DUDEK

TECHNICAL MEMORANDUM 1

To: Jerry Rolwing, General Manger Borrego Water District
From: Tom Falk, PE
Subject: Preliminary Evaluation of Cocopah Well
Date: May 16, 2013 (Revised July 17, 2013)
cc: Bill Berkley

Dudek evaluated the feasibility of conversion and permitting the Cocopah Well to potable standards and the means to produce and convey water as the source of supply for the Rams Hill Golf Course (Rams Hill). This Technical Memorandum 1 (TM1) summarizes that analysis.

Cocopah Well

The Cocopah Well (a.k.a. Center Pivot Well) is an existing agricultural well located approximately 2,000 feet north of Palm Canyon Drive, in the northeast portion of the Borrego Water District's (BWD) service area. Dudek's review of the Cocopah Well construction records and water quality data did not reveal any concerns with the feasibility of permitting the well to potable standards; doing so would allow it to be incorporated into the BWD's existing drinking water system, should that approach be pursued by the project stakeholders. Table 1 provides construction details for the Cocopah Well.

Table 1. Cocopah Well Construction Details

Parameter	Value
Well Depth	933 feet
Conductor Size/Depth	24 inches/50 feet
Well Casing Type/Thickness	Steel/0.312 for conductor casing Steel/0.375 for well casing
Well Casing Diameter	14 inches
Blank Casing Intervals	0-603 feet
Screen Type/slot size	Unknown/0.093 inch slot
Screen Intervals	603-933 feet

Source: DWR Well Completion Report.

Existing System Hydraulics

The BWD's water distribution system is operated in distinct pressure zones that generally correspond to ground elevations to maintain acceptable system pressures to all customers in specific "Improvement Districts" (ID). ID-4 and ID-5 represent the northwest portion of the BWD service area and are operated separately (via normally-closed isolation valve) from ID-1 and ID-3 which are located in the southern portion of the BWD service area. A normally closed isolation valve on Borrego Springs Road separates ID-5 from ID-3. The Rams Hill development is ID-1. ID-1 and ID-3 consist of three potable water pressure zones:

800 Zone – Serves ID-3; water supply from by wells ID1-16 and ID1-10; storage in "800 Tank" (0.75 million gallons) which floats the system.

900 Zone – Serves ID-1 from wells ID1-12 and ID1-8; storage in Rams Hill Tank 1 (1.25 million gallons) which floats the northern portion of the Rams Hill development.

1000 Zone – Serves ID-1, fed from booster station out of Rams Hill Tank 1storage in Rams Hill Tank 2 (0.44 million gallons) which floats the southern portion of the Rams Hill development.

Dudek reviewed BWD's existing water distribution system maps, BWD well production records, and available data describing aquifer characteristics. The BWD's consultant District Engineer, David Dale, PE (Dynamic Consulting Engineers, DCE) maintains a hydraulic model of the District's system. Dudek reviewed the hydraulic model network and results of specific hydraulic scenarios to assess the behavior of the distribution system under normal operating scenarios. DCE performed a static-state hydraulic model run and provided pipe/node, well, and tank reports for Dudek's use.

Figure 1 presents relevant water system data for ID-1 and ID-3 for reference throughout this technical memorandum. Figure 1 also presents the potential alignments for a transmission main from the Cocopah Well to ID-1 as described later in this memorandum.

ID-4

ID4-4
EL=600
GWL=419
HGLd=940
Q=256 GPM

ID4-11
EL=619
GWL=431
HGLd=941
Q=1,000 GPM

COCOPAH
(CENTER PIVOT WELL)
EL=580
GWL=455
HGLd=
Q=1100 GPM (ASSUMED)

CONCEPT 1: CONNECT TO POTABLE WATER SYSTEM

CONCEPT 2A: CONNECT TO POTABLE WATER SYSTEM

CONCEPT 2B: CONNECT TO NON-POTABLE WATER SYSTEM

CONCEPT 2C: CONNECT TO DIRECTLY TO RAMS HILL STORAGE LAKE

ID5-5
EL=575
HGLd=950
Q=1250 GPM

ID-5

ID1-12
EL=530
GWL=408
HGLd=964
Q=900 GPM

ID1-16
EL=623
GWL=408
HGLd=940
Q=780 GPM

ID1-10
EL=595
GWL=416
HGLd=915
Q=450 GPM

ID-3

WILCOX WELL
EL=695
GWL=413

ID1-8
EL=523
GWL=458
HGLd=914
Q=430 GPM

ID1-1
EL=532
GWL=470
HGLd=964
Q=186 GPM

ID1-2
EL=577
GWL=463
HGLd=956
Q=215 GPM

ID-1

800 TANK
BASE=793
MAX WSE=808
VOL=0.75 MG

R-1 TANK
BASE=900
MAX WSE=925
VOL=0.44 MG

R-2 TANK
BASE=907
MAX WSE=1027
VOL=1.0 MG

RAMS HILL TANK 1
BASE EL=907
MAX WSE=935
VOL=1.25 MG

RAMS HILL TANK 2
BASE=1002
MAX WSE=1027
VOL=0.44 MG

RAMS HILL LAKE
WSE=700

BIG HORN RD
LAZY S DR
DIEGUENO RD
CAHULLA RD
VERBENA DR
BORREGO SPRINGS RD
DI GIORGO RD
BORREGO WATER DISTRICT
PALM CANYON DR
BORREGO VALLEY AIRPORT
BORREGO VALLEY RD
CLUB CIRCLE GOLF COURSE
COUNTRY CLUB RD
TILTING T DR
BROKEN ARROW RD
RANGO WY
YAQUI PASS RD
WATER RECLAMATION FACILITY (EL 520±)
RAMS HILL COUNTRY CLUB (EL 600-900±)
RAMS HILLS RD
PRV
C.V.

LEGEND

- WELL
- TANK
- BOOSTER PUMP
- ID BOUNDARY
- VALVE
- EXISTING POTABLE WATER PIPE
- EXISTING RECLAIMED/NON-POTABLE WATER PIPE
- CONCEPT 1 PIPE ALIGNMENT
- CONCEPT 2A PIPE ALIGNMENT
- CONCEPT 2B PIPE ALIGNMENT
- CONCEPT 2C PIPE ALIGNMENT

GRAPHIC SCALE
0 1'
SCALE: 1" = 3000'

FIGURE 1

COCAPAH WELL
CONVEYANCE INFRASTRUCTURE MAP

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5/17/2013 6:19:07 PM P:\101.Engineering\Borrego Water District\7801 Rams Hill Golf Course Supply Evaluation\06-Design\CADD\7801 FIG 01

Seasonal Demand Trends

Historical data provided by T2 Borrego, LLC[1] and well production data provided by the BWD indicates that the average annual demand at the golf course over the period of 2001-2004 and 2008-2009 was approximately 1,200 acre-feet per year; The water usage over the periods 2005-2006 (Average 824 AFY), 2007 (Average 1748 AFY) and 2010-2011 (Average 500 AFY) were excluded due to atypical usage patterns associated with the construction activities, intensive watering during startup, and subsequent closing of the golf course. Modifications will be made to the golf course irrigation operations that will affect the future water usage at the golf course; in particular, existing non-native landscaping will be replaced with a native vegetation scheme and grasses will be selected to minimize irrigation requirements. Olympia Partners also intends to operate the golf course differently than the previous owners. The golf course will be closed during the hot summer months such that historical demands from May through July are anticipated to be reduced by up to 70%. During these summer months, the fairways will be watered twice a week instead of twice a day and the greens will be watered sparingly. Historical demands should decrease by about 40% from November through May due to the elimination of non-native vegetation. An approximate long-term average annual demand of up to 750 AFY was initially estimated by the RHGC consultants, although subsequently reduced to between 500 to 550 AFY; Refer to associated TM4 – Water Supply Evaluation for detailed analysis of demand and supply for the Rams Hill Golf Course.

Seasonal flowrates were not provided by Olympia Partners and the annual average demand of 750 acre-feet per year is used as the basis for this TM1 evaluation. The average annual demand of 750 acre-feet per year correlates to an average day demand of 0.6 mgd. Considering the watering schedule proposed by Olympia Partners between September to April, it appears that the average daily demand during that period might be closer to 0.9 mgd. Furthermore, the intensive watering requirement of the "over-seeding" process during September and October might be closer to 1.35 mgd (940 gpm). Available data indicates that the Cocopah Well is capable of producing water at a rate to meet this maximum month demand.

Conveyance Concepts

Dudek evaluated the feasibility of several concepts to beneficially utilize water produced by the Cocopah Well.

Concept 1: The initial concept for inclusion of the Cocopah Well into the BWD's potable water system was to connect the transmission main to the existing system along Palm Canyon

[1] Bill Berkley, President, email dated 05/07/13

Road and to utilize the BWD's existing system to convey water to ID-1. The concept was based on the use of the District's system to "wheel" water produced by the "private" Cocopah Well to Rams Hill. Connecting the Cocopah Well to the BWD's system in this fashion revealed the following constraints:

- Pumping into the existing pipe on Palm Canyon Road delivers water to ID-4, which has adequate supply via existing wells in that pressure zone. ID-4 and ID-5 are operated independently of ID-1 and ID-3 such that significant operational changes would be required to the BWD's system in order to beneficially use water produced from Cocopah Well to ID-1. In other words, the additional supply from Cocopah Well to ID-4 does not provide immediate benefit to BWD.

- Rams Hill is in ID1 and water deliveries to the Golf Course reservoirs (R-1 and R-2) from the potable water system are conveyed via the 900-zone. Ground elevation at the Cocopah Well site is approximately 580-ft above mean sea level (amsl) and the groundwater level is approximately 450-ft amsl. To convey water from Cocopah Well through the existing system to ID1 would require well pump discharge pressures exceeding 170 psi. This pressure would reduce production or shut off existing well pumps in the lower pressure zone. Furthermore, the elevated hydraulic grade line in ID4 would increase the operating pressures in the downtown areas which prompt concerns about the ability of the existing system piping to perform reliably.

Concept 1 is not feasible due to hydraulic and operational constraints of the BWD's existing system. Concept 1 is eliminated from further consideration.

Concept 2: To avoid negative impacts to the BWD's existing potable water system, Dudek evaluated options to convey water produced from the Cocopah Well directly to Rams Hill. Refer to Figures 1 for conveyance pipeline alignments. Figures 2, 3, and 4 provide simple hydraulic profiles for Concepts 2a, 2b, and 2c, respectively. The concepts considered include:

- **Concept 2a**: Piping to the existing potable water system at the proximity of Well #12. A total of 3.6 miles of 12-inch pipeline would be required. The concept would require shared use of the BWD's existing system from Well #12 to Rams Hill and would require Cocopah Well to be converted to potable and to pump to the 900-zone with a discharge pressure of approximately 180-psi. Conceptually, the shared piping would prohibit Cocopah Well and Well #12 from operating at the same time since the combined flow, up to 2,000 gpm, in the existing 10" pipeline along Borrego Valley Road/Rango Way/Yaqui Pass Road would result in pipeline velocities exceeding 8 feet per second and an excessive headloss rate at 26-ft per 1,000 feet. Refer to Figure 2 for

hydraulic profile. The full impact of a shared pipeline on BWD's potable water system operations would require further evaluation and could potentially require additional system upgrades, supplemental water supplies, and significant changes to operational/management practices, the costs of which have not been defined through this preliminary evaluation.

- **Concept 2b**: Piping to the existing non-potable water system in the proximity of the Water Reclamation Facility. A total of 6 miles of 12-inch pipeline would be required. The concept would relieve the need to convert Cocopah Well to potable and alleviates the constraint of shared potable water piping. The Cocopah Well would still pump to the 900-zone to utilize existing onsite storage facilities. Refer to Figure 3 for hydraulic profile.

- **Concept 2c**: Piping directly to the Rams Hill storage lake at an elevation of 700-ft amsl. A total of 6.5 miles of 12-inch pipeline would be required. The Cocopah Well would pump to a hydraulic grade line of 700 (instead of 900 as required in the previous two examples), reducing pumping energy. Refer to Figure 4 for hydraulic profile.

Figure 2 – Concept 2a Hydraulic Profile

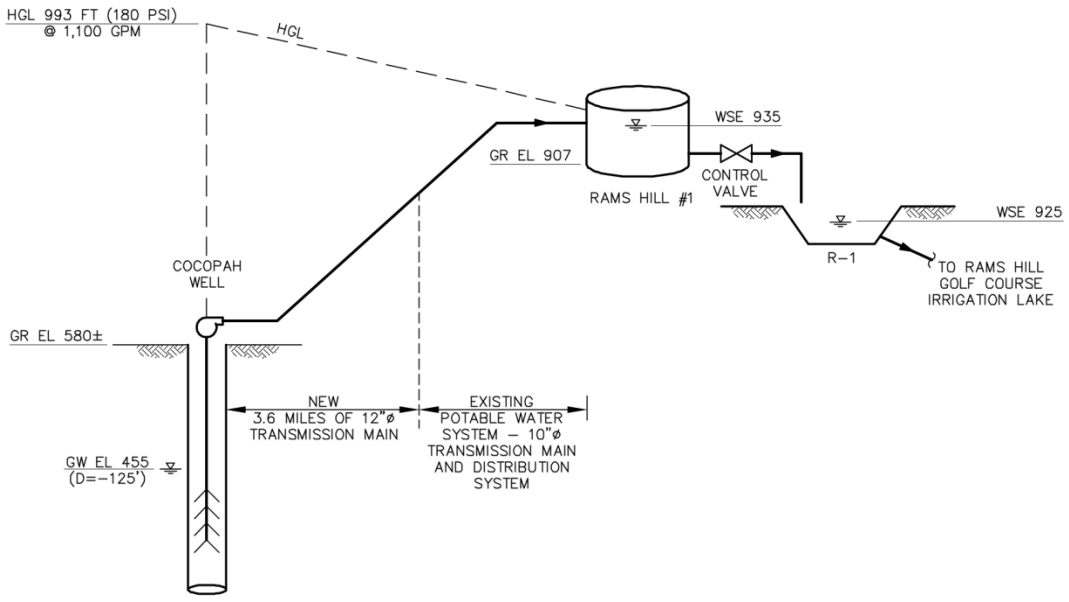


Figure 3 – Concept 2b Hydraulic Profile

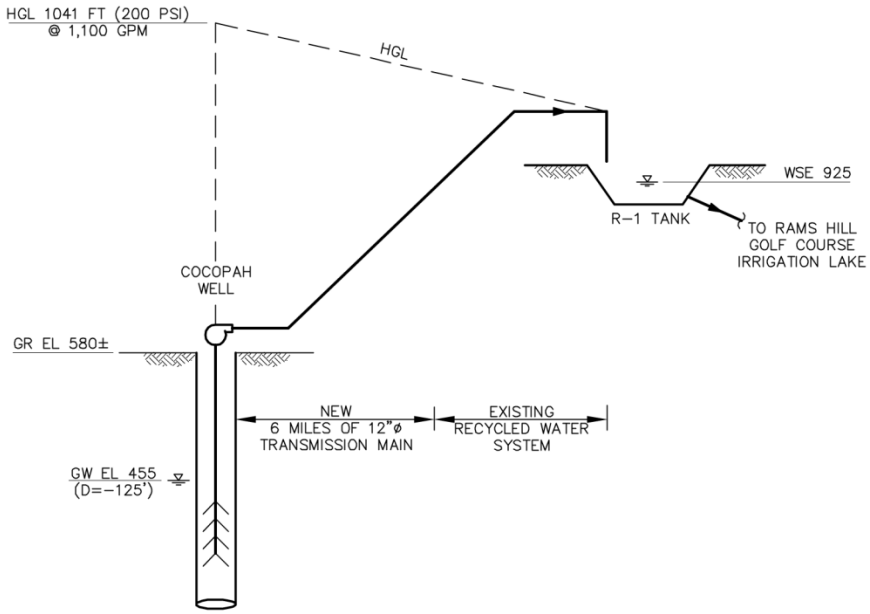
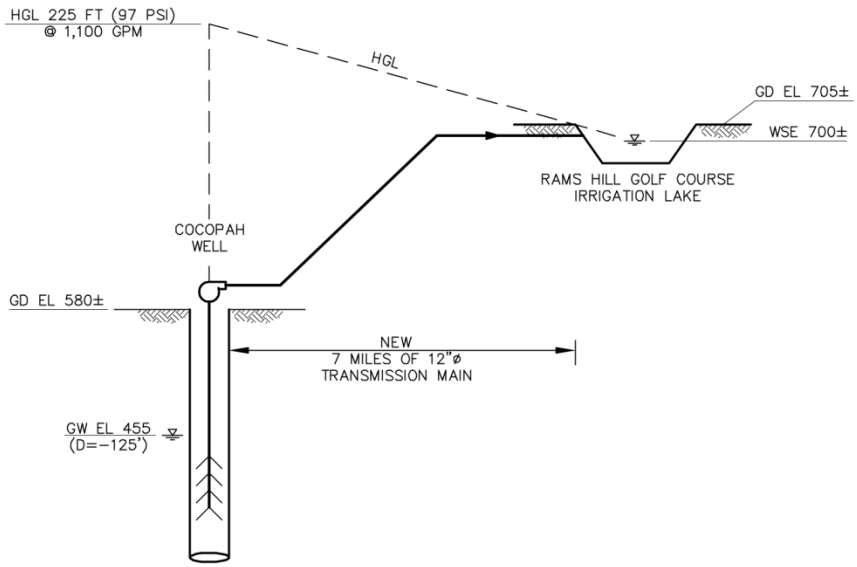


Figure 4 – Concept 2c Hydraulic Profile



Concept 2 is based on the presumption that Rams Hill would permit, build, own, and maintain a transmission main in County of San Diego right-of-way. Dudek contacted the County of San

Diego[2] to review precedent and procedures for a private entity to construct and own a facility in public right-of-way. The County of San Diego confirmed that a private waterline as contemplated in Concept 2 is permitable. The following procedures must be followed:

- The pipeline must be designed in accordance with the County of San Diego Regional Standard Drawings; the design must be plan-checked and approved prior to construction, including payment of project review deposit of $500.00 and plan-check fees.

- The contractor must be licensed, insured, bonded, and must secure an Application for Excavation Permit and pay a $110.00 application fee and a minimum $600.00 inspection deposit. Inspection fees are currently $5.00 per linear feet for the first 1,000 feet and $1.75 per linear foot thereafter.

- The owner must submit an encroachment permit (Application to Encroach upon County Highway) and pay a permit fee based on the length of encroachment.

Hydraulics: Pipeline hydraulics were calculated using a Hazen-Williams friction factor of C=120, 12-inch diameter pipe, and approximate lengths indicated above. The pumping rate of 900-gpm was assumed; the velocity of 900-gpm in a 12-inch pipe is 2.6 fps and the headloss rate is 2.44-ft per 1,000-ft of pipe.

Conveyance – Opinion of Probable Costs

Dudek evaluated major project costs for the concepts identified above including capital costs and operating costs. The cost estimates presented herein are classified as "Class 4" in accordance with the *Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries* (AACE International Recommended Practice No. 18R-97). Class 4 estimates have accuracy of -20% and +30%, which defines a range below and above the estimated cost in which the actual project is expected to be delivered. The following assumptions were utilized:

- Costs data utilized herein are normalized to the Engineering News Record, Construction Cost Index (ENR-CCI), 20-City Average for April 2013 of 9484.

[2] Hector Ramos, email dated 05/10/13

- Project financing assumed that infrastructure costs would be financed with a 20-year loan period at 3% interest (A/P, 3%, 20-yrs = 0.0672) to determine "annualized cost" of capital cost components.
- Life-cycle costs used a 20-year period and a 3% discount rate (P/A, 3%, 20-yrs = 14.877).
- Operating and maintenance costs were estimated as an annual cost using industry-standard cost factors that reflect the complexity and scale of the projects.
- A 15% contingency was included in all cost estimates to account to reflect unknowns at an early project stage, risk, uncertainty in project development, engineering constraints, etc.
- A 20% allowance for project implementation or "soft costs" was applied to each project.

Dudek contacted two pipeline contractors[3] familiar with the Borrego Springs area to discuss project requirements and to obtain input on constructability and local bidding climate. The project concepts were based on 12" PVC (AWWA, C900), typical 3-ft of cover, constructed in the Borrego Springs area in accordance with applicable San Diego Regional Standard Drawings. The following cost data was determined to be appropriate for this project:

- Unit price for non-prevailing wage of $47.5/LF ($66/LF includes repaving)
- Unit price for prevailing wage of $54.6/LF ($76.4/LF includes repaving)

Project cost multipliers totaling "2.05" was applied to the quoted pipeline installation unit prices presented above to account for: contractor's OH&P, general construction activities such as mobilization/demobilization, and soft costs (e.g., planning, design, construction management).

Pump operating costs were estimated based on the Cocopah Well pump producing 750 acre-feet per year at a pumping rate of approximately 900-gpm at total dynamic head ranging between 350-ft and 590-ft, depending on the operating scenario. SDG&E power cost was assumed to be $0.10/kwh.

Table 2 summarizes the cost analysis for Concept 2a, 2b, and 2c. These costs include estimates for the construction and O&M of the pipeline and pumping costs as defined above. Excluded from the immediate project cost analysis are the following considerations:

[3] RADCO Construction and A&R Construction; contacted May 9 to May 10, 2013.

- Purchasing, permitting, and maintaining the Cocopah Well.
- Fees to Borrego Water District for conveying or "wheeling" water through its potable water system.
- Costs to purchase the non-potable water system.
- Costs for rehabilitation or replacement of non-potable water system facilities (e.g., tanks R-1 and R-2 and pipelines).

With respect to Concept 2a, the full impact of a shared pipeline on BWD's potable water system operations would require further evaluation and could potentially require additional system upgrades, supplemental water supplies, and significant changes to operational/management practices, the costs of which have not been defined through this preliminary evaluation. Due to the uncertainty of costs associated with Concept 2a, it is eliminated from further consideration.

The anticipated cost of producing and delivering water from Cocopah Well to Rams Hill in ID-1 is anticipated to range between $400 and $450 per acre-foot. This cost is substantially lower than the price of potable water. These costs should be refined as capital costs are confirmed and the terms of the purchase and respective legal issues are resolved between BWD and Olympia Partners.

Table 2 – Conveyance Concept 2 Cost Comparison

Parameter	Unit	Alternative		
		2a	2b	2c
Name	--	Cocopah Well to Potable System	Cocopah Well to Non-Potable System	Cocopah Well to Rams Hill Irrigation Lake
Connection Point	--	Existing Potable System at Well #12	Existing Non-Potable System at WRP	Existing Golf Course Lake
Existing System HGL @ Connection Point	Elevation, ft (AMSL)	935	945	700
Groundwater Level	Elevation, ft (AMSL)	455	455	455
Static Head	ft	480	490	245
Pumping Rate	gpm	900	900	900
New Transmission Main Piping	Length, ft	19,008	31,680	34,320
	Length, miles	3.6	6.0	6.5
	Diameter, in	12	12	12
	Headloss, ft	40	67	72
	Capital Cost, $	$1,850,000	$3,080,000	$3,340,000
	Annualized Cap Cost, $ (3%, 20-yrs)	$120,000	$210,000	$220,000
Total Dynamic Head	ft	520	557	317
Pumping Horsepower	HP	182	195	111
Annual Average Demand	AFY	750	750	750
Average Daily Pumping Duration	hours	12	12	12
Pumping Power	kwh/day	1,684	1,802	1,027
	kwh/year	614,481	657,768	374,777
Pumping Cost	$/year	$61,400	$65,800	$37,500
	$, PW (3%, 20-yrs)	$913,400	$978,900	$557,900
Maintenance Cost	$,/yr. (2%/yr. of Cap. Cost)	$37,000	$62,000	$67,000
Total Present Worth (20-yr)	$	$2,800,400	$4,120,900	$3,964,900
Annualized Cost	$	$218,400	$337,800	$324,500
Cost per AF	$/AF	$291 (See Note 1)	$450	$433

Notes:

1. The full impact of a shared pipeline on BWD's potable water system operations would require further evaluation and could potentially require additional system upgrades, supplemental water supplies, and significant changes to operational/management practices, the costs of which have not been defined through this preliminary evaluation. Due to the uncertainty of costs associated with Concept 2a, it is eliminated from further consideration.