$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures			$ (3,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
	Proposed USDA Debt Service										
15	Loan Principal & Interest			$ -	$ -	$ (17,540)	$ (17,540)	$ (17,540)	$ (17,540)		
16	Debt Service Reserve			$ -	$ -	$ (1,754)	$ (1,754)	$ (1,754)	$ (1,754)		
17	Depreciation Reserve for Short-Lived Assets			$ -	$ -	$ (27,067)	$ (27,067)	$ (27,067)	$ (27,067)		
18	**Total Revenue Requirements**			$ (329,853)	$ (353,063)	$ (442,870)	$ (467,186)	$ (493,608)	$ (522,371)		
19	**Net Funds**			$ (39,853)	$ 110,937	$ 79,130	$ 54,814	$ 28,392	$ (371)		
20	**Beginning Sewer Fund Balance**			$ 44,674	$ 4,821	$ 115,758	$ 194,888	$ 249,701	$ 278,094		
21	**Ending Sewer Fund Balance**			$ 4,821	$ 115,758	$ 194,888	$ 249,701	$ 278,094	$ 277,722		
22	**Target Sewer Fund Balance after 5 years****								$ (109,110)	**<**	$ 277,722
										CHECK	

* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

Table 4

Sewer Fund - Alternative 1 & 1A

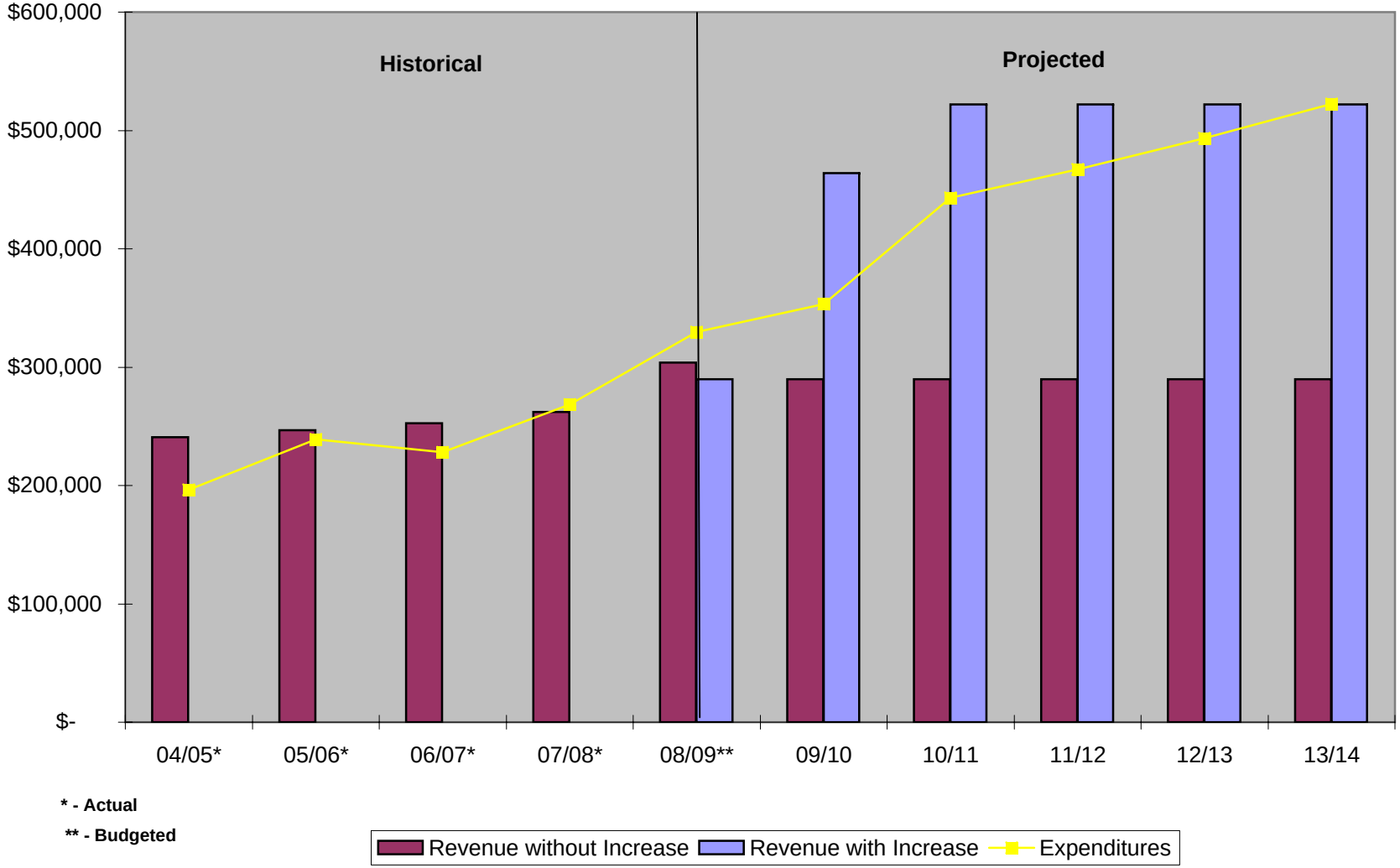


Table 5
City of San Joaquin

Water Utility
Flow of Funds
Alternative 1 and 1A

Line No.	Description			Fiscal Year 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
1	Water Service Operating Income			$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000		
	Changes to Service Charges Required:										
	Fiscal Year	% Increase									
2	2008-09	0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	72			$ 169,020	* $ 225,360	$ 225,360	$ 225,360	$ 225,360		
4	2010-11	0				$ -	$ -	$ -	$ -		
5	2011-12	0					$ -	$ -	$ -		
6	2012-13	0						$ -	$ -		
7	Total Change in Service Charge Revenue			$ -	$ 169,020	$ 225,360	$ 225,360	$ 225,360	$ 225,360		
8	**Total Water Service Operating Income**			$ 313,000	$ 482,020	$ 538,360	$ 538,360	$ 538,360	$ 538,360		
9	Impact/Connection Fee Income			$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**			$ 313,000	$ 482,020	$ 538,360	$ 538,360	$ 538,360	$ 538,360		
	Revenue Requirements										
11	Operation and Maintenance Expenses			$ (177,600)	$ (227,632)	$ (226,845)	$ (242,486)	$ (259,735)	$ (278,795)		
12	Existing Debt Service			$ (25,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)		
13	Employee Services			$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures			$ (2,500)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
15	**Total Revenue Requirements**			$ (366,631)	$ (437,163)	$ (447,649)	$ (475,345)	$ (505,493)	$ (538,364)		
16	**Net Funds**			$ (53,631)	$ 44,857	$ 90,711	$ 63,015	$ 32,867	$ (4)		
17	**Beginning Water Fund Balance**			$ 238,510	$ 184,879	$ 229,736	$ 320,447	$ 383,462	$ 416,329		
18	**Ending Water Fund Balance**			$ 184,879	$ 229,736	$ 320,447	$ 383,462	$ 416,329	$ 416,325		
19	**Target Water Fund Balance after 5 years****								$ (119,699)	<	$ 416,325

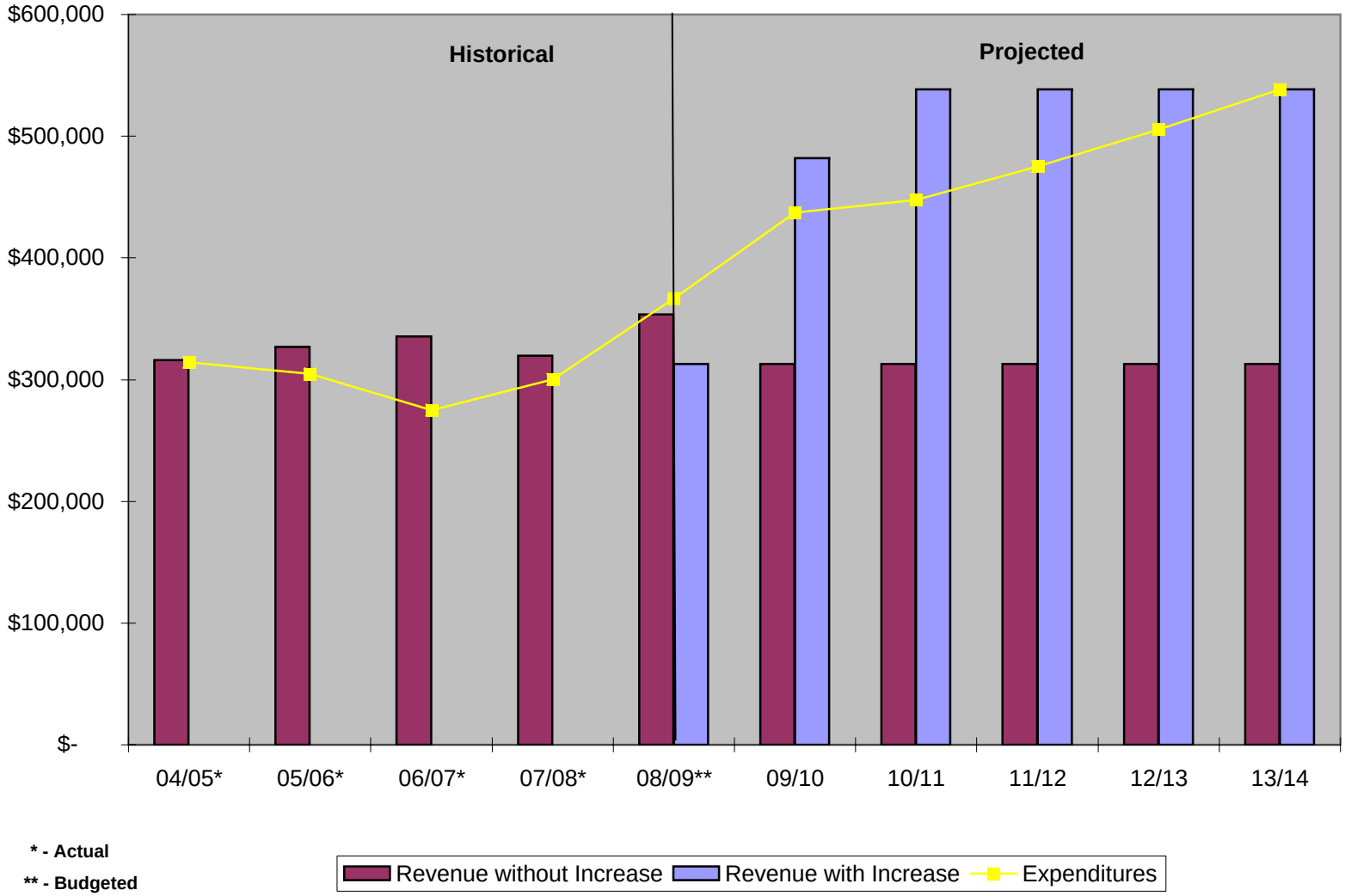
* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

CHECK

Table 6

Water Fund - Alternative 1 & 1A



*** - Actual**

**** - Budgeted**

Table 7
City of San Joaquin

Sewer Utility
Flow of Funds
Alternative 2

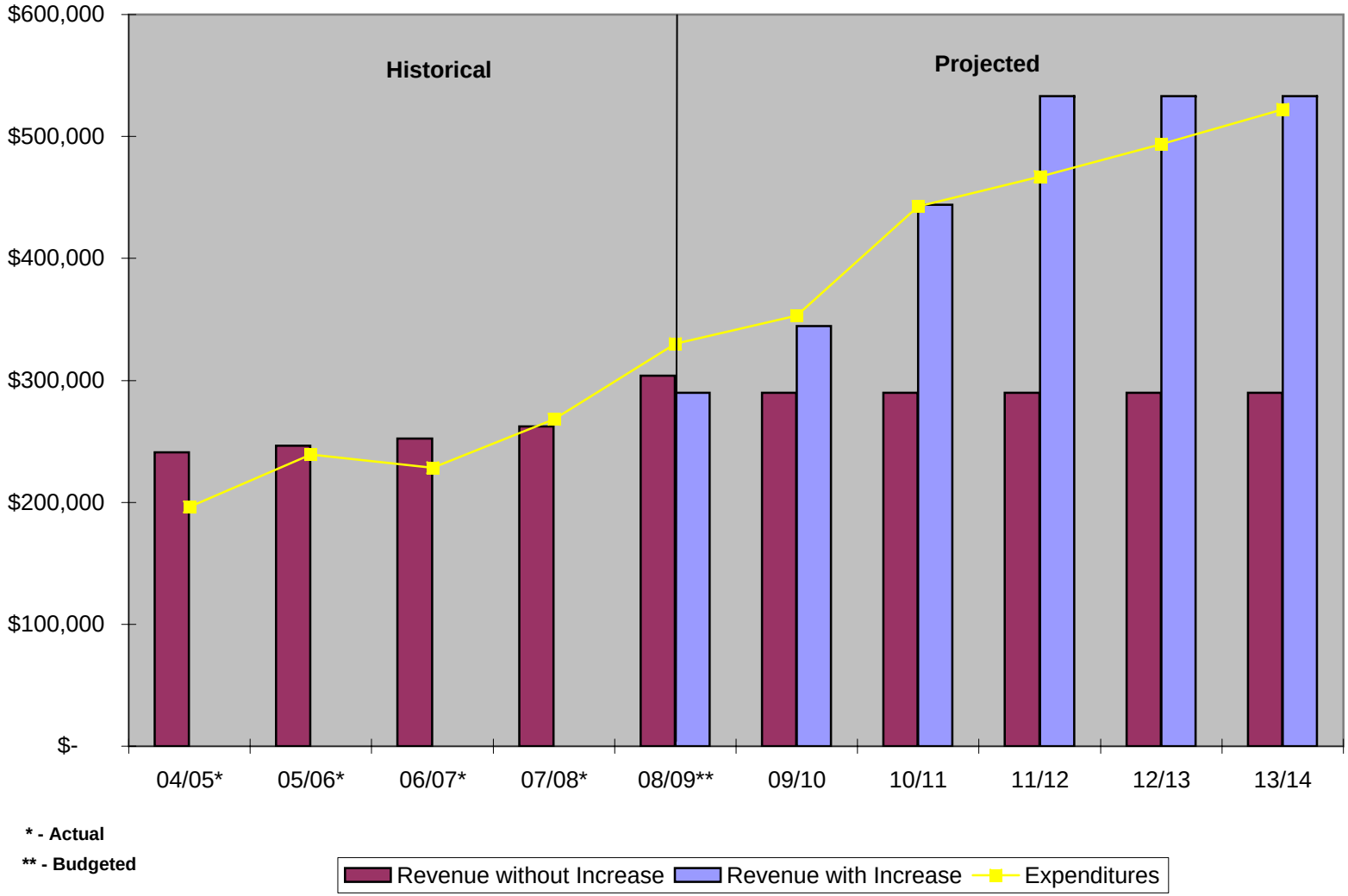
Line No.	Description			2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
						Fiscal Year					
1	Sewer Service Operating Income			$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000		
	Changes to Service Charges Required:										
	Fiscal Year	% Increase									
2	2008-09	0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	25			$ 54,375 *	$ 72,500	$ 72,500	$ 72,500	$ 72,500		
4	2010-11	22.5				$ 81,563	$ 81,563	$ 81,563	$ 81,563		
5	2011-12	20					$ 88,813	$ 88,813	$ 88,813		
6	2012-13	0						$ -	$ -		
7	Total Change in Service Charge Revenue			$ -	$ 54,375	$ 154,063	$ 242,875	$ 242,875	$ 242,875		
8	**Total Sewer Service Operating Income**			$ 290,000	$ 344,375	$ 444,063	$ 532,875	$ 532,875	$ 532,875		
9	Impact/Connection Fee Income			$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**			$ 290,000	$ 344,375	$ 444,063	$ 532,875	$ 532,875	$ 532,875		
	Revenue Requirements										
11	Operation and Maintenance Expenses			$ (143,750)	$ (163,532)	$ (195,706)	$ (207,967)	$ (221,488)	$ (236,441)		
12	Existing Debt Service			$ (21,572)	$ -	$ -	$ -	$ -	$ -		
13	Employee Services			$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures			$ (3,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
	Proposed USDA Debt Service										
15	Loan Principal & Interest			$ -	$ -	$ (17,540)	$ (17,540)	$ (17,540)	$ (17,540)		
16	Debt Service Reserve			$ -	$ -	$ (1,754)	$ (1,754)	$ (1,754)	$ (1,754)		
17	Depreciation Reserve for Short-Lived Assets			$ -	$ -	$ (27,067)	$ (27,067)	$ (27,067)	$ (27,067)		
18	**Total Revenue Requirements**			$ (329,853)	$ (353,063)	$ (442,870)	$ (467,186)	$ (493,608)	$ (522,371)		
19	**Net Funds**			$ (39,853)	$ (8,688)	$ 1,192	$ 65,689	$ 39,267	$ 10,504		
20	**Beginning Sewer Fund Balance**			$ 44,674	$ 4,821	$ (3,867)	$ (2,675)	$ 63,014	$ 102,281		
21	**Ending Sewer Fund Balance**			$ 4,821	$ (3,867)	$ (2,675)	$ 63,014	$ 102,281	$ 112,785		
22	**Target Sewer Fund Balance after 5 years****								$ (109,110)	**<**	$ 112,785
										CHECK	

* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

Table 8

Sewer Fund - Alternative 2



*** - Actual**

**** - Budgeted**

Table 9
City of San Joaquin

Water Utility
Flow of Funds
Alternative 2

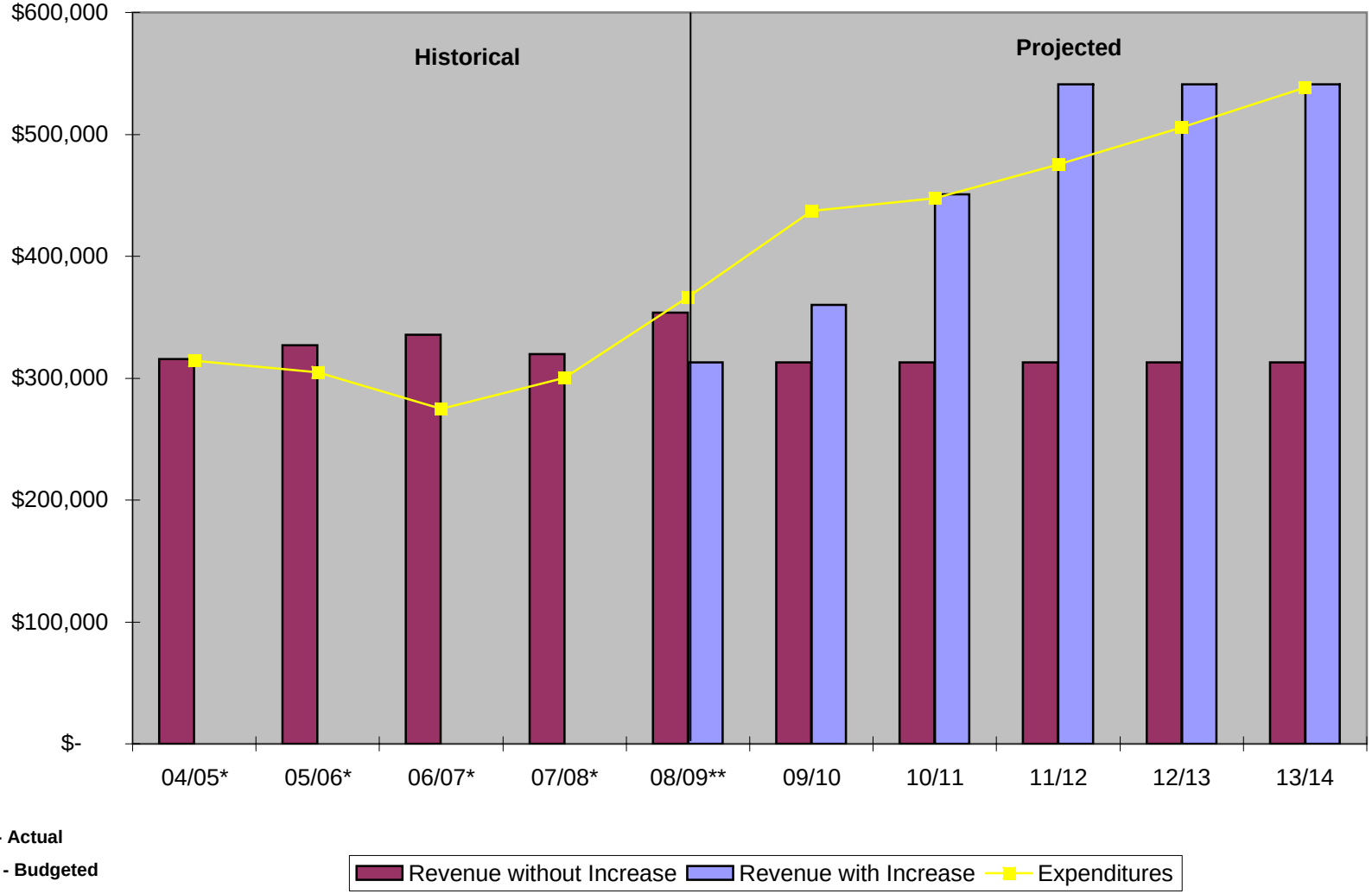
Line No.	Description			Fiscal Year 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
1	Water Service Operating Income			$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000		
	Changes to Service Charges Required:										
	Fiscal Year	% Increase									
2	2008-09	0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	20			$ 46,950	* $ 62,600	$ 62,600	$ 62,600	$ 62,600		
4	2010-11	20				$ 75,120	$ 75,120	$ 75,120	$ 75,120		
5	2011-12	20					$ 90,144	$ 90,144	$ 90,144		
6	2012-13	0						$ -	$ -		
7	Total Change in Service Charge Revenue			$ -	$ 46,950	$ 137,720	$ 227,864	$ 227,864	$ 227,864		
8	**Total Water Service Operating Income**			$ 313,000	$ 359,950	$ 450,720	$ 540,864	$ 540,864	$ 540,864		
9	Impact/Connection Fee Income			$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**			$ 313,000	$ 359,950	$ 450,720	$ 540,864	$ 540,864	$ 540,864		
	Revenue Requirements										
11	Operation and Maintenance Expenses			$ (177,600)	$ (227,632)	$ (226,845)	$ (242,486)	$ (259,735)	$ (278,795)		
12	Existing Debt Service			$ (25,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)		
13	Employee Services			$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures			$ (2,500)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
15	**Total Revenue Requirements**			$ (366,631)	$ (437,163)	$ (447,649)	$ (475,345)	$ (505,493)	$ (538,364)		
16	**Net Funds**			$ (53,631)	$ (77,213)	$ 3,071	$ 65,519	$ 35,371	$ 2,500		
17	**Beginning Water Fund Balance**			$ 238,510	$ 184,879	$ 107,666	$ 110,737	$ 176,256	$ 211,627		
18	**Ending Water Fund Balance**			$ 184,879	$ 107,666	$ 110,737	$ 176,256	$ 211,627	$ 214,127		
19	**Target Water Fund Balance after 5 years****								$ (119,699)	**<**	$ 214,127

* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

CHECK

Table 10
Water Fund - Alternative 2



*** - Actual**

**** - Budgeted**

Table 11
City of San Joaquin

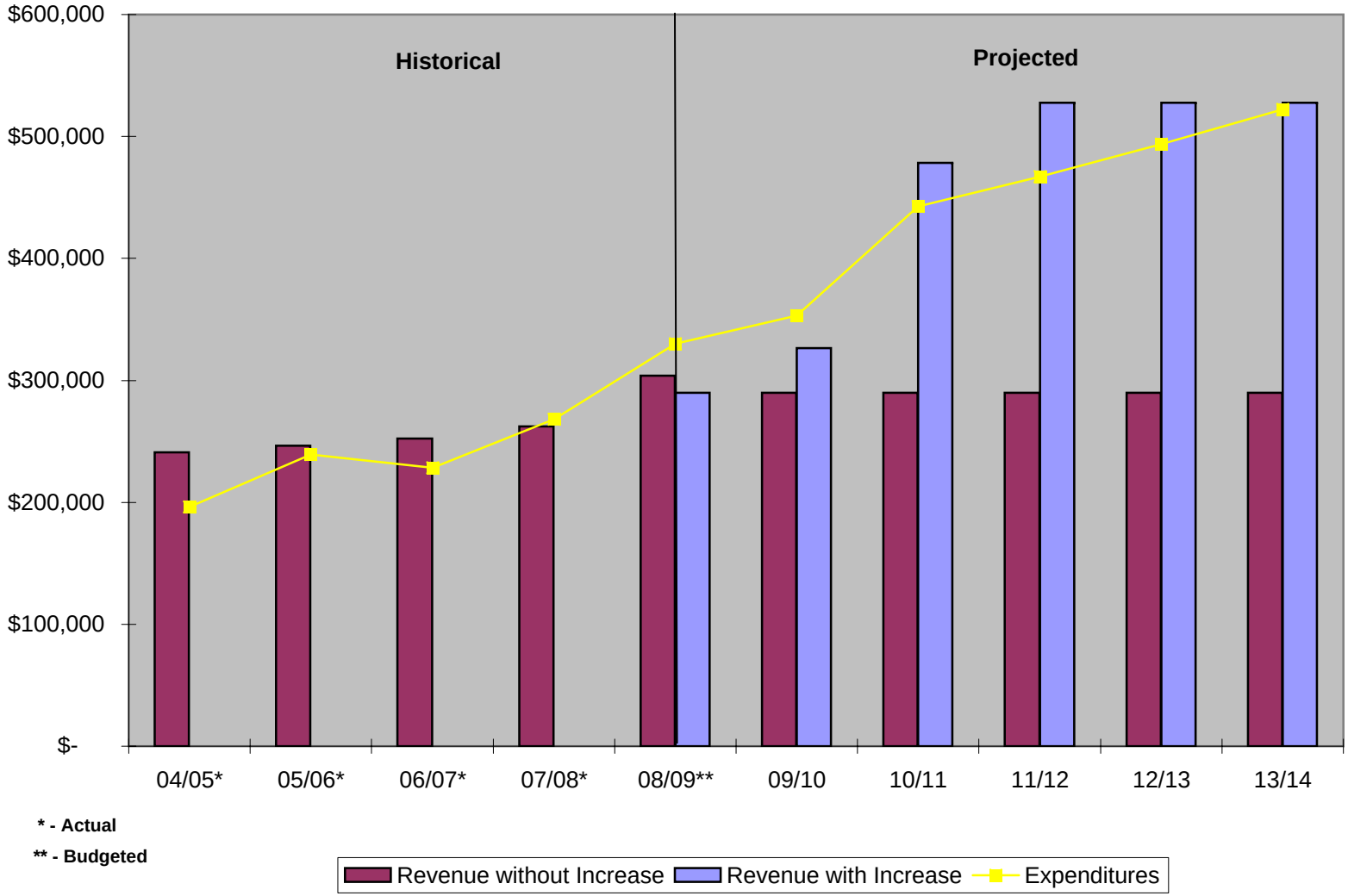
Sewer Utility
Flow of Funds
Alternative 3

Line No.	Description				Fiscal Year 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
1	Sewer Service Operating Income				$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000	$ 290,000		
	Changes to Service Charges Required:											
	Fiscal Year	6 mon. term	% Increase									
2	2008-09		0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	1st (3 mon.)	0			$ -	* $ -	$ -	$ -	$ -		
		2nd	25			$ 36,250	$ 72,500	$ 72,500	$ 72,500	$ 72,500		
4	2010-11	1st	20				$ 72,500	$ 72,500	$ 72,500	$ 72,500		
		2nd	10				$ 43,500	$ 43,500	$ 43,500	$ 43,500		
5	2011-12	1st	5					$ 23,925	$ 23,925	$ 23,925		
		2nd	5					$ 25,121	$ 25,121	$ 25,121		
6	2012-13								$ -	$ -		
7	Total Change in Service Charge Revenue				$ -	$ 36,250	$ 188,500	$ 237,546	$ 237,546	$ 237,546		
8	**Total Sewer Service Operating Income**				$ 290,000	$ 326,250	$ 478,500	$ 527,546	$ 527,546	$ 527,546		
9	Impact/Connection Fee Income				$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**				$ 290,000	$ 326,250	$ 478,500	$ 527,546	$ 527,546	$ 527,546		
	Revenue Requirements											
11	Operation and Maintenance Expenses				$ (143,750)	$ (163,532)	$ (195,706)	$ (207,967)	$ (221,488)	$ (236,441)		
12	Existing Debt Service				$ (21,572)	$ -	$ -	$ -	$ -	$ -		
13	Employee Services				$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures				$ (3,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
	Proposed USDA Debt Service											
15	Loan Principal & Interest				$ -	$ -	$ (17,540)	$ (17,540)	$ (17,540)	$ (17,540)		
16	Debt Service Reserve				$ -	$ -	$ (1,754)	$ (1,754)	$ (1,754)	$ (1,754)		
17	Depreciation Reserve for Short-Lived Assets				$ -	$ -	$ (27,067)	$ (27,067)	$ (27,067)	$ (27,067)		
18	**Total Revenue Requirements**				$ (329,853)	$ (353,063)	$ (442,870)	$ (467,186)	$ (493,608)	$ (522,371)		
19	**Net Funds**				$ (39,853)	$ (26,813)	$ 35,630	$ 60,360	$ 33,939	$ 5,175		
20	**Beginning Sewer Fund Balance**				$ 44,674	$ 4,821	$ (21,992)	$ 13,638	$ 73,998	$ 107,936		
21	**Ending Sewer Fund Balance**				$ 4,821	$ (21,992)	$ 13,638	$ 73,998	$ 107,936	$ 113,111		
22	**Target Sewer Fund Balance after 5 years****									$ (109,110)	**<**	$ 113,111
											CHECK	

* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

Table 12
Sewer Fund - Alternative 3



*** - Actual**
**** - Budgeted**

Table 13
City of San Joaquin

Water Utility
Flow of Funds
Alternative 3

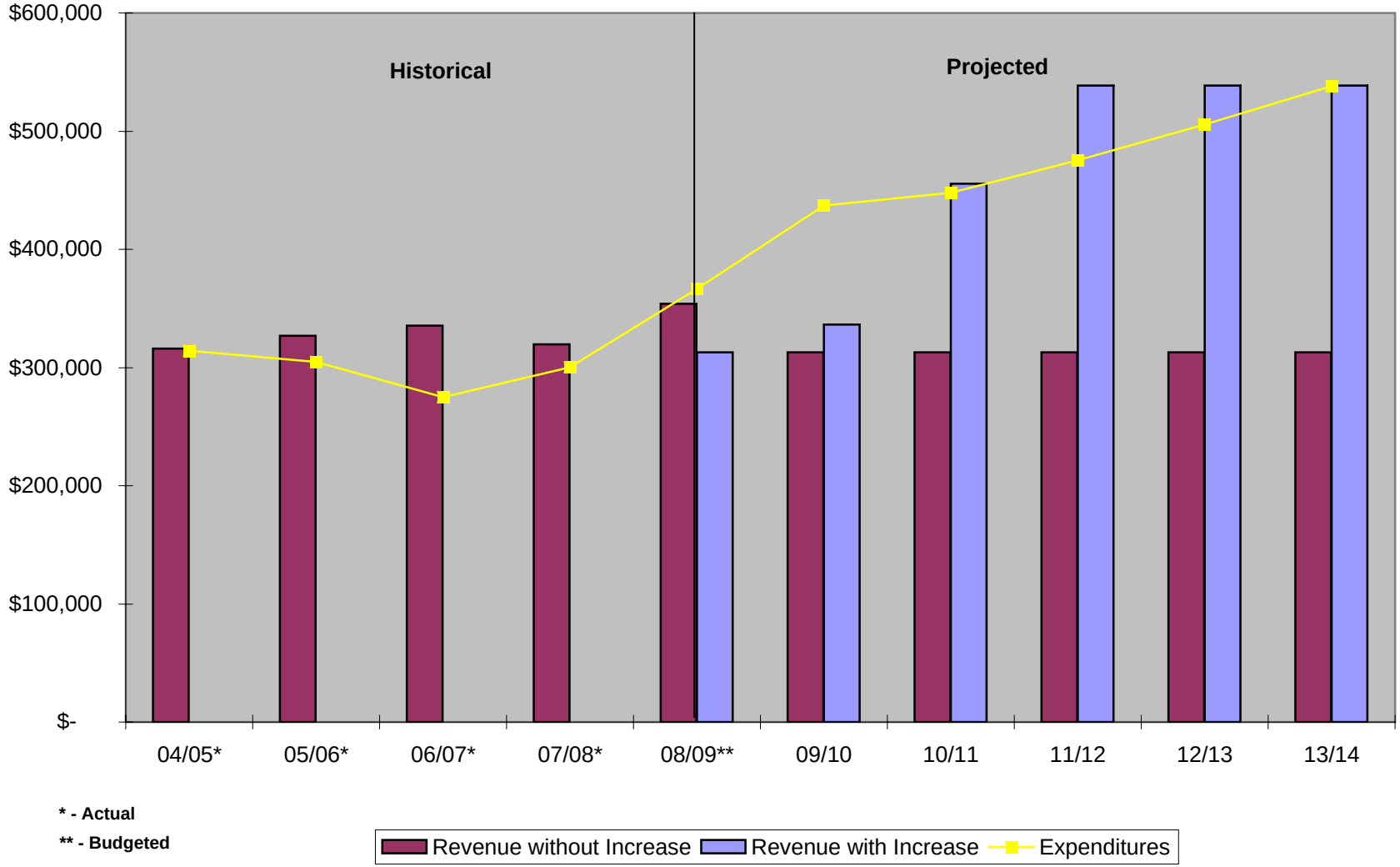
Line No.	Description				Fiscal Year 2008-09	2009-10	2010-11	2011-12	2012-13	2013-14		
1	Water Service Operating Income				$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000	$ 313,000		
	Changes to Service Charges Required:											
	Fiscal Year	6 mon. term	% Increase									
2	2008-09		0		$ -	$ -	$ -	$ -	$ -	$ -		
3	2009-10	1st (3 mon.)	0			$ -	* $ -	$ -	$ -	$ -		
		2nd	15			$ 23,475	$ 46,950	$ 46,950	$ 46,950	$ 46,950		
4	2010-11	1st	15				$ 53,993	$ 53,993	$ 53,993	$ 53,993		
		2nd	10				$ 41,394	$ 41,394	$ 41,394	$ 41,394		
5	2011-12	1st	10					$ 45,534	$ 45,534	$ 45,534		
		2nd	7.5					$ 37,565	$ 37,565	$ 37,565		
6	2012-13								$ -	$ -		
7	Total Change in Service Charge Revenue				$ -	$ 23,475	$ 142,337	$ 225,436	$ 225,436	$ 225,436		
8	**Total Water Service Operating Income**				$ 313,000	$ 336,475	$ 455,337	$ 538,436	$ 538,436	$ 538,436		
9	Impact/Connection Fee Income				$ -	$ -	$ -	$ -	$ -	$ -		
10	**Total Revenue**				$ 313,000	$ 336,475	$ 455,337	$ 538,436	$ 538,436	$ 538,436		
	Revenue Requirements											
11	Operation and Maintenance Expenses				$ (177,600)	$ (227,632)	$ (226,845)	$ (242,486)	$ (259,735)	$ (278,795)		
12	Existing Debt Service				$ (25,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)	$ (20,000)		
13	Employee Services				$ (161,531)	$ (181,531)	$ (192,803)	$ (204,859)	$ (217,759)	$ (231,569)		
14	Machinery & Equipment Expenditures				$ (2,500)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)	$ (8,000)		
15	**Total Revenue Requirements**				$ (366,631)	$ (437,163)	$ (447,649)	$ (475,345)	$ (505,493)	$ (538,364)		
16	**Net Funds**				$ (53,631)	$ (100,688)	$ 7,688	$ 63,091	$ 32,943	$ 71		
17	**Beginning Water Fund Balance**				$ 238,510	$ 184,879	$ 84,191	$ 91,879	$ 154,970	$ 187,912		
18	**Ending Water Fund Balance**				$ 184,879	$ 84,191	$ 91,879	$ 154,970	$ 187,912	$ 187,984		
19	**Target Water Fund Balance after 5 years****									$ (119,699)	<	$ 187,984

* Represents 9 months of additional revenue collection.

** Represents 90 days of Operation and Maintenance Expense + $50,000 Capital Reserve

CHECK

Table 14
Water Fund - Alternative 3



*** - Actual**
**** - Budgeted**

Table 15
City of San Joaquin

Comparison of Proposed Single Family Residential Sewer Rates with Other Local Communities in Effect as of July 2009

Community	Basis	Ultimate Rate	
Firebaugh	DU	$ 47.64	
San Joaquin	DU	$ 36.90	**Alternative 1 & 1A**
		$ 37.68	**Alternative 2**
		$ 37.29	**Alternative 3**
Mendota	DU	$ 31.00	
Huron	DU	$ 26.00	
Orange Cove	DU	$ 24.20	
Kerman	DU	$ 23.50	
Selma	DU	$ 23.28	

Table 16
City of San Joaquin

Comparison of Proposed Single Family Residential Water Rates with Other Local Communities in Effect as of July 2009

Community	Meter Size	Rate	Addt'l Volume Charge: Volume (gal)	Addt'l Volume Charge: Charge	Cost at 20,400 gal	
Firebaugh	None	$ 45.31	None	$ -		
	All sizes	$ 36.74	First 12,000	$0.00/1000 gal	**$ 62.44**	
			Next 10,000	$3.06/1000 gal		
			Next 10,000	$3.34/1000 gal		
			Over 32,000	$3.63/1000 gal		
Huron	3/4 in	$ 15.15	First 8,000	$ -		
			Over 8,000	$3.20/1000 gal		
	1 in	$ 18.95	First 10,000	$ -	**$ 52.23**	
			Over 10,000	$3.20/1000 gal		
	1 1/2 in	$ 23.70	First 12,500	$ -		
			Over 12,500	$3.20/1000 gal		
	2 in	$ 33.15	First 17,500	$ -		
			Over 17,500	$3.20/1000 gal		
	3 in	$ 56.85	First 30,000	$ -		
			Over 30,000	$3.20/1000 gal		
Mendota	3/4 in	$ 32.40	First 12,000	$ -		
			Over 12,000	$1.40/1000 gal		
	1 in	$ 34.45	First 12,000	$ -	**$ 46.21**	
			Over 12,000	$1.40/1000 gal		
	1 1/2 in	$ 62.64	First 12,000	$ -		
			Over 12,000	$1.40/1000 gal		
	2 in	$ 84.96	First 12,000	$ -		
			Over 12,000	$1.40/1000 gal		
	3 in	$ 140.22	First 12,000	$ -		
			Over 12,000	$1.40/1000 gal		
San Joaquin	None	$ 44.72	None	$ -	**$ 44.72**	**Alternative 1 & 1A**
		$ 46.80			**$ 44.93**	**Alternative 2**
					$ 44.73	**Alternative 3**
Orange Cove	None	$ 36.50	None	$ -	**$ 36.50**	
Selma	1 in	$ 35.21 *	None	$ - *	**$ 35.21**	
Kerman	None	$ 24.55	None	$ -	**$ 24.55**	

* Applies to single family residences with premises between 6001 and 10000 sq. ft.

City of San Joaquin

Water Conservation Strategy

Prepared by

Victoria Doyle & Justin Dunning

October 2, 2009

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Executive Summary

The Water Conservation Strategy for the City of San Joaquin (the City) was developed to ensure the City's compliance with funding requirements from the United States Environmental Protection Agency (EPA) for its wastewater treatment expansion project. This strategy includes a plan of actions that will result in measurable water savings for the City. This document was prepared using the US EPA's Water Conservation Plan Guidelines and the California Green Building Standards Code (2011 Title 24-Part 11)

Introduction

The City is currently in the enviable position of having enough water capacity to meet its demand. Statewide, however, concerns over the availability of water continue to grow. The Water Conservation Strategy will be used not only as the City's support for continued sustainable water usage but as a model for other California communities.

The City's current wastewater treatment facility is also a major factor in the decision to create a water conservation strategy. While the current facility is able to meet capacity, the deteriorating infrastructure poses a challenge in terms of maintenance and potential failure. The waste water facility receives waters from the City's residents, commercial buildings, and runoff. Improvements to the management of the City's water supply will result in less wastewater due to conservation. Using less water puts less pressure on the wastewater facility

Goals

There are two goals of this conservation strategy. The first is a citywide reduction in water use of 20% by the year 2011. A 20% reduction in water usage by 2011 mirrors the reduction goals of the current California Green Building Standards Code. These savings will be accomplished through two primary means: equipment upgrades and a targeted education and community outreach programs.

The second goal is to have installed water meters on all service accounts by the year 2020. California state law requires meters on all service accounts by the year 2025. Installing meters can also lead to reduced water use, and will enable the city to charge residents based on actual water usage. The cost of installing meters, however, is quite high, and the city will likely need to find grant funding in order to carry out the installations.

Analysis

Water Baseline

In 2007, the City supplied 261.7 million gallons of waters. There was a 3 million gallon (1.2%) reduction in 2008 when water demand decreased to 258.7 million gallons of water. The net total water supply does not account for the total City's population. A common metric for the water use of public water supplies is gallon per capita per day (gpcd). The gpcd shows the average water supply per person. The 2008 population of 4,062 resulted in a 181 gpcd. The City's gpcd is identical with the national average of 181 gpcd[1]. Figure 1 below shows the total water supply of the City, as well as the gpcd over the past 10 years. Fluctuations in gpcd from year to year can be explained by a variety of economic, demographic, and climate factors.

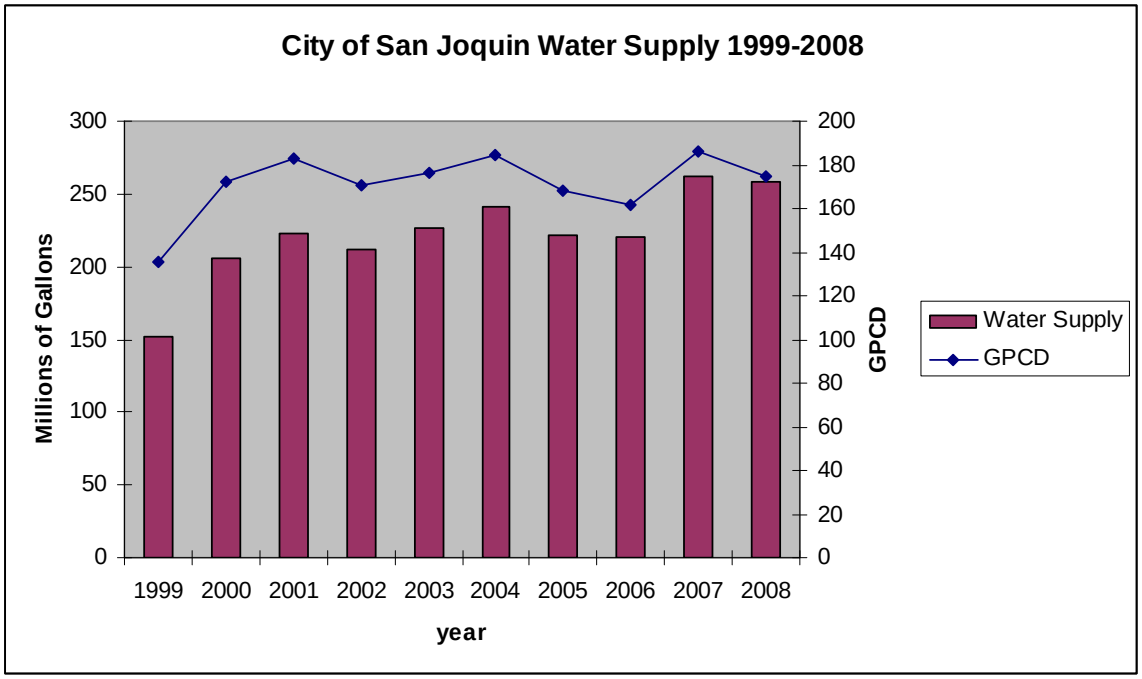


Figure 1. City of San Joaquin Water Supply 1999-2008

Significant components for water analysis include the average demand and peak demand. Peak demand is the governing factor when determining future water supply due to the need to distribute a greater capacity of water in a given time frame. The City is serviced by three ground-water wells. Combined, these wells have a maximum capacity of 3,500 gallons per minute (gpm) and 5 million gallons per day (gpd.) In 2008, 49% (1,723 gpm) of the maximum ground-water well capacity was supplied during peak consumption for the City.

[1] Figure calculated from 2000 US Census figures and data from the USGS indicating 85% of the population was served by public water supplies and the 2000 public water supply was 43,300 million gallons per day. (http://ga.water.usgs.gov/edu/wups.html)

Appendix A provides a completed copy of the water systems profile worksheet contained in the US EPA Water Conservation Plan Guidelines.

Demand Forecast

Based on current analysis, the City is not expected to outstrip its supply capacity or lose ability to met peak demand over the next 10 years. The water conservation strategy will assist with fulfilling this outcome by providing a buffering water capacity. Using a projected growth rate of 2.6% and target water reduction goal of 20%, the US EPA demand forecast worksheet has been filled out and is available in Appendix B.

Description of Water Use

Public water includes both commercial and residential uses. In the City, 48 of the 953 (5%) service accounts are for commercial uses. Approximately 20% of these commercial accounts are metered. Of the metered accounts, they average approximately 210,000 gallons of water per year. Extrapolating this water usage to the entire commercial sector results in yearly water usage of approximately 12 million gallons, which is slightly less than 5% of the total city supply. When commercial water use is separated from the residential water accounts, the resulting residential supply is 166 gpcd.

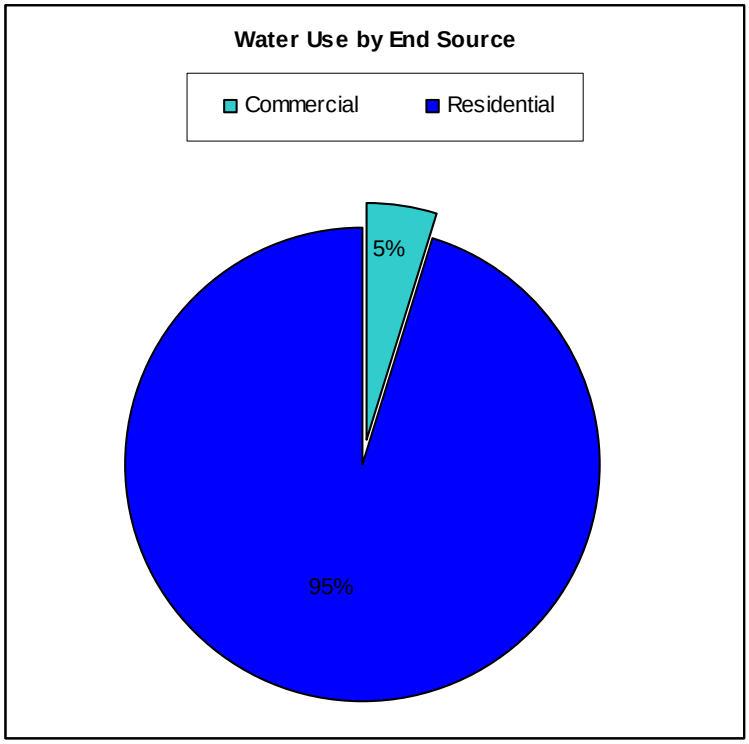


Figure 2. Water End Source (Residential vs. Commercial)

The majority of water use in the City is by residential accounts. Figure 3 below shows the result of a 1999 national residential water use survey.

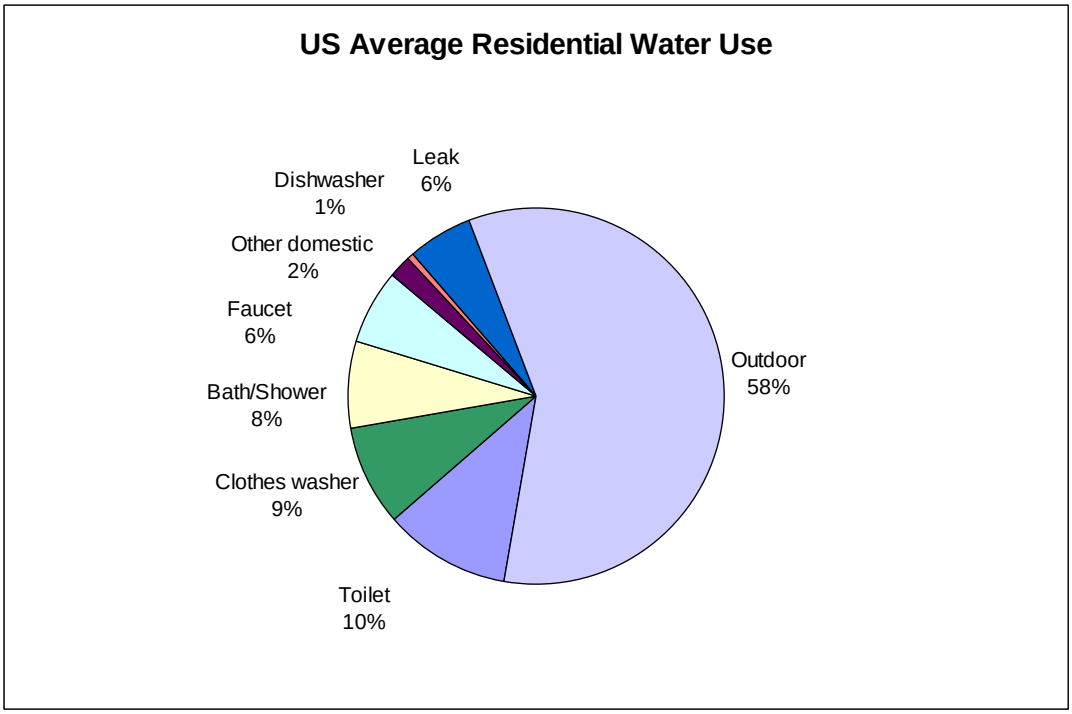


Figure 3. Average US Residential Water Use[2]

In the United States, residential water use is typically dominated by landscape water use, and the City is no exception. The ratio of water received in the sewer system can provide an estimate of the amount of water used on landscaping. Essentially, sewers capture all the water that goes down a drain: showers, sinks, toilets, etc, and also some runoff from outdoor water use. However, the bulk of landscaping water is lost to evaporation. Figure 5 shows the percentage of the water supply that is *not* returned through the sewer system. Landscape water use peaks in the summer months when landscaping demands the most water due to raised temperatures and reduced rainfall. Over the course of the year, 61% of the city's water supply goes to landscaping. This is slightly more than the national average, which is consistent with the lower precipitation and longer growing season found in the Central Valley relative to the rest of the country, **as well as the hard soil conditions in San Joaquin which lead to increased run off**.

[2] http://www.aquacraft.com/Publications/resident.htm

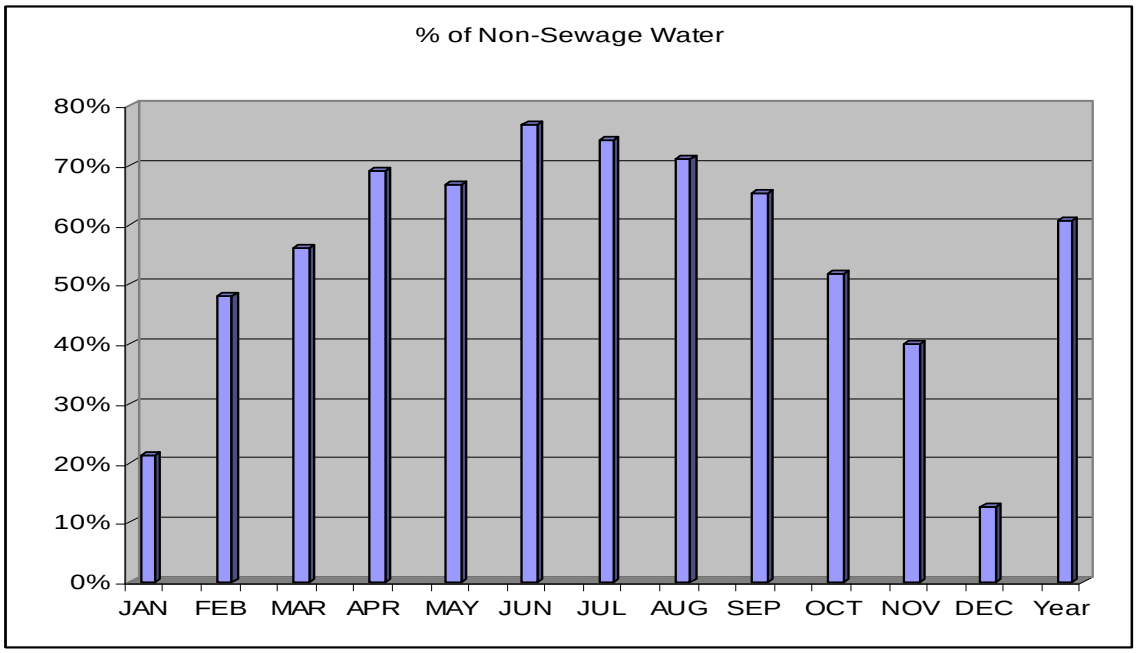


Figure 4. Percentage of Non-Sewage Water

As a factor of the whole water supply, if the water used to landscape was removed or reduced to an insignificant value, the City's residential water use will decrease to 65 gpcd. The baseline water use provided by the US EPA is identical to the City's reduced gpcd (Appendix B: Demand Forecast Worksheet).The US EPA recommended baseline water use can be seen in Table 1.

Type of Use	Amount (gpcd)	Percent of total	Amount (gpcd)	Percent of total	Savings
Toilets	18.3	28.4%	10.4	23.2%	44%
Clothes washers	14.9	23.1%	10.5	23.4%	30%
Showers	12.2	18.8%	10.0	22.4%	18%
Faucets	10.3	16.0%	10.0	22.5%	2%
Leaks	6.6	10.2%	1.5	3.4%	77%
Baths	1.2	1.9%	1.2	2.7%	0%
Dish washers	1.1	1.6%	1.1	2.4%	0%
Total indoor water use	64.6	100%	44.7	100%	31%

Table 1. Recent Estimates of Indoor Water Use With and Without Conservation [3]

[3] Source: AWWA Water Wiser, "Household End Use of Water Without and With Conservation," 1997 Residential Water Use Summary-Typical Single Family Home- Table B1 (http://www.waterwiser.org/wateruse/tables.html).

Evaluation of Conservation Measures

Water Meters

This section will include a quantitative and qualitative discussion of potential conservation measures. The first measure to be evaluated will be the installation of water meters on all service accounts. Installing water meters is one of the first steps recommended by the EPA, and state law requires that meters be installed by 2025. Studies have shown that cities with metered water use up to 15% less water than cities without meters. When meters are used to institute a tiered pricing structure, another 10% savings occurs. In addition to providing customers with feedback on their consumption levels, service meters in conjunction with supply meters, enable a system to better account for leaks in the system. The guidance from the EPA estimates that by installing meters water use can be reduced by 20%.

The difficulty arises in the cost of the installation. The cost to install water meters on existing homes ranges between $1200 and $2000. The city of Sacramento recently approved funding of $20 million to install 13,000 meters ($1,538 per meter.)[4] In cases where access to the water main requires excavation through cement, the cost of meter installation is even more prohibitive.

Conservation Measure Worksheet - Water Meters

Typical Water Savings (% reduction | GPC/year)		20%	33,149
Number of Planned Installations		905	
Number of Years		10	
Line A	Item Budget for Measure	Amount Per Unit	Amount Total Cost
1	Materials	$ 800	$ 724,000
2	Labor	$ 800	$ 724,000
8	Total Program Cost	$ 1,600	$1,448,000
B	Total Savings		
9	Number of Units Installed	905	
10	Per unit Water Savings (gal.)	33,149	
11	Total Annual Savings for Measure (gal.)	29,999,845	
12	Expected Life Span of Measure (years)	20	
13	Total Life Span Savings (gal.)	599,996,900	
14	Cost per gallon of Water Saved	$ 0.0024	

Table 2: Water Meter Worksheet

A ten year program installing 100 meter per year would cost $160,000 per year. This is equal to $168 per service account per year, or an additional $14 per month per service account. There are however, potential alternate funding sources, both public and private. A list of potential public funding sources can be found in Appendix E of the EPA Water Conservation Plan Guidelines and is reproduced as Appendix C of this

[4] http://www.sacramentopress.com/headline/13363/Water_Meter_Installation_in_Sacramento

document. The most promising source of funding is through the Department of Housing and Urban Developments Community Block Grant Program.

Ultimately, the installation of water meters city wide would cost approximately $1.5 million and has the potential to save 30 million gallons of water per year. Over the 20 year life span of the water meters, the savings would be 600 million gallons, making the total cost of the program approximately one-quarter of one cent per gallon.

Showerhead and Faucet Replacement

From Table 1, showers and faucet account for one quarter of indoor water use. The Energy Policy Act of 1992 set the maximum flow rate of any showerhead or faucet manufactured in 1994 or later at 2.5 gallons per minute (gpm.) Showerheads installed before this time could have flow rates up to 5 gallons per minute. For the purposes of this analysis, the average flow rate will be assumed to be 3.4 gpm. Faucet flow rates will be assumed to be 2.5 gpm. California Green Building Standards Code estimates the average shower length at 8 minutes per person and kitchen and lavatory faucet use at 4.25 minutes per person[5]. Replacing showerheads with 2.0 gpm showerheads and installing aerators in the faucets to bring the flow rate to 1.8 gpm, could save an average of 17.75 gallons per capita per day. Citywide, the savings potential is over 26 million gallons per year.

Replacement showerheads can be purchased for approximately $18, and aerators for the faucets are approximately $3 each. The average home is assumed to have one showerhead and three faucets. The installation of the showerhead and aerator is a quick process and can be left up to the homeowner or can be installed by a city employee. **These fixture upgrades are already planned to be part of the upgrades installed as part of the city's low income housing rehabilitation program.**

Conservation Measure Worksheet - Showerheads and Faucets

Typical Water Savings (% reduction | Gallons/year)	10%	32,394
Number of Planned installations	905	
Number of Years	1	

Line A	Item Budget for Measure	Amount Per Unit	Amount Total Cost
1	Materials	$ 27	$ 24,435
2	Labor	$ 27	$ 24,435
8	Total Program Cost	$ 54	$ 48,870
B	Total Savings		
9	Number of Units Installed	905	
10	Per unit Water Savings (gallons)	32,394	
11	Total Annual Savings for Measure	29,316,344	
12	Expected Life Span of Measure	10	
13	Total Life Span Savings	293,163,438	
14	Cost per gallon of Water Saved	$ 0.0002	

Table 3: Showerhead and Faucet Worksheet

[5] http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf page 68

Replacing fixtures is over ten times more cost-effective than installing water meters. For an investment of less than $50,000, the City of San Joaquin could save nearly 30 million gallons per year. If the cost of the program is spread over five years, an increase in water rates by $1 per month would be able to cover the upgrade. These installations are also subject to the same assistance as the water meters which could bring the cost to the city and ratepayers down even further.

Toilet Replacement

The other large block of water use inside the home comes from toilets. Like showerheads and faucets, the maximum flow rate of toilets was fixed by the Energy Policy Act of 1992. Toilets manufactured after 1994 have a flow rate of 1.6 gallons per flush (gpf) or less. Toilets installed between 1980 and 1994 generally had a capacity of 3.5 gpf and toilets installed before 1980 have capacities of 5 gpf. For the purposes of this plan, the average flow rate city wide is assumed to be 3.5 gpf, and the flush rate is four times per person per day.

Toilets vary in cost from $50 to $200 and installation costs fall in a similar range For the purpose of this analysis, the total cost for purchase and installation will be assumed to be $200. **Like the fixtures, upgrading toilets will also be a required step to participate in San Joaquin's low-income housing rehabilitation program.**

Conservation Measure Worksheet - Toilet Replacement

Typical Water Savings (% reduction | Gallons/year)	10%	13,870
Number of Planned installations	905	
Number of Years	1	

Line A	Item Budget for Measure	Amount Per Unit	Amount Total Cost
1	Materials	$ 100	$ 90,500
2	Labor	$ 100	$ 90,500
8	Total Program Cost	$ 200	$ 181,000
B	Total Savings		
9	Number of Units Installed	905	
10	Per unit Water Savings (gallons)	13,870	
11	Total Annual Savings for Measure	12,552,350	
12	Expected Life Span of Measure	20	
13	Total Life Span Savings	251,047,000	
14	Cost per gallon of Water Saved	$ 0.0007	

Table 4: Toilet Replacement Worksheet

Replacing toilets has a savings potential of nearly 14,000 gallons per household per year with a citywide savings of 12.5 million gallons per year. The cost to replace toilets would be $181,000. Spread over five years, toilet retrofits would add $3.33 to a customer's water bill. Toilet replacement is also an activity eligible for funding assistance from the sources listed in Appendix C.

Landscaping Ordinance

The largest single source of residential water use is landscaping. There are several steps that can be taken to reduce water use for landscaping: Selecting plants that use less water, providing plants with the correct amount of water, and irrigating more efficiently.

Many species of turf grass lose as much water per day as an uncovered swimming pool. By using drought tolerant species of grass or planting low water use shrubs and plants, the overall water needs of the landscape can be minimized.

A study of Southern California homeowners done by the Irvine Ranch Water District showed that the average homeowner over-watered their landscaping by 40 to 60 percent. Plants lose water throughout the day through a process called evapotranspiration. This value depends on the climactic conditions and the type of plant. The purpose of watering a landscape is to replace the water lost through this process. There is no benefit to providing plants with more water than they lose.

In order to minimize over-watering, the city can make watering schedules available. Publicizing, through postcards or flyers or city websites, how much certain plants need to be watered at certain times during the year has been shown to reduce the amount of landscape water used by up to 15%. The City's current ordinance that allows watering only on certain days is a fairly effective method of preventing over watering. Providing a more detailed schedule, however, would increase water savings. Unfortunately, many of these gains are lost after the first year as homeowners revert to their old habits. For reductions to be maintained, guidance and reminders should be an annual occurrence.

A more expensive, but more effective method is the installation of a weather-based irrigation controller (WBIC.) WBICs utilize real time weather data, either from in-ground moisture sensors or from a radio or satellite feed, to adjust the water schedule to match climactic conditions automatically. These controllers are $150-$500, and require an irrigation system.

Irrigating more efficiently can be accomplished in two ways: by using appropriately placed, efficient sprinkler systems and by watering at the correct time of day. By irrigating during the day, a larger portion of the water used will evaporate before it can be absorbed by the plant or turf. The City already has an ordinance limiting when residents can water. Another factor is the placement and adjustments of sprinkler systems. Incidentally, many irrigation systems also water sidewalks and driveways. An audit program to adjust spray heads so they are delivering water only where it is needed will also help irrigation efficiency.

The California Department of Water Resources recently released a model landscape ordinance. The ordinance is primarily focused on new construction with landscaped areas greater than 2,500 square feet and existing landscapes greater than one acre. The ordinance provides a methodology for determining the water needs of a particular landscape design and requires the design to use less water than a maximum allowable

amount. The ordinance also has requirements for the irrigation system, included the mandatory inclusion of WBIC.

Below is an evaluation of a program to send out watering schedules to all 905 residential accounts in the service area. The assumed savings are 10% of the irrigation water, and the cost of the program is assumed to be $2000: $1000 to develop the watering schedule and $1000 to produce and distribute the schedule. For these savings to become permanent, the distribution of the schedule will need to be repeated every year. This effort can be funded by an $0.18 per month increase to the utility bill. **However, with the current state of the economy, and the recent water and sewer rate increase, raising rates, even by this amount, is unlikely.**

Conservation Measure Worksheet – Watering Schedules

Typical Water Savings (% reduction | Gallons/year)	10%	18,480
Number of Planned installations	905	
Number of Years	10	

Line A	Item Budget for Measure	Amount Per Unit	Amount Total Cost
1	Materials	$ 1.10	$ 1,000
2	Labor	$ 1.10	$ 1,000
8	Total Program Cost	$ 2.21	$ 2,000
B	Total Savings		
9	Number of Units Installed	905	
10	Per unit Water Savings (gallons)	18,480	
11	Total Annual Savings for Measure	16,724,355	
12	Expected Life Span of Measure	1	
13	Total Life Span Savings	16,724,355	
14	Cost per gallon of Water Saved	$ 0.0001	

Table 5: Watering Schedule Worksheet

Educational Program

Homeowner behavior is the final and perhaps most important piece of the puzzle. Turing off the bathroom sink when brushing teeth, not leaving the kitchen sink running while washing dishes, and taking shorter showers are just a few behaviors, that when spread across an entire community, can lead to significant water savings.

The ideal situation is to reinforce these conserving behaviors early. To that end, the Department of Water Resources has a variety of educational materials available to California Teachers free of charge. An example of a Parent/Student Water Checklist is provided in Appendix D[6]. The checklists are often included as the capstone to a classroom module concerning issues surrounding water conservation. Teachers can browse a variety of workbooks, activity sheets and classroom aides at the Department of Water Resources website.

[6] http://www.water.ca.gov/education/wffcatalog.cfm

It is difficult to quantify exact savings from educational programs, but the EPA guidance suggests a 2-5% reduction is reasonable. An evaluation of the savings potential of an educational program is listed below. The potential savings is 8.2 million gallons per year.

Conservation Measure Worksheet – Education

Typical Water Savings (% reduction | Gallons/year)		3%	9,089
Number of Planned installations		905	
Number of Years		10	
Line A	Item Budget for Measure	Amount Per Unit	Amount Total Cost
1	Materials	$ -	$ -
2	Labor	$ -	$ -
8	Total Program Cost	$ -	$ -
B	Total Savings		
9	Number of Units Installed	905	
10	Per unit Water Savings (gallons)	9,089	
11	Total Annual Savings for Measure	8,225,093	
12	Expected Life Span of Measure	1	
13	Total Life Span Savings	8,225,093	
14	Cost per gallon of Water Saved	$ -	

Table 6: Classroom Education Worksheet

Summary

Table 7 below displays the program cost and annual savings for each of the measures detailed above. There is a wide discrepancy in the cost effectiveness of the measures. The City could achieve its water use reduction goal by focusing on the three most cost effective measures: Classroom education, watering schedules, and shower and faucet retrofits. Replacing old toilets and installing water meters have great water use reduction potential, but the higher cost of these measures make them impractical to implement in a short time frame. If, however, outside funding for these measures can be secured, they should help the City exceed its water use goals.

Conservation Measure Summary Sheet

Measure	Annual Savings (gallons)	Total Program Cost	Gallons Saved per Dollar
Water Meters	29,999,845	$1,448,000	21
Showers and Faucets	29,316,344	$48,870	600
Toilets	12,552,350	$181,000	69
Watering Schedule	16,724,355	$2,000	8,362
Classroom Education	8,225,093	$0	---
Total	96,817,987	1,679,870	58

Table 7: Conservation Measure Summary

Implementation Strategy

The size of the City affords it opportunities that may not be available to a larger, more populous city. It is easier to reach a greater percentage of the population and for that reason; a water conservation strategy can be enacted more quickly. The City will spend the next 12 months laying the groundwork for its water conservation activities with the goal of reducing the city wide water use in 2011 to 206 million gallons (a 20% reduction from 2008 levels.)

As a first step, the City of San Joaquin should sign up as a Promotional Partner for the U.S. Environmental Protection Agency's WaterSense Program. Becoming a partner is free of charge, and will give the city access to a variety of promotional materials and public service announcements. Additionally, becoming a promotional partner will allow San Joaquin to learn what other communities are doing to reduce water use. Additional information as well as the sign-up form can be found at http://www.epa.gov/WaterSense/partners/join/promote.htm.

Beginning in the 2010-2011 academic year, students at San Joaquin Elementary School will receive water conservation education. The school faculty and administration will be consulted about the best way to handle this, whether through in-class modules tailored to the different grade levels or a school wide assembly. Every student at San Joaquin

Elementary will be given the Parent/Student Water Conservation Checklist (copy provided in Appendix D) to complete at home. To reach those households that do not have children attending the elementary school, the city will host a community outreach event, where it will make the checklist available to any interested party. This education session and the checklist will become a yearly event, by the time a child has matriculated to high school, they will have filled out several water conservation checklists with the hope that they have developed many water conserving habits.

The landscape watering schedules will be distributed as bi-annual inserts in the resident's utility bill. The inserts should be included in the last bill before the beginning of April and the last bill before the beginning of October. The April bill should provide a summer watering schedule and the October bill should provide a winter schedule. The first insert to be sent out will be in the fall of 2010. The fall insert, at a minimum, will provide a reminder to the homeowner to water less, regardless of whether they water by hand or with an automated irrigation controller. There will, however, be more detailed information provided. Specially, the insert will detail how much water should be used per week. This information will be given in inches of water needed per week and in terms of how long an average sprinkler system will need to run. This data can be found at watertight.org, a website run by the Center for Irrigation Technology at the California State University, Fresno.

The replacement showerhead and aerator program will plan to distribute the fixtures to homeowners right before the holiday season of 2010. The goal is to have provided replacements to every household by the start of 2011. The overall cost of the fixtures is estimated to be approximately $50,000, before any rebates or grants are factored in. The city should investigate partnering with EPA, Pacific Gas and Electric, and the California Urban Water Conservation Council. The aerator and showerhead installation is fairly straightforward; however, the city should make staff available on an appointment basis for homeowners who need assistance with the replacement.

In the October 2011 bill insert, the city will include information on the city wide water use over the first sixth months of 2011, and compare that water use to the baseline year of 2008. The April 2012 bill insert will report on the water use for the entire year of 2011.

Along with the above activities, the city will begin looking for funding sources for community wide installation of water meters. The federal sources listed in Appendix C as well as state and private sources should be investigated.

Most of the above is focused on existing homes. For any future construction in San Joaquin, the impact on the city's water resources could be minimized by adopting the Department of Water Resources Landscape Ordinance[7]. Additionally, the city can require all new construction to be built to accommodate a greywater system. Greywater systems divert water from clothes washers, bathtubs, showers, and lavatory sinks from the sewer in order to be used to water the landscape. Greywater systems can save upwards of 10,000 gallons of water per year for an average household. The City of

[7] http://www.water.ca.gov/wateruseefficiency/docs/MWELO09-10-09.doc

Tucson has such an ordinance in place[8] and can be used as a template by San Joaquin.

Community Involvement

Changes in individual's behavior can often have the largest impact on reducing water consumption. The ultimate success of programs aimed at changing behavior often depend on how effective they are at bringing about a permanent change: in many cases, individuals will adopt conservative habits immediately after the program, but will soon revert to their original behavior. In order to effect lasting change, it is not only important to change behavior, but to change the individual's perspective. It is important the individuals know not only *what* they should do but *why* they are doing it.

To this end, involving the community as a whole in the development of the conservation strategy becomes very important. Without elevating the perceived need for water conservation, any change brought about through education programs would likely be short lived.

The city can also use community outreach to assist in workforce training. San Joaquin should contact government agencies and non-profit organizations in order to provide residents training to become water efficiency professionals. One such organization is GreywaterAction.org, which offers training open to individuals of all experience and skill levels. The training covers the installation of Greywater systems in existing homes.

[8] http://www.ci.tucson.az.us/water/docs/graywaterord.pdf

Appendix A: EPA Water System Profile Worksheet

Worksheet 3-1: Water System Profile				
	Summarize System Characteristics			
A	**Service Characteristics**	**Number**		
1	Estimated Service Population	4,062		
2	Estimated Service Area (square miles)	1 square mile		
B	**Annual Water Supply**		**Annual Volume (gal)**	**Percent Metered**
3	Total Annual Water Supply		258,700,000	0.12%
C	**Service Connections**		**Connections**	**Percent Metered**
4	Residential, Single-family		598	0.00%
5	Other		355	2.54%
6	Total Connections		953	0.94%
D	**Water Demand**	**Annual Volume**	**Percent of Total**	**Per Connection**
7	Metered Residential Sales	0	0	0
8	Metered Non-Residential Sales	2,159,630	1%	2,266
9	Other Metered Sales	0	0	0
10	Other Unmetered Sales	0	0	0
11	Nonaccount Water	256,540,370	99%	269,192
12	Total System Demand (total use)	258,700,000		271,459
E	**Average & Peak Demand**	**Volume**	**Total Supply Capacity**	**Percent of Total Capacity**
13	Average-Day Demand	708,767	5,040,000	14%
14	Maximum-Day Demand	1,416,900	5,040,000	28%
F	**Pricing**	**Rate Structure**	**Metering Schedule**	**Billing Schedule**
15	Residential Rate	$31.20	N/A	monthly
16	Non-Residential Rate	$31.20	Monthly	monthly
17	Other Rate	N/A	N/A	N/A
G	**Planning**	**Prepared a Plan**	**Date**	**Filed with State**
18	Capital, Facility, or Supply Plan	No	N/A	N/A
19	Drought or Emergency Plan	No	N/A	N/A
20	Water Conservation Plan	No	N/A	N/A
H	**Planning Questions**	**Yes**	**No**	**Comment**
21	Is the system in a designated critical water supply area?		X	
22	Does the system experience frequency shortages or supply emergencies?		X	
23	Does the system have a substantial unaccounted for and lost water?		X	
24	Is the system experiencing a high rate of population and or demand growth?		X	
25	Is the system planning substantial improvements or additions?		X	

Appendix B: Demand Forecast Worksheet

Worksheet 3.2 – Demand Forecast

Line	Item	Current Year	5- Year Forecast	10 – Year Forecast
A	**Total Annual Water Demand**			
1	Current Total Annual Demand	258,700,000		
2	Current Population Served	4,062		
3	Total Demand per Capita	63,688		
4	Projected Population		4,618	5,251
5	Projected Total Annual Water Demand		294,125,875	334,402,901
6	Adjustments to forecast		(25,870,000)	(25,870,000)
7	Adjusted Total annual water demand		268,255,875	308,532,901
8	Current annual demand and forecast	258,700,000	268,255,875	308,532,901
9	Current and projected annual supply capacity	1,839,600,000	1,839,600,000	1,839,600,000
10	Difference between demand and supply	1,580,900,000	1,571,344,125	1,531,067,099
B	**Average-Day and Maximum-Day Demand**			
11	Current and forecast average day demand	708,767	734,948	845,296
12	Current maximum day demand	1,416,900		
13	Maximum-day to average day demand ratio	2.0		
14	Projected maximum-day demand		1,469,238	1,689,835
15	Adjustment to maximum-day demand forecast			
16	Current and adjusted maximum day demand forecast	1,416,900	1,469,238	1,689,835
17	Daily supply capacity	5,040,000	5,040,000	5,040,000
18	Ratio of maximum-day demand to daily supply capacity	28.1%	29.2%	33.5%

Appendix C: EPA List of Potential Funding Sources

FEDERAL FUNDING SOURCES FOR WATER CONSERVATION

Agency	Elements	Information
U.S. Environmental Protection Agency	Program	Drinking Water State Revolving Fund (DWSRF) Program
	National contact	Jamie Bourne, (202) 260-5557
	Regional contacts	Each state has an agency that administers the program. See Appendix F. Contact information can be found at www.epa.gov/ogwdw/dwsrf.html
	Type of assistance	Primarily loans.
	Eligibility	Drinking water systems including public and private community water systems and non-profit non-community water systems.
	Eligible activities	Construction of facilities which will facilitate compliance with national primary drinking water regulations or further the health protection objectives of the Safe Drinking Water Act.
	Eligible measures	Residential water meters are eligible for DWSRF funding if part of an eligible project.
U.S. Environmental Protection Agency	Program	Clean Water State Revolving Fund (CWSRF) Program
	National contact	Richard Kuhlman, (202) 260-7366. Also see CWSRF website at www.epa.gov/OWM/finan.htm
	Regional contacts	Each state has an agency that administers the program. For state contact call (202) 260-7359.
	Type of assistance	EPA capitalizes state revolving loan funds. States issue or refinance loans, purchase or guarantee local debt, or purchase bond insurance.
	Eligibility	Eligibility varies according to each state's program and priorities. Eligible recipients generally include communities, individuals, citizen's groups, non-profits, Indian Tribes, and others.
	Eligible activities	Eligible projects may include a wide range of water-quality projects, such as: ▪ municipal wastewater treatment facilities ▪ agricultural, rural, and urban runoff control ▪ estuary improvement projects ▪ wet weather flow control ▪ groundwater protection projects
	Eligible measures	At a state's option, the following publicly-owned water conservation measures may be eligible for loan funding: Structural Measures ▪ Meters ▪ Plumbing fixture retrofits or replacements ▪ Efficient landscape irrigation equipment ▪ Gray water recycling ▪ Wastewater reuse Nonstructural Measures ▪ Incentive wastewater service charges ▪ Water use ordinances or regulations ▪ Public education programs

Agency	Elements	Information
Bureau of Reclamation, U.S. Department of the Interior	Program National contact	Water Conservation Field Services Program/Efficiency Incentives Program Cindy Dyballa (202) 208-7589. Also, see the Bureau's Watershare website at www.watershare.usbr.gov
	Regional contacts	Reclamation has five regional offices and 21 area offices located in the 17 western states. For contact information visit the Bureau's Watershare website (see above).
	Type of assistance	Grants are awarded but each program office may administer the program differently.
	Eligibility	Eligible recipients generally include water systems that contract for water supplies through the Bureau of Reclamation.
	Eligible activities	Eligible projects may include a wide range of water conservation projects, including planning, education, demonstration of innovative technologies, and implementation of measures.
	Eligible water conservation measures	The following water conservation measures may be grant eligible: Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Water efficient appliances (e.g. clothes washers) ▪ Efficient landscape irrigation equipment ▪ Gray water recycling ▪ Commercial/institutional conservation equipment ▪ Industrial reuse or recycling ▪ Wastewater reuse Nonstructural Measures ▪ Conservation or non-promotional rate structure ▪ Water use ordinances or regulation ▪ Public education programs
Rural Utilities Service, U.S. Department of Agriculture	Program	Rural Utilities Service, Water and Wastewater Loan/Grant Program
	National contact	Richard Mansfield (202) 690-2670
	Regional contacts	USDA has an office in each state; contact information can be found on the RUS website www.usda.gov/rus/water
	Type of assistance	Grants and loans (loans are more common).
	Eligibility	Cities and towns with populations less than 10,000 that cannot find private funding.
	Eligible activities	The program primarily funds the construction of drinking water and wastewater infrastructure (approximately 60% of assistance is allocated to drinking water improvements).
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Gray water recycling ▪ Wastewater reclamation and reuse

Agency	Elements	Information
Rural Business-Cooperative Service, U.S. Department of Agriculture	Program	Rural Economic Development Loans and Grants
	National contact	Director, Specialty Lenders Division (202) 720-1400
	Regional contacts	Consult phone directory for the number of the local Office of Rural Development
	Type of assistance	Direct loans (most often) and project grants
	Eligibility	Electric and phone utilities that have current loans with the Rural Utilities Service (RUS) or Rural Telephone Bank loans can apply for zero interest loans or grants, and can in turn offer loans to local businesses, nonprofit organizations, etc.
	Eligible activities	Establishment or expansion of rural businesses or community development projects with job creation, including water and sewer industrial development parks and other infrastructure.
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Water-efficient appliances ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse
National Resources Conservation Service, U.S. Department of Agriculture	Program	Resource Conservation and Development
	National contact	Terry D=Addio, National Program Manager, 202-720-2241
	Regional contacts	Each state has a Natural Resources Conservation Service Office.
	Type of assistance	Advisory service and counseling, project loans and grants possible when funding levels allow. The program can offer technical support in the form of a coordinator for adopted projects (including activities pertaining to water management). While funds are not awarded, the agency can help projects find additional funding elsewhere.
	Eligibility	Applicants must be state or local governments and nonprofit organizations with the authority to plan or carry out activities relating to resource use and development in multi-jurisdictional areas (including Puerto Rico, Virgin Islands, Guam, and Northern Marina Islands). Beneficiaries must be located in a designated resource conservation and development area.
	Eligible activities	Resource conservation and development
	Eligible water conservation measures	Indirect support for both structural and nonstructural measures may be obtained.

Agency	Elements	Information
Economic Development Administration, U.S. Department of Commerce	Program	Economic Development Administration=s Public Works and Development Facilities Grants Program
	National contact	David McIlwain (202) 482-5265
	Regional contacts	Each state has a representative; contact information can be found on the Commerce Department website www.doc.gov/eda
	Type of assistance	Grants only.
	Eligibility	Activities to assist in the economic development of economically distressed areas (high unemployment or low income). Most grants are made to rural communities, but urban communities are eligible as well.
	Eligible activities	The program funds public works infrastructure and development facilities, including improvements to drinking water systems and wastewater systems (especially industrial wastewater). Projects that provide immediate assistance will receive special emphasis. Funds may not be used for residential systems.
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Gray water recycling ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse
Appalachian Regional Commission	Program	Appalachian Regional Commission Grant Program
	National contact	Harry Roesch (202) 884-7774
	Regional contacts	Each state has a representative; contact information can be found on the Appalachian Regional Commission website (www.arc.gov).
	Type of assistance	Grants only.
	Eligibility	Activities that expand infrastructure to encourage economic development and meet state environmental statutes in economically distressed areas in Appalachian states from Northeast to Mississippi. Program needs federal agencies (for example RUS, HUD, and Tennessee Valley Authority) to administer funds and requires at least a partial match from either federal, state, or local sources. States make final decisions on whether projects are eligible for funding.
	Eligible activities	The program funds public works infrastructure only, including improvements to drinking water systems and wastewater systems. The water conservation measures can be funded only if they are part of a larger economic-development package.
	Eligible water conservation measures	Structural Measures ▪ Meters Leak detection and control equipment ▪ Gray water recycling ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse

Agency	Elements	Information
U.S. Department of Housing and Urban Development	Program	Community Development Block Grants
	National contact	Yvette Aidara (202) 708-1322 ext. 4378
	Regional contacts	Each state has a HUD office; contact information can be found on the HUD website www.hud.gov
	Type of assistance	Grants and loans (loans are more common).
	Eligibility	Intended to primarily assist low to moderate income communities. Approximately 70% of the total money goes directly to urban areas, mostly low to moderate income; the remaining 30% is allocated to state programs that target nonentitled low to moderate income areas (population less than 50,000/county population less than 200,000).
	Eligible activities	All kinds of activities are eligible, including planning and management efforts, as long as they are a part of a community economic development project. State programs may choose to prioritize infrastructure funding.
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Water-efficient appliances ▪ Water-efficient landscaping or irrigation equipment ▪ Gray water recycling ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse Nonstructural Measures ▪ Development of nonpromotional water rate structures ▪ Developing water use regulations or wastewater ordinances
Community Planning and Development, U.S. Department of Housing and Urban Development	Program	Empowerment Zones Program (Urban)
	National contact	National Office of Community Planning and Development (202) 708-6339, 1-800-998-9999
	Regional contacts	Directors of Community Planning and Development at regional HUD
	Type of assistance	Grants related to revitalization planning.
	Eligibility	An applicant must be nominated by a local government or state where the area is located. Applicants on behalf of nominated beneficiaries may also include, but are not limited to, state and local governments, regional planning agencies, non-profit organizations, community-based organizations, or partnerships of community members and other entities. The beneficiary (urban area) is eligible if it (1) meets certain population requirements; (2) is an area of pervasive poverty, unemployment, and general distress; (3) does not exceed 20 square miles, and (4) meets other locative requirements. While Round I Zones have been selected, Congress has authorized the selection of 15 additional urban Empowerment Zones.

Agency	Elements	Information
	Eligible activities	Potential Empowerment Zones submit creative plans for revitalization and, if chosen, receive grants to help execute these plans.
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Water-efficient appliance ▪ Water-efficient landscaping or irrigation equipment ▪ Gray water recycling ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse
U.S. Department of Health and Human Services	Program	Empowerment Zones Program (Rural)
	National contact	Victor Vasquez (202) 619-7980
	Regional contacts	Jim Gatz (202) 260-0397 can help identify appropriate state agencies.
	Type of assistance	Project grants
	Eligibility	A rural applicant must be nominated by a local government or state where the rural area is located. Applicants on behalf of nominated beneficiaries may also include, but are not limited to, state and local governments, regional planning agencies, non-profit organizations, community-based organizations, or partnerships of community members and other entities. An area is eligible if it (1) has a maximum population of 30,000; (2) is an area of pervasive poverty, unemployment, and general distress; (3) is smaller than 1,000 square miles; and (4) meets other locative requirements. Round I zones have been selected, 5 additional zones have been authorized by Congress.
	Eligible activities	Potential Empowerment Zones submit creative plans for revitalization and, if chosen, receive grants to help execute these plans.
	Eligible water conservation measures	Structural Measures ▪ Meters ▪ Leak detection and control equipment ▪ Plumbing fixture retrofits or replacements ▪ Water-efficient appliance ▪ Water-efficient landscaping or irrigation equipment ▪ Gray water recycling ▪ Commercial/institutional conservation measures ▪ Industrial reuse or recycling ▪ Wastewater reclamation and reuse
Pacific Northwest Laboratory, U.S. Department of Energy	Program	Pacific Northwest National Laboratory
	National contact	Michael Baechler (503) 417-7553. www.pnl.gov/energystar
	Regional contacts	Not applicable
	Type of assistance	Market transformation.
	Eligibility	Bulk purchase of water-efficient clothes washers by high volume purchasers, including multifamily residential units, builders, utilities, energy commissions, and developers, but not retailers.
	Eligible activities	The program provides access to a specific model of high performance water-conserving clothes washers selected in a national competition.
	Eligible water conservation measures	Structural Measures ▪ Water-efficient appliances

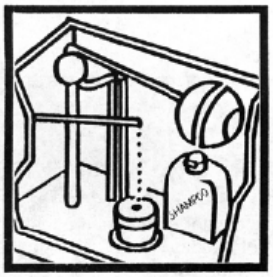
Appendix D: Sample Water Checklist Prepared by DWR for Classroom Education

Parent/Student Water Conservation Checklist

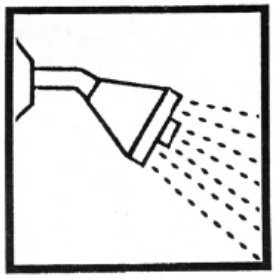
INDOOR USE

Bathrooms

		Suggestions
1 Have toilets been checked for leaks?	[ ] **Yes** [ ] **No**	Place a few drops of food coloring in toilet tank (be sure the water is clear, not colored by in-toilet cleaning dispensers).
2 Is the toilet being used as a wastebasket?	[ ] **Yes** [ ] **No**	Extra toilet flushes can waste as much as 5 plus gallons each.



3 Is there either a plastic bottle or bag in the toilet tank so that each flush uses less water?	[ ] **Yes** [ ] **No**	If you have an older model toilet, put an inch or two of sand or pebbles in the bottom of a one-quart plastic bottle (an empty plastic shampoo bottle works well) and fill the rest of the bottle with water. Cap the bottle tightly. Place the bottle in the toilet tank, safely away from all moving parts. Better yet, consider buying a new ultra-low flow toilet which uses 1.6 gallons per flush (instead of up to 5 plus gallons per flush). See your hardware or plumbing store or contact your local water agency for further information.



4 Are family members taking short showers (5 minutes or less)?	[ ] **Yes** [ ] **No**	Taking quicker showers can help you save up to 3 gallons of water for each minute of shower time reduced. Consider installing a new low-flow shower head which uses 2.5 gallons per minute.

Kitchen/Laundry

5 Are dishwashers and washing machines used only with full loads?	[ ] **Yes** [ ] **No**	Wait until full loads before using appliances. This saves water and energy.

		Suggestions
6 Is water left running while rinsing vegetables, dishes, shaving or brushing teeth?	[ ] **Yes** [ ] **No**	Ponding water (keeping it in the sink with a stopper) is a smart way to conserve water.
7 Have kitchen and all other faucets been check for leaks?	[ ] **Yes** [ ] **No**	Repair leaks as soon as possible. Even small leaks add up to large losses over time.

OUTDOOR USE

8 Is the landscape watered only when the plants really need water?	[ ] **Yes** [ ] **No**	Check lawns and shrubs to see if they need water. A lawn that springs back after being stepped on doesn't need water. Check with your water utility to see what local restrictions apply.
9 Is the landscape being watered before 10:00 a.m. or after 5:00 p.m.?	[ ] **Yes** [ ] **No**	Do not water during the hottest part of the day. The sun can make a lot of the water evaporate before thirsty plants get a chance to drink it.

10 Are your walkways or driveways hosed off for cleaning?	[ ] **Yes** [ ] **No**	Using a broom gets the cleaning job done while saving water, too. A car can be washed using a bucket of soapy water and a fine spray to finish the job. Install a shut-off nozzle on the hoses.

I have reviewed the water-saving tips mentioned above with my son/daughter.

Parent's Signature _____

Local hardware and plumbing stores stock many devices to help you save water and meet current California law. Contact your local water agency for more information on water conservation programs.

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