



Technical Memorandum

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Project Title: Post Point Resource Recovery Plant Biosolids Project Phase 3 – Biosolids Facility Plan and Nitrogen Removal Impact Study and Phase 4 – Preliminary Design

Project No.: 154154.Phase 3.Task 351/10550A00

Technical Memorandum No. 23

Subject: Technical Memorandum 23 – Staffing and Testing Requirements

Date: July 20, 2021

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Limitations:

This is a draft memorandum and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final memorandum.

This document was prepared solely for City of Bellingham in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Bellingham and Brown and Caldwell dated November 15, 2016. This document is governed by the specific scope of work authorized by City of Bellingham; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Bellingham and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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List of Abbreviations

BAF	biological aerated filter
CEPT	chemical enhanced primary treatment
City	City of Bellingham
hr	hour(s)
mgd	million gallon(s) per day
Post Point	Post Point Resource Recovery Plant
Project	Post Point Solids Project
Project Team	Brown and Caldwell/Carollo team
TM	technical memorandum
Total P	Total Phosphorus
TPAD	temperature-phased anaerobic digestion
TS	total solids
VS	volatile solids
yr	year(s)

Section 1: Executive Summary

The City of Bellingham (City) Post Point Resource Recovery Facility (Post Point) is undergoing a biosolids upgrade project to replace its aging solids handling processes. The improvements largely focus on replacing the existing incineration process with a temperature-phased anaerobic digestion system. In addition to the short-term biosolids upgrades, nutrient removal discharge regulations may be required in the future as a separate project. This memorandum estimates the City of Bellingham Public Works staffing changes as a result of both the biosolids upgrade project and a potential future project to implement nutrient removal. This memorandum also describes new laboratory testing requirements for the upgrades.

Estimate labor requirements for the existing solids handling process at Post Point were compared to labor requirements for the biosolids upgrade project and for the future nutrient removal upgrades. Labor estimates included operational, maintenance, and laboratory positions. The analysis yielded the following conclusions:

- Operational labor demands for the biosolids upgrade project are expected to be approximately the same as current operational staffing levels. Up to 1 additional maintenance position and 1 additional laboratory position are expected after the biosolids upgrade, for a total of 2 additional staffing positions.
- Total additional labor demands for both the nutrient removal upgrades and the biosolids upgrades are expected to increase the number of staff by up to 2 staff positions each for operations, maintenance, and laboratory work. Therefore, up to 6 additional staff may be required after the biosolids and nutrient removal upgrades.

Section 2: Introduction

The City is in the planning process to evaluate options for long-term biosolids management and beneficial reuse opportunities for the wastewater residual solids recovered from the Post Point Resource Recovery Plant (Post Point).

The Post Point Biosolids Project (Project) planning process has followed a phased approach, including Phases 1, 2 and 3, to consider all possible alternatives and narrow down options to a preferred biosolids and energy management alternative. The City's phased planning and project implementation process includes Phase 1 – Preferred Conceptual Alternative Selection, Phase 2 – Final Alternative Selection, Phase 3 – Biosolids Facility Plan and Nitrogen Removal Impact Study, Phase 4 – Preliminary Design, Phase 5 – Detailed Design, and Phase 6 – Construction.

Phase 1 included the initial identification of all potential biosolids and energy alternatives, screening to identify viable alternatives for further evaluation, and the selection of a preferred conceptual alternative. In February 2019, the results of Phase 1 were summarized in *Technical Memorandum (TM) No. 1 (TM 1) – Preferred Conceptual Alternative Selection*. Phase 2 further developed the preferred conceptual alternative and evaluated specific processes for biosolids treatment, biogas end uses, and other processes. In May 2019, *TM 2 – Final Alternative Selection* summarized the results of Project planning Phase 2. Phase 3 further refines the selected alternative technical requirements and documents the planning effort within the *Biosolids Facility Planning Report* (Biosolids Facility Plan) and is an update to the City's existing, comprehensive *2011 Wastewater Facility Planning Report* (Carollo, 2011).

This Technical Memorandum (TM) No. 23 (TM 23) was prepared as part of Project planning Phase 3 and documents the staffing needs anticipated for the Project. This includes additional staffing needs after the biosolids upgrade as well as staffing needs after the nutrient removal upgrade. Post Point is replacing its aging solids handling processes as part of the ongoing biosolids upgrade project. In addition, nutrient discharge regulations may be executed in the future, as discussed in *TM 9 – Nitrogen Impacts*.

In this memorandum, the current staffing structure is assessed to establish baseline staffing requirements for current Public Works operations. Labor descriptions and responsibilities after the biosolids upgrade and nutrient removal projects are defined, which includes a description of new laboratory testing after the upgrades. Updated labor hour estimates are performed for both projects. Results of the labor estimates for both projects are compared to current operations to determine additional staffing requirements.

Section 3: Current Staffing

City staff operate Post Point, the City Water Treatment Plant, and associated pump stations in the wastewater conveyance system. The facilities are staffed and operated 24 hours per day, 7 days per week. In general, staffing positions are designated into four categories: supervisory, operations, maintenance, and laboratory. Supervisory, maintenance, and laboratory staff work from 8:00 am to 5:00 pm Monday through Friday, plus call-outs. Operations staff work 12-hour shifts from 8:00 am to 8:00 pm and 8:00 pm to 8:00 am. At minimum, both an incinerator operator and a plants operator are always required to be at Post Point. The incinerator operator is responsible for the incinerator, dewatering, and thickening processes. The incinerator operator is located at the Post Point incinerator control room. The plant operator is responsible for the remaining wastewater processes as well as the water treatment plant and all pump/lift stations. The plant operator works from the Post Point main control room.

The City of Bellingham’s current staffing structure is shown in Appendix A. The staffing structure consists of 46 people organized into maintenance, laboratory, operations, and supervisory personnel. Maintenance and laboratory personnel are generally stationed at Post Point and support all water/wastewater treatment and pump/lift station facilities. Most operations personnel are stationed at Post Point, although some are stationed at the water treatment plant during normal business hours. Many operations personnel have received or are in the process of obtaining both water and wastewater operator training.

This staffing analysis excludes Public Works staffing increases for the following positions:

- The water treatment plant and associated pump stations.
- The wastewater lift stations.
- Contracted services such as custodial, landscaping, solid waste removal, cake hauling, and screenings hauling.
- Supervisory staff, interns, staff-in-training, and those dedicated to processes outside the facilities.

Section 4: Staff Responsibility Changes

This section describes how the Post Point staffing responsibilities will change after the biosolids and nutrient removal upgrades.

The biosolids improvements project will eliminate the following existing processes:

- Scum concentration.
- Solids incineration, exhaust treatment, ash conveyance, ash loadout, and ash hauling.

The biosolids improvements project will add or replace the following processes:

- New solids screening and screening loadout.
- Replacement of the existing thickeners and expansion of the existing thickener room with an additional thickener unit.
- New temperature-phased anaerobic digestion system with intermediate batch tanks and digested solids storage.
- Replacement of the existing dewatering units.
- New biosolids loadout.
- New digester heating heat pumps, heating boilers, and the associated heating loops.
- New digester gas conditioning.
- New renewable natural gas production.
- New waste gas burners and a thermal oxidizer.
- New sidestream treatment for nitrogen removal.
- Replacement of the standby generators may be performed as part of the biosolids project or as a separate contract. Regardless, the generator rated capacity is expected to increase, so a slight increase in maintenance hours to manage the generator maintenance contract have been assumed to account for the larger units.

The nutrient removal upgrades project was assumed to include a tertiary process to provide nitrogen removal. The upgrades are expected to add the following processes:

- A biological aerated filter (BAF) with fine screens was assumed for the purposes of this analysis.
- Chemically enhanced primary treatment (CEPT) and alkalinity addition.
- A tertiary pump station.
- Ancillary chemical systems.

An overview of labor designations required after these upgrades is provided below.

4.1 Operations

General operations tasks for the solids handling equipment will include daily inspections, equipment cleaning, biological and mechanical process monitoring, delivery and hauling coordination, coordination meetings, and site tours. Specific unit processes for the biosolids upgrade will be operated as follows:

- Screenings from the solids screening facility be managed similar to screenings from the existing influent screening facility. Solids screenings will be automatically loaded into a bin and transported to a landfill by a hauling contractor.
- Thickening will continue using protocols similar to existing operations.

- Anaerobic digestion will require new flow and biological health monitoring protocols. The digesters will be monitored for several parameters, including liquid level, digester gas production, digester temperature, feed flowrate, solids retention time, digester gas pressure, and foaming level. Yearly cleanings of the digesters will require close coordination by operations and other staff to ensure safe operations and stable biology.
- Dewatering operations will be similar to existing protocols, but with automation upgrades to reduce the amount of operator oversight required.
- Dewatered biosolids storage and loadout will require level monitoring in the cake bins and coordinating biosolids removal with the hauling contractor.
- Digester gas treatment and renewable natural gas production will require monitoring digester gas pressure, flows, and treated gas quality.
- The waste gas burners will require monitoring digester gas pressure, noise, vibration, and flame stability.
- Sidestream nitrogen removal will require biology monitoring such as nutrient concentrations, pH, temperature, etc.

A biological aerated filter nutrient removal upgrade will require the following operational protocols:

- Biological monitoring to track bacterial growth rates and concentrations.
- Backwash control.
- Chemical delivery management and calibration.
- Pump station monitoring.
- Fine filter cleaning.

In general, all new mechanical equipment will require regular inspections by operating personnel and coordination with maintenance and laboratory staff.

4.2 Maintenance

Maintenance tasks will generally include equipment removal, disassembly, rebuild, and reinstallation. All new mechanical equipment installed as part of the biosolids and nutrient removal upgrades will require periodic maintenance. Regular maintenance activities will include daily checks to ensure that equipment is operating properly and identify any maintenance issues that require attention. In general, rotating equipment such as solids screens, thickeners, centrifuges, and pumps will require monthly cleaning and replacement of lubrication oil, filters, and other parts. Quarterly maintenance includes filter replacement, belt tension adjustment and replacement, chemical pump calibration, etc. All other equipment will require semi-annual or annual maintenance, including internal inspection, impeller adjustment (for pumps and blowers), vibration check, etc.

4.3 Laboratory

Laboratory staff are responsible for regular monitoring of process performance and permit-required analysis, including sampling at various locations in the plant, laboratory analysis of the samples, report preparation, and nutrient analysis.

Table 4-1 shows the routine laboratory testing required after the biosolids improvements project. These tests are an estimate of the minimum additional testing required and are recommended in addition to testing currently performed by Post Point. Other testing may occasionally be required for process monitoring or for third-party testing. Biosolids will continue to be sampled for regulated pollutants (heavy metals) at the current frequency and using the same methodology.

Table 4-1. Routine Laboratory Testing Required for Biosolids Improvements Project			
Parameter	Sample Matrix	Sampling Frequency	Recommended Analysis Method (or equivalent)
Total Solids	Digested Solids Sidestream Treatment Tank	2-3/week (all)	Standard Methods 2540 ⁽¹⁾
Volatile Solids	Digested Solids Sidestream Treatment Tank	2-3/week (all)	Standard Methods 2540 ⁽¹⁾
Digester Gas Composition (CO ₂ , O ₂ , H ₂ S, and Siloxanes)	Digester Gas	1-2/week	3 rd -Party Laboratory
Total Alkalinity	Digested Solids Sidestream Treatment Tank	1-2/month 1-2/month	Hach Model 16900 with portable titrator
Volatile Fatty Acids	Digested Solids	2/month	Standard Methods 5560 ⁽¹⁾
Ammonia	Digested Solids Sidestream Treatment Tank	1/month 2-3/week	Hach Method 8038
Nitrate	Sidestream Treatment Tank	2-3/week	Standard Methods 4500 ⁽¹⁾
Total Kjeldahl Nitrogen	Digested Solids	1/month	Hach Method 8075
Chemical Oxygen Demand	Thickened Solids	1/month	Hach Method 8000
Fecal Coliform or Salmonella sp. bacteria	Dewatered Cake	6/yr	EPA Method 1680 ⁽²⁾ EPA Method 1682 ⁽²⁾

References:

1. Standard Methods for the Examination of Water and Wastewater, 23rd edition, 2018.
2. United States Environmental Protection Agency, Office of Water, September 2014

Table 4-2 shows the routine laboratory testing required after the nutrient removal upgrades.

Table 4-2. Routine Laboratory Testing Required for Nutrient Removal Upgrades			
Parameter	Sample Matrix	Sampling Frequency	Recommended Method (or equivalent)
Ammonia	Tertiary Treatment	2-3/week (all)	Standard Methods 2540 ⁽¹⁾
Total N	Tertiary Treatment	2-3/week (all)	Standard Methods 2540 ⁽¹⁾

References:

1. Standard Methods for the Examination of Water and Wastewater, 23rd edition, 2018.

Laboratory staff will continue to provide in-situ probe calibration and testing. Performance reports will be compiled based on the laboratory tests.



4.4 Supervisory

Supervisory duties include managing staff, implementing procedures to complete all operation and maintenance tasks, coordinating with other City officials and outside agencies, and ensuring that the plant meets all regulatory requirements. Supervisors schedule staff to ensure that enough personnel are on-site to meet operations, maintenance, and laboratory needs.

Section 5: Labor Estimation

Operations, maintenance, and laboratory labor estimates were primarily adapted from *The Northeast Guide for Estimating Staffing at Publicly and Privately Owned Wastewater Treatment Plants* (Northeast Staffing Guide), prepared by the New England Interstate Water Pollution Control Commission, November 2008. Engineering judgement and data from similar facilities were applied to staffing estimates that were not explicitly included in the Northeast Staffing Guide. The assumptions used to establish the future staffing basis include:

- **Facility size:** Labor estimates were based on a plant that operates 24 hours per day, 7 days per week and with a rated influent capacity greater than 20 million gallons per day (mgd). Post Point normally operates at a significantly lower influent flow rate, but the rated capacity was used for labor estimates to be conservative and because it more reasonably represents the size and amount of equipment required to achieve the plant maximum flow rating.
- **Staff hours per year:** The Northeast Staffing Guide provides recommended time allocations for individual unit processes. The hourly estimates include on-site person-hours for operations and do not include additional time for vacation, sick time, daily breaks, and daily mobilization and demobilization. This analysis assumed that City of Bellingham staff receive 7 weeks of combined vacation, holidays, and sick time. This analysis also assumed 1 hour per day of mobilization/demobilization, training, and breaks. As a result, the number of on-site labor hours assumed per staff was 1,575 hours per year.

This section estimates the existing solids handling staffing demand, the staffing demand after the biosolids upgrade, and the staffing demand after the nutrient removal upgrades. A comparison of staffing requirements for each scenario is provided. Additional staff requirements represent additional positions on the City of Bellingham staffing roster. This analysis did not estimate the number of people per shift or staffing requirements for all water/wastewater facilities.

5.1 Current Labor Estimation

Table 5-1 shows the staff estimate summary for the existing solids handling system, which includes thickening, dewatering, incineration, ash disposal, odor control, polymer, and associated pumping. Time allocations for both staffing positions were split between operations and maintenance based on historical operating records. Approximately 6 shift operators and 3 maintenance technician staff are required for the existing solids handling processes.

This analysis is intended to estimate the relative labor increase or decrease compared to current operations. Removing the incineration process is not expected to reduce laboratory labor below current levels. Therefore, current laboratory labor was not estimated.

Table 5-1. Staff Estimate Summary for the Existing Solids Handling System

	Operations (hr/yr)	Maintenance (hr/yr)	Combined Yearly Hours	Staff (persons)
Gravity Belt Thickening	730	365	1,095	0.7
Centrifuge Dewatering	2,920	365	3,468	2.2
Incineration	5,431	3,329	8,760	5.6
Ash Disposal Management ⁽¹⁾	0	0	0	0.0
Odor Control	365	475	840	0.5
Hour Total	9,446	4,534	13,980	
Staff Total	6.0	2.9	8.9	8.9

References:

1. Ash disposal is currently managed by supervisory staff and was therefore excluded from this analysis.

5.2 Biosolids Upgrade Project Labor Estimation

Table 5-2 shows the operations and maintenance labor estimate summary after the biosolids upgrade. Additional time to manage the temperature phased anaerobic digestion (TPAD) system have been added due to the increased complexity of the process as compared to single-phase thermophilic digestion. The existing odor control system involves two different processes located in different areas of the plant. The new odor control system will be located in a single location and is expected to result in a decrease in operational and maintenance hours compared to the existing process. Struvite management hours are highly dependent on the amount and location of struvite formed in the process. Further information on struvite management is available in *TM 15 – Struvite Mitigation and Recovery Evaluation*. The hours shown for struvite management are based on observed hours from a similar facility but should be regarded as speculative. Labor for biosolids beneficial use management, digester gas conditioning and upgrading, and sidestream treatment are also based on labor hours observed at similar facilities using similar processes. Biosolids beneficial use maintenance management will involve contract maintenance and truck haul coordination. The beneficial use program management is expected to require additional hours for coordination with the biosolids receiver. Standby generator maintenance such as repairs and overhauls were assumed to be outsourced to a third party. However, limited plant staff hours were assumed to manage the third party and perform small repairs. Additional hours were added to the biosolids upgrade labor demand to match the operational labor estimate for the existing solids handling process (6 operations staff). This measure ensures that operational staffing estimates are consistent with current operations, which will allow the City of Bellingham to maintain safe operations that have been shown to reliably meet plant permit regulations. Ultimately, up to 6 operator and 4 maintenance staff positions may be required after the biosolids upgrade.

Table 5-2. Operations and Maintenance Labor Estimate after the Biosolids Upgrade

	Operations (hr/yr)	Maintenance (hr/yr)	Total Yearly Hours	Staff (persons)
Solids Screening	365	1,095	1,460	0.9
Gravity Belt Thickening	730	548	1,278	0.8
Anaerobic Digestion	1,460	1,460	2,920	1.9
Additional Process Tanks	0	365	365	0.2
Centrifuge Dewatering	2,920	548	3,468	2.2
Chemical Addition (Ferric)	0	292	292	0.2

Table 5-2. Operations and Maintenance Labor Estimate after the Biosolids Upgrade				
	Operations (hr/yr)	Maintenance (hr/yr)	Total Yearly Hours	Staff (persons)
Struvite Management	0	216	216	0.1
Beneficial Use Maintenance Management	260	0	260	0.2
Beneficial Use Program Management	1,040	0	1,040	0.7
Digester Gas Conditioning and Upgrade	250	250	500	0.3
Sidestream Treatment	1,278	310	1,588	1.0
Odor Control	183	365	548	0.3
Standby Generator	0	50	50	0.0
Historical Plant Staffing Factor	960	0	960	0.6
Hour Total	9,446	5,498	14,944	
Staff Total	6.0	3.5	9.5	9.5

Table 5-3 shows the laboratory labor estimate summary after the biosolids upgrade. Anticipated laboratory labor represents additional testing required to monitor and maintain the new biosolids processes. Metals testing is already performed by Post Point and will continue to be performed at the current frequency (at least 6 times per year) and using the same method. Therefore, laboratory labor for metals testing is not included in this estimate. Up to 1 laboratory staff position may be required after the biosolids upgrade. The City of Bellingham has stated that the existing laboratory staff are already operating at maximum capacity and may be over-extended. An additional laboratory staff position would help alleviate this issue.

Table 5-3. Laboratory Labor Estimate Summary After the Biosolids Upgrade			
	Testing Time	Frequency	Total Yearly Hours
Acidity (VFAs)	0.75 hr/test	24 tests/yr	18
Alkalinity	0.75 hr/test	9 tests/yr	7
COD	2.5 hr/test	12 tests/yr	30
Coliform	1.0 hr/test	12 tests/yr	12
pH	0.25 hr/test	52 tests/yr	13
Metals	3.0 hr/test	0 tests/yr	0
Total P	2.0 hr/test	52 tests/yr	104
Solids, Total Solids (TS) and Volatile Solids (VS)	3.0 hr/test	52 tests/yr	156
Digester Gas Composition	1.0 hr/test	104 tests/yr	104
Sampling for Contracted Lab Services	0.25 hr/test	52 tests/yr	13
Probes/Instrumentation/Calibration (Additional)	36.5 hr/yr-probe	10 probes	365
Hour Total			822
Staff Total			0.5

5.3 Nutrient Removal Upgrades Project Labor Estimation

Table 5-4 shows the operations and maintenance labor estimate summary after the nutrient removal upgrade. Labor for additional solids handling was scaled using the operations and maintenance labor per



ton of treated solids after the biosolids upgrade multiplied by the anticipated solids load from tertiary treatment. Up to 2 operators and 2 maintenance staff may be required after the nutrient removal upgrade.

Table 5-4. Operations and Maintenance Labor Estimate after the Nutrient Removal Upgrades				
Nutrient Removal	Operations (hr/yr)	Maintenance (hr/yr)	Total Yearly Hours	Staff (persons)
Biological Aerated Filters	1,096	1,115	2,211	1.4
CEPT and Alkalinity	365	414	779	0.5
BAF-N/DN Pump Station	0	150	150	0.1
RAS Pump Station	0	50	50	0.0
Solids Handling Increase and Screening	422	237	659	0.4
Carbon Feed	138	365	503	0.3
Hour Total	2,021	2,331	4,352	
Staff Total	1.3	1.5	2.8	2.8

Table 5-5 shows the laboratory labor estimate summary after the nutrient removal upgrade. Anticipated laboratory labor represent additional testing required to monitor and maintain the tertiary treatment system. Up to 2 laboratory staff positions may be required after the nutrient removal upgrades.

Table 5-5. Laboratory Labor Estimate Summary After the Nutrient Removal Upgrade			
Nutrient Removal	Testing Time	Frequency	Total Yearly Hours
Ammonia	2.0 hr/test	365 tests/yr	730
Total N	2.0 hr/test	365 tests/yr	730
Probes/Instrumentation/Calibration	36.5 hr/yr-probe	4 probes	146
Process Control Testing	3.0 hr/test	52 tests/yr	156
Hour Total			1,762
Staff Total			1.1

5.4 Additional Labor Calculation

Table 5-6 shows a staffing increase summary for the biosolids improvements project and the nutrient removal upgrades. Labor hours for the current solids handling process were subtracted from anticipated labor hour requirements after the upgrades to calculate the net additional staffing required after each project. Anticipated staffing after the nutrient removal upgrades also includes staffing for the biosolids upgrade.

Operational labor demands for the biosolids upgrade project are expected to be approximately the same as current operational staffing levels. However, up to 1 additional maintenance position and 1 additional laboratory position are anticipated after the biosolids upgrade, for a total of up to 2 additional staffing positions after the biosolids upgrade.

Additional labor demands for both the biosolids upgrade and the nutrient removal upgrades are expected to increase the number of staff by up to 2 staff positions each for operations, maintenance, and laboratory work, for a total of 6 additional staffing positions after the nutrient removal upgrades.

Table 5-6. Staffing Increase Summary for the Biosolids Improvements Project and the Nutrient Removal Upgrades		
	Hr/Yr	Staff (persons)
Existing Solids Process		
Operations	9,400	6.0
Maintenance	4,500	2.9
Lab	-	-
Net Total	13,900	8.9
Additional Staff Needed after Biosolids Upgrades		
Operations	0	0.0
Maintenance	1,000	0.6
Lab	800	0.5
Net Total	1,800	1.1
Total Staff Needed after both Biosolids Upgrades and Nutrient Removal Upgrades		
Operations	2,000	1.3
Maintenance	3,300	2.1
Lab	2,600	1.6
Net Total	7,900	5.0

Appendix B compiles all the operational, maintenance, and laboratory labor estimates for existing and future Post Point operations.

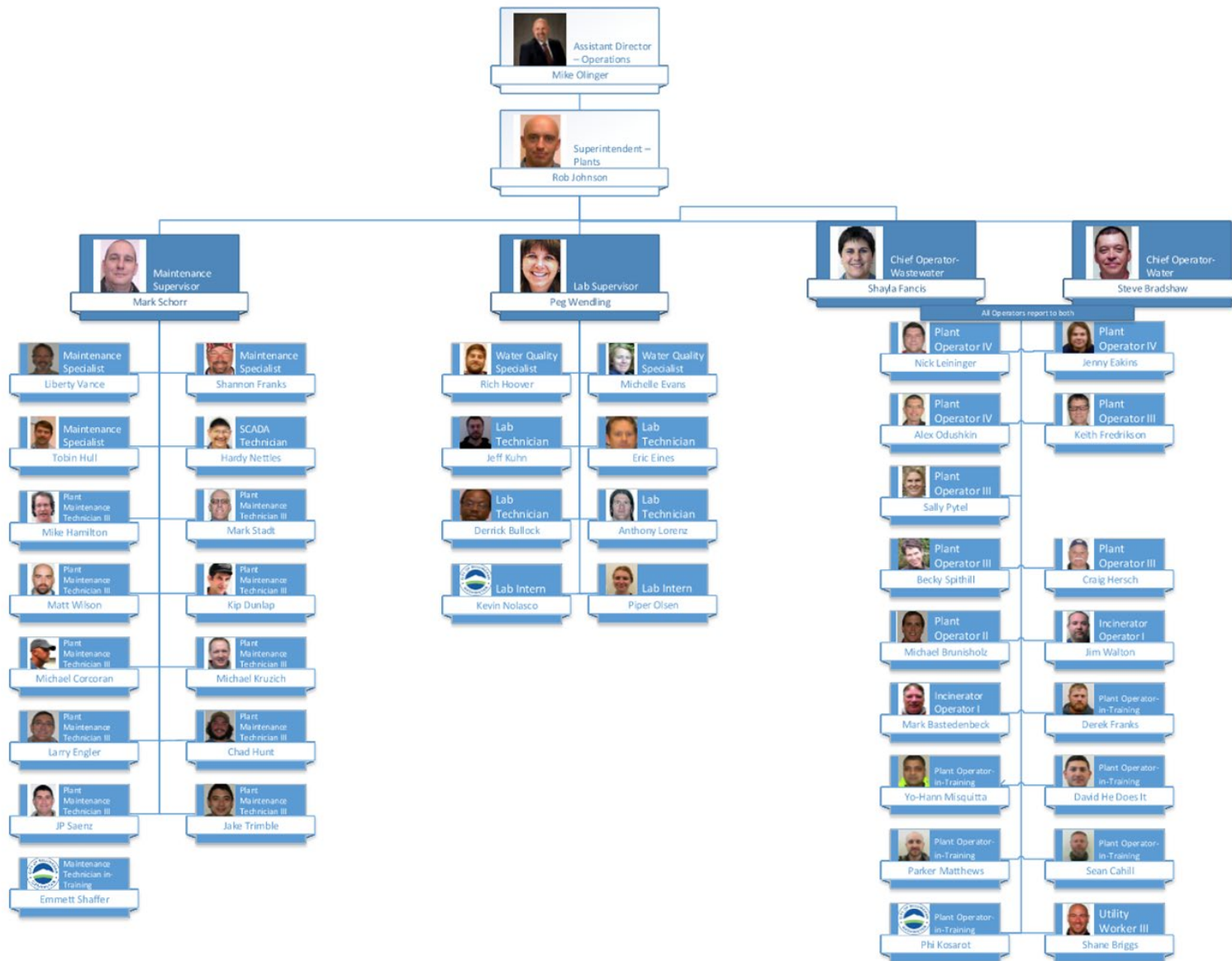
Section 6: Conclusion

Labor requirements were estimated for the existing solids handling process at Post Point. Existing labor requirements were compared to anticipated labor requirements after the biosolids upgrade project and the future nutrient removal upgrades. Labor estimates included operational, maintenance, and laboratory responsibilities. The analysis yielded the following conclusions:

- Operational labor demands for the biosolids upgrade project are expected to be approximately the same as current operational staffing levels. Up to 1 additional maintenance position and 1 additional laboratory position are expected after the biosolids upgrade, for a total of 2 additional staffing positions.
- Additional labor demands for both the nutrient removal upgrades and the biosolids upgrade are expected to increase the number of staff by up to 2 staff positions each for operations, maintenance, and laboratory work. Therefore, up to 6 additional staff may be required after the biosolids and nutrient removal upgrades.


Attachment A: City of Bellingham Water and Wastewater Treatment Plant Staffing Roster





Attachment B: Labor Demand Summary



Future Staffing Estimates				
Post Point Biosolids Project				
City of Bellingham				
Prepared by: M. Neyestani and C. Clark				
Reviewed by: S. Leung and A. Conklin				
Staff Estimate Summary at Post Point				
	Operations (hr/yr)	Maintenance (hr/yr)	Total Yearly Hours	Staff
Existing Solids Handling				
Gravity Belt Thickening	730	365	1,095	0.7
Centrifuge Dewatering	2,920	365	3,285	2.1
Incineration	5,431	3,329	8,760	5.6
Ash Disposal Mgt	0	0	0	0.0
Odor Control	365	475	840	0.5
Total Hour Subtotal	9,446	4,534	13,980	
Staff Subtotal	6.0	2.9	8.9	8.9
Biosolids Improvements				
Solids Screening	365	1,095	1,460	0.9
Gravity Belt Thickening	730	548	1,278	0.8
Anaerobic Digestion	1,460	1,460	2,920	1.9
Additional Process Tanks	0	365	365	0.2
Centrifuge Dewatering	2,920	548	3,468	2.2
Chemical Addition (Ferric)	0	292	292	0.2
Struvite Management	0	216	216	0.1
End Use Maintenance Management	260	0	260	0.2
End Use Program Management	1,040	0	1,040	0.7
<i>End use production - Blending</i>	N/A	N/A	N/A	N/A
Digester Gas Conditioning and Upgrade	250	250	500	0.3
Deammonification	1,278	310	1,588	1.0
Odor Control	183	365	548	0.3
Standby Generator	0	50	50	0.0
Historical Plant Staffing Factor	960	0	960	0.6
Total Hour Subtotal	9,446	5,498	14,944	
Staff Subtotal	6.0	3.5	9.5	9.5
Nutrient Removal				
Biological Aerated Filters	1,096	1,115	2,211	1.4
CEPT and Alkalinity	365	414	779	0.5
BAF-N/DN Pump Station	0	150	150	0.1
RAS Pump Station	0	50	50	0.0
Solids Handling Increase and Screening	422	246	668	0.4
Carbon Feed	138	365	503	0.3
Total Hour Subtotal	2,021	2,340	4,361	
Staff Subtotal	1.3	1.5	2.8	2.8
Lab Testing				
	Testing Time (hr)	Freq (#/yr)	Total Yearly Hours	
Biosolids Improvements				
Acidity (VFAs)	0.75	24	18	
Alkalinity	0.75	9	7	
COD	2.5	12	30	
Coliform	1.0	12	12	
pH	0.25	52	13	
Metals	3.0	0	0	
Total P	2.0	52	104	
Solids, TS and VS	3.0	52	156	
Digester Gas Composition	1.0	104	104	
Sampling for Contracted Lab Services	0.25	52	13	
Additional Probes/Instrumentation/Calibration	36.5	10	365	
Total Hour Subtotal			822	
Staff Subtotal			0.5	
Nutrient Removal				
Ammonia	2.0	365	730	
Total N	2.0	365	730	
Additional Probes/Instrumentation/Calibration	36.5	4	146	
Process Control Testing	3.0	52	156	
Total Hour Subtotal			1,762	
Staff Subtotal			1.1	
Summary				
Existing Solids Process	Hr/Yr	Staff		
Operations	9,400	6.0		
Maintenance	4,500	2.9		
Lab	-	-		
Net Total	13,900	8.9		
Biosolids Upgrade - Existing	Hr/Yr	Staff		
Operations	0	0.0		
Maintenance	1,000	0.6		
Lab	800	0.5		
Net Total	1,800	1.1		
Biosolids Upgrade + Nutrient Removal - Existing	Hr/Yr	Staff		
Operations	2,000	1.3		
Maintenance	3,300	2.1		
Lab	2,600	1.6		
Net Total	7,900	5.0		
General Notes:				
1. Annual hours per staff person assuming average of 7 weeks of PTO/holidays & 1 hr/working day for mobilization/demobilization/training/breaks: 1,575 hr/yr-staff				
2. Annual on-site hours do not include work generally performed by Operator IV and above, utilities specialist, or interns.				
3. Staff estimates are limited to directly supporting process related areas only and do not include general facility maintenance such as cleaning or landscaping.				
4. On-site operator staffing at Post Point to maintain 2 shift operators at all times				