# 7.0 Assessment of Reuse Opportunities

**Water Reuse Study**



This analysis is consolidated into a combination of reuse opportunities, which are referred to as *strategies*. These strategies offer the San Diego public and Council a set of diverse reuse options for both the North City and South Bay systems. Decision charts, which could be referred to as roadmaps for each strategy's implementation, are included to summarize facilities and reuse volumes and were developed to help answer the primary study questions of: (1) which water recycling opportunities to pursue; and, (2) depending on the opportunity, how much water to recycle. Supporting text includes the benefits of each strategy, the value of recycled water, detailed costs for each strategy, and information on other water supply options.

In summary, this chapter:

- Revisits valuing recycled water as part of a diversified water supply portfolio and looks beyond unit costs when considering recycled water projects;
- Consolidates the opportunities listed in Sections 5 and 6 into six individual implementable strategies. Three strategies each are presented for North City and South Bay;
- Maps out the implementation of each strategy by steps;
- Presents detail of individual strategy costs along with the evaluation criteria established at the first Assembly workshop;
- Presents other water supply costs;
- Summarizes the conclusions for each strategy.

## 7.1 Recognizing the Value of Recycled Water

Understanding the uses and long-term value of recycled water is critical to making informed choices and decisions. The public, stakeholders, and policy makers have a challenging role in discussing and debating the strategies presented. Recycled water is a valuable asset – one that provides a locally controlled water supply, enhances supply reliability by diversifying supply sources, and enhances sustainability by limiting water diversions from other California ecosystems. Based on these benefits, the public and policy makers have been asked to determine the role of water reuse in San Diego's future.

## 7.2 Overview of Alternative Implementation Strategies

Six alternative implementation strategies were developed by combining individual opportunities from Sections 5 and 6 into a logical sequence of projects. Three opportunities are for the North City system and three are for the South Bay system. The strategies were developed to provide:

- A balanced and diverse set of both non-potable and indirect potable opportunities that represent the broad policy options available,
- A range of project steps that add new increments of recycled water usage within each strategy,
- A geographically balanced mix of projects.

Each strategy begins with the City's existing and planned projects, and then adds projects over a series of steps. The steps are not specifically defined in time, but for review purposes generally could be considered as approximately five-year increments from 2010 to 2025. The projects included in each step were organized based on a number of considerations, including:

- Maximizing the use of recycled water based on available supplies at each step,
- Selecting a lower cost project before a higher cost project, and
- Maximizing the ability to build upon existing or a previous step's infrastructure.

Most strategies can be pursued step-by-step all the way through to their final step or to some intermediate step. Some strategies maximize reuse in one large-scale project, while other strategies increase use gradually through smaller increments.

For each strategy, a summary table based on the evaluation criteria established at the first Assembly workshop was developed. The summary includes a description of the criteria with associated objectives and performance measures. A brief discussion is provided regarding those measures specific to the strategy.

## 7.3 North City Strategies

The City remains committed to completing the Phase I and II expansion of the North City recycled water distribution system. The City has also decided to pursue the infill opportunity described in Section 5. Infill provides the best approach to meet the City's Northern Service Area goal of beneficially using 12 MGD (13,400 AFY) by 2010. Other opportunities are more costly and/or cannot be completed by 2010. Therefore, infill is shown as the first component in each North City strategy.

### Description of North City Strategies

The components in each North City strategy, referred to as NC-1 through NC-3, are summarized in the following paragraphs. After each component summary is a strategy decision chart and two-page summary for each strategy. The two-page summary includes a figure displaying strategy components, text summarizing strategy details, primary strategy benefits, amendment of recycled water usage, implementation issues, and analysis of evaluation criteria developed at the first Assembly workshop.

**NC-1:** The NC-1 Strategy includes only non-potable projects similar to the City's existing recycled water program. This strategy includes infill, Phase III expansion into Rancho Bernardo, and expansion of the system south into the Central Service Area. A seasonal storage project is included to increase supplies. NC-1 includes a created wetlands project in Rose Canyon.

**NC-2:** The NC-2 Strategy includes a mixture of non-potable and IPR opportunities. NC-2 starts off identical to NC-1 with infill and Phase III expansion. A small-scale IPR project at Lake Hodges and a seasonal storage project to meet peak demands for non-potable uses completes this strategy.

**NC-3:** The NC-3 Strategy includes infill and a large-scale IPR opportunity at San Vicente Reservoir that fully utilizes all of the remaining available recycled water supply.

### Summary of North City Strategies

The resulting volume of reuse and associated costs vary per step and per strategy. The total reuse at the last step also varies between strategies depending on the approach and specific opportunities. **Table 7-1** summarizes the total reuse achieved for each opportunity in each strategy, both in AFY and as a percentage of the NCWRP's production capacity.

**Table 7-1**
**Reuse Quantities for North City Strategies**

| Reuse Project Components | Recycled Water Use By Strategy (AFY) | | |
|---|---|---|---|
| | **NC-1** | **NC-2** | **NC-3** |
| **Reuse**[1] | | | |
| Existing System (including Phases I and II) | 9,440 | 9,440 | 9,440 |
| Infill | 3,820 | 3,820 | 3,820 |
| Rancho Bernardo Phase III | 2,110 | 2,110 | - |
| San Vicente IPR (16 MGD Plant) | - | - | 10,500 |
| Central Service Area (CSA) | 1,120 | - | - |
| Lake Hodges IPR (2 MGD Plant) | - | 1,800 | - |
| Seasonal Storage | 2,390 | 870 | - |
| Wetlands | 800 | - | - |
| *Subtotal Demands* | *19,680* | *18,040* | *23,760* |
| **Supply** | | | |
| NCWRP Supply | 26,880 | 26,880 | 26,880 |
| Demineralization supply credit[2] | - | - | 670 |
| Advanced treatment process loss[2] | - | -635 | -3,790 |
| *Subtotal Supply* | *26,880* | *26,245* | *23,760* |
| **Treatment Capacity Utilized, %** | **73** | **69** | **100** |

1 Project reuse volumes assume the availability of seasonal storage as needed to supply peak summertime uses.
2 Supply credits and losses were used to account for water lost as part of treatment processes. For IPR opportunities, demineralization is not needed at NCWRP (resulting in a supply credit), but losses will occur at the advanced water treatment plant (resulting in a loss of supply).

### North City Decision Chart

A decision chart of North City strategies is presented in **Figure 7-1**. Unit costs, the estimated effect on a typical monthly residential water bill, reuse volumes, and the proposed implementation plan are also shown. The decision chart is intended to help answer the following primary study questions: (1) which water recycling opportunities to pursue; and, (2) depending on the opportunity, how much water to recycle.

## NORTH CITY DECISION CHART

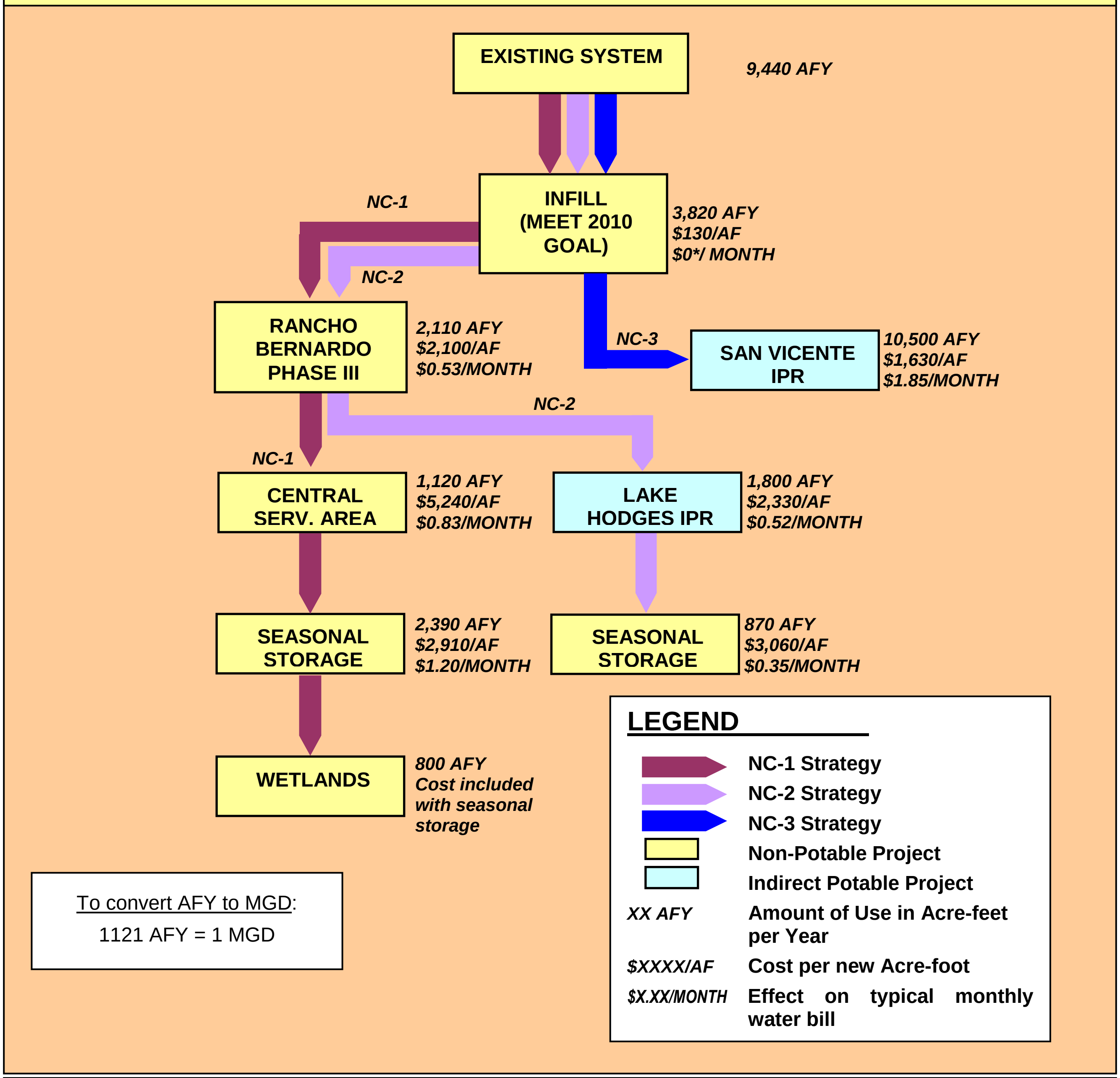


**Figure 7-1 –** The decision chart summarizes potential water reuse strategies for the North City Water Reclamation Plant. All strategies for North City start with meeting the City's 2010 goal via infill. The NC-1 strategy includes non-potable opportunities. The NC-2 strategy includes a mix of both non-potable and indirect potable reuse opportunities. The NC-3 strategy is predominantly an indirect potable reuse opportunity. Costs are shown for each strategy.

* Increased recycled water sales are projected to offset project costs.

# North City Strategy NC-1 Two-Page Summary

## Project Description

Expansion of the non-potable system to serve infill, Phase III Rancho Bernardo, the Central Service Area, and Rose Canyon wetlands.

## Primary Benefit of this Strategy

NC-1 provides the lowest initial capital cost and lowest unit cost through the second step of the strategy. However, if the desire is to maximize use of the available recycled water supply, subsequent steps have higher unit costs and make this alternative comparatively more expensive. This strategy appears to be the appropriate choice if the driving decision factors are to minimize initial capital outlays and to commit to a non-potable reuse approach.

## Implementation:

- Infill to serve new customers within one-quarter mile of the existing distribution system (up to 3,820 AFY).
- Phase III expansion of the existing system into Rancho Bernardo to primarily serve golf courses (up to 2,110 AFY) .
- Expansion into the Central Service Area to serve Mission Bay and Balboa Parks (up to 1,120 AFY).
- Through the initial implementation steps, purchase raw or treated potable water to meet summer demand peaks. Subsequent development of recycled water seasonal storage would store surplus recycled water during the winter for use in the summer.
- Use of excess recycled water in winter months for a created wetland in Rose Canyon (800 AFY).

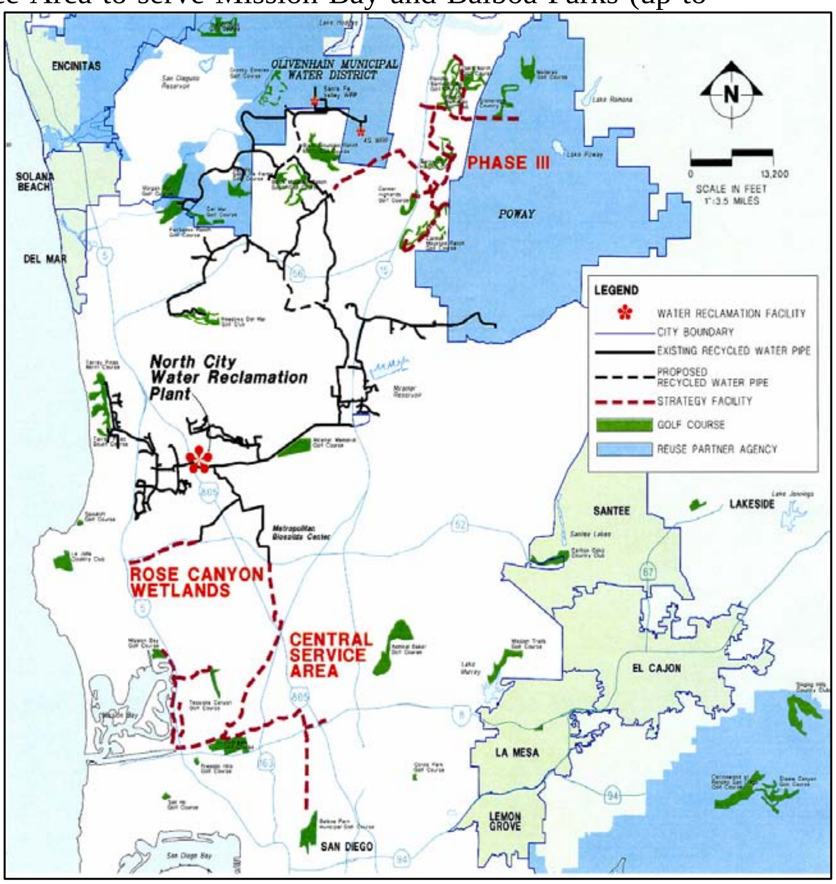


**Figure 7-2 - North City Strategy NC-1**

| NC-1 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Non-potable recycled water distribution system serves a human need by replacing potable water use. However, the system's distribution system is limited and not everyone directly benefits from recycled water use.<br>**Public Perception:** The public in general perceives that non-potable use of recycled water is preferable to indirect potable reuse. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **19,680 AFY** of recycled water is reused in this strategy. This amounts to approximately **73%** of the available recycled water from the NCWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Use of non-potable, recycled water for irrigation provides the benefit of nutrient value to irrigated areas. City ensures TDS to be equal or less than 1000 mg/l. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The facilities must be built in a cost-effective and timely manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | Recycled water treatment and distribution systems are not operated with redundancy of facilities in mind. Outages of recycled water service are more likely to occur than in a potable water system. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | Non-potable recycled water projects are generally easier to implement than indirect potable projects as they require less regulatory permitting. These types of projects have a regulatory framework to follow and general public support. |

**Figure 7-3 NC 1 – Evaluation Criteria Detail**

## North City Strategy NC-2 Two-Page Summary

### Project Description

Expansion of the non-potable system to serve infill and Phase III Rancho Bernardo, followed by a small-scale IPR project at Lake Hodges.

### Primary Benefit of this Strategy

Strategy NC-2 provides the opportunity to switch from non-potable to IPR. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial expenditures, while still having the ability to accomplish an IPR project.

### Implementation:

- Infill to serve new customers within one quarter-mile of the existing distribution system (up to 3,820 AFY).
- Phase III expansion of the existing system into Rancho Bernardo to primarily serve golf courses (up to 2,110 AFY).
- Small-scale IPR project at Lake Hodges (1,800 AFY).
- Through early implementation steps, summer peak can be met with purchased potable or raw water. Subsequent development of recycled water seasonal storage would store surplus recycled water during the winter for use in the summer.

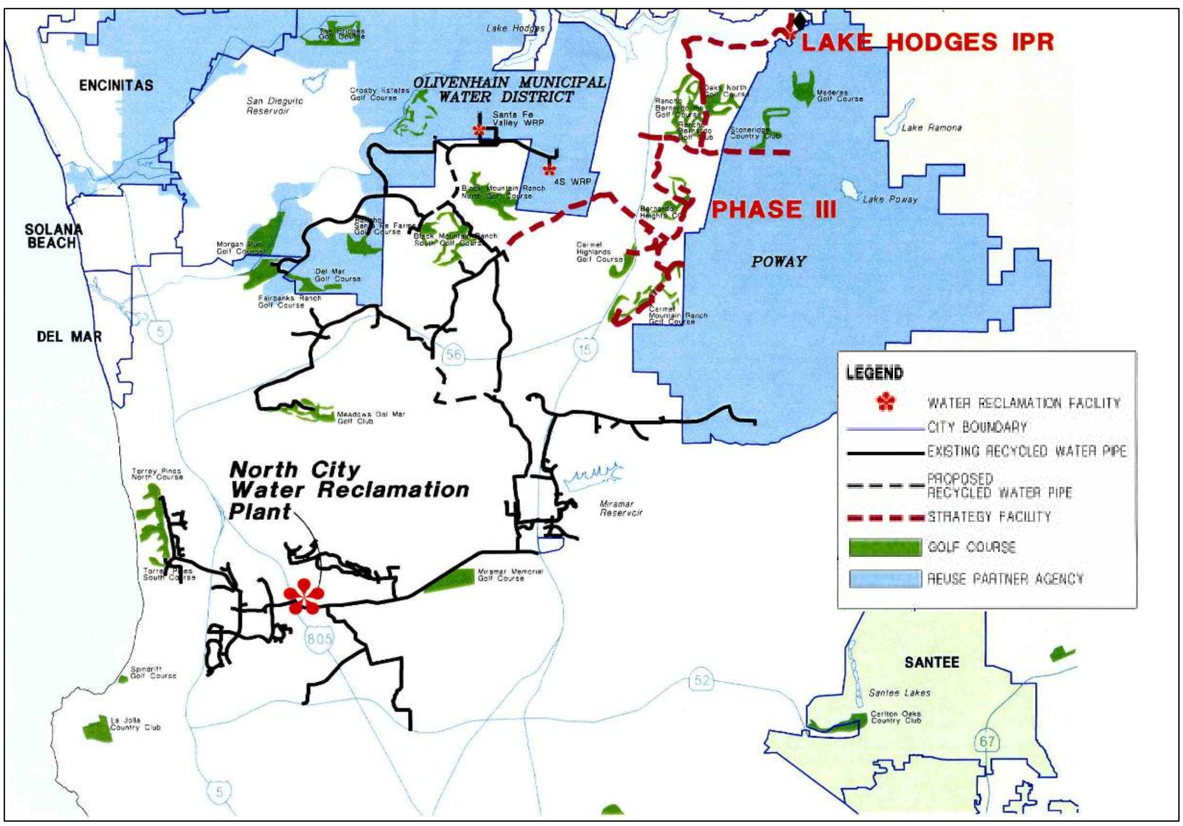


Figure 7-4 North City Strategy NC-2

| NC-2 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. New IPR projects would be designed to meet federal, state and local regulatory requirements. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Both non-potable and IPR provide water to the community, but IPR projects distribute the purified water to a greater number of people.<br>**Public Perception:** Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **18,040 AFY** of recycled water is used in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately **69%** of the available recycled water from the NCWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The necessary facilities must be built in a timely and cost-effective manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | IPR project provides operational reliability as it takes full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | IPR project is anticipated to be more difficult to implement due to regulatory and social issues. Extensive public outreach effort will be required to implement the IPR component of this strategy. The Lake Hodges IPR project has additional hurdles since the first inline water treatment plants are not City facilities. |

**Figure 7-5 NC 2 – Evaluation Criteria Detail**

# North City Strategy NC-3 Two-Page Summary

## Project Description

Expansion of the non-potable system to serve infill, followed by a large-scale San Vicente Reservoir IPR project sized to maximize available supplies.

## Primary Benefit of this Strategy

NC-3 maximizes the available North City water supply in one step through IPR. For a strategy that fully maximizes use of the available recycled water supply, it provides the lowest overall unit cost. Accomplishing this, however, involves the highest initial capital costs. This strategy appears to be the appropriate choice if the driving decision factors are to maximize recycled water use and have the lowest ultimate unit cost.

## Implementation:

- Infill to serve new customers within one-quarter mile of the existing distribution system (up to 3,820 AFY).
- Large-scale 16 MGD capacity San Vicente Reservoir Augmentation (IPR) project to utilize the wintertime supply from the NCWRP, after other non-potable uses (10,500 AFY).
- Small amount of potable water may be needed to meet summer demand with purchased potable water.

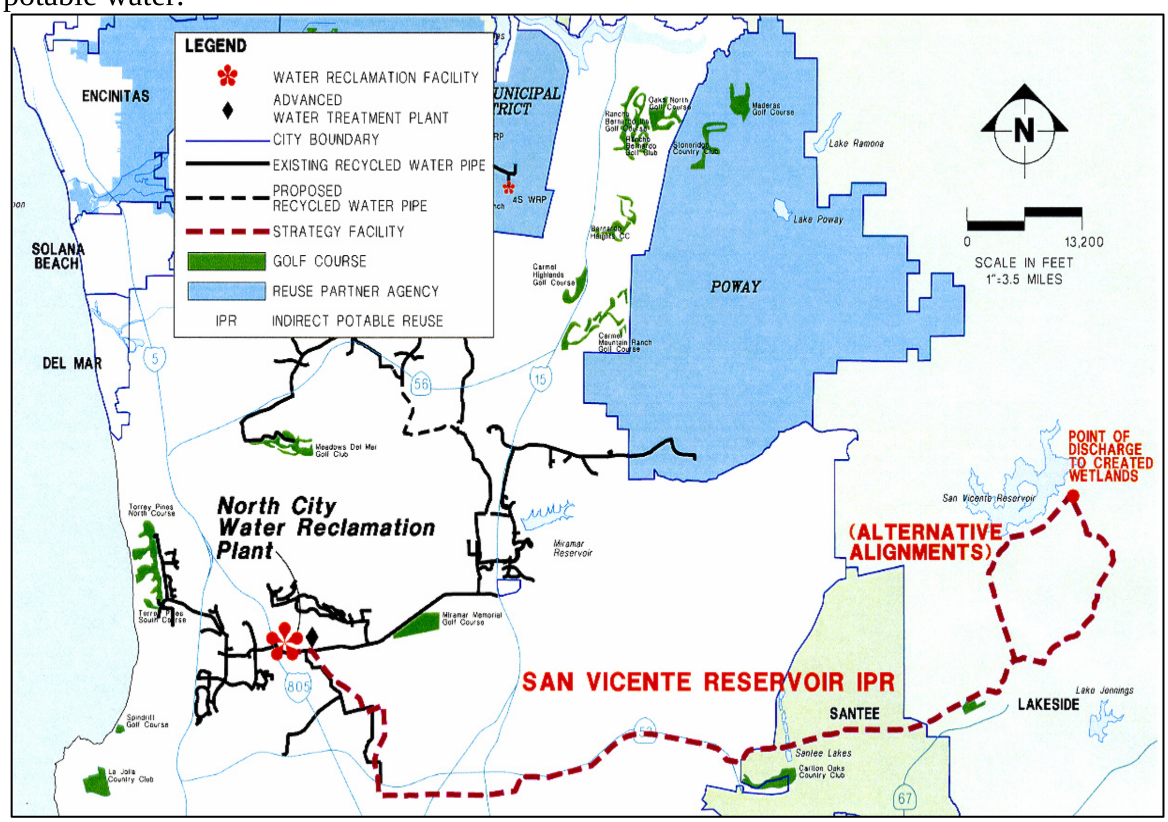


**Figure 7-6 North City Strategy NC-3**

| NC-3 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. New indirect potable project would be designed to meet federal, state and local regulatory requirements. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Both non-potable and IPR provide water to the community, but IPR projects distribute the purified water to a greater number of people.<br>**Public Perception:** Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with IPR projects are generally acceptable to environmentalists. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **23,760 AFY** of recycled water is used in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy achieves **100 %** utilization of the available recycled water from the NCWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The necessary facilities must be built in a timely and cost-effective manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | IPR project provides operational reliability as it takes full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plants. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | IPR project is anticipated to be more difficult to implement due to the regulatory and social issues. Extensive public outreach effort will be required to implement the IPR component of this strategy. |

**Figure 7-7 NC 3 – Evaluation Criteria Detail**

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## 7.4 South Bay Strategies

All South Bay strategies include the existing uses at the South Bay and IBWC treatment plants. In addition, the City plans to fulfill their 6 MGD commitment to the OWD by 2007. Therefore, existing uses and service to OWD are shown as the first components in each South Bay strategy.

### Description of South Bay Strategies

The paragraphs below summarize the components in each South Bay strategy, referred to as SB-1 through SB-3. Following the component summary is a strategy decision chart and two-page summary for each strategy. The two-page summary includes a figure displaying strategy components, text summarizing the strategy details, primary strategy benefits, strategy usage, implementation issues, and analysis of evaluation criteria developed at the first Assembly workshop.

**SB-1:** The SB-1 Strategy includes only non-potable projects similar to the City's existing recycled water program. After serving OWD, SB-1 proposes to serve Sweetwater Authority with the remaining available recycled water supply.

**SB-2:** The SB-2 Strategy includes a small-scale IPR opportunity at Otay Lakes, following the baseline OWD project.

**SB-3:** The SB-3 Strategy includes a large-scale IPR opportunity at Otay Lakes, following the baseline OWD project, which maximizes use from the SBWRP in one step.

## Summary of South Bay Strategies

The resulting volume of use and costs vary per step and per strategy. The total use at the last step also varies between strategies depending on the approach and specific opportunities. **Table 7-2** summarizes the total use achieved for each opportunity in each strategy, and the percent of SBWRP capacity utilized.

### Table 7-2
### Reuse Quantities for South Bay Strategies

| Reuse Project Components | Recycled Water Use By Strategy (AFY) | | |
|---|---|---|---|
| | SB-1 | SB-2 | SB-3 |
| **Reuse**[1] | | | |
| SBWRP onsite usage | 560 | 560 | 560 |
| IBWC onsite usage | 840 | 840 | 840 |
| Otay Water District | 5,760 | 5,760 | 5,760 |
| Sweetwater Authority | 5,880 | - | - |
| Otay IPR Small-Scale (2 MGD Plant) | - | 1,800 | - |
| Otay IPR Large-Scale (7.5 MGD Plant) | - | - | 5,500 |
| *Subtotal Demands* | *13,040* | *8,960* | *12,660* |
| **Supply** | | | |
| SBWRP Supply | 15,120 | 15,120 | 15,120 |
| Demineralization supply credit[2] | - | - | - |
| Advanced treatment process loss[2] | - | -640 | -1940 |
| *Subtotal Supply* | *15,120* | *14,480* | *13,180* |
| **Treatment Capacity Utilized, %** | **86** | **62** | **96** |

1 Project reuse volumes assume the availability of seasonal storage as needed to supply peak summertime uses.

2 Supply credits and losses were used to account for water lost as part of treatment processes. For IPR opportunities, demineralization is not needed at SBWRP (resulting in a supply credit), but losses will occur at the advanced water treatment plant (resulting in a loss of supply).

## South Bay Decision Chart

A decision chart of South Bay strategies is presented in Figure 7-8. Unit costs, the effect on a typical monthly residential water bill, reuse volumes, and the proposed implementation plan are also shown. The decision chart is intended to help answer the following primary study questions: (1) which water recycling opportunities to pursue and (2) depending on the opportunity, how much water to recycle.

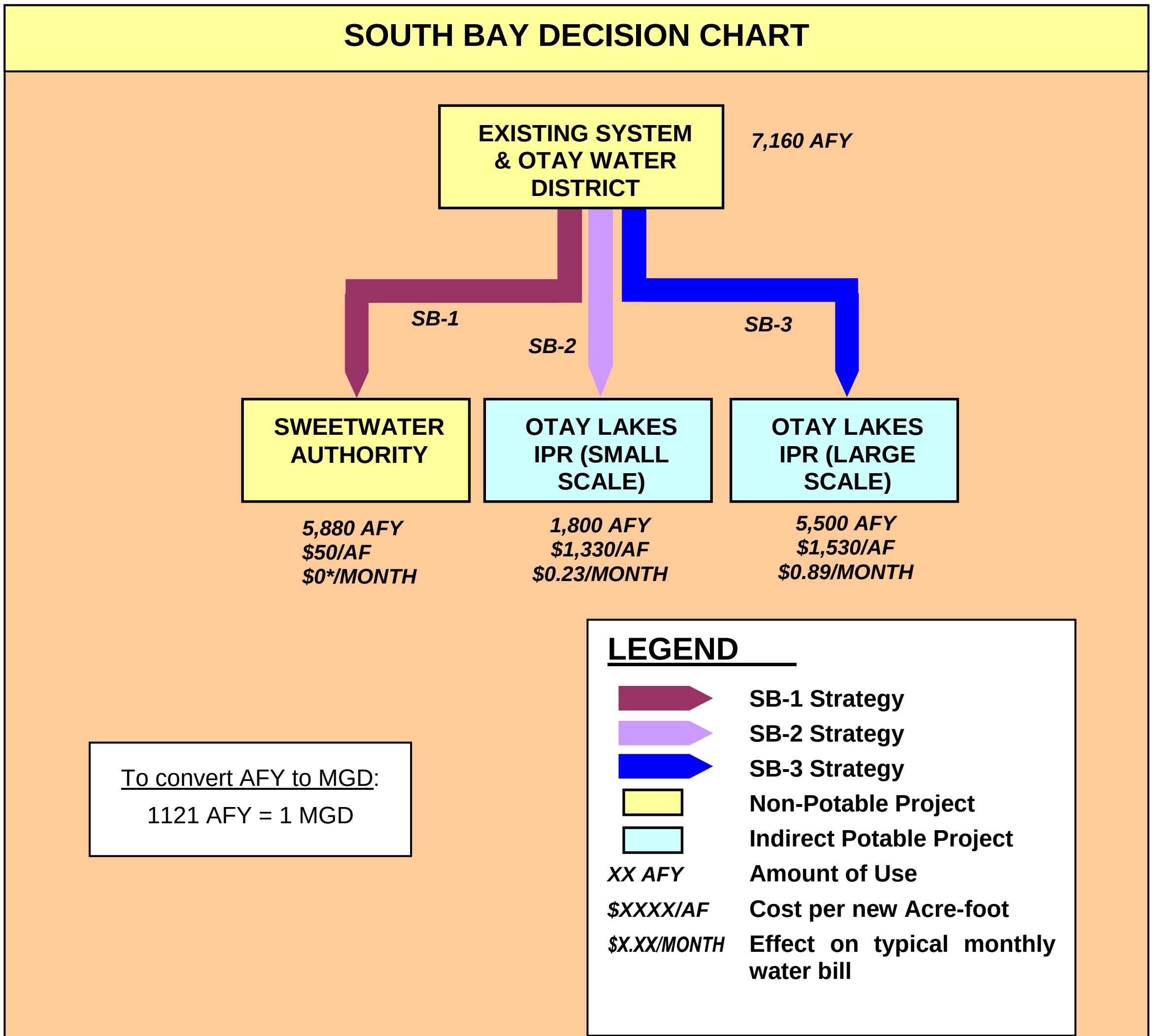


**Figure 7-8 –** This decision chart summarizes potential water reuse strategies for the South Bay Water Reclamation Plant. All strategies for South Bay start with serving planned San Diego and Otay Water District customers. The SB-1 strategy includes non-potable opportunities. The SB-2 strategy includes a small-scale indirect potable reuse project at Otay Lakes. The SB-3 strategy is a larger scale indirect potable reuse opportunity at Otay Lakes. Costs are shown for each strategy.

* Increased recycled water sales are projected to off-set project costs.

## South Bay Strategy SB-1 Two-Page Summary

### Project Description

Expansion of the non-potable system to serve OWD and Sweetwater Authority.

### Primary Benefit of this Strategy

Strategy SB-1 results in the lowest initial capital cost and lowest unit cost of all South Bay strategies. This strategy appears to be the appropriate choice if the driving decision factor is to minimize expenditures, even if the use occurs outside City service areas.

### Implementation:

- Existing System and OWD (up to 7,160 AFY).
- Expansion of the existing system to serve Sweetwater Authority and its customers (up to 5,880 AFY).

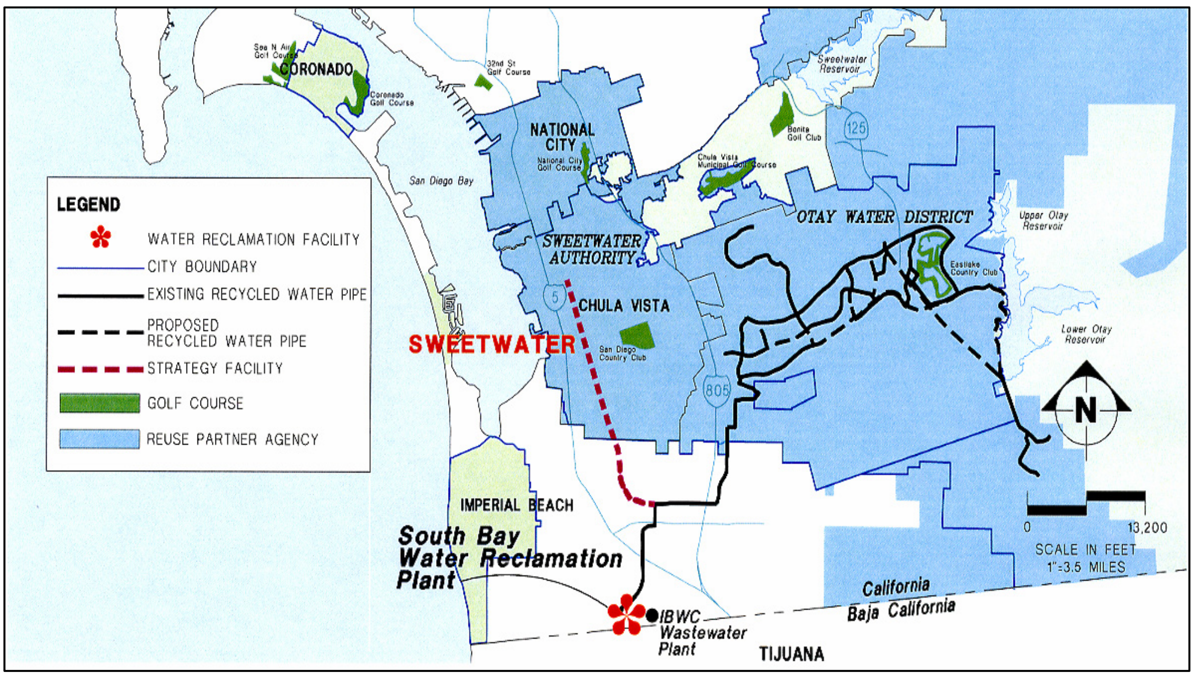


**Figure 7-9 South Bay Strategy SB-1**

| SB-1 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Non-potable use serves a human need by replacing potable water use. However, the system's distribution system is limited and not everyone directly benefits from recycled water use.<br>**Public Perception:** The public in general perceives that non-potable use of recycled water is preferable to IPR. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **13,040 AFY** of recycled water is used in this strategy. This amounts to approximately **86%** of the available recycled water from the SBWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Use of non-potable, recycled water for irrigation provides the benefit of nutrient value to irrigated areas. City ensures TDS to be equal or less than 1000 mg/L. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The necessary facilities must be built in a timely and cost-effective manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | Recycled water treatment and distribution systems are not operated with redundancy of facilities in mind. Outages of recycled water service are more likely to occur than in a potable water system. This scenario takes advantage of a new regional interconnection with Sweetwater Authority. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | The implementation of this strategy relies upon a new large customer moving into the Sweetwater Authority Service Area. |

**Figure 7-10 SB-1 – Evaluation Criteria Detail**

## South Bay Strategy SB-2 Two-Page Summary

### Project Description

Expansion of the non-potable system to serve OWD, followed by a small-scale IPR opportunity at Lower Otay Reservoir.

### Primary Benefit of this Strategy

Strategy SB-2 includes a mix of non-potable uses and a small-scale IPR project. This strategy appears to be an appropriate choice if either of the driving decision factors are to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

### Implementation:

- Existing System and OWD (up to 7,160 AFY).
- A small-scale IPR project at Lower Otay Reservoir with created wetlands located upstream of the Upper Otay Reservoir (1,800 AFY).

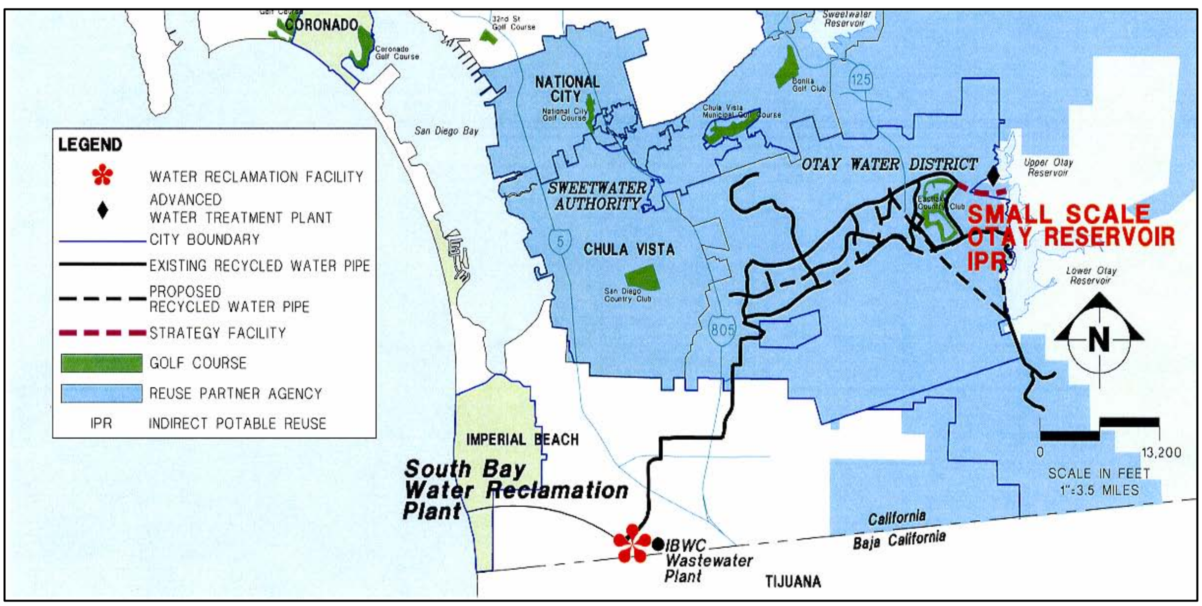


**Figure 7-11 South Bay Strategy SB-2**

| SB-2 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. New indirect potable project would be designed to meet federal, state and local regulatory requirements. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Both non-potable and IPR provide water to the community, but an IPR project distributes purified water to a greater number of people.<br>**Public Perception:** Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with an IPR project are generally acceptable to environmentalists. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **8,960 AFY** of recycled water is used in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately **62%** of the available recycled water from the SBWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The necessary facilities must be built in a timely and cost-effective manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | An IPR project provides operational reliability as it takes full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plant. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | An IPR project is anticipated to be more difficult to implement due to regulatory and social issues. Extensive public outreach efforts will be required to implement the IPR component of this strategy. |

**Figure 7-12 SB-2 – Evaluation Criteria Detail**

# South Bay Strategy SB-3 Two-Page Summary

## Project Description

Expansion of the non-potable system to serve OWD, followed by a large-scale IPR opportunity at Lower Otay Reservoir.

## Primary Benefit of this Strategy

Strategy SB-3 includes a mix of non-potable uses and a large-scale IPR project. This strategy appears to be an appropriate choice if the driving decision factors are to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

## Implementation:

- Existing System and OWD (up to 7,160 AFY).
- A large-scale IPR project at Lower Otay Reservoir with created wetlands located upstream of the Upper Otay Reservoir (5,500 AFY).

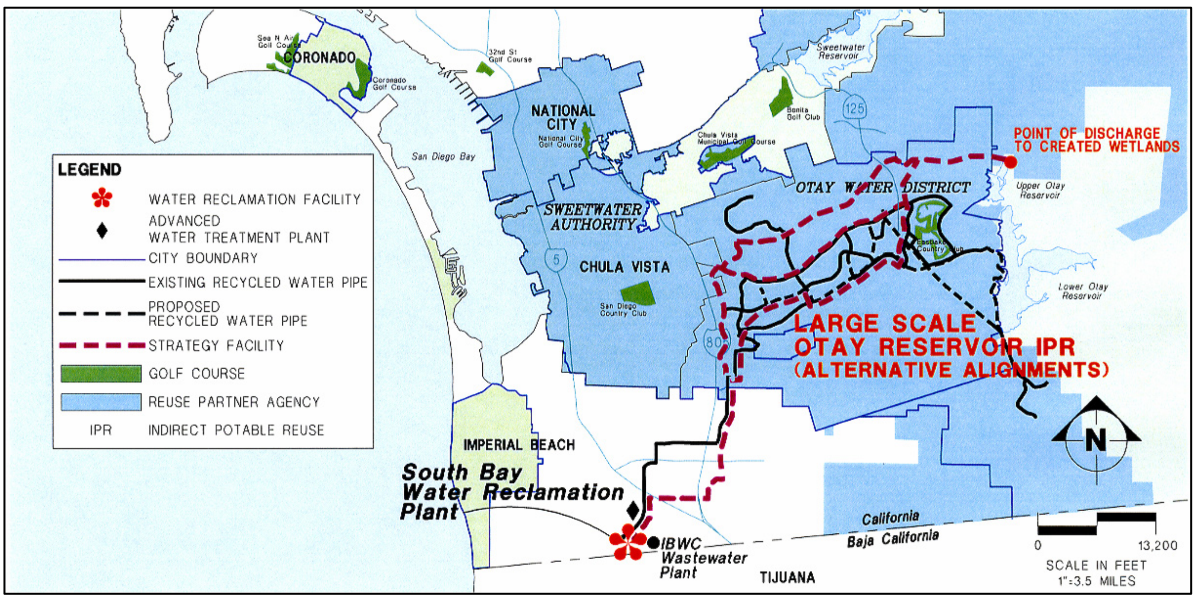


**Figure 7-13 South Bay Strategy SB-3**

| SB-3 – Evaluation Criteria Detail | | |
|---|---|---|
| **Criteria** | **Objective and Performance Measure** | **Discussion** |
| Health and Safety | To protect human health and safety with regard to recycled water use. Meets or exceeds federal, state and local regulatory criteria for recycled water uses. | City's non-potable service of recycled water meets federal, state and local regulatory criteria and has been safely operated since 1997. New indirect potable projects would be designed to meet federal, state and local regulatory requirements. |
| Social Value | To maximize beneficial use of recycled water with regard to quality of life and equal service to all socioeconomic groups. Comparison of beneficial uses and their effect on human needs and aesthetics, as well as public perception. | **Human Need:** Both non-potable and IPR provide water to the community, but an IPR project distributes purified water to a greater number of people.<br>**Public Perception:** Non-potable uses are highly supported based on the findings of the Study's public outreach efforts, but IPR projects are not as high. |
| Environmental Value | To enhance, develop or improve local habitat or ecosystems and avoid or minimize negative environmental impacts. Comparison of environmental impacts and/or enhancements, environmental impacts avoided, and permits are required. | Offsets discharge of wastewater to the ocean. Negative environmental impacts due to construction are temporary. Wetlands associated with an IPR project are generally acceptable to environmentalists.. |
| Local Water Reliability | To substantially increase the percentage of water supply that comes from water reuse, thereby offsetting the need for imported water. Increases percent of water recycling and improves local reliability. | Up to **12,660 AFY** of recycled water is used in this strategy. Including advanced treatment process uses for the IPR components, the complete strategy utilizes approximately **96%** of the available recycled water from the SBWRP. |
| Water Quality | Meets or exceeds level of quality required for the intended use and customer needs; to meet all customer quality requirements. | Treatment methodology and monitoring will ensure appropriate water quality for intended uses: non-potable or indirect potable. |
| Technical Feasibility | To assess the physical implementation of the strategy. | The necessary facilities must be built in a timely and cost-effective manner. |
| Operational Reliability | To maximize ability of facilities to perform under a range of future conditions. Level of demand met and opportunities for system interconnections and operational flexibility are addressed. | An IPR project provides operational reliability as it takes full advantage of the redundancy of the City's potable water distribution system and increases the use of water produced at the City's water reclamation plant. |
| Cost | To minimize total cost to the community. Comparison of estimated capital improvement costs, operational costs, and revenues for each reuse opportunity, as well as comparison of estimated avoided costs such as future regional water and wastewater infrastructure costs and costs to develop alternative water supplies (e.g. desalination). | See Section 7.5 for Cost Discussion. |
| Ability to Implement | To evaluate viability or fatal flaws and assess political and public acceptability. Level of difficulty in physical, social or regulatory implementation. | An IPR project is anticipated to be more difficult to implement due to regulatory and social issues. Extensive public outreach efforts will be required to implement the IPR component of this strategy. |

**Figure 7-14 SB-3 – Evaluation Criteria Detail**

## 7.5 Cost Evaluations

### Cost Evaluation Overview

As part of the Reuse Study, costs the City would incur for each of the six strategies, and for every step of each strategy, were evaluated. All costs are presented on a common basis in 2005 dollars[2]. This report highlights three key measures of project costs:

- **Capital Costs:** Capital costs are an estimate of the City's initial capital outlay for project construction and implementation exclusive of operations and maintenance costs. These costs include all costs for project planning, permitting, design, construction, and construction administration.

- **Unit Costs:** The unit cost of water delivered provides a common basis for comparison among projects with differing reuse volumes. The analysis is based on the total equivalent annual cost of each project, including capital and operating costs. Capital costs are amortized over a 40-year term at an interest rate of 6 percent. The 40-year term is representative of the average economic life of the mix of capital facilities presented. Unit costs are then calculated by dividing total equivalent annual costs by the annual volume of recycled water put to beneficial use. Finally, the resulting value is adjusted to account for various incentive credits and avoided costs, as described later in this section.

- **Impact on Typical Monthly Residential Water Bill:** This measure is an estimate of the impact on a typical monthly City residential water bill necessary to fund the reuse projects over a 40-year finance period. The actual rate effect may vary due to differences in financing, funding grants, and other factors, but this measure nevertheless provides a reasonable estimate for evaluation and comparison purposes.

As with the other evaluations presented in this section, this cost evaluation data is intended to help inform the Council, stakeholders, and the public regarding the City's decisions of which strategy to pursue and how far the strategy should be pursued. While costs are a key evaluation factor, as noted in the preface of this report, there may be other factors that could lead the City to select a more costly alternative over a less costly one. In addition, the City fully intends to pursue State and local grant funding for any options selected or decided upon by the Council. The costs presented herein do not reflect or assume grant funding.

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[2] Construction costs are referenced to an Engineering News Record Los Angeles Construction Cost Index of 8193 (January 2005).

## Cost Evaluations – North City Strategies

Reuse volumes, capital costs, unit costs, and rate effects for each phase of the three North City strategies are summarized below.

North City water reuse volumes are shown in **Table 7-3**, along with the total annual volume, in acre feet, of recycled water used for each strategy. There are three section headings: (1) "Incremental Use of New Projects" lists the amount of new recycled water added by new projects within a particular step; (2) "Cumulative Use of New Projects" lists the total volume of recycled water added by all of the new projects; and (3) "Cumulative Total Use of New and Existing Projects" lists the total volume of reuse of all the new and existing projects.

### Table 7-3
### North City Reuse Volumes (AFY)

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Use of New Projects*** | | | | |
| NC-1 | 3,820 | 2,110 | 1,120 | 3,190 |
| NC-2 | 3,820 | 2,110 | 1,800 | 870 |
| NC-3 | 3,820 | 10,500 | - | - |
| ***Cumulative Use of New Projects*** | | | | |
| NC-1 | 3,820 | 5,930 | 7,050 | 10,240 |
| NC-2 | 3,820 | 5,930 | 7,730 | 8,600 |
| NC-3 | 3,820 | 14,320 | - | - |
| ***Cumulative Total Use of New and Existing Projects*** | | | | |
| NC-1 | 13,260 | 15,370 | 16,490 | 19,680 |
| NC-2 | 13,260 | 15,370 | 17,170 | 18,040 |
| NC-3 | 13,260 | 23,760 | - | - |

Note: Refer to Figures 7-3 through 7-5 on preceding pages for components included in each step.

**Table 7-4** summarizes the capital costs for the new North City projects in 2005 dollars. There are two section headings: (1) "Incremental Cost of New Projects" lists the additional capital costs added by new projects within a particular step; and (2) "Cumulative Cost of New Projects" lists the total capital costs added by all of the new projects up to a given step.

**Table 7-4**
**North City Capital Costs**

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Costs of New Projects*** | | | | |
| NC-1 | $27,600,000 | $50,400,000 | $65,100,000 | $141,600,000 |
| NC-2 | $27,600,000 | $50,400,000 | $65,100,000 | $45,200,000 |
| NC-3 | $27,600,000 | $210,000,000 | - | - |
| ***Cumulative Costs of New Projects*** | | | | |
| NC-1 | $27,600,000 | $78,000,000 | $143,100,000 | $284,700,000 |
| NC-2 | $27,600,000 | $78,000,000 | $143,100,000 | $188,300,000 |
| NC-3 | $27,600,000 | $237,600,000 | - | - |

Unit costs for the new North City projects in dollars per acre-foot are summarized in **Table 7-5**, based on a 40-year term at 6-percent interest. There are two section headings: 1) "Incremental Unit Costs of New Projects" lists the individual unit costs of each new project addition; and 2) "Melded Unit Costs of New Projects" lists the weighted average or melded unit costs of all of the new projects up to a given step.

**Table 7-5**
**North City Unit Costs ($/AF)**

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Unit Costs of New Projects*** | | | | |
| NC-1 | $130 | $2,100 | $5,240 | $2,910 |
| NC-2 | $130 | $2,100 | $2,330 | $3,060 |
| NC-3 | $130 | $1,630 | - | - |
| ***Melded Unit Costs of New Projects*** | | | | |
| NC-1 | $130 | $830 | $1,530 | $1,960 |
| NC-2 | $130 | $830 | $1,180 | $1,370 |
| NC-3 | $130 | $1,230 | - | - |

**Table 7-6** presents the approximate increase to a typical monthly residential water bill that would be necessary to fund each strategy. There are two section headings: (1) "Incremental Effect of New Projects" lists the individual rate effect of each new project addition; and (2) "Cumulative Effect of New Projects" lists the cumulative or total rate effect of all of the new projects up to a given step.

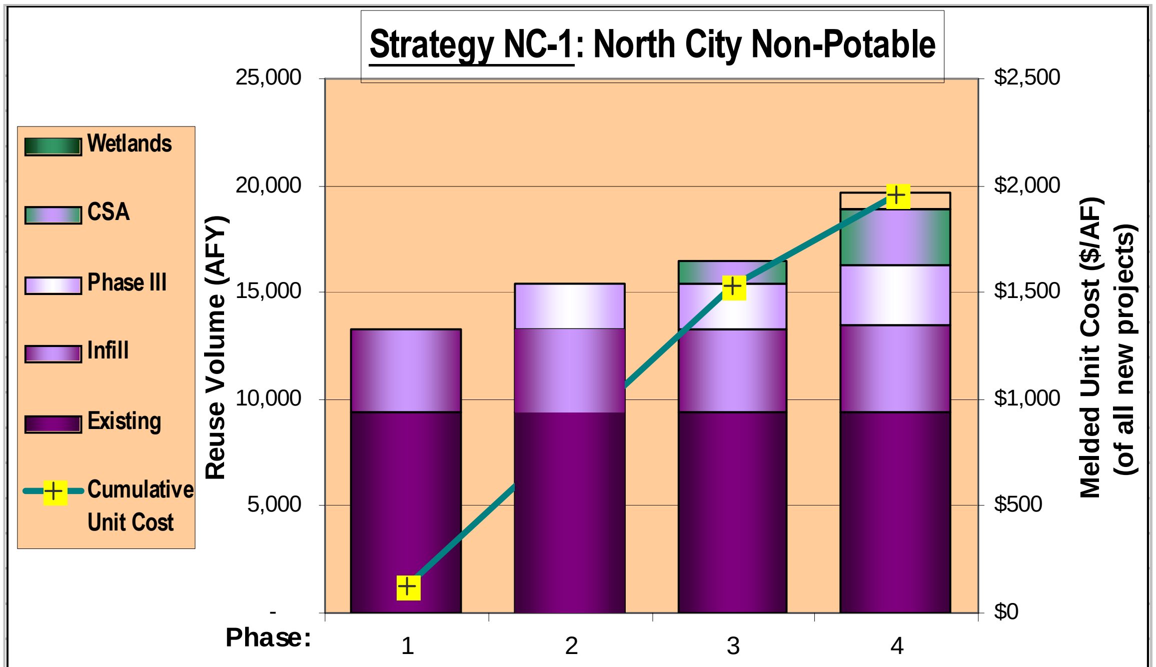
**Table 7-6**
**North City Estimated Monthly Rate Increase to Typical Residential Water Bill ($/mo)**

| Strategy | Step 1* | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Effect of New Projects*** | | | | |
| NC-1 | $0 | $0.53 | $0.83 | $1.20 |
| NC-2 | $0 | $0.53 | $0.52 | $0.35 |
| NC-3 | $0 | $1.85 | - | - |
| ***Cumulative Effect of New Projects*** | | | | |
| NC-1 | $0 | $0.31 | $1.13 | $2.34 |
| NC-2 | $0 | $0.31 | $0.82 | $1.17 |
| NC-3 | $0 | $1.63 | - | - |

* Increased revenue from new customers are projected to offset the cost for this step.

Volume and cost data specific to each strategy are also presented in **Figures 7-3, 7-4,** and **7-5** for strategies NC-1, NC-2, and NC-3, respectively. These cost charts provide a graphical representation of costs in relation to the steps and reuse volume of each strategy. In the graph, the columns represent the individual project opportunities in each strategy. The legend to the left of the columns identifies each project. The height of the column is the volume of reuse, measured on the left axis labeled "Reuse (AFY)". The graphed line overlapping the columns represents the cumulative unit cost per step, measured on the right axis labeled "Average Cost per AF (for new projects)."

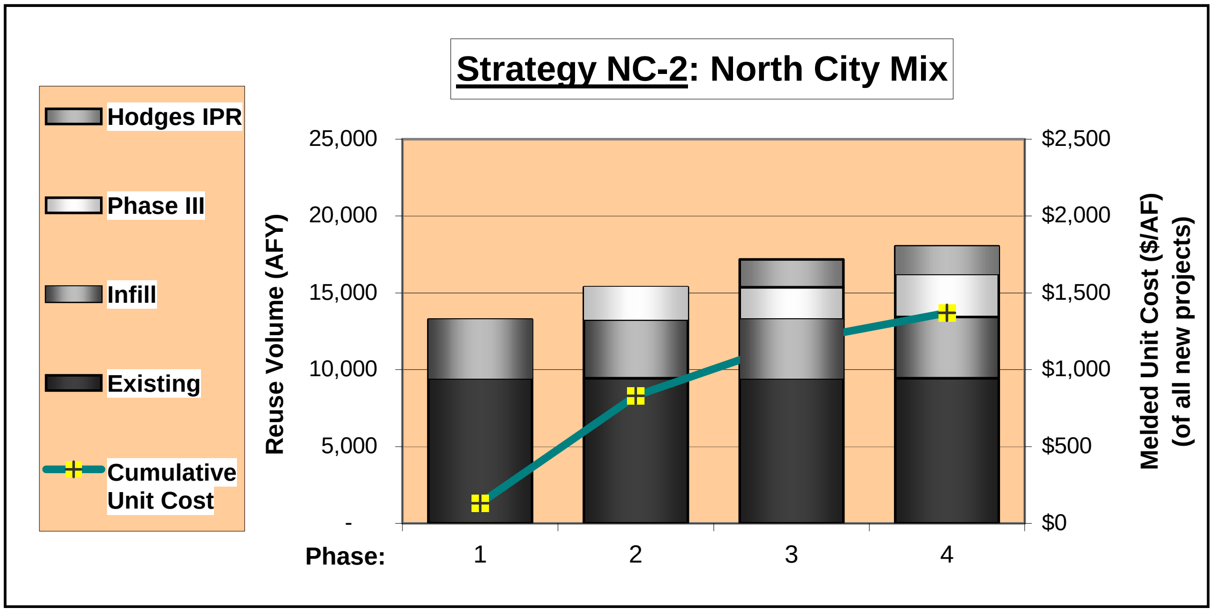
The tabular data below the graph includes reuse volumes, capital costs, unit costs, and the effect of the projects on a typical monthly residential water bill. The costs and the "new increment" reuse volumes shown in the supporting tables reflect new projects only, exclusive of existing projects such as the City's Phase I and Phase II North City distribution system expansions.




| Reuse Volume, by Phase: | | | | | w/ Seasonal Storage* |
|---|---|---|---|---|---|
| -- New Project Use (Increase by Phase) | (AFY) | 3,820 | 2,110 | 1,120 | 3,190 |
| | (MGD) | 3.4 | 1.9 | 1.0 | 2.8 |
| -- Total (Cumulative) (Including Existing) | (AFY) | 13,260 | 15,370 | 16,490 | 19,680 |
| | (MGD) | 11.8 | 13.7 | 14.7 | 17.6 |
| | | | | | |
| **Incremental Costs of Individual New Projects, by Phase:** | | | | | |
| -- Capital Cost | ($) | $27,600,000 | $50,400,000 | $65,100,000 | $141,600,000 |
| **-- Unit Cost** | **($/AF)** | **$130** | **$2,100** | **$5,240** | **$2,910** |
| -- Increase to Typical Residential Water Bill | ($/mo) | $0.00 | $0.31 | $0.83 | $1.20 |
| | | | | | |
| **Cumulative Costs of All New Projects, by Phase:** | | | | | |
| -- Capital Cost | ($) | $27,600,000 | $78,000,000 | $143,100,000 | $284,700,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$130** | **$830** | **$1,530** | **$1,960** |
| -- Increase to Typical Residential Water Bill | ($/mo) | $0.00 | $0.31 | $1.13 | $2.34 |

**Figure 7-15 – Volume and Cost Summary for Strategy NC-1**

* As NCWRP inflow volume increases over time, reuse volume will correspondingly increase.



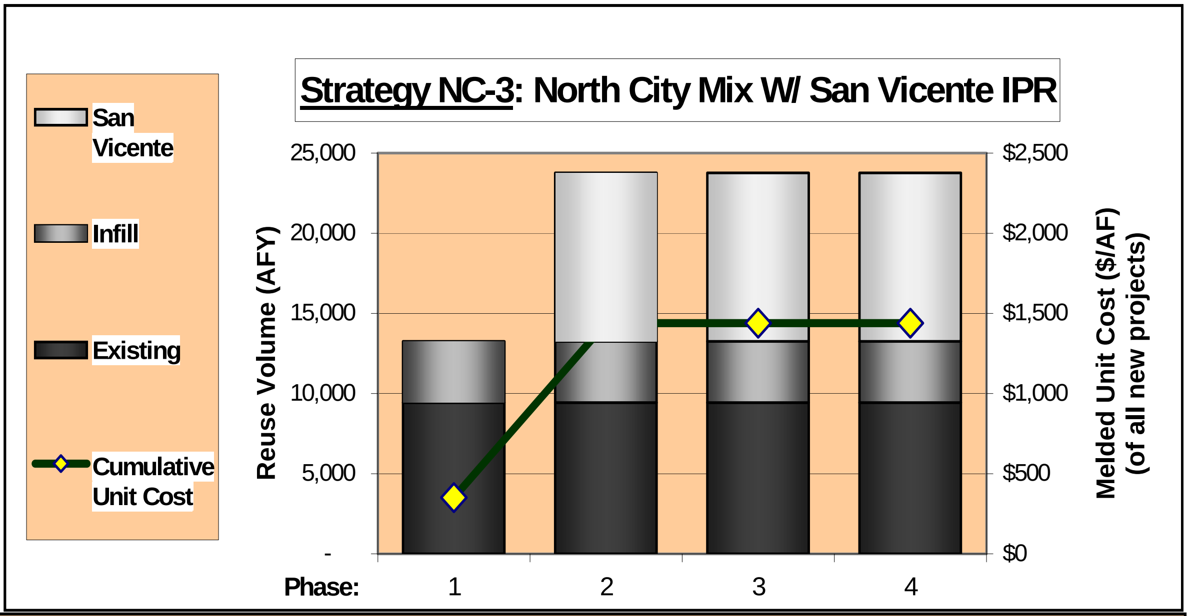

| Reuse Volume, by Phase: | | | | | w/ Seasonal Storage* |
|---|---|---|---|---|---|
| -- New Project Use (Increase by Phase) | (AFY) | 3,820 | 2,110 | 1,800 | 870 |
| | (MGD) | 3.4 | 1.9 | 1.6 | 0.8 |
| -- Total (Cumulative) (Including Existing) | (AFY) | 13,260 | 15,370 | 17,170 | 18,040 |
| | (MGD) | 11.8 | 13.7 | 15.3 | 16.1 |

| Incremental Costs of Individual New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $27,600,000 | $50,400,000 | $65,100,000 | $45,200,000 |
| **-- Unit Cost** | **($/AF)** | **$130** | **$2,100** | **$2,330** | **$3,060** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.00 | $0.31 | $0.52 | $0.35 |

| Cumulative Costs of All New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $27,600,000 | $78,000,000 | $143,100,000 | $188,300,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$130** | **$830** | **$1,180** | **$1,370** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.00 | $0.31 | $0.82 | $1.17 |

**Figure 7-16 – Volume and Cost Summary for Strategy NC-2**

* As NCWRP inflow volume increases over time, reuse volume will correspondingly increase.




| Reuse Volume, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- New Project Use (Increase by Phase) | (AFY) | 3,820 | 10,500 | 0 | 0 |
| | (MGD) | 3.4 | 9.4 | 0.0 | 0.0 |
| -- Total (Cumulative) (Including Existing) | (AFY) | 13,260 | 23,760 | 23,760 | 23,760 |
| | (MGD) | 11.8 | 21.2 | 21.2 | 21.2 |

| Incremental Costs of Individual New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $27,600,000 | $210,000,000 | - | - |
| **-- Unit Cost** | **($/AF)** | **$130** | **$1,630** | **-** | **-** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.00 | $1.63 | - | - |

| Cumulative Costs of All New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $27,600,000 | $237,600,000 | $237,600,000 | $237,600,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$130** | **$1,230** | **$1,230** | **$1,230** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.00 | $1.63 | $1.63 | $1.63 |

**Figure 7-17 – Volume and Cost Summary for Strategy NC-3**

* As NCWRP inflow volume increases over time, reuse volume will correspondingly increase.

## Cost Evaluations – South Bay Strategies

Reuse volumes, capital costs, unit costs, and rate effects for each step of the three South Bay strategies are summarized below.

South Bay water reuse volumes are shown in **Table 7-7**, along with the total annual volume, in acre-feet, of recycled water that is used for each strategy. There are three section headings: (1) "Incremental Use of New Projects" lists the amount of new recycled water added by new projects within a particular step; (2) "Cumulative Use of New Projects" lists the total volume of recycled water added by all of the new projects; and (3) "Cumulative Total Use of New and Existing Projects" lists the total volume of reuse of all the new and existing projects.

### Table 7-7
### South Bay Reuse Volumes (AFY)

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Use of New Projects*** | | | | |
| SB-1 | 0 | 2,860 | 4,990 | 450 |
| SB-2 | 1,800 | 1,260 | 710 | 450 |
| SB-3 | 0 | 6,760 | 710 | 450 |
| ***Cumulative Use of New Projects*** | | | | |
| SB-1 | 0 | 1,600 | 5,880 | - |
| SB-2 | 1,800 | 1,800 | 1,800 | - |
| SB-3 | 0 | 5,500 | 5,500 | - |
| ***Cumulative Total Use of New and Existing Projects (Including OWD)*** | | | | |
| SB-1 | 4,740 | 7,600 | 12,590 | 13,040 |
| SB-2 | 6,540 | 7,800 | 8,510 | 8,960 |
| SB-3 | 4,740 | 11,500 | 12,210 | 12,660 |

**Table 7-8** summarizes the capital costs of the new South Bay projects in 2005 dollars. There are two section headings: (1) "Incremental Cost of New Projects" lists the additional capital costs added by new projects within a particular step; and (2) "Cumulative Cost of New Projects" lists the total capital costs added by all of the new projects up to a given step.

### Table 7-8
### South Bay Capital Costs

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Costs of New Projects*** | | | | |
| SB-1* | $0 | $1,000,000 | - | - |
| SB-2 | $21,600,000 | - | - | - |
| SB-3 | $0 | $96,100,000 | - | - |
| ***Cumulative Costs of New Projects*** | | | | |
| SB-1* | $0 | $1,000,000 | - | - |
| SB-2 | $21,600,000 | - | - | - |
| SB-3 | $0 | $96,100,000 | - | - |

* Increased revenue from new customers are projected to offset the cost for this step.

Unit costs of the new South Bay projects in dollars per acre-foot are summarized in **Table 7-9**, based on a 40 year term at 6-percent interest. There are two section headings: (1) "Incremental Unit Costs of New Projects" lists the individual unit costs of each new project addition; and (2) "Melded Unit Costs of New Projects" lists the weighted average or melded unit costs of all of the new projects up to a given step.

### Table 7-9
### South Bay Unit Costs ($/AF)

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Unit Costs of New Projects*** | | | | |
| SB-1* | $0 | $50 | - | - |
| SB-2 | $1,330 | - | - | - |
| SB-3 | $0 | $1,530 | - | - |
| ***Melded Unit Costs of New Projects*** | | | | |
| SB-1* | $0 | $70 | - | - |
| SB-2 | $1,330 | - | - | - |
| SB-3 | $0 | $1,530 | - | - |

Note: Refer to Figure 7-6 through 7-8 on succeeding pages for components included in each step.
* Increased revenue from new customers are projected to offset the cost for this step.

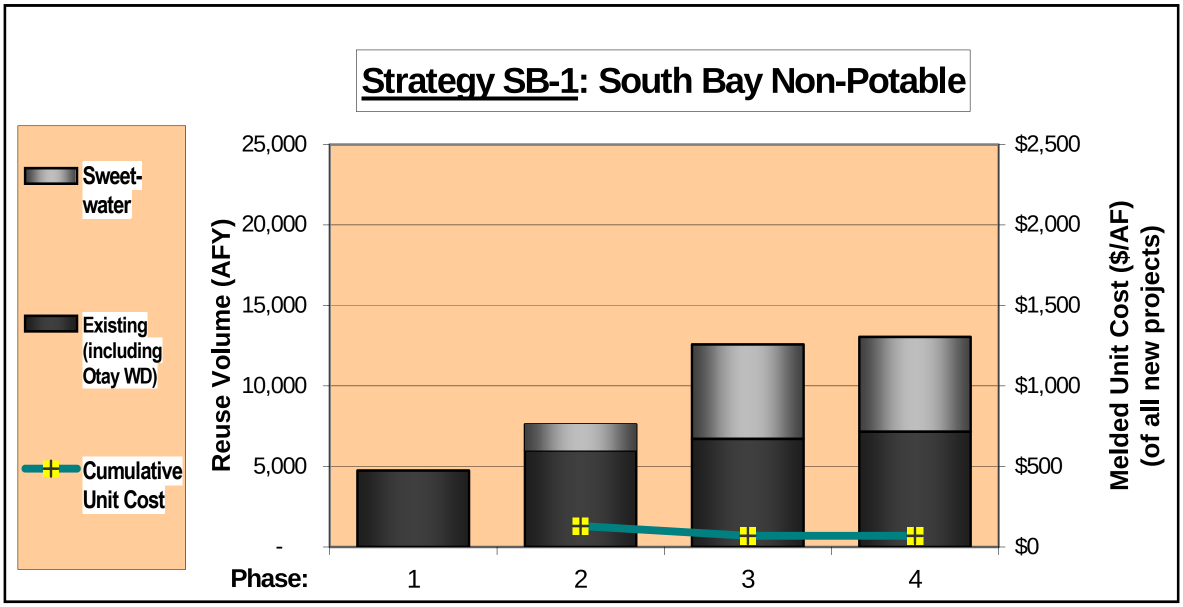
**Table 7-10** presents the projected increase to a typical monthly residential water bill that would be necessary to fund each strategy. There are two section headings: (1) "Incremental Effect of New Projects" lists the individual rate effect of each new project addition; and (2) "Cumulative Effect of New Projects" lists the cumulative or total rate effect of all of the new projects up to a given step.

**Table 7-10**
**South Bay Estimated Monthly Rate Increase to Typical Residential Water Bill ($/mo)**

| Strategy | Step 1 | Step 2 | Step 3 | Step 4 |
|---|---|---|---|---|
| ***Incremental Effect of New Projects*** | | | | |
| SB-1 | $0.00 | $0.00 | - | - |
| SB-2 | $0.23 | - | - | - |
| SB-3 | $0.00 | $0.89 | - | - |
| ***Cumulative Effect of New Projects*** | | | | |
| SB-1 | $0.00 | $0.00 | - | - |
| SB-2 | $0.23 | - | - | - |
| SB-3 | $0.00 | $0.89 | - | - |

Volume and cost data specific to each strategy are also presented in **Figures 7-6, 7-7,** and **7-8** for strategies SB-1, SB-2, and SB-3, respectively. These cost charts provide a graphical representation of costs in relation to the steps and reuse volume of each strategy. In the graph, the columns represent the individual project opportunities in each strategy. The legend to the left of the columns identifies each project. The height of the column is the volume of reuse, measured on the left axis labeled "Reuse (AFY)". The graphed line overlapping the columns represents the cumulative unit cost per step, measured on the right axis labeled "Average Cost per AF (for new projects)."

The tabular data below the graph includes reuse volumes, capital costs, unit costs, and the effect of the projects on a typical monthly residential water bill. The costs and the "new increment" reuse volumes shown in the supporting tables reflect new projects only, exclusive of existing projects such as sales to the OWD.



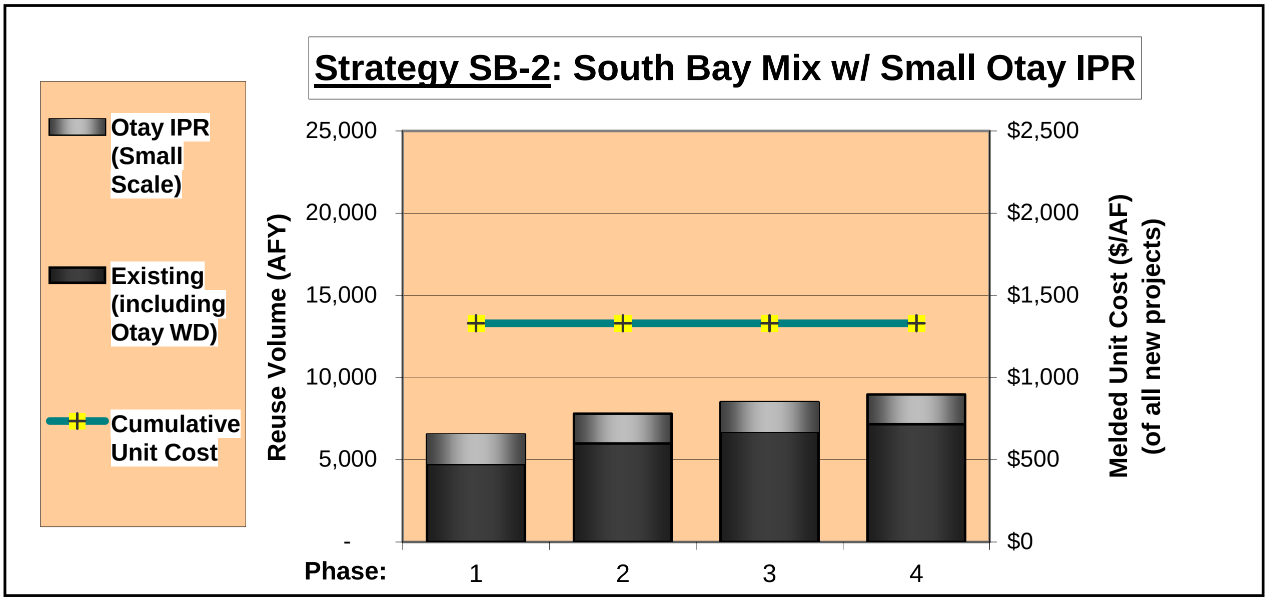

| Reuse Volume, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- New Project Use (Increase by Phase) | (AFY) | 0 | 2,860 | 4,990 | 450 |
| | (MGD) | 0.0 | 2.6 | 4.5 | 0.4 |
| -- Total Use (Cumulative) (Including Existing) | (AFY) | 4,740 | 7,600 | 12,590 | 13,040 |
| | (MGD) | 4.2 | 6.8 | 11.2 | 11.6 |

| Incremental Costs of Individual New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $0 | $1,000,000 | $0 | - |
| **-- Unit Cost** | **($/AF)** | **$0** | **$130** | **$50** | **-** |
| -- Increase to Typical Residential Water Bill | ($/mo) | $0.00 | $0.00 | $0.00 | - |

| Cumulative Costs of All New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $0 | $1,000,000 | $1,000,000 | $1,000,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$0** | **$130** | **$70** | **$70** |
| -- Increase to Typical Residential Water Bill | ($/mo) | $0.00 | $0.00 | $0.00 | $0.00 |

**Figure 7-18 – Volume and Cost Summary for Strategy SB-1**

* As SBWRP inflow volume increases over time, reuse volume will correspondingly increase.



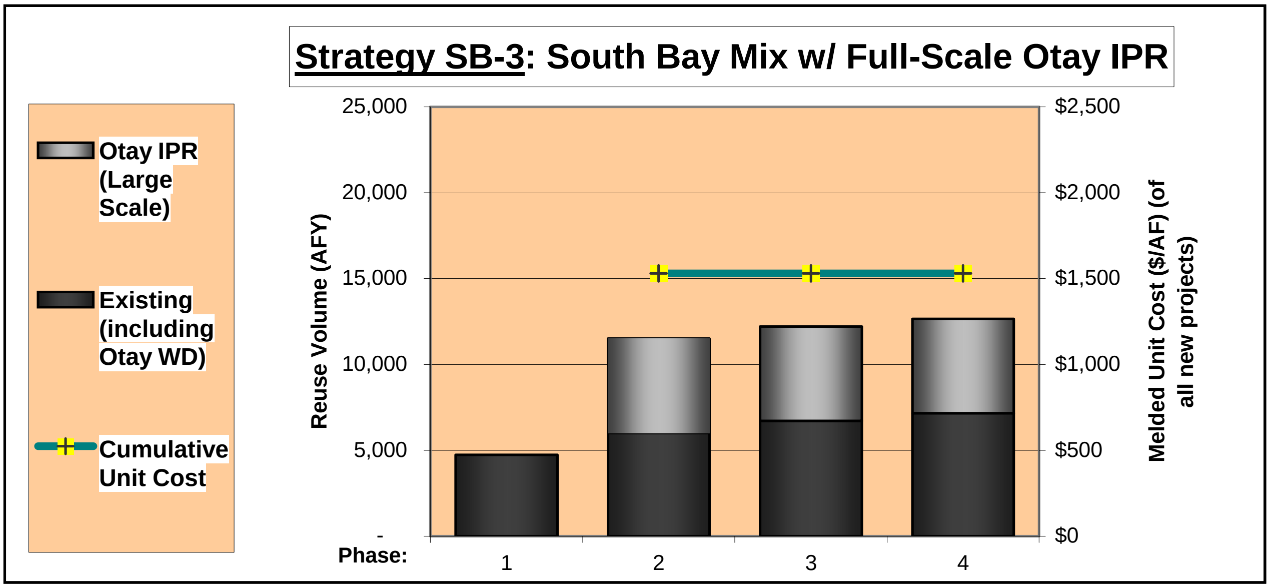

| Reuse Volume, by Phase: | | | | | |
|---|---|---|---|---|---|
| **-- New Project Use (Increase by Phase)** | **(AFY)** | **1,800** | **1,260** | **710** | **450** |
| | **(MGD)** | **1.6** | **1.1** | **0.6** | **0.4** |
| **-- Total (Cumulative) (Including Existing)** | **(AFY)** | **6,540** | **7,800** | **8,510** | **8,960** |
| | **(MGD)** | **5.8** | **7.0** | **7.6** | **8.0** |

| Incremental Costs of Individual New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $21,600,000 | - | - | - |
| **-- Unit Cost** | **($/AF)** | **$1,330** | - | - | - |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.23 | - | - | - |

| Cumulative Costs of All New Projects, by Phase: | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $21,600,000 | $21,600,000 | $21,600,000 | $21,600,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$1,330** | **$1,330** | **$1,330** | **$1,330** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.23 | $0.23 | $0.23 | $0.23 |

**Figure 7-19 – Volume and Cost Summary for Strategy SB-2**

* As SBWRP inflow volume increases over time, reuse volume will correspondingly increase.




| **Reuse Volume, by Phase:** | | | | | |
|---|---|---|---|---|---|
| **-- New Project Use (Increase by Phase)** | **(AFY)** | **0** | **6,760** | **710** | **450** |
| | **(MGD)** | **0.0** | **6.0** | **0.6** | **0.4** |
| **-- Total (Cumulative) (Including Existing)** | **(AFY)** | **4,740** | **11,500** | **12,210** | **12,660** |
| | **(MGD)** | **4.2** | **10.3** | **10.9** | **11.3** |

| **Incremental Costs of Individual New Projects, by Phase:** | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $0 | $96,100,000 | - | - |
| **-- Unit Cost** | **($/AF)** | **$0** | **$1,530** | - | - |
| -- Increase to Typical | | | | | |
| Residential Water Bill | **($/mo)** | $0.00 | $0.89 | - | - |

| **Cumulative Costs of All New Projects, by Phase:** | | | | | |
|---|---|---|---|---|---|
| -- Capital Cost | ($) | $0 | $96,100,000 | $96,100,000 | $96,100,000 |
| **-- Unit Cost (Melded)** | **($/AF)** | **$0** | **$1,530** | **$1,530** | **$1,530** |
| -- Increase to Typical Residential Water Bill | **($/mo)** | $0.00 | $0.89 | $0.89 | $0.89 |

**Figure 7-20 – Volume and Cost Summary for Strategy SB-3**

* As SBWRP inflow volume increases over time, reuse volume will correspondingly increase.

### Incentive Credits and Avoided Costs

The actual cost of each alternative implementation strategy to the City will likely be, in most cases, less than the straight sum of the component project capital and operating costs. Two factors that could contribute to this cost reduction are:

- **Incentive Credits:** The first factor that could reduce the City's cost is the availability of incentive credits for water reuse projects. These monetary credits are provided by the MWD and the Water Authority as a means of promoting the development of water reuse and other alternative local water supply projects.

- **Avoided Costs:** The second factor that could reduce the City's cost for water reuse projects is the potential for these projects to offset other water and wastewater capital and operating costs that the City would otherwise incur. Economists call such cost offsets avoided costs. Avoided costs can be credited to the cost of the water reuse project, reducing its effective cost to the City as a whole. Some avoided costs are ***direct*** cost offsets, in that they place real dollars in the City's accounts concurrent with the operation of the project. Other avoided costs are ***indirect*** cost offsets, in that they avoid or lessen the need for some possible future project, or provide other benefits that do not directly put real dollars in the City's accounts.

Reuse credits and avoided costs are summarized in **Tables 7-11** and **7-12**. **Table 7-11** describes each credit or avoided cost factor, and **Table 7-12** summarizes the net dollar effect for each of several categories of projects. These credits and avoided costs are factored into the unit cost and rate effect data presented in the previous cost tables and figures.

## Table 7-11
## Summary of Reuse Incentive Credits and Avoided Costs

| Cost Component | Description | Dollar Amount | Direct or Indirect? |
|---|---|---|---|
| **Incentive Credits:** | | | |
| 1. Water Authority Credit | Financial incentive program by Water Authority. Designed to encourage development of reuse projects. | **$100/AF savings**, all projects | Direct |
| 2. MWDSC Credit | Financial incentive program by the MWD. Credit amount is per the City's agreement with Metropolitan. | **$250/AF savings**, all projects except wetlands and sales to other agencies | Direct |
| **Avoided Facility Operating and Capital Costs:** | | | |
| 3. Avoided Wastewater Operating Costs | The NCWRP reduces the plant's discharges to Point Loma, saving operations costs to and through Point Loma.<br>No similar savings accrue at the SBWRP because the facility has its own ocean outfall. | **$60/AF savings**, all North City projects | Direct |
| 4. Incurred Wastewater Operating Costs | To produce recycled water, the City incurs additional operating costs to operate the tertiary filters at both the NCWRP and SBWRP, and also the demineralization facility at the NCWRP. The latter does not apply for reservoir augmentation projects. | **$100/AF cost**, all North City except reservoir augmentation (IPR)<br>**$50/AF cost**, all other | Direct |
| 5. Avoided Wastewater Capital Costs | At the NCWRP, recycled water put to beneficial use reduces the wastewater inflow to Point Loma. However, this does not offset any capital costs because the City is required to maintain full wet-weather backup flow disposal capacity to convey NCWRP flows to Point Loma.<br>At the SBWRP, recycled water reduces the flow of treated wastewater out the ocean outfall, but does not offset any capital costs. | **$0/AF savings,** all projects | Indirect |
| 6. Avoided Water Treatment Plant Capital Costs | Some projects may offset the need for the City to expand its water treatment plants, or may allow existing plants to treat a higher percentage of the City's total potable supply. Eligible projects are all types except wetlands creation, which does not offset a potable water demand, and reservoir augmentation, which does not reduce water treatment plant capacity requirements.<br>At the NCWRP, existing and planned summertime uses already utilize approximately 18 MGD of the plant's 24 MGD capacity. Thus the potential treatment plant cost offset for new projects is limited to the remaining 6 MGD of capacity. At the SBWRP, all of the contemplated new uses are either uses outside the City, or are Reservoir Augmentation projects, and do not offset any City treatment plant costs.<br>Based on the City's actual costs to expand the Miramar Filtration Plant ($167,000,000 for 75 MGD), the City values treatment capacity at approximately $2,200,000 per MGD. | **$2,200,000 savings per MGD of summertime use**, first 6 MGD of additional qualifying North City summertime use | Indirect |
| 7. IPR Water Quality Benefit | IPR projects will produce water that has a lower TDS concentration than existing imported water supplies. This reduction assists the City with water reclamation efforts and groundwater management efforts by reducing the need for expensive demineralization processes, and benefits the City's customers by extending the life of water heaters and other household fixtures.<br>The value of this benefit has been estimated based on data from the 1999 Salinity Management Study (MWD, U.S. Bureau of Reclamation). The analysis assumes that IPR projects will produce water with a TDS approximately 400 mg/L less than imported water. | **$200/AF savings**, All IPR projects | Indirect |

**Table 7-12**
**Summary of Cost Credits by Category of Reuse**

| | | Types and Locations of Reuse ($/AF) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Recycled Supply from NCWRP | | | | Recycled Supply from SBWRP | | |
| Cost Component | Direct / Indirect | Title 22 (except wetlands) | Wetlands | Reservoir IPR | Ground-water IPR | Title 22 | Sale to others (Title 22) | Reservoir IPR |
| 1. SDCWA Credit | Direct | $100 | -- | $100 | $100 | $100 | -- | $100 |
| 2. MWDSC Credit | Direct | $250 | -- | $250 | $250 | $250 | -- | $250 |
| 3. Avoided Wastewater Operating Costs | Direct | $60 | $60 | $60 | $60 | -- | -- | -- |
| 4. Incurred Wastewater Operating Costs | Direct | ($100) | ($100) | ($50) | ($100) | ($50) | ($50) | ($50) |
| 5. Avoided Wastewater Capital Costs | Indirect | -- | -- | -- | -- | -- | -- | -- |
| 6. Avoided Water Treatment Plant Capital Costs | Indirect | $13 M capital credit to first 6 MGD of new reuse | -- | -- | -- | -- | -- | -- |
| 7. IPR Water Quality Benefit | Indirect | -- | -- | $200 | $200 | -- | -- | $200 |
| TOTALS – DIRECT: | | $310 | ($40) | $360 | $310 | $300 | $(50) | $300 |
| TOTALS – INDIRECT: | | See No. 6 credit | -- | $200 | $200 | -- | -- | $200 |

## Cost Considerations Regarding Supplemental Water or Seasonal Storage to Meet Peak Summer Demands

*To meet peak summer demands, some strategies require either supplemental purchases of imported water, or seasonal storage. These are factored into the summary cost tables earlier in this section.*

In some of the strategies, the summertime peak demand for recycled water exceeds the recycled water production capacity of the corresponding water reclamation plant. When this peak demand occurs, the cost tables and figures presented earlier in this section include the costs for the City to do one of two things:

**Supplement:** One option is to supplement the recycled water supply with purchased imported water. This option does not maximize the volume of water reused, but is generally less expensive than providing seasonal storage, even after accounting for water purchases as an operating cost of the strategy.

**Seasonal Storage:** The other option is to provide seasonal storage. This option maximizes the volume of water reused, but is generally more expensive than supplementing with imported water.

Because of the high cost of seasonal storage, that option has been deferred until the last steps of the implementation strategies. Should less expensive seasonal storage opportunities become available to the City, or should summer peak demands turn out to be different than forecasted, the City could re-evaluate this decision. The cost tables and figures presented earlier in this section include the costs for supplemental water purchases or seasonal storage as required.

### Comparison of Water Reuse Project Costs with Other Sources of New Water

One of the main benefits of developing additional uses of recycled water is that these uses help to reduce the City's need to purchase imported water or to develop other water supplies to meet its growing demands. Every acre-foot of beneficially used recycled water is an acre-foot of imported water that the City does not need to purchase. Other water supplies include imported water, seawater desalination and water transfers.

The City purchases imported water from the Water Authority, which in turn purchases a majority of its water from the MWD. The Water Authority's current treated water rates are $526 for treated municipal and industrial (M&I) water, consisting of a $431/AF MWD cost of supply, and a $95/AF Water Authority charge. Untreated M&I water rates are $444/AF, consisting of the $349/AF MWD untreated rate, and a $95/AF Water Authority charge.

The City mostly purchases untreated water, at a current price of $444/AF, and treats this water at its own treatment plants prior to distribution to customers. Accounting for costs to operate the treatment plant, the City's current average cost to purchase and treat water is approximately **$500/AF**.

*The City's current average cost to purchase and treat water is approximately $500/AF.*

In their efforts to serve increasing demands, both the Water Authority and MWD are pursuing new sources of supply, including seawater desalination and water transfers. These new supplies are often more expensive than existing supplies, and as such may represent the true marginal cost of water, and the more appropriate point of comparison for water reuse costs.

**Seawater Desalination:** Continued improvements in desalination technology have lowered costs to the point that many water agencies up and down the coast of California are evaluating seawater desalination projects as a possible means of supplementing their water supplies. Locally, the Water Authority is continuing to investigate the possibility of building a 50 MGD or larger seawater desalination facility at the Cabrillo power plant in Carlsbad. This proposed facility can be used as a basis for estimating the unit costs of desalination.

The Carlsbad project, as currently proposed, would involve the construction and operation of a desalination plant by a private developer. In 2003, the developer offered to sell water from the proposed plant to the Water Authority for a set price of slightly less than $800/AF, exclusive of conveyance, and with the price indexed to several factors, (including power costs) to provide mechanisms for escalation. Since that time, the Water Authority and the plant developer have had difficulty agreeing on the actual terms of the agreement, and the project remains in the negotiating stage. Accounting for construction price inflation over the past two years, and accounting for the negotiating difficulties encountered to date, it is reasonable to assume that the 2005 price for a project agreement

*A reasonable comparative cost for seawater desalination in San Diego County is approximately $1,400/AF.*

acceptable to both the developer and the Water Authority will be approximately $1,000 to $1,100/AF, exclusive of conveyance. Based on capital and operating cost numbers reported by the Water Authority in their preliminary analysis of project conveyance facilities, the unit cost of conveying this water back to the Water Authority aqueduct system would be approximately $300 to $400/AF. Combining the average estimates for treatment and conveyance, a reasonable comparative cost for seawater desalination in San Diego County is approximately **$1,400/AF**. This figure does not include any incentives, grants or credits.

**Water Transfers:** In 2003, the Water Authority completed its efforts to secure a long-term water transfer agreement with the IID. The agreement provides for IID to transfer 200,000 AFY of water to the Water Authority, starting with 20,000 AF in 2004 and ramping up to the full 200,000 AF over the course of approximately ten years. As part of the overall package of implementing agreements, the Water Authority also obtained rights to approximately 77,000 AFY of water that will be conserved by the lining of the All American and Coachella Canals. The Water Authority estimates that its current cost of transferred water, before treatment, is $534/AF. The Water Authority is also incurring related project costs for mitigation of project environmental and socioeconomic effects in the Imperial Valley. In addition, over the long-term the Water Authority will incur additional costs to provide the transmission capacity to deliver this water to San Diego County. Finally, the City will incur additional costs to treat this water at one of the City's water treatment plants Accounting for these additional project costs, the Study suggests that a reasonable comparative cost for water transfers in San Diego County is approximately **$800/AF**.

*A reasonable comparative cost for water transfer costs is approximately $800/AF.*

## 7.6 Evaluation Summary

The principal findings from the preceding evaluations of the six strategy alternatives are as follows:

1. **All of the presented alternatives are feasible.** For both the North City and South Bay systems, there is a range of reuse strategies that are feasible from an engineering, scientific, and regulatory perspective. For the IPR strategies, public acceptance will depend on the City's commitment and ability to garner public support through an extensive public involvement program.

2. **The City faces choices between non-potable and indirect-potable uses.** The strategies differ in their type of use, specifically, between those that exclusively pursue non-potable uses and those that include IPR. In deciding which strategies to pursue, the City will need to weigh the merits of each type of use.

3. **The City faces choices in deciding how far to pursue a selected strategy.** Within each strategy, there are implementation steps that add new units of use, usually at progressively higher and higher incremental costs. In deciding how far along each strategy to advance, the City will need to weigh these costs with water supply reliability, sustainability, and other values suggested in the preface of this report.

4. **Specific North City strategy findings include:**

   - **NC-1** has the lowest initial capital cost and lowest unit cost of all North City strategies through the second step of the strategy. However, if the desire is to fully maximize use of the available recycled water supply, subsequent steps have higher unit costs and make this alternative comparatively more expensive. This strategy appears to be the appropriate choice if the driving decision factors are to minimize initial capital outlays and to commit to a non-potable reuse approach.
   - **NC-2** includes the opportunity to switch from non-potable to IPR. This strategy appears to be the appropriate choice if the driving decision factor is to minimize initial expenditures, while still having the ability to accomplish an IPR project.
   - **NC-3** maximizes the available North City water supply in one step through IPR. For a strategy that fully maximizes use of the available recycled water supply, it provides the lowest overall unit cost. However, this strategy has the highest initial capital costs. This strategy appears to be the appropriate choice if the driving decision factors are to maximize recycled water use and have the lowest ultimate unit cost.

5. **Specific South Bay strategy findings include:**

   - **SB-1** has the lowest initial capital cost and lowest unit cost of all South Bay strategies. This strategy appears to be the appropriate choice if the driving decision factor is to minimize expenditures, even if the use occurs outside City service areas.
   - **SB-2** includes a mix of non-potable uses and a small-scale IPR project. This strategy appears to be an appropriate choice either if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.
   - **SB-3** includes a mix of non-potable uses and a large-scale IPR project. This strategy appears to be an appropriate choice either if the driving decision factor is to retain use of the South Bay recycled water within the City, or if the projected non-potable uses envisioned in strategy SB-1 do not come to fruition.

## 7.7 Next Steps

This Study simply assesses the advantages, constraints, and values of the different water reuse opportunities available to the City. The Study does not seek to recommend a specific strategy.

This report was reviewed by the Assembly and the IAP. Both of these groups have issued written statements commenting on the Study's analysis and findings, and are included as Appendices B, C and E.

This report was presented to the PUAC on August 21st, 2005; their resolution has been included as Appendix D. The Study will be presented to the City's Natural Resources and Culture Committee and subsequently to Council for their consideration and direction as to the City's future course of water reuse development.

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