SOUTHERN NEVADA WATER AUTHORITY

2006 COST ESTIMATING GUIDE
For
CAPITAL PROJECTS

JANUARY, 2006

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1. INTRODUCTION

1.1 Background

A Treatment and Transmission Facility Cost Estimating Criteria document (1994 Guide), dated August 31, 1994, was prepared for the Southern Nevada Water Authority (SNWA). The cost estimating criteria were developed from comments by the Colorado River Commission, Carollo/Black & Veatch, and the Las Vegas Valley Water District. The cost estimating criteria were intended as a method to develop consistent rough order of magnitude estimates as the project developed. The 1994 Guide is outdated and does not include all of the facility components for future projects.

SNWA is now identifying additional projects throughout Clark County and in Lincoln County, and White Pine counties. This 2006 Cost Estimating Guide for Capital Projects (2006 Guide) updates and expands the 1994 Guide. **Cost curves, formulas, and table costs were developed based on January 2005 costs and must be increased by 5% to reflect January 2006 costs.**

1.2 Objective

The objective of this 2006 Guide is to develop a consistent cost estimating methodology for project facilities. Project components in this 2006 Guide include:

1. Water pipelines ranging from 8 inches in diameter to 114 inches in diameter
2. Water reservoirs from 0.5 to 10 million gallons
3. Water wells from 1,000 to 2,000 feet deep
4. Pumping stations from 400 hp to 60,000 horsepower
5. Water treatment for arsenic removal, fluoride addition, and disinfection
6. Tunneling for pipelines, power transmission lines, hydroelectric plants, land, environmental restoration, and other miscellaneous elements.

The 2006 Guide uses a methodology similar to the 1994 Guide, thus ensuring that all the different elements are priced using the same cost basis. Project costs may be developed for capital, administrative, operations and maintenance, and contingency costs. Guidelines for developing each of these costs are presented in the next sections of this document.

2. FACILITY CAPITAL COSTS

2.1 Basis of Cost Estimating

Either unit cost curves or cost tables were developed for facilities. These curves and tables should only be used to estimate the project alternatives for conceptual facilities with an accuracy range from +50% to –30%. As project alternatives are further refined, more detailed cost estimating criteria must be developed to more accurately determine project costs. Unit cost curves were formed by developing an equation derived from the regression of the construction data collected. Cost tables were developed using construction data. Those data were from SNWA and water facility projects in Nevada, Arizona, Colorado, and Southern California derived from recent construction costs for similar facilities between 1995 and 2003. The data was consistently escalated to January 2005, adjusted to the Nevada marketplace, representative of the past five years, and adjusted to a mean value. An allowance of 20% to 50% was added to these costs to account for project variables. For example, the pipeline pressure class may not be known nor the availability or type of pipeline bedding. For pumping stations, the type of pumps may not be known nor whether the pumping station is buried or partially buried.

Table 2-1 summarizes the major facility costs presented in this 2006 Guide. **Note that these formulas reflect January 2005 costs and must be increased by 5% to reflect January 2006 costs.**

Table 2-1. Summary of Cost Estimating Criteria [1]

Water pipelines more than 24 inches diameter	See Figure 2-1A
Water pipelines less than or equal to 24 inches diameter	$/LF= 9.6 x D + 5
Water Reservoirs	$/Gal = 1.42 x V ^ $^{-.3}$
Water Wells	$/Well = 162 x PD + 1,066,000
Water Pumping Stations	See Figure 2.4
Bulk Purchased Sodium Hypochlorite	$/Gallon/day = .913 x C ^ $^{C-.85}$
Fluorososilicic Acid Treatment	$/Gallon/day = 1.03 x C^ $^{C-.97}$
Tunnels	See Para. 2.7
Power Transmission and Distribution System	See Para. 2.8
Hydroelectric Plants	$=(1,800+5.3*Q+0.08*Q^^{2})1000
Rate of Flow Control Stations	See Para 2.10
Maintenance Roads	
Two lane asphalt maintenance road (26 ft wide)	$ 900,000/mile
Gravel Service Road (12 ft wide)	$ 360,000/mile
Bridge (two lane maximum)	$ 2,520/LF
Rural Private Land Acquisition	$15,000/Acre+
Las Vegas Valley Private Land Acquisition	3-5% of Construction Cost
Buildings	$ 220/sq. ft

[1] Cost criteria are based on actual construction cost of facilities for the Southern Nevada area, and do not consider SNWA administration costs, program management costs, legal services, financial costs, engineering, construction management, environmental costs, and other non construction direct costs. Escalate costs by 5% to bring costs to January 2006. Use the escalation factors in Section 4 for cost beyond January 2006.

2.2 Pipeline Unit Cost

For pipelines with diameters greater than 24 inches, the pipeline unit cost curve was generated using actual construction costs from 31 random projects in Nevada with bid dates from 1995 to 2003 for pipelines ranging from 30 inches to 108 inches in diameter. The construction cost represents the construction cost plus an allowance of from 20% to 45%, depending on the pipe sizes. The allowance increased with the size of pipe.

Pipeline materials included:

1. Mortar lined and coal tar coated steel
2. Mortar lined and tape coated steel
3. Mortar lined and mortar coated steel

The pipeline installation conditions included:

1. Hard digging
2. Normal alluvial deposit trenching
3. Micro tunneling (boring and jacking under roadway crossings)

The 1994 Guide included pipeline diameters ranging from 24 inches to 108 inches with an average trench depth of 16 feet. The pipeline pressure class ranged from 150 to 450 psig, with most of the data points in the 200-psig pressure class rating. The new historical data assumes the same pipeline categorization for this study. Projects may require a deeper or shallower trench depth and therefore the final cost must be adjusted to reflect that. See FEG, Volume 1, Section 4.1 for adjusting the cost for surface conditions.

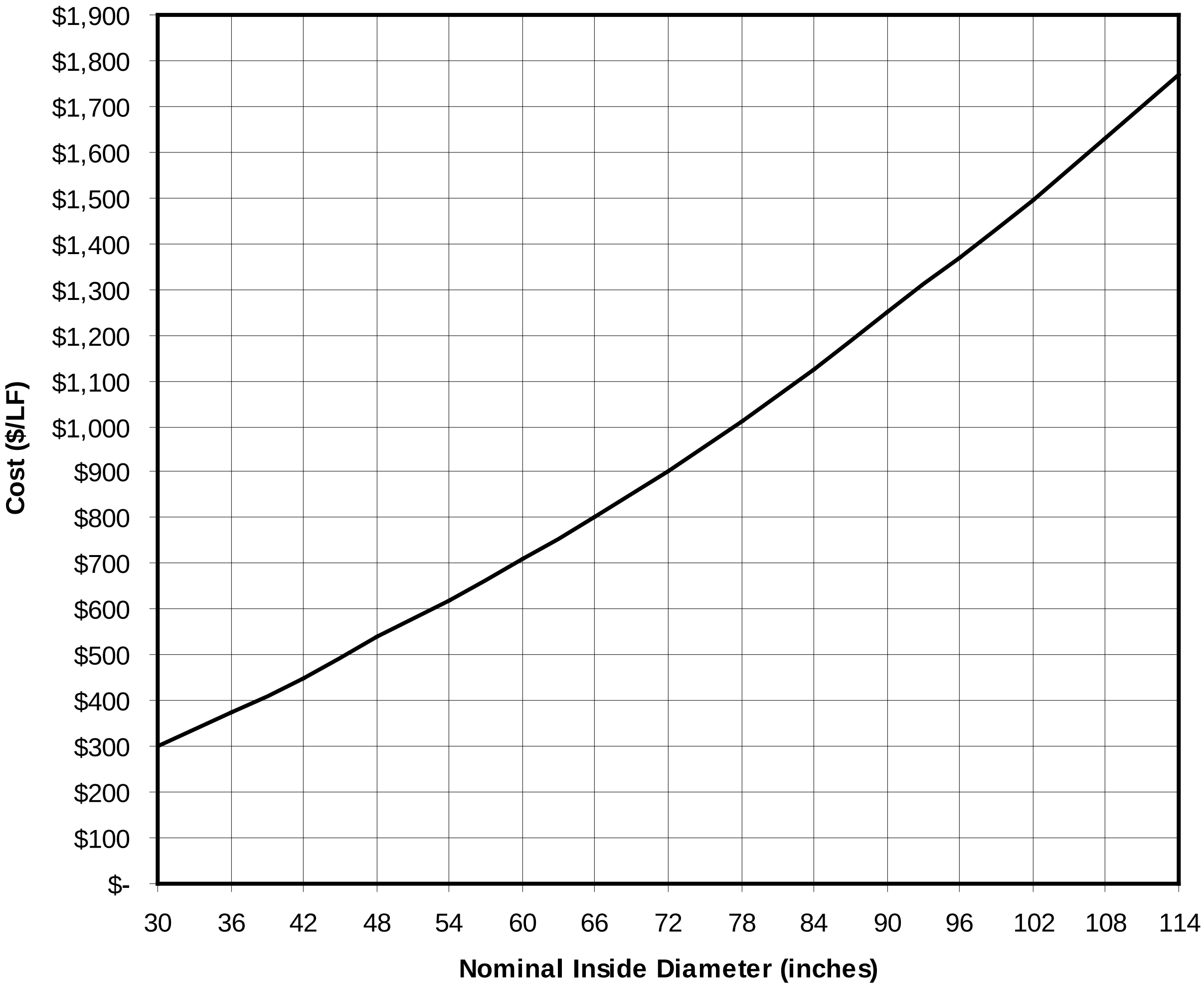
Estimated values were calculated for pipeline diameters less than 24 inches. The historical data reviewed did not include enough information to develop a qualified curve for these points. Three projects in Southern Nevada with bid dates from 1998 to 2002 were used for the 24-inch pipeline cost. A unit cost curve was developed based on estimated values below 24-inch pipeline, using as references the Boyle NRS Draft Final Concept Plan Report, LVVWD Cost Opinion values, and costs from the City of Denver. The pipeline material considered is ductile iron with a pressure class up to 350 psig. A 25% allowance was included.

The pipeline unit cost curve in Figure 2–1A represents a best-fit regression curve through the pipeline construction cost data for pipelines greater than 24 inches in diameter with an allowance of from 20% to 45%, depending on the pipe size.

The pipeline unit cost curve in Figure 2–1B represents a curve for pipelines less than or equal to 24 inches in diameter. The equation of the curve is:

$/LF for pipe less than or equal to 24 inches in diameter = 9.6 x D + 5
Where D = diameter of pipe in inches.

Figure 2-1A Pipelines > 24 in 2005 Cost Curve



Basis of Data:

Pipeline type: mortar lined – coal tar coated steel, mortar lined – tape coated steel, and mortar lined – mortar coated

Pipeline conditions: standard trenching, alluvial ground digs, hard dig conditions, decomposed granite, and minor microtunneling.

Pipeline diameter data range: 30 inches to 108 inches

The number of pipeline construction projects in Southern Nevada: 31

Pipeline allowance included: 20–45% depending on pipe sizes

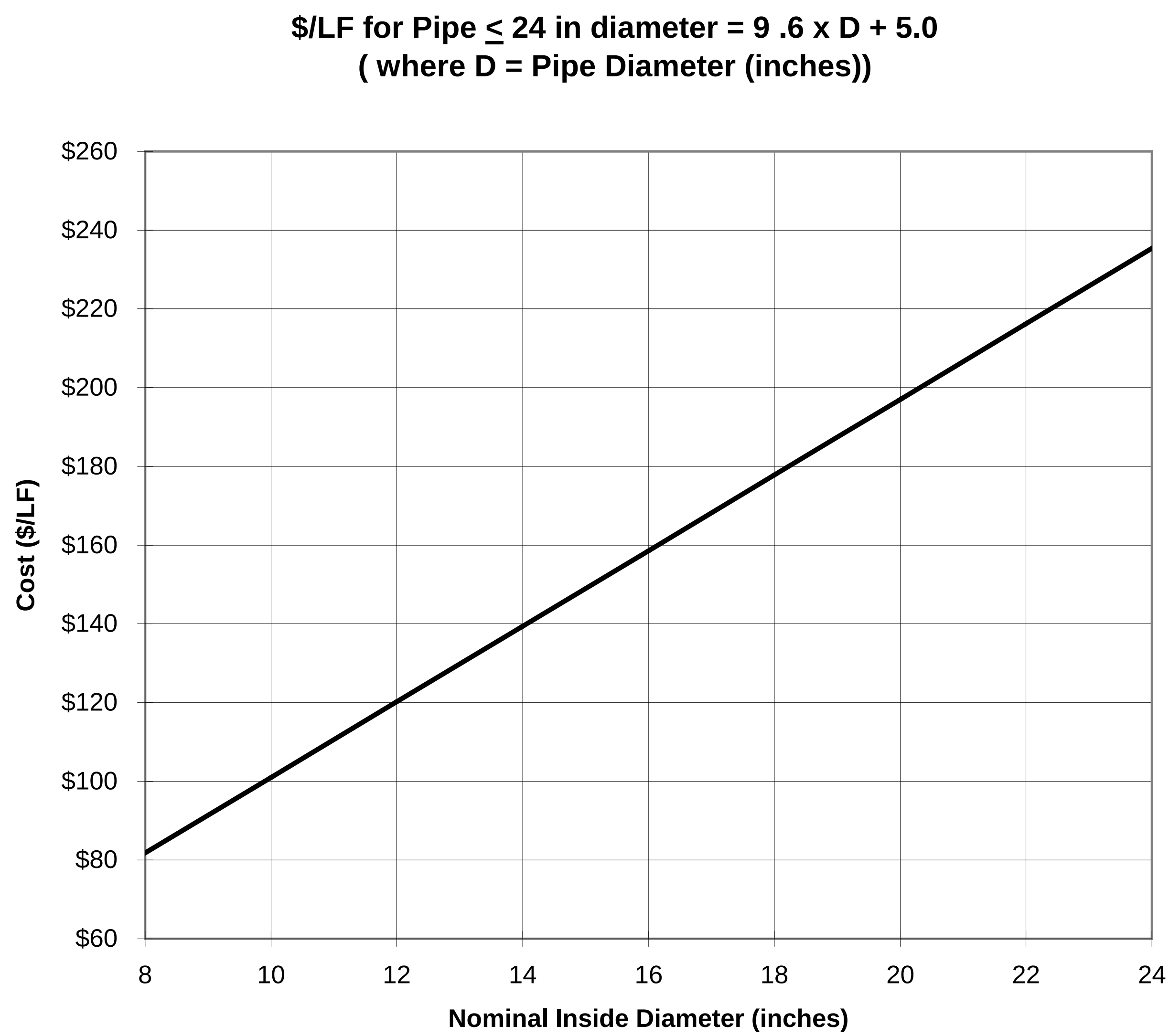
Pipeline data project locations: Southern Nevada

Construction date range: 1995–2003

Accuracy range: +50% to –30%

Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

Figure 2-1B Pipeline (≤ 24in) 2005 Cost Curve



Basis of Data:

Pipeline type: ductile iron

Pipeline conditions: standard trenching

Pipeline diameter data range: 8 inches to 24 inches

Pipeline allowance included: 25%

Number of construction projects in Southern Nevada: 5

Accuracy range: +50% to –30%

Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.3 Covered Reservoir Unit Cost

The reservoir unit cost curve was generated using actual construction costs from 10 random projects from Southern California and Nevada over the past four years. For the unit cost curve, the construction data was adjusted to reflect the Nevada marketplace and a 20% allowance was added to the construction costs.

The reservoir construction data consisted of water capacities ranging from 1.6 to 25 mg. In addition, a 65-mg tank from 1994 data was escalated and used for the 2006 Guide. The construction projects include the following reservoirs types over a wide range of degrees of construction difficulty, earthwork quantities, foundations, regulating tanks, and associated inlet/outlet piping arrangements.

The random reservoir projects represent the following applications:

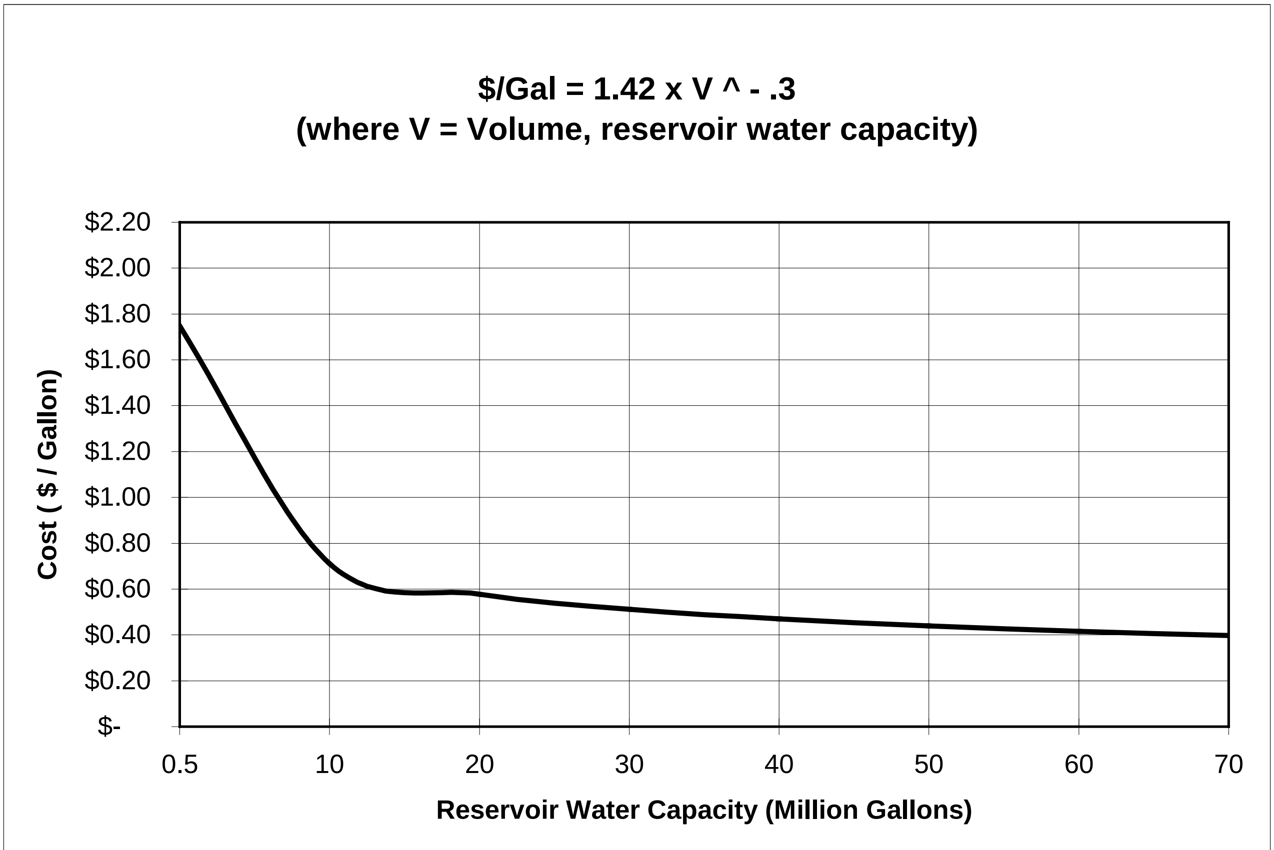
1. Partially buried circular prestressed concrete
2. Partially buried cast-in-place reinforced concrete
3. Completely buried cast-in-place reinforced concrete
4. Reservoir with regulating tank

The reservoir unit cost curve in Figure 2-2 represents a best-fit curve through the construction cost data. The equation for the best-fit curve is:

$\$/Gal = 1.42 \times V ^ {-.3}$
Where V = Volume, reservoir water capacity (million of gallons)

The unit cost is the cost for a water reservoir depending on the capacity of water per million of gallons.

Figure 2-2 Reservoir 2005 Cost Curve



Basis of Data:

Reservoir type: partially buried prestressed circular concrete, partially buried cast-in-place concrete, reservoir with regulation tank, and completely buried reinforced concrete.

Reservoir water capacity data range: 1.6 to 65 mg

The number of project data from Southern Nevada and Southern California: 10

Reservoir allowance included: 20%

Reservoir data project locations: Southern Nevada and Southern California

Pipeline data date range: 1997–2003

Accuracy range: +50% to –30%

Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.4 Well Unit Cost

The water well unit cost curve was generated using actual construction costs from 10 random projects in Nevada with bid dates ranging from 1995 to 2003. For the unit cost curve a 50% allowance was included in the construction cost data.

The random projects represented wells applicable to the program, and included:

1. The site preparation, geophysical testing, installation and removal of the test pump, well conductor casing and cap, stainless steel well screen and production bore hole, disinfection (sodium hypochlorite) for the gravel pack and well bores, aquifer testing, and insurances and bonds of contractors.
2. On-grade wells equipped with 700 sf concrete masonry unit-type building.
3. 100% of the construction data represented 24-inch stainless steel well screen.
4. Steel ASTM A53 Grade B perforations may cost approximately 16% less than data.
5. "Equipping," which includes pumps, controls, motors, associated mechanical piping, and electrical service in the well site.

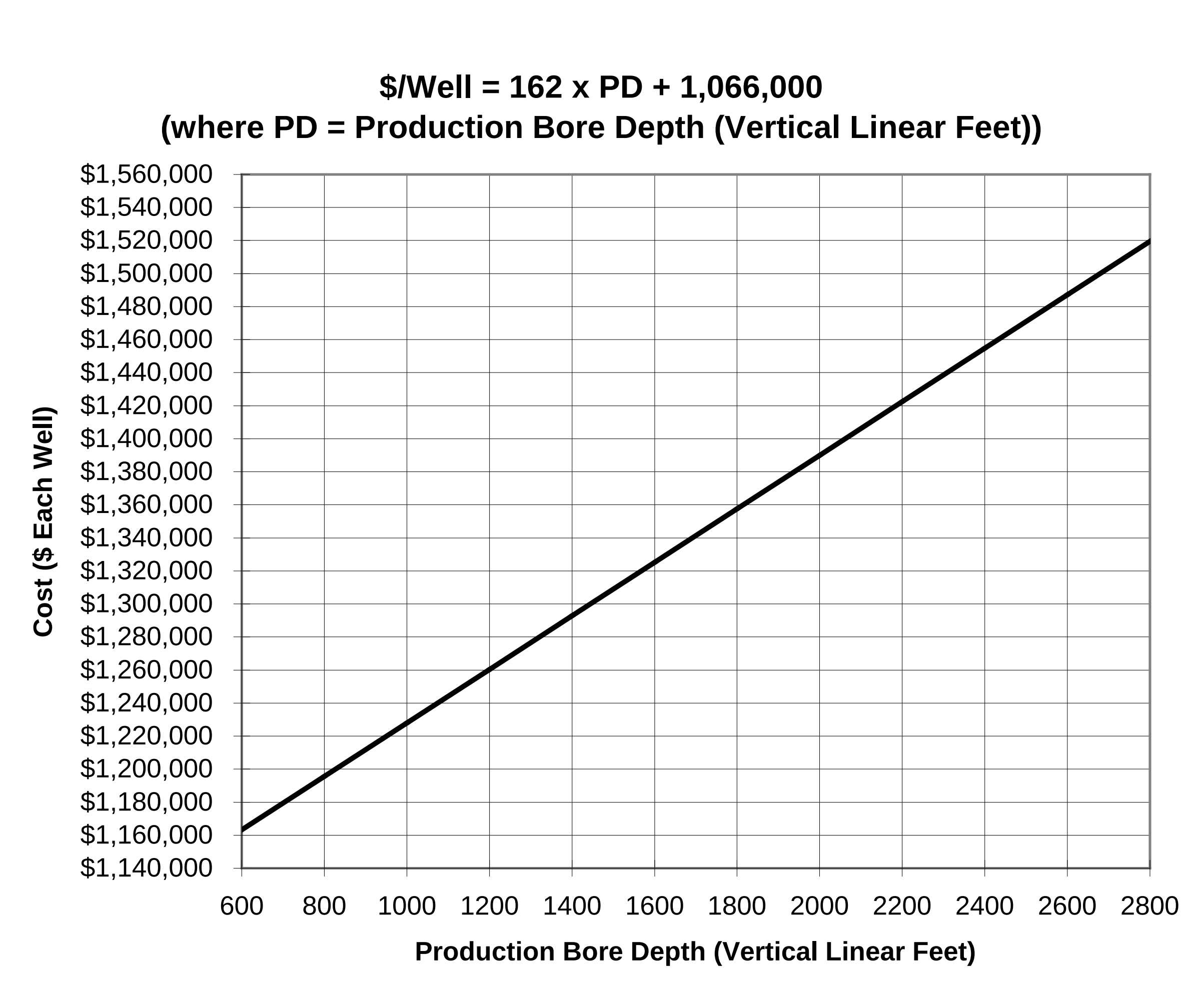
The water well data include SCADA controls (estimated at $45,000) plus equipping cost (estimated at $400,000) plus the actual historical drilling costs. The actual cost for equipping was not available at the time this report was prepared. However, equipping costs may increase to reflect the production (in gallons per minute) of the well. The estimated equipping value of $400,000 was estimated to produce an approximate flow of 3,000 gpm using a 400 hp pump. The cost for a well with horsepower significantly higher or lower than 400 hp may need to be adjusted to reflect the horsepower difference.

The well costs exclude the cost of generators, water treatment facilities, and electrical substations.

The well unit cost curve in Figure 2–3 represents a best-fit curve through the construction cost data. The equation of the best-fit curve is:

$/Well = 162 x PD + 1,066,000
Where PD = production bore depth in vertical linear feet

Figure 2-3   Well 2005 Cost Curve



Basis of Data:

Water wells include: reverse circulation rotary drilling, 24-inch diameter stainless steel well screens, 34-inch production bore holes, 14-inch pilot bore drilling, removal and installation of test pumps, geophysical testing, gravel pack, well bore disinfection and well equipping.

Water well conditions: All soil conditions relative to southern Nevada.

Water well depth data range: 1,000 feet to 2,460 feet

The number of construction projects in Southern Nevada: 11

Water well allowance included: 50%

Water well data project locations: Southern Nevada

Water well data date range: 1995 through 2003

Accuracy range: +50% to –30%

Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.5 Pumping Station Unit Cost

The pumping stations unit cost curve was generated using actual construction costs from eight water pumping station projects in San Diego and Nevada constructed over the past four years. For the unit cost curve a 50% allowance was added to all construction costs. In addition, some projects were modified to exclude non-pump station-related items such as demolition and large concrete forebays.

The pumping station capacity data ranged from 450 to 17,500 net hp. The data represented pumping stations that contain from 4 to 9 pumps each. The San Diego pumping stations used vertical turbine pumps, and those costs were adjusted to the Nevada labor market and escalated to January 2005 pricing. The Nevada pumping stations used horizontal split-case pumps and those costs were also escalated to January 2005. The construction projects covered locations with a wide range of degrees of construction difficulty, earthwork quantities, foundation, and associated piping. The pumping stations included associated inlet and outlet piping, related site works, pumping station building, electrical and instrumentation work on site. The pumping stations costs did not include forebay, electrical transformer, or power generator costs.

The pumping station projects represented the following applications:

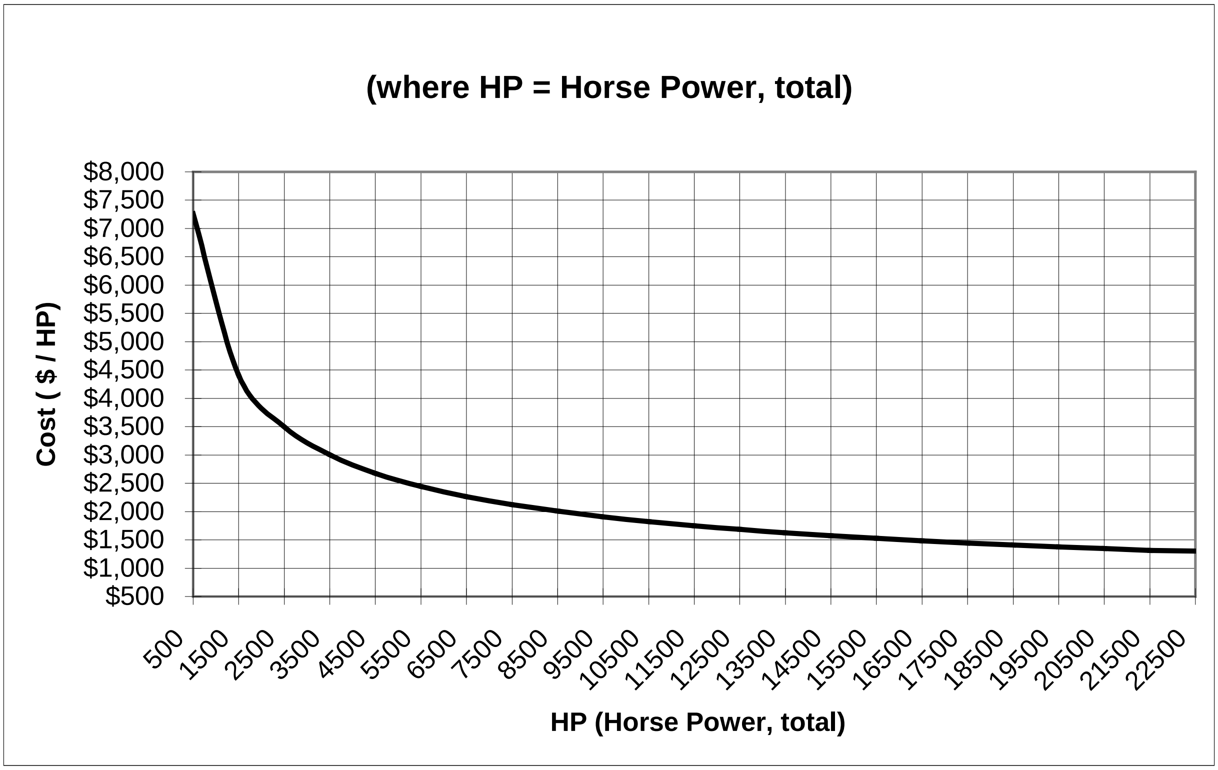
1. Horizontal split-case centrifugal pumping stations
2. Vertical turbine pumping stations
3. Pumping stations with associated pumps, motors, and mechanical piping

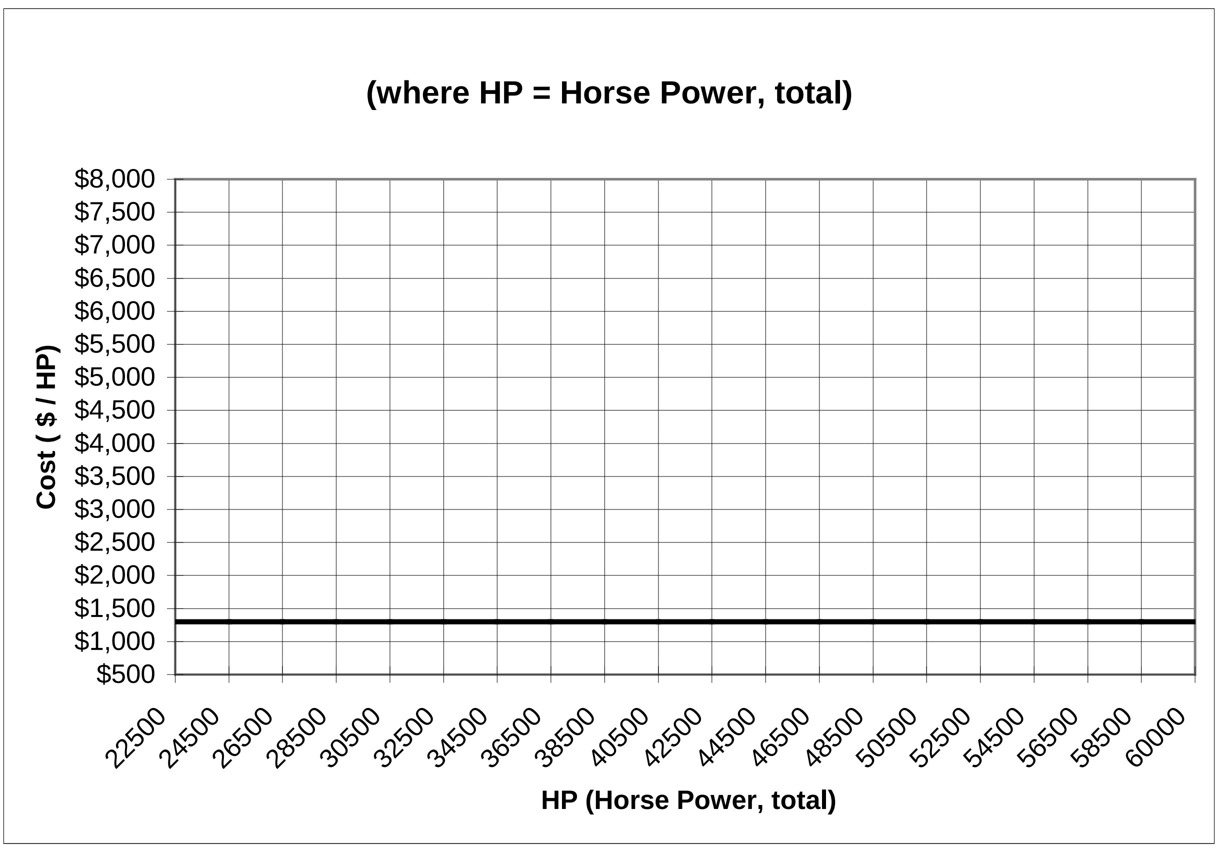
The pumping station unit cost curve in Figure 2-4 represents a best-fit curve through the construction cost data. Horsepower is the total station connected horsepower load. The equation of the best-fit curve for horsepower's up to 22,000 is:

$\$/HP = 122{,}000 \times HP^{\wedge -.454}$
Where HP = total horsepower

For horsepower's between 22,000 and 60,000 use $1300/HP.

Figure 2-4 Pumping Station 2005 Cost Curve





Basis of Data:

Pumping station type: vertical turbines and horizontal split-case pumps

Pumping station data project locations: Nevada and San Diego

Pumping station capacity data range: 450 to 17,500 hp.

The number of construction projects in Nevada and San Diego, California: 8

Pumping station cost allowance included: 50%

Pumping station data date range: 1997–2003

Accuracy range: +50% to –30%

Note: $/ HP = 122,000 x HP ^ - .454 for up to 17,500 HP

Cost curves reflect January 2005 costs. Increase by 5% for January 2006 costs.

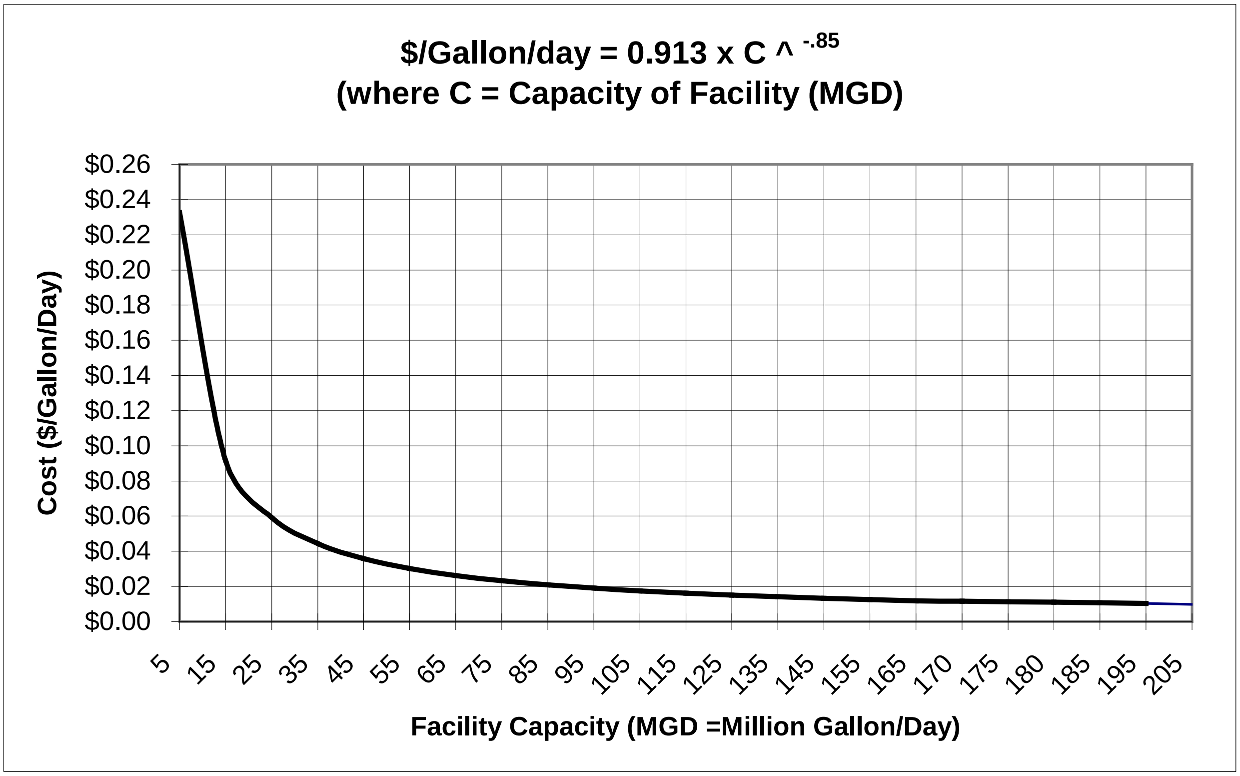
2.6 Water Treatment Facilities Cost

2.6.1 Disinfection – Bulk Purchased Sodium Hypochlorite

The unit cost curves for bulk purchased sodium hypochlorite disinfection facilities were developed from seven cost estimate models using SNWA facilities at Carleton Square and Twin Lakes as model projects. The cost estimating models ranged from a 6.3-mgd facility to a 176-mgd facility. Bulk purchased sodium hypochlorite at 14% (trade) concentration is received in tanker truck quantities and immediately diluted on-site with softened water and stored as a more stable 5% to 6% solution. Equipment sizing was based on equivalent applied chlorine doses of 1 to 5 mg/L. Costs were built up from January 2005 equipment supplier quotes for major pieces of equipment including diaphragm metering pumps, water softeners, and FRP storage tanks. For the unit cost curve a 30% allowance was added. Figure 2-5 is the unit cost curve for the bulk purchased sodium hypochlorite disinfection facilities.

\$/ Gallon/day = 0.913 x C ^ $^{-.85}$
(where C = capacity of facility, mgd)

Figure 2-5 Disinfection – Bulk Purchased Sodium Hypochlorite 2005 Cost Curve



Basis of Data:

Facility type: bulk purchased sodium hypochlorite facility
Data project locations: Nevada
Capacity data range: 6.3 mgd to 176 mgd
Number of construction cost models: 7
Cost allowance included: 30%
Accuracy range: +50% to –30%
Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

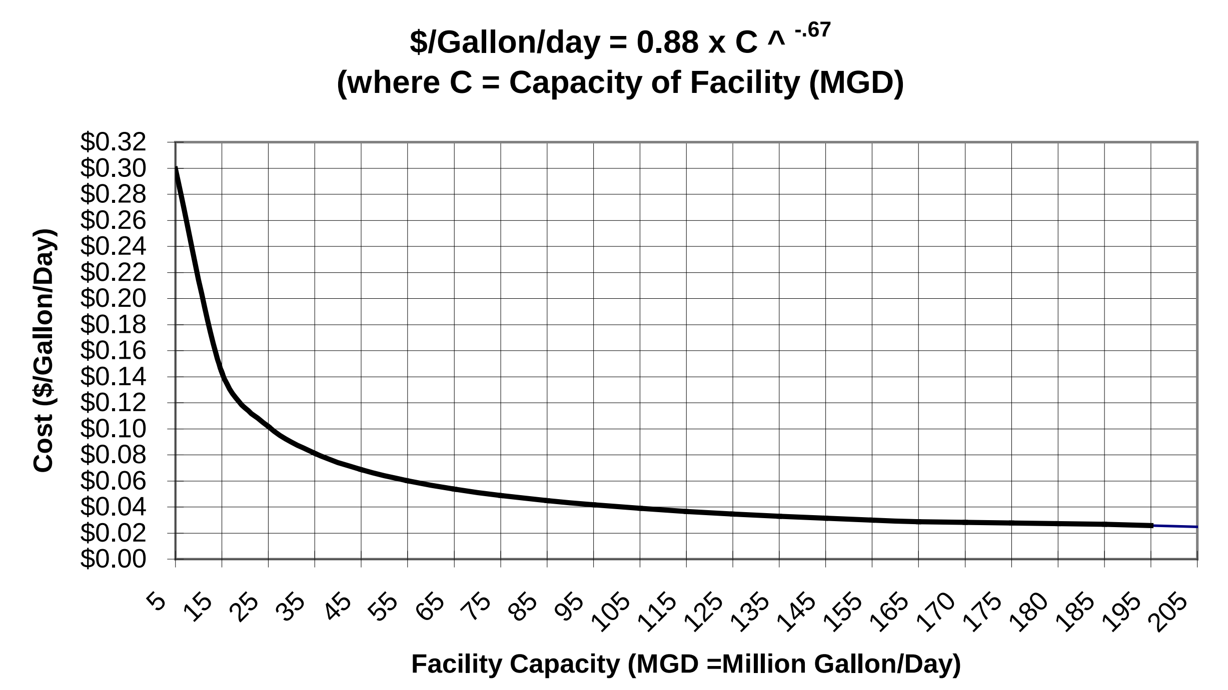
2.6.2 Disinfection –On-site Generated Sodium Hypochlorite

The unit cost curves for on-site generated sodium hypochlorite disinfection facility were developed from seven cost estimates models using SNWA's River Mountains Water Treatment Plant as a model project. The cost estimating models ranged from a 6.3-mgd facility to a 176-mgd facility. Bulk purchased sodium chloride salt (solid) is received in truck quantities and combined with softened water within electrolytic cells to produce a stable 0.8% to 1.0% solution. Equipment sizing was based on equivalent applied chlorine doses of 1 to 5 mg/L.

Costs were built up from January 2005 equipment supplier quotes for major pieces of equipment including on-site generators systems, diaphragm metering pumps, water softeners, and FRP storage tanks. The costs include an allowance for the on-site concrete tank storage of water softener backwash and rinse wastes that would be continuously generated. The projected costs also assumed a 100% redundancy in the on-site generator system. For the unit cost curve a 30% allowance was added. Figure 2-6 the unit cost curve for the on-site generated sodium hypochlorite disinfection facilities:

\$/ Gallon/day = .88 x C ^ -.67
(where C = capacity of facility, mgd)

Figure 2-6 Disinfection – On-site Purchased Sodium Hypochlorite 2005 Cost Curve



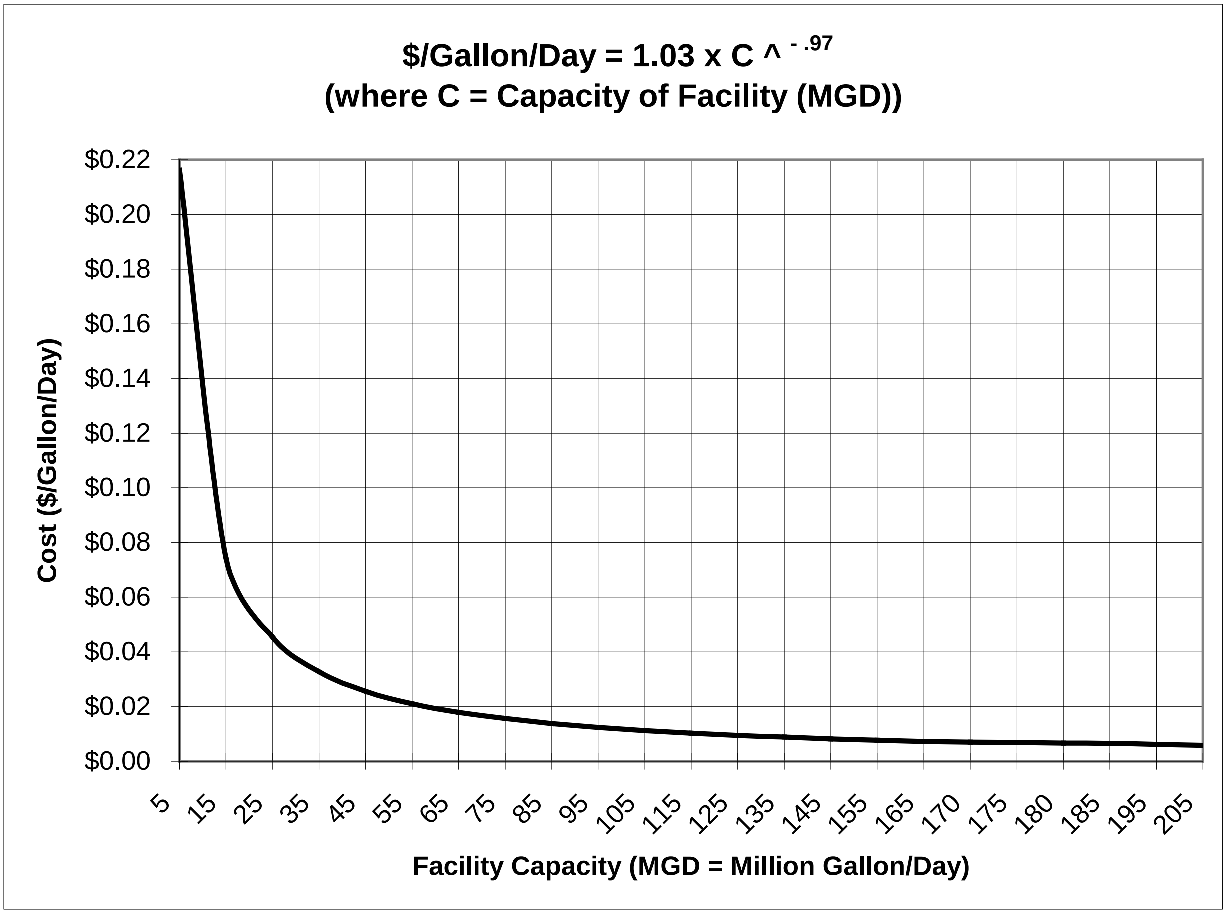
Basis of Data:
Facility type: on-site generated sodium hypochlorite facility
Pump station data project locations: Nevada
Pump station capacity data range: 6.3 mgd to 176 mgd
Number of construction cost models: 7
Construction cost data allowance included: 30%
Accuracy range: +50% to –30%
Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.6.3 Fluoridation – Fluorosilicic Acid Storage and Feed System

The unit cost curves for fluorosilicic acid storage and feed facilities were developed from seven cost estimate models using SNWA's River Mountains Water Treatment Plant as a model project. The models ranged from a 6.3-mgd facility to a 176-mgd facility. Bulk purchased fluorosilicic acid at 25% concentration is received in tanker truck quantities. Equipment sizing was based on equivalent applied fluoride doses of 0.1 to 1.2 mg/L. Costs were built up from January 2005 equipment supplier quotes for major pieces of equipment including diaphragm metering pumps, seal-less transfer pumps, FRP day tank, and FRP storage tanks. For the unit cost curve a 30% allowance was added. Figure 2-7 is the unit cost curve for the fluorosilicic acid storage and feed facility:

\$/ Gallon/day = 1.03 x C ^ $^{-.97}$
(where C = capacity of facility, mgd)

Figure 2-7 Fluorosilicic Acid Storage and Feed 2005 Cost Curve



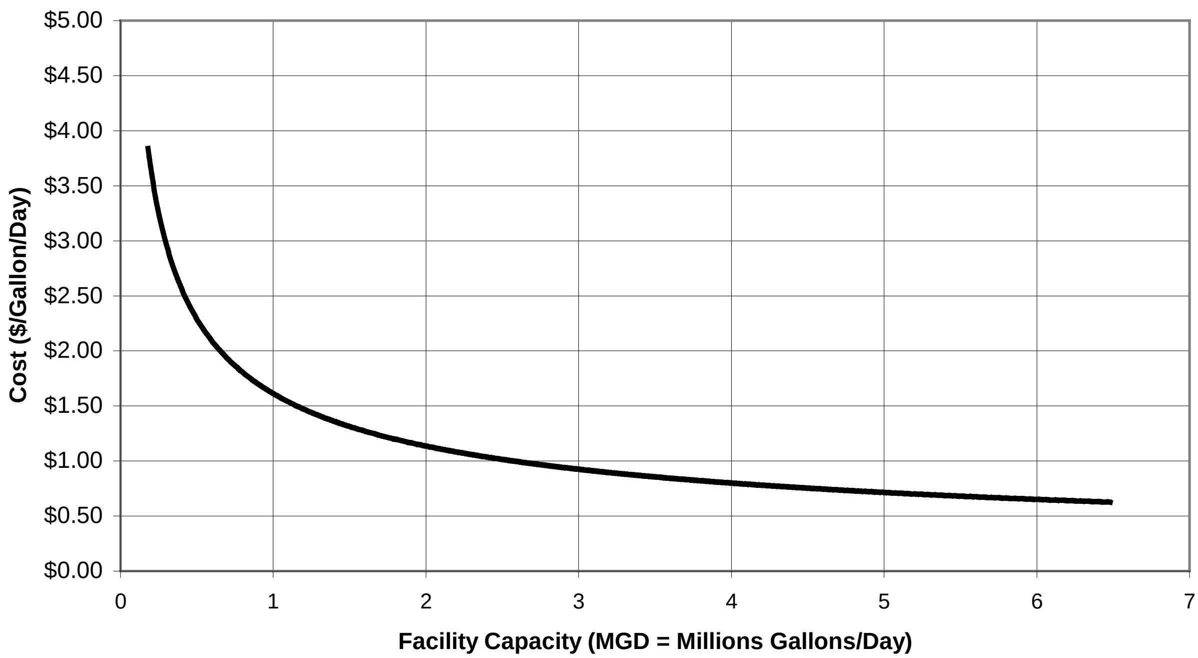
Basis of Data:

Facility type: fluoridation – fluorosilicic acid storage and feed system
Data project locations: Nevada
Capacity data range: 6.3 mgd to 176 mgd
Number of construction cost models: 7
Construction cost data allowance included: 30%
Accuracy range: +50% to –30%
Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.6.4 Arsenic Removal – Well Head Treatment

The unit cost curves for arsenic removal were developed for systems using adsorption onto proprietary iron based media such as granular ferric hydroxides or granular ferric oxides. Equipment sizing was based on the need to remove approximately 10 to 30 µg/L of arsenic in a groundwater matrix with a co-contaminant of fluoride in greater milligrams per liter concentrations. Costs were built up from January 2005 equipment supplier quotes for major pieces of equipment including adsorption media and contactors. Costs assume a one-time use of the media to facilitate disposal of concentrated, accumulated arsenic in the solid phase (along with the media) that will pass toxicity characteristic leaching potential (TCLP) criteria. For the unit cost curve a 30% allowance was added. Figure 2-8 is the unit cost curve for arsenic removal:

Figure 2-8 Arsenic Removal 2005 Cost Curve



Basis of Data:

Facility type: arsenic removal– wellhead treatment unit

Data: Compilation of vendor equipment quotes

Construction cost data allowance included: 30%

Accuracy range: +50% to –30%

Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.7 Tunnel Unit Cost

Tunneling costs vary greatly since they depend on ground conditions, which widely vary depending on a tunnel's location. Ground conditions affect initial and final liner types and tunneling methodology, and thus construction costs. Also, costs are affected by how the tunnel is accessed and the remoteness of the site, by portal or shaft. Shaft access can add 10% to 25% or more to the cost of tunneling, depending on shaft depth. Mobilization and providing special access roads to the site can also add 10% to 25% more to the costs of tunneling.

The 1994 Guide were probably developed for the capital improvement projects envisioned at that time for larger diameter pipelines with the final liner being either cast-in-place concrete or welded steel pipe with diameters of from 6.5 feet to 12 feet. For the 2006 Guide, the pipeline and liner sizes range from about 18 inches to 96 inches, using PVC or HDPE for the smaller-sized pipes and WSP for the larger pipes. The excavated tunnel diameter sizes range from 6 to 12 feet, with a minimum of about 6 to 8 feet diameter for tunnels longer than about 500 to 1,500 feet, depending on ground conditions. Longer tunnels require man entry and therefore special safety precautions for ventilation and materials handling. Shorter tunnels with smaller-diameter carrier pipes in soil may have jacked casings or tunneled casings about 2 to 3 feet larger than the carrier pipe.

For planning purposes and since the variation in carrier pipes vary widely depending on location and project, a unit cost approach is suggested with engineering judgment as required. The following tunnel costs include a 30% contingency.

To obtain January 2006 cost for tunnels, escalate the above costs by 5%.

A. For small diameter (1.5 foot to less than 5 foot OD casings) bore and jack tunnel crossings typically less than 500 feet long through soil above groundwater table:

For PVC use $24.00 per inch outside casing diameter per foot
For ductile iron use $29.25 per inch outside casing diameter per foot

B. For tunnels less than 5,000 feet long in hard massive to fractured rock (welded tuff, older fractured crystalline limestone, sandstone, rock formations):

For small diameter pipes within larger tunnel use $29.50 per inch excavated diameter per foot.

For WSP use $38.50 per inch excavated diameter per foot

For shafts add 10% for shaft up to 30 feet deep and 25% for shafts up to 130 feet deep.

For the shaft itself use $51.00 per inch diameter of excavated shaft diameter per foot.

C. For tunnels less than 5000 feet long in weak self-supporting rock (tertiary volcanics, massive sandstone siltstones):

For small diameter pipes within larger tunnel use $23.00 per inch excavated diameter per foot.

For WSP use $31.50 per inch excavated diameter per foot

For shafts add 10% for shaft up to 30 feet deep and 25% for shafts up to 130 feet deep.

For the shaft itself use $44.50 per inch diameter of excavated shaft diameter per foot.

D. For tunnels greater than 5000 feet long in hard massive to fractured rock (welded tuff, older fractured crystalline limestone, sandstone, rock formations):

For small diameter pipes within larger tunnel use $23.00 per inch excavated diameter per foot.

For WSP use $30.00 per inch excavated diameter per foot

For shafts add 10% for shaft up to 30 feet deep and 25% for shafts up to 130 feet deep.

For the shaft itself use $51.00 per inch diameter of excavated shaft diameter per foot.

E. For tunnels greater than 5000 feet long in weak self-supporting rock (tertiary volcanics, massive sandstone siltstones):

For small diameter pipes within larger tunnel use $16.50 per inch excavated diameter per foot.

For WSP use $23.50 per inch excavated diameter per foot

For shafts add 10% for shaft up to 30 feet deep and 25% for shafts up to 130 feet deep.

For the shaft itself use: $44.50 per inch diameter of excavated shaft diameter per foot.

2.8 Power Transmission and Distribution Unit Cost

The unit cost criteria for power transmission and substation service were based on escalating and modifying the 1994 Guide.

The 1994 Cost Estimating Criteria for power transmission service was:

1.	138-kV double pole service	$573,000/mile
2.	69-kV double pole service	$491,000/mile

Escalated to January 2005, the 1994 cost estimate criteria would be as follows:

1.	138-kV double pole service	$659,000/mile
2.	69-kV double pole service	$565,000/mile

Different cost models were developed for a variety of applications. Based on these models, the 1994 cost criteria were excessive. It was recommended to use the average cost estimate model of $275,000 for a 138-kV power service and $203,000 for a 69-kV power service, plus a 30% allowance. Additional costs were developed by updating previous constructed projects and from local electric utility companies. The January 2005 cost criteria are as follows:

Power transmission and distribution lines:

1.	230-kV power transmission lines =	$521,000/mile
2.	138-kV power transmission lines =	$357,000/mile
3.	69-kV power transmission lines =	$264,000/ mile
4.	12-kV or 25-kV distribution lines =	$195,769/ mile
5.	Rebuilt existing 69-kV to 138-kV transmission line =	$232,000/ mile
6.	138-kV with 12-kV underbuild transmission line =	$371,000/ mile
7.	69-kV with 12-kV underbuild transmission line =	$291,000/ mile
8.	Underground 69-kV line ductbank =	$209/foot
9.	Underground 23-kV line ductbank =	$189/foot
10.	Underground 12-kV line =	$131/foot

To obtain January 2006 cost for power transmission and distribution lines, escalate the above costs by 5%.

In an effort to qualify the new recommended cost criteria, a cost comparison was developed between the new criteria and an actual project dated January 2004.

Cost Comparison:
January 2004 – Coyote Spring power line = $2,088,520
This project involved replacing a 69-kV with a 138-kV power line for 10 miles
This cost represented a value of $208,825 (approx. 32% of cost criteria)
The 2005 cost criteria are $232,000/mi x 10 mi = $2,320,000

Furthermore, in developing the cost criteria for electrical substations, the 1994 Guide were modified. The intent of the electrical substation is to service the power connection from the transmission power lines to the actual facilities, such as pump stations and water treatment facilities. The 1994 cost criteria were as follows:

1.	138-kV to 4.16-kV substation (two transformers) =	$2,650,000
2.	69-kV to 4.16-kV substation (two transformers) =	$2,195,000

Escalated to 2005, the 1994 cost estimate criteria would be:

1.	138-kV to 4.16-kV substation (two transformers) =	$3,047,500

2. 69-kV to 4.16-kV substation (two transformers) = $2,524,250

Because of the lack of historical project data, it was recommended to reduce the 1994 cost criteria from two transformers to one transformer for In-State Water Resources projects. If two transformers are required for the project, increase the substation costs accordingly. The 138-kV and the 69-kV substation costs were developed with the reduction of the transformer and the addition of a 30% construction allowance. Costs from the Colorado River Commission and from manufacturers and construction contractors were used to develop additional substation costs. The January 2005 cost criteria for the electrical power substations are:

138-kV/4.16-kV, single transformer substation =	$2,294,000
138-kV/69-kV, small transformer substation =	$1,478,000
69-kV/4.16-kV, single transformer substation =	$1,900,000
230-kV/69-kV, transformer substation =	$10,426,000
Upgrade 69-kV to 138-kV transformer substation =	$3,475,000
Small substation for hydropower plants less than 1000 kW =	$1,158,000
69-kV/23-kV transformer substation underground service =	$1,158,000
69-kV/23-kV transformer substation overhead service =	$1,900,000
Electric service to wells and small pump stations, underground =	$35,000
Electric service to wells and small pump stations, overhead =	$116,000

To obtain January 2006 cost for substations, escalate the above costs by 5%.

These cost estimates are based on the using facility making the power connections to the load side of the substation and providing any additional protection equipment required.

Additional electrical distribution or service cost is expected to be in the facilities unit cost criteria. This includes wire distribution, switches, distribution panels, auxiliary transformers, etc.

2.9 Pelton Turbine Hydroelectric Plant Unit Cost

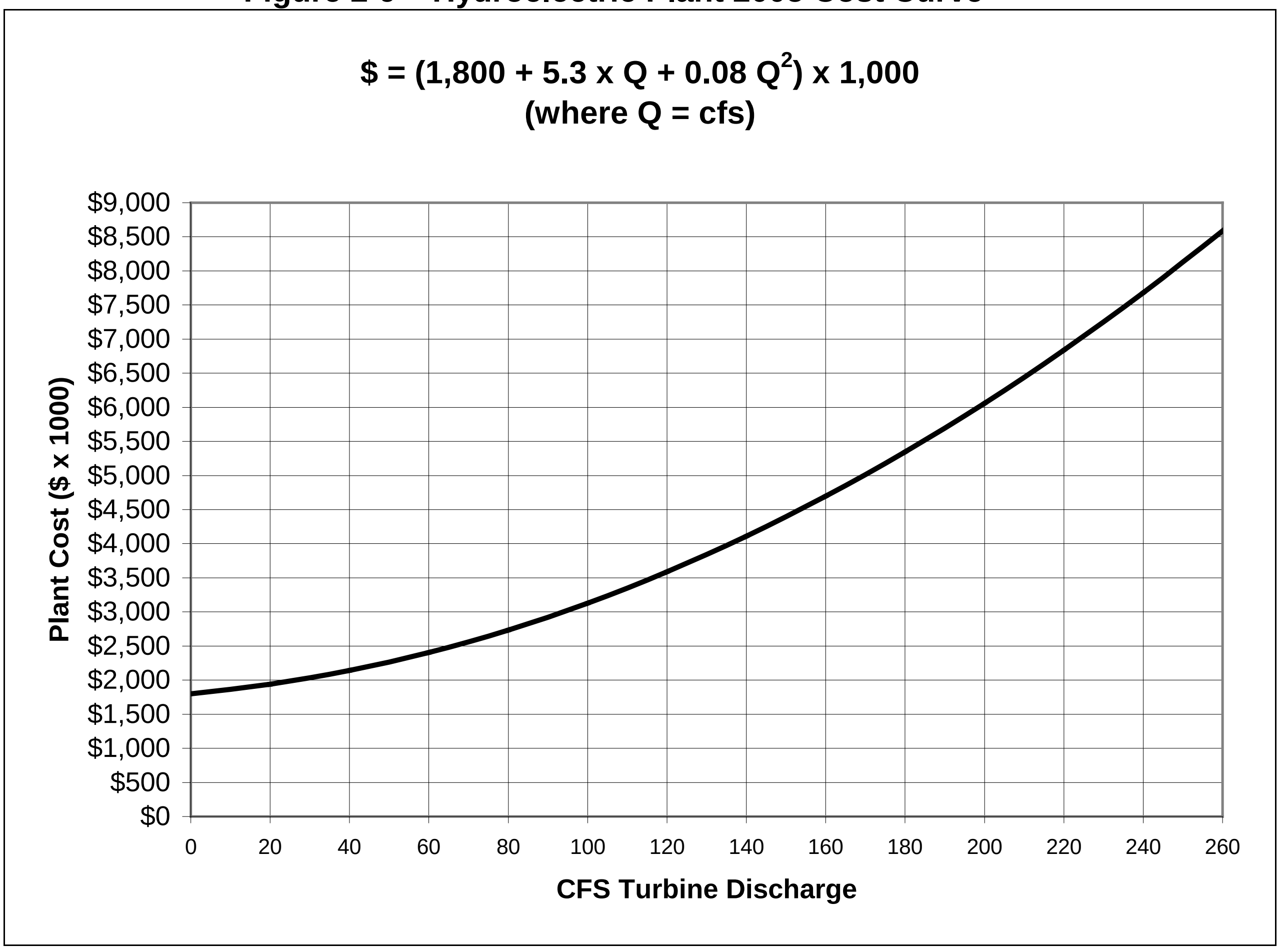
The Pelton Turbine Hydroelectric Plant cost curve was generated using cost experience for the various components of typical hydroelectric plants. Very few similar plants have been constructed in the U.S. over the past 10 years, so direct cost data for such plants is not available. For the unit cost curve a 30% allowance was added to the construction costs.

A variety of hypothetical high head hydroelectric plants were analyzed, over a head range from 700 feet to 3,000 feet, and from 10 cfs to 220 cfs. The turbine speeds were limited to 1,200 rpm maximum, and the most economical configuration was assumed for each set of head and flow conditions, with up to six jets per turbine. Each plant included a turbine shutoff valve and a sleeve-style bypass valve for flow continuation in a turbine-generator outage. All plants were presumed to have a single turbine-generator set and medium voltage switchgear, and be equipped with a single feeder outdoor substation with one substation transformer and a high-voltage circuit switcher for a radial transmission line connection at 35 kV, and controls for fully automatic unattended operation. The generating and control equipment were assumed to be indoor, with a 40-foot by 50-foot concrete block powerhouse building. An $180,000 allowance was made for civil works, including an open tailrace tank. Surge tanks were not included.

The results of the calculated costs were plotted against discharge. The effect of variation of head on the cost is small.

The Pelton Turbine Hydroelectric Plant cost curve in Figure 2-9 represents a best-fit curve through the calculated cost data. The turbine discharge is the maximum flow rate in cubic-ft/sec for the hydroelectric plant. For transmission line voltages greater than 35 kV, $700/kV greater than 35 kV should be added to the costs obtained from the curve.

Figure 2-9 Hydroelectric Plant 2005 Cost Curve



Basis of Data:
Hydroelectric plant: Includes powerhouse, substation, and equipment
Hydroelectric plant type: Pelton turbines
Range: 700 feet to 3000 feet
Hydroelectric plant cost allowance included: 30%
Accuracy range: +50% to -30%
Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.10 Rate of Flow Control Station Unit Cost

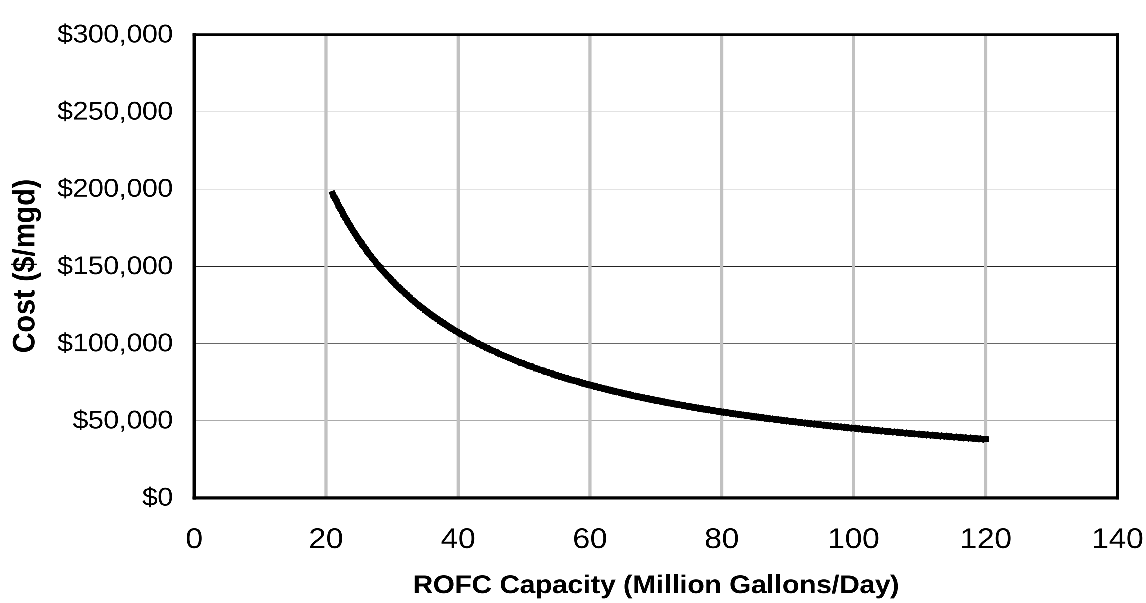
The Rate of Flow Control Station (ROFC) unit cost curve was generated using actual data from four SNWA CIP projects over the past seven years. For the unit cost curve, the construction data was adjusted to include a 30% allowance. In addition the construction costs were escalated to January 2005.

The ROFC data consisted of flow capacities from 20 mgd to 120 mgd. The construction projects were generally very similar and included some site works.

The ROFC unit cost curve in Figure 2-10 represents a best-fit curve through the construction cost data.

The unit cost is the cost for a ROFC depending on the flow rate of water per million of gallons per day.

Figure 2-10 Rate of Flow Control Station 2005 Cost Curve



Basis of Data:
ROFC Station: Includes enclosure and equipment
ROFC Type: Butterfly or sleeve valves
Range: 20 to 120 mgd
Cost allowance included: 30%
Accuracy range: +50% to -30%
Cost curve reflects January 2005 costs. Increase by 5% for January 2006 costs.

2.11 Maintenance Road Unit Cost

The maintenance road costs were developed using the 1994 Guide and included a 10% allowance for unknown, unquantifiable variables. The 1994 cost criteria were $750,000 per mile for a two-lane, 26-foot-wide, asphalt maintenance road; $300,000 per mile for a 12-foot-wide gravel service road; and $2,100 per linear foot for a bridge. The maintenance road unit cost was developed by escalating the 1994 cost criteria to January 2005. The January 2005 cost criteria for maintenance roads are:

1.	Two lane asphalt maintenance road (26 feet wide)	$900,000/mile
2.	Gravel service road (12 feet wide)	$360,000/mile
3.	Bridges (two lane road maximum)	$2,520/lf

To obtain January 2006 cost for roadways and bridges, escalate the above costs by 5%.

2.12 Land Acquisition Cost

The land unit costs represent the acquisition and purchases prices of the land for the required facilities. Land costs will vary depending primarily on location and whether they are privately owned or owned by the federal government. For some facilities, such as pumping stations, the land should be purchased. For other facilities, such as pipelines, an easement in fee simple may be satisfactory. In many cases, temporary construction easements will also be required to have sufficient room to construct the facilities and store material and equipment.

The 1994 Guide used 3% to 5% of the construction cost for land costs. These lands were primarily in the Las Vegas Valley (LVV) and these values can be used for projects in the LVV. Because much of the land for the out valley projects would be federal or rural private land, other cost criteria needed to be developed.

For Bureau of Land Management lands in Clark County, land costs include costs for a legal description and application fee. For Federal land outside Clark County there would be a rental fee. Since fees and cost for Federal lands are negligible they will not be included in cost estimating at the concept level of a project. As a project develops, if Federal land costs are required to be estimated the SNWA Engineering department should be consulted.

For purchase of private land, the costs include surveying, writing legal descriptions, negotiation fees, appraisal fees, title reports, and purchase price of the land. The January 2005 cost criteria for private lands are shown in Table 2.2.

Table 2-2. Land Acquisition Costs

Type Land	Purchase Cost	Incidental Cost per Acre
Purchase Private Rural Land	$15,000 per Acre	50% of purchase cost
Purchase LVV Private Land	3-5% of construction cost	NA

To obtain January 2006 cost for land, escalate the above costs by 5%.

2.13 Environmental Costs

2.13.1 Revegetation Costs

Revegetation may be required on Federal land where the facilities are constructed. This includes land disturbed by construction activities and over the pipelines. Some revegetation costs may be required for other facilities such as pumping stations. Final determination of required revegetation will be decided during the Environmental Impact Statement review process. Costs for revegetation vary widely depending on the density and types of plants required for revegetation. In some areas, the plants in the construction path must be temporarily relocated and replanted in the disturbed area. The cost of revegetation may range between $2,500 and $5,500 per acre. A 50% allowance on the low side and 100% on the high side was considered for the limited cost data available. Therefore, a cost of between $3,750 and $11,000 per acre should be used for conceptual planning.

For a pipeline requiring a 100-foot construction width, the cost to revegetate should be between $45,000 and $132,000 per mile.

To obtain January 2006 cost for revegetation costs, escalate the above costs by 5%.

2.13.2 Other Environmental Costs

Other environmental costs, such as, monitoring, permits and other types of mitigation are included in the Administrative cost in Section 3. If specific mitigation requirements can be identified, these costs should be determined and included in the facility and project costs as separate line items.

2.14 Building Costs

Building costs are included in the unit cost curves for pumping stations, wells, water treatment facilities, and hydroelectric plants. If additional single story, unoccupied, utility type buildings are necessary, construction costs are estimated at $220/sq ft. The types of uses would include enclosures for on-site disinfection equipment, communication equipment, electrical equipment, and material storage. The cost is for a concrete masonry building, including foundation and roof. This cost includes a 30% allowance to account for different building systems. Costs for major interior improvements and site development are not included in the building costs. **To obtain January 2006 cost for buildings, escalate the above costs by 5%.**

3. ADMINSTRATIVE COSTS

In addition to the unit cost curves and cost data described earlier in this report, administrative costs should be included in the overall project cost estimate. These administrative costs include engineering, design, legal, construction management, environmental mitigation not included in Section 2, procurement, and facility startup.

For conceptual level projects, the administrative cost will be 25% of the capital cost.

Administrative Costs = 0.25 x capital costs

A summary of these costs include:

Program Management	Includes 2 years design management, procurement assistance for design and construction for each project
Lead Design Services	Includes 2 years design phase services, permit acquisition, public information assistance, and assistance to acquire land
Design Services	Includes 1 year design services
Design Services During Construction	Includes lead design services
Legal and Financial Services	For bond sales, consulting services, and legal services
Easement, ROW's, Land Acquisition	Includes 2, years, administrative cost of acquiring the land. Excludes capital cost of the land
Expediting	Procurement assistance and inspection services at vendors shops, 1.5 years
Environmental Mitigation	Includes capital cost of mitigation, other than revegetation, and permit fees
Construction Management Services	Includes 2 years, environmental compliance monitoring during construction
Startup and Training	Includes O&M manuals

4. LIFE CYCLE COST

Life cycle cost for the appropriate facilities should be included in the overall project costs. Life cycle costs include the post-construction costs for the economic life of the facilities and include amortization period of facilities, discount rates, escalation rates and operation and maintenance cost of each facility. The operation and maintenance (O&M) cost is shown as a percentage plus the cost of power and chemicals. The power and chemical cost are listed separately. Table 4-1 summarizes these costs.

Table 4-1. Life Cycle Cost Criteria

General	**Criteria**
Amortization period	30-50 years
Discount rate	5.5% per year
Escalation rate for Jan. 2005 – Jan. 2006 (1)	5%
Escalation rate for future years (2)	4% per year
Power escalation rate	2% per year
Economic Life of Facilities	
Intake	50 years
Pipelines	50 years
Tunnels	50 year
Pumping stations	
Structural and piping	50 years
Mechanical and electrical equipment	20 years
Water treatment facilities	
Structural and piping	50 years
Mechanical and piping	20 years
Reservoirs	50 years
Power facilities	25 years
Normal O&M	
Intake	1 % of construction cost/year
Pipelines	1 % of construction cost/year
Tunnels	1 % of construction cost/year
Pumping stations	3% of construction cost/year
Water treatment facilities	3% of construction cost/year
Brine ponds	1% of construction cost/year
Forebays	2% of construction cost/year
Raw water reservoir	2% of construction cost/year
Hydropower/ROFC facilities	3% of construction cost/year
Wells	3% of construction cost/year
Maintenance Roads	1% of construction cost/year
Power supply facilities	1% of construction cost/year
Power cost	6 cents/kWh in 2005
Chemical cost	Use projected actual

Notes:

1) For estimating current cost for periods beyond January 2006 use the ENR index for 20 cities of 7660.29.
2) Use the future escalation rate with caution. Discuss with the SNWA project manager to determine if a different rate should be considered for cost estimating.

5. CONTINGENCY

Each project should include contingencies for unforeseen and unknown costs. The recommended contingencies are:

Table 5-1 Contingency Criteria	
Project Phase	**Contingencies**
Concept Planning	30%
Facility Development	25%
50% Design Drawings	15%
90% Design Drawings	10%
Construction Contract	5%

Contingency costs shall be calculated by multiplying the contingency factor times the construction costs.

The total project costs should include the construction costs plus administration cost plus the contingency cost.

The American Association of Cost Estimating Engineers provides the following definitions and expected accuracies for engineering cost estimates. For this cost criteria the definitions have been summarized as follows

- Rough Order of Magnitude – This is an approximate estimate made without detailed engineering data. Normal accuracy ranges +50% to –30%.
- Budget Estimate – The owner's budget and prepared with layouts and equipment details. Normal accuracy ranges +30% to –15%.
- Definitive Estimate – A detailed estimate prepared from detailed engineering data. Normal accuracy ranges +15% to –10%.