Technical Memorandum

RMC Water and Environment

Groundwater Recharge Using Recycled Water Project

Subject:	**Fatal Flaw Analysis**
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This Technical Memorandum (TM) presents the results of the Fatal Flaw Analysis (FFA) conducted for the Lancaster Area Groundwater Recharge (GWR) Pilot Project (Pilot Project) on behalf of the City of Lancaster (City).

The Pilot Project was originally recommended in the GWR Feasibility Study (FS) (RMC 2007). The objectives of the FFA were to:

- Provide more detail on the Pilot Project including a description of the facilities needed, timing of operations, maintenance requirements, estimated costs and benefits
- Identify and evaluate potential fatal flaws for various implementation considerations that would permanently impede implementation of the project. Potential fatal flaw areas investigated include:
    - Technical
    - Regulatory
    - Environmental
    - Institutional
- Make recommendations on how to move forward with Pilot Project implementation

This TM is organized into the following sections:

1. Project Overview
2. Background
3. Pilot Project Original Concept
4. Pilot Project Refinements
5. Recommended Pilot Project
6. Fatal Flaw Analysis
7. Conclusions and Recommendations

The appendices shown below are attached to the TM:

A. Hydrologic Analysis
B. Detailed Costs
C. Soil Hydraulic Properties
D. Nitrogen and Trihalomethanes Attenuation via Soil Aquifer Treatment
E. State Water Resources Control Board Recycled Water Policy Comments

F. Management of Microconstituents
G. Minutes from Regional Water Quality Control Board and California Department of Public Health Meeting
H. Summary of Meeting with California Department of Fish and Game
I. Responses to Comments on the Draft Fatal Flaw Analysis

The GWR FS and information provided by project partners were used in part as a basis for this TM. Project partners include:

- Antelope Valley State Water Contractors Association (AVSWCA), which includes Antelope Valley East Kern Water Agency (AVEK) and Palmdale Water District (PWD)
- County Sanitation Districts of Los Angeles County (LACSD)
- City of Palmdale (Palmdale)
- Los Angeles County Department of Public Works, Waterworks District No. 40 (WWD No. 40)

Responses to comments on the Draft TM from the Project partners that were not directly addressed in the TM are provided in Appendix I.

1 Project Overview

The Pilot Project would enhance the feasibility of future large-scale, regional GWR projects using recycled water, including the Lancaster Area Groundwater Recharge Project as defined in the GWR FS, by (1) providing water quality data that will help optimize a regional project definition and demonstrate attainment of regulatory requirements, while avoiding basin-wide issues such as salt and nitrogen management and related Basin Plan Amendment, (2) providing a forum for regional collaboration and public involvement, and (3) tackling institutional barriers surrounding a regional project with a reduced number of participant agencies and at reduced risk given the small scale nature of the project. The City is the primary project proponent, although the project is supported by other stakeholders including AVEK, WWD No. 40, LACSD, Building Industry Association (BIA) and Rosamond Community Services District (RCSD).

2 Project History

As documented in the Antelope Valley Integrated Water Management Plan (IRWMP 2007), the Antelope Valley needs to tackle a number of major water resource issues to sustain its current economy as well as its projected growth. These water resource issues include:

- An overdrafted groundwater basin, which limits the amount of water that can be economically and sustainably pumped in the long-term
- Uncertain future reliability of imported water from the State Water Project (SWP) water supplies due to factors such as climate change, levee breach, earthquake, power outage, or environmental and wildlife protection needs
- Limited local water treatment and conveyance capacity and increasingly stringent potable water quality standards, which will require significant capital improvements in the next 20 years
- Limited effluent management options and increasingly stringent wastewater discharge requirements, which will require significant capital improvements in the next 20 years

The entities in charge of water resources management in the Valley have been working on developing and implementing solutions to address these various issues. The solutions are at different stages of development and implementation; but there appears to be a broad agreement amongst stakeholders that

GWR projects, including GWR with recycled water (GWR-RW), will need to be part of the ultimate solution (IRWMP 2007).

Groundwater recharge projects that use recycled water are of particular interest because:

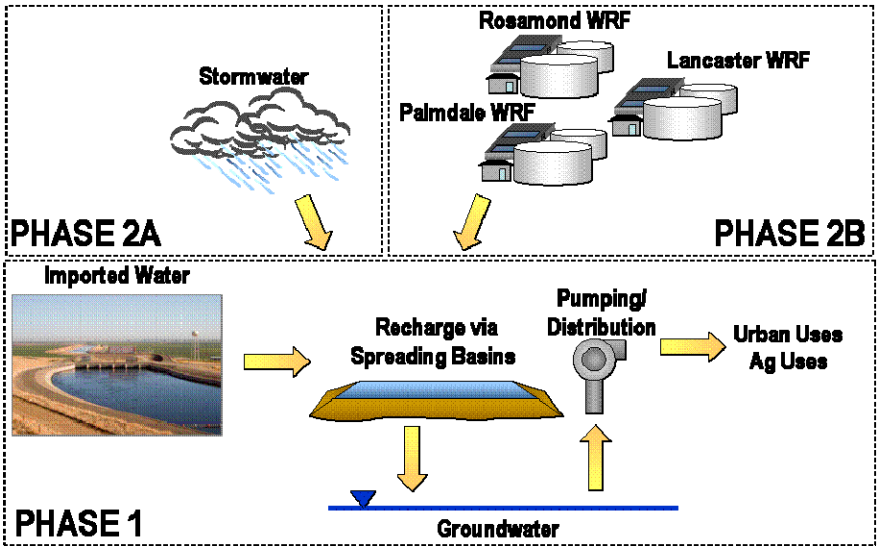
- Recycled water available from the Lancaster Wastewater Treatment Plant and Palmdale Wastewater Treatment Plant could represent approximately 20,000 acre-feet per year (afy) of new water supply by the year 2011. This represents a significant portion of the 200,000 afy which is the estimated total Antelope Valley water supply (IRWMP 2007).
- Recycled water is locally produced and a reliable source of supply (not subject to drought or other reliability issues associated with imported water)
- Urban recycled water use alone cannot maximize the use of recycled water in Antelope Valley (KJ 2006 and RMC 2006)
- Other uses for recycled water, primarily landscape irrigation, have the highest demand during summer months; whereas GWR may be operated during the winter months.

GWR Feasibility Study

The City of Lancaster and its partners conducted a GWR FS in 2007, which evaluated the concept of utilizing recycled water for groundwater recharge in Antelope Valley. As established in the Groundwater Recharge Feasibility Study, large-scale GWR with recycled water within the Antelope Valley shows high potential. A benefit-cost analysis completed as part of the Feasibility Study showed the fiscal appropriateness of recharging a blend of imported water and recycled water from the Lancaster Water Reclamation Facility compared to imported water only. Benefit-cost analysis based on the Groundwater Recharge Feasibility Study and the Lancaster Recycled Water Master Plan (RMC 2006) also shows long-term fiscal appropriateness of expanding GWR operations to include recycled water compared to implementing all phases of urban reuse projects in the Lancaster Area.

The basic concept of large-scale GWR with recycled water considered in the GWR FS is illustrated in Figure 2-1Error! Reference source not found.. In general, it would consist of an expansion of planned GWR using imported water only (referred to as Phase 1 in Figure 2-1**Error! Reference source not found.**), such as the Water Supply Stabilization Project – Westside sponsored by AVEK, ACSWCA, and LACWWD 40. This expansion (shown as Phase 2B in Figure 2-1**Error! Reference source not found.**) would consist of blending recycled water produced at the Lancaster Water Reclamation Facility, Palmdale Water Reclamation Facility or Rosamond Treatment Plant with imported water prior to recharge via spreading basins. The blend ratio would be defined to meet all regulatory requirements. This expansion would likely be implemented in parallel to GWR with stormwater (shown as Phase 2A in Figure 2-1**Error! Reference source not found.**) – although this concept has yet to be fully developed.

Figure 2-1: Large-Scale GWR Concept Considered in Groundwater Recharge Feasibility Study (RMC, 2007)



The GWR FS particularly focused on a Lancaster Area GWR project, which was deemed technically feasible. The full-scale Lancaster Area GWR-RW project would recharge 50,000 afy of blended water. The blend water would include 10,000 afy of recycled water from Lancaster Water Reclamation Plant (LWRP). Costs associated with the Lancaster Area GWR-RW project were estimated at $200 million (in 2007 dollars), including approximately $25 million for implementation (such as engineering, legal services and environmental documentation), excluding any stormwater components. The GWR FS estimated that it would take four to nine years to implement such a project assuming that the recommended implementation plan is followed.

The GWR FS noted that the timing of the project depends on two processes: timing of large-scale GWR projects with imported water and resolution of the adjudication process. It also noted that several critical steps must be taken before a decision to move forward with implementation (which would entail permitting, design, and construction activities) can be made:

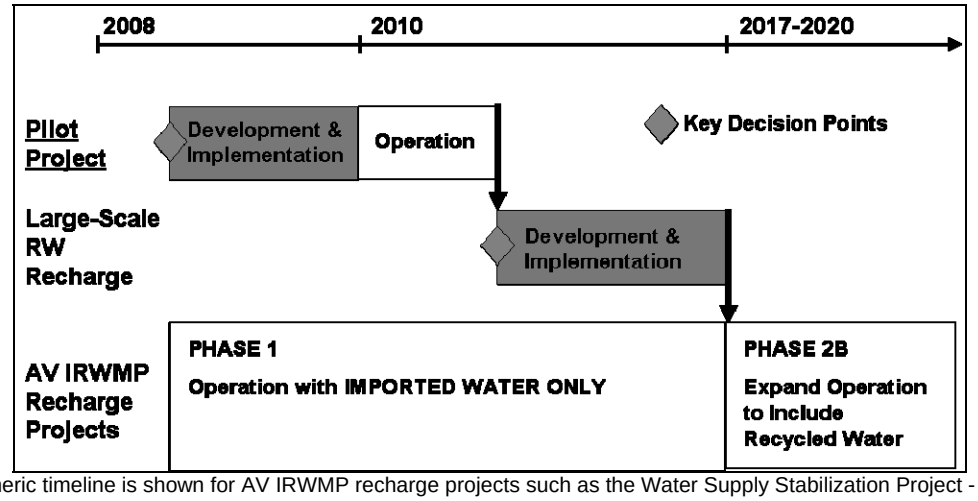
- Demonstrate the ability to attain regulatory requirements
- Involve the public
- Optimize the definition of the Lancaster Area GWR Project and other large-scale GWR projects using recycled water
- Tackle key institutional issues, such as identifying the lead project proponent, and developing preliminary interagency agreements

A pilot project, which is the focus of this TM, was therefore recommended as a first and necessary step. Specific objectives of the pilot project would be as follows:

1. Provide water quality data to optimize regional project(s) definition and demonstrate attainment of regulatory requirements, while avoiding basin-wide issues such as salt and nitrogen management and related Basin Plan Amendment,
2. Provide a forum for regional collaboration and public involvement, and
3. Tackle institutional barriers surrounding the regional project with a reduced number of participant agencies and at reduced risk given the small scale nature of the project.

Figure 2-2 illustrates how the proposed Pilot Project fits in the overall timeline and decision process for expanding GWR operation to include recycled water.

Figure 2-2: Regional and Pilot Projects Implementation Timelines



1. While a generic timeline is shown for AV IRWMP recharge projects such as the Water Supply Stabilization Project - Westside and Eastside Projects, Palmdale's Groundwater Recharge Recycled Water Project and the AV Water Bank each project will follow its own specific timeline laid out in the AV IRWMP (IRWMP 2007).
2. The timeline for shown for large-scale RW recharge projects in the Lancaster Area was established in the GWR FS.
3. The duration of this task is dependent on many factors, particularly the magnitude of recycled water included in the initial phase(s) of the GWR-RW project and the related scope of an anti-degradation analysis. Also, a Salt / Nitrogen Basin Plan Amendment may be developed, which could take many years, but a GWR-RW project could be implemented in the interim.

Pilot Project and Fatal Flaw Analysis Objectives

Based on preliminary estimates, the Pilot Project would have represented approximately a $6 million investment (excluding cost associated with the stormwater facilities), i.e. about 3% of the full-scale GWR-RW project capital costs evaluated in the GWR FS.

Completion of a Fatal Flaw Analysis was therefore recommended, with three primary objectives:

- Refine the Pilot Project definition, including benefits and estimated costs
- Identify and evaluate potential fatal flaws for various implementation considerations that would permanently impede implementation of the project. Potential fatal flaw areas investigated include:
    - Technical
    - Regulatory
    - Environmental
    - Institutional
- Make recommendations on whether and how to move forward with Pilot Project implementation

Special activities performed under the FFA to achieve the objectives listed above included:

- Coordination with Lahontan Regional Water Quality Control Board, Department of Public Health, Department of Fish and Game, Fox Field Airport – Three meetings were held to coordinate with various regulatory and stakeholder (in the case of Fox Field Airport) groups. Minutes from the meetings are attached as Appendices.
- Subsurface Site Investigation (conducted by the City) – An investigation looking at subsurface soils was conducted by the City where two soil borings were drilled in the vicinity of the Pilot

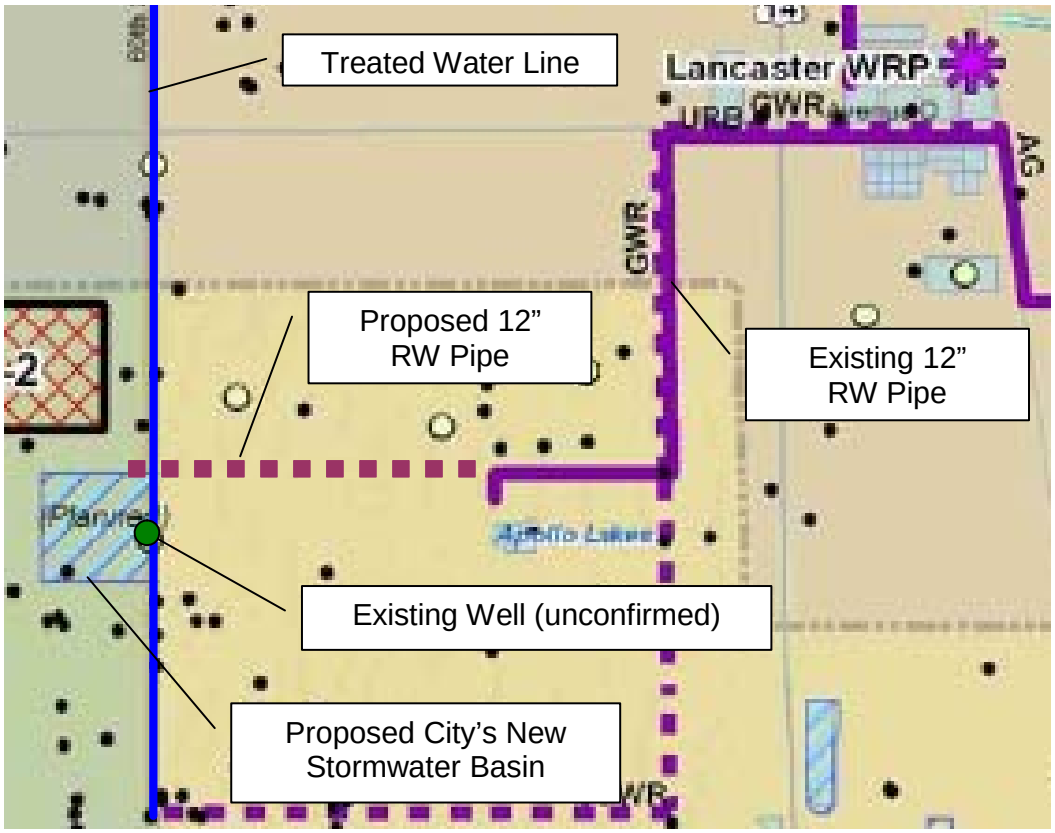
Project recharge basin. Results from the investigation are discussed in greater detail in Section 6.1 of this TM.

- Stakeholder involvement – Two stakeholder meetings were held during the FFA including one in August 2007 and one in January 2008. Stakeholders attending these meetings included AVEK, PWD, WWD No. 40, LACSD, Palmdale and RCSD. One-on-one discussions were also held between the City and Palmdale.

3 Pilot Project Original Concept

The Pilot Project concept envisioned in the GWR FS is illustrated on **Figure 3-1** and described below.

Figure 3-1 Pilot Project Original Concept



Source: GWR FS

- The Pilot Project would recharge a blend of stormwater and recycled water from the LWRP. A supplemental diluent supply (local groundwater, raw imported water or treated imported water) would likely be needed.
- Recharge would occur at the proposed City 100-acre stormwater basin at 60th Street West and Avenue F in western Lancaster.
- The original concept was to recharge up to 2,500 acre-feet (af) of water annually, including 500 af of recycled water. The proposed project has been downsized to recharge up to 625 af of water annually, including 125 af of recycled water.
- The recharged water would be pumped to serve either non-potable uses or municipal and industrial uses, after an initial monitoring phase is complete.

The proposed Pilot Project GWR site was selected based on the following considerations:

- The City already planned to construct a stormwater recharge basin at the site
- The City has completed the land transfer from Los Angeles County
- The timing of the Pilot Project matches expected LWRP tertiary treatment expansion schedule
- A recycled water pipeline already connects LWRP with Apollo Lakes Regional County Park (Apollo Lakes), which is only two miles east of the site
- Stormwater would be available as a diluent supply based on City stormwater recharge basin plans
- The site is in the vicinity of the full-scale Lancaster Area GWR-RW project recharge basins proposed in the GWR FS

4 Pilot Project Refinements

The Pilot Project as proposed in the GWR FS was developed at a very conceptual level. Refinements were therefore necessary to conduct the FFA. These refinements involved evaluating water supply options and blend strategy, evaluating potential operational scheme and associated basin configuration, and evaluating alternative conveyance facilities options.

These refinements were made with two goals in mind: (1) minimize Pilot Project capital and operating costs; and (2) minimize potential for technical, regulatory, environmental or institutional fatal flaws. The recommended project based on these refinements is presented in Section 4.

4.1 Water Supply Options and Preferred Blend Strategy

The primary strategy to meet California Department of Public Health (CDPH) Draft GWR Regulations as established in the GWR FS is to achieve a 4:1 ratio of diluent water to recycled water (80% diluent water and 20% recycled water). Water supply options to achieve that blend ratio for the Pilot Project are summarized below.

4.1.1 Recycled Water

The Pilot Project plans to use a minimum of 125 afy of recycled water from the upgraded LWRP, which is expected to be operational in late 2010 (LACSD, p.c. 2007).

Recycled Water Quantity

A volume of 500 afy was originally considered to maximize recycled water use from the existing 0.5 MGD AVTTP and the new 1.0 MGD membrane bioreactor (MBR) system.

It was established during the FFA that recharging 125 afy of recycled water would be sufficient to achieve the established Pilot Project objectives and would minimize capital and O&M costs associated with the Pilot Project (particularly stormwater basin costs).

Recycled Water Source

Using recycled water from the existing 0.5 million gallons per day (MGD) Antelope Valley Tertiary Treatment Plant (AVTTP) and the new 1.0 MGD membrane bioreactor (MBR) system which is expected to be operational in late 2007 was originally considered. Based on further considerations, the recommended source for recycled water for the pilot project is the upgraded LWRP:

- Recycled water from the upgraded LWRP would be available in sufficient quantity by the time the Pilot Project is operational

- The same quality recycled water would be used for the full-scale GWR-RW project

Recycled water from the upgraded LWRP cannot be used to serve Apollo Lakes because of the need for phosphorus reduction. Therefore, the recycled water pipe to Apollo Lakes can only be used by the Pilot Project as a recycled water conveyance facility during months when there are no deliveries to Apollo Lakes.

Because there is some uncertainty associated with the timing of the LWRP upgrade, the feasibility of the second option was also considered in the Pilot Project refinement and fatal flaw analysis. The evaluation concluded that:

- LACSD has commitments to provide effluent from LWRP, AVTTP and MBR to meet the demands of Apollo Lakes, the Lancaster Division Street Project, Piute Ponds, and the Impoundment Areas. Currently, AVTTP provides the recycled water for Apollo Lakes. The new MBR system is the planned supply for Lancaster until LWRP upgrades are complete. Demands from Piute Ponds and the Impoundment Areas exceed the combined treatment capacity of AVTTP and the MBR system, therefore supplies are assumed to be produced by LWRP (prior to and after upgrades).
- Based on monthly supply and demand estimates in **Table 4-1**, 125 af or more of recycled water should be available from a combination of AVTTP and MBR flows from December through March. Therefore, the Pilot Project would have adequate recycled water supplies even if the LWRP upgrades are not completed by 2010.

Table 4-1: AVTTP & MBR Combined Flows[1]

Units = af	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Dec-Mar
Total[1]	140	140	140	140	140	140	140	140	140	140	140	140	**1,680**	**560**
Apollo Lakes[2]	-	-	-	5	24	29	29	29	22	29	5	-	**172**	**-**
Lancaster[3]	11	12	26	37	47	53	54	48	36	26	13	9	**371**	**58**
Available	129	128	114	97	63	51	49	55	76	78	120	131		**502**

Notes:
1. Assumes 0.5 MGD and 1.0 MGD flows from AVTTP and MBR, respectively.
2. Source: LACSD, 2004
3. Lancaster Division Street Project demands through 2010.

- However, use of recycled water from AVTTP and MBR could raise water quality and related regulatory issues. These issues are discussed in Section 6.2.1.

4.1.2 Diluent Water Supply Options

The GWR FS recommended use of raw (untreated) imported water and stormwater as diluent supplies for blending with recycled water for the full-scale GWR-RW project. Ideally, the Pilot Project would therefore also use raw (untreated) imported water and stormwater as diluent supplies. Given the recycled water volume assumed, 500 afy of raw (untreated) imported water and/or stormwater would be needed.

There is no existing raw imported water infrastructure in close proximity to the Pilot Project GWR site. In addition, in an average rainfall year, there will likely not be enough stormwater to provide for a 4:1 blend ratio. Alternative diluent water supply options were therefore considered for the Pilot Project, including

treated imported water, and potable groundwater[1]. Each option is further discussed in the paragraphs below.

Stormwater

Of the diluent supplies considered, stormwater is the preferred option for the Pilot Project because it is the most relevant to the large scale GWR-RW and it is likely that it has few water quality concerns related to total dissolved solids (TDS), disinfection by-products (DBPs), and nitrogen. A drawback of stormwater is that precipitation in the Antelope Valley can be characterized by large and infrequent storms, which lead to large, infrequent peak stormwater flows. Also, California Department of Fish and Game (CDFG) could require minimum outflows from the basin, thus limiting the volume that could be captured.

For the purposes of the FFA, the average, available volume of stormwater that could be captured over the December – March timeframe estimated for the Pilot Project was 500 af based on the assumptions shown in bullets below. To be conservative, it was assumed that only one quarter of this 500 af would be available on a yearly basis for the pilot. If more than 125 af of stormwater can be detained and recharged, the amount of alternative blend supply would decrease accordingly.

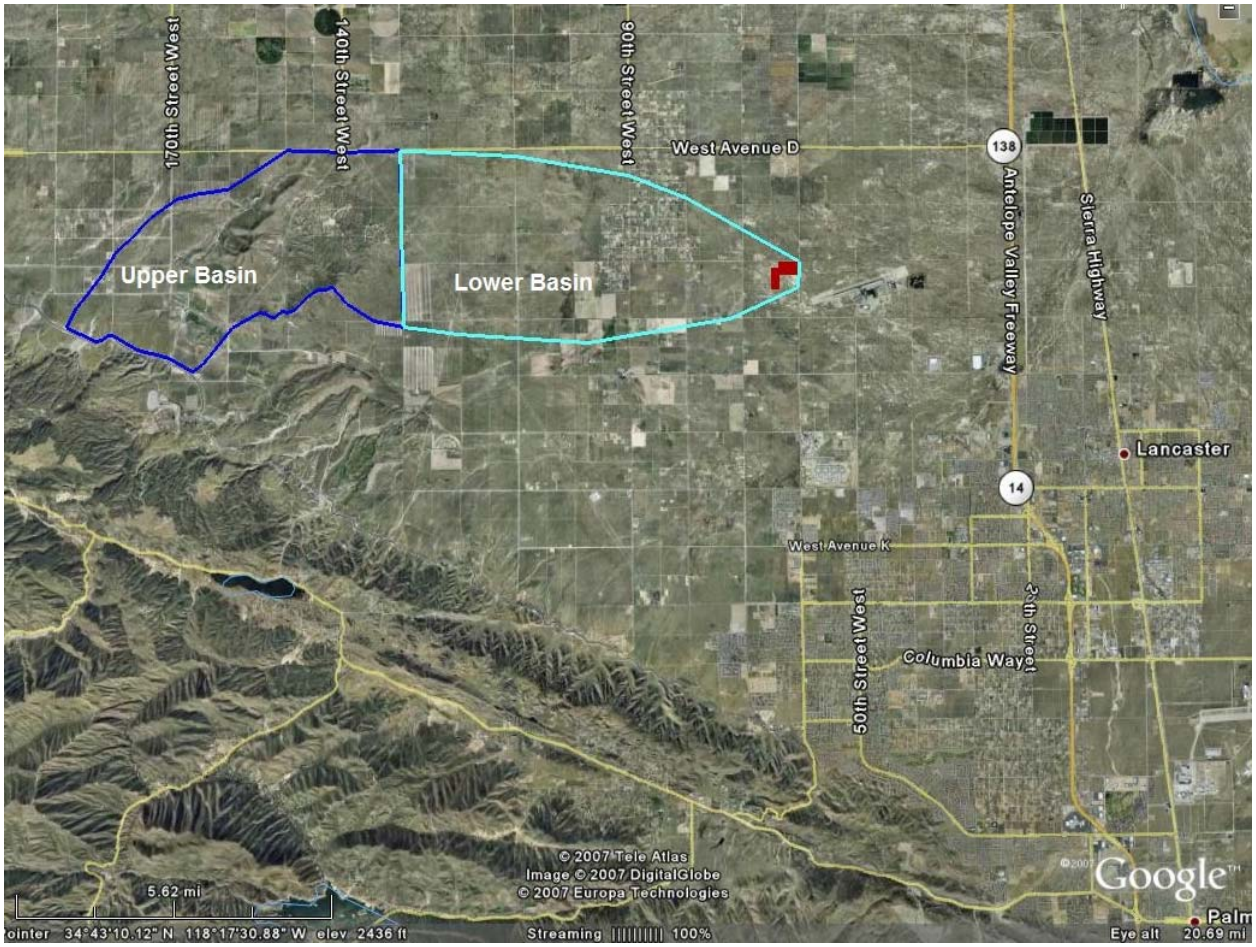
Assumptions used in determining volume of stormwater available for recharge:

- Pilot site has two distinct drainage areas referred to herein as the upper basin and lower basin. The distinction between the basins is the topography, slope and average annual rainfall. The combined drainage area is approximately 31.6 square miles (see **Figure 4-1**).
- The upper basin is 13.7 square miles and receives approximately 12 inches of rainfall per year.
- The lower basin is approximately 17.9 square miles and receives approximately 8 inches of rainfall per year.
- Soil type is a sandy-loam (Natural Resources Conservation Service, NRCS; Soil Survey)
- Due to the nature of rainfall in the area (large, infrequent storms), approximately 75% of the average annual rainfall will become runoff. Of this runoff, approximately 5% (minimum) to 10% (maximum) will be conveyed through natural and man-made flood channels to the site (see Appendix A).
- Of this conveyed flow, it was assumed that 50% (correlating to 500 afy) could be retained in the recharge basins. This percentage is based on the inability to capture more than 200 af during heavy rainfall (approximately 1-2 storms per year based on data from 1997 through 2006), and the need to maintain enough flow in the downstream channel to maintain riparian habitat (see Appendix A). To be conservative, this percentage was lowered to 12.5% retainage (correlating to 125 af) for the Pilot Project.

An XP-SWMM runoff model and the LA County Rational Method were used to confirm the estimates of runoff and infiltration. The preliminary hydrology analysis is attached as Appendix A. These estimates must be improved upon in later stages of program development to obtain a more reliable stormwater capture estimate. Overestimation of stormwater supply could be a fatal flaw if alternative diluent supplies are not available; however, this does not seem likely based on more detailed discussion of these supplies in the following sections.

[1] Even though 4-Fox well, located by recharge site, cannot be used because of arsenic levels above the MCL.

Figure 4-1: Approximate Pilot Project Recharge Basin Drainage Area



Source: USGS Topographic maps and Google Earth.
Note: Stormwater recharge basin parcel shown in red.

Non-Potable Groundwater

WWD No. 40 has a well (4-FOX) with groundwater from the lower (deep) Antelope Valley Groundwater Basin aquifer with high[2] arsenic concentrations, 4-FOX, that is located approximately 2 miles from the Pilot Project GWR site. Putting this existing well to beneficial use to minimize the cost of the Pilot Project was considered given the absence of raw imported water infrastructure in close proximity to the Pilot Project GWR site and lack of sufficient stormwater to provide for a 4:1 blend ratio.

Arsenic concentrations at 4-FOX are approximately 16.8 ug/L (WWD No. 40, p.c. 2007), which would require a 3:1:1 blend (groundwater to recycled water to stormwater) to meet the 10 ug/L maximum contaminant level (MCL).

WWD No. 40 is currently attempting to retrofit the 4-FOX well screen to minimize intake of high arsenic groundwater. The well would likely be used for potable supply and, therefore, would likely not be available for the Pilot Project if these efforts are successful.

[2] Arsenic levels above 10 ug/L, which is the new U.S. Environmental Protection Agency MCL as of January 2006.

More importantly, the high arsenic groundwater would not meet CDPH Draft GWR Regulations (discussed in more detail in Section 6.2.1) for diluent water because the arsenic MCL is exceeded. Therefore, use of the 4-FOX well water as a diluent supply was not deemed a feasible option.

Treated Imported Water

Although treated imported water is not an ideal diluent supply because of its high purchase price as well as TDS and DBPs water quality concerns, it was considered for the Pilot Project for lack of a better option.

The closest existing potable water supply would be from a WWD No. 40 pipeline approximately 2 miles from the Pilot Project GWR site that terminates at Ave G and 50th St W (WWD, p.c. 2007). WWD No. 40 also has a potable water line that terminates at Ave I and 60th St W. AVEK has plans to construct a new treated imported water line by 2010 along 80th St W, which is approximately 1.5 miles from the Pilot Project GWR site (AVEK p.c., 2007).

For the purposes of the FFA, the Pilot Project's treated imported water from AVEK is assumed to be the preferred treated, imported water supply because: (1) the pipeline is closest to the Pilot Project GWR site; (2) the pipeline will likely be larger than WWD's line, which minimizes concerns regarding delivery capacity available for GWR; and (3) WWD's line at the connection point has a high groundwater[3] content as opposed to treated, imported water.

Potable Groundwater

Groundwater was not evaluated as a diluent supply in the GWR FS since it would be uneconomical to pump groundwater and then recharge it back to the same aquifer. Use of groundwater as a diluent supply for the full-scale GWR-RW project is not recommended; however, using groundwater from the upper (principal) aquifer of the Antelope Valley Groundwater Basin may be necessary for the Pilot Project for lack of alternate supplies other than treated imported water to supplement stormwater as a blend supply. An added benefit for the Pilot Project is that groundwater could act as a control supply as part of the water quality evaluation.

Summary

Conclusions and recommendations for each option are summarized in **Table 4-2**.

[3] Recharge utilizing groundwater is not thought to be an ideal beneficial use of groundwater; therefore utilizing treated, imported water is preferred to utilizing water from WWD's line at the connection point which has a high groundwater content.

Table 4-2: Summary of Diluent Water Supplies Evaluation for the Pilot Project

Supplies	Evaluation	Recommendation
Raw Imported Water[1]	No conveyance facilities in the vicinity of the Pilot Project GWR site	Use alternate diluent water supply to minimize Pilot Project cost
Stormwater[1]	125 afy or more available during average wet year	Assume that 375 afy of supplemental supply is needed on average
High Arsenic Groundwater from Deep Aquifer	Does not meet CDPH Draft GWR Regulations (fatal flaw)	Not feasible / recommended
Groundwater from Principal Aquifer	Possible diluent supply but not best use of resource	Potential back-up supplemental diluent water supply. Not preferred.
Treated Imported Water	High operational cost and GWR water quality concerns but easily accessed Three potential sources: - AVEK planned water line along 80th - WWD No. 40 Line @ Ave G & 50th - WWD No. 40 Line @ Ave I & 60th	Supplement stormwater with treated water from AVEK line

Note: 1. Recommended diluent water supplies for the full-scale GWR-RW project.

4.2 Operations

Pilot Project operations are driven by three factors: (1) constraints on recycled water conveyance; (2) seasonal variations in diluent water availability; and (3) environmental concerns (e.g., bird nesting).

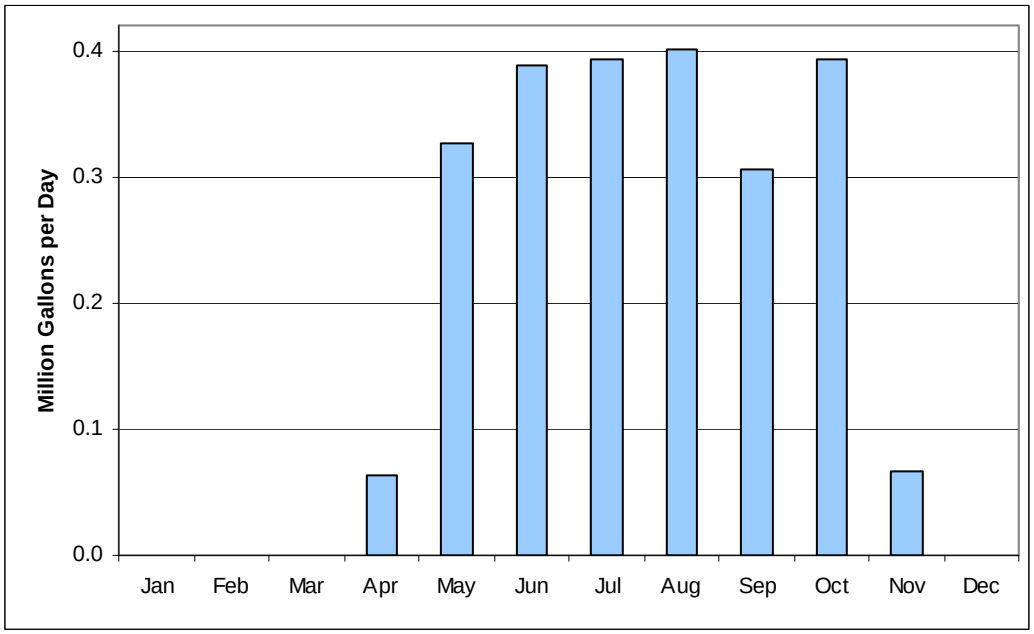
Recycled Water Conveyance

Existing recycled water supplies in the Antelope Valley include the AVTTP, which has been operating since 1969, and the new (as of 2007) MBR system. Both supplies are located at the LWRP site, which is approximately 6 miles northeast of the Pilot Project GWR site. The AVTTP currently provides recycled water to Apollo Lakes, which is approximately two miles east of the Pilot Project GWR site, via an existing 3.9 mile, 12" diameter pipeline that is owned and operated by the Los Angeles County Department of Parks and Recreation (LACDPR). The Pilot Project proposes to use this pipeline to minimize capital costs. No direct connection from the LWRP to the AVTTP pipeline currently exists or is planned for, however, this will need to be evaluated in the next phase of the Pilot Project.

The Apollo Lakes pipeline cannot be used simultaneously for recycled water delivery for Apollo Lakes and the Pilot Project due to the different water quality requirements for each use and the related different recycled water quality from the AVTTP, MBR system and LWRP. The AVTTP is the only supply for Apollo Lakes because phosphorus removal is included to mitigate algae growth. Neither the MBR system nor LWRP plan to have phosphorus removal, therefore, only AVTTP supplies can provide water to Apollo Lakes. Use of the existing Apollo Lakes pipeline is therefore limited to the period of the year when deliveries cease or are low.

As shown in **Figure 4-2**, there is no flow to Apollo Lakes from December through March and only 5.5% of total flows occur from November through April. Based on this, the Pilot Project assumes availability of the Apollo Lakes pipeline for a minimum of four months and maximum of six months assuming that 5.5% of all flows to the Lakes could contain higher concentrations of phosphorus. For the FFA, five months of operations are assumed from mid-November to mid-April.

Figure 4-2: 1998-2002 Average Monthly Recycled Water Delivery to Apollo Lakes



Source: LWRP 2020 Plan (LACSD, 2004)

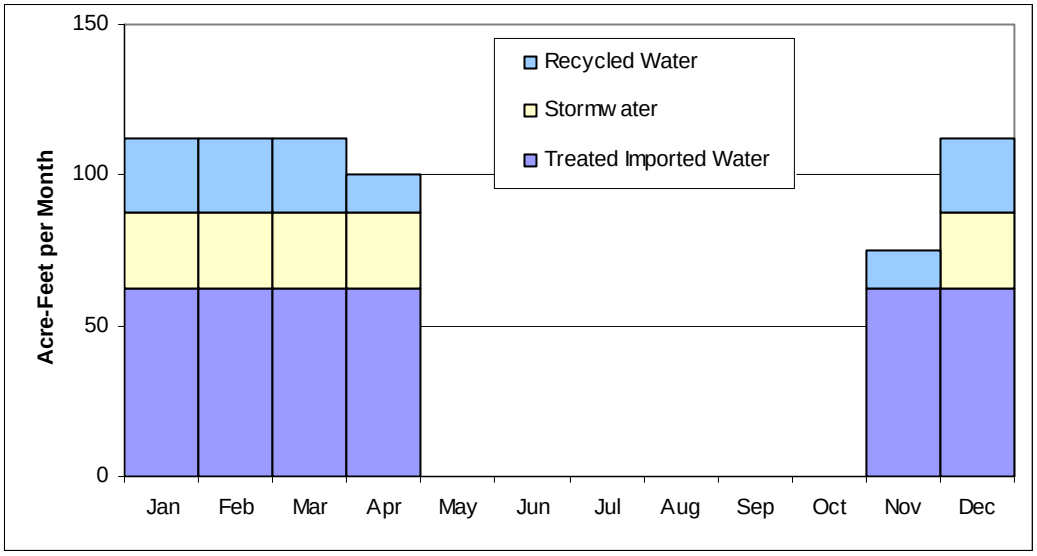
Diluent Supplies

Treated imported water is assumed to be available through the year while stormwater is assumed to occur during the wet season (December to April). Two recharge operational scenarios were considered as described below: (1) winter-only; and (2) year-round. Winter operations could be recommended to minimize potential environmental fatal flaws (discussed in Section 6.3) and year-round operations would be recommended to minimize recharge basins costs since a smaller area would be required.

Winter Operations Only

Figure 4-3 combines each of the three recharge supplies on a monthly basis for an annual total of 625 af. The maximum recharge volume (112.5 af per month) occurs from December through March. Assuming a recharge rate 1 foot (ft) per day, see *Section 5.1- Hydrogeologic Investigation of Recharge Basin Area*, a minimum of 3.8 acres would be required for recharge 625 afy.

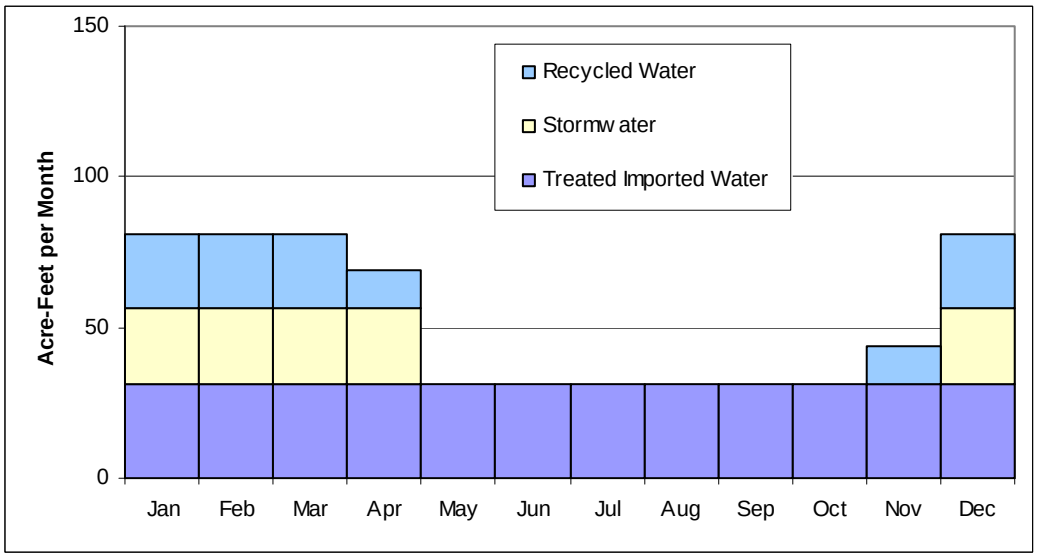
Figure 4-3: Monthly Recharge Volumes without Summer Deliveries



Year-Round Operations

The maximum recharge volume could be reduced to approximately 81 af per month by recharging imported water year round, as shown in **Figure 4-4**. This approach would reduce minimum basin size to 2.7 acres.

Figure 4-4: Monthly Recharge Volumes with Summer Deliveries



Based on estimated monthly recharge volumes in the previous section, the minimum Pilot Project GWR basin size ranges from 2.7 to 3.8 acres. For the purposes of the FFA, 5 acres of recharge basins is assumed. It would provide additionally flexibility in the system to recharge more water if available and if the estimated percolation rate of 1 foot per day can be achieved at the pilot scale. The ultimate size will be determined during future design phases, which should have refined percolation estimates and input on operational constraints.

4.3 Facilities

Facilities including recharge basins, conveyance piping and appurtenances are described below.

4.3.1 Recharge Basin Configuration

The City recently purchased a 100-acre parcel to construct stormwater GWR basins (see **Figure 5-1**). The Pilot Project GWR basin has been sited on the southwest side of the 100-acre parcel where flows enter the parcel from an existing earthen channel to minimize costs associated with stormwater conveyance. This location maximizes the distance of the recharge basins from Fox Airfield but the recycled water pipeline would be extended up to one mile further than if the Pilot Project GWR site was located in the northeast corner of the parcel.

For the FFA, the Pilot Project was assumed to use one 5 acre basin for recharge. If a berm was built into the basin to subdivide the basin it would increase operational flexibility and allow for basin maintenance during wetting and drying cycles while still operating. Clogging of the infiltrating surface is the main problem for surface infiltration recharge systems and can be caused by physical, biological and chemical processes. Clogging layers are much less permeable than the natural soil material and cause a reduction in the recharge basin's infiltration rate. Clogging can be controlled by periodically allowing the basins to dry out to allow for drying, shrinking and cracking of the clogging layer, which can then be removed at the end of a drying period. Removal is generally done mechanically with scrapers, front-end loaders, graders or manually by raking. By designing multiple basins within the parcel, each basin can be taken out of service separately to complete a drying cycle or for other necessary maintenance, such as vegetation management, while the other basins continue to be utilized for recharge. The exact configuration of subbasins verses one large basin will be determined during future design phases.

Use of an infiltration gallery[4] (which would minimize potential for creation of habitat since there is no open water basin that could attract birds which could pose a threat to the nearby airfield) was considered for the FFA. One of the largest underground systems to date in California is at the new Airbus Terminal in Los Angeles and is infiltrating only 10.4 afy (Stormwater 2007) compared to the Pilot Project's goal of infiltrating 625 afy. Because of the difference in size of the facilities, costs were not developed for an underground system for the Pilot Project, but could be looked at further in the pre-design phase.

4.3.2 Conveyance Facilities

The Pilot Project requires conveyance of recycled water, stormwater, and treated imported water to the Pilot Project GWR site.

As assumed in the original Pilot Project concept, recycled water would be conveyed from LWRP to the vicinity of Apollo Lakes through the existing LACDPR pipeline and to the Pilot Project GWR site through a new, 2.7 mile, 12" diameter pipeline. As discussed in the previous section, the Pilot Project GWR basins were sited by an existing earthen stormwater channel to minimize stormwater conveyance infrastructure. Treated imported water would be conveyed from the AVEK 80th St W pipeline to the Pilot Project GWR site through a new 1.5 mile, 12" diameter pipeline

While not considered in the FFA, above ground conveyance could be looked at in terms of further optimizing project costs during the pre-design phase.

[4] Infiltration galleries consist of a dug out area with a base layer of aggregate, an engineered chamber (which vary from open crates to arched chambers), additional aggregate and engineered soil backfilled to the ground surface. Water is conveyed to the system in a network of conduit piping. It fills the chambers and infiltrates into the ground surface.

5 Recommended Pilot Project

The recommended Pilot Project including blend strategy and operations, facilities, operations, estimated costs, benefits, proposed schedule, and potential funding mechanism is presented below. The recommended Pilot Project accounts for the refinements to the original concept described in the previous section.

5.1 Blend Strategy and Operations

The Pilot Project will utilize a minimum of 125 afy of recycled water from upgraded LWRP, which is scheduled to become available in late 2010. To meet the required blending ratio of 4:1 (diluent water to recycled water), approximately 500 afy of diluent water is needed. It is anticipated that 125 afy of stormwater, and 375 afy of treated imported water from AVEK will be utilized as diluent water. If more stormwater is available, it will be utilized in lieu of treated water. Conversely, if less stormwater is available, up to 500 afy of treated water will be utilized to meet the 4:1 blend ratio.

Should the upgraded LWRP start of operation be delayed, the Pilot Project would have adequate recycled water supplies from a combination of AVTTP and MBR flows, as discussed in Section 3. However, AVTTP and MBR recycled water use could raise water quality and related regulatory issues because each has a different treatment process than those planned for LWRP. These issues are discussed in Section 5.

The Pilot Project would recharge for two to five years and monitoring would likely continue for a couple of years past the conclusion of recharge operations. The length of time of recharge operations or criteria for future operational decisions will be determined during future design and permitting phases based on ongoing discussions with the Lahontan Regional Water Quality Control Board (LRWQCB) and CDPH.

Recharge operation at the site could be prolonged if the Pilot Project is successful and a large scale project is implemented in the Lancaster Area as described in the GWR FS. This determination cannot be made at this point in time.

5.2 Facilities

Planning-level design criteria for the facilities, including recharge basins, conveyance facilities, and monitoring facilities, are described below

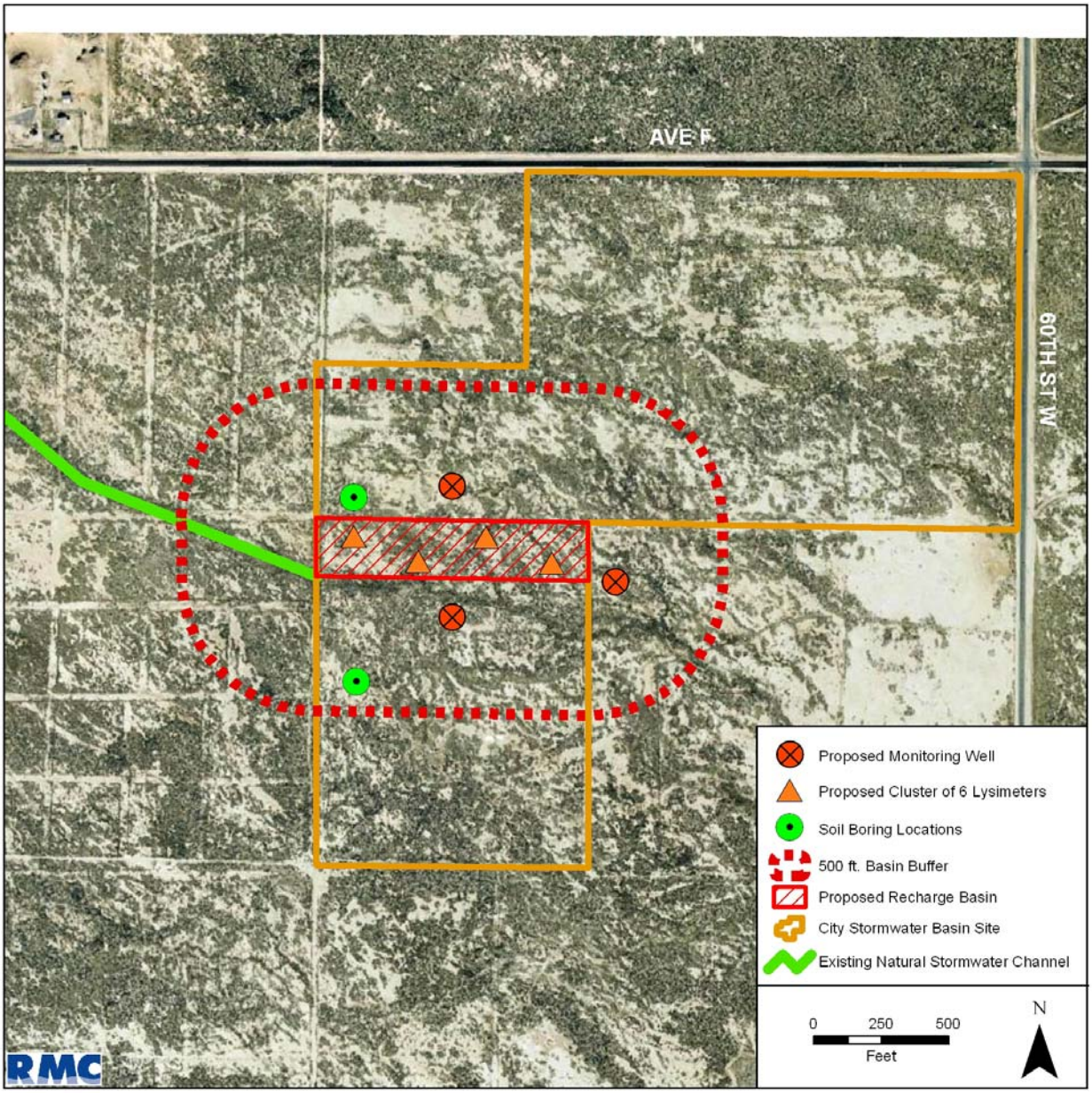
5.2.1 Recharge Basins

The Pilot Project GWR site is located in the western section of the City-owned parcel where flows enter the parcel from an existing earthen channel to minimize stormwater conveyance cost. The recharge basin will consist of a 5-acre basin, illustrated in **Figure 5-1. Table 5-1** provides Pilot Project GWR basin planning-level design criteria.

Table 5-1: Pilot Project GWR Basin Planning-Level Design Criteria

Elements	Description	Comments
Basin Height	<6 ft	Classified as a dam if greater than 6 ft
Freeboard	2 ft	
Berm Crest Width	12 ft	Wide enough to accommodate vehicles
Slope	3:1	
Berm Base Width	48 ft	
Basin Dimensions:	264’ x 825’ = 5 ac	Configuration could include a berm or divider to separate basin into subbasins
Total Footprint (includes berms):	360’ x 921’ = 7.6 ac	

Figure 5-1: Pilot Project Recharge Site Facilities



Note: Location of the basins will be further refined so the 500 foot buffer zone does not prevent development within the area.

5.2.2 Conveyance Facilities

Recycled water would be conveyed from LWRP to the vicinity of Apollo Lakes through the existing LACDPR pipeline and to the Pilot Project GWR site through a new 2.7 mile, 12" diameter pipeline. A direct connection from the LWRP to the AVTTP pipeline will need to be evaluated as part of the next phase of the Pilot Program to deliver water from LWRP to Apollo Lakes. Stormwater would be conveyed to the recharge site by an existing earthen channel. Treated imported water would be conveyed from the proposed AVEK pipeline along 80th St W to the Pilot Project GWR site through a new 1.5 mile, 12" diameter pipeline. Alternatively, treated imported water could be conveyed from existing pipelines at 50th W and Avenue G or 60th West and Avenue H. Final determination will be made during the design phase.

5.2.3 Monitoring Facilities

The Pilot Project proposes to monitor groundwater in the vicinity of the recharge site but no plans exist to extract the water until full-scale GWR-RW project extraction system plans are further developed. Groundwater monitoring would consist of three wells sited downgradient of the recharge site and located to comply with CDPH Draft GWR Regulations. Monitoring of the soil column below the recharge site would occur with lysimeters.

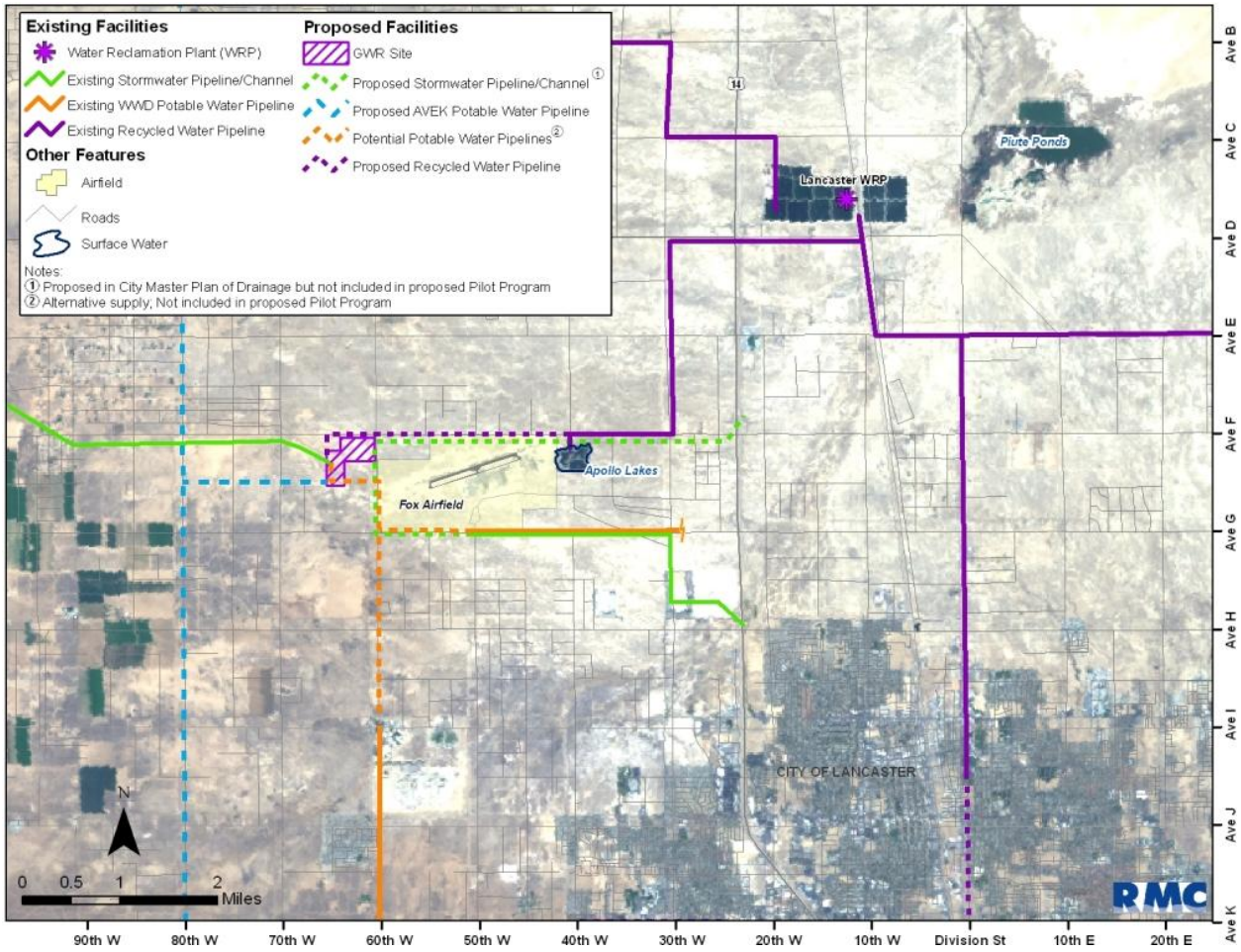
5.2.4 Facilities Summary

Proposed Pilot Project facilities are summarized in **Table 5-2** and shown on **Figure 5-2**. **Figure 5-3** provides a schematic of the proposed blending and operating strategy.

Table 5-2: Summary of Pilot Project Facilities

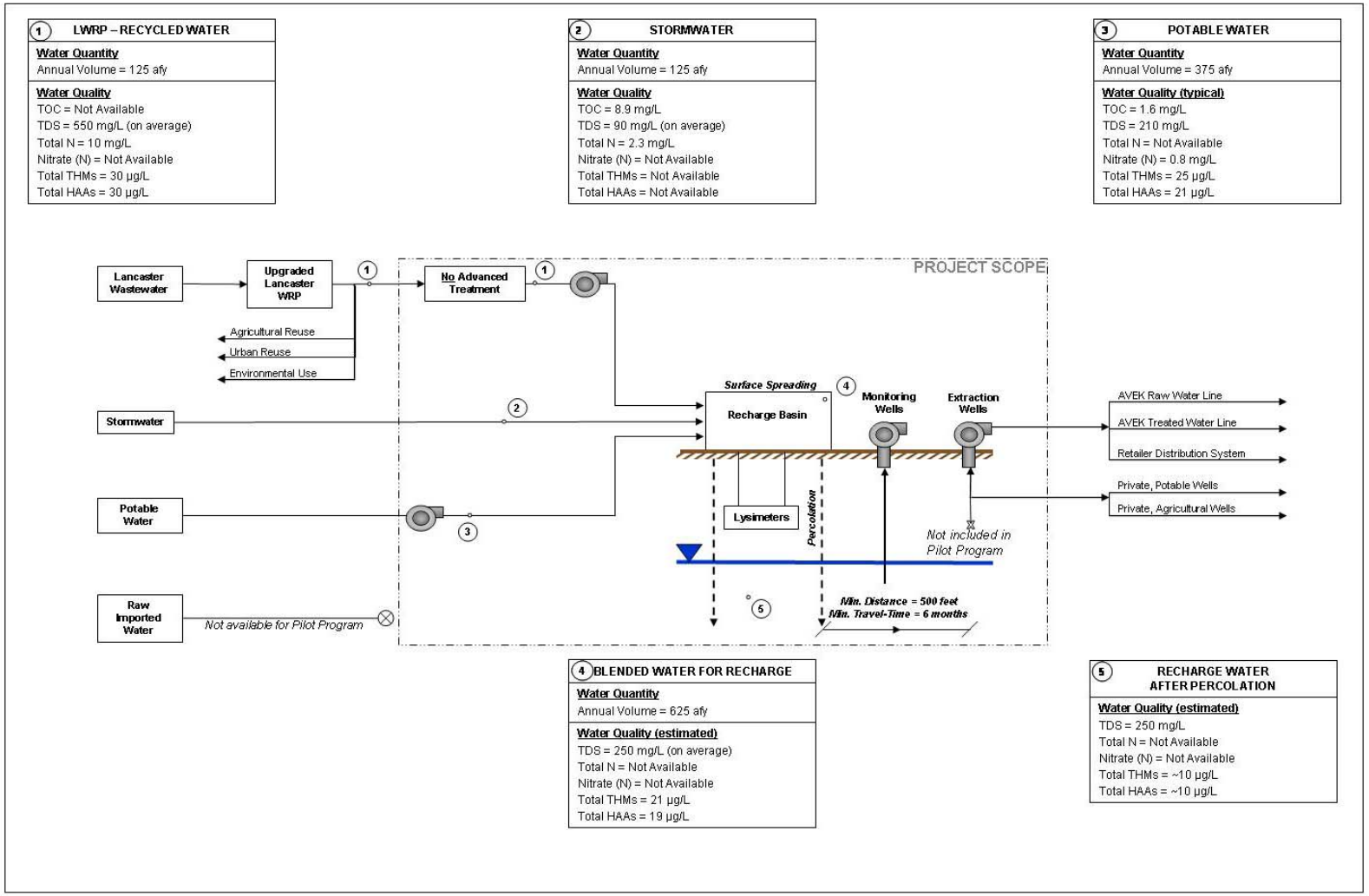
Facilities	Description	Comments
Recharge Basin	5-acre recharge basin	Details provided in Table 5-1; No additional conveyance infrastructure is needed.
Recycled Water Conveyance	Pipe: 2.7 mi; 12” dia. PVC	Capacity to supply 125 afy or more from Apollo Lakes to project site from November through April
Treated Imported Water Conveyance	Pipe: 1.5 mi; 12” dia. PVC	Capacity to supply 375 afy or more of blend supply
Monitoring Wells	3 wells	Sited per CDPH Draft GWR Regulations
Lysimeters	4 clusters of 6 lysimeters	Sited per RWQCB consultation

Figure 5-2: Major Pilot Project Facilities



Note: Figure 5-2 is out of date. There is currently no direct connection planned between the LWRP tertiary facilities and the AVTTP pipeline as is implied by the above figure. This connection modification will be necessary to operate the recharge basins as described therefore it will be evaluated during the facility planning phase and estimated costs for the connection will be developed. Additionally, the pipeline to Apollo Lakes is a separate line from the pipeline to the eastern agricultural site. This will be shown as new figures are developed.

Figure 5-3: Pilot Project Schematic



5.3 Estimated Costs

Table 5-3 presents the estimated Pilot Project capital costs (2007).

Table 5-3: Summary of Pilot Project Capital Costs

Pilot Project Elements	Cost (2007$)
Recharge Basins	$840,000
Recycled Water Conveyance	$1,890,000
Diluent Water Conveyance	$1,040,000
Wells and Lysimeters	$690,000
Raw Construction Cost	***$4,460,000***
Conceptual-Level Unknown Allowance (30%)	$1,340,000
Total Construction Cost	***$5,800,000***
Land Acquisition	-
Planning Costs – Engr, Env, Legal and Admin (30%)	$1,800,000
Capital Cost	***$7,600,000***
Annualized Capital Cost	$559,000
Annualized O&M Cost	$360,000
Annual Water Purchase Cost	$102,500
Total Annual Cost	***$1,021,500***

Note: See Appendix B for a detailed cost estimate. Baseline well sampling costs are not included in the O&M estimate. Capital costs shown assume that some costs including public outreach, will be covered by a regional Joint Powers Authority being formed for groundwater recharge, herein referred to as the regional groundwater recharge program. Capital costs do not currently include costs for a direct connection from the LWRP to the AVTTP pipeline. These costs will be developed and included in facilities planning cost estimates to be completed in the next phase.

Table 5-4 presents estimated annual capital cash flow through the start of project operations.

Table 5-4: Annual Capital Allocation

	2007/2008	2008/2009	2009/2010	2010/2011	Total
Planning and Construction	$205,000	$902,000	$4,176,000	$1,953,000	**7,600,000**[1]

1): Total project cost includes $365,000 for 2006/2007 Feasibility Study not shown.

Table 5-5 presents estimated Pilot Project operating costs. The largest single line item is sampling. The next largest is purchase of imported water from AVEK[5].

[5] Assumes $240/af rate for second priority surplus treated water for groundwater replenishment.

Table 5-5: Summary of Pilot Project Operating Costs

Facilities	Annual Operation Cost	Comments
Capital Facilities	$35,600	Includes pipes, wells, and lysimeters maintenance
Recharge Basins	$20,000	Assumes $4,000 per acre
Sampling	$305,600	Assumes monthly well sampling during the year and weekly lysimeter sampling during recycled water recharge (22 weeks)
Imported Water Purchase	$90,000	Assumes purchase of 375 afy from AVEK
Recycled Water Purchase	$12,500	Assumes $100/af for 125 afy of recycled water
Total Annual Cost	**$464,000**	

Note: See Appendix B for detailed cost estimate. Baseline well sampling costs are not included in the O&M estimate. Capital costs shown assume that some costs including public outreach, will be covered under the regional groundwater recharge program.

5.4 Benefits

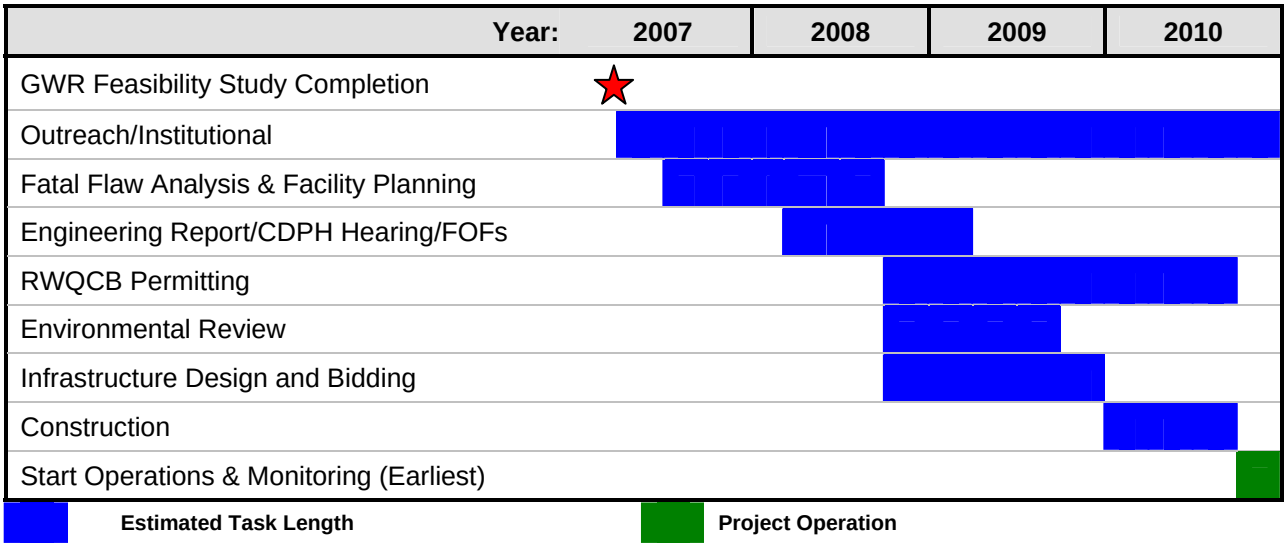
As discussed in Section 1, the primary goal of the Pilot Project is to provide the basis for decision making and ultimately allow implementing a Lancaster Area large-scale GWR Project6 or any other large-scale, regional GWR projects using recycled water. As documented in the GWR FS, full-scale projects using recycled water could provide over 20,000 afy of new, local and reliable water supply to the Valley, in addition to providing an alternative effluent management mechanism to LACSD.

5.5 Proposed Schedule

Implementation of the Pilot Project is expected to take three to four years, as shown in **Figure 5-4**. Operations are estimated to begin by 2009-2010 or the 2010-2011 wet season.

[6] The full Lancaster Area GWR Project would ultimately recharge 50,000 AFY of blend water, with blend water consisting of 40,000 AFY of storm water and/or imported SWP water and 10,000 AFY of recycled water from Lancaster WRP. The project would extract 48,000 AFY of recharged water, on average, via a new well field and deliver the water to wholesaler/retailer distribution system(s) and private agricultural users. Water extractions would mostly occur in dry years to meet water supply shortfalls while recharge of imported water would mostly occur in wet years.

Figure 5-4: Pilot GWR-RW Program Timeline



6 Fatal Flaw Analysis

Table 6-1 summarizes key issues identified during the course of the FFA.

Table 6-1: Summary of Potential Pilot Project Issues

Issue	Description	Conclusions and Recommendations
Technical		
Local Hydrogeology	The primary concern is the ability to recharge water given subsurface lithology.	Given subsurface lithology identified during soil boring investigation, recharge was determined to be feasible with an infiltration rate of 1 ft/day. No fatal flaws identified given subsurface conditions.
Regulatory		
LRWQCB and CDPH Issues	Key concerns include total organic carbon, nitrates and nitrogen, salt and disinfection by-products. Key concerns addressed through the blend strategy and blend supply selection	No fatal flaw identified based on initial discussions with LRWQCB and CDPH; need to continue engaging with regulatory agencies to discuss the program, identify potential regulatory issues and work with regulators to develop acceptable solutions to these issues.
CDFG	Issues with potential creation of habitat in basins, inability to maintain minimum downstream flows, destruction of habitat during drilling activities.	No fatal flaw identified based on initial meeting with CDFG. Best management practices (BMPs) will be developed to ensure the basins are maintained in a way so as not to create potential habitat. Mitigation for drilling activities and construction will be included as part of the overall project and a Streambed Alteration Agreement will be needed as part of the permitting process.

Issue	Description	Conclusions and Recommendations
Environmental		
Bird-Strike	Issue with creation of standing water near airport attracting birds which could potentially create a hazard for airplanes.	No fatal flaw identified based on initial meeting with Airport and existence of Apollo Lakes (adjacent to airport). The City will need to continue to coordinate with the airport during design and maintain recharge basins so no habitat is formed during operations. Design should investigate utilizing physical barriers such as wire grids or netting.
Institutional		
Cost/Public & Political Support	Relatively large investment without revenue source.	Potential fatal flaw unless: • Outside funding (Prop 50, Prop 84, AB303, Prop 1E, etc) is obtained • Cost sharing mechanism is established

6.1 Hydrogeologic Investigation of the Recharge Basin Area

From the beginning of the Pilot Project, the key technical issue identified that was whether or not groundwater recharge operations were feasible given the soil conditions at the site. To make this determination, the City conducted a Subsurface Site Investigation which consisted of drilling two soil borings from the ground surface to just past the water table. Lithologic logs and samples from the borings were analyzed for grain size to determine the feasibility of recharge and the associated infiltration rate given the soil types encountered.

Two soil borings were drilled in the general vicinity of the proposed groundwater recharge basins. The borings were drilled to 155 feet below the ground surface (bgs) using the sonic drilling method. The benefit of using this method is a relatively continuous sediment core is obtained, aiding in the identification of subsurface materials and their depth. Soil samples were collected from each boring and analyzed to determine grain size distribution. Emphasis was placed on fine grained sediment layers for selection of grain size analysis, as these sediments types will be the limiting factor related to the performance of recharge basins. Estimates of vertical hydraulic conductivity were made using grain size distribution results and are summarized below. Estimates of soil hydraulic properties in the soil samples are attached as **Appendix C**.

6.1.1 Analysis of Boring Logs

Soil boring SB-01 is approximately 800 feet north of boring SB-02. In general, the soils beneath the site consist of interbedded gravels, sands, silts, clays and various mixtures of each. No thick (>5 feet) clay layers were encountered in either boring. Two continuous, thin clay layers were encountered in each boring at depths of approximately 33 to 43 feet and 115 to 125 feet below grade. Each clay layer is relatively thin (approximately 2.5 to 3.5 feet thick) with varying amounts of sand. The clays dip gently to the south at a gradient of approximately 0.0125 feet/feet. Perched water was encountered in boring SB-02 at a depth of 54.5 feet below grade within a clayey sand layer. Groundwater was encountered in SB-01 and SB-02 at depths of 134 ft-bgs and 131 ft-bgs, respectively.

6.1.2 The Analysis of Hydraulic Properties based on Soil Particle Size Distribution

An analysis of the vertical hydraulic conductivity was performed using the grain size distribution data from the soil samples collected from SB-01 and SB-02. **Table 6-2** summarizes the sample depths, soil types and particle size distribution.

Table 6-2: Summary of Grain Size Distribution Analysis

Sample ID	Depth (ft/bgs)	Soil Type (USCS code)	%Gravel	%Sand	%Silt	%Clay
SB-01 (6)	6.0	Silty Sand (SM)	3.4	72.5	24.2	
SB-01 (16)	16.0	Clayey Silt (ML)	na	na	na	37
SB-01 (30)	30.0	Sand w/ Silt and Gravel (SW-SM)	25.5	67.7	6.8	
SB-01 (59)	59.0	Silty Sand (SM)	0.0	70.9	29.1	
SB-01 (64.5)	64.5	Sandy Silt w/ Clay	na	na	na	27.7
SB-01 (89)	89.0	Sand with Clay (SP-SC)	na	na	na	13.2
SB-01 (106)	106.0	Sandy Silt w/ Clay (ML)	na	na	na	28.2
SB-01 (131)	131.0	Silty Sand (SM)	6.1	80.1	13.8	
SB-01 (141)	141.0	Silty Sand (SM)	0.0	84.3	15.7	
SB-02 (7.5)	7.5	Silty Sand (SM)	2.7	76.7	20.6	
SB-02 (18)	18.0	Sand w/ Silt and Gravel (SP-SG)	19.4	72.5	8.1	
SB-02 (41)	41.0	Clayey Silt w/ Sand (ML)	na	na	na	30.9
SB-02 (65)	65.0	Silty Sand (SM)	7.1	75.1	17.8	
SB-02 (71)	71.0	Silty Sand (SM)	0.5	60.1	39.4	
SB-02 (105)	105.0	Sand w/ Silt (SP-SM)	6.7	83.3	10.0	
SB-02 (119)	119.0	Sand w/ Silt (SP-SM)	0.2	91.3	8.4	
SB-02 (151)	151.0	Silty Sand (SM)	na	na	na	8.4

Soil hydraulic properties are essential for simulating water flow and solute transport in the vadose zone. The soil hydraulic properties determine the potential infiltration rate at the proposed recharge basin. There are no available measurements of the soil hydraulic properties in the Antelope Valley. Fortunately, the values of hydraulic parameters vary systematically with USDA soil textural classes (McCuen et al. 1981). In other words, each soil class has its own hydraulic properties, which allows for the appropriate values of the hydraulic parameters to be determined, based on soil class. National soil databases have been developed for this purpose. The database compiled by CARSEL (Carsel and Parrish, 1988), provides accurate estimates of soil hydraulic properties (Wang, 2003).

In general, the recharge basin infiltration rate is controlled by vertical hydraulic conductivity and hydraulic gradient, the unit value of the latter is generally correct if the mounding groundwater table does not reach the bottom of recharge basin (i.e. the water moves down vertically). The vertical hydraulic conductivity in the vadose zone ranges from 0.3 ft/day to 2.0 ft/day under partially saturated (90%)

conditions. Considering the heterogeneity and potential horizontal flow above the clay lenses (which results in lower vertical hydraulic conductivity), the estimated average infiltration rate of recharge basins within the study area is about 1.0 ft/day.

6.1.3 Conclusions from Subsurface Investigation

The soils encountered within borings SB-01 and SB-02 and the results of the grain size analyses do not indicate any fatal flaws to groundwater recharge through spreading basins. Although there are some continuous clay layers beneath the site, they are thin and do not appear to be barriers to vertical groundwater movement. Vertical hydraulic conductivity of samples collected from beneath the site ranges from 0.3 ft/day to 2.0 ft/day under partially saturated conditions. These ranges do not necessarily represent the entire range of vertical hydraulic conductivity beneath the site, but are representative of the materials sampled and the subsurface in general.

Although the results of this analysis do not indicate any fatal flaws, further subsurface investigation is necessary prior to the determination of final basin location and design. Further investigation includes geotechnical work and Cone Penetrometer Testing (CPT) on a grid within the proposed basin to confirm similarity to soils seen during the subsurface site investigation.

6.2 Regulatory Considerations

The Pilot Project needs to meet a combination of public health and environmental objectives and evolving regulations. Thus, a key part of the FFA was to build on work done as part of the GWR FS by further consulting with regulatory agencies to:

- Discuss the proposed Pilot Project
- Identify potential issues or concerns
- Evaluate whether these issues or concerns can be resolved prior to or as part of the implementation of the Pilot Project

Agencies that were contacted included the CDPH (formerly the California Department of Health Services), the LRWQCB, and the CDFG. Based on these consultations, there appear to be no specific regulatory issues that would prevent a Pilot Project from going forward at this time.

6.2.1 California Department of Public Health & Lahontan Regional Water Quality Control Board

From the perspective of the CDPH and LRWQCB, the GWR FS identified four key regulatory issues that would impact the Pilot Project. These issues and proposed approaches for resolving them are listed in **Table 6-3.**

Table 6-3: Summary of Key Regulatory Issues

Key Regulatory Issues	Proposed Approach for Pilot Project
Total Organic Carbon (TOC)	• Blending • Soil Aquifer Treatment
Nitrates & Nitrogen	• Blending • Soil Aquifer Treatment • Allowable Assimilative Capacity
Salt	• Blending • Allowable Assimilative Capacity

Key Regulatory Issues	Proposed Approach for Pilot Project
Disinfection Byproducts (DBPs), including Trihalomethanes (THMs)	• Blending • Soil Aquifer Treatment • Allowable Assimilative Capacity

Source: GWR FS (RMC, 2007)

A conference call was held on July 18, 2007 with representatives from the CDPH and LRWQCB to discuss these key issues and any other relevant items.[7] For TOC, it was agreed that the requirements in the CDPH Draft GWR Regulations (latest version is dated January 4, 2007) can be satisfied for the Pilot Project with a 4:1 blend ratio of recycled water and diluent water. For nitrogen, salt, and the THMs, it is clear that groundwater degradation will be an important issue to be considered by the LRWQCB in permitting the Pilot Project and, as a result, the Engineering Report will have to be consider blending of supplies, soil aquifer treatment (SAT) and assimilative capacity of the groundwater basin. Water quality data is discussed in the following section.

A more detailed anti-degradation analysis for nitrogen, salt, and the THMs will likely have to be completed as part of the Pilot Project Engineering Report to evaluate potential impacts and their geographical extent, alternative treatment technologies, costs/benefits, etc. The LRWQCB also recommended that salt mobilization studies be conducted using soil columns as part of the Engineering Report.

Water Quality

As noted in the GWR FS, recycled and diluent water quality analysis for the full range of constituents of concern is lacking. The new upgraded LWRP, will not produce recycled water until at least 2010 so water quality samples from LWRP cannot be evaluated during planning for the Pilot Project. In the interim, LACSD has estimated water quality from LWRP. LACSD has water quality results from the existing AVTTP and limited results from a blend of MBR and AVTTP flows. Water quality for recycled water and diluent supplies are presented in **Table 6-4.**

Table 6-4: Water Quality of GWR-RW Pilot Supplies

Constituent	Units	MBR / AVTTP Blend [a]	Upgraded LWRP [b]	Stormwater [c]	Raw Imported Water [d]	Treated Imported Water [e]	Ground-water [f]
TOC	mg/L	8.1 [g]	-	8.9	2.9	1.6	-
TDS	mg/L	580	550	90	244	210	220
Total N	mg/L	4.1 [h]	10	2.3	1.1 [h]	-	-
Nitrate (N)	mg/L	3.95	-	-	0.9	0.8	0.8
Nitrite (N)	mg/L	< 0.02	-	-	ND	ND	-
Total THMs	ug/L	100 [i]	30	-	-	25	ND
Total HAAs	ug/L	150 [i]	30	-	-	21	-
NDMA	ug/L	- [j]	-	-	-	-	-

"-" Not available
ND None Detected
Notes:

[7] Conference call minutes are included in Appendix G.

a. Unless otherwise noted, values are based on samples collected between February and June 2007 from a blend of MBR (1.0 MGD) and AVTTP (0.3 MGD). The blended supply was disinfected with chlorine upstream of the sampling point.
b. All concentrations are predicted values [LACSD No. 14 LRWQCB Waste Discharge Requirements, Table No. 3 (April 5, 2007)].
c. Source: Chino Basin GWR-RW Project Title 22 Engineering Report (DDB 2006)
d. SWP Check 41; DWR Division of O&M, SWP Water Quality Data Reports (http://wdl.water.ca.gov/wq-gst/)
e. Unless otherwise noted, values are from the AVEK 2006 Annual Water Quality Report; Los Angeles County System. TOC, TDS, THM, HAA and nitrate data are specifically from the Quartz Hill WTP.
f. Source: Lancaster GWR FS (RMC, 2007); Table 3-2.
g. LACSD collected five TOC samples from AVTTP effluent (no mix with MBR) between June and August 2007. The results ranged from 7.5 to 8.6 mg/L and averaged 8.1 mg/L. LACSD plans to collect additional TOC samples between July and September 2007.
h. Total nitrogen estimated by adding concentrations of nitrate, nitrite, and total kjeldahl nitrogen.
i. Total THM and Total HAA concentrations estimated by summing individual THM and HAA constituents. Samples were collected from AVTTP without a blend with MBR from October 2005 through January 2007.
j. LACSD plans to collect at least two NDMA samples between July and September 2007.

Several water quality data gaps were identified during the FFA, including:

- Recycled water: NDMA, total nitrogen, and arsenic
- Treated Imported water: Total nitrogen
- Raw imported water: Total nitrogen, total THMs and total HAAs
- Stormwater: Samples needed for all constituents from Pilot Project GWR site
- Groundwater: Data collection from regional database needed

None of these data gaps present a fatal flaw for the Pilot Project but they should be addressed during preparation of the Engineering Report.

As an example, **Table 6-5** presents estimated water quality for blend water assuming 125 af of recycled water, 125 af of stormwater, and 375 af of diluent water. Groundwater, raw imported water, and potable water are considered for diluent water sources. Based on this analysis, blend water quality would likely meet drinking water standards but could raise anti-degradation issues, which are discussed in the next section.

Table 6-5: Source Water Quality with Various Diluent Water Supplies

Constituent	Units	Groundwater	Raw Imported Water	Treated Imported Water
TDS	mg/L	260	280	250
Total N	mg/L	Not available for diluent supply	1.9	Not available for diluent supply
Nitrate (as N)	mg/L		Not available for stormwater	
Total THMs	ug/L	5	Not available for raw imported water	21
Total HAAs	ug/L	5	Not available for raw imported water	19

The blend water quality presented in **Table 6-5** does not account for additional constituent removal via SAT prior to recharge water reaching groundwater or the assimilative capacity of the groundwater basin. See Appendix D for information on anticipated nitrogen and THM removal via SAT.

Other Issues

In addition to the four key issues discussed in the previous section (see **Table 6-3**), several other items were identified on the CDPH/LRWQCB conference call, including:

- CDPH Draft GWR Regulations
- Draft SWRCB Water Recycling Policy
- Salt impacts of Pilot Project compared with cumulative impacts of other projects with salt loads in the region
- Unregulated chemicals, particularly microconstituents

In terms of the Draft CDPH GWR Regulations, there were no issues identified that would impact the FFA.

The SWRCB released their Draft Water Recycling Policy[8] in September 2007. A detailed review of the draft policy is included in Appendix E but two provisions stand out. The most problematic provision in the draft policy is No. 11, which could result in all GWR-RW projects having to install advanced treatment, and thus could make projects financially infeasible, including the Pilot Project. Provision 7(d), although intended only for irrigation projects, could also be applied by Regional Boards to GWR-RW projects. Should that occur, it would hinder the proposed Pilot Project since it would not be possible to meet this condition end-of-pipe without treatment, and seems to disallow blending with diluent water as a compliance option. CDPH has similar concerns about many of the provisions in the draft policy.

The SWRCB hearing to consider adoption of the draft policy is scheduled for February 2008. SWRCB staff is currently working on a staff report on the draft policy and a draft California Environmental Quality Act (CEQA) document. The impact of the draft policy will be reevaluated upon release of the next revision.

While the cumulative salt impacts of projects in the region are of concern to the LRWQCB, it was agreed that a cumulative assessment would likely not be required for the Pilot Project based on the assumption that its individual contribution of salt would be minor. It was acknowledged that salt management is an issue that should be addressed for the region by all stakeholders.

For unregulated trace organic chemicals such as pharmaceuticals, personal care products, and endocrine disruptors (e.g., microconstituents) that may be present in recycled water, the LRWQCB indicated that this is an important issue inasmuch as these chemicals are not naturally occurring and their presence in groundwater due to a proposed recharge project would have to be considered in the context of the Anti-degradation Policy. There are a number of research projects about to be completed in the next year that should provide information that can be used to better characterize the potential significance of microconstituents, including the development of "safe concentrations" and data on their removal by different types of treatment. The LRWQCB and CDPH recommended that:

1. This TM should summarize information on microconstituent treatment performance and the Engineering Report should discuss this in more detail along with concomitant costs.
2. This TM should note the importance of enhanced source control for unregulated organics and mention the kinds of programs in place.

This information is presented in Appendix F.

[8] Copies of the Draft Water Recycling Policy and workshop notice are available at the following web site address: http://www.waterboards.ca.gov/water_recycling_policy/index.html

6.2.2 California Department of Fish and Game

A coordination meeting with the CDFG was held on August 15, 2007 in Lancaster.[9] An overview of the project was discussed and CDFG presented their questions and concerns. CDFG will provide formal comments at the time a Draft TM is distributed.

In summary, no fatal flaws were identified in the meeting with CDFG. CDFG generally supports the idea of groundwater recharge but had some concerns regarding the mention of a potential outfall to Amargosa Creek or Littlerock Creek, and noted that the recharge basin would come under their jurisdiction once filled. Under CDFG jurisdiction, the basin will need to be managed properly on a regular basis so it does not support habitat, this type of management is planned for the basin and is not viewed as a fatal flaw. Should the Pilot Project proceed, the City and CDFG should develop an agreement regarding the degree, timing and type of maintenance that should occur to minimize effects to species potentially occurring in the basin area.

Anticipated permit requirements for the Pilot Project include a Streambed Alteration Agreement (SAA) for any changes to drainage on site and potentially a "take" permit. Depending on the character of drainage, a Memorandum of Understanding (MOU) between CDFG and Lancaster is possible, rather than a SAA. The City may also need to obtain a "take" permit for any effects to species listed under the California Endangered Species Act that could be located at the site. A biological survey will be completed during pre-design to determine what species are present at the site and whether the "take" permit is necessary.

For activities pertaining to the FFA including a site investigation in which deep borings would be installed, CDFG recommended that a biological survey be conducted at drilling locations to avoid potential sensitive species habitat. The City will submit a letter to CDFG that notices when the drilling will occur; and documents access routes, anticipated disturbance to drainage and tributaries, and clearing to be performed. A biologist will flag approved access routes. It was determined that mitigation for drilling activities can be included as part of the overall project mitigation.

6.3 Preliminary Environmental Screening

A preliminary review of the environmental impacts of the Pilot Project was conducted to determine if any fatal flaws existed. To complete this review, RMC utilized the CEQA checklist to guide the preliminary review. This checklist directs attention to several categories of environmental impacts ranging from aesthetics to utilities and service systems. Each category is listed in **Table 6-6** along with a brief description of potential impacts from the Pilot Project and their significance.

The most significant environmental impacts identified for the Pilot Project are considered to be the issue of bird-strike due to the recharge basins capability of attracting birds and its vicinity to Fox Airfield; and the potential for degradation of groundwater quality given the chemistry of recharge water.

- The bird-strike issue was discussed with the Airport staff at a meeting in Lancaster on August 13, 2007. Federal Aviation Agency (FAA) guidelines suggest that wildlife attractants (such as an open water recharge basin) are not constructed within 10,000 feet of a commercial airport with turbine-powered aircraft. A five-mile range is also suggested to protect the approach, departure, and circling airspace. As the Pilot Project basin is within this limit range, several barrier methods are suggested in the FAA guidelines including wire grids or netting so birds are prevented access to open water. Additional deterrents include construction of steep basin sidewalls and elimination/prevention of vegetation within and around the basin. These types of physical barriers will be considered during the design phase. It was noted in the meeting that the Apollo Lakes

[9] Meeting minutes are included in Appendix H.

surface water basin is located immediately east of the Fox Airfield and no issues have arisen with bird-strike.

As discussed in the Section 6.2.1, the potential for degrading the groundwater basin as a result of recharging recycled water is not thought to be a fatal flaw.

- Other issues raised by the public during AVEK's scoping meeting regarding a regional groundwater bank held on May 22, 2007 included the potential for flooding of septic tanks due to poor percolation of recharge water and that the project would be constructed in a floodplain. As no residential areas are located near the proposed Pilot Project location, flooding of septic tanks due to recharged water is not anticipated to be an issue for this Pilot Project, nor is the project located within a FEMA-mapped floodplain.

Table 6-6: Potential Impacts by Resource Category

Resource Categories	Potential Impacts	Significance
Aesthetics	The project will not have any adverse affects on aesthetic resources. The basin will be constructed below grade with berms around the perimeter which will protect drivers on nearby roads from any reflection or glare resulting from stored water in the basin.	Less than significant
Agricultural Resources	The land use for the project is designated as "public" on the general plan map and no part of the project would convert farmland or areas zoned for agricultural use to non-agricultural. The parcel overlies land categorized by the NRCS as "Area which falls outside of the NRCS soil survey. Not mapped by the FMMP (Farmland Mapping and Monitoring Program)."[a]	No impact
Air Quality	The generation of dust during construction presents a potential impact however, there are no sensitive receptors located within ¼ mile of the project. To minimize air quality impacts during construction and operation of the project, appropriate BMPs will be implemented.	Less than significant with mitigation
Biological Resources	Local Special Status Species include the Mojave Swainson hawk and the Mojave ground squirrel. These animals are listed in California as threatened but are not federally listed. The closest occurrence of these animals is 18 and 15 miles from the Parcel, respectively[b]. As part of preconstruction work, a biological survey of the site will be conducted. A wetland delineation will also be conducted as part of the biological survey. The existence of wetlands would not be a fatal flaw however the City would need to go through permitting for a 404 Streambed Alteration Agreement. Further discussion of biological resources can be found in Section 5.2 of this TM.	Less than significant with mitigation
Cultural Resources	Historic resources are not anticipated to be found at the site. A cultural survey will be conducted prior to construction at the site to confirm this assumption.	No impact
Geology and Soils	The embankment of the recharge basin will be designed so as not fall under the Division of Dam Safety jurisdiction. Inundation or flooding from retained waters is not anticipated as the basin will be dug down, below the ground surface, and the berms will be engineered as appropriate to safeguard against possible seismic activity. No active faults are located in the vicinity of the basin. The nearest faults are the San Andreas Zone, about 10 miles to the southwest, and the Garlock Zone, 20 miles to the northwest of the parcel[c]. The recharge basin will be designed to withstand the appropriate level of seismic shaking.	Less than significant with mitigation
Hazards and Hazardous Materials	A review of the DTSC Cortese List which lists documented hazardous materials release sites did not reveal any sites located in Lancaster. BMPs will be utilized to minimize worker exposure and impacts from typical hazardous materials found on construction sites including gasoline, diesel fuel, and paint, and other materials during construction.	Less than significant with mitigation
Hydrology and Water Quality	A mass loading or similar analysis will be completed during design of the project to determine the level impact on groundwater quality. The potential for degradation of groundwater quality exists however; this is not thought to be a fatal flaw.	Potentially significant impact

Resource Categories	Potential Impacts	Significance
Land Use and Planning	The project is located on the outskirts of town in a relatively undeveloped area and would not physically divide an established community or conflict with any land use plans or policies.	No impact
Mineral Resources	According to USGS Mineral Resource Data System, there are no known metallic and nonmetallic mineral resources on this parcel. Closest known mineral resources are gold, silver, quartz, misc gemstones, copper, clay, sand and gravel. The closest known deposits are about 2-3 miles away, therefore use of the parcel for groundwater recharge would have no impact on mineral resources.[d]	No impact
Noise	BMPs will be implemented to protect workers from elevated noise and vibration levels during construction. The recharge basin operations are not anticipated to generate noise with the exception of occasional, temporary maintenance procedures in which BMPs will be implemented to minimize exposure.	Less than significant with mitigation
Population and Housing	The Pilot Project is not intended to provide additional water supplies and will be constructed on undeveloped land; and therefore has no anticipated effect on population and housing. Ultimately, the project may lead to augmentation of water supplies; however, growth will be regulated by the General Plan under these circumstances.	Less than significant
Public Services	The site shall be made secure with fencing to increase public safety (drowning) and limit the potential for vandalism which would place an additional burden on police and emergency services.	Less than significant
Recreation	The project will be constructed in an undeveloped area and has no impact on recreational facilities.	No impact
Transportation/ Traffic	Transportation/Traffic impacts are temporary resulting from construction of facilities and will be mitigated through traffic plans and similar measures. These impacts are not considered to be a fatal flaw.	Less than significant with mitigation
Utilities and Service Systems	No significant impacts are anticipated on utilities and service systems due to construction and operation of the project.	Less than significant with mitigation
Mandatory Findings of Significance	The project has the potential to degrade groundwater quality and adversely affect humans due to the potential issue of bird-strike incidence with the nearby airport. Cumulative impacts are not considered to be significant.	Potentially significant impact

Notes:

a. California Department of Conservation, Division of Land Resource Protection. Farmland Mapping and Monitoring Program Digital spatial data (GIS) accessed September 10th, 2007 from http://www.consrv.ca.gov/DLRP/fmmp/map_products/index.htm.
b. California Fish and Game, Natural Diversity Database using Rare Find 3. Accessed September 10, 2007.
c. Quaternary Fault and Fold Database of the United States. Retrieved September 10, 2007, from http://earthquake.usgs.gov/regional/qfaults/google.php
d. USGS Mineral Resource Program, Mineral Resources Data System. Retrieved September 10, 2007 from http://www.consrv.ca.gov/DLRP/fmmp/map_products/index.htm

6.4 Institutional

The two categories of institutional issues that were considered as part of the FFA are cost sharing and interagency agreements, and public/political acceptance

6.4.1 Cost Sharing and Interagency Agreements

Since the Pilot Project is not anticipated to generate revenue (since no extraction wells are planned at this time), ability to fund the project could be a fatal flaw unless outside funding can be obtained and project partners agree to a cost sharing mechanism to cover the remainder of the funding needs.

At this point in time, as much as $4.9M in Prop 50 grant funding is being pursued for the Pilot Project and several project partners have expressed support for the project in writing. A more formal cost sharing agreement will need to be developed in the near-term to allow completion of the implementation activities as shown in Figure 5-4.

Development of interagency agreements is not anticipated to be a fatal flaw since an objective of the Pilot Project is to "tackle key institutional issues, such as identifying the lead project proponent, and developing preliminary interagency agreements".

Assuming the City remains the lead project proponent, interagency agreements that will need to be developed include:

- City and LACSD for purchase of recycled water
- City and AVEK for purchase of imported water
- City and LACDPR for use of the Apollo Lakes recycled water pipeline
- City and WWD No. 40 for purchase of potable water, if necessary

The AV IRWMP governance structure includes continued governance by the Regional Water Management Group, which includes 11 signatories to the group's Memorandum of Understanding. Eight of the signatories are partners in the Pilot Project, including AVEK, PWD, City of Lancaster, City of Palmdale, WWD No. 40, LACSD (No. 14 & No. 20), RCSD, AVSWCA. The governance structure also includes a seven-member Leadership Team to provide focused initiative and effort to accomplish objectives for the governance structure. These objectives include promoting regional water recycling and groundwater banking. As such, the Pilot Project proponent (the City) will likely provide project updates to the Leadership Team. Although, no formal agreements are required between the Pilot Project proponent (the City) and Regional Water Management Group or Leadership Team.

Also, the AVSWCA will be the lead agency for the Prop 50 application and, if grant funds are received from the State, the Pilot Project proponent (the City) will provide quarterly progress reports to the AVSWCA throughout project operations.

6.4.2 Public/Political Acceptance

Successful GWR-RW projects such as the Orange County Water District Groundwater Replenishment Program and the Scottsdale [Arizona] Water Campus project have incorporated extensive public relations campaigns. These and other projects were case studies used in the preparation of the recommendations in the WateReuse Foundation study *Best Practices for Developing Indirect Potable Reuse Projects, Phase 1 Report*[10]and the related web site[11]. The recommended approach in the GWR FS, which is outlined below,

[10] Best Practices for Developing Indirect Potable Reuse Projects: Phase 1 Report (WateReuse Foundation, 2004). Available at: www.watereuse.org/Foundation/researchreport.htm
[11] www.watereuse.org/Foundation/resproject/WaterSupplyReplenishmt/index.htm

is modeled on the recommendations of the aforementioned *Best Practices Report* and web site. Key recommendations include:

1. Understand and Support Policy Makers
2. Build Strong Relationships
3. Communicate with Purpose and Diligence

The Pilot Project assumes that overall GWR outreach will be done thru AVSWCA GWR JPA and specific outreach about the project will be performed by the City.

A potential fatal flaw would be failing to implement these recommendations.

7 Conclusions and Recommendations

Conclusions and recommendations as they relate to the FFA objectives are as follows:

- *Refine the Pilot Project definition, including benefits and estimated costs* – Based on project refinements completed for the FFA, the Pilot Project was decreased in size from 20 acres to 5 acres and the blend water strategy was determined to be 125 af of recycled water, 125 af of stormwater and 375 af of treated, imported water. The project is currently designed at the 10% level and further project refinement should be completed in the Facility Planning phase to determine the exact size and location of the basin. This information is essential to develop a comprehensive project description to be used to move forward with the Engineering Report and CDPH Hearing, and eventually for the environmental documentation slated to begin in the forth quarter of 2008 (Figure 5-4).
- *Identify and evaluate potential fatal flaws for various implementation considerations that would permanently impede implementation of the project* - A summary of issues and mechanisms for their resolution was presented in **Table 6-1**. No issues identified during this analysis were determined to be fatal flaws. From a technical standpoint, the subsurface investigation and subsequent modeling indicated that recharge in this area is feasible with an estimated infiltration rate of 1 ft/day. Issues that have the ability to become fatal flaws are institutional in nature and include lack of support from project partners, lack of funding, and the potential for public/political opposition for the project.

  To resolve these issues, it is recommended that the City and project partners move forward immediately with determining cost sharing to complete the implementation activities as shown in Figure 5-4.

  Other critical path items include outlining and implementing a political and public outreach strategy, and continuing coordination with regulatory agencies and Fox Airfield.
- *Make recommendations on how to move forward with Pilot Project implementation* – As part of the FFA, an implementation schedule was developed (Figure 5-4). The immediate next steps for Pilot Project implementation on the institutional side include ongoing institutional arrangements such as development of a cost sharing agreement between partners and public/political outreach. These items will be essential to keep the project moving forward on schedule as shown in Figure 5-4.

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Appendix A - Hydrologic Analysis

DRAFT Technical Memorandum

Lancaster GWR Site – Preliminary Hydrology Analysis

Subject:	**Preliminary Hydrology Analysis TM**
Prepared For:	City of Lancaster
Prepared by:	Tom Molls, Christy Kennedy
Reviewed by:	
Date:	October 17, 2007
Reference:	0128-007.04

1 Introduction

The purpose of this technical memorandum (TM) is to document the preliminary hydrologic analysis performed in support of the Lancaster GWR Pilot Project (Project). The main intent of the hydrologic analysis was to estimate the surface runoff entering the proposed GWR site located northwest of the City of Lancaster. Both an XP-SWMM model and the LA County Modified Rational Method were used to estimate the surface runoff captured by the Project.

2 Project Site and Basin Delineation

The Project is located northwest of the City of Lancaster in a relatively undeveloped portion of the Antelope Valley. The proposed groundwater retention (GWR) site is located immediately west of Fox Airfield near at the corner of West Avenue F and 60th Street West. Surface water drains to the GWR site from a Basin of approximately 31.6 mi^2. Figure 1 shows the approximate limits of the drainage Basin feeding the proposed GWR site. The Basin limits were estimated using USGS topographic maps and Google Earth. The runoff Basin is largely undeveloped. The USDA soil type within the basin is classified as "sandy loam" (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). Based on the LA County Hydrology Manual (http://dpw.lacounty.gov/wrd/publication/), the basin is comprised of the following soil types: 120, 124, and 134.

The Basin can be divided into two relatively distinct regions – an Upper Subbasin and a Lower Subbasin. The Upper Subbasin is relatively steep and receives more rain than the flatter Lower Subbasin. Approximate properties associated with the Upper and Lower Subbasins are as follows:

- Upper Subbains
  - Area = 13.7 mi^2 = 8,719 acres
  - Average Length = 5.3 mi
  - Average Width = 2.6 mi
  - Elevation Change = 450 ft
  - Average Slope = 0.016
  - 24-hr Rainfall Volumes
    - 100-yr = 5.0 in (average) ; 6.6 in (max) ; 3.2 in (min)
    - 25-yr = 4.3 in (average) ; 5.8 in (max) ; 2.8 in (min)

        - 10-yr = 3.5 in (average) ; 4.7 in (max) ; 2.3 in (min)
        - 2-yr = 2.0 in (average)

- Lower Subbasin
    - Area = 17.9 mi^2 = 11,433 acres
    - Average Length = 7.0 mi
    - Average Width = 2.55 mi
    - Elevation Change = 190 ft
    - Average Slope = 0.005
    - 24-hr Rainfall Volumes
        - 100-yr = 2.9 in (average) ; 3.2 in (max) ; 2.7 in (min)
        - 25-yr = 2.5 in (average) ; 2.8 in (max) ; 2.4 in (min)
        - 10-yr = 2.1 in (average) ; 2.3 in (max) ; 1.9 in (min)
        - 2-yr = 1.5 in (average)

The 24-hr 100-yr, 50-yr, and 10-yr rainfall volumes were estimated from the LA County Hydrology Manual; while, the 2-yr 24-hr rainfall volume was estimated from NOAA Atlas 2.

3 Preliminary Hydrologic Analysis

The surface runoff from the drainage Basin (see Figure 1) was estimated using two different techniques: a simple 2-basin XP-SWMM runoff model and the LA County Modified Rational Method. Both methods assumed the following: (1) undeveloped conditions (i.e. no impervious area), (2) rainfall volumes as listed in Section 2, (3) LA County 24-hr design storm (see Figure 2).

An XP-SWMM model was setup to simulate the runoff from the Upper and Lower Subbasins. The physical attributes for each subbasin were input into the SWMM model. Infiltration was modeled according to the Green-Ampt formulation using the following recommended default parameters for "sandy loam": average capillary suction = 4.33 in, saturated hydraulic conductivity = 0.86 in/hr, and initial moisture deficit (vol. of air / vol. of voids) = 0.358. For the 2-yr and 10-yr events, the XP-SWMM model did not produce any appreciable surface runoff (i.e. all the water was infiltrated). By adjusting the Green-Ampt parameters (within reasonable limits for "sandy loam"), the XP-SWMM model could be made to produce a small volume of runoff for the 2-yr and 10-yr events. Thus, assuming an undeveloped Basin with "sandy loam", the XP-SWMM model indicates minimal surface runoff from the drainage Basin feeding the GWR site (for the 2-yr and 10-yr events).

In addition to the XP-SWMM model, the LA County Modified Rational Method was used to estimate the runoff from the GWR Site drainage Basin. This method is describe in the LA County Hydrology Manual and uses an Excel spreadsheet entitled "TC Calculator" (http://dpw.lacounty.gov/wrd/publication/) to compute the runoff volume and peak flow rate. The "TC Calculator" spreadsheet limits the maximum parcel size to 200 acres and caps the time of concentration at 30 minutes. Therefore, for the GWR drainage Basin, the runoff volumes obtained using the "TC Calculator" spreadsheet should be viewed as maximum runoff volumes. Assuming a square 200 acre parcel, Table 1 lists the runoff values for three rainfall volumes for the three soil types (defined in the LA County Hydrology Manual) that comprise the GWR drainage Basin.

Table 1 - Runoff Values (using the Modified Rational Method)

Soil Type	Rainfall Volume (inches)	Runoff Ratio (%)*	Runoff Volume from GWR Basin (acre-ft)
120	1	9.9	166
120	3	10.3	519
120	6	14.5	1,461
124	1	9.9	166
124	3	9.9	499
124	6	10.0	1,008
134	1	9.9	166
134	3	9.9	499
134	6	14.4	1,451
* Runoff Ratio = (Runoff / Rainfall) x 100			

4 Surface Water Runoff Capture Estimation

The volume of stormwater captured within the basin was estimated using the average rainfall for both the upper and lower basin shown on Figure 4-1.

Figure 4-1: Mean Annual Precipitation in Antelope Valley

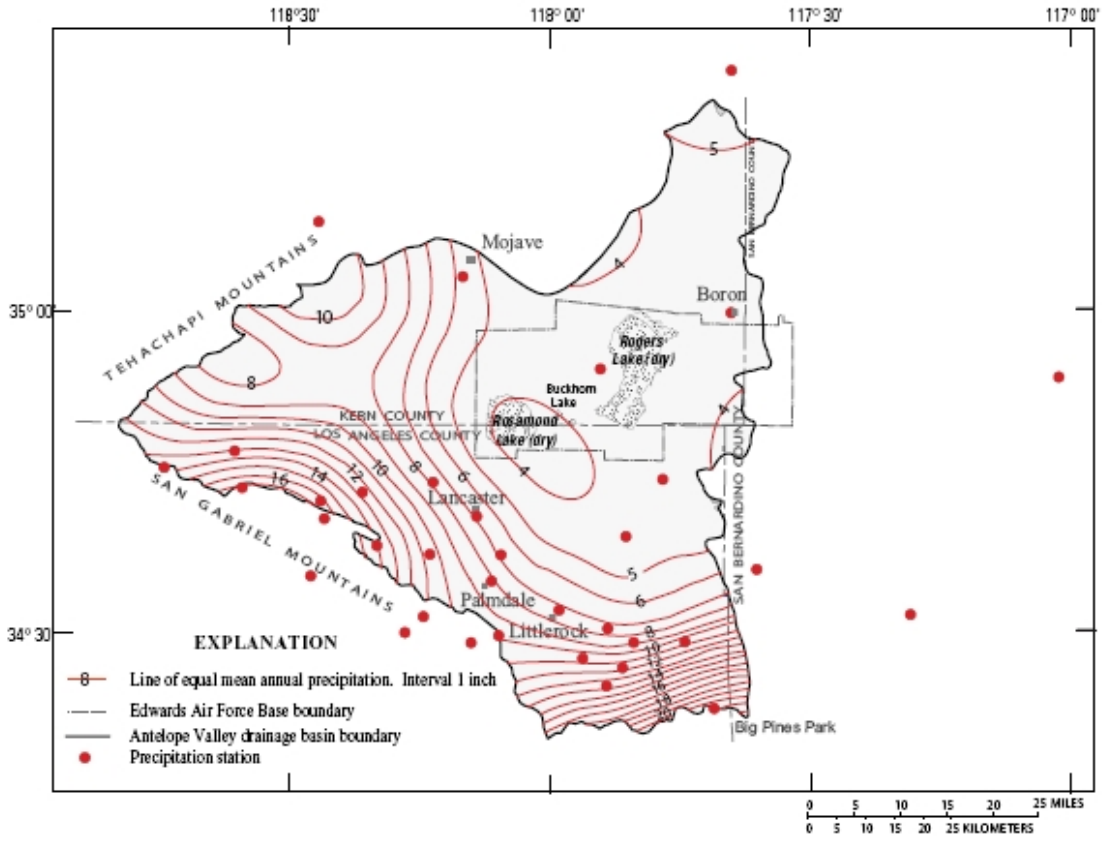


Figure 2—Mean annual precipitation in Antelope Valley, California. (Modified from Blodgett, 1996, fig. 7)

This was assumed to be 8-inches in the lower basin and 12-inches in the upper basin. It was assumed that 75% of the total rainfall would runoff. Of this 75% of runoff between 90% and 95% would infiltrate into before it could the stormwater basin. Therefore a low estimate (assuming 5% reaches the basin) is 615 afy, and a high estimate is 1,230 afy reaches the basin.

While between 615 afy and 1,230 afy of stormwater will reach the basin, the basin can only accept up to 200 af per storm. Given this parameter, there are 1-2 storms per year that yield enough rainfall to allow more than 200 afy to reach the basin at any one time, and therefore some water from these peak storms must bypass the basin. Additionally, enough flow must be present in the natural channel downstream of the basin to maintain the existing riparian habitat. With these constraints, it was assumed that approximately 50% percent of the runoff reaching the basin will be captured. Using a rough average of the low and high volumes estimated, it was estimated that approximately 500 afy of stormwater could be captured in an average rainfall year. To be conservative only 125 af of stormwater per year was assumed to be captured and recharge. If more (up to 500 af or more) is available, this will be used in lieu of other blend water (treated, imported water).

5 Summary

A preliminary hydrologic analysis was performed to estimate the surface runoff from a 31.6 mi^2 drainage Basin northwest of Lancaster, CA. For undeveloped land with “sandy loam, a simple XP-SWMM model indicated no appreciable surface runoff for the 2-yr and 10-yr rainfall events. The LA County Modified rational Method indicated approximately 10% of the total rainfall volume would be transformed to surface runoff. Due to several limitations associated with the Modified Rational Method, the 10% runoff value should be viewed as a maximum value. It should be noted that the runoff values obtained for this analysis were based on undeveloped conditions (i.e. no impervious area). If significant development occurs within the Basin, the surface runoff will increase. Based on the hydrologic analysis, the total runoff captured by the basin was determined to be up to 500 afy, however, only 125 af is assumed for the Fatal Flaw Analysis to be conservative.

Figure 5-1 - Location Map (GWR Site Drainage Basin)

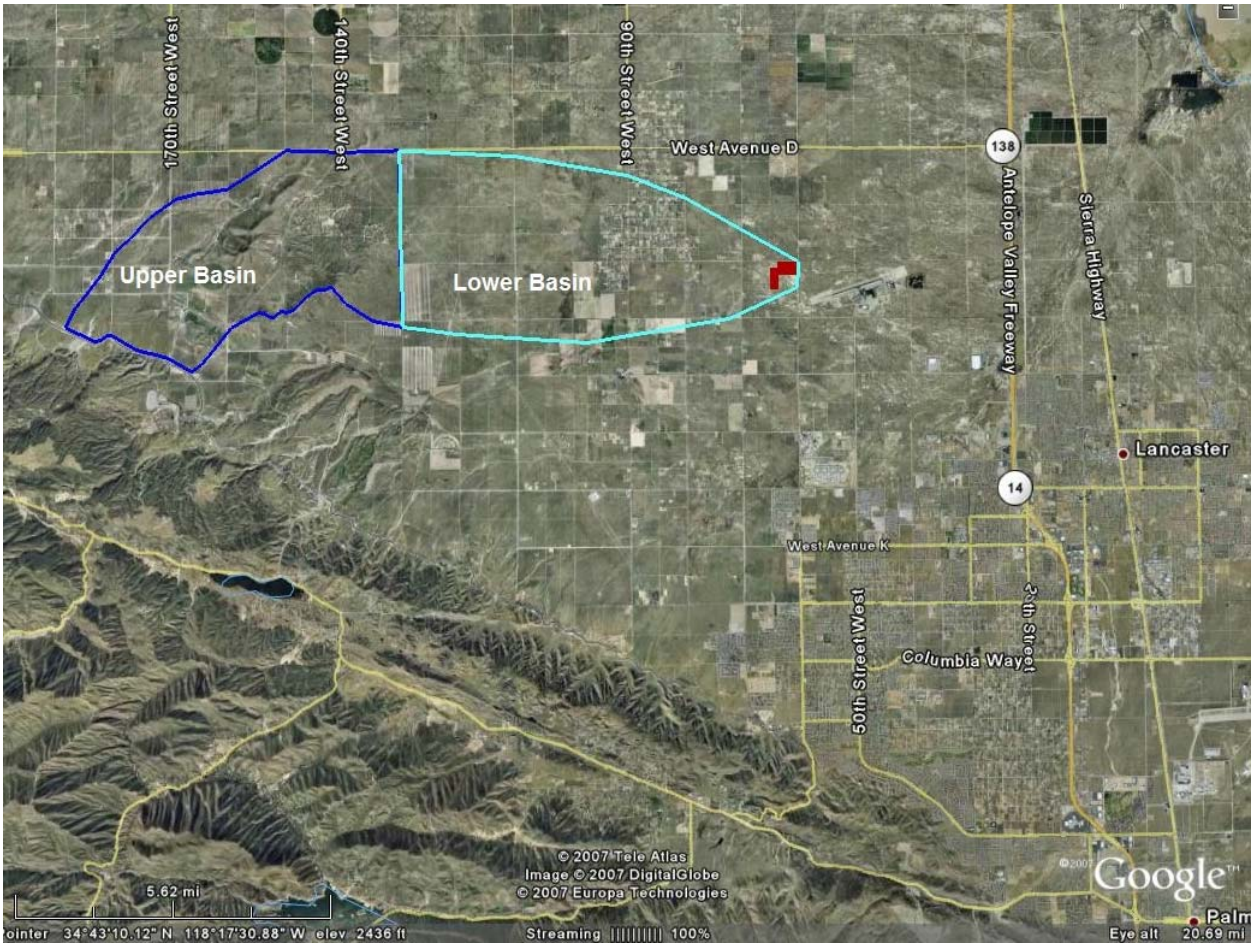
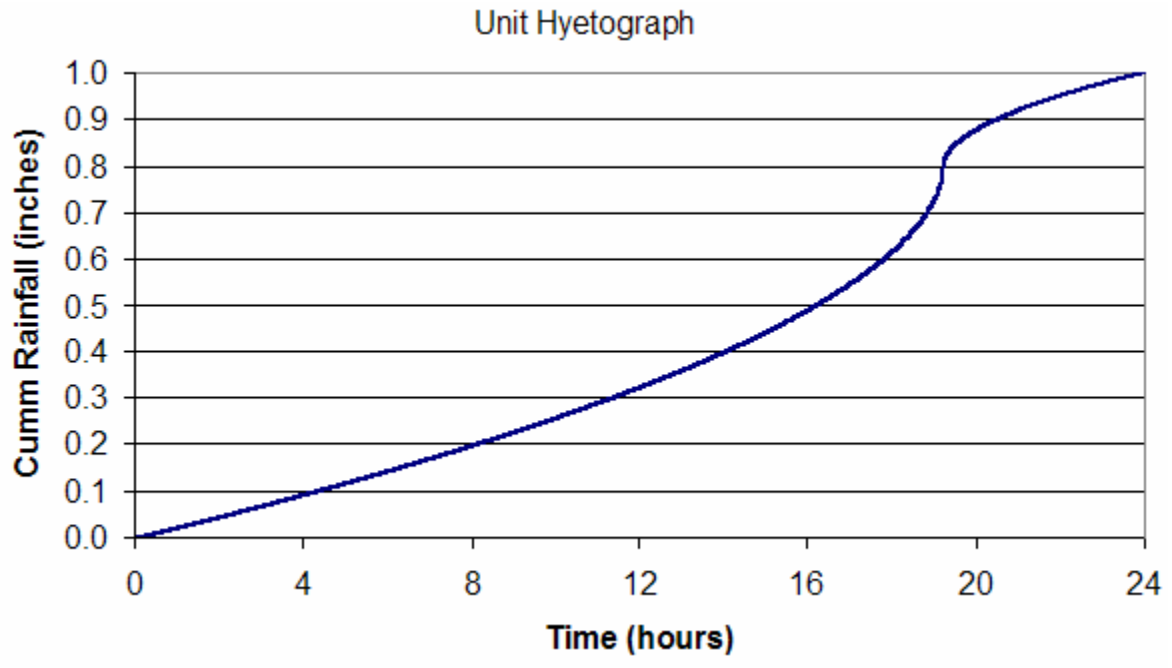


Figure 5-2 – 24-hour Design Storm (from LA County Hydrology Manual)



Appendix B - Detailed Costs

RMC Water and Environment

Project: Lancaster Area GWR-RW Project

Aspect: Lancaster Area Pilot GWR-RW Program

Date: January 23, 2008

Prepared by: CK
Checked by: HK
Check Date: January 8, 2008

Estimate Type: Conceptual

ESTIMATE SUMMARY

Pilot Program Elements		Cost	Unit Cost
Recharge Basins		$ 840,000	
Recycled Water Conveyance		$ 1,890,000	
Diluent Water Conveyance		$ 1,040,000	
Wells & Lysimeters		$ 690,000	
Raw Construction Cost		*$ 4,460,000*	
Conceptual-Level Unknown Allowance	30%	$ 1,340,000	
Total Construction Cost		*$ 5,800,000*	
Land Acquisition		$ -	
Planning Costs - Engr, Env, Legal, & Admin	30%	$ 1,800,000	
Capital Cost		**$ 7,600,000**	
Annualized Capital Cost		$ 559,000	
Annual O&M Cost		**$ 360,000**	
Annual Water Purchase Cost		**$ 102,500**	
Total Annual Cost		**$ 1,021,500**	**$ 410**

Stormwater Recharge Only
$ 840,000
$ -
$ -
$ -
$ 840,000
$ 252,000
$ 1,092,000
$ -
$ 328,000
$ 1,420,000

Element	Item	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes	Cost References
Recharge Basins							**$ 840,000**		
	Excavation	5	ac	121,000	CY	$ 5.00	$ 605,000	Assumes 15' basin depth per Lancaster SW Plan	Lancaster SW Plan
	Fencing	5	ac	1,870	LF	$ 20	$ 37,000		Lancaster SW Plan
	Pump Station at M-2 Basin			1	LS	$ 200,000	$ 200,000	To be verified	
	Land / Right-of-Way Acquisition				AC	$ 60,000	$ -	100 acres dedicated by the County at no cost	
Recycled Water Conveyance							**$ 1,890,000**		
	Recycled Water Distribution Pipe	12	in-dia	14,300	LF	$ 120	$ 1,716,000	From Apollo Lakes to recharge basin	
	Pipe Appurtenances			$ 1,716,000	EA	10%	$ 171,600	10% of Pipeline Costs	
	Pump Station from LACSD Ag Pipe	0	hp	0	EA	$ 290,000	$ -	Pressure at Apollo Lakes is sufficient	
	Easement / Right-of-Way	-	-	-	-	-	-	Included in Pipe Cost Allowance; Assumes City/County ROW	
Diluent Water Conveyance							**$ 1,040,000**		
	Stormwater						$ -	Included in Recharge Basins costs	
	Treated Imported Water Delivery Pipe	12	in-dia	7,900	LF	$ 120	$ 948,000	From proposed AVEK pipe along 80th St	
	Pipe Appurtenances			$ 948,000	EA	10%	$ 94,800	10% of Pipeline Costs	
	Easement/ Right-of-Way	-	-	-	-	-	-	Included in Unit Costs and/or Allowance	
Alt Source:	*Potable Water Delivery Pipe*	*12*	*in-dia*	*10,000*	*LF*	*$ 120*	*$ 1,200,000*	*From WWD No. 40 @ xxxxx*	
	Pipe Appurtenances			*$ 1,200,000*	*EA*	*10%*	*$ 120,000*	*10% of Pipeline Costs*	
Alt Source:	*Groundwater Well*			*1*	*EA*	*$ 400,000*	*$ 400,000*	*Includes baseline well sampling*	
	Well Appurtenances			*$ 400,000*	*EA*	*10%*	*$ 40,000*	*10% of Well Costs*	
Wells & Lysimeters							**$ 690,000**		
	Monitoring Wells			3	EA	$ 150,000	$ 450,000		WEI/RMC
	Monitoring Wells / Soil Borings			0	EA	$ 50,000	$ -	Unit cost is additional cost to convert borings to wells	WEI/RMC
	Well Appurtenances			$ 450,000	EA	10%	$ 45,000	10% of Well Costs	
	Baseline Well Sampling			3	EA	$ 5,000	$ 15,000		WEI
	Lysimeters			4	EA	$ 45,000	$ 180,000	6 lysimeters per cluster & 1 cluster per sub-basin (4)	WEI
Alternative:	*Recharged Water Extraction Wells*			*2*	*EA*	*$ 400,000*	*$ 800,000*	*2 wells at 1,500 gpm to extract ~2,500 af over 6 months*	
Alternative:	*Pipe Appurtenances*			*$ 800,000*	*EA*	*10%*	*$ 80,000*	*10% of Well Costs*	
					FACILITY RAW CONSTRUCTION COST		**$ 4,462,000**		
Annual O&M							**$ 360,000**		
	Recharge Basin O&M Costs			5	AC	$ 4,000	$ 20,000		
	Recycled Water Pipeline O&M Cost			$ 1,716,000	EA	1%	$ 17,160		
	Treated Imported Water Pipeline O&M Cost			$ 948,000	EA	1%	$ 9,480		
	Monitoring Wells & Lysimeters Maintenance			$ 180,000	EA	5%	$ 9,000	5% of Well & Lysimeters Facilities Subtotal Cost	
	Lysimeter Sampling			22	WK	$ 10,400	$ 228,800	Required weekly during operations (5 months) for each cluster (4)	WEI
	Monitoring Well Sampling			12	MO	$ 5,000	$ 60,000	Required monthly throughout the year for each well (3)	WEI
	Blend Water Extraction Well Sampling			12	MO	$ 1,400	$ 16,800	Required monthly throughout the year for each well (1)	WEI
Alt Source:	*Blend Water Extraction Well Pumping*	*600*	*kWh/af*	*225,000*	*kwh*	*$ 0.12*	*$ 27,000*	*Assumes depth to water is 150 ft + 80 psi delivery*	
Alt Source:	*Blend Water Extraction Wells O&M*			*$ 400,000*	*EA*	*1%*	*$ 4,000*		

Project: Lancaster Area GWR-RW Project

Aspect: Lancaster Area Pilot GWR-RW Program

Date: January 23, 2008

Prepared by: CK
Checked by: HK
Check Date: January 8, 2008

Estimate Type: Conceptual

Alternative:	*Recharged Water Extraction Wells Pumping*	500	kWh/af	*312,500*	*kwh*	*$*	*0.12*	*$*	*37,500*	
Annual Water Supply Purchases								**$**	**102,500**	
	Recycled Water			125	AF	$	100	$	12,500	
	Stormwater			125	AF	$	-	$	-	
	Treated Imported Water			375	AF	$	240	$	90,000	AVEK rate for surplus treated water for groundwater replenishment
					ESTIMATED ANNUAL O&M COSTS			**$**	**464,000**	

Planning Items					
	Feasibility Study	1	LS	$ 365,000	$ 365,000	
	Fatal Flaw Analysis	1	LS	$ 95,000	$ 95,000	Assumes geotechnical work is completed by the City and water quality monitoring will be conducted by agencies as necessary
	Facilities Plan	1	LS	$ 130,000	$ 130,000	
	Engineering Report	1	LS	$ 100,000	$ 100,000	
	Regulatory Compliance	1	LS	$ 100,000	$ 100,000	
	Environmental Documentation	1	LS	$ 100,000	$ 100,000	Assumes IS/MND tiered from Regional Recycled Water Project EIR (being prepared by ESA for LA County Waterworks)
	Final Design, Bid, & Award	1	LS	$ 500,000	$ 500,000	Assumes bid & award phase is lead by agencies
	Public/Stakeholder/Political Outreach	1	LS	$ 80,000	$ 80,000	Assumes most activities are conducted as part of the AVSWC JPA program management activities
	Institutional / Funding	1	LS	$ -	$ -	Assumed to be handled by AVSWC JPA
	Stormwater Basin Design	1	LS	$ 328,000	$ 328,000	30% of stormwater basin construction total
			ESTIMATED PLANNING COSTS, by line item		**$** **1,800,000**	
			ESTIMATED PLANNING COSTS USED FOR FFA		**$** **1,800,000**	Assumes 30% Eng, Legal, Env of Construction Total

Appendix C - Soil Hydraulic Properties

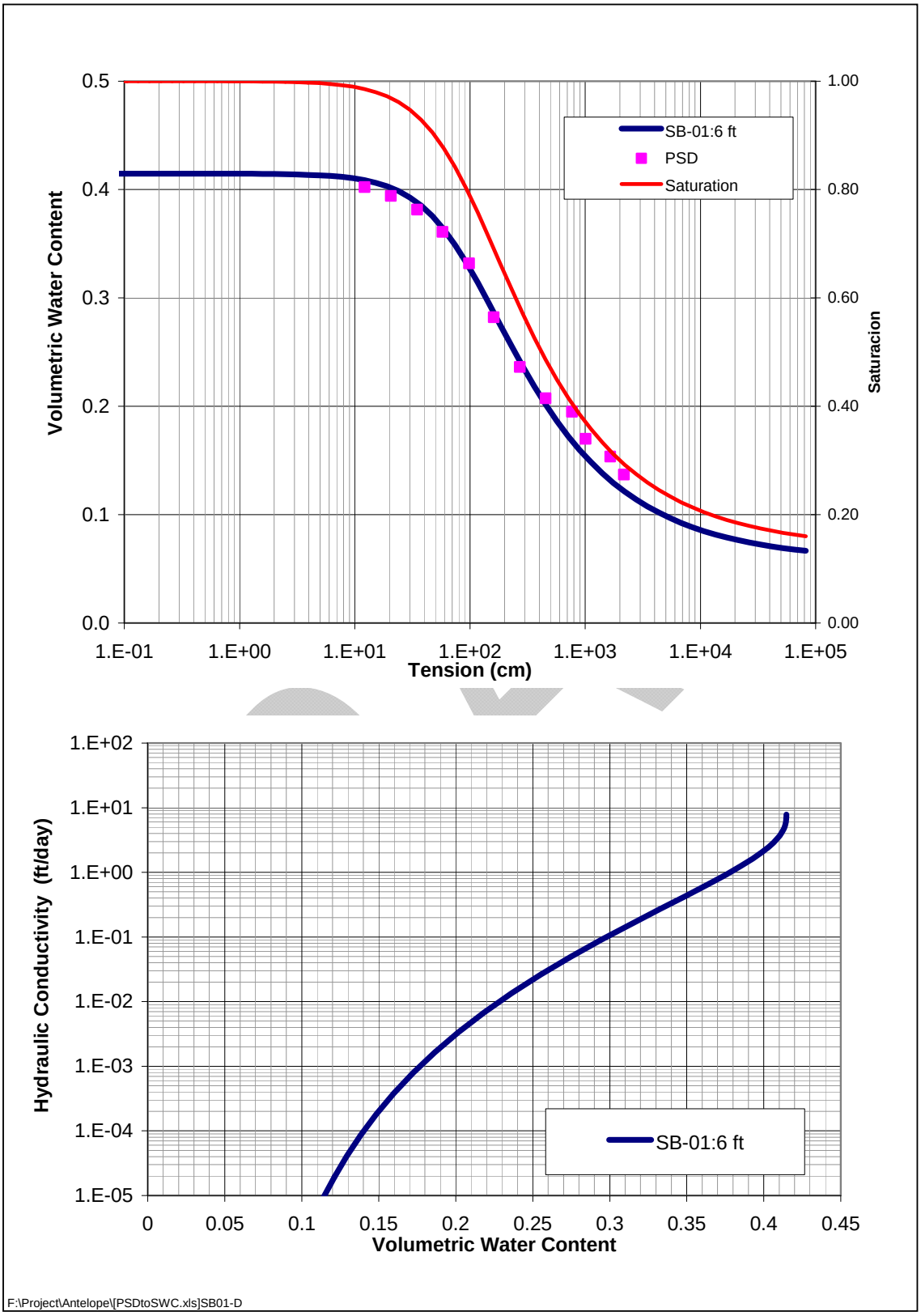


Figure 1. Estimates of soil hydraulic properties in the soil samples of SB01 well

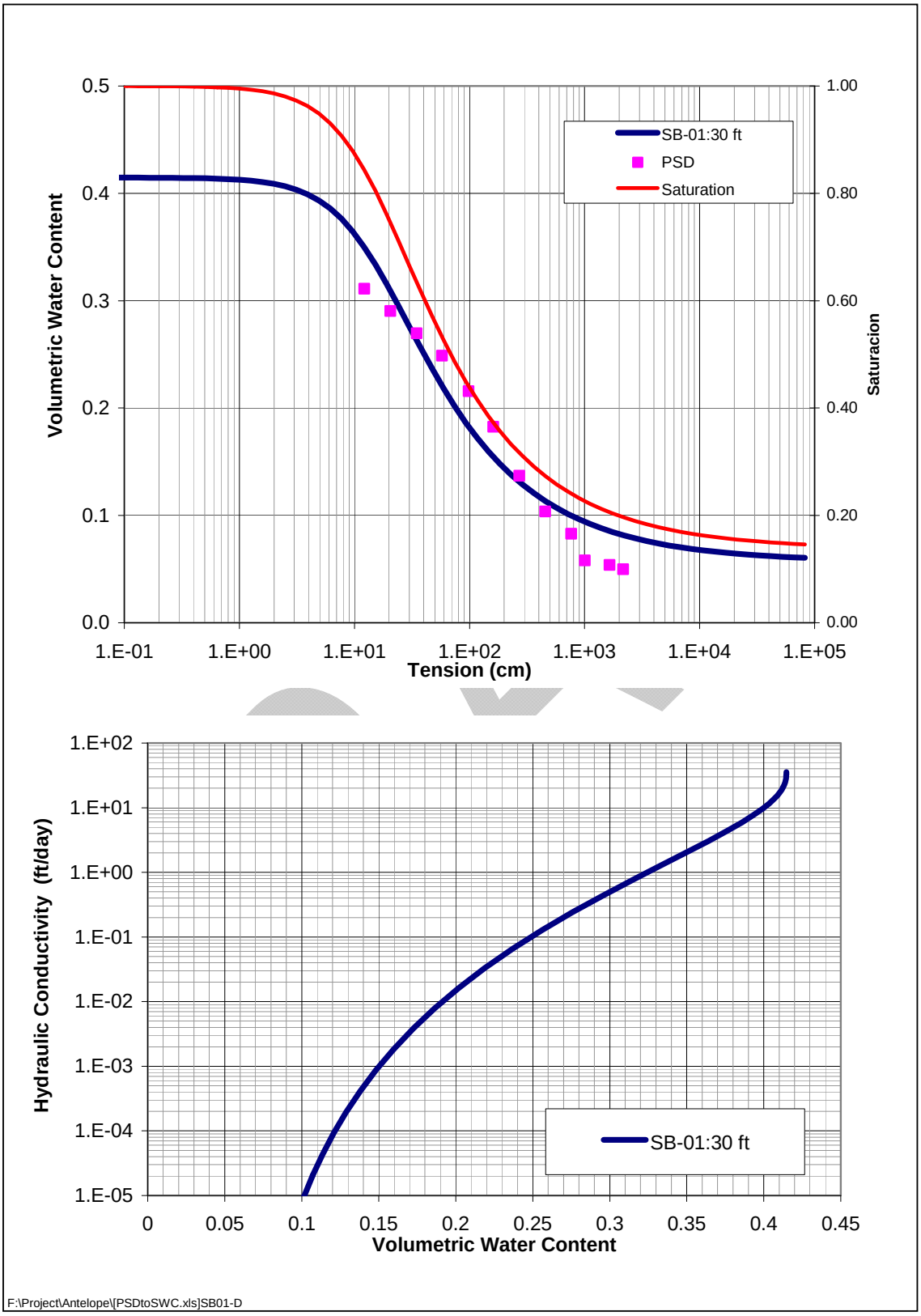


Figure 2. Estimates of soil hydraulic properties in the soil samples of SB01 well

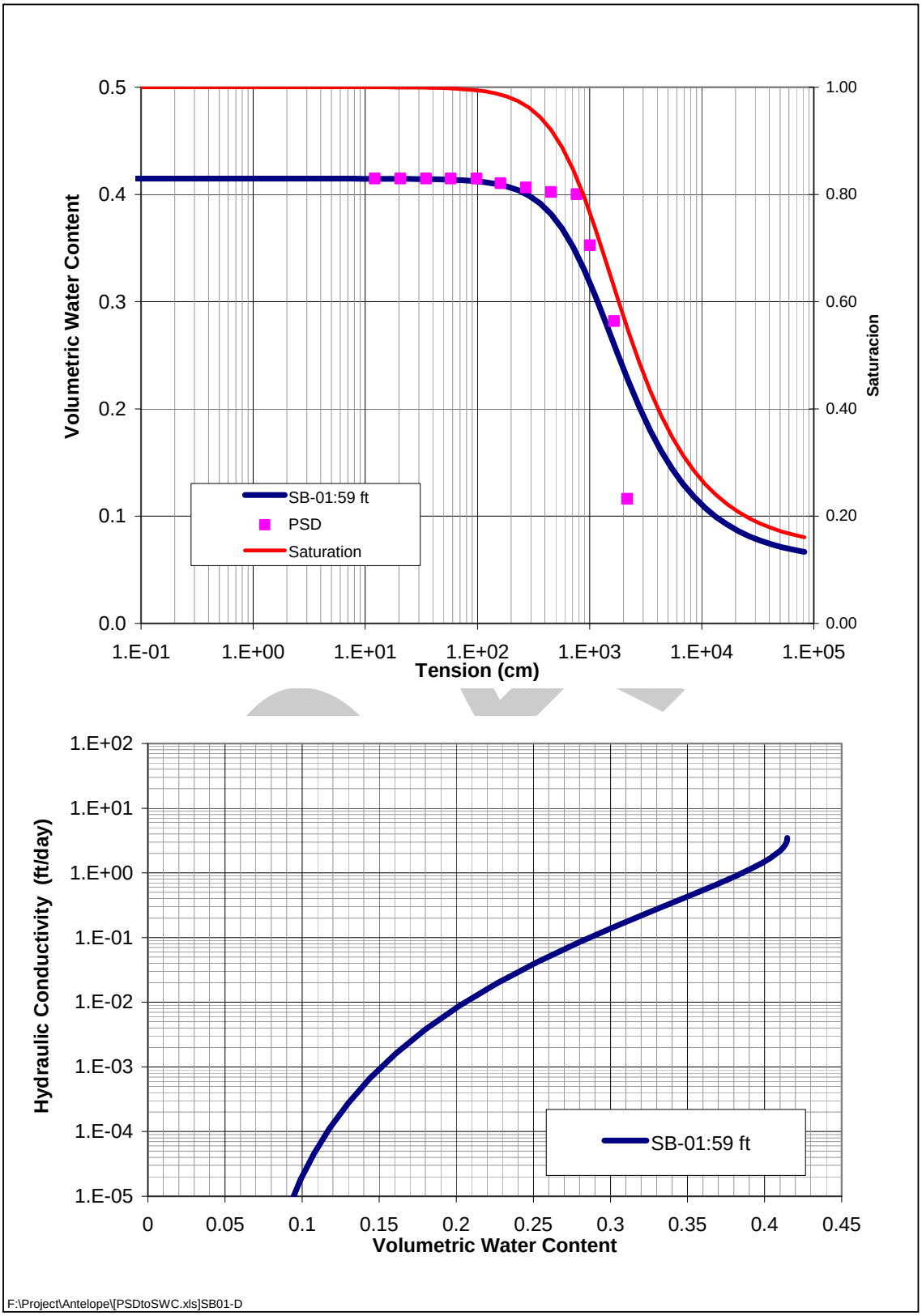


Figure 3. Estimates of soil hydraulic properties in the soil samples of SB01 well

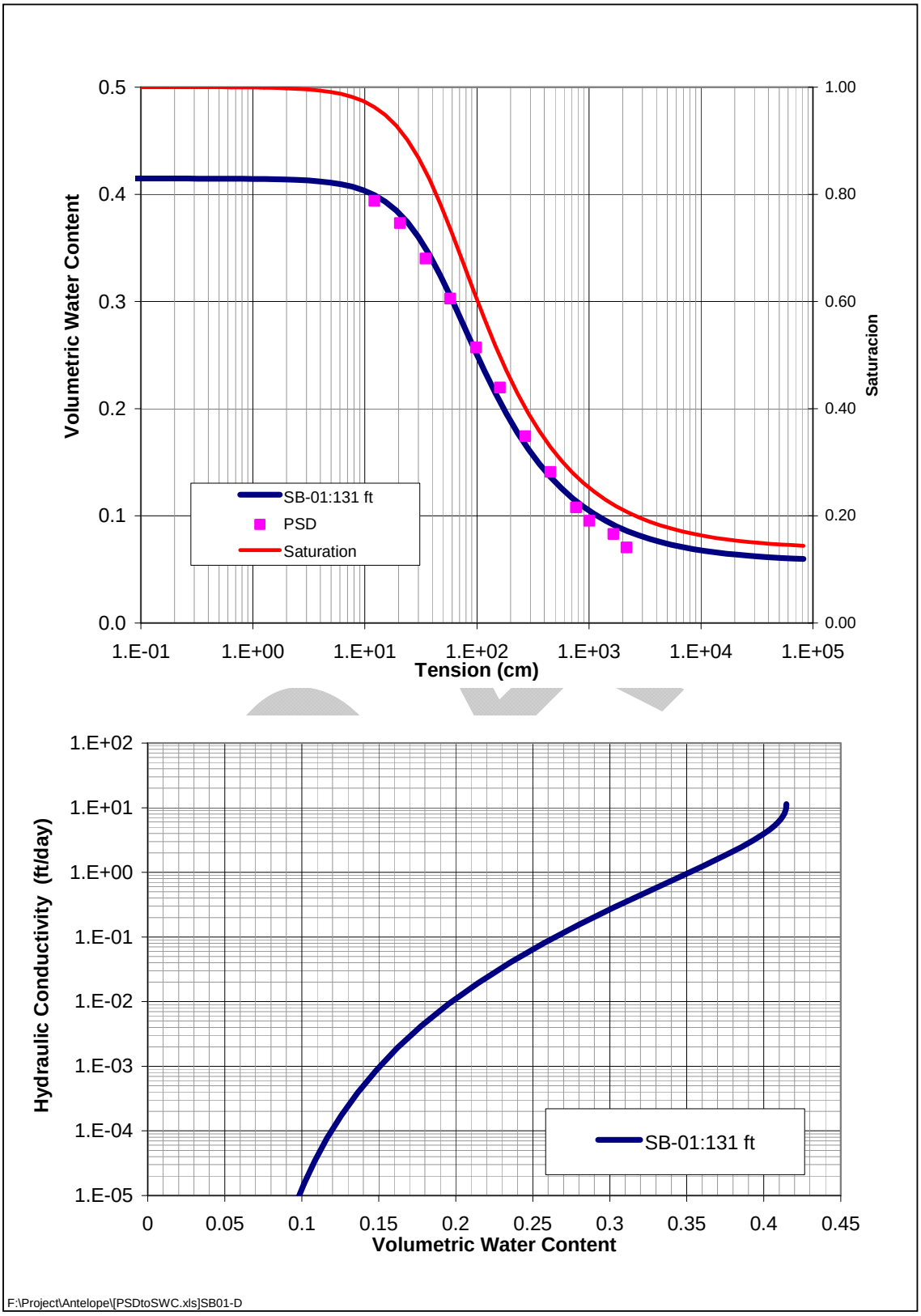


Figure 4. Estimates of soil hydraulic properties in the soil samples of SB01 well

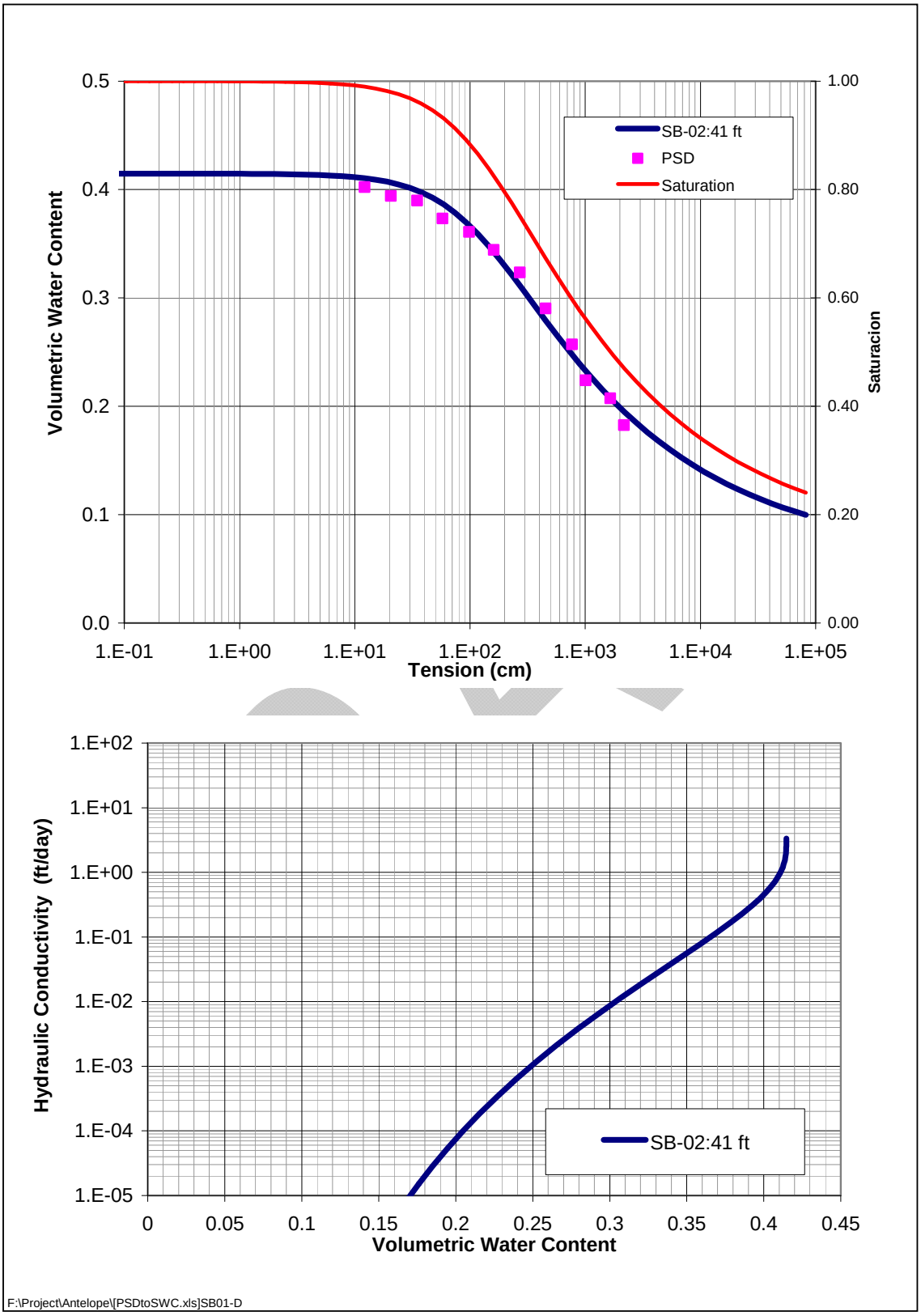


Figure 5. Estimates of soil hydraulic properties in the soil samples of SB02 well

Appendix D - Nitrogen and Trihalomethanes Attenuation via Soil Aquifer Treatment

Memorandum

RMC Water and Environment

Lancaster Groundwater Recharge Pilot Program

Subject: Nitrogen and Trihalomethanes Attenuation via Soil Aquifer Treatment

Prepared by: Margie Nellor (Nellor Environmental)

Reviewed by: Rob Morrow, Helene Kubler

Date: September 10, 2007

The concept of soil aquifer treatment (SAT) during groundwater recharge (GWR) depends on blended water infiltration into the soil and subsurface movement away from the recharge basin. Improvements in water quality can be made because of the many different mechanisms that occur in soil, such as filtration, biological degradation, physical sorption, ion exchange, and precipitation. These mechanisms are effective in removing organic carbon, nitrogen, phosphorus, suspended solids, pathogens, trace metals, and trace organic compounds. The removal of bulk and trace organics and nitrogen can be a continuous sustainable process that relies primarily on biodegradation.

For example, denitrified effluent produced by the city of Mesa, AZ had a total nitrogen concentration in the range of 2 to 6 mg/L. Local groundwater, which is dominated by the effluent and is one year removed from the infiltration basins, contained nitrogen levels of roughly half that magnitude (Fox *et al*., 2001). For the Chino Basin GWR Project, which produces denitrified effluents with total nitrogen concentrations averaging 6.3 mg/L (Regional Plant No. 4) and 3.7 mg/L (Regional Plant No. 1), total nitrogen removals of 80 percent or greater has been observed in the vadose zone as a result of soil aquifer treatment (IEUA, 2007).

For trihalomethanes (THMs), a number of studies have shown significant removal during soil aquifer treatment. Chloroform in tertiary effluent from the Los Angeles County Sanitation Districts (LACSD) Whittier Narrows Water Reclamation Plant was reduced by 52 percent in the vadose zone (Nellor *et al.*, 1984; Nellor *et al*., 1985). And samples of spiked effluent used for sprinkler irrigation showed removals in the vadose zone of 63 percent for chloroform, 46 percent for bromoform, and 66 percent for dibromochloromethane (Parker and Jenkins, 1986). For the Chino Basin GWR Project, which produces a recycled water with THM concentrations above the drinking water standard (100 ug/L), THM removal ranging from 34 percent to 87 percent has been observed in the vadose zone as a result of soil aquifer treatment, with all samples well below the drinking water standard (IEUA, 2007).

References

- Fox, P., *et al.*, 2001. *An Investigation of Soil Aquifer Treatment for Sustainable Water Reuse*. AWWA Research Foundation and American Water Works Association, Denver, CO.
- Inland Empire Utilities Agency (IEUA), 2007. Chino Basin Recycled Water Groundwater Recharge Program Quarterly Monitoring Report for April through June 2007.
- Nellor, M., *et al.*, 1984. *Health Effects Study Final Report*. LACSD.
- Nellor, M., *et al.*, 1985. Health Effects of Indirect Potable Water Reuse. *Journal AWWA*. 88-96, July 1985.
- Parker, L. and T. Jenkins, 1986. Removal of Trace-Level Organics by Slow-Rate Land Treatment. Water Research, 20(11)1417-1426.

Appendix E - State Water Resources Control Board Recycled Water Policy Comments

Memorandum

RMC Water and Environment

Groundwater Recharge Pilot Program

Subject:	Comments on State Water Resources Control Board's Draft Water Recycling Policy
Prepared By:	Margie Nellor (Nellor Environmental)
Reviewed By:	Rob Morrow
Date:	September 19, 2007

Background

The SWRCB is developing a statewide Water Recycling Policy (Policy) that is intended to establish more uniform requirements for recycled water projects in the context of anti-degradation. A scoping workshop was held in March 2007 to obtain input from stakeholders on a number of technical and regulatory issues that the SWRCB was considering to include or address in the Policy. Last week, the SWRCB issued the draft Policy and a notice for a workshop session. The workshop session will be held as part of the October 2, 2007 SWRCB meeting in Los Angeles. The SWRCB will hear comments on the draft Policy, but will not be taking actions to adopt the Policy at the workshop session. Written comments on the draft Policy must be submitted by October 26, 2007. The SWRCB hearing to consider adoption of the draft Policy has been scheduled for December 4, 2007. SWRCB staff is currently working on a staff report on the draft Policy and a draft California Environmental Quality Act document. Copies of the draft Policy and workshop notice are available at the following web site address:

http://www.waterboards.ca.gov/water_recycling_policy/index.html

Discussion

The draft Policy includes provisions for both recycled water irrigation projects and groundwater recharge projects. While it was the water reuse community's understanding that the SWRCB intended to help facilitate recycling by issuing the Policy, it is apparent that there are many problematic provisions that will have the opposite effect unless the Policy is significantly modified. This memo addresses those sections of the draft Policy that appear to be problematic for groundwater recharge projects. As a side note, the California Section of the Water Reuse Association (WRA) is likely in its comments to ask the SWRCB to remove the groundwater recharge provisions from the draft Policy since they usurp the authority of the California Department of Public Health (CDPH), nullify the Order issued by the SWRCB for the Alamitos Barrier Project that prevented the inclusion of permit limits for CDPH advisory Notification Levels, and conflict with some of the provisions in the CDPH draft groundwater recharge regulations. The draft recharge regulations are evolving and are expected to be revised after the Policy is adopted, and thus the potential for conflicts could increase. Since there is no need for the Policy to address groundwater recharge, the relevant provisions should be deleted. The WRA also has significant comments/concerns regarding the irrigation provisions in the draft Policy.

These comments are provided for the provisions of the draft Policy in the order they are presented.

> ***4.*** *For the purpose of this Policy, "recycled water" has the same meaning as in Water Code section 13050(n).*

Comment: I am currently participating on the CDPH Groundwater Recharge Regulations Working Group meeting, which is discussing the January 2007 draft regulations. This provision in the draft Policy

may conflict with the development of the new definition of "recharge water" in the draft recharge regulations, which would be used as the basis for determining compliance with portions of the draft recharge regulations. Per the Memorandum of Understanding (MOU) between the SWRCB and CDPH, both agencies are supposed to confer about policies and regulations regarding water recycling. For the draft Policy, this did not occur before the draft Policy was released by the SWRCB. As a general, comment the reuse community is going to ask that any sections of the draft Policy that conflict with CDPH's draft regulations be deleted.

> ***7.(d)*** *the monthly average TDS concentration in the recycled water to not exceed the monthly average TDS concentration of the source water supply, plus 300 mg/l. The monthly average TDS concentration of the source water supply shall be the flow-weighted monthly average TDS concentration of the public water supply of the service area that generates sewage from which the recycled water is produced;*

Comment: While this provision applies to irrigation projects, it is likely that a Regional Board might also apply it to groundwater recharge projects. It is my understanding from discussions with the County Sanitation Districts of Los Angeles County, that it will not be possible to meet this requirement for the Antelope Valley water reclamation plants. **Thus, this provision could potentially be an obstacle for the proposed pilot groundwater recharge project that would necessitate treatment to remove salts.** There appears to be no scientific basis for setting the increment at 300 mg/L; nor is it reasonable to make these determinations on a monthly basis for an area's water supply. The WRA is going to ask that this language be revised so that the annual average TDS concentration in the recycled water is limited to the annual average TDS concentration of the source water supply, plus 500 mg/L.

> ***10.*** *For constituents for which CDPH has established an MCL, when interpreting a narrative objective for toxicity to develop a numeric effluent limitation for the constituent for protection of public health for a groundwater recharge reuse project, the Regional Water Board shall establish the effluent limitation at a concentration equivalent to the MCL. A Regional Water Board may establish a limitation that is more stringent than the MCL, if necessary to protect a designated beneficial use other than municipal or domestic use, such as agricultural use.*

Comment: This language is conflicts with the current discussions the CDPH Working Group is having regarding the draft recharge regulations that will allow compliance with disinfection byproduct MCLs in the recharge water before or after spreading or injection; and with the current version of the draft regulations which exclude the secondary MCL for color as a recycled water limitation. Any sections of the draft Policy that conflict with CDPH's draft regulations should be deleted.

> ***11.*** *For constituents for which CDPH has not established an MCL, a Regional Water Board may interpret a narrative objective for toxicity for protection of human health to establish an effluent limitation for the constituent for a groundwater recharge reuse project, only if it finds that: (a) the constituent is present in the recycled water; (b) the constituent is likely to be persistent in groundwater in the recharge area; (c) adequate information is available to characterize the toxicity of the constituent and establish an effluent limitation; and (d) approved analytical methods are available to measure the concentration of the constituent.*

Comment: <u>This provision potentially could be a huge obstacle for any groundwater recharge projects in terms of cost since could lead to having to install advanced waste treatment</u>. Per discussions with SWRCB members, this was not the intent of the provision, but as drafted it certainly can be interpreted to create this problem, and should be deleted from the draft Policy.

The provision usurps the Order issued by the State Board for the Alamitos Barrier Project that concluded it was not appropriate to include Notification Level[1] based limits in the indirect potable permit and found that the Regional Boards should follow CDPH recommendations with regard to protection of human health. This conclusion in the Alamitos Order was made in concert with a previous Orders issued by the State Board whereby they ruled that effluent limitations can be based on criteria that have not been adopted as water quality standards, so long as appropriate findings are made (see Footnote 4 from Alamitos Order : "See, e.g. WQ 95-4 and WQO 2001-16. Thus, we have held that "non-regulatory" limitations may be used to develop effluent limitations where appropriate findings are made. (See, e.g. WQO 2002-0015 (Vacaville) at p. 35 (permit may include limitations based on DHS recommendations).")

The (a), (b), and (c) elements in this provision appear to be an attempt to do an "end-around" of the Alamitos Order by establishing what those findings can be; however, these three conditions are so easy to meet that they will not limit the authority of the Regional Boards in any meaningful way and will provide the Regional Boards with new authority to disregard CDPH recommendations since:

- For (a), depending on detection limits, it is likely that a whole host of chemicals without MCLs can be detected in recycled water. This likelihood will increase as more sensitive analytical methods are developed.
- For (b), "adequate" toxicity information is a very subjective term and a Regional Board could easily say that one study in the literature can be used to establish limits since this is done for establishing other kinds of water quality objectives. Clearly chemicals with Notification Levels would qualify for having effluent limits under this provision, even though they are advisory levels. Also, this provision allows a limit to be established without going through a rigorous standard setting process as is done for MCLs or water quality objectives.
- For (c), approved analytical methods is also a very subjective term. If this is limited to 40 CFR 136 methods, then this may not be a problem; but if it is a method that the Regional Board approves or CDPH has approved for monitoring purposes for groundwater recharge projects, then it enables limits to be set for a wide range of chemicals that are detected.
- And perhaps most troubling is that this approach gives a Regional Board the authority to set limits based on detection of a chemical and not whether the chemical is present at levels of health concern, and takes CDPH completely out of the loop for setting appropriate requirements for protection of public health.
- This provision also seems to set up a *de facto* mechanism for a Regional Board to disregard a recommendation made by CDPH with regard to protection of public health for recharge permits.

12. *For groundwater recharge reuse projects, if a Regional Water Board finds that attenuation of a constituent will occur within soil, the vadose zone or groundwater, in lieu of establishing an effluent limitation, the Regional Water Board may establish a groundwater limitation for the constituent. If a groundwater limitation is established, the Regional Water Board shall require monitoring of the constituent in groundwater. The groundwater shall comply with the limitation at specified monitoring points. The discharger shall have legal control over the attenuation area between the discharge points and the monitoring points to prevent the use of domestic or municipal wells within the attenuation area.*

[1] Notification Levels are health-based advisory levels established by CDPH for chemicals in drinking water that lack MCLs. Notification Levels are not enforceable standards, and are revised as needed by CDPH, but do not go through a regulatory process. If a chemical is detected above its Notification Level, certain notification requirements and recommendations apply to drinking water purveyors.

Comment: This language will conflict with the draft groundwater recharge regulations, which allow for compliance to be determined in the vadose zone for some constituents. This is important for projects such as proposed pilot project, where the groundwater table is so deep, compliance determinations are not possible in groundwater and lysimeters will have to be used, similar to the Chino Basin project. Any sections of the draft Policy that conflict with CDPH's draft regulations should be deleted.

> ***14.*** *For groundwater recharge reuse projects that use injection wells, the Regional Water Board shall require that the discharger comply with conditions established by CDPH when making its findings of non-degradation in accordance with Water Code section 13540, or, if the Regional Water Board disagrees with the conditions, the Regional Water Board shall follow the conflict resolution process prescribed in the 1996 "Memorandum of Agreement between the Department of Health Services and the State Water Resources Control Board on the Use of Reclaimed Water."*
>
> ***15.*** *For groundwater recharge reuse projects that use spreading basins, the Regional Water Board shall require the discharger to implement the recommendation provided by CDPH, or, if the Regional Water Board disagrees with the recommendation, the Regional Water Board shall follow the conflict resolution process prescribed in the 1996 "Memorandum of Agreement between the Department of Health Services and the State Water Resources Control Board on the Use of Reclaimed Water."*

Comment: These two provisions are poorly written and inaccurate, and should be revised. Ideally, they should be combined into one provision that is revised as follows:

> For groundwater recharge reuse projects, after a public hearing, CDPH issues findings of fact and conditions for each project, which are provided as recommendations to the Regional Water Board when issuing the permit for a project. ~~that use injection wells, the Regional Water Board shall require that the discharger comply with conditions established by CDPH when making its findings of non-degradation in accordance with Water Code section 13540, or, if~~ For protection of public health, the Regional Board shall defer to the recommendations of CDPH. If the Regional Water Board disagrees with ~~the~~ other CDPH recommendations regarding the project, the Regional Water Board shall follow the conflict resolution process prescribed in the 1996 "Memorandum of Agreement between the Department of Health Services and the State Water Resources Control Board on the Use of Reclaimed Water."

Also, in some regions, the conflict resolution process is not being followed, nor is the process in keeping with the Alamitos Barrier Order. The Policy should clearly state that for matters of human health protection, CDPH should be given deference and not have to go through this process. For other non-health related issues, the conflict resolution process should be followed.

> ***18.*** *The Regional Water Board shall include at least the liability description in paragraph No. 17 in requirements for groundwater recharge reuse projects. In addition, Regional Water Boards may, at their discretion, require project owners to pass a financial means test or otherwise provide financial assurances of their ability to bear such liability. Regional Water Board staff shall consult with appropriate State Water Board staff prior to recommending specific language implementing any such financial means/assurance requirements.*

Comment: Per our discussions at the CDPH Working Group meetings, CDPH does have concerns about a project proponent having the financial ability to deal with problems that might occur as a result of a groundwater recharge project, but that this would be handled by developing the CDPH approved plan in Section 60320(b) of the draft groundwater recharge regulations that requires project proponents to have a plan for providing water or well-head treatment should a recharge project adversely impact a well so that it cannot be used as a source of drinking water. This requirement in the draft Policy to pass a financial

means test is problematic since it is not clear what kind of test this would be or how complicated it would be to get approved by a Regional Board. Also, when the issue of financial liability was discussed in 2001 when the CDPH draft groundwater recharge regulations included provisions for project sponsors to establish financial assurance mechanisms if wells became unusable as a result of recharge, it was felt that this approach was too vague and indirect, compared with having a specific approved response plan in place, and subsequent drafts of the recharge regulations did not include this provision. Thus, this provision should be deleted.

> ***19.*** *If CDPH and the Regional Water Board disagree on proposed water reclamation requirements or waste discharge requirements for a water recycling project, the Regional Water Board shall follow the conflict resolution process prescribed in the 1996 "Memorandum of Agreement between the Department of Health Services and the State Water Resources Control Board on the Use of Reclaimed Water."*

Comment: The conflict resolution process is not being followed, nor is the process in keeping with the Alamitos Barrier Order. The Policy should clearly state that for matters of human health protection, CDPH should be given deference and not have to go through this process. For other non-health related issues, the conflict resolution process should be followed.

Summary

The most problematic provision in the draft Policy is No. 11, which could result in all groundwater recharge projects having to install advanced treatment, and thus could make projects financially infeasible. Provision 7(d), although intended only for irrigation projects, could also be applied by Regional Boards to groundwater recharge projects. Should that occur, it would hinder the proposed groundwater recharge pilot project since it would not be possible to meet this condition end-of-pipe without treatment, and seems to disallow blending with diluent water as a compliance option.

The SWRCB has indicated that the draft Policy may be revised before the October 2 workshop. CDPH is under the impression that its comments will be included in a revised draft that will be available in advance of the workshop; the Department has similar concerns about many of the provisions in the draft Policy. Should changes be made to the draft Policy, these will be evaluated with regard to the FAA for the proposed pilot groundwater recharge project.

Appendix F - Management of Microconstituents

Memorandum

RMC Water and Environment

Lancaster Groundwater Recharge Pilot Program

Subject: Management of Microconstituents

Prepared by: Margie Nellor (Nellor Environmental Associates)

Reviewed by: Rob Morrow, Helene Kubler

Date: September 10, 2007

The California Department of Public Health (CDPH) and Lahontan Regional Water Quality Control Board (LRWQCB) recommended that:

1. The Fatal Flaw Analysis (FFA) Technical Memorandum (TM) should summarize information on microconstituent performance for soil aquifer treatment and the Engineering Report for the pilot project should discuss this in more detail for additional treatment processes along with concomitant costs
2. The FAA TM should note the importance of enhanced source control for unregulated organics and mention the kinds of programs in place

The following sections address these recommendations.

Treatment Performance

Wastewater treatment and soil aquifer treatment (SAT) can remove many microconstituents, but some are recalcitrant and can be detected at very low concentrations (Dickenson, 2006; Drewes *et al*., 2001; Drewes, 2006; Drewes, 2007a; Drewes, 2007b; Fox *et al*., 2001; Fox *et al*., 2006; Snyder, 2006). Of particular interest are compounds that can affect the endocrine system, which are called endocrine disruptors. Estrogenicity as measured by using *in vitro* and *in vivo* assays was efficiently removed during SAT (Fox *et al*., 2006). These endocrine disrupting compounds (ECDs) are expected to be nonpolar and biodegradable, and their transport in the subsurface is limited (Heberer *et al*., 2002). Additionally, as analytical methods are modified to permit the detection of ultra-trace levels of contaminants (e.g., nanograms per liter (ηg/L) or less) more compounds will be found. However, the ability to detect a compound does not necessarily translate to health concerns. Examples of SAT performance for selected indicator compounds are presented in **Table 1**. Information on the health effects of many of these compounds is expected to be available in the next 12 to 18 months.

Table 1: Natural Attenuation / SAT

Good Removal			Intermediate Removal		Poor Removal
> 90%			50 - 90%	25 - 50%	< 25%
• Atenolol[1] • Atorvastatin[2] • Caffeine • Diclofenac[3] • Estrone[4] • Fluoxetine[5] • Gemfibrozil[6] • Ibuprofen[3]	• Iopromide[7] • Meprobamate[8] • Naproxen[3] • NDMA[9] • Norfluoxetine[5] • o-Hydroxy atorvastatin[2]	• p-Hydroxy atorvastatin[2] • Salicyclic Acid[10] • Simvastatin Hydroxy Acid[2] • Sulfamethoxazole[11] • Triclosan[12] • Trimethoprim[11]	• Dilantin[13]	• TCEP[14]	• Carbamazepine[13] • Primidone[13] • TCPP[15] • TDCPP[16]

Sources: Drewes, 2007a and Drewes, 2007b

[1] Beta blocker
[2] Statin
[3] Nonsteroidal anti-inflammatory
[4] Naturally occurring estrogen
[5] Antidepressant
[6] Lipid-regulator
[7] Radiological contrast agent
[8] Anti-anxiety drug
[9] N-Nitrosodimethlyamine
[10] Analgesic
[11] Antibiotic
[12] Antibacterial chemical
[13] Anti-epileptic drug
[14] Tris(2-chloroethyl)-phosphate, flame redartant
[15] Tris(2-chloroisopropyl)-phosphate, flame redartant
[16] Tris(1,3-dichloro-2-propyl)-phosphate, flame redartant

Source Control

The Draft CDPH GWR Regulations require that agencies maintain a comprehensive industrial wastewater pretreatment and source control program for controlling discharges of waste from commercial and industrial sources that could adversely affect the quality of the recycled water used for recharge. Four agencies that operate pretreatment programs and either directly operate recharge projects or provide recycled water for recharge projects have developed specific program elements to address the draft regulations:

1. Orange County Sanitation Districts
2. Los Angeles County Sanitation Districts (LACSD)
3. Inland Empire Utilities Agency
4. City of Los Angeles Bureau of Sanitation

These elements include a "book" of information on compounds with CDPH Notification Levels for the agencies' field inspectors to use as part of their oversight of industries. The book includes information such as where they come from and how they are used. The agencies are also leveraging existing databases, such as the ones maintained by county fire departments, which can be searched if compounds of concern are identified. The agencies also maintain and update their own chemical databases, and have response plans when chemicals of concern are identified.

The West Basin Municipal Water District, which receives secondary effluent from the City of Los Angeles, but does not operate a pretreatment program, has developed a Source Control Plan to supplement the scope and purpose of the City of Los Angeles source control program. The Water Replenishment District has entered into to a Memorandum of Understanding with the LACSD with regard to source control duties and responsibilities for the Alamitos Barrier Project.

References

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- Drewes, J. E., *et al*., 2001. Removal of Pharmaceuticals during Conventional Wastewater Treatment, Advanced Membrane Treatment and Soil-aquifer Treatment. *Proceedings 2nd International Conference on Pharmaceuticals and Endocrine Disrupting Chemicals in Water, Minneapolis, Minnesota, October 2001*.
- Drewes, J., 2006. Viability of TOC as a Surrogate for Unregulated Trace Organics in Indirect Potable Reuse Applications. Presentation at 10th Annual WateReuse Foundation Research Conference, Phoenix, AZ, May 2006.
- Drewes, J. *et al*., 2007a. Identifying Indicators and Surrogates for Chemical Contaminant Removal during Indirect Potable Reuse. Presentation to the California DPH Groundwater Recharge Regulation Working Group, April 2007.
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Appendix G - Minutes from Regional Water Quality Control Board and California Department of Public Health Meeting

Conference Call Summary (Draft)

Groundwater Recharge Pilot Program; Fatal Flaw Analysis

Subject:	Summary of Conference Call with Lahontan Regional Water Quality Control Board (RWQCB) and California Department of Public Health (CDPH)
Prepared By:	Margie Nellor, NEA
Date/Time:	July 18, 2007 (8:00 am – 9:00 am)
RMC Project Number:	0128-007.04

Attendees:
Mike Plaziak, Curt Shifrer, (RWQCB);
Jeff Stone, Kurt Souza, Stefan Cajina, Chi Diep (CDPH);
Steve Dassler, Jamshed Yazdani (City of Lancaster)
Helene Kubler, Margie Nellor (NEA-RMC Team)

Purpose of Meeting

- Provide an update on the outcome of the Lancaster Area Groundwater Recharge Feasibility Study and plans for a pilot groundwater recharge project using recycled water
- Discuss what information CDPH and the RWQCB would need to have for a pilot project to proceed
- Discuss key issues CDPH and the RWQCB believe would need to be considered as part of the Fatal Flaw Analysis (FFA) currently being conducted

Discussion

A. Introductions.

B. Overview.

1. Helene went through a series of slides to provide an overview of the pilot project and the purpose and scope of the FFA. A copy of the slides is provided at the end of this document. The discussion covered the outcome of the Groundwater Recharge Feasibility Study and decision to conduct a pilot project; a description of the pilot project; and the pilot program activities schedule.

2. In terms of comparative scale, the Groundwater Recharge Feasibility Study recommended a full-scale project that would recharge approximately 10,000 acre-feet/year (AFY) of recycled water from the Lancaster Water Reclamation Plant (disinfected tertiary effluent) and 40,000 AFY of imported water and storm water, with 43,000 AFY of water extracted for urban and agricultural uses. In comparison, the proposed pilot project would recharge 500 AFY of recycled water and 2,000 AFY of a blend of storm water and/or local groundwater, raw imported water or treated imported water. The water would be recharged in a proposed 100-acre storm water basin at 60th Street West and Avenue F in Lancaster. No decision has been made for the pilot project as to whether it will be a long-term or short-term program or if the recharged water will be extracted. The earliest date the pilot project could begin based on the estimated implementation time line is 2010 or 2011.

3. Because the pilot project will be a $6 million investment, the participating agencies were interested in conducting a FFA before proceeding with the project to identify any obstacles or risks that could be incurred.

4. It was also pointed out that the FFA is distinct from the Engineering Report for the pilot project, which would collect more detailed information on all aspects of the project for regulatory evaluation. A CEQA evaluation in the form of an Environmental Impact Report would also be done.

5. As part of the discussion of the pilot project, the participants noted issues that should be addressed as part of the FFA and/or the Engineering Report prepared for the pilot project including the following:

    - The question was raised regarding land use in and around the area where water will be spread. The City believes the site was not farmed, but may have been used for light industrial or large lot residential uses. It was noted that if the site was used for agriculture, it could impact background levels of salt and nitrogen in the soils. The concern would be that salt and nitrogen would be mobilized and impact groundwater quality. ***It was recommended that the FFA look at what's already available that describes historical land use with more detail provided in the Engineering Report.***

    - The question was raised regarding the ability of the site to percolate water. The FAA is including work to drill 3 bore holes in a 10 acre section of the proposed recharge site to characterize the suitability of the soils for percolation and to collect data on background groundwater quality. ***It was suggested that as part of the FFA to 1) review any existing USGS mapping information that characterizes soils in the area of the recharge site, and 2) characterize the soil borings for parameters used to describe percolation capacity.***

    - The question was raised regarding the amount of stormwater that can be captured at the recharge site. This number will be refined as part of the FFA, but will be further evaluated as part of Engineering Report.

    - The question was raised regarding the location of existing production wells near the proposed recharge site. A preliminary assessment will be included as part of the FFA with a more detailed assessment done for the Engineering Report to address the draft CDPH Groundwater Recharge Regulations.

C. Information needed by CDPH and RWQCB for a pilot groundwater recharge project to proceed.

1. The purpose of this and the next agenda item was to identify any issues/concerns regulators might have that can be resolved prior to implementation of a pilot program, and if these issues should be addressed in the FFA and/or Engineering Report.

2. The Feasibility Study identified four key regulatory issues that would impact a full-scale or pilot-scale recharge project and the proposed approaches for resolving them. The issues were: TOC, nitrates/nitrogen, salt and THMs.

3. For TOC, it is believed that the requirements in the draft Groundwater Recharge Regulations can be satisfied for the pilot project by the blend of recycled water and diluent water used. This information will be reviewed in the FFA, with more detail provided in the Engineering Report.

4. The issue of nitrogen impacts was discussed with regard to the FFA and Engineering Report. Groundwater degradation will be an important issue to be considered by the RWQCB in permitting a proposed recharge projects. The FFA will include a conceptual discussion of nitrogen contributed by the planned sources of recharge water and information on anticipated

nitrogen removal based on the experience of the Chino Basin Recharge Project and research conducted as part of the Soil Aquifer Treatment Study. A more detailed evaluation will be done for the Engineering Report in terms of source quality, background water quality and impacts. The RWQCB noted that for any permit, pursuant to the Basin Plan and Resolution 68-16, an antidegradation analysis (ADA) for nitrogen will be required that evaluates potential impacts and geographical extent, alternative treatment technologies, costs/benefits, etc. ***It was recommended that as part of the FFA, the soil borings be analyzed for nitrogen to determine background soil levels***

5. The issue of salt impacts was discussed with regard to the FFA and Engineering Report. Mobilization of salt and groundwater degradation will be very important issues to be considered by the RWQCB in permitting a recharge project. The FFA will include a conceptual discussion of salt contributed by the planned sources of recharge water. A more detailed evaluation will be done for the Engineering Report in terms of source quality, background water quality and impacts. The RWQCB noted that for any permit, an ADA for salt will be required that evaluates potential impacts and geographical extent, alternative treatment technologies, costs/benefits, etc. The City of Lancaster has recommended that stakeholders address salt management at one of the next the Antelope Valley Integrated Regional Water Management Plan meetings. ***It was recommended that as part of the FFA, 1) the soil borings be analyzed for nitrogen to determine background soil levels, and 2) existing information on indigenous salt levels in soils at the proposed recharge site be reviewed such as the 1960 Antelope Valley Soil Conservation Report. As part of the Engineering Report, it would be valuable to conduct salt mobilization studies using soil columns***.

6. For the THMs, the FFA will provide information on levels in the planned sources of recharge. More detailed information would be included in the Engineering Report in terms of source quality, background water quality and impacts. The RWQCB reiterated that for a permit, these compounds would need to be addressed as part of an ADA.

D. Key issues to consider as part of the FAA.

1. In addition to the four key issues identified in the Feasibility Study, several other potential issues were discussed, including the pilot project salt impacts vs. cumulative impacts of other recycling projects in the region; unregulated chemicals; and the SWRCB draft Recycling Policy and draft CDPH Groundwater Recharge Regulations.

2. While the cumulative impacts of projects in the region is an issue of concern to the RWQCB, it was agreed that a cumulative assessment would likely not be required for the pilot project based on the assumption that its individual contribution of salt would be minor. ***Thus, this issue would not need to be addressed for the FFA, and in all likelihood, not for the Engineering Report.*** It was acknowledged that salt management is an issue that needs to be addressed for the region by all stakeholders.

3. For unregulated organics, the RWQCB indicated that this is an important issue for the Board inasmuch as these compounds are not naturally occurring and their presence in groundwater due to a proposed recharge project would have to be considered in the context of the Antidegradation Policy. There are a number of research projects about to be completed in the next year that will provide information that can be used to better characterize their potential significance including the development of "safe" concentrations and their removal by different types of treatment. ***It was recommended that 1) this information on treatment performance be summarized in the FFA, and discussed in more detail along with concomitant costs in the Engineering Report, and 2) the FFA should note the importance***

of enhanced source control for unregulated organics and mention the kinds of programs in place (e.g., West Basin, Orange County Water District, etc).

4. In terms of the Draft Recycling Policy and the Draft Groundwater Recharge Regulations, there were no issues identified that would impact the FFA.

E. Next Steps/Action Items

1. Participants will email Margie with any additional issues that should be addressed as part of the FFA by July 25, 2007.
2. These will be incorporated into a draft conference call summary that will be distributed to participants by July 31, 2007.
3. Participants will be invited to participate in a tour of the Chino Basin Groundwater Recharge Project (to be arranged).
4. Participants will be invited to review the draft FFA; this may be a workshop format to be held in September or October 2007.

Appendix H - Summary of Meeting with California Department of Fish and Game

Meeting Summary

Groundwater Recharge Pilot Program, Fatal Flaw Analysis

Subject:	Coordination Meeting with the California Department of Fish and Game
Prepared By:	Robin Cort
Date/Time:	August 15, 2007; (10:00am – 12:00pm)
Location:	City of Lancaster
Project Number:	0128-007.04

Attendees: Scott Harris (CDFG), Jamie Jackson (CDFG), Peter Zorba (City of Lancaster), Steve Dassler (City of Lancaster), Randy Williams (City of Lancaster), Steve Irving (Fox Field) Robin Cort (RMC), Helene Kubler (RMC – by phone)

Purpose of Meeting

- Provide an update on the outcome of the Lancaster Area Groundwater Recharge Feasibility Study and plans for a pilot groundwater recharge project using recycled water
- Discuss key issues CDFG believes should be considered as part of the Fatal Flaw Analysis currently being conducted

Meeting Summary

- After introductions and a presentation of the project, CDFG presented their questions and concerns. A copy of the presentation is attached at the end of these minutes. CDFG will provide formal comments at the time the Fatal Flaw Analysis and other reports are produced.
- **Comment/question on slide No. 4**: CDFG generally supports the idea of groundwater recharge, but commented that in addition to groundwater recharge, City should be pursuing other avenues for addressing reductions in groundwater levels. This should include management of runoff and control of illegal well-drilling. City confirmed that they are working on runoff issues, but that control of well-drilling is currently outside of their purview. City also referred to the Integrated Resources Water Management Plan currently being developed, which takes a holistic approach to water resources issues in Antelope Valley and to solutions development.
- **Comment/question on slide No. 6**: CDFG asked about the level of treatment of recycled water and City confirmed that all water would be tertiary treated recycled water.
- **Comment/question on slide No. 7**: CDFG asked whether the large scale groundwater recharge project would be co-located at the Pilot Program site. RMC responded that the pilot program site could be part of the large scale project, but that a lot more land would be needed. RMC also pointed out that other recharge areas are being considered in the West Lancaster, Little Rock Creek and Armagosa Creek areas. CDFG noted that they would have a lot of questions if an "outfall" to Armogosa Creek or Little Rock Creek was going to be considered.

  City added that the Pilot Program site was picked based on availability of City owned land, potential to blend with stormwater, and proximity of an existing recycled water line; however, subsurface investigation is needed to confirm the feasibility of recharging water at that site.
- **Comment/question on slide No. 9**: CDFG pointed out that once the sediment pond/recharge basin is filled with water it will come under CDFG jurisdiction and will need to be managed carefully and regularly so that it will not start to support habitat. If maintenance is ever deferred

and habitat becomes established, mitigation will be required if habitat is removed in subsequent years. CDFG asked about cycles of filling and draining the pond, and RMC explained that the pond would only be filled when water is available for blending, typically during the wet months of October-April. The pond would be allowed to dry out naturally in the dry months and would need to be maintained to ensure that sediments do not accumulate, which would prevent recharge from occurring. This could include discing of the bottom of the pond.

CDFG emphasized that maintenance should be timed so that nesting birds cannot become established at the pond. If birds establish nests they cannot be disturbed until nesting is completed and young have fledged. City and CDFG should develop an agreement regarding the degree, timing and type of maintenance that should occur to minimize effects to species.

Additional discussion of CEQA documentation for the project identified issues that should be evaluated which included:

- Surveying the site for sensitive resources during appropriate survey periods
- Documentation of the project's affect on downstream resources
- Evaluation of potential use of the site by birds (recommended doing survey of Avenue H pond to determine likely species of birds)

Anticipated permit requirements include an SAA for any changes to drainage on site (though an MOU is possible, depending on the character of the drainage. A take permit for any effects to species listed under the California Endangered Species Act could also be required, depending on results of biological survey.

- **Comment/question on slide No. 10**: CDFG enquired about CEQA review for the project, and RMC confirmed that a CEQA document would be prepared, possibly in coordination with the City's project to provide a stormwater detention basin at the site. CDFG stated that CEQA analysis should include analysis of other methods to address water supply needs, such as requirements for less green landscaping. City pointed out that they have a program to encourage landscaping with drought-tolerant plants.
- **Comment/question on slide No. 11**: City and RMC explained that the proposed site would need further evaluation to determine if it is hydrologically suitable for recharge. CDFG pointed out that drilling would need to be conducted in such a way as to avoid disruption to resources, and that if the drainage crossing the site was going to be affected, a streambed alteration agreement (SAA) would be required. City showed an aerial photograph of the site for review. CDFG recommended that a biological survey be done and that drilling locations be established so as to avoid potential habitat for sensitive species. Species of concern include:
  - Mojave ground squirrel (habitat is generally east of freeway, but CDFG uses a 5-mile radius from there, and we are within 5 miles of freeway)
  - Alkali mariposa lily (not blooming now, so we can only identify potential habitat)
  - Burrowing owl

  CDFG recommended the following procedure for approval of drilling on the site. City should submit notice that drilling will occur, and document access routes and any disturbance to drainage and tributaries. A biologist should flag approved access routes for the driller. Any clearing performed as part of the drilling operation should also be documented. Mitigation for the drilling activity can then be included as part of the overall project mitigation. Mitigation will typically include preservation of occupied habitat for species of concern. There are no mitigation banks currently available, so City will need to work to identify mitigation lands that can be set aside.

- **Next Steps**: CDFG staff agreed to visit the site with City staff later that same day, and to provide preliminary guidance regarding any sensitive features that they observed on the property. CDFG will provide formal comments at the time the Fatal Flaw Analysis and other reports will be produced.

Groundwater Recharge Pilot Program Using Recycled Water

Meeting with California Department of Fish and Game

August 15, 2007

RMC *Innovative Solutions for Water and the Environment*

Agenda

A. Introductions

B. Project Overview

C. CDFG Concerns

D. Next Steps

Project Overview Outline

1. Groundwater Recharge Feasibility Study Outcomes
2. Intent of the Pilot Program
3. Pilot Program Description
4. Pilot Program Activities Schedule
5. Questions and Answers

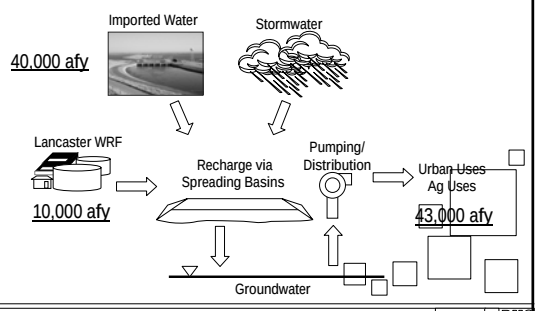
Need for Groundwater Recharge Projects in Antelope Valley

- Major water resource issues must be tackled to sustain economy in Antelope Valley
  - Overdrafted groundwater basin
  - Uncertain future reliability of SWP supplies
  - Limited effluent management options
- Groundwater recharge projects are part of the solution

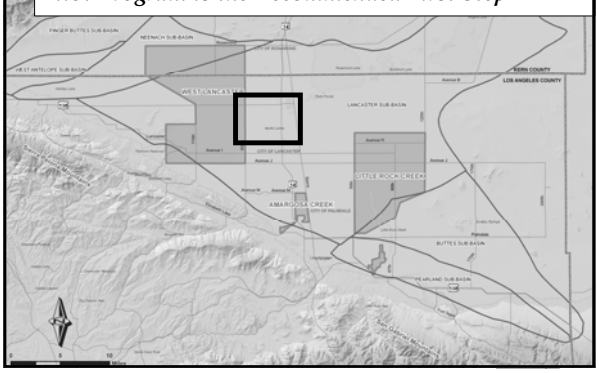
Why Consider Groundwater Recharge with Recycled Water?

- RW is a locally produced and reliable source of supply
- Urban use alone is not sufficient to maximize use of recycled water
- Ag use is not the most beneficial use of RW
- Available RW from Lancaster Wastewater Treatment Plant represents approximately 10,000 AF per year

GWR Feasibility Study (RMC, 2007) Evaluated the Concept of Groundwater Recharge with Recycled Water in Lancaster Area



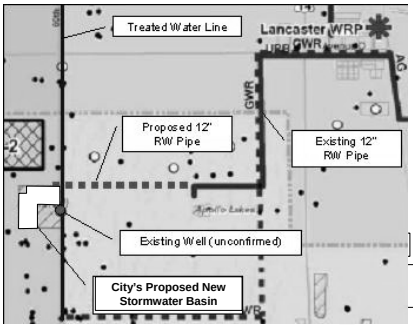
Project was Deemed Feasible; Pilot Program is the Recommended First Step



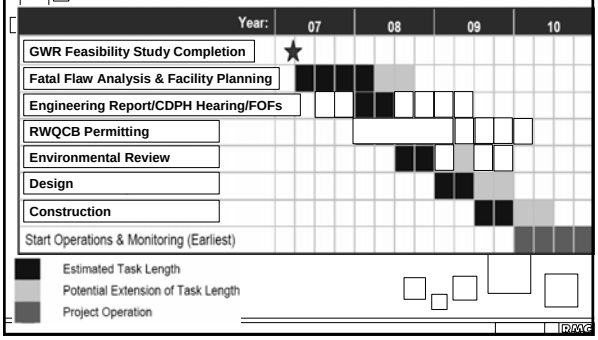
Pilot Program Intent

1. Provide water quality data to help optimize the regional project definition
2. Demonstrate attainment of regulatory requirements
3. Provide forum for regional collaboration & public involvement
4. Tackle institutional barriers surrounding the regional project with a reduced number of participant agencies

GWR Feasibility Study Identified a Potential Pilot Program in Lancaster Area



Pilot Program Would Be a $6M Investment; City and Partners are Therefore Conducting a Fatal Flaw Analysis



Fatal Flaw Analysis Scope

Geotechnical and Water Quality Data Collection
Alternatives Assessment/Facilities Description Refinement
Cost Refinement
Regulatory Agency Coordination
Draft Environmental Check-list
Draft Cost Sharing Agreement
Participant/Stakeholder Outreach

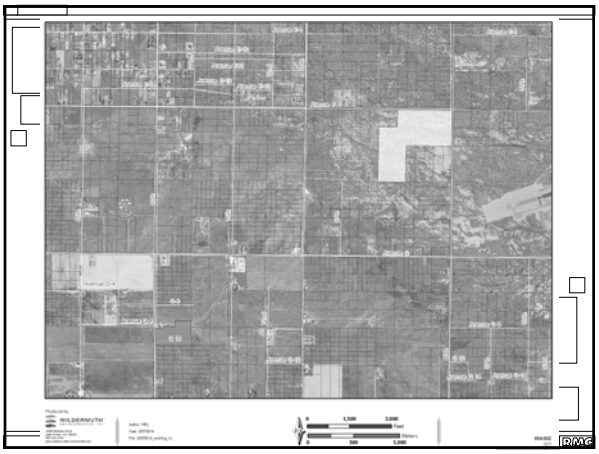
Agenda

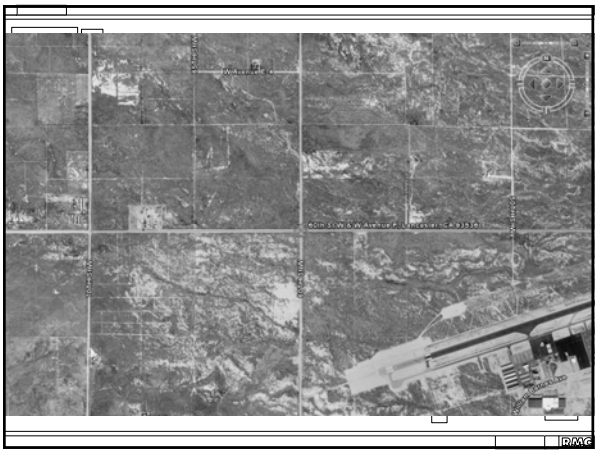
A. Introductions

B. Project Overview

C. CDFG Concerns

D. Next Steps





Agenda

A. Introductions

B. Project Overview

C. CDFG Concerns

D. Next Steps

Appendix I - Response to Comments on the Draft Fatal Flaw Analysis

Draft Fatal Flaw Analysis - Response to Comments
City of Lancaster Groundwater Recharge Pilot Project

Commenter	Page #	Comment	Response
Brian Dietrick LACSD	7	"Recycled Water Source". Some issues to consider. If the pipeline to Apollo Lakes is used to convey LWRP tertiary effluent, it may have to be flushed before and after recharge ops. Depending on how this is done, some AVTTP and/or MBR effluent could be discharged to the recharge site. This mixture of effluents may complicate matters when trying to determine attenuation of various parameters in the eyes of the Regional Board. If the objective is to ultimately use *only* LWRP tertiary effluent, it may be prudent to find a way to convey it to the recharge sites without using the Apollo pipeline.	The project would not be feasible from a cost standpoint if an additional pipeline were necessary to convey water to the recharge site instead of using the Apollo pipeline. The function of the pilot is to test these issues and learn from them with monitoring, therefore we think it would be ok to contain and recharge the flushed water. It should be noted that additional recharge basins will be considered which may negate the need for use of the Apollo pipeline. This will be further looked into during the Facility Planning/Predesign phase.
Brian Dietrick LACSD	7	Last bullet on page. Same issue as above regarding mixing of AVTTP, MBR, and LWRP tertiary effluent.	See response above.
Brian Dietrick LACSD	10	"Potable Groundwater". Does this idea comply with the "spirit" of the Regional Board's net mixing requirements? It seems odd to list this as a potential source of blend water.	This was evaluated as a potential source, but it was determined not to be feasible for the reason you bring up. It does not seem to be reasonable to recharge with groundwater so this alternative source was dropped from further analysis. The reason it is included on page 10 is to note that it was looked into as an alternative.
Brian Dietrick LACSD	15	"Facilities". Note that there is currently no direct connection planned between the LWRP tertiary facilities and the AVTTP pipeline. The AVTTP is a side stream facility that currently takes secondary effluent from the oxidation ponds. After 2010, the AVTTP will take secondary effluent from the CAS/NDN. A direct connection between the tertiary unit ops and the AVTTP pipeline would be necessary to operate the recharge basins as described.	We will work with LACSD to get details regarding the feasibility and cost of the connection and will include it in our Facilities Planning/predesign. A footnote has been added to Figure 5-2 on page 20, that describes the connection.
David Rydman LADPW		It seems the regional board is really promoting salt management plans for regions that are working on recycled water irrigation and recharge projects. It may be worth noting in the FFA that a salt management plan for the region may need to be in place before the pilot project could commence.	We believe that a salt management plant for the region will need to be in place before a large scale project could commence (see Groundwater Recharge Feasibility Study implementation plan). For the pilot project, we don't believe that a regional plan will need to be in place (we actually verified that with RWQCB). But there will be a need for a water quality impact analysis as part of the permitting process.
David Rydman LADPW		I think it would make more sense, at least for the pilot project, for the amount of dilutant water available to be the determining factor in the total amount of water that will be recharged. Since raw SWP is not available, why not utilize only the stormwater for the dilutant source and then blend it with 1/4 as much recycled water? I know this would significantly reduce the volume of water for the pilot, but it may alleviate some of the concerns regarding cost/justification for using treated water and even require a smaller basin.	This is a good idea and we actually had hoped that there would be enough stormwater to do exactly what you are describing. However, based on a recent site visit after a large storm (early February 2008), it became clear that there would not be enough stormwater to have a meaningful pilot program unless we were to do the pilot project in an more urbanized area such as by the Division Street Corridor recycled water pipeline (the existing stormwater basins were full). RMC has discussed keeping this as an option (for now) with the City.
David Rydman LADPW		I was under the assumption that the MBR facility is somewhat mobile, but that may not be true. If it is, could it be relocated to Apollo Park so that the recycled water line could be used year round to supply water to the pilot project?	We don't think that this is possible due to the size and complexity of the unit (MBR + UV) as well as permitting issues; but we will confirm with LACSD during the Facilities Planning/predesign.

Commenter	Page #	Comment	Response
David Rydman LADPW		I was surprised that the 4:1 blend ration was not a factor considered in the FFA. Because SWP will only be available for recharge during the winter, I wonder how much longer the region will be able to divert enough of it to justify additional infrastructure to bring 1/4 as much recycled water to the same site for recharge. The region will be doing groundwater banking and building conveyance systems big enough to handle as much SWP as we can divert for recharge. I don't ever see us decreasing the size of our conveyance for SWP to offset the cost for constructing recycled water infrastructure. This comment is not at all intended to question whether we should do recharge with recycled water, but rather, should we pursue it while we're still required or resigned to meet a 4:1 blend ratio.	We are not resigned to meet a 4:1 blend ratio, but it is a reasonable starting point for the pilot project given current regulations and water quality of available blend water. There are possibilities that we could lower the blend ratio, particularly for a large scale project, based on upcoming changes in the GWR regulations (we are tracking those closely; regs are looking into potentially moving away from TOC requirements and towards biodegradable dissolved organic carbon and specific chemical indicators. It could mean that after the first year at 20% RWC, a project could go substantially higher (<50%) if the BDOC is removed after soil aquifer treatment and the indicators perform as expected). One of the objectives of the pilot project could become to provide data to demonstrate regulatory requirements attainment at blend ratio of potentially less than 4 to 1 (it would probably involve running the project for more than 2 years); but this could also be done on the large scale project by phasing it (e.g. starts Phase 1 of large scale project at 4:1; demonstrates attainment of objectives; do Phase 2 at 2:1 by expanding rec
David Rydman LADPW		Page 23 indicates a perched water table was encountered in well SB-02 at 54 ft bgs. Why didn't the conductivity tests include analysis of a soil sample below this perched water table? Page 25 indicates there were no barriers to vertical groundwater movement observed, but I would think a perched water table is a pretty clear indication of a barrier.	Samples were collected from beneath the perched water table, however, conductivity tests were not run on any of the test samples. As is written on Page 25, the term "barrier" was used to indicate that no impermeable boundaries were encountered in the soil borings. A perched zone of groundwater implies some impedance to flow in this area, but not an impermeable barrier which was the main focus of the subsurface investigation. No perched groundwater was seen in SB-01 which indicates variable subsurface conditions at the site, but no uniform impermeable barrier which would constitute a fatal flaw was encountered.
Chi Diep CDPH		No comments per email communication on March 3, 2008.	
Tom Barnes AVEK		No comments submitted	
Curtis Paxton		No comments submitted	
RWQCB		No comments submitted	