Appendix E - Tunnel South of County Line Supporting Technical Information

Tunnel South of County Line

Supporting Technical Information

This appendix contains technical information developed as part of the Tunnel South of County Line alternative. The following information is included in this appendix:

1. Hydrogeology Memorandum, October 5, 2005 – Gus Yates, PG, CHG, developed a memorandum summarizing the available hydrogeology information in regards to the project area. Included in this memorandum were figures detailing groundwater well locations and groundwater model results projecting groundwater surface elevations in March and September of 2003.
2. Hydrogeology Memorandum, November 16, 2005 – Gus Yates provided a second memorandum characterizing the groundwater conditions along the two alignment alternatives. Included in this memorandum were profile drawings of groundwater elevations along each alignment. These drawings were modified and are included as figures in Section 4.2.
3. Basis for Conceptual Costs Estimates Memorandum, October 18, 2005 – Glenn Boyce, PhD, PE, lead the Jacobs Associates project team in developing planning level cost estimates for tunnel Alternatives 1 and 2. The memorandum describes cost assumptions and the work included per each estimate. Also included in the memorandum are detailed cost estimate summaries for each tunnel alternative. The cost estimates prepared by Jacobs Associates served as the basis for the cost estimates presented in Section 5.2. Note that the cost estimates prepared by Jacobs Associates did not include implementation costs or costs for other necessary construction work, such as potential storm drain improvements.
4. John Daly Alignment (Tunnel Alternative 3), Alternate Retrieval Location: Option B, March 9, 2006 – A third tunnel alternative, the John Daly Alignment, was investigated at the request of the City of Daly City. Details for Alternative 3 are presented in the Vista Grande Watershed Study, however an alternate retrieval shaft and inlet location were also investigated. The Option B memo presents details associated with this alternate location.
5. Basis for Conceptual Costs Estimates Memorandum, John Daly Alignment (Alternative 3), January 6, 2006 – Jacobs Associates developed planning level cost estimates for tunnel Alternative 3. The memorandum describes cost assumptions and the work included per the estimate and a detailed cost estimate summary. The cost estimate was developed assuming the use of retrieval Option B and served as the basis for the cost estimates presented in Section 5.2. Note that the cost estimates prepared by Jacobs Associates did not include implementation costs or costs for other necessary construction work, such as potential storm drain improvements.

MEMORANDUM

Gus Yates, PG, CHg, Consulting Hydrologist • 1809 California Street, Berkeley, CA 94703
tel/fax 510-849-4412 • gusyates@earthlink.net

DATE: 5 October 2005
TO: Kevin Smith, RMC
FROM: Gus Yates, Consulting Hydrologist
SUBJECT: Groundwater Conditions along Proposed New Vista Grande Stormwater Tunnels

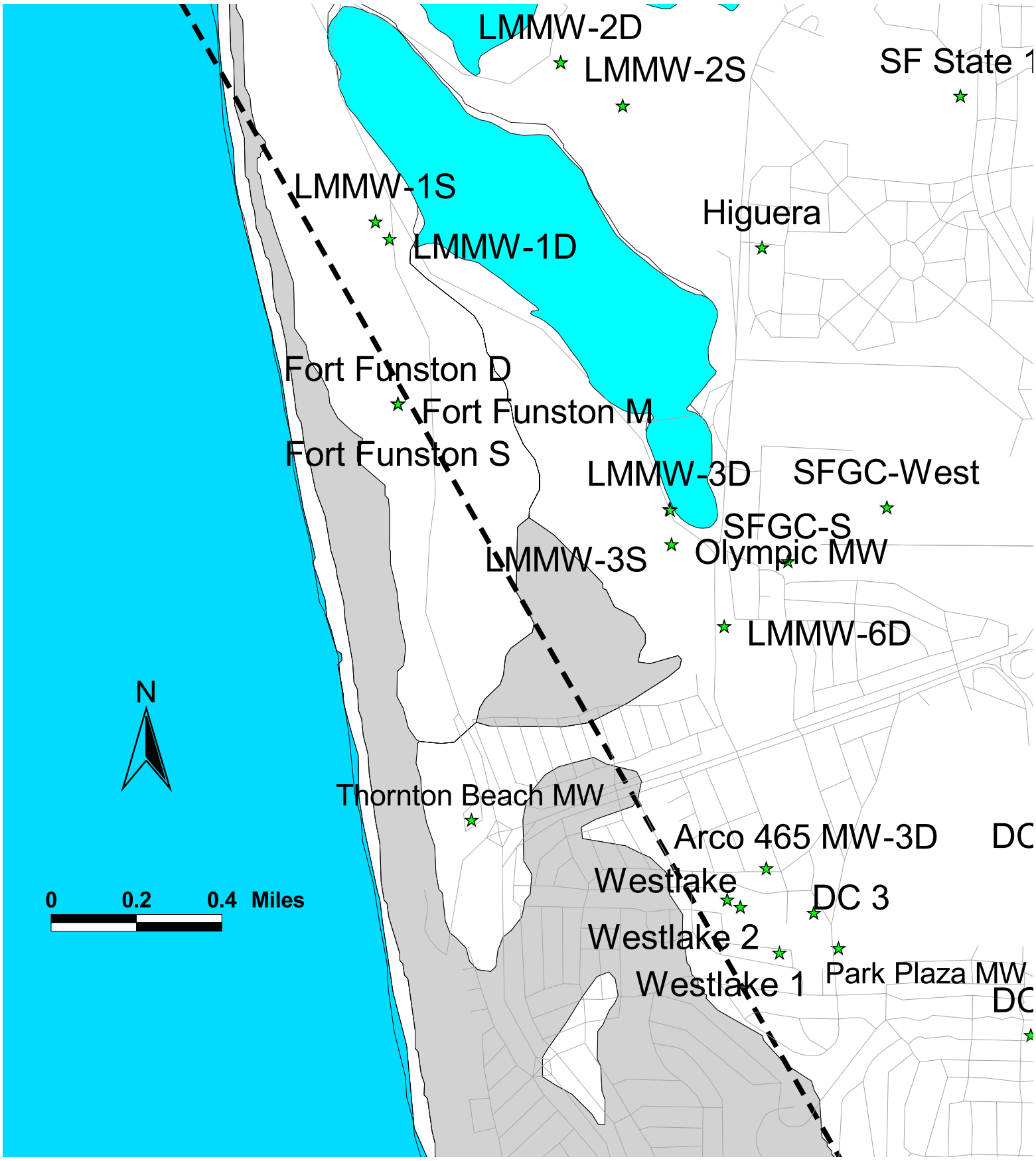
At your request, I am sending some preliminary information regarding groundwater conditions along the proposed alignments for the new Vista Grande stormwater tunnel. Some of the items I am transmitting by e-mail, the rest by surface mail.

A few comments on the materials:

- Well location map (pdf). This figure shows the locations of the wells for which I am also including hydrographs (plus other wells in the vicinity of the Olympic Golf Club). The Serra Fault is shown on the figure as a heavy, black dashed line.
- Hydrographs of measured and simulated groundwater elevations in those wells, in feet above sea level (NGVD 1929) (two pdf files). You'll want to pay attention to shallow wells corresponding to model layer 1, since the tunnel would be in that layer.
- At the east end of the tunnel (near Lake Merced Blvd), groundwater gradients are downward and southward. Near Impound Lake (hydrograph for monitoring well LMMW 3S), groundwater elevation is 6-8 feet above sea level. At the Daly City WWTP, groundwater elevation in a deeper monitoring well (LMMW 6D) is 30-40 feet below sea level.
- Two monitoring wells are present farther west, near Skyline Boulevard. The Fort Funston well cluster is located about 0.5 mile north of the tunnel alignments. The shallow well at this location has water levels about 9 feet above sea level. This well was redeveloped in 2002, and older data are not reliable. The Thornton Beach well cluster is located at the intersection of Skyline Boulevard and John Daly Boulevard, about 0.4 mile south of the tunnel alignments. The shallow well at that location has a water level about 82 feet above sea level.
- Two contour maps of simulated water levels in model layer 1 (the topmost layer) are also enclosed, one for March 2003 and one for September 2003 (two pdf files). The model is still undergoing development, but the general pattern of simulated water levels in this area will likely remain about the same. Generally, it shows that the Serra Fault (zig-zag red line) separates an area of relatively flat groundwater elevations (on the northeast side of the fault) from a ridge of elevated groundwater levels on the southwest side. The southwest side of the fault consists of a tilted and possibly folded block of primarily Merced Formation. This deformation results in low horizontal hydraulic conductivity, which is why the Thornton Beach well has such a high water level. The contours suggest that the water level near the tunnel

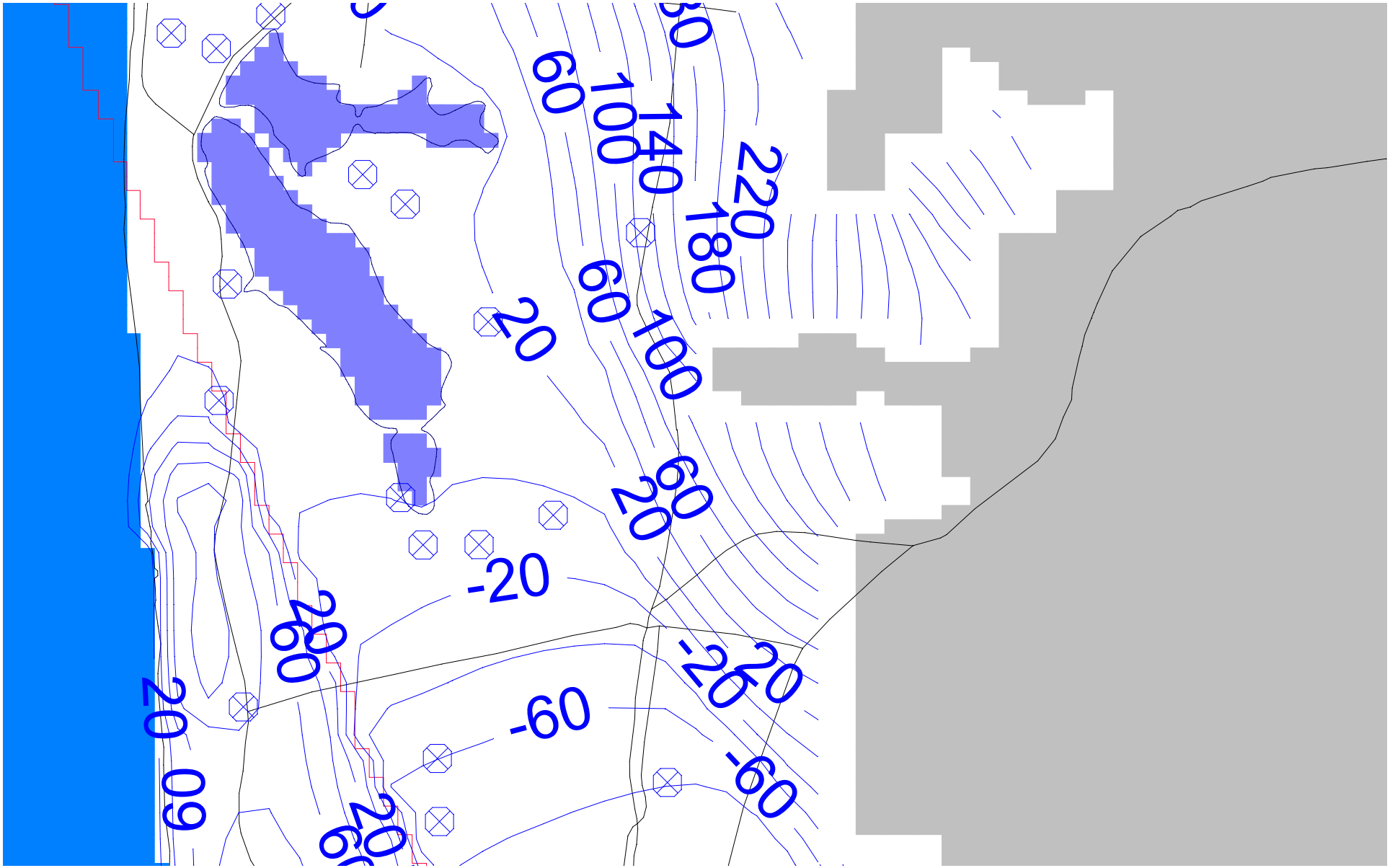
alignments would peak at about 100 feet above sea level in spring and 75 feet above sea level in fall. Actually, I would expect less seasonal variation than indicated here, because of the thick unsaturated zone that attenuates recharge pulses.

- The upshot of all of this is that the east end of the tunnel might be above the water table, but farther to the west it will definitely be below the water table. This transition might not occur until the tunneling reaches the Serra Fault, but it is possible that the water table slopes more uniformly along the alignment and would be encountered in the excavation between the fault and Lake Merced Blvd.
- I am sending various references regarding the Merced Formation and the Serra Fault that may be of use to the geotechnical consultants for the tunneling operation:
    - Drew Kennedy's 2002 masters thesis is the most recent work in the area. Fortunately, I have it as a pdf and will send it on a CD. The key thing to keep in mind is that the Serra Fault appears to be active at a slip rate exceeding 1 mm/yr in this area. The fault is buried but is expressed near the surface as a "vergent" (overturned) fold. The tunnel design should allow for vertical movement on the fault and probably also adjacent deformation.
    - Jennifer Barr's 1999 master's thesis on the Serra Fault (paper copy). She was the first to present the overturned fold hypothesis.
    - Two of numerous articles by Ed Clifton and Ralph Hunter (USGS) on the geology of the Merced Formation as exposed in the cliffs along Ocean Beach (paper copy).
- All of these geologic reports show a large mapped landslide on the bluff face at the ocean end of the tunnel alignment. Presumably, this will have implications for tunel engineering.
- The datum conversion chart from the March 2002 hydrogeologic conceptualization report by Luhdorff and Scalmanini Consulting Engineers (paper copy)

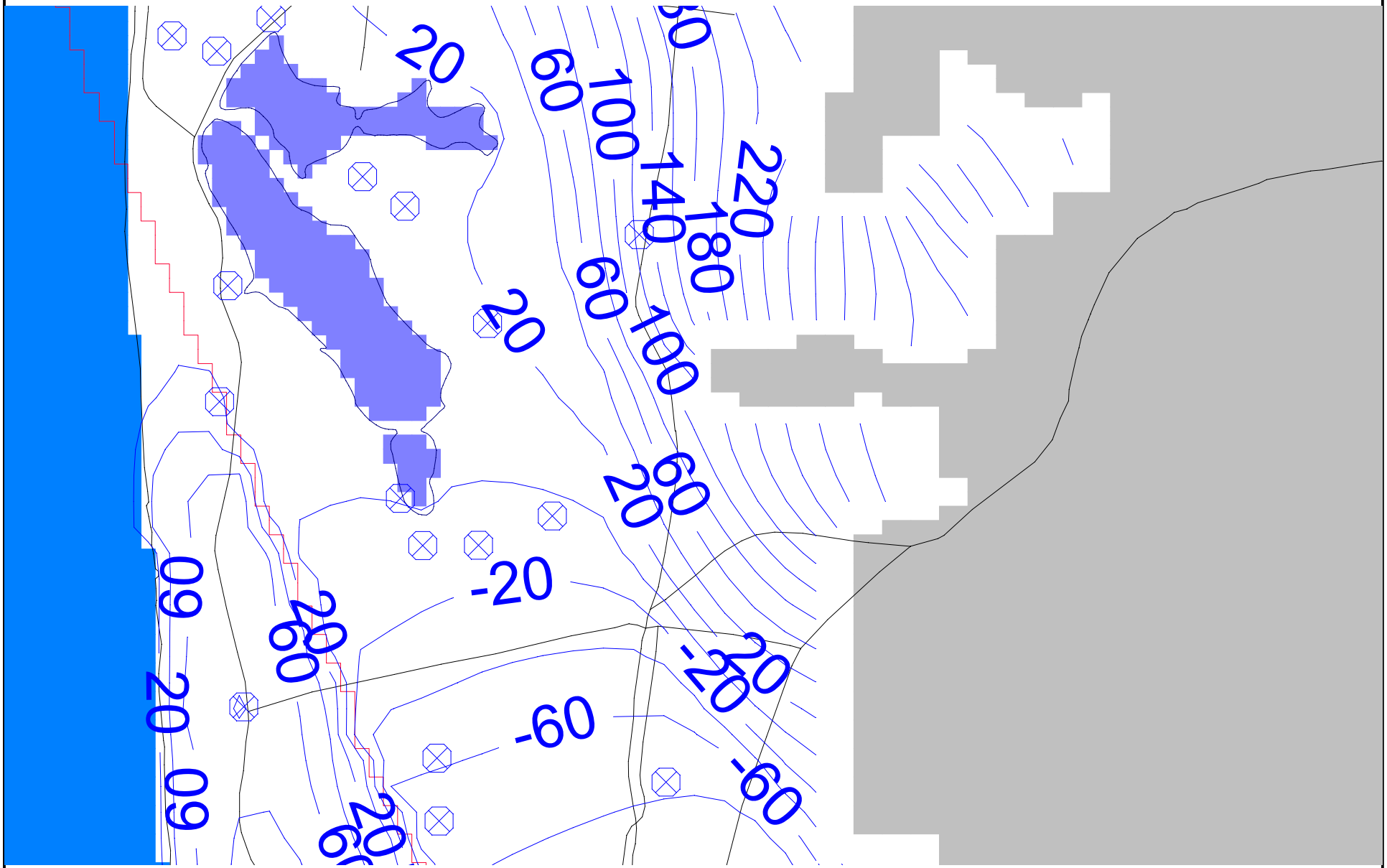


Locations of Wells with Water-Level Data

Westside Basin Groundwater Model (Draft) Simulation Layer 1 Groundwater Elevation, March 2003



Westside Basin Groundwater Model (Draft) Simulation Layer 1 Groundwater Elevation, Sept. 2003



MEMORANDUM

Gus Yates, PG, CHg, Consulting Hydrologist • 1809 California Street, Berkeley, CA 94703
tel/fax 510-849-4412 • gusyates@earthlink.net

DATE: 16 November 2005
TO: Kevin Smith, RMC
FROM: Gus Yates, Consulting Hydrologist
SUBJECT: Groundwater Profiles along Proposed New Vista Grande Stormwater Tunnels

I superimposed my estimate of the water table elevation on the profile drawings for the two proposed Vista Grande tunnel alignments (see attached). Please have your graphics department add the following label to the Y axis of the profiles: "Elevation in Feet above San Francisco Datum (-8.62 feet NGVD 1929)". All of my data and modeling use the NGVD 1929 sea level datum, and those values can be converted to the SF datum by subtracting 8.62 feet. This includes the hydrographs and water-level contour maps that accompanied my October 5, 2005 memorandum. For the present exercise, I shifted the water table profiles downward on the cross section diagrams to correspond to the San Francisco datum. With multiple firms and individuals working on this project, it is essential to indicate the datum for all elevation information, or there will be a substantial risk of error in the design and construction process.

The water table profile lines are a bit uneven because I was using the Adobe Acrobat freehand pencil tool, which allows no editing of the line once it is drawn. However, the profiles are consistent with the following geologic and groundwater data:

- There is a large water-level drop across the Serra Fault, which crosses the two profiles about one-third of the way between Skyline Boulevard and the eastern ends of the profiles.

- Simulations with a regional groundwater model suggest that the water table profile is quite flat east of the fault and forms a high mound west of the fault, dropping steeply to a seepage face near the toe of the beach bluff cliffs.

- The closest monitoring wells used to calibrate the model are the Thornton Beach monitoring well cluster, the Fort Funston monioring well cluster, LMMW-1S, LMMW-3S and -3D, and LMMW-6D. My October 5 memorandum included a map showing the locations of the wells and fault.

- The Thornton Beach and Fort Funston wells are west of the fault and substantiate the considerable water table mounding that occurs in the deformed Merced Formation beds west of the fault. Interpolating between the well locations with the assistance of the groundwater model suggests a water table elevation of 60-65 feet (NGVD 1929) at the crest of the mound.

- East of the fault, the regional water table slopes southward toward a major pumping depression in the Westlake area. Shallow clay layers that support the shallow aquifer become discontinuous somewhere between Impound Lake and John Daly Boulevard. As the clays become discontinuous, the downward slope steepens and the water table plunges to an elevation of approximately 100 feet below sea level (NGVD 1929) in the Westlake area. The exact shape of the water table as it slopes southward is poorly known. However, the water table is certainly lower at the eastern end of tunnel profile 2 (Senior Center) than at the eastern end of tunnel profile 1 (John Muir Drive). On the profiles, it appears that the tunnel inverts would be above the water table elevation at the eastern ends of both profiles, but only by a couple of feet for profile 1.

- My profiles show the water table rising only very gradually between the east ends of the profiles and the Serra Fault. No monitoring wells are available in this interval, and it is quite possible that the water table rises more steeply.

- The Serra Fault is more deeply buried and appears to have less offset along this northern segment compared to its more obvious surface exposures in the San Bruno area. Two recent masters theses have investigated this segment of the fault (Barr 1999, Kennedy 2002) and characterize it as a blind (buried) thrust fault expressed at the surface as steep "vergent" folds. The effect of folding on the water table profile would likely be spread out more broadly than the effect of a fault plane. This suggests that the groundwater model simulates too abrupt a water-level drop across the fault, and that the water table might slope more uniformly from the crest of the mound eastward toward the eastern ends of the profiles.

- My general conclusions are that the tunneling operation might be above the water table at the eastern end (with a higher probability of dry conditions for the southern alignment), but that it would encounter the water table at most about halfway to the coast, and possibly sooner.

JACOBS ASSOCIATES

Engineers/Consultants

PROJECT MEMORANDUM

To: Glenn M. Boyce

From: Paul W. Dutton and John M. Stolz

Date: October 18, 2005

Job No.: 3957 Vista Grande Tunnel

Subject: Basis for Conceptual Cost Estimates

The purpose of this memorandum is to set forth the basis for developing the subject conceptual cost estimates.

Estimates were prepared for two alternatives:

1. Alternate 1 – Intake Structure at Intersection of John Muir Drive and Lake Merced Blvd. This alternate is estimated to cost $39.5M and require an 18-month construction period.
2. Alternate 2 – Intake Structure in Parking Lot of Westpark Community Center. This alternate is estimated to cost $43.5 M and require a 21-month construction period.

Estimated costs represent the current expected low bid for construction, and include a 30 percent allowance for contingency. This relatively high amount of contingency is intended to reflect the low level of project definition, the current bidding climate in the underground construction industry, and the recent volatility in material prices for such items as steel and cement. The estimates do not include the following:

- Escalation; however the estimates include a memo entry for escalation calculated to the time of expenditure.
- Design and construction management fees.
- Right-of-way and land acquisition.
- Cost for preparing an Environmental Impact Report and obtaining permits.
- Other costs that may be incurred by the City of Daly City and San Francisco PUC, including any allowances for change orders executed during construction.

The cost estimates were prepared using all available information, with judicial assessments where no information was available, and comprise production-type cost estimating methods:

- Current prevailing labor rates were taken from California Department of Industrial Relations and are fully burdened rates, including payroll taxes and insurance, and worker's compensation and commercial general liability insurance.

- Equipment rates were developed using the current US Army Corps of Engineers *Construction Equipment Ownership and Operating Expense Schedule (Region VII)*, published in 2003 for the western states.
- Material and subcontract costs are based on current market prices. Quotes were obtained for large items such as bolted, gasketed tunnel segments.

Work common to both Alternatives involved construction of the following:

- A 32-foot diameter Access Shaft sized to permit subsequent tunneling, and construction of a permanent inlet structure.
- A 15-foot ID tunnel, 4,750- and 4,900- linear foot long for Alternates 1 and 2, respectively. Since the water table is expected to be above the tunnel, construction was based on the use of an Earth Pressure Balance Tunnel Machine so that the alignment would not require dewatering. The tunnel was estimated to be supported using bolted, gasketed precast concrete segments, thereby eliminating the need for a final cast-in-place concrete lining. Tunnel muck (i.e., spoils) was estimated to be disposed of on local beaches (within 10 miles) as remediation material with no associated dump fees.
- An Outlet Structure. Due to the lack of beach access, construction was estimated to be staged entirely from within the tunnel. The concrete structure was estimated to be founded on mini-piles, socketed into the rock face, and equipped with a steel grate and sand pocket.
- A cast-in-place concrete Inlet Structure.

Alternate 1 includes a temporary diversion structure to handle up to 680 cfs of flows into the canal along John Muir Drive for the entire contract period.

Alternate 2 includes the following additional work:

- Construction of a 550-foot-long microtunnel between the new Inlet Structure and a tie-in point to a 60-inch storm drain located on Cliffside Dr. This work includes construction of an access shaft over the tie-in location used to recover the microtunneling machine and affect the tie-in.
- Construction of approximately 300 linear feet of box culvert connecting a tie-in with the existing 7 foot by 6 foot box culvert along Lake Merced Blvd and the new Inlet Structure.

Not included in the Alternate 2 cost estimate is the cost of a small pump station to pump any flows collecting in the existing canal back to the Westpark Community Center.

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Project	Client	Job No.	Estimator	Rev	Date
Vista Grande Tunnel	**RMC**	**3957.0**	**PD/JS**	**0**	**10/11/2005**

Conceptual Cost Estimate - Alternate 1 Tunnel Portal at Corner of John Muir and Lake Merced Blvd.

SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

No.	Item or Group Item Description	Item Quantity/Unit		Item Unit Cost		Status	Item Cost
001	Clear/Grub Inlet Structure Site		LS				$5,000
002	Excavate/Support Access Shaft/Diversion Str		LS				$391,208
003	Pregrout Shaft Portal	1,200	cf	$27.86	/cf		$33,431
004	Fit out Shaft Tunneling Plant		LS				$41,491
005	Assemble EPBM and Backup		LS				$237,746
006	Excavate/Support Tunnel	4,750	lf	$3,262	/lf		$15,496,775
007	Disassemble EPBM / Backup through Tunnel		LS				$334,334
008	Construct Outlet Structure	277	cy	$1,312	/cy		$363,329
009	Remove Tunnel Services		LS				$33,654
010	Construct Inlet Structure	480	cy	$559	/cy		$268,136
011	Backfill Temp. Diversion and Effect Tie-in		LS				$59,361
012	Restore Site		LS				$7,500
				Subtotal Direct Cost			**$17,271,964**
013	Equipment Ownership/Mobilization			19.3%	of cost		$5,872,643
014	General Mobilization	Total 3.6% of unescalated cost		2.8%	of cost		$847,859
015	Demobilization			0.9%	of cost		$260,600
016	General Plant Operation and Maintenance	13.5	mo	$11,539	/mo		$155,775
017	Weekend Maintenance	53	day	$3,827	/day		$202,847
018	Field Supervision	18.3	mo	$102,672	/mo		$1,878,904
019	Overhead Maintenance and Service	18.3	mo	$17,179	/mo		$314,371
020	Bonds, Insurance, and Taxes not in General Mob			1.0%	of cost		$309,725
021	Markup			9.8%	of cost		$2,980,889
022	Financing Charges			1.0%	of cost		$309,143
				Subtotal Indirect Cost			**$13,132,756**
023	Escalation-excluded from estimate	$4,560,501	(3.7% composite annual rate)				-
February 2009 NTP: 18.3 month duration				**Opinion of Probable Construction Bid**			**$30,404,721**

Cost Componant	Labor	Equipment	Material	Subcontract	Total
Direct Cost	$3,666,231	$884,647	$11,972,170	$748,916	$17,271,964
Indirect Cost	$2,130,225	$5,222,159	$5,702,673	$77,700	$13,132,756
Escalation-excluded from estimate	-	-	-	-	-
Summary Breakdown by Cost Type	**$5,796,456**	**$6,106,806**	**$17,674,843**	**$826,616**	**$30,404,721**

Owner Contingency	Project definition	30%	of bid	$9,121,416
	Subtotal Owner Contingency	**30%**	**of bid**	**$9,121,416**
	Opinion of Probable Construction Bid with Owner Contingency			**$39,526,137**

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Project	Client	Job No.	Estimator	Rev	Date
Vista Grande Tunnel	**RMC**	**3957.0**	**PD/JS**	**0**	**10/18/2005**

Conceptual Cost Estimate - Alternate 2 Shaft Construction Near Senior Center.

SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

No.	Item or Group Item Description	Item Quantity/Unit	Item Unit Cost	Status	Item Cost
001	Site Preparation at Inlet Structure Location	1 LS	$15,000 /LS		$15,000
002	Excavate/Support Access Shaft	LS			$137,994
003	Pregrout Shaft Portal	1,200 cf	$27.86 /cf		$33,431
004	Fit out Shaft Tunneling Plant	LS			$41,491
005	Assemble EPBM and Backup	LS			$237,746
006	Excavate/Support Tunnel	4,900 lf	$3,292 /lf		$16,128,854
007	Disassemble EPBM / Backup through Tunnel	LS			$334,334
008	Construct Outlet Structure	277 cy	$1,312 /cy		$363,329
009	Construct Drop Shaft on Cliffside Drive	1 LS	$185,000 /LS		$185,000
010	Micro tunnel to Cliffside Receiving Shaft	550 lf	$2,145 /lf		$1,179,660
011	Remove Tunnel Services	LS			$33,654
012	Construct Inlet Structure	480 cy	$559 /cy		$268,136
013	Erect New Box Culvert - Tie In System	300 lf	$1,615 /lf		$484,466
014	Restore Site	LS			$7,500
			Subtotal Direct Cost		**$19,450,595**
015	Equipment Ownership/Mobilization		17.9% of cost		$5,993,640
016	General Mobilization	Total 3.2% of unescalated cost	2.5% of cost		$842,237
017	Demobilization		0.7% of cost		$238,900
018	General Plant Operation and Maintenance	15.5 mo	$11,556 /mo		$179,125
019	Weekend Maintenance	52 day	$3,831 /day		$199,208
020	Field Supervision	21.0 mo	$100,273 /mo		$2,105,726
021	Overhead Maintenance and Service	21.0 mo	$16,368 /mo		$343,725
022	Bonds, Insurance, and Taxes not in General Mob		1.1% of cost		$370,551
023	Markup		10.1% of cost		$3,367,369
024	Financing Charges		1.0% of cost		$336,019
			Subtotal Indirect Cost		**$13,976,501**
025	Escalation-excluded from estimate	$5,183,451 (3.8% composite annual rate)			-
February 2009 NTP: 21 month duration			**Opinion of Probable Construction Bid**		**$33,427,096**

Cost Componant	Labor	Equipment	Material	Subcontract	Total
Direct Cost	$3,947,648	$962,072	$12,419,090	$2,121,785	$19,450,595
Indirect Cost	$2,345,914	$5,326,590	$6,219,897	$84,100	$13,976,501
Escalation-excluded from estimate	-	-	-	-	-
Summary Breakdown by Cost Type	**$6,293,562**	**$6,288,663**	**$18,638,986**	**$2,205,885**	**$33,427,096**

Owner Contingency	Project definition	30% of bid	$10,028,129
	Subtotal Owner Contingency	**30% of bid**	**$10,028,129**
	Opinion of Probable Construction Bid with Owner Contingency		**$43,455,225**

Vista Grande Watershed Study

RMC

Prepared by: Kevin Smith

Reviewed by: Randy Raines, Roxanne Stachon

Date: March 9, 2006

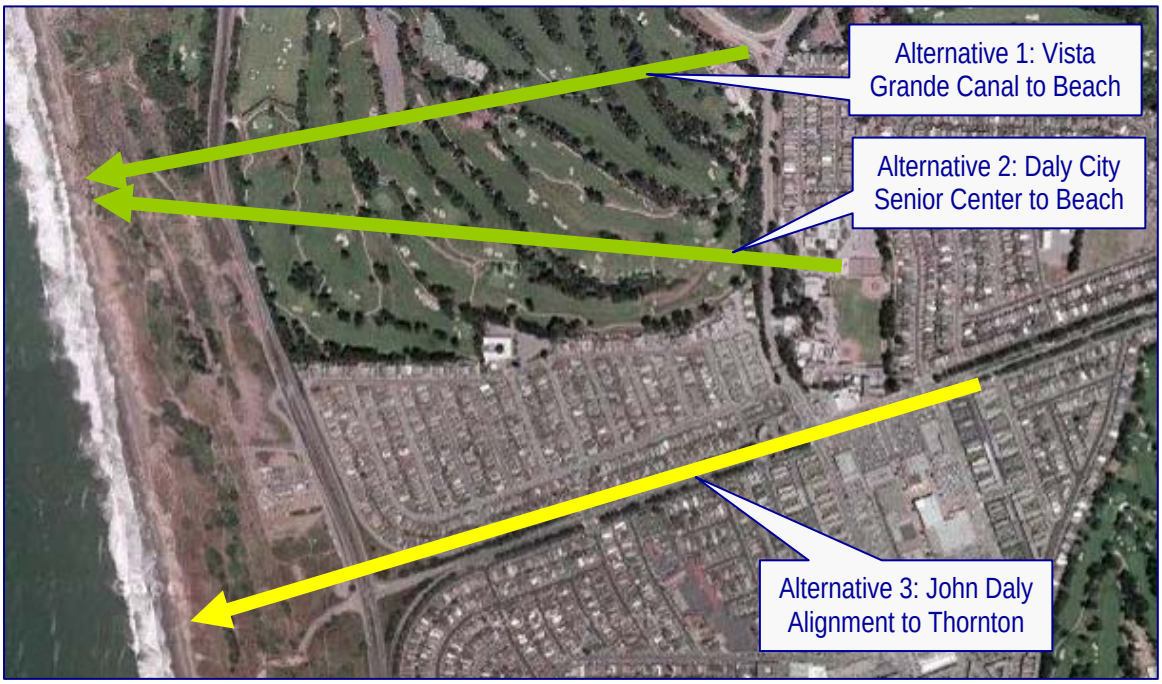
Subject: **John Daly Alignment (Tunnel Alternative 3)**
Alternate Retrieval Location – Option B

1 Background

The John Daly Alignment (JDA) is being considered, along with two other tunnel alternatives, for the downstream flood protection component of the Vista Grande Watershed Study. The JDA tunnel would convey stormwater from a location near the Westlake Shopping Center to a beach discharge structure in Thornton State Beach. Details regarding the JDA alternative are presented in the Vista Grande Watershed Study. This memo presents details developed for an alternate retrieval location for the JDA alternative, located at South Mayfair Avenue at Lake Merced Boulevard and known as Option B. A retrieval location is the site where a construction shaft is excavated and the tunnel boring machine is retrieved. It is the location of the upstream inlet structure for the tunnel.

Figure 1 shows the JDA alternative and the two other alignment alternatives considered in the Study.

Figure 1: John Daly Alignment Tunnel Alternative



The development of the JDA Option B was based on the same hydrologic, hydraulic, and groundwater assumptions presented in the Vista Grande Watershed Study. The JDA Option B would require the same facilities and construction requirements as described for the JDA alternative in the Vista Grande

Watershed Study except in regards to the retrieval location. These details include the following major components:

- Primary construction site located near the termination of John Daly Boulevard at Skyline Boulevard, between Daly City's Thornton Beach Vista and the horse stables to the north. A 215-ft deep, 32-ft diameter access shaft sized to permit subsequent tunneling, in two directions with limited disturbance to the general public.
- The 15-ft I.D. tunnel would be mined in two sections. The first section would be mined with a tunneling shield and would extend from the access shaft to the ocean shore. The second portion of the tunnel would extend from the access shaft the retrieval shaft location.
- Construction of the tunnel utilizes an Earth Pressure Balance Tunnel Machine (EPBM), which can operate below the water table so that dewatering is not required.

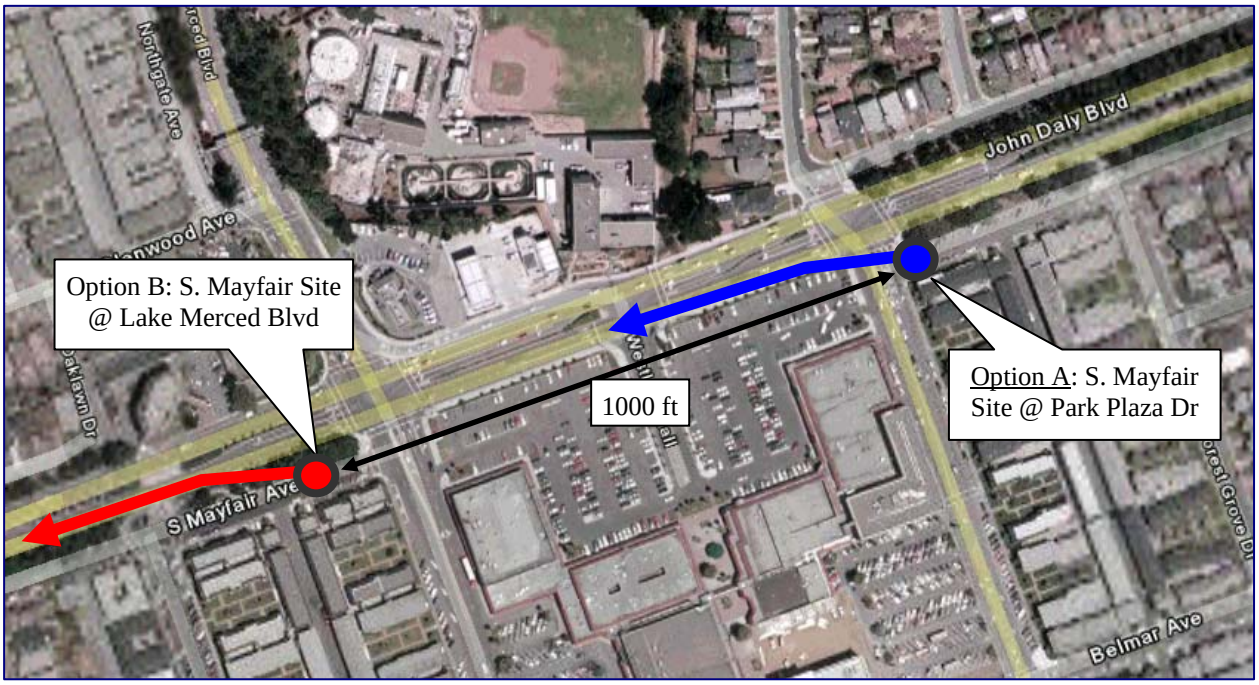
2 JDA Option B Facility Details

2.1 Retrieval Location

The EPBM would begin excavating the tunnel at the primary construction site and travel upstream toward the EPBM retrieval location. The retrieval location for the EPBM and the upstream inlet of the JDA tunnel alternative would be located near the Westpark Shopping Center. Through field visits and discussions with Daly City staff, two alternate retrieval locations were selected: South Mayfair Avenue at Park Plaza Drive (presented in the Vista Grande Watershed Study) and South Mayfair Avenue at Lake Merced Boulevard (Option B). Figure 2 illustrates the two potential sites. Construction work for Option B would include the following:

- An 80-ft deep, 25-ft diameter retrieval shaft sized to allow recovery of the EPBM. The retrieval shaft would be located at South Mayfair Avenue at Lake Merced Boulevard.
- Construction of a cast-in-place concrete inlet structure
- Restoration of the site after construction is completed
- Storm drain connections, detailed in the following section

Figure 2: Retrieval Locations



2.2 Storm Drain Connections

Extensive storm drain connections are required for Option B. Daly City's three storm drain sub-basins (Glenwood Avenue, Lake Merced Boulevard, and Cliffside Drive trunk lines) would have to be connected to the retrieval shaft location. As illustrated in Figure 3, storm drain connections for Option B would require the following:

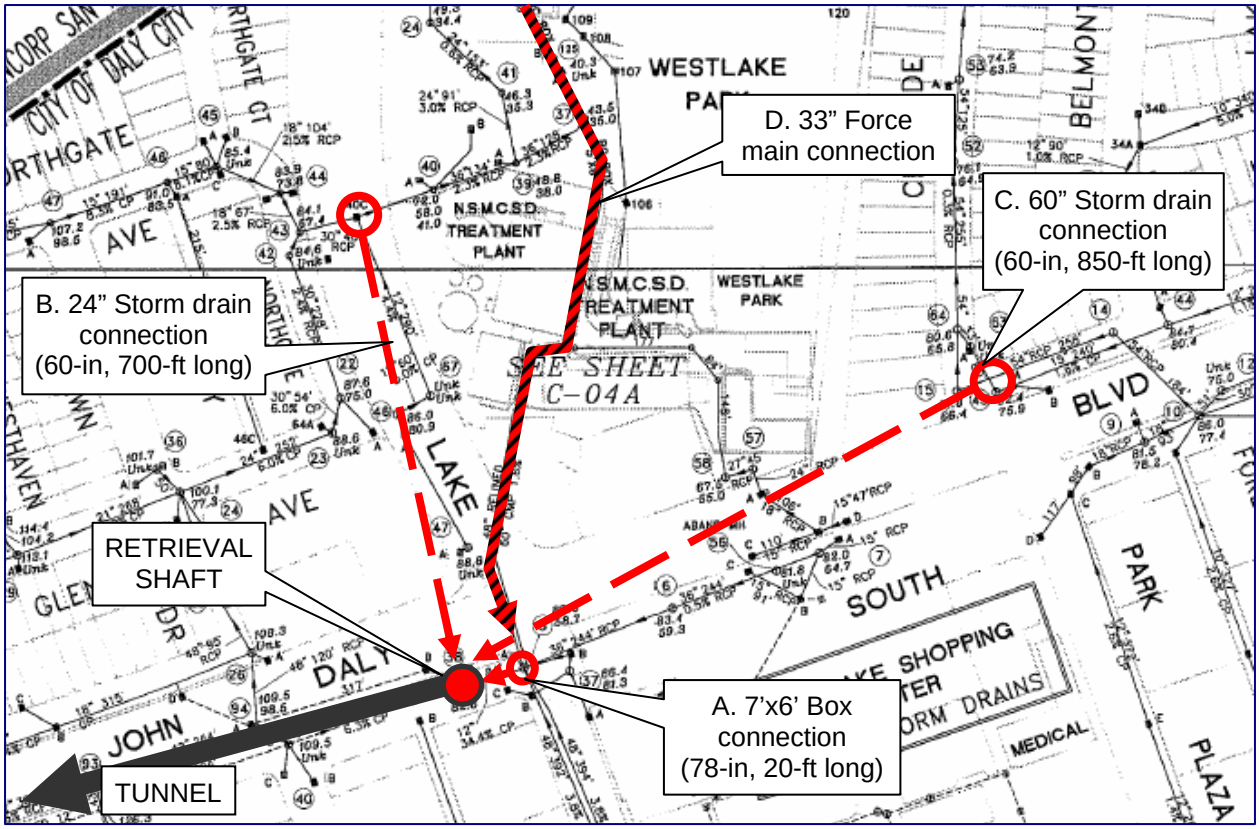
A. Construction of approximately 20 ft of RCP pipe-jacked tunnel, connecting an existing manhole (7-ft x 6-ft storm drain) in Lake Merced Boulevard to the new inlet structure.

B. Construction of a 700-foot long, 60-inch I.D. micro-tunnel connecting the new inlet structure with the 24-inch storm drain at an existing manhole. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and install a tie-in structure.

C. Construction of an 850-foot long, 60-inch I.D. micro-tunnel connecting the new inlet structure with the 60-inch storm drains at an existing manhole. This work includes construction of an access shaft at the connection location to recover the micro-tunneling machine and install a tie-in structure. Both micro-tunnel connections were assumed to use the same micro-tunnel size for construction cost savings. The size of both micro-tunnels would be refined during the design process based on the findings of the upstream storm drain improvements program included in the Vista Grande Watershed Study.

D. Installation of a pump station and 33" force main to convey stormwater collected in the sub-basins downstream of the connection points. This "remainder" flow would flow toward the existing Vista Grande canal but then be pumped back to the tunnel connection shaft. The pump station would be located underground near the Vista Grande canal and the force main would be installed in the existing 7-ft x 6-ft box storm drain.

Figure 3: Storm drain Connections to JDA Tunnel Retrieval Site Option B



2.3 Cost Estimates

Planning level costs estimates for the JDA Option B with the retrieval site at South Mayfair Avenue and Lake Merced Boulevard would be approximately $77 million ($98 million escalated to 2010). Option B would cost approximately $4.5 million less than the JDA alternative presented in the Vista Grande Watershed Study. The cost difference is due to the following two reasons:

- Option B reduces the total length of the tunnel by 1000-ft. However, additional micro-tunneling to connect the 60-inch storm drain sub-basin would be required.
- Option B requires only one 80-ft deep excavation pit. The JDA alternative presented in the Vista Grande Watershed Study requires two: one to retrieve the EFBM and another to connect the 24-inch and 7-ft x 6-ft box storm drains to the tunnel. A second drop structure and inlet structure are also required.

Other project details, such as the outlet structure, operation and maintenance, project benefits, environmental impacts, and implementation schedule are assumed to be the same as the details for the JDA alternative presented in the Vista Grande Watershed Study.

JACOBS ASSOCIATES

Engineers/Consultants

PROJECT MEMORANDUM

To: Glenn M. Boyce

From: Paul W. Dutton and John M. Stolz

Date: January 6, 2006

Job No.: 3957 Vista Grande Tunnel

Subject: Basis for Conceptual Cost Estimate – Alternate 3

The purpose of this memorandum is to set forth the basis for developing the third conceptual cost estimate for the Vista Grande Tunnel. This third estimate was prepared in addition to the estimates for Alternates 1 and 2, prepared in October 2005:

1. Alternate 1 – Intake Structure at Intersection of John Muir Dr. and Lake Merced Blvd. This alternate is estimated to cost $39.5M and require an 18 month construction period.
2. Alternate 2 – Intake Structure in Parking Lot of Westpark Community Center. This alternate is estimated to cost $43.5 M and require a 21 month construction period.
3. Alternate 3 – Intake Structure along South Mayfair Avenue just to the west of the Westlake Shopping Center. Most of the construction activity for this Alternate would be centered around an access shaft located at the Horse Ranch near the intersection of John Daly Boulevard and Skyline Drive. This alternate is estimated to cost $53.3M and require a 14 month construction period.

Estimated costs represent the current expected low bid for construction, and include a 30 percent allowance for contingency. This relatively high amount of contingency is intended to reflect the low level of project definition, the current bidding climate in the underground construction industry, and the recent volatility in material prices for such items as steel and cement. The estimates do not include the following:

- Escalation; however the estimates include a memo entry for escalation calculated to the time of expenditure.
- Design and construction management fees.
- Right-of-way and land acquisition.
- Cost for preparing an Environmental Impact Report and obtaining permits.
- Other costs which may be incurred by the City of Daly City and San Francisco PUC, including any allowances for change orders executed during construction.

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This cost estimate was prepared using all available information, utilizing production-type cost estimating methods.

- Current prevailing labor rates were taken from California Department of Industrial Relations and are fully burdened rates, including payroll taxes and insurance, and worker's compensation and commercial general liability insurance.
- Equipment rates were developed using the current US Army Corps of Engineers *Construction Equipment Ownership and Operating Expense Schedule (Region VII)*, published in 2003 for the western states.
- Material and subcontract costs are based on current market prices. Quotes were obtained for large items such as bolted, gasketed tunnel segments.

Work involved in this construction Alternative includes the following:

- A 215 ft deep, 32 ft diameter Access Shaft sized to permit subsequent tunneling, in two directions with limited disturbance to the general public.
- An 82 ft deep, 25 ft diameter Retrieval Shaft sized to allow recovery of the EPBM and construction of an intake structure.
- A 15 ft I.D. tunnel, mined in two sections. The first section is mined with a tunneling shield and extends 1200 linear feet from the Access Shaft at the horse ranch to the ocean shore. The second portion of the tunnel extends from the Access Shaft to the Retrieval Shaft constructed at a location along South Mayfair Ave just west of the Westlake Shopping Center, a distance of approximately 3200 lf. Since the water table is expected to be above the tunnel, construction of the 3200 lf reach is based on the use of an Earth Pressure Balance Tunnel Machine (EPBM) so that this alignment would not require dewatering. The entire length of 4,400 lf tunnel was estimated to be supported using bolted, gasketed precast concrete segments, thereby eliminating the need for a final cast-in-place concrete lining. Tunnel muck (i.e., spoils) was estimated to be disposed of on local beaches (within 10 miles) as remediation material with no associated dump fees.
- An Outlet Structure. Due to the lack of beach access, construction is estimated to be staged entirely from within the tunnel. The concrete structure is estimated to be founded on mini-piles, socketed into the rock face, and equipped with a steel grate and sand pocket.
- A cast-in-place concrete Inlet Structure.
- Construction of two 48 inch I.D. micro-tunnels totaling 1550 lf connecting the new Inlet Structure with two tie-in points at existing manholes. This work includes construction of an access shaft at each of the tie-in locations which is used to recover the micro-tunneling machine. A new tie-in structure will be constructed in the shaft.
- Construction of approximately 20 lf of RCP pipe-jacked tunnel, connecting the existing Manhole-3 in Lake Merced Blvd to the new Inlet Structure.

The estimated cost of Alternate 2 without contingency is $33.3M while Alternate 3 has a before contingency cost of $41M. This $7.7M increase is due to the following:

- $2.8M additional equipment costs including a second tunneling shield and a second crane.
- $1.4M for a 215 ft deep Access Shaft.
- The Retrieval Shaft in Alt. 3 is $0.7M more than the Access Shaft in Alt. 2.
- $2.4M added Micro-tunneling costs.

The shaft at the Horse Ranch has been finished for permanent access to the tunnel should it be needed in the future for maintenance.

Jacobs Associates ♦ Engineers/Consultants
San Francisco ♦ Los Angeles ♦ San Diego ♦ Seattle ♦ Portland

Project	Client	Job No.	Estimator	Rev	Date
Vista Grande Tunnel	**RMC**	**3957.0**	**Dutton**	**0**	**1/6/2006**

Conceptual Cost Estimate - Alternate 3 Shaft Construction at Horse Ranch, Alignment Along John Daly Blvd.

SUMMARY OPINION OF PROBABLE CONSTRUCTION BID WITH OWNER CONTINGENCY

No.	Item or Group Item Description	Item Quantity/Unit	Item Unit Cost	Status	Item Cost
001	Site Preparation at Horse Ranch Location	1 ls	$15,000 /ls		$15,000
002	Pre-Excavation Grout Access Shaft	13,316 cf	$20.86 /cf		$277,736
003	Excavate/Support Access Shaft	215 vf	$5,461 /vf		$1,174,104
004	Fit out Shaft Tunneling Plant	1 ls	$79,580 /ls		$79,580
005	Assemble Excavation Shield and Backup	1 ls	$152,260 /ls		$152,260
006	Excavate/Support Tunnel with Shield	1,200 lf	$3,648 /lf		$4,377,045
007	Construct Outlet Structure	277 cy	$1,269 /cy		$351,618
008	Assemble EPBM and Backup	1 ls	$475,462 /ls		$475,462
009	Excavate/Support Tunnel with EPBM	3,200 lf	$3,256 /lf		$10,419,881
010	Site Preparation at Mayfair Ave. Location	1 ls	$15,000 /ls		$15,000
011	Pre-Ex Grout Retrieval Shaft	6,372 cf	$66.88 /cf		$426,183
012	Excavate/Support Retrieval Shaft	82 vf	$4,842 /vf		$397,053
013	78" RCP Connection to MH-3	20 lf	$8,890 /lf		$177,799
014	Micro-tunnel Additional Tie-ins	1,550 lf	$1,954 /lf		$3,028,290
015	MicroTBM Retrieval Shafts and Drop Structures	1 ls	$370,000 /ls		$370,000
016	Disassemble and Retrieve EPBM	1 ls	$179,733 /ls		$179,733
017	Construct Drop Structure in Retrieval Shaft	1 ls	$365,391 /ls		$365,391
018	Remove Tunnel Services	1 ls	$47,722 /ls		$47,722
019	Permanent Access and Backfill Temp Shaft	4,348 cy	$228 /cy		$991,267
020	Site Restoration - Mayfair Ave.	1 ls	$50,000 /ls		$50,000
021	Site Restoration - Horse Ranch	1 ls	$7,500 /ls		$7,500
			Subtotal Direct Cost		**$23,378,623**
022	Equipment Ownership/Mobilization		20.6% of cost		$8,462,681
023	General Mobilization	Total 4.6% of unescalated cost	3.0% of cost		$1,240,259
024	Demobilization		1.6% of cost		$649,750
025	General Plant Operation and Maintenance	11.5 mo	$12,142 /mo		$139,638
026	Weekend Maintenance	21 day	$3,613 /day		$75,881
027	Field Supervision	13.8 mo	$136,370 /mo		$1,881,905
028	Overhead Maintenance and Service	13.8 mo	$20,715 /mo		$285,867
029	Bonds, Insurance, and Taxes not in General Mob		0.8% of cost		$318,851
030	Markup		10.4% of cost		$4,274,798
031	Financing Charges		0.8% of cost		$332,750
			Subtotal Indirect Cost		**$17,662,379**
032	Escalation-excluded from estimate	$5,694,655 (3.8% composite annual rate)			-
February 2009 NTP: 13.8 month duration			**Opinion of Probable Construction Bid**		**$41,041,002**

Cost Componant	Labor	Equipment	Material	Subcontract	Total
Direct Cost	$5,558,114	$1,370,463	$11,780,055	$4,669,991	$23,378,623
Indirect Cost	$2,036,324	$7,431,781	$8,088,474	$105,800	$17,662,379
Escalation-excluded from estimate	-	-	-	-	-
Summary Breakdown by Cost Type	**$7,594,438**	**$8,802,244**	**$19,868,529**	**$4,775,791**	**$41,041,002**

Owner Contingency	Project definition	30% of bid		$12,312,301
	Subtotal Owner Contingency	**30% of bid**		**$12,312,301**
	Opinion of Probable Construction Bid with Owner Contingency			**$53,353,303**