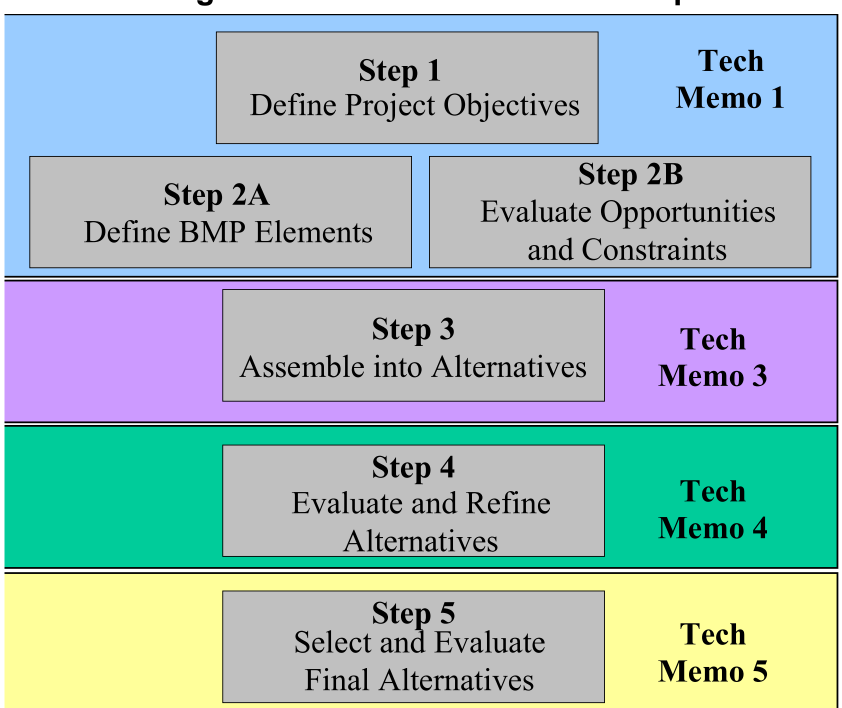
Section 4
Alternatives Evaluation Process

ALTERNATIVE SELECTION PROCESS

The framework for determining final sample alternatives was established collaboratively by the County and MWH. The process is depicted graphically in **Figure 4-1**. Four of the technical memoranda prepared to date summarize the results of the alternative development process. Technical Memorandum No. 1 (Tech Memo 1) summarized the detailed project objectives, defined BMP elements, and evaluated opportunities and constraints. Technical Memorandum No. 3 (Tech Memo 3) described 22 alternatives that are identified to meet the project objectives. Technical Memorandum No. 4 (Tech Memo 4) refined the results of Tech Memo 3 by further detailing six (6) alternatives. Technical Memorandum No. 5 (Tech Memo 5) evaluated four final sample alternatives.

Figure 4-1
Watershed Management Plan Alternative Development Process



Technical Memorandum No. 2 summarizes model modifications, baseline model results and methodologies for linking of the models. It is not considered part of the alternative development process.

This section summarizes what occurred in Step 4, Evaluate and Refine Alternatives, and Step 5, Select and Evaluate Final Alternatives. A summary table of the 22 alternatives developed in Step 3, Assemble into Alternatives, is located in Appendix C.

EVALUATE AND REFINE ALTERNATIVES (FINAL SIX ALTERNATIVES)

Description

Development of the final six alternatives consists of the following three steps:

1. Review the results of Tech Memo 3.
2. Define general strategies for the six alternatives.
3. Formulate new alternatives that include the selected strategies.

Each of these steps is described below.

Review the results of Tech Memo 3

Several general strategies are identified in Tech Memo 3 for achieving the project objectives. These strategies involve maximizing either a particular type of flood control solution, such as storage or conveyance, or one of the defined project objectives. One or more specific alternatives are then developed within each general strategy. This approach is used to assure that at least one alternative attempts to optimize the benefits that could be derived in each major project objective category. A total of 22 alternatives are evaluated in Tech Memo 3. These alternatives are not fully developed or modeled. These alternatives are listed in Appendix C.

Based on a ranking of the 22 alternatives, 12 alternatives are selected for further consideration (see Appendix C). The information provided by this selection process is used to evaluate how each general strategy contributes to a successful solution for the Sun Valley Watershed.

Define general strategies for the six alternatives

Based on the analysis provided in Tech Memo 3, several general strategies are prevalent in the selected 12 alternatives. These are:

- Infiltration
- Stormwater reuse
- Onsite, non-regional BMPs
- Subsurface conveyance systems, such as tunnels or storm drains

Formulate new alternatives

The general strategies listed above are used to develop six alternatives. For each general strategy, one alternative is developed to focus on maximizing that strategy. The sixth alternative combines the best of these five strategies. The six alternatives are:

1. Maximize use of onsite and regional infiltration projects
2. Maximize use of onsite and regional stormwater reuse projects
3. Maximize stormwater transfer opportunities where stormwater from outside of the Sun Valley Watershed can be utilized within the Watershed.
4. Maximize use of onsite, non-regional BMPs
5. Maximize use of subsurface conveyance systems
6. Combination of Alternatives 1-5

Each of these six alternatives is developed such that the following four specific requirements are met:

- All alternatives must provide Capital Storm (50-year storm with ultimate land use) flood protection. When specific regional flood control projects such as gravel pit storage are not able to achieve that level of protection throughout the watershed, it is assumed that onsite, non-regional BMPs will be applied to reduce flows and volumes.
- Because of the need to protect groundwater quality, all infiltration projects are assumed to require pre-treatment of some kind to reduce loads of pollutants such as sediment, nutrients, industrial compounds, and heavy metals.
- It is assumed that all alternatives include application of basic pollution prevention activities in the watershed as required by the current NPDES stormwater discharge permit held by the City of Los Angeles.
- All alternatives will include the application of tree planting, mulching, and similar practices that are not dependent on the specific components of the alternative.

The components of the six alternatives are summarized in **Table 4-1**. As shown in this table, all alternatives include all five Phase 1 projects, with the exception of Alternative 4 (Maximize BMPs), which does not include the Cal Mat Pit Phase 1 project.

Some of the project components listed in Table 4-1 are not part of the final four sample alternatives. These components are not discussed in detail in this report, but are described in Tech Memo 4. These components are:

- San Fernando/Tuxford – Cal Mat Pit Tunnel
- Vineland Avenue Pump Station and Force Main
- Burbank Airport Retention Basin
- Non-Potable Water Distribution System

Table 4-1
Summary of Alternative Characteristics

Number	Description	Alternative 1 Maximize Infiltration	Alternative 2 Maximize Reuse	Alternative 3 Water Transfer	Alternative 4 Maximize Onsite, Non-regional BMPs	Alternative 5 Tunnel/Force Main	Alternative 6 Combination
Included Project Components							
1	Sheldon Pit	No	Yes	Yes	No	No	No
2	Tujunga Wash Diversion[2]	No	No	Yes	No	No	No
3	Bradley Landfill	Yes	Yes	Yes	Yes	Yes	Yes
4	San Fernando/Tuxford – Cal Mat Pit Tunnel	No	No	No	No	Yes	No
5	Strathern Pit	Yes	Yes	No	No	Yes	Yes
6	Vineland Avenue Pump Station and Force Main	No	No	No	No	Yes	No
7	Burbank Airport Retention Basin	Yes	Yes	No	Yes	No	No
8	Powerline Easement	Yes	Yes	No	No	No	Yes
9	Non-Potable Water Distribution System	No	Yes	No	No	No	Yes - Limited
10	Sun Valley Park	Yes	Yes	Yes	Yes	Yes	Yes
11	Trunk Storm Drains	No	No	Yes - South of I-5	No	No	No
12	Lateral Storm Drains	Yes - South of I-5	Yes - South of I-5	Yes - South of I-5	No	Yes - South of I-5	Yes - South of I-5
Phase 1 Projects							
1	LADWP Steam Plant	Yes - Phases 1 & 2	Yes - Phases 1 & 2	Yes - Phases 1 & 2	Yes - Phase 1	Yes - Phases 1 & 2	Yes - Phases 1 & 2
2	Cal Mat Gravel Pit	Yes - Phases 1 & 2	Yes - Phases 1 & 2	Yes - Phases 1 & 2	No	Yes - Phases 1 & 2	Yes - Phases 1 & 2
3	Vulcan Gravel Processing Plant	Yes	Yes	Yes	Yes	Yes	Yes
4	Tuxford Green	Yes	Yes	Yes	Yes	Yes	Yes
5	Sun Valley Middle School	Yes	Yes	Yes	Yes	Yes	Yes
Onsite, Non-regional BMPs							
1	Municipal Cisterns	No	Yes - 20% Participation	Yes - 20% Participation	Yes - 100% Participation	Yes - 20% Participation	Yes - 40% Participation
2	Infiltrators on Residential Property	Yes - 20% Participation	No	Yes - 20% Participation	Yes - 100% Participation	Yes - 20% Participation	Yes - 40% Participation
3	Infiltrators on Commercial Property	Yes - 20% Participation	No	Yes - 20% Participation	Yes - 100% Participation	Yes - 20% Participation	Yes - 40% Participation
4	Infiltrators on Industrial Property[1]	Yes - 20% Participation	No	No	No	No	No
5	Street Storage	Yes	Yes	Yes	Yes	Yes	No

1 - Pretreament would be required for infiltration of runoff from industrial properties to comply with RWQCB standards.
2- Tujunga Wash Diversion is now included as part of the Sheldon Pit component

Evaluation

The six alternatives are evaluated by comparing the benefits, constraints, and cost. **Figure 4-2** diagrams the alternative creation and evaluation process. The six alternatives are compared according to the evaluation criteria is summarized in **Table 4-2**. This table also provides a summary of the primary lessons learned from each alternative.

Figure 4-2
Alternative Development and Evaluation Process

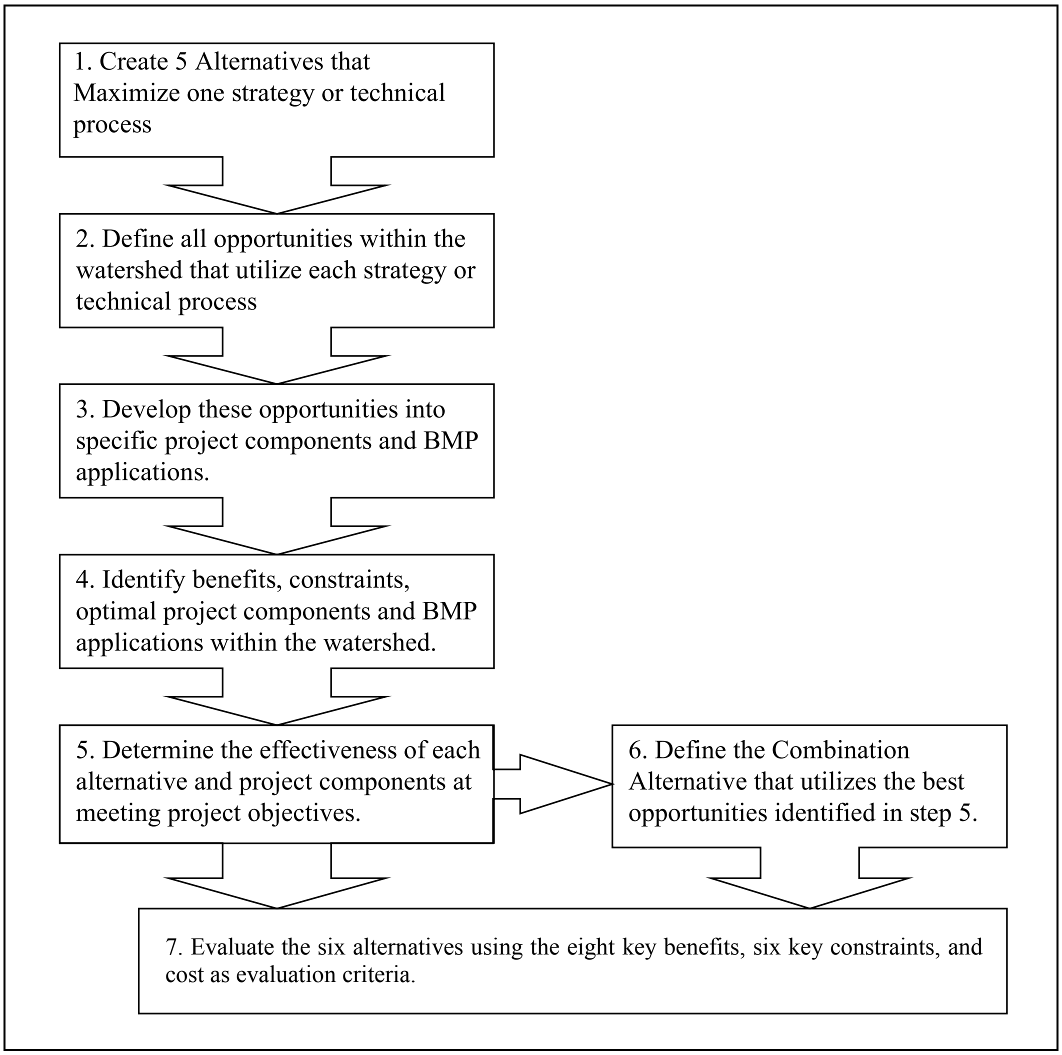


Table 4-2
Evaluation of Six Alternatives

Description	Alternative 1 Maximize Infiltration	Alternative 2 Maximize Reuse	Alternative 3 Water Transfer	Alternative 4 Maximize Onsite, Non-regional BMPs	Alternative 5 Tunnel/Force Main	Alternative 6 Combination
Benefits						
Flood Control	Effective	Effective	Effective	Effective	Effective	Effective
Remaining Flooded Areas	None per HEC-1 analysis	None per HEC-1 analysis	None per HEC-1 analysis	None per HEC-1 analysis	None per HEC-1 analysis	None per F0601 analysis
Pollution Reduction	Pretreatment and Infiltration	Settling at Retention Sites	More pollutant load is likely discharged from downstream end of SV watershed due to cleaner water transferred from Tuj. Wash	Pretreatment and Infiltration	Settling, Pretreatment, Infiltration	Settling, Pretreatment, Infiltration
Water Conservation: Infiltrated	2,152 acre-ft	52 acre-ft	6,655 acre-ft	1,507 acre-ft	1,280 acre-ft	2,417 acre-ft
Water Conservation: Reused	284 acre-ft	2,384 acre-ft	905 acre-ft	929 acre-ft	1,156 acre-ft	1,083 acre-ft
Water Conservation: Total	2,436 acre-ft	2,436 acre-ft	7,560 acre-ft	2,436 acre-ft	2,436 acre-ft	1,334 acre-ft
Reduction of Energy Costs	Mulching & tree planting reduces energy and waste management cost.	Mulching & tree planting reduces energy and waste management cost.	Mulching & tree planting reduces energy and waste management cost.	Reduced pumping costs at Bradley Landfill due to reuse. Mulching & tree planting reduces energy and waste mgmt cost.	Mulching & tree planting reduces energy and waste management cost.	Mulching & tree planting reduces energy and waste management cost.
Active and Passive Recreation	Additional active recreation at Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional active recreation at Sheldon Pit, Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional active recreation at Sheldon Pit, Cal Mat Pit	Minimal additional active recreation	Additional active recreation at Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional active recreation at Cal Mat Pit, Strathern Pit, and the Powerline Easement
Wildlife Habitat	Additional wildlife habitat at Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional wildlife habitat at Sheldon Pit, Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional wildlife habitat at Sheldon Pit, Cal Mat Pit	Minimal additional wildlife habitat	Additional wildlife habitat at Cal Mat Pit, Strathern Pit, and the Powerline Easement	Additional wildlife habitat at Cal Mat Pit, Strathern Pit, and the Powerline Easement
Improved Air Quality	Mulching & tree planting improves air quality	Mulching & tree planting improves air quality	Mulching & tree planting improves air quality	Mulching & tree planting improves air quality	Mulching & tree planting improves air quality	Mulching & tree planting improves air quality
Constraints						
LA City water rights need to be addressed	Only at Bradley Landfill	In all major projects	At Bradley Landfill - probably offset by increase in groundwater recharge from Tujunga Wash	At Bradley Landfill and Industrial Cistern BMPs throughout watershed	At Bradley Landfill, Cal Mat Pit, Strathern Pit, and Industrial Cistern BMPs in Lower WS	At Bradley Landfill and Vulcan Gravel Processing Plant
Major Pipeline Construction Required	City Laterals south of I-5	Stormwater Reuse Distribution Line	County Project 9250 south of I-5 City Laterals south of I-5	None	Tunnel and Force Main/Pump Station	City Laterals south of I-5
Pumping Required	Groundwater pumping required due to large volume of water infiltrated	Pumping required to deliver reuse water to non-potable customers.	Groundwater pumping required due to large volume of water infiltrated	Groundwater pumping required due to large volume of water infiltrated	Extremely large stormwater pump station required.	Pumping required to deliver reuse water to non-potable customer.
High level of participation in Onsite, Non-regional BMPs	Low: 20%	Low: 20%	Low: 20%	High: 100%	Low: 20%	Moderate: 40%
Impact on Groundwater Remediation Efforts	Possibly Significant	None	None - Infiltration in Upper Watershed only	Possibly Significant	Insignificant	Possible impacts at Powerline Easement
Acquisition of Gravel Pits	Strathern, Cal Mat	Sheldon, Strathern, Cal Mat	Sheldon, Cal Mat	None	Cal Mat with current bottom elevation, & Strathern	Cal Mat & Strathern
Total Cost	**$ 493 million**	**$ 324 million**	**$ 138 million**	**$ 746 million**	**$ 409 million**	**$ 231 million**
Lessons Learned	Infiltration on a large scale is effective at meeting many project goals	Reuse on an abbreviated scale is effective at meeting many project goals	Water transfer provides massive water conservation benefits at a low cost, but does not eliminate the need for storm drains	BMPs are expensive and meet only the flood control, water conservation, and reduced pollution goals, but fail to provide regional parks/habitat	The tunnel and force main are expensive and don't eliminate the need for storm drains	The combination of down-sized water transfer, reuse, and infiltration systems is effective at meeting many project goals

SELECT AND EVALUATE FINAL ALTERNATIVES

This section summarizes Step 5 as shown in Figure 4-1.

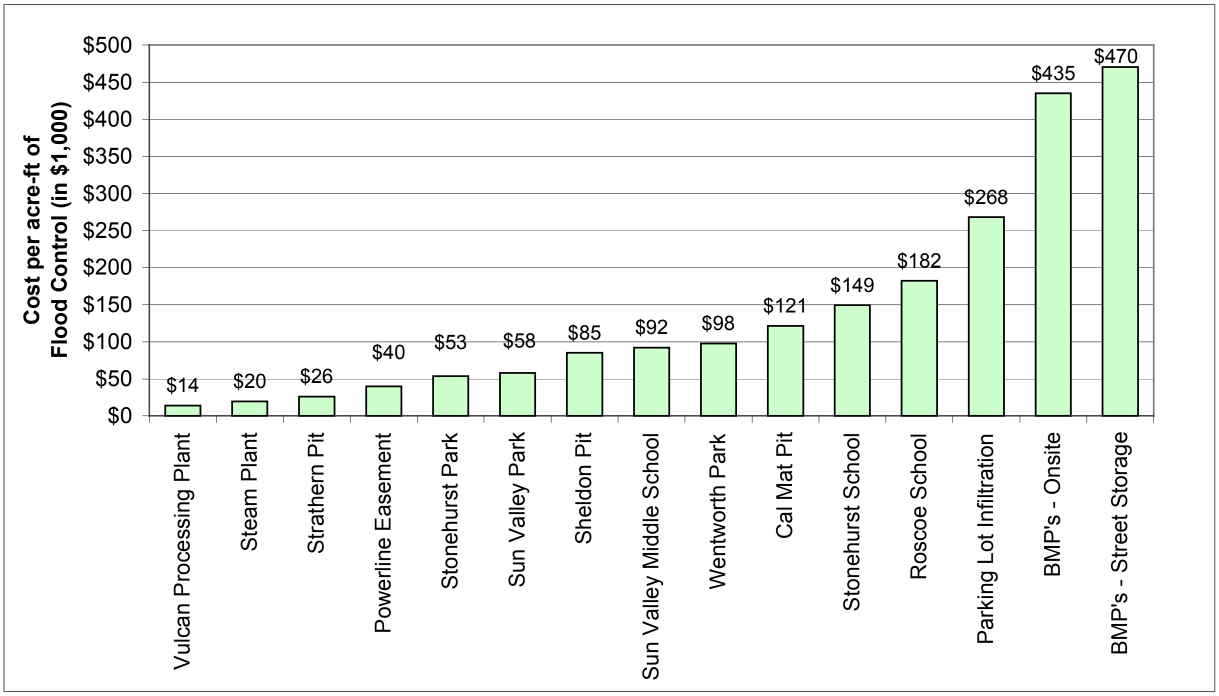
The four final sample alternatives were developed from the six alternatives described in Tech Memo 4. The six alternatives created in Tech Memo 4 were evaluated using the costs and key benefits and constraints developed at that time. Two of the six alternatives, "Maximize Onsite BMPs" and "Maximize Tunnels and Force Mains", are discarded because their constraints and costs are high, and their qualitative benefits are low. The remaining four alternatives are refined to produce the final four sample alternatives based on additional information on costs and benefits. Tech Memo 5 presents refined cost estimates and quantification of benefits for each of the four final sample alternatives. The process of refinement of the sample alternatives is described in the following steps:

1. **Select four alternatives from Tech Memo 4 to serve as the basis for the final four sample alternatives.**

2. **Finalize the concept designs and costs of each project component.** Each project component developed in Tech Memo 4 is reexamined and the concept designs refined. Some project components are not considered further, such as the Burbank Airport Retention. Some project components are added, such as Roscoe School, Stonehurst School, and Stonehurst Park. The costs are recalculated after the designs are refined.

3. **Develop unit costs for flood control in dollars per acre-foot for each project component.** The volume of flood control for each project component calculated using a mass-balance that produces the volume of retention as a function of tributary area and hydrologic factors such as subbasin area and land use. The project component cost is divided by this volume to produce the unit cost for flood control in dollars per acre-foot. The unit costs are shown in **Figure 4-3**.

Figure 4-3
Average Unit Cost of Flood Control per Project Component



4. **Develop a qualitative assessment of all of the remaining key benefits for each project component.** The key benefits examined qualitatively are:

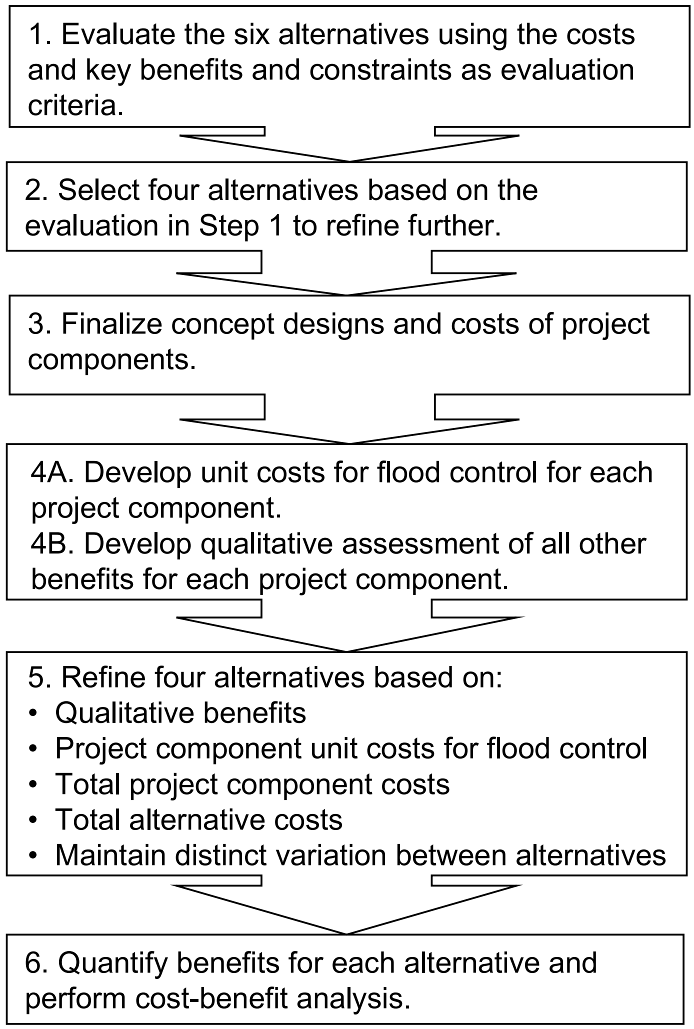
    - Water conservation
    - Improve water quality
    - Reduce energy consumption
    - Increase active and passive recreational areas
    - Increase wildlife habitat
    - Improve air quality

5. **Refine the four alternatives from Tech Memo 4 using the following criteria:**

    - Provide high qualitative benefits
    - Use components with a low unit cost for flood control
    - Use components with low total project component costs
    - Consider the impact of certain combinations of projects on the total alternative costs
    - Maintain a distinctive variation between the alternatives

Each alternative is modified to produce combinations of project components that better meet the objectives and keep the costs as low as possible. The alternatives changed from maximizing specific processes, such as infiltration or reuse, to emphasizing those processes and complementing them with other project components. The process of developing the final four sample alternatives (described above) is shown in **Figure 4-4**.

Figure 4-4
Alternative Development and Evaluation Process



A summary of the final four sample alternatives is presented in **Table 4-3**. The alternative descriptions and the hydrologic conditions for each alternative are presented in the first rows of the table. The second portion of the table includes the "baseline components" which are those project components and Pilot and Phase 1 projects that are included in all alternatives. The remaining projects are listed as differentiating components.

Table 4-3
Summary of Alternatives

Alternative	1 - Infiltration	2 - Water Conservation	3 - Stormwater Reuse	4 - Urban Storm Protection
Description	Widely Distributed Small Projects	Maximizes Wildlife Habitat	Maximizes Stormwater Reuse for Industry	Full Conveyance with Regional BMPs
Retention Basin Size	50-Year	50-Year: Subareas 1-6 10-Year: Subareas 7-8	50-Year	10-Year
Net Volume Discharged to Los Angeles River in Capital Storm	21 acre-ft	0 acre-ft	8 acre-ft	598 acre-ft
Baseline Components				
LADWP Steam Plant	Yes	Yes	Yes	Yes
Vulcan Gravel Processing Plant	Yes	Yes	Yes	Yes
Tuxford Green	Yes	Yes	Yes	Yes
Sun Valley Middle School	Yes	Yes	Yes	Yes
Sun Valley Park	Yes	Yes	Yes	Yes
Tree Planting and Mulching	Yes	Yes	Yes	Yes
Lateral Storm Drains	Yes	Yes	Yes	Yes
Trunk Storm Drains	Yes	Yes	Yes	Yes
Differentiating Components				
Stonehurst School	Yes	No	No	No
Stonehurst Park	Yes	No	No	No
Roscoe School	Yes	No	No	No
Park on Wentworth	Yes	No	No	No
Sheldon Pit	No	Yes	No	No
Cal Mat Pit	No	No	Yes	Yes
Strathern Pit	Yes	Yes	Yes	Yes
Parking Lot Infiltration	Yes	Yes	No	Yes
Street Storage	Yes – 1.5 miles	Yes – 0.6 miles	Yes – 5.1 miles	Yes – 0.4 miles
Onsite BMPs	Yes - 2-yr Storm, 40% Participation	Yes - 2-yr Storm, 20% Participation	Yes - 50-yr Storm, 40% Participation	Yes - 2-yr Storm, 20% Participation
Powerline Easement	Yes – 1.1 miles	Yes – 0.5 miles	Yes – 0.9 miles	Yes – 0.8 miles

Note: Water quality BMPs are not listed in the table because they are part of the listed components

COMPARISON OF FINAL SAMPLE ALTERNATIVES

The four final sample alternatives are evaluated using three primary criteria:

- Results of the benefit-cost analysis
- Ability to meet project objectives
- Consistency with guiding principles applicable to any watershed planning

These criteria are discussed below.

Benefit/Cost Analysis

This section provides a summary of the benefits and costs of the final four sample alternatives, and also describes the methodology for developing the value for each category of benefit. The full benefit/cost analysis (BCA) can be found in Technical Memorandum 5. In addition, the costs and benefits of the final alternatives are compared with the costs and benefits of the proposed single-purpose flood control project (Project 9250).

Categories of benefits are developed based on the detailed project objectives identified by the Stakeholders as well as an understanding of future potential funding partners. While the results of the BCA will likely have significant value in attracting additional funding partners, it is not intended to serve as the basis for allocating costs among potential funding partners at this time. Potential funding partners were not asked to confirm the assumptions regarding valuation of benefits during this preliminary BCA and therefore may not agree with the results. For example, the Department of Water and Power is not asked to confirm the assumptions about the value of developing a local water supply to offset the costs of importing water from outside the region. This BCA can be used as an initial point of discussion with potential funding partners, but should be viewed as a very preliminary first draft that is intended to open a dialog about appropriate assumptions to be used in a formal BCA agreed to by all partners.

Methodology

The following section presents a summary of the general assumptions used in developing the BCA and provides a discussion of the specific methodology utilized to value each of the ten categories of defined benefits. Various methods are used to evaluate the benefits including cost avoidance, willingness to pay, and valuation pricing. Where practicable, the BCA incorporates the methodologies described in the benefit/cost analysis model developed by TreePeople.

General Assumptions

The following general assumptions are made for the BCA:

- The BCA quantifies both the benefits and the costs of each alternative over a 50-year time horizon.
- The costs used in the model include all capital facilities costs, land acquisition costs, and expected O&M costs over the 50-year evaluation period.
- Annual benefits and O&M costs are assumed constant from year to year.
- A 4 percent discount factor net of inflation is used to determine the present value of the benefits and costs over the 50-year evaluation period. The net 4 percent discount rate is based on a 7 percent discount rate with an assumed 3 percent inflation rate. Actual inflation is not included in the analysis.
- All capital costs are incurred in year one. Capital cost assumptions are developed based on costs obtained from industry manufacturers, MWH's experience on similar planning projects, and data provided by LACDPW. All estimates have been adjusted to an Engineering News Record (ENR) Construction Cost Index (CCI) of 7572 (Los Angeles, March, 2003) and are consistent with the American Association of Cost Engineers guidelines for developing reconnaissance-level estimates which should range between 50 percent above and 30 percent below actual capital expenditures. A 50 percent contingency is included in the cost

estimates. The engineering, administration, and legal costs are estimated to be 25 percent of construction costs. The engineering, administration, and legal costs also include typical services such as inspection, materials testing, and construction management.
- O&M costs are a total annual amount starting in year two.
- All valuations in the model are presented in 2002 dollars.

A ratio of benefits to cost is ultimately calculated based on the assumptions presented above and the methodologies described below. A ratio greater than 1 indicates an alternative with greater benefits than cost. A ratio less than 1 indicates an alternative with costs greater than benefits.

Specific Methodology

The project benefits for each of the four final sample alternatives have been disaggregated into the categories summarized below. The methodology for valuing each of the following categories of benefit is summarized briefly below. Methodology details for each category are available in Technical Memorandum 5. The BCA categories are:

- Flood Control – assess the avoided cost of facilities needed to provide comparable local and downstream flood protection.
- Water Quality Improvement – assess the avoided cost of the removal of bacteria and other listed pollutants from waters that contribute to the Los Angeles River.
- Water Conservation – assess the benefit of using stormwater for groundwater recharge and associated water supply augmentation instead of purchasing imported water.
- Energy – assess the reduction of energy consumption by planting shade trees and decreasing the amount of energy used to pump imported water into the Los Angeles Basin.
- Air Quality Improvement – assess the benefits of absorption of pollutants by the tree canopy, pollution reduction by reducing the amount of emissions related to greenwaste hauling, and reduced emissions from power plants from decreased energy consumption.
- Greenwaste Reduction – assess the cost avoidance of hauling and tipping for landfill disposal of greenwaste.
- Ecosystem Restoration – assess the benefits of increased habitat and open space.
- Recreation – assess the value of parkland and recreation for the area.
- Property Values – assess the value of project components to nearby property values.

BCA Summary

The results of the BCA are summarized in the following tables. The capital cost and O&M cost estimates for each alternative are shown in **Table 4-4** and **Table 4-5**. **Table 4-6** presents a summary of the benefits of the project on an annual basis while **Table 4-7** presents a summary of the present value of each benefit over the 50-year evaluation period.

Table 4-4
Summary of Capital Costs for Each Alternative

Project Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lateral Storm Drains	$7,469,000	$6,362,000	$6,450,000	$10,006,000
Trunk Storm Drain	44,145,000	36,816,000	34,996,000	57,824,000
LADWP Steam Plant	4,539,000	4,539,000	4,539,000	2,852,000
Vulcan Gravel Processing Plant	952,000	952,000	952,000	346,000
Tuxford Green	4,350,000	4,350,000	4,350,000	4,350,000
Sun Valley Park	2,800,000	2,800,000	2,800,000	2,800,000
Sun Valley Middle School	3,033,000	3,033,000	3,033,000	2,535,000
Tree Planting and Mulching	4,400,000	2,200,000	4,400,000	2,200,000
Stonehurst School	1,077,000	n/a	n/a	n/a
Stonehurst Park	833,000	n/a	n/a	n/a
Roscoe School	975,000	n/a	n/a	n/a
Park on Wentworth	816,000	n/a	n/a	n/a
Water Transfer in Sheldon Pit	n/a	650,000	n/a	n/a
Sheldon Pit	n/a	16,850,000	n/a	n/a
Cal Mat Pit	n/a	n/a	27,480,000	26,400,000
Strathern Pit	17,450,000	15,500,000	12,800,000	11,000,000
Parking Lot Infiltration	33,100,000	15,300,000	n/a	21,300,000
Street Storage	29,177,000	17,643,000	129,758,000	17,643,000
Onsite BMPs	32,811,000	16,407,000	32,811,000	16,407,000
Powerline Easement	18,100,000	7,500,000	14,900,000	13,300,000
Total	**$206,027,000**	**$150,902,000**	**$279,269,000**	**$188,963,000**

Table 4-5
Summary of O&M Costs for Each Alternative

Project Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Bradley Landfill	n/a	n/a	n/a	n/a
Sun Valley Park	16,000	16,000	16,000	16,000
LADWP Steam Plant	71,000	71,000	71,000	71,000
Vulcan Gravel Processing Plant	10,000	10,000	10,000	10,000
Tuxford Green	18,000	18,000	18,000	18,000
Sun Valley Middle School	6,000	6,000	6,000	6,000
Tree Planting	98,000	33,000	98,000	33,000
Mulching	0	0	0	0
Water Transfer	n/a	206,000	n/a	n/a
Stonehurst School	70,000	n/a	n/a	n/a
Stonehurst Park	78,000	n/a	n/a	n/a
Roscoe School	66,000	n/a	n/a	n/a
New Park in Subarea 2	30,000	n/a	n/a	n/a
Sheldon Pit	n/a	100,000	n/a	n/a
Cal Mat Pit	n/a	n/a	71,000	71,000
Strathern Pit with Transport to TSG/Vulcan	239,000	208,000	194,000	151,000
Parking Lot Infiltration (Subarea 33)	35,000	17,000	n/a	20,000
Street Storage	21,000	13,000	57,000	28,000
Onsite BMPs	91,000	46,000	91,000	46,000
Powerline Easement	54,000	25,000	49,000	44,000
Storm drain - Trunklines	171,000	139,000	131,000	236,000
Storm drain - Laterals (City + County)	64,000	57,000	58,000	73,000
Total	**1,135,000**	**963,000**	**867,000**	**821,000**

Table 4-6
Annual Benefits in $ Million

Benefit	Alternative				
	9250	1	2	3	4
County Flood Control					
Regional damage avoidance	$3.00	$3.00	$3.00	$3.00	$3.00
Change in downstream flooding	($0.05)	$0.25	$0.17	$0.25	$0.15
City Flood Control	$0.47	$0.47	$0.47	$0.47	$0.47
Water Quality					
Bacteria TMDL	$0.00	$1.07	$1.07	$1.07	$1.07
Additional water quality	$0.00	$3.03	$3.03	$3.03	$3.03
Water Conservation					
Water transfer	$0.00	$0.00	$2.80	$0.00	$0.00
Avoided cost of imported water	$0.00	$1.04	$0.83	$1.12	$1.05
Energy Reduction	$0.00	$0.20	$0.08	$0.20	$0.08
Air Quality	$0.00	$0.95	$0.38	$0.95	$0.38
Greenwaste	$0.00	$0.93	$0.47	$0.93	$0.47
Ecosystem Restoration	$0.00	$0.09	$0.19	$0.21	$0.21
Recreation	$0.00	$1.09	$1.09	$1.09	$1.09
Property Values	$0.00	$0.47	$0.18	$0.47	$0.18
Total Annual Benefits	**$3.42**	**$12.59**	**$13.75**	**$12.80**	**$11.17**

Table 4-7
Present Value of the Total Annual Benefits in $ Million

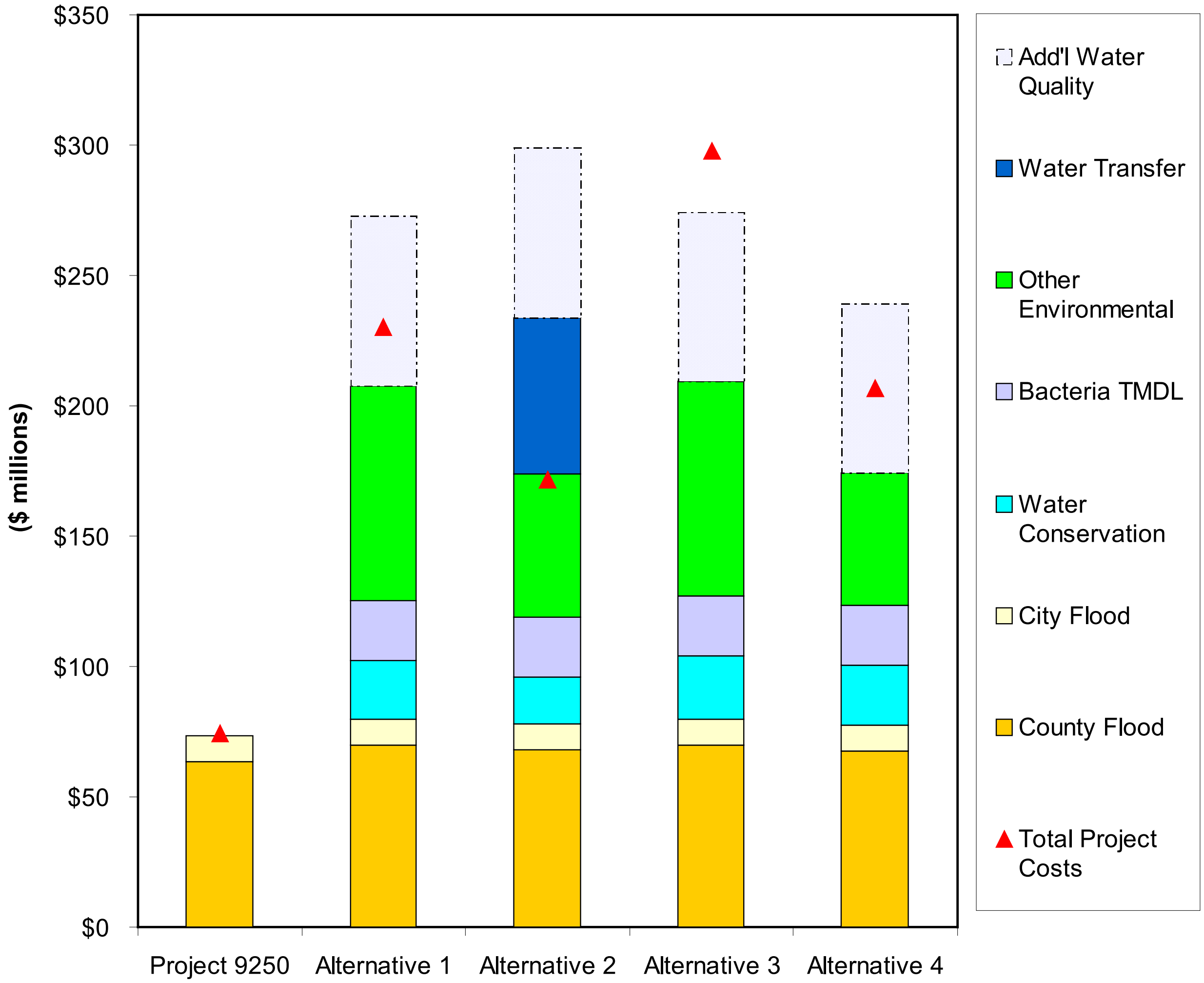
Benefit	Alternative				
	9250	1	2	3	4
County Flood Control					
Regional damage avoidance	$64.46	$64.46	$64.46	$64.46	$64.46
Change in downstream flooding	($1.03)	$5.37	$3.65	$5.37	$3.22
City Flood Control	$10.01	$10.01	$10.01	$10.01	$10.01
Water Quality					
Bacteria TMDL	$0.00	$22.95	$22.95	$22.95	$22.95
Additional water quality	$0.00	$65.15	$65.15	$65.15	$65.15
Water Conservation					
Water transfer	$0.00	$0.00	$60.21	$0.00	$0.00
Avoided cost of imported water	$0.00	$22.35	$17.89	$24.07	$22.65
Energy Reduction	$0.00	$4.30	$1.70	$4.30	$1.70
Air Quality	$0.00	$20.50	$8.10	$20.50	$8.10
Greenwaste	$0.00	$20.00	$10.00	$20.00	$10.00
Ecosystem Restoration	$0.00	$1.86	$4.04	$4.58	$4.48
Recreation	$0.00	$23.34	$23.34	$23.34	$23.34
Property Values	$0.00	$10.20	$3.90	$10.20	$3.90
Total Benefits	**$73.44**	**$270.47**	**$295.39**	**$274.93**	**$239.95**

The Benefit/Cost ratio for each alternative is shown in **Table 4-8**. A graphical summary of the benefits and costs for each alternative is presented in **Figure 4-5**. The ratios use the present value of the total project cost including O&M over the 50-year evaluation period and the summed benefits over the same evaluation period.

Table 4-8
Benefit/Cost Ratio for Each Alternative

Benefit	Alternative				
	9250	1	2	3	4
Present Value of All Benefits (in $ million)	$73.44	$270.47	$295.39	$274.93	$239.95
Present Value of Capital and O&M Costs (in $ million)	$74.46	$230.40	$171.58	$297.90	$206.61
Benefit/Cost Ratio	**0.99**	**1.17**	**1.72**	**0.92**	**1.16**

Figure 4-5
Benefits of the Sun Valley Alternatives



Alternative 2, Water Conservation, has the highest benefit-to-cost ratio of 1.72. This is largely due to the combination of 1) higher overall benefits and 2) lower total project costs. The higher benefits are associated with the water transfer from Tujunga Wash to Sheldon Pit, which provides almost four times the groundwater recharge provided by any other alternative. If this component were included in the other alternatives, their benefit-to-cost ratios would also increase. The lower cost results from implementing fewer retention projects to accomplish flood control for Sun Valley and releasing water from the watershed outlet during large storm events. In the Capital Flood, Alternative 2 releases 426 acre-ft of water from the bottom of the watershed, and it transfers more than 500 acre-ft into the watershed from Tujunga Wash, reducing the total flow to the Los Angeles River.

Sample Alternative 2 has the highest benefit-to-cost ratio. Due to circumstances out of the control of LACDPW, the components that are ultimately implemented may vary from those of sample Alternative 2. It should be noted that although Alternative 2 provides numerous benefits at a relatively low cost, it is not the optimal solution because of the criteria to make each alternative distinct from one another. Based on information developed in this analysis, improvements could be made to Alternative 2 to boost the benefits and further lower the cost. While these improvements would tend to make this alternative less distinct from the others, they would optimize the alternative, which is the ultimate goal. Some possible improvements include:

- Replace Parking Lot Infiltration with an extended Powerline Easement project. The powerline easement has an opportunity to meet many project goals efficiently, while Parking Lot Infiltration only provides flood control, water conservation, and water quality improvement. Parking Lot Infiltration is also significantly more expensive per acre-foot of flood control than the Powerline Easement project.
- Include Stonehurst Park and the Park on Wentworth as projects that highly visible in the community and provide cost-effective flood control.
- Propose low-tech onsite BMPs at each participating parcel, such as retention grading and disconnection of downspouts to drain to the lawn rather than the street. While these less expensive BMPs provide limited storage for flood control, if they are used in combination with drywells, infiltrators, or cisterns, the total cost per acre-foot of flood control may be reduced.

It is recommended that these and other potential improvements to sample Alternative 2 be investigated before project designs are initiated.

Ability to Meet Project Objectives

Each alternative's ability to meet the detailed project objectives was evaluated. These objectives, agreed upon by the stakeholders at the inception of the Sun Valley Watershed Management Project, are the following:

- Reduce local flooding
- Improve water quality
- Increase water conservation
- Provide additional environmental benefits
- Increase recreational opportunities
- Increase wildlife habitat

Each of the final four sample alternatives is consistent with the detailed project objectives.

Guiding Principles Applicable to Any Watershed

General guiding principles that are applicable to any watershed become apparent when refining the alternatives to meet the stated project objectives. These principles are described below with examples of how the sample alternatives implement each principle:

1. Components should include multiple benefits whenever feasible.

   Example a) The powerline easement concept meets the objectives of flood control, water quality, and recreation.

2. Components should be designed in consideration of the other components as a system in order to meet objectives in the most efficient manner.

   Example a) The amount of water captured in an upstream component affects the amount of water that a downstream component must capture. The two can be designed together so that the flood control objective is met in the most efficient manner.

   Example b) Two project components with habitat benefits may be designed so that they are linked by green space. Linkages between components increase the overall habitat benefit.

3. The project should consider the regional setting along with existing and future opportunities to extend project benefits beyond the watershed to the region.

   Example a) The water quality components in Sun Valley will actually improve the water quality of the Los Angeles River, approximately 3.5 miles south of the watershed.

   Example b) Recreational and habitat opportunities in Sun Valley may connect with existing and future recreation and habitat opportunities in the regional system.

Each of the final four sample alternatives developed in the Sun Valley Watershed Management Plan is consistent with the principles presented above.