5.0 Estimated Costs, Implementation Schedule and Recommendations

The American Association for Cost Estimating (AACE) has defined three basic categories of estimates in an effort to establish the expected accuracy range for various types of cost estimates. The three basic categories listed from least accurate to most accurate include: Order of Magnitude Estimates, Budget Estimates, and Definitive Estimates.

All cost estimates provided in this study are Order of Magnitude Estimates. This is defined as an approximate estimate made without detailed engineering data. This level of cost estimate comes from cost estimating curves, estimates using scale up or scale-down factors and an approximate ratio estimate. An estimate of this type is typically expected to be within a +50 percent and -30 percent range.

5.1 Costs Included in Plant Site Evaluation

The estimate developed for this study is intended to compare the cost of construction at each one of the five sites that have been evaluated. Assumptions pertaining to specific items are identified in the section of the study covering that topic. Costs associated with planning and engineering are based on a percentage of the construction costs.

Costs are presented in 2013 dollars and a 3% inflation rate was applied to inflate the project costs to match the estimated project schedule. Markups for construction in a mountain town, design contingency, contractor general conditions, and overhead and profit are all included. Engineering fees were estimated at $500,000 for the planning studies and at 20% of the total construction cost for design and construction services.

The budgetary estimate includes the cost to construct the recommended conventional treatment plant with drying beds, with a single raw water intake located at the preferred location identified in Section 3. Alterations to this base option include utilizing packaged treatment units in place of the process trains constructed on site, mechanical dewatering in place of drying beds, and selecting an alternative intake site that is south of the preferred intake site on the Blue River.

Package plants can be an attractive alternative for small treatment plants because the equipment costs are typically less. However, a plant sized for 3 MGD may not save a substantial amount of capital costs for the same treatment. A cost was solicited from Tonka Equipment Company for 3 MGD of treatment capacity in package treatment units. Tonka's budget cost for their Unitized Treatment System equipment is $1.8 million dollars. These costs do not include the costs associated with the building required to house the equipment. In comparison, the estimated cost of the equipment for the conventional treatment recommendation including the rapid mix, flocculation, plate settlers and filters is approximately $1.3 million dollars, which does not including tankage. Some of the differences in treatment flexibility and design between these package units and an individualized design are discussed in Section 2 of this study.

Mechanical dewatering costs are estimated at $1.5 million dollars. The cost estimate for this alternative assumes that a screw press will be utilized for dewatering and that it will be housed in a building adjacent to the main treatment plant. Manufacturer's information for a screw press can be found in the Appendix, along with the detailed cost estimate for constructing this alternative.

If an alternative intake site were to be selected at a location upstream of the preferred intake location in the reach between Swan Mountain Road and the Highway 9 bridge and below the confluence with the Swan River, the capital cost of raw water piping and pump stations to sites 3, 4, and 5 would be reduced by approximately $1M. Raw water piping and pump station cost to Site 2 would be the same as with the preferred intake site and to Site 1 would increase by approximately $750,000. Operational pumping costs for raw water would decrease to all site locations, with a reduction of approximately $6,000 at Site 1, $39,000 at Site 2, and $113,000 to $116,000 at Sites 3, 4, and 5. Finished water pumping costs would not change at any of the proposed plant sites.

Included in the cost summary for each site is the budgetary cost to construct a 3 MGD treatment plant, the estimated cost to acquire the property and the estimated cost associated with improvements on each site. Table 5-1 summarizes the estimated cost for each of the five sites. The costs are projected at an estimated low level and an estimated high level due to the multiple uncertainties still outstanding at each site.

5.1.1 Cost Alternative for 1.5 MGD WTP

The Town requested that a cost estimate be provided for construction of a 1.5 MGD water treatment plant that would initially feed only new customers in the High School zone and possibly some in the Airport zone. For this scenario, a single treatment train would be constructed consisting of rapid mix, flocculation, settling using plate settlers, two media filters, and a clearwell. The backwash clarifier would be constructed along with drying beds sized appropriately for a 1.5 MGD plant. Most of the 16" finished water pipeline would not need to be constructed to connect the plant to the entire system initially, so the cost of finished water pipelines would be reduced. However, a raw water pipeline from the intake to the plant site would be constructed to accommodate 3 MGD of flow because the majority of the installation cost for a pipeline is the trenching and placement so the cost savings of installing a smaller pipeline to start is not cost effective. This scenario would only be applicable if the plant is constructed at Site 1 or 2, because the cost savings on pipelines is only applicable at those sites. The estimated reduction in cost by constructing a 1.5 MGD plant instead of a 3 MGD plant is approximately $4,000,000.

Considerations for this alternative include the following concerns:

- If this option is implemented, fire flow to the newly served area will be dependent on the excess available production from the water treatment plant unless a storage tank is provided. The other source of fire flow is the single feed from the system through the High School PRV and it is not clear whether that can adequately provide adequate pressure with a required fire flow of 3,000 gpm for 3 hours. A fire pump could be installed in the finished water pump station and if the clearwell is sized initially for 3 MGD instead of 1.5 MGD, the problem might be resolved, although at

an added cost, but this needs additional evaluation. In general, utilizing a clearwell for system storage is not a good practice because the clearwell is a treatment unit and must be controlled to provide adequate chlorine contact time at all flows. The cost estimate for this option includes a fire pump and a storage tank at the plant site.

- Construction of the plant at any size without connecting it to the entire distribution system eliminates a number of the advantages of having a second plant. A 1.5 MGD plant with limited distribution of finished water will not provide a backup source for taking the Gary Roberts WTP off line for improvements or a backup source for surviving the water quality impacts of wild fire. If the finished water is not shared to the system, it may be that the Gary Roberts WTP will not be able to supply enough water to the remainder of the system, particularly because of the inability to fill the North Storage Tank (hydraulic grade line problem). When the Tarn is drought-limited, which occurs at an approximate demand of 4 MGD to the system, the second plant cannot supplement the supply if it is not connected to the whole distribution system.
- If the plant is constructed as a 1.5 MGD plant that only serves specific new customers, the augmentation benefits are limited by the raw water withdrawals needed to feed only those customers.
- Constructing a plant of any size that does not supplement the whole system may make operating the plant more difficult because it will only need to produce water for a small segment of the users. It will operate to treat only to meet that demand, creating a need for a relatively low turn-down on the flow into the plant and possibly being shut down at night. Conventional treatment processes work best in a continuous operation mode, so shutting down at night will impact finished water quality on a daily basis.

In general, construction of the plant at any size without completing the connections to the entire system is not recommended. Many of the strongest and long-term benefits of having a second water treatment plant would be lost if the plant is not connected to the system.

5.2 Cost of Distribution System Improvements

Cost estimates for the distribution system improvements to meet the future 8 MGD demand were developed by system zone. Typically, the improvements in each zone would likely be completed as a single project. The costs include improvements associated with build-out and to make necessary improvements within areas already served within the system. Table 5-2 details the distribution system costs by zone including pipelines, pump stations, storage and PRVs.

Distribution system costs are independent of the location of the new raw water intake or treatment plant.

Table 5-1: Summary of Costs for a 3 MGD Water Treatment Plant at Five Potential Treatment Plant Sites

Item No.	Description	Total Cost at Each Potential Site									
		Site 1		Site 2		Site 3		Site 4		Site 5	
		Low	High	Low	High	Low	High	Low	High	Low	High
1	Treatment Building	$ 9,649,000	$ 10,613,900	$ 9,649,000	$ 10,613,900	$ 9,330,000	$ 10,263,000	$ 9,649,000	$ 10,613,900	$ 9,649,000	$ 10,613,900
2	Utilities	$ 192,000	$ 211,200	$ 192,000	$ 211,200	$ 192,000	$ 211,200	$ 596,000	$ 655,600	$ 192,000	$ 211,200
3	Site Improvements	$ 1,207,000	$ 1,327,700	$ 1,246,000	$ 1,370,600	$ 1,317,000	$ 1,448,700	$ 1,670,000	$ 1,837,000	$ 1,748,000	$ 1,922,800
4	Property Acquisition	$ 611,000	$ 672,100	$ -	$ -	$ 446,000	$ 490,600	$ -	$ -	$ -	$ -
5	Raw and Finished Pipeline and Pump Stations	$ 5,030,000	$ 5,533,000	$ 5,382,000	$ 5,920,200	$ 3,886,000	$ 4,274,600	$ 5,031,000	$ 5,534,100	$ 7,376,000	$ 8,113,600
Subtotal Direct Construction Cost		**$ 16,689,000**	**$ 18,357,900**	**$ 16,469,000**	**$ 18,115,900**	**$ 15,490,000**	**$ 16,688,100**	**$ 16,542,000**	**$ 18,640,600**	**$ 18,965,000**	**$ 20,861,500**
Mountain Factor (10%)		$ 1,668,900	$ 1,835,790	$ 1,646,900	$ 1,811,590	$ 1,549,000	$ 1,668,810	$ 1,654,200	$ 1,864,060	$ 1,896,500	$ 2,086,150
Total Direct Construction Costs		**$ 18,357,900**	**$ 20,193,690**	**$ 18,115,900**	**$ 19,927,490**	**$ 17,039,000**	**$ 18,356,910**	**$ 18,196,200**	**$ 20,504,660**	**$ 20,861,500**	**$ 22,947,650**
Standard General Conditions (10%)		$ 1,835,790	$ 2,019,369	$ 1,811,590	$ 1,992,749	$ 1,703,900	$ 1,835,691	$ 1,819,620	$ 2,050,466	$ 2,086,150	$ 2,294,765
Subtotal NET Construction Cost		**$ 20,193,690**	**$ 22,213,059**	**$ 19,927,490**	**$ 21,920,239**	**$ 18,742,900**	**$ 20,192,601**	**$ 20,015,820**	**$ 22,555,126**	**$ 22,947,650**	**$ 25,242,415**
Overhead and Profit (15%)		$ 3,029,054	$ 3,331,959	$ 2,989,124	$ 3,288,036	$ 2,811,435	$ 3,028,890	$ 3,002,373	$ 3,383,269	$ 3,442,148	$ 3,786,362
Estimated NET Construction Cost (2013)		**$ 23,222,744**	**$ 25,545,018**	**$ 22,916,614**	**$ 25,208,275**	**$ 21,554,335**	**$ 23,221,491**	**$ 23,018,193**	**$ 25,938,395**	**$ 26,389,798**	**$ 29,028,777**
Inflation Escalation (19 Months to midpoint of construction at 3.0%)		$ 1,103,000	$ 1,213,388	$ 1,089,000	$ 1,197,393	$ 1,024,000	$ 1,103,021	$ 978,000	$ 1,232,074	$ 1,254,000	$ 1,378,867
Estimated NET Construction Cost (2015)		**$ 24,326,000**	**$ 26,758,406**	**$ 24,006,000**	**$ 26,405,668**	**$ 22,578,000**	**$ 24,324,512**	**$ 23,996,000**	**$ 27,170,469**	**$ 27,644,000**	**$ 30,407,644**
Engineering Plans, Studies, and Permit Preparation		$ 500,000	$ 550,000	$ 500,000	$ 550,000	$ 500,000	$ 550,000	$ 500,000	$ 550,000	$ 500,000	$ 550,000
Engineering Design, Construction Services, and Legal (20% on 2013)		$ 4,645,000	$ 5,351,681	$ 4,583,000	$ 5,281,134	$ 4,311,000	$ 4,864,902	$ 4,604,000	$ 5,434,094	$ 5,278,000	$ 6,081,529
Total Estimated Construction Cost (2015)		**$ 29,471,000**	**$ 32,660,087**	**$ 29,089,000**	**$ 32,236,801**	**$ 27,389,000**	**$ 29,739,414**	**$ 29,100,000**	**$ 33,154,562**	**$ 33,422,000**	**$ 37,039,173**

Table 5-2: Cost Summary for Distribution System Improvements

Item No.	Description	Total Cost of System Distribution Improvements	
		Low	**High**
1	Summit Estates Zone	$ 4,852,000	$ 5,337,000
2	Highlands Park Zone	$ 3,197,000	$ 3,517,000
3	Airport Zone	$ 755,000	$ 831,000
4	High School Zone	$ 3,341,000	$ 3,675,000
5	Forest Hill Zone	$ 2,119,000	$ 2,331,000
6	High Point Zone	$ 4,029,000	$4,432,000
7	Mt Baldy Zone	$858,000	$944,000
8	Woodmoor 1 Zone	$250,000	$275,000
9	Woodmoor 2 Zone	$2,764,000	$3,040,000
10	Bunker Hill Zone	$4,748,000	$5,223,000
11	Upper Slope Zone	$30,000	$33,000
12	White Cloud Zone	$30,000	$33,000
13	Tarn Zone	$3,948,000	$4,343,000
14	Tarn Pump Station at Gary Roberts WTP	$350,000	$385,000
Subtotal Direct Construction Cost		**$ 31,271,000**	**$ 34,398,000**
Mountain Factor (10%)		$ 3,127,100	$ 3,439,800
Total Direct Construction Costs		**$ 34,398,100**	**$ 37,837,800**
Standard General Conditions (10%)		$ 3,439,810	$ 3,783,780
Subtotal NET Construction Cost		**$ 37,837,910**	**$ 41,621,580**
Overhead and Profit (15%)		$ 5,675,687	$ 6,243,237
Estimated NET Construction Cost (2013)		**$ 43,513,597**	**$ 47,864,817**
Inflation Escalation (19 Months to midpoint of construction at 3.0%)		$ 2,067,000	$ 2,274,000
Estimated NET Construction Cost (2015)		**$ 45,580,597**	**$ 50,138,817**
Engineering Design, Construction Services, and Legal (20% on 2013)		$ 9,116,119	$ 10,027,763
Total Estimated Construction Cost (2015)		**$ 54,697,000**	**$ 60,167,000**

5.3 Site Comparison and Recommendation

Each proposed site has unique characteristics and comparison of the sites involves consideration of a broad range of factors. In an effort to rank the sites against one another with respect to non-economic factors, a ranking matrix was established to compare the sites and completed at a project workshop attended by the Town and HDR. The matrix is shown in Table 5-3. Rankings in the table are set with 1 being the lowest and 5 being the highest ranking. Each of the categories for ranking was established with the objective of

evaluating those concerns of highest priority to the Town. A brief description of the categories follows:

- Site Suitability – Is the site in a location that meets the needs of the water utility and of the size and layout that will make construction of a plant at the site reasonable?
- Current Property Owner – Is the current owner likely to be willing to sell or lease the property long-term for use by the Town?
- Current Value – For those properties whose value is currently posted on the County Assessor's web site, the value of the property has been identified and ranked.
- Operational Concerns – Does the site present unusual conditions, or is it in a location that will be difficult in terms of regular operational activities?
- Access – Is the site easily accessible from existing roads?
- Constructability – Does the site have topography that is amenable to the construction of a water treatment plant?
- Security Concerns – Water treatment plants are required to have security in place to avoid damage by intruders. Does the site have unusual aspects that would impact security?
- Public Acceptance – Is the site in a location that will be agreeable to the Town's residents and meet the intent of the Town's planning activities?

Based on the ranking matrix results, Site 4 ranks highest, with Site 2 ranking second highest. Based on the distribution system evaluation, the Sites 3 and 4 are best suited to serve the existing and proposed distribution system considering the location of the majority of the future demands and proximity to the North storage tank.

Site 3 has the least capital cost for construction. Site 4 is the second least costly for construction, while Site 2 ranks in the middle of the estimated costs for all five sites. The cost estimates are relatively close to one another and they could change for multiple reasons, not the least of which is the cost of obtaining property for those sites that are not currently owned by the Town.

Table 5-3: Site Comparison Matrix for Non-Economic Factors

Location	Site Suitability	Current Property Owner	Current Value (if known)	Operational Concerns	Access	Constructability	Security Concerns	Public Acceptance	Weighted Ranking Summary	Sum of Estimated Plant, Intake, and Raw and Finished Water Pumping Costs (2015)	Sum of Estimated Distribution System Improvement Costs (2015)
Weight	1	3	3	2	1	3	1	3			
Site 1	1	1	1	2	2	3	4	1	29	$ 33,285,000	$ 30,761,000
Site 2	4	4	3	2	5	5	2	2	57	$ 32,966,000	$ 30,761,000
Site 3	5	2	1	4	2	4	4	1	43	$ 31,206,000	$ 30,761,000
Site 4	3	5	5	4	4	4	4	5	76	$ 31,965,000	$ 30,761,000
Site 5	2	5	5	1	1	1	2	5	55	$ 33,422,000	$ 30,761,000

Notes:

1. Rankings: 1=low priority and 5=high priority

5.4 Schedule

A preliminary schedule that includes all the tasks required prior to construction and start-up of the new WTP is identified in Table 5.4. The schedule is set up to identify three major components of the project including, site selection and predesign activities, permitting and funding, and design and construction

The times allotted for each task are conservative estimates based on preliminary knowledge of the requirements and HDR's experience in permitting, design and construction of new water treatment plants. These tasks and time allotments will vary between the five potential plant site alternatives for reasons such as the difference between site conditions, permit requirements due to Town or County ordinances, and additional infrastructure requirements. The schedule for all sites is assumed to be the same, although there may be minor differences in permitting and other items that are location-sensitive, which should be identified in a future predesign report.

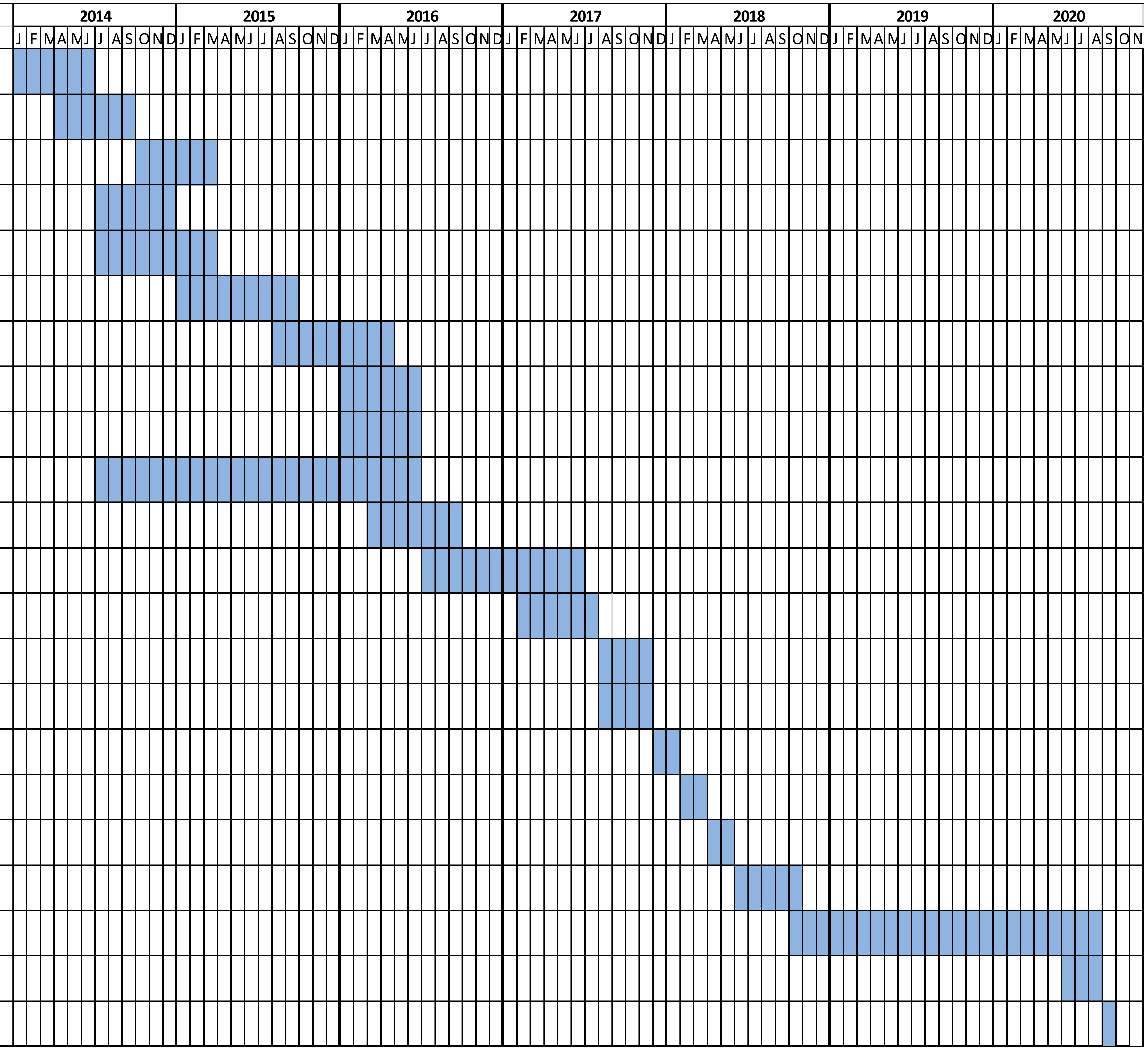
Site selection and predesign activities are the next step in the process after this study.

Most of the permitting and funding activities follow the predesign with the exception of the 404 permit. The 404 permit is identified in the estimated schedule as one of the longest tasks, with an estimated 2 year time frame. The National Army Corps 404 permit is for new projects, such as intakes and water treatment plants that may impact the nation's aquatic ecosystems. The permit process often takes a year to two years to complete because it takes into account the views of other Federal, state and local agencies, interest groups, and the general public on development. These views are reviewed in conjunction with the growth of the economy, while offsetting the authorized impacts to the waters of the US. Mitigation, restoration, enhancement, and other methods are typically advised to balance the improvements with the preservation of natural aquatic functions. Other permits may also be required; however, they are typically less extensive and timelier, so they have not been specifically identified in the schedule.

Design and construction activities are the last category identified. Design documents require review by various agencies, including CDPHE, the Town of Breckenridge and Summit County. Currently, CDPHE design reviews take a minimum of 45 days, and often longer. Construction duration can impact overall construction cost by being too short (or too short in construction seasons) so the construction duration should be revisited during design to minimize cost impacts. This schedule assumes a traditional design-bid-build delivery method. Other delivery methods could be utilized, such as design-build, to accelerate the schedule.

Table 5-4: Estimated Project Schedule

	Activity
1	Flood Plain Delineation Study & Reviews
2	Purchase Property
3	Rezoning
4	Preliminary Design Report(s)
5	Obtain Easement(s)
6	Funding Application(s)
7	Predesign of Intake, Plant and Required Infrastructure
8	Intake Floodplain impact evaluation(s)
9	Evaluation of Impacts to Wetlands & COE Permit
10	404 Permit(s)
11	Stormwater management plan(s)
12	Final Design of Intake, Plant and Required Infrastructure
13	Variance Application(s)
14	CDPHE Plan Review
15	Summit County/Town of Breckenridge Plan Review
16	Advertise for Construction
17	Open Bids, Notice to Proceed, Sign Contract
18	Drainage Plan & Permit to Construct
19	Site Preparation
20	Construct of Intake, Plant and Required Infrastructure
21	Startup and Acceptance Test
22	On Line - Produce Drinking Water



5.5 Recommendations

- A new 3 MGD conventional water treatment plant is recommended for the Town of Breckenridge to meet future build-out demands. The plant treatment processes should include rapid mixing, flocculation, settling using plate settlers, dual media filtration, and disinfection utilizing chlorine, with the option of including potassium permanganate for oxidation and the removal of iron and manganese at the time of design.
- Five of the seven sites considered are deemed viable for construction of the water treatment plant. Of the five sites evaluated in detail, the least capital cost sites are Sites 3 and 4. The sites ranking highest with respect to non-economic factors are Sites 2 and 4.
- From a distribution system standpoint, Sites 3 and 4 are most favorable due to their proximity to the North Storage Tank and delivering water to the Tarn zone without two finished water pump stations (Sites 1 and 2) or with additional pipe to deliver water back to the north end of the system (Site 5). In addition, Sites 3 and 4 could supply finished water to more zones (High School and Airport) with less initial distribution system improvements than any of the other potential sites.
- In the near-term, additional pumping capabilities at the Gary Roberts WTP would allow for the North Storage Tank to be completely filled during high demand periods by helping overcome the normal headloss through the distribution system. It is suggested that a more in-depth evaluation and pre-design be completed during the Gary Roberts WTP evaluation in late 2013/early 2014.
- Building out the distribution system, while establishing and expanding pressure zones, is best sequenced by looking at the relationships between pressure zones, especially considering their interaction with the Tarn zone. Constructing the finished water pump station(s) and connections to the distribution system in the Tarn zone from the second water treatment plant will allow the development of the system expansions from the Tarn zone outwards. Depending on the final location of the second WTP, there may be an opportunity to only connect to the High School and Airport pressure zones before constructing the rest of the distribution system connections to the Tarn zone.