

## **Appendix B: Water Feasibility Studies**

**B.1 - Recommended Alternative for DWP  
(Alda Engineering Inc., February 2011)**

# **ALDA** Engineering Inc.

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February 7, 2011

Bill La Haye, Water Resources Manager  
Big Bear Lake Department of Water & Power  
41972 Garstin Drive  
Big Bear Lake, CA 92315

Subject: **Moon Camp Development Project – Tentative Tract 16136  
Recommended Alternative to Provide Water Service**

Dear Mr. La Haye:

The purpose of this letter is to document the recommended alternative to serve the proposed Moon Camp Development Project in the Fawnskin area. Initially, two alternatives to serve this development were documented in our March 2007 Feasibility Study. Both alternatives considered serving the development off the Upper Fawnskin pressure zone and differ from each other on the alignment of recommended transmission facilities and the size of pumping units.

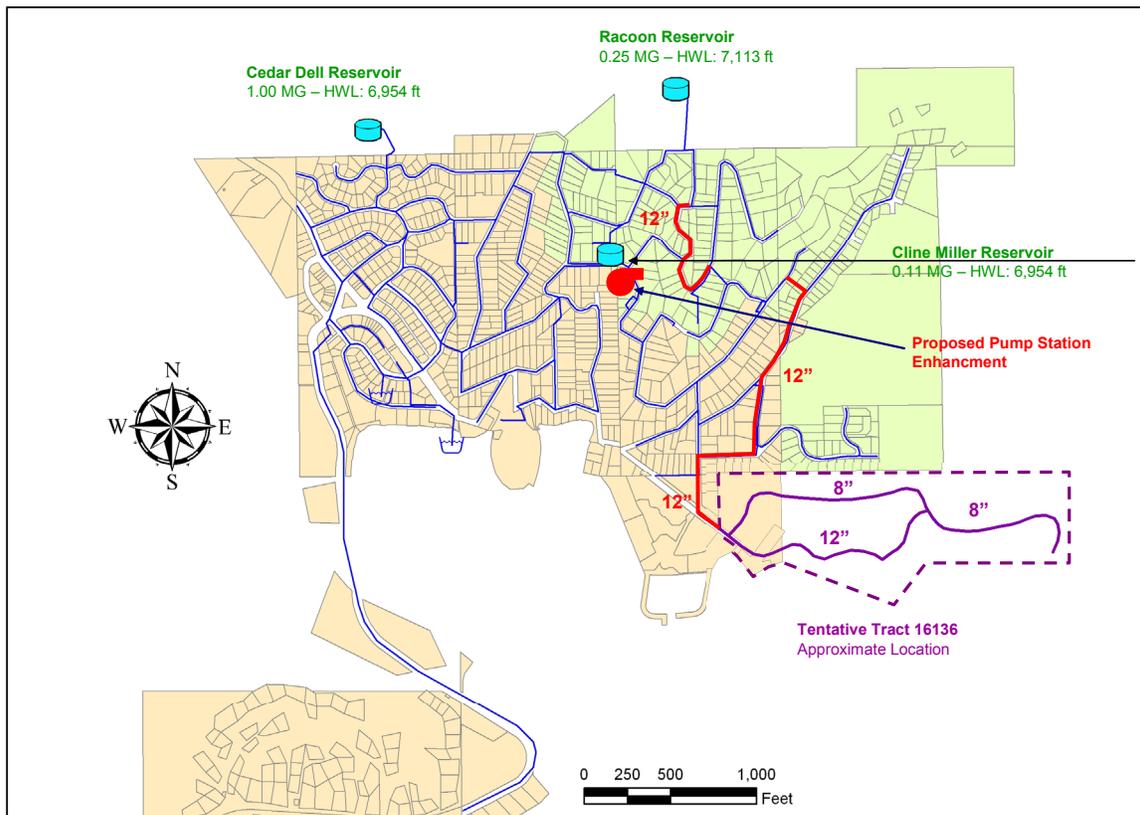
The recommended alternative (Alternative “B”) consists of serving the proposed development by gravity off the existing Racoon Reservoir. Initially, this alternative included the replacement of two undersized pipeline segments that were built along property lines; thus requiring a construction and operations easement. Since the recommended alternative was initially configured, it has been determined that construction along one of these segments will be extremely difficult due to the steepness of the terrain; hence new alignment had to be selected along Ridge Road. Figure 1 illustrates the revised alignment for the recommended alternative; facility requirements to implement this alternative are listed below.

- 900 ft of 12-inch pipeline along Ridge Road from the intersection of Racoon Drive south to tie to an existing 8-inch PVC pipeline on a private easement.
- 200 ft of 12-inch pipeline along private easement to connect Fawnskin Drive and Canyon Road
- 650 ft of 12-inch pipeline along Canyon Road to Chinook Road
- 600 ft of 12-inch pipeline along Chinook Road to Flicker Road
- 500 ft of 12-inch pipeline along Flicker Road to Mesquite Drive
- 400 ft of 12-inch pipeline along Mesquite Road to North Shore Drive
- 250 ft of 12-inch pipeline along North Shore Drive to development westerly boundary

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- Refurbishing existing Cline Miller pump station to augment pumping capacity to approximately 300 gpm
- 50 KW on-site emergency generator at the Cline Miller Reservoir



**Figure 1**  
**Recommended Facilities to Serve Tentative Tract 16136**

Should you have any questions on this matter, please contact us at 909-587-9916 during normal business hours.

Very truly yours

ALDA Engineering Inc.

F. Anibal Blandon, P.E.  
Principal

**B.2 - Water Feasibility Study**  
**(Alda Engineering Inc., March 2007)**

# **ALDA** Engineering Inc.

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March 6, 2007

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager  
City of Big Bear Lake  
Department of Water & Power  
41972 Garstin Drive  
Big Bear Lake, CA 92315

Subject: **Final Feasibility Study to Serve the Proposed Moon Camp Residential Development** (Tentative Tract No. 16136)

Dear Mr. Heule:

Pursuant to your request, ALDA Engineering Inc. (ALDA) has conducted a feasibility study to determine the necessary system facilities to serve the above referenced development. This report summarizes the results of our investigation and recommendations. This report presents the project background, an assessment of demand and supply issues, the results of the system analysis, and the recommended improvements.

## **Project Background**

The proposed Moon Camp development consists of 50 residential lots to be developed over approximately 62 acres of land. The proposed development is located along North Shore Drive, in the community of Fawnskin on the north side of Big Bear Lake, and ranges in elevation from approximately 6,750 ft. near the lake to approximately 6,950 ft. in the northeasterly quadrant. Individual lots range in size from approximately half an acre to well over two acres depending on location and are anticipated to be developed as single family residential units; average lot size is approximately one and a quarter acres. Because of its location and lot size, some of the residential units are anticipated to be fairly large and potentially exceed 4,000 square feet in size.

Water service to the proposed development will be provided off the Upper Fawnskin pressure zone as the Lower Fawnskin zone would not provide enough static head to provide the development adequate fire flow. DWP's closest pipeline off the Upper Fawnskin system is a single 6-inch diameter pipeline located near the intersection of Flicker Road and Chinook Road, approximately 2,000 ft away from the westerly boundary of the proposed development. Significant transmission improvements in the Fawnskin system are needed to provide fire flow to the proposed tract.

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Currently, there are two groundwater production wells within the proposed residential tract. These wells are located in subarea A of the North Shore hydrologic subunit. It is our understanding that these wells will be deeded to the DWP at the time the tract map is recorded. The developer plans to equip the FP-2 well initially to meet the development projected water demands. The DWP will use excess capacity from this well to help reduce reliance on the leased North Shore Well No. 1. Groundwater production capacity from this well is estimated at approximately 100 gallons per minute. The second well (FP-3), located to the east of the FP-2 well, will not be initially equipped by DWP.

## **Pressure Zone Service Area**

Based on the elevation range of the proposed development, 6,750 ft. to 6,950 ft., the development can be served off the Upper Fawnskin pressure zone. This pressure zone has an operating hydraulic grade of 7,113 ft. set by the high water level of the existing 0.25-million gallon Racoon Reservoir. Based on this hydraulic elevation, static pressures would range from a low of 71 psi at the highest point in Lot 18 to 157 psi near the lake. Individual pressure regulators would be required for all lots with static pressures exceeding 80 psi.

Water supply in the Fawnskin area is provided by two groundwater wells in the Lower Fawnskin pressure zone and by slant wells in the vicinity of the Racoon Reservoir. Excess groundwater production from the Lower Fawnskin pressure zone is conveyed to the Upper Fawnskin pressure zone through a booster station located at the Cline Miller Reservoir.

## **Water Demand**

Projected water demand for the proposed development is based on the average consumption rate of 250 gallons per day per connection. Maximum day demand is estimated based on information provided in the recently completed water master plan and it is equivalent to 1.76 times the average day demand. Therefore, the average and maximum day demands for the proposed 50-lot subdivision are estimated as follows:

- Average Day Demand (ADD) = 12,500 gpd or 8.68 gpm
- Maximum Day Demand (MDD) = 15.27 gpm

Based on an estimated average day demand of 12,500 gallons, the annual water demand for the development is estimated at 4.56 million gallons or 14.00 ac-ft per year.

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## **Water Supply**

Water supply sources for this development must meet projected maximum day demands during the summer as well as annual demands. The existing on-site FP-2 well, when equipped by the developer, would be capable of meeting the projected maximum day demand for the proposed Tract 16136.

To meet the projected annual demand, the developer would have to participate in the Water Demand Offset Plan currently being implemented by DWP. This plan requires that any development that creates new lots must pay for the necessary facilities to reduce water demand somewhere else in the service area. The demand to be reduced is equivalent to one half of the average water demand for residential parcels in the service area, estimated at 250 gallons per day, for each new lot developed. Therefore, in the case of the proposed tract, a demand equivalent to 6,250 gallons per day (50 EDUs times 250 gallons per day per EDU times 50 percent) would need to be offset.

## **Fire Flow Requirements**

Fire flow protection in the Fawnskin area is provided by the County of San Bernardino Fire Department. Information obtained from the Office of the Fire Marshall for the county indicates the following fire flow requirements for residential structures in the Fawnskin area:

- Structures less than 3,600 ft<sup>2</sup> - 1,000 gpm @ 20 psi with a two-hour duration
- Structures between 3,601 to 4,800 ft<sup>2</sup> - 1,750 gpm @ 20 psi with a two-hour duration
- Structures between 4,801 to 6,200 ft<sup>2</sup> - 2,000 gpm @ 20 psi with a two-hour duration

Additional information provided by the Office of the Fire Marshall indicates that fire flow requirements could be lowered if fire sprinklers are installed; however, actual requirements are determined individually based on the construction plans for individual residences.

For the purpose of this analysis and based on discussions held with DWP staff, a fire flow of 1,750 gpm @ 20 psi with a two-hour duration was used to size transmission, pumping, and storage facilities that would be needed to serve the proposed development.

## **Storage Requirements**

Storage capacity for this development was sized to meet the operational, emergency and fire flow storage requirements. Operational storage is used to meet the hourly fluctuations in demand during maximum day conditions and has been established as 30 percent of maximum day. Emergency storage is used to meet demands during a power outage or other emergency situation when supply sources and boosting pumps may not be available; DWP requirements for emergency storage are equivalent to one day of maximum day demand.

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Fire flow storage is equal to the fire flow capacity (1,750 gpm) times its duration (two-hours). Storage requirements for the proposed development are as follows:

- Operational Storage = 30% of MDD (15.27 gpm): 6,600 gallons
  - Emergency Storage = 100% of MDD (15.27 gpm): 22,000 gallons
  - Fire Flow Storage for 1,750 gpm (based on 120 min): 210,000 gallons
- Total storage requirement for indoor use: 238,600 gallons

According to the recently completed water master plan, DWP has sized its storage facilities to provide a maximum fire flow of 1,500 gpm with a two-hour duration for residential development. Additional storage to provide incremental fire flow requirements would be the responsibility of individual developers in each of the pressure zones impacted. In the case of Tract 16136, the incremental fire flow of 250 gpm (1,750 gpm – 1,500 gpm) results in an additional storage requirement of 30,000 gallons. Storage requirements for operational and emergency storage are provided by the DWP as part of the meter connection charges.

Existing storage facilities in the Upper Fawnskin pressure zone consist of a single 0.25 million gallon reservoir that is fed by a combination of slant wells, located in the vicinity of the reservoir site, and the Cline Miller booster station that supplies water from the Lower Fawnskin pressure zone. The existing reservoir capacity is adequately sized to meet current storage requirements of existing users while providing fire flow protection for a flow rate of 1,500 gpm over a two-hour duration. Current storage requirements in this zone are estimated at approximately 225,000 gallons; this value is approximately 10 percent below existing storage capacity.

An additional storage of 30,000 gallons would be required in the Upper Fawnskin pressure zone to supply the recommended 1,750 gpm fire flow over a two-hour duration. This additional storage could be provided by either constructing a second reservoir adjacent to the existing Racoon Reservoir or conveying surplus storage capacity in the Lower Fawnskin pressure zone through the existing Cline Miller booster station. This booster station consists of two booster units with a combined capacity of approximately 190 gpm. To make surplus storage from the Lower Fawnskin pressure zone available during power outages, a backup generator at the Cline Miller booster station would be needed. In addition, the capacity of the existing booster station would need to be increased to pump 303 gpm. This flow rate represents a combination of a) estimated maximum day demand at full development in the Upper Fawnskin pressure zone of 38 gpm, b) estimated maximum day demand of 15 gpm from tract 16136, and c) 250 gpm of incremental fire flow into the Upper pressure zone.

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## **Alternatives to Serve Proposed Tract 16136**

Under average and peak summer demands, the proposed development could be served by simply extending existing facilities in the Upper Fawnskin pressure zone. The closest facility in this pressure zone that the development can be connected to consist of a 6-inch pipeline in the vicinity of Flicker Road and Chinook Road. However, existing distribution facilities would not be able to provide the required fire flow capacity needed to protect future residential development in the area. Existing system facilities consist of pipelines ranging in size from 2 to 8 inches in diameter with limited fire flow carrying capacity.

To provide the fire flow requirements indicated by the Office of the Fire Marshall, transmission improvements will be required in the Upper Fawnskin pressure zone. Two alternatives were evaluated to serve the proposed development; a brief description of these alternatives and the required facilities is presented below. Figure 1 illustrates the alignment of proposed transmission facilities for each alternative and the recommended pipelines within the proposed residential tract.

**Facilities Common to Both Alternatives.** Transmission facilities south of the intersection of Flicker Road and Mesquite Drive to the westerly boundary of the proposed tract are common to both alternatives and consist of approximately 700 ft of 12-inch diameter pipeline. The alignment of this pipeline is shown in Figure 1.

**Alternative A.** This alternative consists of serving the proposed tract by constructing a dedicated 12-inch transmission pipeline from the vicinity of the Cline Miller Reservoir to the proposed development site. This alternative would also require the construction of a fire booster station at the Cline Miller Reservoir site to augment the capacity of the existing booster units as they are not adequate to provide the recommended fire flow capacity into the Upper Fawnskin pressure zone. To assure that the fire booster unit is operational during power outages, the installation of a 200 kilowatt on-site electric generator is recommended.

The alignment of the recommended transmission pipeline between the Cline Miller Reservoir and the intersection of Flicker Road and Mesquite Drive is depicted in Figure 1. The estimated length of this pipeline is approximately 2,450 ft.

**Alternative B.** This alternative consists of serving the proposed development by gravity off the existing Racoon Reservoir. Transmission improvements in the Upper Fawnskin pressure zone would be required as existing distribution facilities have limited fire flow carrying capacity; they consist primarily of small pipelines ranging in size from 2 to 8 inches in diameter. Recommended improvements consist of a series of 12-inch segments between the reservoir site and the intersection of Flicker Road and Mesquite Drive as illustrated in Figure 1. The estimated combined length of proposed facilities is approximately 2,800 ft.

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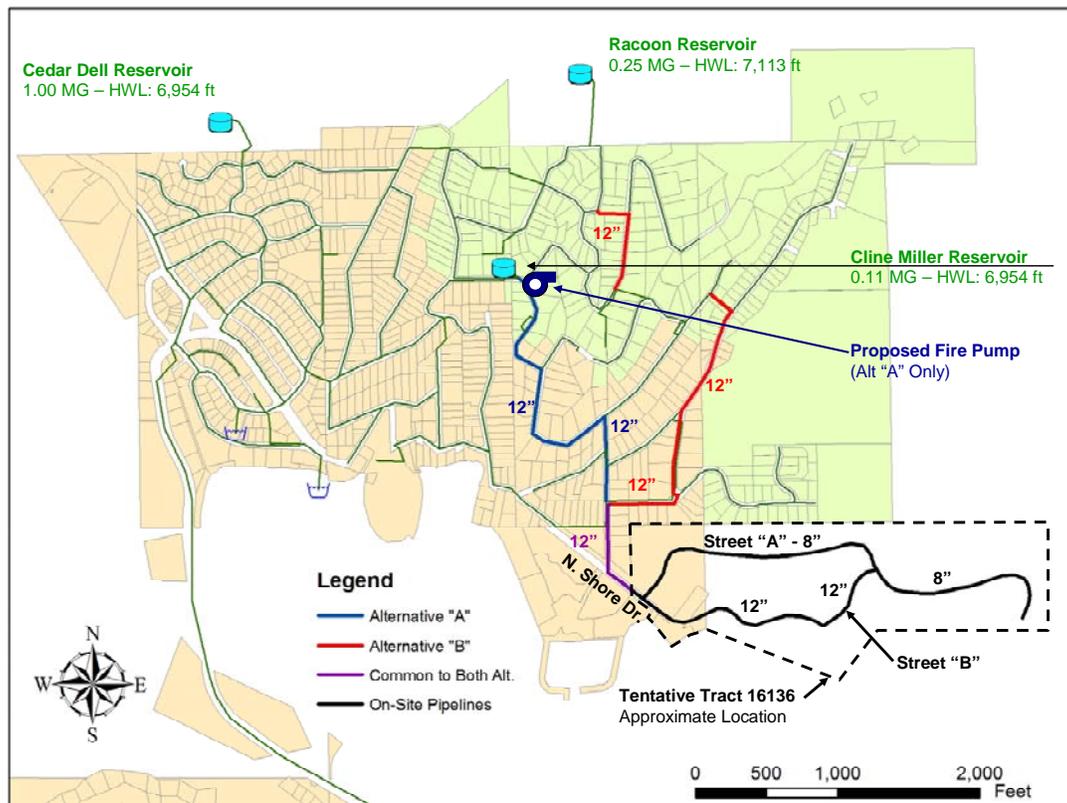


Figure 1  
 Tentative Tract 16136 - Recommended Facilities Both Alternatives

Alternative "B" would not require the construction of a fire pump at the Cline Miller Reservoir to pump from the Lower to the Upper Fawnskin pressure zone as the majority of the fire flow would be provided by gravity off the existing Raccoon Reservoir. However, the existing Cline Miller booster station would have to be refurbished to increase its capacity to convey surplus storage from the Lower Fawnskin pressure zone during a fire flow event. The capacity of this booster station would be increased from its current capacity of 190 gpm to 303 gpm. In addition, an on-site generator would be required to operate the station during power outages. The enhancement of this booster station would eliminate the need to construct additional storage facilities in USFS lands, which are difficult to obtain approval for.

**On-Site Facilities.** The sizing of pipelines within the proposed tract is the same for both alternatives. Recommended pipeline diameters for the various street segments shown in Figure 1 are described as follows:

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- North Shore Dr. from tract boundary to Street "A": 150 ft of 12-inch pipeline
- North Shore Dr. from Street "A" to Street "B": 1,600 ft of 12-inch pipeline
- Street "B" from North Shore Dr. to Street "A": 700 ft of 12-inch pipeline
- Street "A" from North Shore Dr. to Street "B": 2,000 ft of 8-inch pipeline
- Street "A" from Street "B" to end of Cul-de-sac: 1,500 ft of 8-inch pipeline

### Estimated Cost of Improvements

The capital cost of proposed improvements was based on construction information provided by DWP and from other construction cost information available. The estimated cost of construction for pipelines is estimated at \$15 per diameter inch; the cost for pump stations is estimated at \$2,500 per horsepower. Construction contingencies are estimated at 20 percent while engineering cost is estimated at 15 percent.

It should be noted that estimated capital cost of proposed improvements shown here is for planning purposes only; actual cost of improvements may vary significantly depending on materials and labor cost at the time of construction.

### *Alternative "A" – Dedicated line from the Cline Miller Reservoir*

■ 2,450 ft of 12-inch diameter off-site pipeline	\$ 440,000
■ 700 ft of 12-inch diameter off-site – Common to both Alt.	\$ 130,000
■ 175 Hp Cline Miller booster fire pump	\$ 440,000
■ 200 KW on-site emergency generator <sup>(1)</sup>	<u>\$ 65,000</u>
Sub-total:	\$ 1,075,000
Contingency during construction – 20 percent	\$ 215,000
Engineering, administration, inspection – 15 percent	<u>\$ 165,000</u>
Overall construction cost for off-site improvements	\$ 1,455,000

(1) Capital cost estimate includes cost of generator and transfer switch.

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## **Alternative “B” – Gravity flow from the Racoon Reservoir**

■ 2,800 ft of 12-inch diameter off-site pipeline	\$ 505,000
■ 700 ft of 12-inch diameter off-site – Common to both Alt.	\$ 130,000
■ Refurbishing of existing Cline Miller booster station	\$ 100,000
■ 50 KW on-site emergency generator <sup>(1)</sup>	<u>\$ 35,000</u>
Sub-total:	\$ 770,000
Contingency during construction – 20 percent	\$ 155,000
Engineering, administration, inspection – 15 percent	<u>\$ 115,000</u>
Overall construction cost for off-site improvements	\$ 1,030,000

(2) Capital cost estimate includes cost of generator and transfer switch.

## **Recommendations**

The implementation of either alternative should provide the proposed development with the necessary facilities to meet the recommended fire flow protection of 1,750 gpm during maximum day demand conditions. However, Alternative “B” is preferred because it also enhances the distribution and fire flow capacity of the existing system in the Upper Fawskin pressure zone. In addition, the implementation of this alternative is approximately 29 percent less expensive than Alternative “A”.

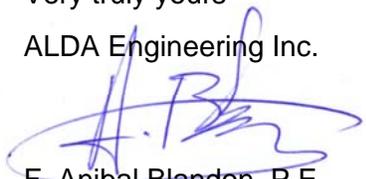
## **Disclaimer**

This feasibility study is based on current system conditions and it is valid for a period of 12 months from the date of this letter. The feasibility of developing the Tract 16136 subdivision may need to be revised and/or reassessed if the project is delayed for a significant period of time. Revisions may result from changes in future water demands, system conditions, and construction cost of recommended facilities.

Should you have any questions, please contact us at 909-587-9916 during normal business hours.

Very truly yours

ALDA Engineering Inc.



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