2019

DRAFT Nutrient Temporary Standards for: City of Raton Wastewater Treatment Plant NPDES Permit No. NM0020273 to Doggett Creek

New Mexico Environment Department

Surface Water Quality Bureau

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Background

Nutrients are one of the leading causes of water quality impairment in New Mexico waters. According to the state's 2018-2020 Integrated Report, nutrients are the second leading cause of impairment in New Mexico perennial rivers and streams and the fourth leading cause of impairment in lakes and reservoirs, impairing 1,140 miles and 5,750 acres, respectively. Nutrient pollution in waterbodies results in large daily swings of dissolved oxygen (DO), which can change aquatic community dynamics. In some cases, these changes can result in nuisance algal blooms that lead to fish kills and other harmful effects, such as harmful algal blooms, considerably reduced recreational opportunities, and taste and odor problems in drinking water.

New Mexico's Narrative Nutrient Criterion and Nutrient Thresholds

Water quality standards regulations in 20.6.4 NMAC include a narrative criterion for distinguishing nutrient conditions that contribute to production of undesirable or nuisance aquatic life. The criterion states, "*Plant nutrients from other than natural causes shall not be present in concentrations that will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state*" (20.6.4.13.E NMAC). The state interprets this narrative criterion using numeric nutrient threshold values, which are based on reference conditions and applied to specific site classes in perennial, wadable streams, as shown in Table 1.

Table 1. New Mexico Nutrient Thresholds for Each Site Class (Jessup 2015)

	TN (mg/L)			TP (mg/L)		
	TN Flat	TN Moderate	TN Steep	TP High-Volcanic	TP Flat-Moderate	TP Steep
Threshold	0.69	0.42	0.30	0.105	0.061	0.030

Notes: mg/L = milligram per liter; TN = total nitrogen; TP = total phosphorus.

Facilities discharging to surface waters covered by the thresholds will likely need water quality-based effluent limits (WQBELs) for nutrients. Because of the limited available dilution in many receiving waters, some facilities will have WQBELs (whether based on total maximum daily loads or not) that require the threshold concentrations to be met "end-of-pipe." However, these required WQBELs might not be economically or technologically achievable for many permittees.

New Mexico's Temporary Standards Regulation

In 2017, the New Mexico Water Quality Control Commission (Commission) approved the New Mexico water quality standards (WQS) regulation creating a framework for adopting temporary standards. In promulgating this regulation, the Commission sought to address situations where WQBELs are not achievable by creating a clear path to compliance that is achievable and affordable in the near-term and encourages improvements to water quality. The New Mexico temporary standards regulation is based on the U.S. Environmental Protection Agency (EPA) regulation on WQS variances at 40 *Code of Federal Regulations* (CFR) 131.14. EPA approved the New Mexico regulation as Clean Water Act (CWA) effective on August 11, 2017.

A temporary standard could be an appropriate tool for implementing New Mexico's WQS when a petitioner demonstrates that the underlying designated use and criterion, including numeric interpretations of narrative criteria, are not attainable now or within a defined period of time but may be attainable in the future. A temporary standard may be appropriate when all of the following are met:

1. Existing or proposed discharge control technologies will comply with applicable technology-based effluent limitations, feasible technological controls and other management alternatives;
2. The underlying designated use and criterion, including numeric interpretations of narrative criteria, are not attainable now or within a defined period of time, but may be attainable in the longer term;
3. It is feasible to make incremental improvements in water quality during the proposed term of the temporary standard;
4. The temporary standard will not result in any lowering of currently attained ambient water quality, unless the temporary standard will be used for restoration activities (20.6.4.10.F(1)(b) NMAC, 40 CFR 131.14(b)(2)(i)(A)(2)).

As discussed above, New Mexico's temporary standards regulation at 20.6.4.10(F) NMAC is based on the EPA regulation on WQS variances at 40 CFR 131.14. The New Mexico regulation defines a temporary standard as "a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition (HAC) during the term of the temporary standard" (20.6.4.10.F.12 NMAC). For a temporary standard that applies to a specific discharger, the HAC, which may be considered synonymous with New Mexico's definition of "highest degree of protection feasible in the short-term," must be a quantifiable expression that is one of the following (40 CFR 131.14(b)(1)(ii)(A)):

1. The highest attainable interim criterion; or
2. The interim effluent condition that reflects the greatest pollutant reduction achievable; or
3. If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the state adopts the WQS variance (temporary standard), and the adoption and implementation of a pollutant minimization program (PMP)[1].

By reflecting the HAC, a temporary standard provides a mechanism for making progress toward attaining a designated use and water quality criterion that are not currently attainable. Note also that if a temporary standard has a term longer than 5 years, the HAC must be re-evaluated at least once every five (5) years with the opportunity for public input (40 CFR 131.14(b)(1)(v)).

The New Mexico regulations state that "Any person may petition the commission to adopt a temporary standard applicable to all or part of a surface water of the state as provided for in this section and applicable subsections in 40 CFR 131.14" (20.6.4.10.F.1 NMAC). These regulations also specify that the petitioner for a temporary standard must demonstrate that attainment of the underlying designated use and criterion is not attainable in the short term based on one of the following seven factors:

1. Naturally occurring pollutant concentrations prevent the attainment of the use; or
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or

[1] A PMP is a structured set of activities to improve processes and pollutant controls that will prevent and reduce pollutant loadings (40 CFR 131.3(p)).

3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6. Controls more stringent than those required by sections 301(b) and 306 of the CWA would result in substantial and widespread economic and social impact; or
7. Due to the implementation of actions necessary to facilitate restoration such as through dam removal or other significant wetland or water body reconfiguration activities as demonstrated by the petition and supporting work plan requirements in Paragraphs (4) and (5) of Subsection F of 20.6.4.10 NMAC (in federal regulation at 40 CFR 131.14(b)(2)(i)(A)(2) “Actions necessary to facilitate lake, wetland, or stream restoration through dam removal or other significant reconfiguration activities preclude attainment of the designated use and criterion while the actions are being implemented.”).

New Mexico’s regulation outlines documentation requirements for a temporary standard petition submitted to the Water Quality Control Commission (WQCC) to demonstrate how the proposed temporary standard meets the requirements, including demonstrating that attainment of the underlying designated use and criterion is not feasible and that the proposed temporary standard represents the HAC.

Purpose

The purpose of this proposal is to apply the State’s framework established in 20.6.4 NMAC to the City of Raton Wastewater Treatment Plant (National Pollutant Discharge Elimination System [NPDES] permit no. NM0020273) (hereafter Raton WWTP) to request a temporary standard from the underlying water quality standards for plant nutrients (i.e., total phosphorus and total nitrogen). Once a temporary standard has been adopted by the WQCC and approved by EPA under CWA section 303(c), it is effective for CWA purposes and serves as the applicable WQS from which federal CWA permits must derive from and comply with as enforceable limits and conditions (20.6.4.12 NMAC).

Attainment of the underlying designated use and criterion is not feasible for the Raton WWTP, and the proposed temporary standard represents the highest attainable condition during the term of the temporary standard. All other designated uses and associated criteria not specified in this proposed temporary standard remain applicable for all CWA and New Mexico Water Quality Act (WQA) purposes and are required through NPDES permit no. NM0020273.

Discharger/Receiving Waters:
The only discharger to be permitted under the terms and conditions of this proposed temporary standard is the Raton WWTP (NM0020273) within the City of Raton in Colfax County, New Mexico. The WWTP discharges to Doggett Creek which is a tributary to Raton Creek, Chicorica Creek, and the Canadian River. Doggett Creek (AU ID NM-2305.A_255) is located in the Raton Creek 12-digit hydrologic unit code (HUC) 110800010104 in northeastern New Mexico. There are no other permitted discharges to Doggett Creek; however, the City of Raton Water Treatment Facility (NPDES #NM0029891) is permitted to discharge to Raton Creek approximately four miles upstream of its confluence with Doggett Creek.

Site Background

Raton is the county seat of Colfax County and is located approximately six and a half miles south of Raton Pass on the Colorado-New Mexico border. Other nearby towns include Maxwell (25 miles), Cimarron (40 miles), Springer (40 miles), and Folsom (35 miles) in New Mexico and Trinidad (20 miles) in Colorado. According to the U.S. Census of 2000, the City covers eight square miles with 7,282 people, 3,035 households, and 1,981 families residing within the city's boundaries. Almost 31% of the households had children under the age of 18 living with them; 31% of the households were individuals with 14% of those households being individuals 65 years of age or older; and 35% of the households were non-families. The median income for a household in the City was $27,028, the median income for a family was $31,762, and the per capita income was $14,223. About 15% of families and 17% of the population were below the poverty line in 2000. Since then, the population of Raton dropped to 6,885 in the 2010 Census and was estimated to have dropped to 6,066 by July 1, 2018. The adjusted median household income based on January 2017$ is $29,773.

Watershed Description

Doggett Creek is part of the larger Canadian Headwaters watershed, which is bounded by the Sangre de Cristo Mountains to the west and the Great Plains to the east. From a point south-southeast of Maxwell, NM to its headwaters, the HUC drains approximately 1,725 square miles. Elevation ranges from 11,610 feet above sea level at Vermejo Peak to 5,640 feet at USGS Gage 07211500 near Taylor Springs, NM. Tributaries in this watershed include: Caliente Canyon Creek, York Canyon Creek, Leandro Creek, Vermejo River, VanBremmer Creek, Raton Creek, Chicorica Creek, Uña de Gato Creek, Blosser Arroyo, and Tinaja Creek. The upper portion of Leandro Creek in Valle Vidal Unit of the Carson National Forest is designated as an Outstanding National Resource Water (ONRW). However, Leandro Creek is a tributary to the Vermejo River, which enters the Canadian River south of Maxwell, NM, approximately 30 miles south of the Raton WWTP discharge, and is not expected to be influenced or impacted by this temporary standard.

The geology of the Canadian Headwaters watershed is characterized by sandstone, shale, mudstone, and claystone that are flanked by limestone or calcareous rocks in the west and mafic volcanic rocks in the east. Land cover in the New Mexico portion of watershed is 49% grassland, 31% evergreen forest, 15% shrub/scrub and 2% deciduous forest. Much of the land ownership is private with the exceptions of Maxwell National Wildlife Refuge and a small portion of the Valle Vidal in the headwaters of Leandro Creek. The average annual precipitation in Colfax County is 16.34 inches. Average annual snowfall in the watershed is 72 inches (or 7.2 inches of precipitation).

Water Quality Standards and Designated Uses

Doggett Creek is classified as a perennial water in New Mexico's surface water quality standards[2] (20.6.4.99 NMAC) with designated uses of warmwater aquatic life, livestock watering, wildlife habitat and primary contact. Doggett Creek is listed on the 2018-2020 Integrated List[3] as impaired due to nutrients and *E. coli* bacteria. The nutrient impairment was first identified in 1998 with data from the 1980s and 1990s. Subsequent sampling results from 2006 and 2015-2016 confirmed the nutrient impairment. Doggett Creek was most recently sampled during NMED's 2015-2016 Canadian watershed

[2] https://www.env.nm.gov/surface-water-quality/wqs/
[3] https://www.env.nm.gov/surface-water-quality/303d-305b/

survey. Total nitrogen and total phosphorus thresholds were exceeded in 100% of the samples at the station below the Raton WWTP, with a documented diel dissolved oxygen (DO) swing of 13.41 mg/L and periodic DO concentrations below 5.0 mg/L for greater than 4 hours.

Currently Attained Water Quality

Based on current effluent limitations in NPDES permit no. NM0020273 and the Raton Creek Watershed Total Maximum Daily Load Implementation Plan for the City of Raton WWTP (Appendix D), implementation of this temporary standard will not result in the lowering of existing water quality. The temporary standard includes an implementation schedule for improvements (Appendix C). The current effluent quality will be improved during the term of the temporary standard as described in this proposal. In addition, according to the NPDES permit, the City of Raton is required to conduct a Whole Effluent Toxicity (WET) Test once per year.

Biological Evaluation of Threatened and Endangered Species

Since the unattainable water quality standard is an *aquatic life criterion*, NMED and EPA must ensure that granting the variance is not likely to jeopardize the continued existence of any threatened or endangered species listed under the Endangered Species Act or result in the destruction or adverse modification of such species' critical habitat (per OAR-340-041-0059(1)(b)(B)). Threatened and endangered species in the Raton Creek watershed include the New Mexican Meadow Jumping Mouse (*Zapus hudsonius luteus*), Canada Lynx (*Lynx canadensis*), North American Wolverine (*Gulo gulo luscus*), Mexican Spotted Owl (*Strix occidentalis lucida*), Piping Plover (*Charadrius melodus*), and Southwestern Willow Flycatcher (*Empidonax trailii extimus*). There are no critical habitats identified in this watershed (USFWS Information for Planning and Consultation, IPaC, *https://ecos.fws.gov/ipac/*).

It is not anticipated that granting this temporary standard will jeopardize threatened and endangered species or result in the destruction or adverse modification of critical habitat. Nor should the temporary standard jeopardize natural communities of conservation concern (e.g., emergent wetland, riverine wetland, prairie, glade, fen) because habitat will not be impacted, and water quality will improve.

TEMPORARY STANDARD DEMONSTRATION

Existing and Planned Controls and Current Performance

The Raton Wastewater Treatment Plant (WWTP) is an activated sludge system using an enhanced sequential batch reactor (SBR) (intermittent cycle extended aeration system or ICEAS). The facility operates in a biological nutrient removal (BNR) mode by alternating phases of aeration and anoxic/anaerobic cycles. The secondary effluent from the SBR process is decanted to an effluent equalization basin. The effluent from the equalization basin flows by gravity to either the reuse facility or to ultra-violet (UV) Disinfection. The effluent going through the UV Disinfection is discharged to Doggett Creek. The facility has a design flow of 0.9 million gallons per day (MGD). Its effluent discharge volume averages approximately 0.36 MGD with a maximum weekly average discharge of 0.62 MGD. NMED consulted with the Office of the State Engineer (OSE) to determine whether water rights may constrain treatment options for Raton. OSE confirmed that Raton WWTP does not have any return flow obligations.

Raton's current NPDES permit (NPDES permit no. NM0020273; issued July 1, 2015) has performance-based 30-day average effluent limits expressed in terms of both concentration and mass. These limits are 10 mg/L and 46.7 lbs/day total nitrogen (TN) and 3.0 mg/L and 14.0 lbs/day total phosphorus (TP). Although these limits are performance-based, they were included in the NPDES permit to protect and maintain existing water quality and prevent further degradation of the receiving water. Discharge monitoring data for the period from January 2017 through September 2018 indicate a long-term average effluent TN concentration of approximately 7.3 mg/L and a long-term average TP concentration of approximately 2.37 mg/L.

Anticipating that its future NPDES permits will include effluent limits based on New Mexico's numeric nutrient thresholds, Raton is examining how the use of chemical precipitation (alum) would affect its treatment system and its effluent pollutant concentrations. Chemical precipitation is one potential treatment option for phosphorus removal. Raton is still at the pilot scale; therefore, the facility has not used chemical precipitation for the full waste stream.

Technology-Based Effluent Limits for Nutrients

There are no technology-based requirements for nutrients applicable to publicly owned treatment works. Therefore, technology-based effluent limits are not sufficient to meet water quality standards.

Water Quality-Based Effluent Limits for Nutrients

The Raton WWTP discharges to Doggett Creek, a tributary to Raton Creek, Chicorica Creek, and the Canadian River. New Mexico's narrative nutrient criterion applies to this receiving water, and NMED uses the threshold values for TN and TP in Table 1 to interpret this criterion. NMED has determined that the receiving water falls within the TN Flat class for total nitrogen and the TP Flat-Moderate class for total phosphorus. Thus, the following nutrient threshold concentrations would be used to interpret the narrative criterion and derive the WQBEL:

- TN = 0.69 mg/L
- TP = 0.061 mg/L

The nutrient threshold values are being interpreted as 30-day average values and, therefore, WQBELs may be appropriately expressed as average monthly limits. In the case of Raton, the receiving water has no allowance for mixing because the effluent composes the bulk of flow in Doggett Creek. Thus, the threshold values are applied as "end of pipe" WQBELs. In other words, the average monthly limits for TN and TP are equal to the TN and TP thresholds expressed above.

Potential Technology Options to Attain the Applicable Water Quality Standard

Appropriate technology options were selected by considering:

- current wastewater treatment plant processes and configuration along with known upgrades being considered (advanced SBR; investigating chemical precipitation for TP removal),
- current effluent concentrations for TN and TP as well as any existing effluent limitations, and
- comparison of design flow and long-term effluent volume (average 30-day discharge is 0.36 million gallons per day (mgd); maximum weekly average discharge is 0.62 mgd; design flow is 0.9 mgd) – the maximum weekly average discharge was used for cost estimations.

With the exception of reverse osmosis (RO), all of the target effluent concentrations for the various treatment options are well above the levels needed to meet WQBELs that would achieve the threshold values. RO is the only technology that approaches the underlying numeric nutrient thresholds. However even with RO, attainment of the underlying nutrient thresholds (Table 1) is uncertain. It was assumed that the RO system would be added to the end of the existing treatment process and that 100% of the effluent would be treated through the RO system. Because RO is the only option that would allow the facility to approach the underlying designated use and criterion, this option was further considered in the attainability analysis described below.

Factor Precluding Attainment of the Applicable Water Quality Standard

The basis for this temporary standard request is 40 CFR § 131.10(g) Factor 6, "controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact," as supported by the June 26, 2018 *Substantial and Widespread Economic and Social Impact and Highest Attainable Condition Analysis Report for Raton, New Mexico* ("the Report") prepared by Tetra Tech and ECONorthwest for EPA and NMED, and included as Appendix A of this document.

Reverse osmosis, which could potentially attain the underlying designated use and criteria (i.e., nutrient thresholds), is not economically feasible to install and operate and would lead to substantial and widespread social and economic impacts throughout the community. EPA's Interim Economic Guidance[4] describes substantial and widespread economic and social impacts as two separate analyses. For public-sector entities, substantial impacts refer to the financial impacts on the community, taking into consideration current socioeconomic conditions. Widespread impacts, on the other hand, refer to changes in the community's socioeconomic conditions.

Substantial Impact Analysis

Whether or not the community faces substantial impacts from additional pollution control options needed to meet the underlying designated use and TN and TP thresholds depends on both the cost of the additional pollution control and the general financial and economic health of the community. The Report estimated the cost of RO based on the average weekly effluent flow of 0.62 mgd, normalized to January 2017$, and annualized capital costs using a discount rate of 5 percent and a term of 20 years. These costs were added to the annual operation and maintenance (O&M) cost estimates to determine total annual costs. The cost estimate for RO is shown in Table 2.

Table 2. Estimated Costs for Reverse Osmosis (January 2017$)

Technology	Target Effluent Concentration	Capital Cost	O&M Cost	Annualized Costs[1]	Reference
Reverse Osmosis	< 1.0 mg/L TN < 0.01 mg/L TP	$10,750,800	$847,916	$1,710,130	Falk et al. 2011

[1]Annualized costs are based on a discount rate, *i*, of 5%, and term, *n*, of 20 years.

Sewage authorities charge for services, and thus can recover pollution control costs through user fees. The most recent information on the population, number of households, and median household income (MHI) in Raton was collected and used to evaluate the potential impact to the community of installing additional pollution controls at the WWTP. The expected annual cost per household after installing RO would be $822.06 assuming that 100% of the costs of the project are borne by households. This cost includes the current annual pollution control cost per household ($230.16) plus the estimated annual incremental pollution control cost per household for RO ($591.90).

[4] Available online at https://www.epa.gov/wqs-tech/economic-guidance-water-quality-standards.

EPA's Interim Economic Guidance describes two tests for determining whether the socioeconomic impact of requiring a pollution control measure would be *substantial*:

- Municipal Preliminary Screener (MPS)
- Secondary Test Indicators

The MPS estimates the total annual pollution control costs per household (existing costs plus those attributable to the proposed project) as a percentage of MHI:

MPS = Average Total Pollution Control Cost per Household/MHI

The analysis proceeds to the Secondary Test if:

- The total annual cost per household exceeds 2.0 percent of MHI—EPA's Interim Economic Guidance suggests the project is likely to result in a substantial economic impact.
- The total annual cost per household is between 1.0 and 2.0 percent of MHI—EPA's Interim Economic Guidance suggests the project may result in a substantial economic impact.

The existing annual sewer cost per household in Raton of $230.16 is 0.8% of MHI ($29,773). Requiring RO would increase the annual costs per household to $822.06, which is 2.8% of MHI, suggesting that the additional treatment is likely to result in a substantial economic impact to the community, therefore the analysis proceeds to the Secondary Test.

The Secondary Test is designed to build upon the characterization of the financial burden identified in the MPS. The Secondary Test indicators for Raton are shown in Table 3.

Table 3. Secondary Test Indicators

Indicator	Value for Raton
Debt Indicators	
Bond Rating (if available)	Not available*
Overall Net Debt as a Percent of Full Market Value of Taxable Property	$5,073,348
Socioeconomic Indicators	
Unemployment Rate	6.1%
Adjusted Median Household Income (January 2017)	$29,773
Financial Management Indicators	
Property Tax Revenue as a Percent of Full Market Value of Taxable Property	$637,160
Property Tax Collection Rate	99%

*Raton does not have a bond rating.

Using the Secondary Test Indicators in Table 3, an average secondary test score of 2.0 was calculated, which indicates socioeconomic conditions that are at the low end of the mid-range category. The Substantial Impacts Matrix from EPA's Interim Guidance was used to determine if RO would result in substantial impacts. The MPS score is considered jointly with the secondary test score to determine the degree of impact. Evaluating the MPS and Secondary Test scores suggests that installation of RO would likely result in substantial economic impacts to the community (highlighted cell in Table 4).

Table 4. Assessment of Substantial Impacts Matrix for Installing RO

MPS: 2.8%			
Secondary Test Score: 2.0			
Secondary Test Score	MPS		
	< 1.0%	1.0%–2.0%	> 2.0%
Less than 1.5	?	X	X
Between 1.5 and 2.5	✓	?	X
Greater than 2.5	✓	✓	?

Key:
✓: Impact is not likely to be substantial
X: Impact is likely to be substantial
?: Impact is unclear
X: Raton score

Widespread Impact Analysis

The EPA considers widespread impacts to occur if the project will have significant adverse impacts on the local, surrounding community. There are several key factors suggestive of Raton's disadvantaged condition which would contribute to the widespread impact on the community. The widespread impact analysis considered several indicators, including:

- Estimated change in MHI;
- Estimated change in unemployment rate;
- Estimated change in overall net debt as a percent of full market value of taxable property;
- Estimated change in the percentage of households below the poverty line;
- Impact on commercial development potential; and,
- Impact on property values.

Summary of Widespread Indicators for the City of Raton:

- The pollution control project (RO) needed for Raton to meet WQBELs based on New Mexico's numeric nutrient thresholds would increase the average household annual sewer rates from approximately \$230, or 0.8% of median annual household income, to approximately \$822, or 2.8% of median annual household income. The magnitude of the changes in the percent of MHI for pollution control costs associated with meeting the underlying designated use and criterion (RO) is significant, with sewer fees more than tripling.
- The community median annual household income (MHI) was approximately \$29,600 in 2016, which is substantially lower than the statewide median annual household income of approximately \$45,700. Raton's MHI is consistently substantially lower than national and state averages and has shown stagnant or declining conditions while state and national levels have increased slightly. In addition, wages for jobs in Raton are generally lower than wages in the state as a whole.
- Another factor suggesting that the substantial economic impacts associated with installing RO would be widespread is that the impacts would occur across the entire community. Almost all households and businesses in the community pay for wastewater treatment. The increase in wastewater treatment rates necessary to install RO would apply to all rate payers and thus to almost the entire community. A substantial community-wide increase in wastewater treatment rates would likely have broad negative effects on community financial health. Such broad negative effects on community financial health would likely alter the ways in which people live, work, play, relate to one another, and organize their activities.

Achieving WQBELs derived from the underlying designated use and criterion through treatment would necessitate the installation and operation of RO at the Raton WWTP and would lead to substantial and widespread economic and social impacts to the community.

All analyses can be found in the *Substantial and Widespread Impacts Report* in Appendix A.

Feasibility of Other Potential Options for Achieving the Applicable Water Quality Standard

An alternate discharge location is not a feasible alternative because the downstream water (Raton Creek) is also impaired for nutrients and would not offer much, if any, dilution capacity. However, the City currently reuses a portion of effluent for non-potable reuse at a golf course during summer and fall months. The reuse varies on average between 40 to 50 percent of the influent flow. The City is collecting data to explore the option of a zero discharge/seasonal discharge permit. Monthly average of the influent and reclaim flow data for the periods extending from March to November 2017 and from March to September 2018 were analyzed. In 2017, forty-one percent (41%) of influent flow was directed to reclaim use. In 2018, fifty-five percent (55%) of the influent was directed to reclaim use.

Seasonal Discharge / Zero Discharge Options
The City is evaluating 100% re-use of the WWTP flow during the summer/fall months followed by a seasonal effluent nutrient limit for discharge during the winter months. This approach would require the City to upgrade or add a polishing filter, increase the capacity of the reuse pumps, and increase the size of pipes to minimize pipe losses for 100% effluent re-use. However, during winter months, the WWTP would still need to discharge effluent to Doggett Creek because land application would be constrained due to freezing temperatures. Alternatively, as part of this temporary standard proposal, the City will identify and evaluate costs for sending the effluent to a water resource recovery facility in the winter for additional treatment, processing, and re-use in other capacities. This seasonal combination would result in zero discharge and eliminate the need for a NPDES permit for the WWTP but may not be economically or logistically feasible.

Highest Attainable Effluent Condition (HAC)

A temporary standard is a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the temporary standard. The permit limitations expressed during the term of this temporary standard represent the highest attainable condition (HAC) that can be achieved without causing substantial and widespread economic and social impact.

EPA considers the HAC to mean the condition that is both feasible to attain and is closest to the protection afforded by the designated use and criteria. New Mexico defines the HAC as the highest degree of protection feasible in the short term, and the condition that will be the basis for effluent limits during the term of the temporary standard. The HAC options described below are presented in the form of the *interim effluent condition reflecting the greatest pollutant reduction achievable*.

Summary of Options Evaluated
Treatment options evaluated as candidates for establishing the HAC include optimization of Raton's existing treatment system and technologies (other than RO) that would provide additional reductions in the effluent concentrations of TN and TP. The cost per household was calculated for six potential combinations of treatment options for TN and TP shown in Table 5. The table shows the incremental

annual cost per household of each treatment combination option, total annual pollution control costs per household (including existing annual costs of $230.16 per household), the resulting percentage of MHI for pollution control, and the corresponding increase in annual sewer bills for households in Raton.

There are several factors to consider when evaluating the range of options in Table 5 to determine the HAC for Raton. If the total annual cost per household (existing annual cost plus the incremental cost related to the proposed project) is well below 1.0 percent of MHI, EPA's Interim Economic Guidance suggests the project will likely not impose a substantial economic impact on the community. Typically, the analysis would not proceed further. However, if the total annual cost per household is fairly close to 1.0 percent of MHI, the project may impose a substantial economic impact on the community due to the community's unique circumstances. In such cases, the unique circumstances should be documented in order to determine the HAC.

Table 5. Annual Pollution Control Cost Per Household (2017$) of TN and TP Treatment Combination Options for Raton

Cost Element	Option A Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option B Denitrification Filters (TEC = 3.0 mg/L TN) and No additional TP treatment (TEC = 2.2 mg/L TP)	Option C Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option D Optimize Cycle Times (TEC = 7.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option E Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option F Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)
Capital Cost	$681,360	$1,336,200	$1,557,540	$2,252,160	$2,712,180	$3,588,360
Annual O&M Cost	$150,439	$249,115	$330,001	$472,784	$542,337	$721,899
Total Annualized Cost	$205,113	$356,335	$454,982	$653,503	$759,969	$1,009,838
Incremental Annual Cost Per Household[1]	$70.97	$123.30	$157.43	$226.13	$262.97	$349.42
Existing Annual Pollution Control Costs Per Household	$230.16	$230.16	$230.16	$230.16	$230.16	$230.16
Total Annual Pollution Control Costs Per Household[2]	$301.13	$353.46	$387.59	$456.29	$493.13	$579.58
% of MHI for Pollution Control[3]	1.01	1.19	1.30	1.53	1.66	1.94
% Increase in Annual Sewer Bill	31	54	68	98	114	152
NMED Interpretation of Results	Impact Unclear	Impact Unclear	Substantial	Substantial	Substantial	Substantial

[1] 2,890 households

[2] Annualized at 5% over 20 years.

[3] Based on adjusted (January 2017$) MHI of $29,773.

Other relevant financial or demographic information should be considered that illustrates the unique or atypical circumstances faced by Raton to evaluate its financial capability. Raton's MHI of approximately $29,600 per year in 2016 was below both state ($45,700/year) and national ($55,300/year) medians for the same year and has been declining since 2014. In addition, the city's population and thus the WWTP's revenue base is declining, so that remaining residents will shoulder a higher proportion of the cost burden for WWTP operation every year (i.e., total annual cost per household will increase as population decreases). If the population continues to decline as projected, the percentage of MHI that a given upgrade represents in 2018 will increase over time. The remaining life of the plant's equipment is estimated to be 20 years, and significant cost efficiencies may be gained by incorporating nutrient removal technology as equipment is upgraded as opposed to improving old equipment and processes that will be replaced within a few years. Raton also has indicated in discussions that it has other ongoing and upcoming significant debt obligations related to necessary drinking water and sewer infrastructure upgrades further impeding their financial capability. Accordingly, it was concluded that the costs to implement Options D, E and F would likely cause substantial impacts to the community. Since the widespread indicators do not change depending on the technology option being considered, it was also concluded that the substantial impacts from Options D, E and F would also be widespread throughout the community. Furthermore, Option B was eliminated from consideration because there was no additional treatment required for total phosphorus.

Total residential share of costs between 1.0% and 1.9% of median household income (MHI) are categorized in EPA's Financial Capability Assessment Guidance as having a "medium" burden for the Residential Indicator (RI). Raton's consultant provided a technical memorandum (Appendix B) that further evaluates the feasibility of Options A and C. Several conclusions were drawn.

First, effluent phosphorus concentration is dependent on the amount of particulate phosphorus in the total suspended solids (TSS). Typically, the effluent particulate phosphorus in the TSS varies from one to three percent. This percentage is shifted towards the high end for a WWTP without enhanced phosphorus removal, such as the Raton WWTP. Since the ICEAS process does not have a clarifier and the solids separation is limited to the efficiency of the settle/decant phases of the SBR cycle, a target effluent condition of 0.5 mg/L of total phosphorus may not be regularly attained. Therefore, the target effluent condition (i.e., highest attainable condition), was changed to 1.0 mg/L TP to be consistent with treatment variability.

Second, the required treatment plant improvements necessary to attain TN concentrations of 5 mg/L or less and TP concentrations of 1 mg/L or less require capital equipment expenditures and ongoing operating expenditures. Due to certain process limitations associated with the SBR equipment, it is apparent that the operations expenditures end up comprising the majority of the annual amortized costs, and hence, contributing more to the calculated percentage of MHI increases.

Finally, a comparison of MHI impacts outlined in the Section 4 of the technical memorandum shows that Option C cost impacts are over 5 times more expensive than Option A, resulting in MHI percentage impacts ranging from 1.13 to 1.58 percent, indicating a likely significant impact to the community. Since the widespread indicators do not change depending on the technology option being considered, it was also concluded that the substantial impacts from Option C would also be widespread.

Therefore, based on the widespread and substantial analyses for the six technology options, the ability to make incremental improvements to water quality, and the desire to minimize impacts to the community and ensure an affordable, realistic, and manageable plan, a modified version of Option A was identified as the highest attainable condition for Raton WWTP (NPDES permit no. NM0020273) and is represented by the target effluent concentrations (TECs) presented in Table 6.

Table 6. Highest Attainable Conditions

Pollutant Parameter	Highest Attainable Effluent Condition (mg/L)[1]
Total Nitrogen (TN)	5.0, long-term average; 8.0, 30-day average
Total Phosphorus (TP)	1.0, long-term average; 1.6, 30-day average

1 See Appendix E for conversion from long-term average to 30-day average.

As discussed above, the modified Option A TECs for total nitrogen and total phosphorus are 5.0 mg/L and 1.0 mg/L, respectively. Those TECs represent expected long-term average performance. Consistent with the same principles used to derive NPDES average monthly limits from long-term averages, the long-term average TECs here are converted to highest attainable 30-day interim effluent conditions. Using Table 5-2 from EPA's Technical Support Document for Water Quality-based Toxics Control, a multiplier of 1.6, based on a default coefficient of variation of 0.6, the 95th percentile probability basis, and two samples per month (Appendix E), converts the long-term average TECs to the values provided in Table 6. It is assumed EPA Region 6 will use these 30-day interim effluent condition values as average monthly limit values in the NPDES permit. Where necessary, the state authorizes the use of permit compliance schedules to provide time to meet any WQBEL derived from the highest attainable condition for this temporary standard, consistent with 40 CFR Part 122.47.

Stakeholder Outreach & Public Participation

Initial public participation ahead of the New Mexico Water Quality Control Commission (WQCC) hearing followed public participation processes detailed in the Water Quality Management Plan – Continuing Planning Process (WQMP-CPP[5]). Temporary standard requests require the same opportunity for public review and comment as a formal rule making.

During permit renewal, NPDES permit no. NM0020273, which will reflect the conditions and requirements of the approved temporary standard, will be public noticed. Pursuant to federal regulations at 40 CFR 124.10(c), the EPA provides notice of draft NPDES permits to the applicant; various local, state, federal, tribal and pueblo government agencies; and other interested parties, and it allows at least 30 days of public comment. During each subsequent permit renewal, the revised permit issued under the terms and conditions of the approved temporary standard will be noticed for a 30-day public review and comment period.

The temporary standard also will be located in 20.6.4 NMAC and is subject to additional public review during all subsequent triennial reviews until expiration of the temporary standard.

[5] https://www.env.nm.gov/surface-water-quality/wqmp-cpp/

Re-Evaluation of Temporary Standard

Pursuant to 20.6.4.10(F) NMAC, all temporary standards are subject to a required review during each succeeding review of water quality standards. Furthermore, the term for this temporary standard exceeds five years, therefore, a re-evaluation of the HAC and the financial need for the temporary standard will occur no less than once every five years from the effective date of the temporary standard. The re-evaluation will use all existing and readily available information in accordance with 40 CFR 131.14(b)(1)(v). If additional requirements or a new, more stringent HAC are identified, the permit will be issued with those additional requirements or new higher attainable condition. During the re-evaluation, NMED will also reassess the financial capability of the City of Raton by re-evaluating the municipal preliminary screener (MPS) and secondary test scores for Raton with updated information, as available. If new information determines that the substantial and widespread social and economic impacts are no longer indicated, NMED will work with the City of Raton to determine feasible improvements and an implementation schedule for the City to meet the underlying water quality standards for total nitrogen and total phosphorus.

The State will accommodate public input on the re-evaluation through the public participation process during the triennial review, or through the public notice and comment period for the draft NPDES permit renewal as described in the section above. NMED will submit the initial results of the re-evaluation to the WQCC. In addition, pursuant to 20.6.4.10(F) NMAC, the discharger will provide a written report to the WQCC documenting the progress of proposed actions, pursuant to the reporting schedule stipulated in the approved temporary standard. The purpose of the review is to determine progress consistent with the original conditions of the petition for the duration of the temporary standard. If the discharger cannot demonstrate that sufficient progress has been made the WQCC may revoke approval of the temporary standard or provide additional conditions to the approval of the temporary standard.

After public participation and WQCC review and approval, the State considers the re-evaluation to be "complete." NMED will then submit the re-evaluation to EPA within 30 days of completion. If NMED, or the discharger, does not complete their review at the frequency specified, or does not submit the re-evaluation to EPA within 30 days of completion, the temporary standard will no longer be the applicable water quality standard until NMED and the discharger complete and submit the re-evaluation to EPA.

Proposed Actions and Timelines

The term of this proposed temporary standard is 20 years. This term is only as long as necessary to achieve the highest attainable condition and is consistent with the documentation submitted by the state to justify the term of the temporary standard. NMED has determined the implementation schedule submitted by the City of Raton (Appendix C) and presented in Table 7 to be a reasonable and justified schedule for this temporary standard and will allow the City time to plan and distribute budgets, fees, and expenditures to lessen the impact to the City's utility budget, and promote community support and encourage success of this proposal. The 20-year timeline provides for planning, pilot tests, funding efforts, and construction while minimizing the impact to city and utility budgets as well as to ratepayers during a weakened economy. The schedule proposes both operational optimization and modification of the existing treatment facility in two phases (Phase 1: Coagulation for phosphorus removal and Phase 2: Aeration control upgrades for nitrogen removal), which are dependent on several factors including:

- The overall utility budget, including other priorities, and depressed economic condition in Raton;
- Time needed to complete and approve final designs;

- Time needed to successfully secure financing;
- Successful bidding and construction processes within budget;
- Staff training for complete facility optimization of new and existing processes; and
- Evaluation of progress necessary to comply with the temporary standard.

In Phase 1, the City will incorporate chemical addition into its treatment scheme. Pilot testing of coagulant addition for phosphorus removal will determine the type of coagulant to be used. It is anticipated that initial testing will be with aluminum sulfate since it is the coagulant that Raton utilizes for drinking water treatment. Based on the coagulant selected, the existing solids handling system might require additional attention to determine its ability to handle the increased chemical sludge, including the impact to the effective treatment volume of the aeration basins. Any potential modifications to the sludge handling system and aeration basins due to increased chemical sludge will be added to Phase 2 to determine the overall cost. The potential process changes in addition to the time required to plan for the Phase 2 budget prevents concurrent undertaking of Phase 1 and Phase 2.

Phase 2 involves aeration control upgrades for nitrogen removal and refinement of chemical addition for phosphorus removal, as identified in Phase 1. In general, Phase 2 upgrades include the following:

- Replace the existing ICEAS system (SBR) programmable logic controller (PLC) and upgrade to Xylem's proposed current Biologic Nutrient Removal (BNR) PLC control logic, NURO Controller
- Install ammonia, nitrate, temperature, and DO sensors and transmitters to provide the necessary data and allow the new NURO control logic to optimize the existing process for nitrification and denitrification, while preventing excess blower run times during low loads.
- Reduce the number of "Air Off-Cycles" in the SBR process to enhance the nitrification process. The justification behind reducing the total amount of off-cycle time is that the denitrification process is faster as compared to nitrification process and the decant cycle time will also contribute to the available denitrification time.
- Update the controller logic to operate the aeration blowers based on the dissolved oxygen (DO) input from the SBR basins. Changes to the aeration cycles in response to demand, might require improvements to/retrofits to the existing aeration blowers.
- The addition of variable-frequency drives (VFDs) to the aeration blowers will enable the NURO controller to maintain DO setpoints in the SBR basins. The Xylem BioWin modeling indicates that oxygen carryover from the aeration ON periods to the aeration OFF periods will occur inhibiting denitrification.
- If the aeration blower motors are not suitable for VFDs, either the motor or the entire blower will require replacement.
- Installation of a combination ammonium/nitrate probe located approximately two thirds of the distance down the length of the SBR basin (toward the decanter end).
- Installation of an online phosphate probe to allow continuous online monitoring of phosphate in the SBR basins.
- External alkalinity addition, if required
- External carbon addition will likely be required to provide the necessary carbon required during the denitrification process. The supplemental carbon should be introduced at the beginning of the last Air OFF period for a given total cycle.
- Installation of a coagulation feed system for chemical removal of phosphorus.

Implementation of the temporary standard and associated tasks requires both capital and operational expenses from Raton's utility budget. The schedule proposes to re-evaluate the progress during each review of water quality standards and no less than once every five years from the effective date of the temporary standard. The City will keep NMED updated as the design and funding portions of each project phase progresses.

Table 7. Proposed Actions and Implementation Schedule

Task	Target Completion Date
NPDES Permit Application/Renewal - Continued Optimization Efforts of Existing System - PER for SBR Upgrades to Achieve Nutrient Removal Goal - Pilot Testing of Coagulation - Zero Discharge Feasibility Study	January 2020 – January 2023
- Design for Phase 1 (coagulation for phosphorus removal) - Funding Applications - Zero Discharge Feasibility Study - continued	January 2023 – January 2025
NPDES Permit Application/Renewal - Evaluate Nutrient Temporary Standard Progress incl. Zero Discharge - Complete Final Phase 1 Design - Bidding & Contract Award - Construction of Phase 1 - Construction Completion & Start Up	January 2025 – January 2029
- Optimization of New Processes - Evaluate Process Changes - Review & Evaluate PER Goals/Objectives and Plans	January 2029 – January 2030
NPDES Permit Application/Renewal - Evaluate Nutrient Temporary Standard Progress - Design Phase 2 (aeration control upgrade for nitrogen removal)	January 2030 – January 2031
- Pursue Funding - Complete Final Phase 2 Design	January 2031 – January 2032
- Bidding & Contract Award - Construction of Phase 2 - Construction Completion & Start Up	January 2032 – January 2035
NPDES Permit Application/Renewal - Evaluate Nutrient Temporary Standard Progress - Optimization of New Processes - Evaluate Process Changes - Review & Evaluate PER Goals/Objectives and Plans	January 2035 – January 2037
- Continued Optimization - Evaluate Nutrient Temporary Standard Progress End of Temporary Standard and End of Facility Life	January 2037 – January 2040

Proposed Regulation Language in 20.6.4 NMAC

A temporary standard is a time-limited designated use and criterion that reflects the highest attainable condition during the term specified in this temporary standard. If approved by the EPA, this temporary standard will be the applicable water quality standard in effect for the purposes of developing CWA Section 301(b)(1)(C) NPDES permit limits. The temporary standard may also be used for purposes of CWA Section 401 certifications. Where necessary, the State authorizes the use of permit compliance schedules to provide time to meet any WQBEL derived from the highest attainable condition for this temporary standard, consistent with 40 CFR Part 122.47. The underlying designated use and associated criteria remain applicable for all other CWA purposes, and all other uses and associated criteria not specified in this temporary standard remain applicable for all CWA purposes.

Currently, the receiving water, Doggett Creek, is an unclassified perennial stream under 20.6.4.99 NMAC. To implement this temporary standard, it will be necessary to add a new water quality standards segment. NMED recommends the following underlined language be added to the standards:

20.6.4.318 CANADIAN RIVER BASIN: Doggett creek.

A. **Designated uses:** Warmwater aquatic life, livestock watering, wildlife habitat and primary contact.

B. **Criteria:** The use-specific criteria in 20.6.4.900 NMAC are applicable to the designated uses, except that the following site-specific criteria apply: the monthly geometric mean of E. coli bacteria 206 cfu/100 mL or less, single sample 940 cfu/100 mL or less.

C. **Discharger-specific temporary standard:**

(1) **Discharger:** City of Raton wastewater treatment plant

(2) **NPDES permit number:** NM0020273, Outfall 001

(3) **Receiving waterbody:** Doggett creek, 20.6.4.318 NMAC

(4) **Discharge latitude/longitude:** 36° 52' 13.91" N / 104° 25' 39.18" W

(5) **Pollutant(s):** nutrients; total nitrogen and total phosphorus

(6) **Factor of issuance:** substantial and widespread economic and social impacts (40 CFR 131.10(g)(6))

(7) **Highest attainable condition:** interim effluent condition of 8.0 mg/L total nitrogen and 1.6 mg/L total phosphorus as 30-day averages. The highest attainable condition shall be either the highest attainable condition identified at the time of the adoption, or any higher attainable condition later identified during any reevaluation, whichever is more stringent (40 CFR 131.14(b)(1)(iii)).

(8) **Effective date of temporary standard:** XX-XX-XXXX. This temporary standard becomes effective for Clean Water Act purposes on the date of EPA approval.

(9) **Expiration date of temporary standard:** no later than 20 years from the effective date.

(10) **Reevaluation period:** at each succeeding review of water quality standards and at least once every five years from the effective date of the temporary standard (20.6.4.10.F(8) NMAC, 40 CFR 131.14(b)(1)(v)). If the discharger cannot demonstrate that sufficient progress has been made the commission may revoke approval of the temporary standard or provide additional conditions to the approval of the temporary standard. If the reevaluation is not completed at the frequency specified or the Department does not submit the reevaluation to EPA within 30 days of completion, the underlying designated use and criterion will be the applicable water quality standard for Clean Water Act purposes until the Department completes and submits the reevaluation to EPA. Public input on the reevaluation will be invited during NPDES permit renewals or triennial reviews, as applicable, in accordance with the State's most current approved water quality management plan and continuing planning process.

(11) **Timetable of proposed actions.** Tasks and target completion dates.

(a) Nutrient optimization of existing system, preliminary engineering report for sequencing batch reactor upgrades, pilot testing of coagulation for phosphorus removal, initiate zero discharge feasibility study. Target completion date, January 2023.

(b) Design for phase 1 (coagulation for phosphorus removal), funding applications, complete zero discharge feasibility study. Target completion date, January 2025.

(c) Reevaluation of temporary standard including zero discharge feasibility, progress report. January 2025.
(d) NPDES permit renewal application, final design completion for phase 1, bidding and contract award, construction of phase 1, construction completion and start up. Target completion date, January 2029.
(e) Optimization of facility, evaluation of process changes, review and evaluate engineering report goals, objectives and plans. Target completion date, January 2030.
(f) Reevaluation of temporary standard, progress report. January 2030.
(g) NPDES permit renewal application, design phase 2 (aeration control upgrade for nitrogen removal). Target completion date, January 2031.
(h) Funding applications, final design completion for phase 2. Target completion date January 2032.
(i) Bidding and contract award, construction of phase 2, construction completion and start up. Target completion date, January 2035.
(j) Reevaluation of temporary standard, progress report. January 2035.
(k) NPDES permit renewal application, optimization of facility, evaluation of process changes, review and evaluate engineering report goals, objectives and plans. Target completion date, January 2037.
(l) Continued operational optimization, reevaluation of temporary standard, progress report. January 2040.

Appendices

Appendix A: Raton Temporary Standard Final Report
Appendix B: City of Raton and FEI Engineer Technical Memorandum
Appendix C: City of Raton/Raton Water Works Nutrient Removal Schedule
Appendix D: Total Maximum Daily Load (TMDL) Implementation Plan for Raton WWTP
Appendix E: Calculation of the Highest Attainable Interim Effluent Conditions

APPENDIX A

Substantial and Widespread Economic and Social Impact and Highest Attainable Condition Analysis Report for Raton, New Mexico

Substantial and Widespread Economic and Social Impact and Highest Attainable Condition Analysis Report for Raton, New Mexico

Prepared by

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for

U.S. Environmental Protection Agency, Standards and Health Protection Division &

New Mexico Environment Department

June 26, 2018

Disclaimer

The U.S. Environmental Protection Agency (EPA) provided New Mexico with this report as technical assistance to inform a future water quality standards (WQS) variance demonstration under 40 CFR 131.14, which the state calls "temporary standards" under state law. EPA's technical assistance does not imply EPA Clean Water Act (CWA) 303(c) approval or acceptance of the results or conclusions of temporary standard petitions based on this report. Any changes to New Mexico water quality standards based on this report would have to be submitted to the EPA separately for review. This report is intended for the state and discharger's use for its own purposes and decision-making.

This report does not have bearing on current EPA policy or bind EPA to any changes in policy or specific actions in the future. Further, this report does not impose legally binding requirements on the EPA, states, tribes, or the regulated community, nor does it confer legal rights or impose legal obligations on any member of the public. The CWA provisions and the EPA regulations described in this document contain legally binding requirements. This report does not constitute a regulation, nor does it change or substitute for any CWA provision or EPA regulation.

Substantial and Widespread Economic and Social Impact and Highest Attainable Condition Analysis Report for Raton, New Mexico

Contents

Acronyms

AACEI	Association for the Advancement of Cost Engineering International
ACS	American Community Survey
BNR	Biological nutrient removal
CFR	*Code of Federal Regulations*
CWA	Clean Water Act
DO	Dissolved oxygen
EBPR	Enhanced biological phosphorus removal
EPA	U.S. Environmental Protection Agency
HAC	Highest attainable condition
ICEAS	Intermittent Cycle Extended Aeration System
MGD	Million gallons per day
MHI	Median household income
MPS	Municipal preliminary screener
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and maintenance
OSE	Office of the State Engineer
PMP	Pollutant Minimization Program
RO	Reverse osmosis
SCADA	Supervisory Control and Data Acquisition
SBR	Sequential batch reactor
TEC	Target effluent concentration
TKN	Total Kjeldahl nitrogen
TN	Total nitrogen
TP	Total phosphorus
WERF	Water Environment Research Foundation
WQBEL	Water quality-based effluent limit
WQS	Water quality standards
WWTF	Wastewater treatment facility

1 Purpose

In 2017, the New Mexico Environment Department's (NMED's) Water Quality Control Commission (Commission) approved the New Mexico water quality standards (WQS) regulation creating a framework for adopting temporary standards. In promulgating this regulation, the Commission sought to address situations where water quality-based effluent limits (WQBELs) are not achievable by creating a clear path to compliance that is achievable and affordable in the near-term and encourages improvements to water quality. The New Mexico temporary standards regulation is based on the U.S. Environmental Protection Agency (EPA) regulation on WQS variances at 40 *Code of Federal Regulations* (CFR) 131.14. EPA approved the New Mexico regulation as Clean Water Act- (CWA-) effective.

The purpose of this report is to apply the framework established in the New Mexico temporary standards regulation to the City of Raton Wastewater Treatment/Reclamation Facility (National Pollutant Discharge Elimination System [NPDES] Permit #NM0020273) (hereafter Raton WWTF). To meet this objective, the report provides:

- A brief characterization of the Raton WWTF's current performance and the controls that would be required to meet WQBELs derived from the applicable nutrient thresholds
- Estimates of the cost to the Raton WWTF of attaining New Mexico's WQS for total nitrogen (TN) and total phosphorus (TP) and an analysis of affordability for the community
- Estimates of various levels of incremental TN and TP reduction that the Raton WWTF could achieve through several potential technological upgrades, the estimated cost of these upgrade options, and an analysis of their affordability for the community

This report can be used towards Raton WWTF's demonstration that attaining the designated use and criterion through various treatment or control options may not be feasible throughout the proposed term of the temporary standard because controls more stringent than those required by sections 301(b) and 306 of the CWA would result in substantial and widespread economic and social impact. The report also provides information on treatment and control options that may help the Raton WWTF identify the current highest attainable condition (HAC) for the facility. In its petition for a temporary standard, the Raton WWTF would need to verify the assumptions made in this analysis and assess other options that are not included in this desk study.

The report does not provide all the information needed to show that the underlying WQS are not attainable now or within a limited period of time or to identify the HAC and justify the duration of the temporary standard. The analysis considers only options for optimizing existing wastewater treatment processes or modifying treatment processes to achieve greater pollutant reductions. It does not consider other options such as pollutant minimization, discharge relocation, or elimination of the discharge to surface waters. The Raton WWTF should consider these options, in addition to treatment options, when petitioning the Commission for a temporary standard, to determine eligibility for a temporary standard, and to evaluate whether any of these options or combination of options would allow the receiving water to achieve the underlying WQS or would result in an interim effluent condition that reflects the HAC.

The options evaluated in this report are intended to capture scenarios where there continues to be a discharge to the stream. In the event that the Raton WWTF identifies a different affordable option leading to a decision that the facility no longer discharges TN and TP at levels that would cause, have the reasonable potential to cause, or contribute to an excursion of New Mexico's WQS (e.g., if the facility identified an option to switch to land application resulting in zero discharge), then a temporary standard would not be necessary.

See section 7 for additional detail on the limitations of this analysis.

2 Background

Nutrients are one of the leading causes of water quality impairment in New Mexico waters. According to the state's 2016–2018 Integrated Report, nutrients are the second leading cause of impairment in New Mexico perennial rivers and streams and the fourth leading cause of impairment in lakes and reservoirs, impairing 1,288 miles and 12,913 acres, respectively. Nutrient pollution in waterbodies results in large daily swings of dissolved oxygen (DO), which can change aquatic community dynamics. In some cases, these changes can result in algal blooms that lead to fish kills and other harmful effects, such as harmful algal blooms, considerably reduced recreational opportunities, and taste and odor problems in drinking water.

2.1 New Mexico Narrative Nutrient Criterion and Nutrient Thresholds

WQS regulations in the New Mexico Administrative Code (NMAC) include a narrative criterion for distinguishing nutrient conditions that contribute to production of undesirable or nuisance aquatic life. The criterion states, "Plant nutrients from other than natural causes shall not be present in concentrations that will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state" (20.6.4.13.E NMAC). The state interprets this narrative criterion using nutrient threshold values, which are based on reference conditions and applied to specific site classes in perennial, wadable streams, as shown in Table 1.

Table 1. New Mexico Nutrient Thresholds for Each Site Class (Jessup 2015)

	TN (mg/L)			TP (mg/L)		
	TN Flat	TN Moderate	TN Steep	TP High-Volcanic	TP Flat-Moderate	TP Steep
Threshold	0.65	0.37	0.30	0.084	0.061	0.03

Notes: mg/L = milligram per liter; TN = total nitrogen; TP = total phosphorus.

Most facilities discharging to catchments covered by the thresholds would need WQBELs for nutrients. Because of the limited available dilution in many receiving waters, some facilities will have WQBELs (whether based on total maximum daily loads or not) that require the threshold concentrations to be met "end-of-pipe." These required WQBELs might not be economically or technologically achievable for many permittees.

2.2 New Mexico's Temporary Standards Regulation

A temporary standard could be an appropriate tool for implementing New Mexico's WQS when a petitioner demonstrates that the underlying WQS, including numeric interpretations of narrative criteria, are not attainable now or within a defined period of time, but may be attainable in the future. A temporary standard may be appropriate when:

1) Existing or proposed discharge control technologies will comply with applicable technology-based effluent limitations, feasible technological controls and other management alternatives;
2) The underlying WQS, including numeric interpretations of narrative criteria, are not attainable now or within a defined period of time, but may be attainable in the longer term;
3) It is feasible to make incremental improvements in water quality during the proposed term of the temporary standard;
4) The temporary standard will not result in any lowering of currently attained ambient water quality, unless the temporary standard will be used for restoration activities.

As discussed in section 1 above, New Mexico's temporary standards regulation at 20.6.4.10(F) NMAC is based on the EPA regulation on WQS variances at 40 CFR 131.14. The New Mexico regulation defines a temporary standard as "a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the HAC during the term of the temporary standard" (20.6.4.10.F.12 NMAC). For a temporary standard that applies to a specific discharger(s), the HAC, which may be considered synonymous with New Mexico's definition of "highest degree of protection feasible in the short-term," must be a quantifiable expression that is one of the following (40 CFR 131.14(b)(1)(ii)(A)):

1) The highest attainable interim criterion; or
2) The interim effluent condition that reflects the greatest pollutant reduction achievable; or
3) If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the state adopts the WQS variance (temporary standard), and the adoption and implementation of a pollutant minimization program (PMP).[1]

By reflecting the HAC, a temporary standard provides a mechanism for making progress toward attaining a designated use and water quality criterion that are not currently attainable. Note also that if a temporary standard has a term longer than 5 years, the HAC must be reevaluated at least once every 5 years.

The New Mexico regulations state that, "Any person may petition the commission to adopt a temporary standard applicable to all or part of a surface water of the state as provided for in this section and applicable subsections in 40 CFR 131.14" (20.6.4.10.F.1 NMAC). These regulations also specify that the petitioner for a temporary standard must demonstrate that attainment of the underlying WQS is not attainable in the short term based on one of the following seven factors:

1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or

[1] A PMP is a structured set of activities to improve processes and pollutant controls that will prevent and reduce pollutant loadings (40 CFR 131.3(p)).

4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact; or
7) Due to the implementation of actions necessary to facilitate restoration such as through dam removal or other significant wetland or water body reconfiguration activities as demonstrated by the petition and supporting work plan requirements in Paragraphs (4) and (5) of Subsection F of 20.6.4.10 NMAC (in federal regulation at 40 CFR 131.14(b)(2)(i)(A)(2) "Actions necessary to facilitate lake, wetland, or stream restoration through dam removal or other significant reconfiguration activities preclude attainment of the designated use and criterion while the actions are being implemented.").

New Mexico's regulation outlines documentation requirements for a temporary standard petition submitted to the Commission to demonstrate how the proposed temporary standard meets the requirements, including demonstrating that attainment of the underlying WQS is not feasible and that the proposed temporary standard represents the HAC.

3 Existing Performance and Controls Needed to Meet Water Quality Standards

The initial steps in a temporary standard demonstration for the Raton WWTF based on factor 6 of the federal regulation (substantial and widespread economic and social impact) are (1) understanding the existing controls and effluent quality; (2) calculating the WQBELs that are derived from and comply with the applicable underlying WQS (40 CFR 122.44(d)(1)(vii)(A)); and (3) identifying the treatment technology needed for Raton to achieve effluent quality that meets these WQBELs.

3.1 Existing and Planned Controls and Current Performance

The Raton WWTF is an activated sludge system using an enhanced sequential batch reactor (SBR) (intermittent cycle extended aeration system or ICEAS). The facility operates in a biological nutrient removal (BNR) mode by alternating phases of aeration and anoxic/anaerobic cycles. The facility has a design flow of 0.9 million gallons per day (MGD). Its effluent volume averages approximately 0.36 MGD with a maximum weekly average flow of 0.62 MGD. NMED consulted with the Office of the State Engineer (OSE) to determine whether water rights may constrain treatment options for Raton. OSE confirmed that Raton WWTP does not have any return flow obligations. Eliminating the discharge to surface waters is an approach that Raton could consider; however, this report does not analyze options for eliminating the discharge to surface waters.

Raton's current NPDES permit (NPDES Permit #NM0020273) has performance-based 30-day average effluent limits expressed in terms of both concentration and mass. These limits are 10 mg/L and 46.7 lb/day TN and 3.0 mg/L and 14.0 lb/day TP. Although these limits are performance-based, they were included in the NPDES permit to protect and maintain water quality and prevent further degradation of the receiving waters. Discharge monitoring data for the period 2012 through 2015 indicate an average effluent TN concentration of approximately 7.4 mg/L and an average TP concentration of approximately 2.2 mg/L.

Anticipating that its future NPDES permits will include effluent limits based on New Mexico's new numeric nutrient thresholds, Raton is conducting studies to examine how the use of chemical precipitation (alum) would affect its treatment system and its effluent pollutant concentrations. Chemical precipitation is one potential treatment option for phosphorus removal. Raton's study is still at the pilot scale; therefore, the facility has not used chemical precipitation for the full waste stream.

3.2 Water Quality-Based Effluent Limits Derived from and Complying with the Applicable Water Quality Standards

The Raton WWTF discharges to Doggett Creek, a tributary to Raton Creek, Chicorica Creek, and the Canadian River. New Mexico's narrative nutrient criterion applies to this receiving water, and NMED uses the threshold values for TN and TP in Table 1 to interpret this criterion. NMED has determined that the receiving water falls within the TN Flat class for total nitrogen and the TP Flat-Moderate class for total phosphorus. Thus, the following nutrient threshold concentrations would be used to interpret the narrative criterion and derive the WQBEL:

- TN = 0.65 mg/L
- TP = 0.061 mg/L

Tetra Tech determined the WQBELs that would apply to Raton based on the underlying WQS using the nutrient threshold values and the procedure outlined in Appendix A. The nutrient threshold values are being interpreted as 30-day average values and, therefore, WQBELs may be appropriately expressed as average monthly limits. In the case of Raton, the receiving water has no allowance for mixing because the effluent composes the bulk of flow in Doggett Creek. Thus, the threshold values are applied as "end of pipe" WQBELs. In other words, the average monthly limits for TN and TP, as shown in Table 2, are equal to the TN and TP thresholds.

Table 2. Nutrient WQBELs for Raton Based on Underlying WQS

	TN	TP
Average Monthly Limit	0.65 mg/L	0.061 mg/L

3.3 Treatment Technology Selection

To select appropriate treatment technologies for Raton WWTF, Tetra Tech considered the potential performance of Raton's existing ICEAS treatment system and options available for optimizing or upgrading activated sludge systems like Raton's (Table 3). There are numerous technology options available to wastewater treatment plants for nutrient removal. Tetra Tech conducted a desk study to determine potential treatment options and the expected effluent concentrations of TN and TP for each option considered.

Table 3. Facility Treatment Selection

Facility Treatment Category	Treatment Technology Options for Total Nitrogen Removal	Treatment Technology Options for Total Phosphorus Removal
Activated Sludge	• Optimization of existing activated sludge process to promote nitrification/denitrification • Biological nitrogen removal • Denitrification filters • Reverse osmosis	• Enhanced biological phosphorus removal • Chemical precipitation • Chemical precipitation with tertiary filtration • Reverse osmosis

The primary factors for characterizing and estimating performance capabilities for Raton's existing treatment system were the narrative descriptions of the existing system, current effluent concentrations, and current NPDES permit limits, as summarized in Section 3.1 above. The identification of appropriate target effluent concentrations (TECs) (i.e., effluent condition expected with implementation of the various technology options) resulting from modifications or additions to the existing treatment system to achieve additional TN and TP removal was based on:

1) Actual current treatment performance. If Raton was already meeting a TEC, or should meet a TEC based on its upgrade plans, no estimate was provided for that TEC.
2) Threshold TECs expected to be achievable for standard treatment processes for nutrient removal.
3) WQBELs calculated from the underlying WQS (as described in section 3.2 above).

For the purpose of deriving effluent limits, these TECs are intended to be implemented as long-term averages because they are based on a mix of studies that included long-term averages. A permit writer may calculate average monthly, annual average, or 12-month rolling average WQBELs from these long-term average TECs.

3.3.1 Total Nitrogen Reduction Options Evaluated

As shown in Table 3, Tetra Tech analyzed several treatment options for additional TN removal at Raton. Performance levels, or TECs, for TN represented by these treatment options are presented in Table 4.

Table 4. Total Nitrogen TEC Options for Raton WWTF

TEC	Treatment Technology Options
7.0 mg/L TN	Optimization of existing SBR (ICEAS) process to promote nitrification/denitrification
5.0 mg/L TN	Upgrade Supervisory Control and Data Acquisition (SCADA) system, install new mixers and blowers
3.0 mg/L TN	Biological nitrogen removal: -nitrification/denitrification via anoxic/oxic zone or cycle retrofits and/or -addition of a denitrification filter, or -optimization if approaching limit of technology
< 1.0 mg/L	Reverse osmosis

Optimization of Existing Sequential Batch Reactor (7.0 mg/L TN)

An effluent TN of 7.0 mg/L generally is achievable by activated sludge systems after optimizing existing treatment processes. Optimization typically involves improved control of existing aeration systems using DO, oxidation reduction potential, and/or other measures integrated with existing or new aerator controls. A TEC of 7.0 mg/L is based on the median TN achieved after optimization of 22 WWTFs from across the United States as described in two separate studies of facility optimization (USEPA 2015; Water Planet 2016).

Based on current treatment performance (a 3-year average concentration of 7.4 mg/L), Tetra Tech assumes that the Raton WWTF could be optimized to meet a long-term average TEC of 7.0 mg/L TN. Raton's current NPDES permit contains an effluent limit of 10 mg/L TN expressed as a 30-day average limit, and the WWTF is designed and operated for nitrogen removal. Because the facility consistently complies with the TN effluent limitation, it should be capable of meeting the TEC of 7.0 mg/L TN by optimizing the existing treatment system without having to invest in additional upgrades. While Tetra Tech assumed no additional costs for this option based on Raton's current performance, it is important to note that actual optimization costs could vary widely, are facility-specific, and can be difficult to generalize. The determination that the Raton WWTF could achieve an average TEC of 7.0 mg/L TN is based on a desk study with limited information about operation of the facility; before submitting its petition for a temporary standard, Raton should verify this assumption and adjust the analysis as appropriate.

Additional Optimization (5.0 mg/L TN)

Raton should be capable of a higher level of performance to achieve a long-term average TEC of 5.0 mg/L TN following efforts to optimize the existing treatment processes and upgrade and modernize existing systems. The existing system at Raton is configured for nitrogen removal and achieves effluent TN concentrations below 6 mg/L at times. Nitrogen removal is achieved via a combination of nutrient uptake and the nitrification and denitrification processes. Upgrades to supervisory control and data acquisition (SCADA) software systems (Sagues 2013), investments in new, more energy efficient blowers, and new, efficient mixers for use while the system is in anoxic/anaerobic modes would result in achieving the TEC of 5.0 mg/L. Tetra Tech based this estimated level of performance on effluent concentrations for TN from other optimized SBR treatment systems (Klebs 2005; USEPA 2015).

Denitrification Filters (3.0 mg/L TN)

Raton should be able to achieve a long-term average TEC of 3.0 mg/L TN with an investment in additional treatment systems/facilities. The TEC of 3.0 mg/L TN is defined based on widely-accepted performance expectations for systems specifically designed for BNR. Achieving 3.0 mg/L TN generally requires investing in additional treatment facilities (e.g., denitrification filters, reactors, mixers, recycle lines). These approaches leverage BNR-sequential nitrification and denitrification, which can be achieved using unaerated (anoxic) and aerated (oxic) zones or cycles. Tetra Tech estimated that Raton could achieve a TEC of 3.0 mg/L TN after first optimizing the existing treatment system (cycle times, blowers, mixers, instrumentation), as described above in the discussion of the Additional Optimization (5.0 mg/L) option, and then installing denitrification filters in the existing basin for further TN removal.

Reverse Osmosis (< 1.0 mg/L TN)

Reverse osmosis (RO) is a technology that uses a high-pressure pump to increase the pressure on the feed side and forces wastewater across a semi-permeable RO membrane, leaving pollutants behind in the reject stream. Based on Water Environment Research Foundation (WERF) studies on environmental and economic sustainability of treatment technologies that could be implemented by WWTFs to meet nutrient limits at various levels (Falk et al. 2011), Tetra Tech estimated that installation of RO would reduce effluent concentrations to < 1.0 mg/L TN. Thus, RO is the only option that would provide effluent quality sufficient to approach compliance with the WQBEL derived from New Mexico's threshold value, though the ability to consistently achieve the WQBEL of 0.65 mg/L as a monthly average is uncertain, even with RO.

3.3.2 Total Phosphorus Reduction Options Evaluated

Tetra Tech also analyzed several treatment options for additional TP removal at the Raton WWTF. For TP, each increment of reduction typically requires significant changes in technology and associated costs. The treatment options evaluated, and the various performance levels or TECs they represent, are shown in Table 5.

Table 5. Total Phosphorus TEC Options for Raton WWTF

TEC	Treatment Technology Options
0.5 mg/L TP	Chemical precipitation or Enhanced biological phosphorus removal—anaerobic selector technology with tertiary filtration
0.1 mg/L TP	Chemical precipitation with tertiary filtration
< 0.01 mg/L	Reverse osmosis

Chemical Precipitation (0.5 mg/L TP)

Raton could expect to achieve a long-term average effluent concentration of 0.5 mg/L TP through enhanced biological phosphorus removal (EBPR) with tertiary filtration (e.g., moving bed filters, media filters, cloth/screen filters) or chemical precipitation (Ohio EPA 2013). Because Raton is testing and considering installing a chemical (alum) precipitation system and the capital costs of chemical removal systems for TP reductions generally are lower than the costs for EBPR, Tetra Tech did not estimate the cost of an EBPR upgrade for this analysis.

Chemical treatment is the most common method used for phosphorus removal to meet effluent concentrations below 1.0 mg/L (MPCA 2006). Chemical treatment for phosphorus removal involves the addition of metal salts to react with soluble phosphate. This process forms solid precipitates that are removed by solids separation processes, such as clarification. As discussed below, tertiary filtration may be added to achieve lower TP effluent concentrations. The most common metal salts used are in the form of alum (aluminum sulfate), sodium aluminate, ferric chloride, ferric sulfate, ferrous sulfate, and ferrous chloride.

Less complicated than biological approaches, the chemical treatment design approach consists of a mass balance between chemical addition, the stoichiometry of the chemical added and phosphorus removed, and the phosphorus concentration after chemical addition.

When examining chemical addition, facilities should be evaluated for two scenarios:

1) Effluent polishing in the secondary process: The chemical addition point is in the secondary treatment process, where it is added to the mixed liquor stream just before the secondary clarifier.
2) Two-point chemical addition: Chemical is applied in both the primary clarifier feed and also just before the secondary clarifier. Two-point addition is popular for many applications because it achieves the most efficient use of chemicals for phosphorus precipitation.

With chemical addition, sludge production increases in the wastewater treatment unit process where the chemical is applied. Sludge production has been noted to increase by 40 percent in the primary treatment process and 26 percent in activated sludge plants.

Chemical Precipitation Plus Filtration (0.1 mg/L TP)

Raton should be able to achieve a TEC of 0.1 mg/L TP as a long-term average by investing in chemical precipitation with the addition of tertiary filtration. Using this treatment approach, phosphorus that has been adsorbed to solid particles is removed from the wastewater with filtration, rather than with clarification alone. This technology is often capable of reducing TP concentrations to 0.05 mg/L or even less, but a desk study is not sufficient to determine whether concentrations approaching this level could be reliably achieved at a specific facility such as Raton WWTF.

Reverse Osmosis (< 0.01 mg/L)

Based on a WERF report (Falk et al. 2011), Tetra Tech estimated that installation of RO would reduce effluent concentrations to < 0.01 mg/L TP. Therefore, RO would be required for Raton to discharge at concentrations for TP that achieve the WQBEL derived from New Mexico's nutrient threshold value.

4 Engineering Cost Estimation

After determining potential treatment options and the expected effluent concentrations of TN and TP for each option, the next step in Tetra Tech's analysis was to estimate the cost of each option. For each option considered for Raton, Tetra Tech estimated capital and operation and maintenance (O&M) costs. These cost estimates were used later in the economic and social impact analysis to justify the need for a temporary standard and in the analysis of treatment options that could be used to identify the HAC.

4.1 Engineering Cost Assumptions

For each treatment technology option considered, Tetra Tech conducted an engineering cost estimation using CapdetWorks, which is a software tool for preliminary design and cost estimation of wastewater treatment plant construction project alternatives. CapdetWorks is based on the CAPDET program originally developed by the U.S. Army Corps of Engineers (Corps) and later upgraded based on an agreement between the Corps and EPA. CapdetWorks designs unit processes in a given layout based on influent characteristics and then estimates the cost of the design. The program uses defaults for each unit process to produce an acceptable design and to make the software easy to use for developing planning-level cost estimates for a new facility or an upgrade to an existing facility. The design override tab provides the ability to fine-tune a suggested design. The program focuses on estimating the costs of the treatment system components, rather than on the details of the design or the expected effluent quality.

Tetra Tech applied CapdetWorks to estimate capital and O&M costs for Raton by considering different treatment systems added to the existing treatment train to achieve various levels of treatment for TN and TP. To estimate costs for process upgrades to instrumentation, mixers, and aeration that were not part of a new treatment unit, a full treatment system similar to Raton's at an influent flow of 0.62 MGD was developed and costed using CapdetWorks. The specific capital and O&M costs for upgraded instrumentation, aeration, and mixing for this configuration were then extracted from the total cost of the treatment system estimated by CapdetWorks. CapdetWorks includes all treatment options costed in this analysis except RO. Cost estimates for RO were calculated separately using existing, published information from WERF on treatment costs (Falk et al. 2011).

Costs were updated to 2017 dollars, and capital costs were annualized and added to the O&M costs to obtain a total annualized cost for each level of treatment. In estimating these costs, Tetra Tech made assumptions, detailed below, concerning the required accuracy of the cost estimates, the Raton WWTF influent concentrations and effluent flow that will be treated for nutrient removal, and the interest rates and amortization period for financing any capital costs.

4.1.1 Accuracy of Estimates

CapdetWorks accounts for changing costs over time in its costing algorithms by using several equipment-related cost indices to adjust costs to the present. CapdetWorks allows users to choose from multiple equipment costing databases. Tetra Tech used the Hydromantis 2014 USA Average database for cost estimates.[2] The cost estimates in the database are obtained from construction and equipment cost indices published on a regular basis in several popular trade publications (Marshall and Swift, *Engineering News Record*, *Chemical Engineering* magazine). The cost indices tab in CapdetWorks allows the user to update cost estimates to reflect current year dollars. For this analysis, Tetra Tech converted 2014$ to 2017$. Tetra Tech used the average cost of electricity in New Mexico when estimating energy costs.

Using the algorithms and current costing indices in CapdetWorks along with energy costs specific to New Mexico provides information sufficient to develop Class 4 cost estimates as described by the Association for the Advancement of Cost Engineering International (AACEI) (formerly known as the American Association of Cost Engineers). Class 4 cost estimates generally are prepared based on limited information and used for purposes including detailed planning, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval. The accuracy of the Class 4 cost estimates is estimated to be in the range of -30 percent to +50 percent (AACEI 2005).

The cost estimates for RO are consistent with Class 5 cost estimates as described by AACEI. These estimates are less precise than the estimates for other treatment options because they are based on the WERF study (Falk et al. 2011) of the performance and cost of hypothetical treatment trains, without benefit of a detailed analysis of current influent quality and performance for the Raton WWTF to factor into the analysis. AACEI indicates that the accuracy of Class 5 cost estimates is in the range of -50 percent to +100 percent. Class 5 estimates typically are prepared for strategic business planning

[2] CapdetWorks is a Hydromantis product.

purposes (e.g., assessment of initial viability; evaluation of alternate schemes; project screening; evaluation of resources needs and budgeting; long range capital planning).

As stated in EPA's Interim Economic Guidance (USEPA 1995), the first step of an economic analysis is to evaluate and verify project costs. Because the strength of the analysis is dependent upon the accuracy of the estimates, it is important for Raton to consider site specific information, if available. This would allow Raton to fine-tune this analysis to any site-specific factors that were not identified in this report and make more accurate estimates of the costs that the city would incur to install the technology options.

4.1.2 Influent Concentrations and Treated Flow

CapdetWorks considers both influent concentrations of parameters of concern and the treated effluent volume to produce a specific layout of treatment processes and estimate costs. Flow data are included in the discharge monitoring report records for Raton; however, influent concentrations of TN and TP are not available. Tetra Tech used the CapdetWorks default influent concentration of 8 mg/L TP. CapdetWorks does not provide a default influent TN concentration, but it does provide default influent concentrations for various nitrogen species and assumes no nitrification has occurred prior to treatment. The default concentrations, which were used in the analysis, are:

- total Kjeldahl nitrogen (TKN) = 40 mg/L
- soluble TKN = 28 mg/L
- ammonia = 25 mg/L
- nitrate = 0 mg/L
- nitrite = 0 mg/L.

TN is the sum of TKN, nitrate, and nitrite which, in this case, is 40 mg/L.

The effluent volume used to calculate pollution control costs should reasonably represent expectations for flow for the duration of the temporary standard and should be supported by a reasonable explanation for the selection made for the analysis. In the evaluation for Raton, Tetra Tech assumed that facility flows will remain constant; there is no explicit consideration for population change (growth or decline). Raton WWTF managers indicated the population of Raton is declining. Based on U.S. Census Bureau records, EPA confirmed that Raton's population has been declining by an average of 21–26 households per year since 1980.[3]

For Raton, Tetra Tech, in consultation with NMED and EPA, determined that the selected flow value would be the lesser of:

- the maximum of the average weekly effluent flows observed from a representative period of record (generally 3 to 5 years) or
- the design flow (average monthly, if available).

[3] http://population.us/nm/raton/ shows Raton's population at 8,225 in 1980—the year the decline started—then 6,885 in 2010, and 6,326 in 2014. https://www.census.gov/quickfacts/fact/table/ratoncitynewmexico/PST045216 shows an estimated 2.15 persons per household (2012–2016). Based on this information, the average number of households lost per year was 20.8 from 1980 to 2010 (8225-6885)/2.15/30 and 26.0 from 1980–2014 (8225-6326)/2.15/34. This assumes the number of persons per household is constant and was the same in 1980.

The nutrient threshold values that are the basis for effluent limits derived from the underlying WQS are being interpreted as 30-day average values. Although it would be reasonable to use a measure of average monthly effluent flow to establish treatment costs for attaining these standards, using the weekly average flow provides a “factor of safety” that accounts for intra-month variability in flows, as well as the possibility of future growth during the term of a proposed temporary standard.

The design flow for the Raton WWTF is 0.9 MGD, while the maximum of the average weekly effluent flows was 0.62 MGD over a period from 2014 to 2017. Therefore, a flow of 0.62 MGD was used for costing purposes. In Raton’s case, the maximum of weekly average flows is currently well below the design flow for the facility. As noted above, the population of Raton has been declining in recent years; therefore, it is appropriate for calculations for the temporary standards analysis to reflect the costs to treat nutrient pollution at an effluent flow that is below the facility’s treatment capacity. This approach assumes that treatment and controls for nutrients is scalable. In other words, if, in the future, actual flow increases and approaches the design flow for the rest of the facility, treatment for nutrient removal could be scaled up to treat a higher flow volume.

4.1.3 Interest Rates and Amortization Period

CapdetWorks estimates both capital and O&M costs for each treatment process included in the treatment train. Estimated capital costs were converted to annual costs using standard engineering economics tables assuming an interest rate, *i*, of 5 percent and a term, *n*, of 20 years. Annualized capital costs were added to the annual O&M cost estimates to determine overall annualized costs.

4.2 Cost Estimate for Each Pollutant Reduction Option Evaluated

Tetra Tech estimated the cost of each technology option on the basis of the standard of practice for each at the average weekly effluent flow of 0.62 MGD. In all cases, cost data were normalized to January 2017$ by multiplying costs by the ratio of the January 2017 cost index to the 2014 cost index in the CapdetWorks model. For RO, where CapdetWorks was not used to estimate costs, cost data were normalized to January 2017$ by multiplying costs by the ratio of the January 2017 cost index to the historical cost index for the study in question (RSMeans construction cost indexing data were used). Tetra Tech annualized capital costs using a discount rate of 5 percent and a term of 20 years, as discussed in Section 4.1.3 above. These costs were added to the annual O&M cost estimates to determine total annual costs. The cost estimates for each treatment technology option evaluated are shown in Table 6.

Table 6. Estimated Costs of Technology Options (January 2017$)

Technology	TEC	Capital Cost	O&M Cost	Annualized Costs[1]	Reference
Optimization of Existing SBR	TEC 7.0 TN	$0	$0	$0	
Additional Optimization	TEC 5.0 TN	$460,020	$69,553	$106,427	CapdetWorks
Denitrification Filters	TEC 3.0 TN	$1,336,200	$249,115	$356,278	CapdetWorks
Chemical Precipitation	TEC 0.5 TP	$221,340	$80,886	$98,637	CapdetWorks
Chemical Precipitation & Filtration	TEC 0.1 TP	$2,252,160	$472,784	$653,408	CapdetWorks
Reverse Osmosis	TEC < 1.0 mg/L TN TEC < 0.01 mg/L TP	$10,750,800	$847,916	$1,710,130	Falk et al. 2011

[1]Annualized costs are based on a discount rate, *i*, of 5%, and term, *n*, of 20 years.

When estimating the cost of upgrading of instrumentation, blowers, and mixers to achieve a TN concentration of 5.0 mg/L, Tetra Tech used default power consumption and instrumentation costs in the CapdetWorks cost indices. This TEC represents an additional level of treatment between optimization of the existing treatment system and addition of denitrification filters. There is not a linear correlation between moving from a TEC of 7.0 mg/L to 5.0 mg/L to 3.0 mg/L TN and the estimated costs of treatment. If Raton proceeds in a stepwise manner, with 5.0 mg/L TN as an intermediate step on the way to ultimately achieving a TEC of 3.0 mg/L TN, additional analysis and engineering will be required between achieving 5.0 mg/L TN and achieving 3.0 mg/L TN. This additional analysis and engineering accounts for a higher overall cost when taking a stepwise approach to achieving 3.0 mg/L TN.

5 "Factor 6" Justification for a Temporary Standard: Substantial and Widespread Impact Analysis

Consistent with the federal regulations on variances, New Mexico's regulations require that the need for a temporary standard be justified using one of the factors referenced in 40 CFR 131.14 and discussed in section 2.2. Factor 6 states, "controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact." EPA's Interim Economic Guidance describes substantial and widespread economic and social impacts as two separate analyses. For public-sector entities, substantial impacts refer to the financial impacts on the community, taking into consideration current socioeconomic conditions. Widespread impacts, on the other hand, refer to changes in the community's socioeconomic conditions. Demonstration of substantial impacts alone is not sufficient. Rather, to justify the need for a temporary standard, the applicant must also demonstrate that any substantial financial impacts to the community would also result in widespread socioeconomic impacts to the community.

After identifying pollution control options available to Raton and the cost of those options, the next step in the analysis is to determine whether compliance with the WQBELs needed to meet WQS would result in substantial impacts. This step requires compiling information to characterize the community, the existing cost of pollution control, and the additional treatment costs that would be needed to meet the WQBELs based on the numeric nutrient thresholds, and then calculating the total cost of pollution control (existing pollution control costs plus additional treatment costs) per household needed to meet the calculated WQBELs. Tetra Tech used EPA's Interim Economic Guidance spreadsheet tool for "UAAs and Variances – Public Sector[4]" to determine whether the total cost of pollution control would have substantial impacts to the community. If the analysis demonstrates the total cost of pollution control would be substantial, the analysis considers whether those substantial impacts would also be widespread. Output from the spreadsheet tool for RO can be found in Appendix B.

5.1 Community Characteristics and Cost Allocation for Reverse Osmosis Pollution Control

Sewage authorities charge for services, and thus can recover pollution control costs through user fees. Tetra Tech collected the most recent information on the population, number of households, and median household income (MHI) in Raton and used that information to evaluate the potential impact to the community of installing additional pollution controls at the WWTF (Table 7).

[4] Available online at https://www.epa.gov/wqs-tech/economic-guidance-water-quality-standards.

Table 7. Community Characteristics

Characteristic	Value	Source
Population	6,348	U.S. Census Bureau, Population 2012–2016 American Community Survey (ACS) 5-year estimate
Number of Households	2,890	U.S. Census Bureau, 2012–2016 ACS 5-year estimate
Adjusted Median Household Income (January 2017)	$29,773	U.S. Census Bureau, 2012–2016 ACS 5-year estimate

According to the *2016 Public Water and Wastewater User Charge Survey for December 2015 Rates* (NMED 2017), each household in Raton paid $230.16 per year in sewer costs (based on a residential use rate of 6,000 gallons per month). Ratepayers pay 100% of the cost of pollution control. Whether or not the community faces substantial impacts from additional pollution control options for TN and TP depends on both the cost of the additional pollution control (i.e., technology option(s)) and the general financial and economic health of the community.

5.2 Annual Cost Per Household for Reverse Osmosis (Total Nitrogen < 1.0 mg/L; Total Phosphorus < 0.01 mg/L)

Tetra Tech determined that RO is the treatment technology option that comes closest to meeting the WQBELs derived from NMED's numeric nutrient thresholds. RO can achieve a TN effluent concentration of < 1.0 mg/L (potentially still above the threshold) and TP effluent concentration of < 0.01 mg/L (below the threshold). The engineering cost estimates for implementing RO at Raton (Table 6) are summarized in Table 8 below. This table also includes the cost per household based on the community characteristics provided in Table 7 and the existing annual pollution control costs per household of $230.16.

Table 8. Cost of Reverse Osmosis

Cost Element	Amount (2017$)
Capital Cost	$10,750,800
Annual O&M Cost	$847,916
Total Annualized Cost	$1,710,588
Existing Annual Pollution Control Cost Per Household	$230.16
Annual Incremental Pollution Control Cost Per Household	$591.90
Annual Pollution Control Cost Per Household	**$822.06**

As shown in Table 8, the expected annual cost per household after installing RO would be $822.06 assuming that 100 percent of the costs of the project are borne by households. This cost includes the current annual pollution control cost per household ($230.16) plus the estimated annual incremental pollution control cost per household for RO ($591.90).

5.3 Substantial Impact Analysis: Reverse Osmosis Pollution Control to Meet Water Quality-Based Effluent Limits

EPA's Interim Economic Guidance describes two tests for determining whether the socioeconomic impact of requiring a pollution control measure would be *substantial*:

- Municipal Preliminary Screener (MPS)
- Secondary Test Indicators

These tests are discussed in more detail in the following sections.

5.3.1 Municipal Preliminary Screener

The first step in EPA's Interim Economic Guidance to determine whether the socioeconomic impact of requiring a pollution control measure is substantial is to calculate the MPS. The MPS can help determine whether or not the community can clearly pay for the pollution control project. If the MPS suggests a community can clearly pay for the pollution control project, then a temporary standard is not likely justified based on a "factor 6" substantial and widespread economic and social impact demonstration, and performing the Secondary Test may not be necessary.

The MPS estimates the total annual pollution control costs per household (existing costs plus those attributable to the proposed project) as a percentage of MHI:

MPS = Average Total Pollution Control Cost per Household/MHI

The analysis proceeds to the Secondary Test if:

- The total annual cost per household exceeds 2.0 percent of MHI—EPA's Interim Economic Guidance suggests the project <u>is likely to</u> result in a substantial economic impact.
- The total annual cost per household is between 1.0 and 2.0 percent of MHI—EPA's Interim Economic Guidance suggests the project <u>may</u> result in a substantial economic impact.

If the total annual cost per household (existing annual cost plus the incremental cost related to the proposed project) is well below 1.0 percent of MHI, EPA's Interim Economic Guidance suggests the project will likely not impose a substantial economic impact on the community. Typically, the analysis would not proceed further. However, if the total annual cost per household is less than but fairly close to 1.0 percent of MHI, the project may impose a substantial economic impact on the community due to the community's unique circumstances. In such cases, the unique circumstances should be documented, and the analysis proceeds to the Secondary Test.

The existing annual sewer cost per household in Raton of $230.16 is 0.8% of MHI ($29,773). Requiring RO would increase the annual costs per household to $822.06, which is 2.8% of MHI, suggesting that the additional treatment is likely to result in a substantial economic impact to the community, and the analysis proceeds to the Secondary Test.

5.3.2 Secondary Test Indicators

The Secondary Test is designed to build upon the characterization of the financial burden identified in the MPS. EPA's Interim Economic Guidance recommends using six Secondary Test indicators:

Debt Indicators

- Bond Rating (if available)—a measure of credit worthiness of the community.
- Overall Net Debt as a Percent of Full Market Value of Taxable Property—a measure of debt burden on residents within the community.

Socioeconomic Indicators

- Unemployment Rate—a measure of the general economic health of the community.
- MHI—a measure of the wealth of the community.

Financial Management Indicators

- Property Tax Revenue as a Percent of Full Market Value of Taxable Property—a measure of the funding capacity available to support debt based on the wealth of the community.
- Property Tax Collection Rate—a measure of how well the local government is administered.

The Secondary Test indicators for Raton are shown in Table 9.

Table 9. Secondary Test Indicators

Indicator	Value for Raton
Debt Indicators	
Bond Rating (if available)	Not available*
Overall Net Debt as a Percent of Full Market Value of Taxable Property	$5,073,348
Socioeconomic Indicators	
Unemployment Rate	6.1%
Adjusted Median Household Income (January 2017)	$29,773
Financial Management Indicators	
Property Tax Revenue as a Percent of Full Market Value of Taxable Property	$637,160
Property Tax Collection Rate	99%

*Raton does not have a bond rating.

EPA's Interim Economic Guidance provides recommendations on how to score each Secondary Test indicator value. The guidance recommends assigning a score of 1 to an indicator assessed as weak, a 2 to an indicator assessed as mid-range, and a 3 to an indicator assessed as strong. After assigning each Secondary Test indicator value a score, the guidance recommends calculating a cumulative score that is the average of all the individual scores (summing the individual scores and dividing by the number of scores). Using the Secondary Test Indicators in Table 9, Tetra Tech calculated an average secondary test score of 2.0, which indicates socioeconomic conditions that are mid-range between weak and strong.

5.3.3 Substantial Impacts Matrix Assessment

EPA's Interim Economic Guidance recommends that the MPS and the average Secondary Test score be considered together to assess whether substantial impacts are likely to occur from the pollution control project. In the matrix, which is provided as Table 10, an "X" indicates that the impact is likely to be substantial. The closer the community is to the upper right-hand corner of the matrix, the greater the impact. A "✓" indicates that the impact is not likely to be substantial. The closer to the lower left-hand corner of the matrix, the smaller or more insignificant the impact. A "?" indicates that the impact is unclear. EPA's Interim Economic Guidance recommends communities in the "?" category with results for both the MPS and the Secondary Test that are borderline should move into the category closest to it. If results are not borderline, other factors such as the impact on low or fixed income households, the presence of a failing local industry, and other projects the community would have to forgo to comply with WQS should be considered. Evaluating the MPS and the average Secondary Test score suggests that installation of RO would likely result in substantial economic impacts to the community (highlighted cell in Table 10).

Table 10. Assessment of Substantial Impacts Matrix for Installing RO (Raton's Position Highlighted in Orange)

MPS: 2.8%			
Secondary Test Score: 2.0			
Secondary Test Score	MPS		
	< 1.0%	1.0%–2.0%	> 2.0%
Less than 1.5	?	X	X
Between 1.5 and 2.5	✓	?	X
Greater than 2.5	✓	✓	?

Key:
✓: Impact is not likely to be substantial
X: Impact is likely to be substantial
?: Impact is unclear
X: Raton score

5.4 Widespread Impact Analysis: Reverse Osmosis Pollution Control to Meet Water Quality-Based Effluent Limits

Because the financial analysis demonstrates that the economic impacts of installing RO would likely be substantial for Raton, the analysis moves on to the second step of the demonstration—an analysis of whether those substantial impacts would likely be widespread in the community. ECONorthwest conducted the widespread impact analysis, considering several indicators, including:

- Estimated change in MHI;
- Estimated change in the unemployment rate;
- Estimated change in overall net debt as a percent of full market value of taxable property;
- Estimated change in the percentage of households below the poverty line;
- Impact on commercial development potential; and
- Impact on property values.

At a minimum, the analysis should define the affected community (i.e., the geographic area where project costs pass through to the local economy), consider the baseline economic health of the community, and evaluate how the proposed project would affect the socioeconomic well-being of the community.

Raton is in northeastern New Mexico, near the Colorado border. It occupies approximately 8 square miles in Colfax County,[5] a largely rural county. Raton is more than three hours from Albuquerque or Denver, the nearest major metropolitan areas. As of 2016, the population was approximately 6,350 people, with one-third white and nearly two-thirds Hispanic, and the median age was 45.5 (compared to 37.2 for New Mexico as a whole). The area and population affected by the water quality compliance costs under review correspond to the WWTF's service area. There are no other major population centers in close proximity

[5] Data for this section come from the U.S. Census Bureau ACS data for 2016. ACS data are accessible via many pathways, including directly from the U.S. Census Bureau (https://www.census.gov/programs-surveys/acs/data.html) and third party aggregators such as Census Reporter (https://censusreporter.org/).

to Raton. Raton is the county seat for Colfax County, and Raton has approximately half the total county population, while comprising less than 1 percent of the total county area.

The substantial impact analysis indicates that the pollution control project (RO) needed for Raton to meet WQBELs based on New Mexico's numeric nutrient thresholds would increase the average household annual sewer rates from approximately $230, or 0.8% of median annual household income, to approximately $822, or 2.8% of median annual household income. The magnitude of the changes in the percent of MHI for pollution control costs associated with meeting the underlying WQS (RO) is significant, with sewer fees more than tripling.

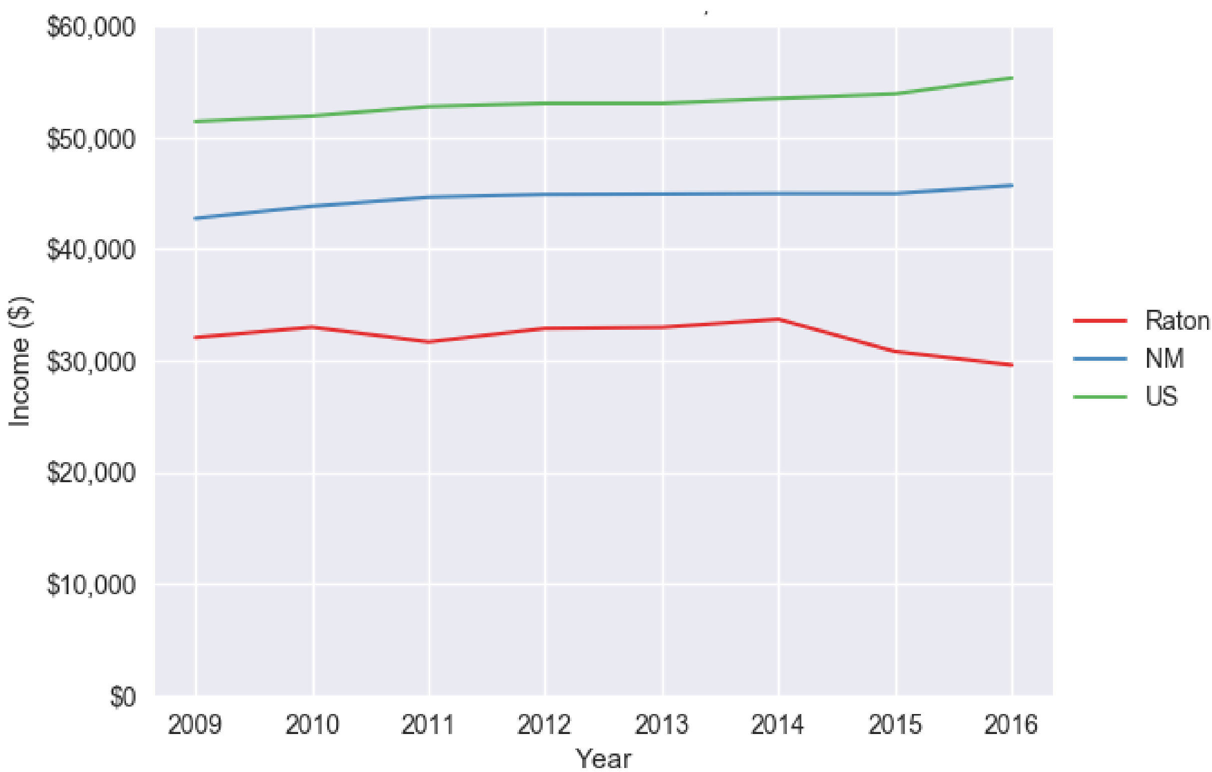

Figure 1. Median Household Income for Raton, New Mexico, 2009–2015 (Calculated by ECONorthwest with data from U.S. Census Bureau, Center for Economic Studies)

The community median annual household income was approximately $29,600 in 2016, which is substantially lower than the statewide median annual household income of approximately $45,700. The data depicted in Figure 1 show that from 2009 to 2016 Raton's MHI has shown stagnant or declining conditions while state and national levels have increased slightly. The substantial economic impacts from upgrades to Raton's WWTP technology would have a higher likelihood of being widespread because Raton's MHI is consistently substantially lower than national and state averages. In addition, wages for jobs in Raton are generally lower than wages in the state as whole.

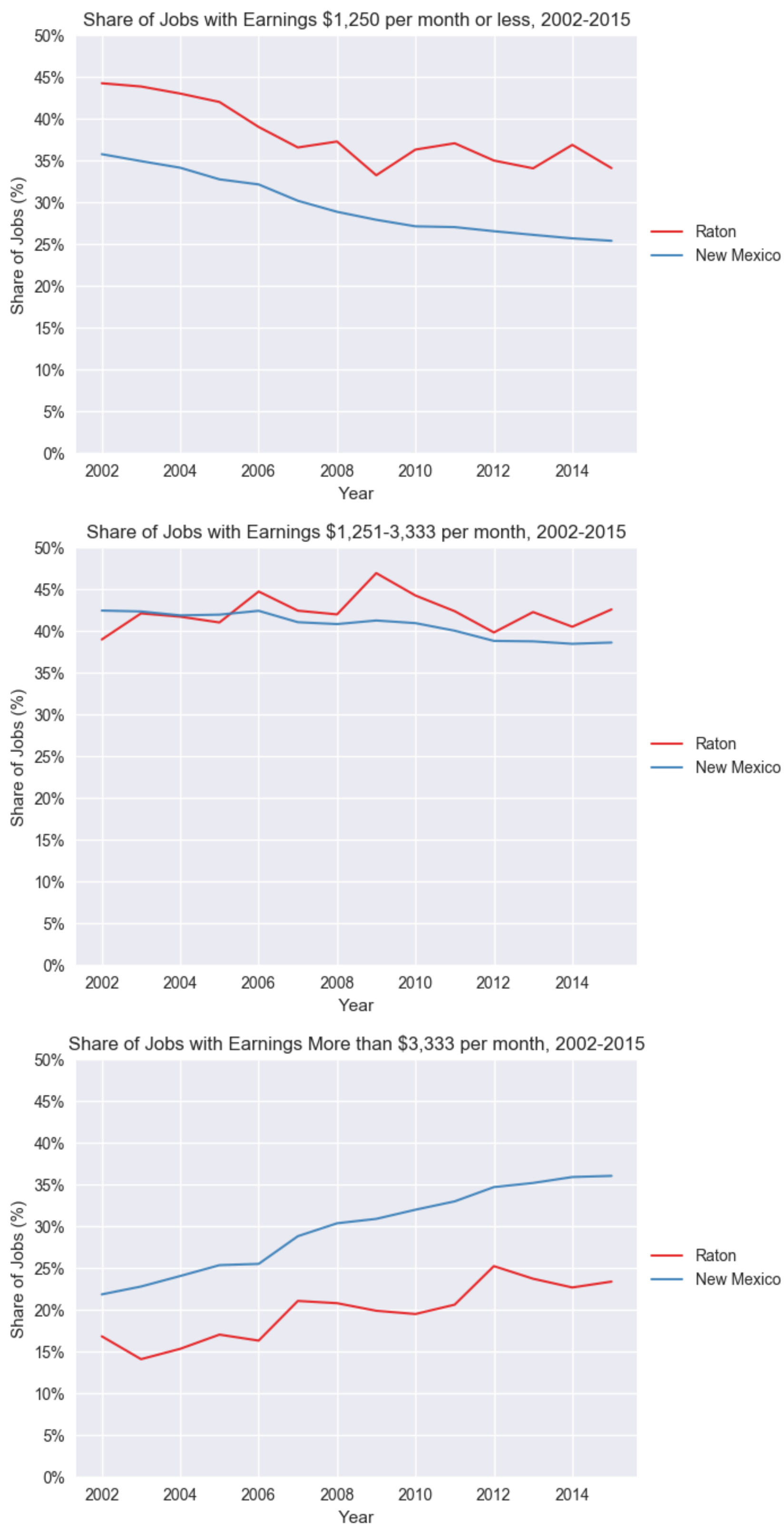

Figure 2. Jobs by Earnings by Monthly Wage, 2002–2015 (Calculated by ECONorthwest with data from U.S. Census Bureau, Center for Economic Studies)

Figure 2 shows that the share of higher paying jobs in Raton is not increasing over time as rapidly as for the state as a whole. Together these changes in MHI levels at the community scale suggest that substantial economic impacts to the Raton community are likely to be widespread.

Another factor suggesting that the substantial economic impacts associated with installing RO demonstrated in Section 5.3 would be widespread is that the impacts would occur across the entire community. Almost all households and businesses in the community pay for wastewater treatment. The increase in wastewater treatment rates necessary to install RO would apply to all rate payers and thus to almost the entire community. A substantial community-wide increase in wastewater treatment rates would likely have broad negative effects on community financial health. Such broad negative effects on community financial health would likely alter the ways in which people live, work, play, relate to one another, and organize their activities.

5.5 Summary and Conclusion

Based on the analysis presented in this report, Tetra Tech concludes that achieving WQBELs derived from the underlying WQS through treatment would necessitate the installation and operation of RO at the Raton WWTF and would lead to substantial and widespread economic and social impacts to the community. As such, the information analyzed by Tetra Tech supports the conclusion that Raton WWTF is able to demonstrate the need for a temporary standard in accordance with 20.6.4.10.F.1.a NMAC and 40 CFR 131.14(b)(2)(i)(A). As noted previously, Raton's petition for a temporary standard should include an assessment of the feasibility of other potential options for achieving WQBELs derived from underlying WQS not examined in this report, such as moving the point of discharge or land application.

6 Highest Attainable Condition Analysis

Where a petitioner can demonstrate that meeting WQBELs based on the underlying standard would cause substantial and widespread economic and social impact to the community, the petitioner must then determine the interim requirements that will apply during the term of the temporary standard. The requirements must reflect the HAC that can be achieved related to the pollutant for which the temporary standard is sought. EPA considers the HAC to mean the condition that is both feasible to attain and is closest to the protection afforded by the designated use and criteria. New Mexico defines the HAC as the highest degree of protection feasible in the short term, and the condition that will be the basis for effluent limits during the term of the temporary standard. For temporary standards applicable to a single discharger—as is the case with Raton—the HAC can be expressed as the highest attainable interim criterion for the receiving water; the interim effluent condition that reflects the greatest pollutant reduction achievable; or, if no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the state adopts the WQS variance, and the adoption and implementation of a PMP. The HAC options described below are presented in the form of interim effluent condition reflecting the greatest pollutant reduction achievable.

After determining that meeting WQBELs derived from the underlying WQS would lead to substantial and widespread economic and social impact, Tetra Tech evaluated potential options to help determine the HAC for the Raton WWTF. As stated in Section 1, the analysis considered only options for optimizing existing wastewater treatment processes or modifying treatment processes to achieve greater pollutant reductions. It did not consider other options such as pollutant minimization, discharge relocation, or elimination of the discharge to surface waters. While these options were not considered as part of this analysis, they should be considered by Raton WWTF in the petition it submits to the Commission to demonstrate eligibility for a temporary standard.

6.1 Summary of Options Evaluated

Treatment options evaluated as candidates for establishing the HAC include optimization of Raton's existing treatment system and technologies (other than RO) that would provide additional reductions in the effluent concentrations of TN and TP. Options for TN and TP were evaluated separately. These options are summarized in Table 11 below.

Table 11. Potential Treatment Technology Options for Establishing the HAC—Raton WWTF

Treatment Technology Options for TN	TEC
Optimization of existing SBR (ICEAS) process to promote nitrification/denitrification	7.0 mg/L TN
Upgrade SCADA system, install new mixers and blowers	5.0 mg/L TN
Biological nitrogen removal: -nitrification/denitrification via anoxic/oxic zone or cycle retrofits AND/OR -addition of a denitrification filter, or -optimization if approaching limit of technology	3.0 mg/L TN
Treatment Technology Options for TP	TEC
Chemical precipitation OR Enhanced biological phosphorus removal—anaerobic selector technology with tertiary filtration	0.5 mg/L TP
Chemical precipitation with tertiary filtration	0.1 mg/L TP

6.2 Evaluation of Impacts of Highest Attainable Condition Options

Tetra Tech calculated the cost per household for six potential combinations of treatment options for TN and TP shown in Table 11. Table 12 shows the incremental annual cost per household of each treatment combination option, total annual pollution control costs per household (including existing annual costs of $230.16 per household), the resulting percentage of MHI for pollution control, and the corresponding increase in annual sewer bills for households in Raton.

These options are intended to capture scenarios where there continues to be a discharge to the stream. In the event that Raton identifies a different affordable option that might lead to the facility no longer having reasonable potential (e.g., if the facility identified an option to switch to land application resulting in zero discharge), then a temporary standard would not be necessary.

Table 12. Annual Pollution Control Cost Per Household (January 2017$) of TN and TP Treatment Combination Options for Raton

Cost Element	Option A Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option B Denitrification Filters (TEC = 3.0 mg/L TN) and No additional TP treatment (TEC = 2.2 mg/L TP)	Option C Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option D Optimize Cycle Times (TEC = 7.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option E Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option F Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)
Capital Cost	$681,360	$1,336,200	$1,557,540	$2,252,160	$2,712,180	$3,588,360
Annual O&M Cost	$150,439	$249,115	$330,001	$472,784	$542,337	$721,899
Total Annualized Cost	$205,113	$356,335	$454,982	$653,503	$759,969	$1,009,838
Incremental Annual Cost Per Household[1]	$70.97	$123.30	$157.43	$226.13	$262.97	$349.42
Existing Annual Pollution Control Costs Per Household	$230.16	$230.16	$230.16	$230.16	$230.16	$230.16
Total Annual Pollution Control Costs Per Household[2]	**$301.13**	**$353.46**	**$387.59**	**$456.29**	**$493.13**	**$579.59**
% of MHI for Pollution Control[3]	**1.01**	**1.19**	**1.30**	**1.53**	**1.66**	**1.95**
% Increase in Annual Sewer Bill	**31**	**54**	**68**	**98**	**114**	**152**

[1]2,890 households

[2]Annualized at 5% over 20 years.

[3]Based on adjusted (January 2017$) MHI of $29,773.

There are several factors to consider when evaluating the range of options in Table 12 to determine the HAC for Raton, including those factors described in EPA's Interim Economic Guidance and further elaborated in EPA's 2014 memorandum "Financial Capability Assessment Framework for Municipal Clean Water Act Requirements" for looking at unique circumstances (USEPA 2014). In evaluating Raton's financial capability and what is feasible for the facility to attain, Raton and NMED should consider these and other relevant financial or demographic information that illustrates circumstances faced by the permittee. Raton has indicated in discussions that it has other ongoing and upcoming significant debt obligations related to necessary drinking water and sewer infrastructure upgrades. Additional detail on these obligations would be informative. Raton's MHI of approximately $29,600 per year in 2016 was below both state ($45,700/year) and national ($55,300/year) medians for the same year and has been declining since 2014. In addition, the city's population and thus the WWTF's revenue base is declining, so that remaining residents will shoulder a higher proportion of the cost burden for WWTF operation every year (i.e., total annual cost per household will increase as population decreases). If the population continues to decline as projected, the percentage of MHI that a given upgrade represents in 2018 will increase over time. The remaining life of the plant's equipment is estimated to be 20 years, and significant cost efficiencies may be gained by incorporating nutrient removal technology as equipment is upgraded as opposed to improving old equipment and processes that will be replaced within a few years.

As stated in EPA's Interim Economic Guidance, the first step of an economic analysis is to evaluate and verify project costs, because the strength of the analysis is dependent upon the accuracy of the estimates. Where possible, Raton should obtain additional information to minimize uncertainty. Refining the cost estimates, for example by obtaining bids from local firms, would minimize uncertainty about which options may or may not lead to substantial and widespread economic impacts. To the extent that Raton may need to raise wastewater service fees gradually to obtain funds to pay for treatment upgrades, installation of specific treatment may need to be staged over time. Thus, the HAC associated with certain treatment may be a function of time. If this is a consideration, then HAC options that are less costly may carry a shorter term of the temporary standard than HAC options with more costly treatment. Time to develop a long-term plan for wastewater treatment given the city's declining population and demand for water reuse may also factor into both selection of HAC and term of the variance.

Prior to submitting its petition to the Commission, Raton should evaluate other options (e.g., no discharge, seasonal discharge, and source control), that are not included in this desk study and that could inform determination of the HAC.

7 Conclusions and Next Steps

This analysis demonstrates that RO is the only technology that would allow Raton WWTF to achieve effluent concentrations approaching or achieving the underlying WQS. Installing RO would trigger substantial and widespread economic and social impact according to 40 CFR 131.10(g)(6). This analysis is only a portion of the information that the Raton WWTF would need to include in a temporary standard petition. The cost estimates are based on a desk study and, as stated in Section 4.1.1, they have an accuracy within the range of -30 percent to +50 percent or, for RO, -50 to +100 percent. Furthermore, both the analysis providing justification for a temporary standard and the analysis of options for determining the HAC consider only treatment options. Raton WWTF should evaluate pollutant minimization, discharge relocation, elimination of the discharge to surface waters, and any other feasible options to determine whether one or more of these options may allow Raton to meet the underlying WQS or lead to the HAC. If these other options achieved compliance with the WQBELs and underlying WQS, then a temporary standard may not be appropriate. In order to determine eligibility for a temporary standard, the petition should include this additional analysis.

Once Raton has refined the temporary standard demonstration and HAC analysis by (1) evaluating other alternatives for reducing nutrient loading to achieve the HAC, such as land application, and (2) refining the cost estimates provided in this report (e.g., through test bids) if it decides to pursue one or more of the HAC options described, Raton WWTF should work with NMED to finalize its petition for a temporary standard to ensure compliance with all state requirements. NMED would review the temporary standard application to ensure that all federal and state requirements are met prior to requesting adoption into the state's WQS and submitting the temporary standard to EPA for final review and approval.

8 References

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Appendix A

WQBEL Calculation

The WQBEL was calculated using the equation below.

Ce = Cs [(FQa + Qe)/Qe)] - Ca (FQa/Qe)

where:

Ce = Allowable effluent concentration

Cs = Applicable water quality criterion determined by interpreting the narrative nutrient criterion using the applicable nutrient threshold value; the applicable nutrient threshold value was determined in consultation with NMED based on Raton's site class for TN and TP

Ca = Ambient stream concentration upstream of discharge

Qe = Wastewater treatment facility design flow in MGD

Qa = Critical low flow of the receiving waters at discharge point in MGD

F = fraction of stream allowed for mixing (as applicable)

= zero (0) for water bodies identified as impaired on the most recent "State of New Mexico Clean Water Act §303(d)/§305(b) Integrated List" with at least one cause(s) of impairment listed as "Nutrient/Eutrophication"

The receiving water is an effluent-dominated stream that is impaired, therefore there is no allowance for mixing and the equation reduces to:

Ce = Cs

In other words, the allowable effluent concentration (Ce) is equal to the applicable nutrient threshold value (Cs).

Based on the above equations, the WQBELs derived from the underlying WQS are as follows:

Parameter	Average Monthly Limitation (AML) mg/L
TN	0.65
TP	0.061

Appendix B

Variance Worksheet for Reverse Osmosis

The tables in this appendix are from the worksheets used to determine whether compliance with the WQBELs needed to meet WQS would result in substantial impacts to the community.

- Table B-1 summarizes the proposed pollution control project (reverse osmosis).
- Table B-2 provides the information used to calculate the MPS.
- Table B-3 shows the MPS calculation.
- Table B-4 provides the data used to calculate the Secondary Test Score.
- Table B-5 shows the Secondary Test Score calculation.
- Table B-6 presents the conclusion of the Substantial Impacts Analysis.

Although similar calculations were completed for all of the treatment options consider, this appendix includes only the results for RO because it is the additional treatment that would be needed to meet the WQBELs based on the applicable New Mexico numeric nutrient thresholds.

Pollution Control Project Summary Information (Worksheet A in the Guidance)
Description: This worksheet identifies and documents the pollution control project(s) needed to meet water quality standards. See the Guidance documentation below for more information. **Instructions**: Enter information in the **cells marked with an asterisk (*)** about the most cost-effective approach to meet water quality standards. The most accurate estimate of project costs may be available from the discharger's design engineers. If site-specific engineering cost estimates are not available, preliminary project cost estimates may be derived from a comparable project in the State or from the judgment of experienced water pollution control engineers. Discharge management options to consider include: • Pollution prevention • End-of-pipe treatment • Upgrades or additions to existing treatment. Types of pollution prevention activities to consider are: • Public education • Change in raw materials • Substitution of process chemicals • Change in process • Water recycling and reuse • Pretreatment requirements. Whatever the approach, the information should demonstrate that the proposed project is the most appropriate means of meeting water quality standards and fully document project cost estimates. If at least one of the options that meets water quality standards will not have a substantial financial impact, then do not proceed with the analysis.

Current Capacity of the Pollution Control System (MGD)	0.62 *
Design Capacity of the Pollution Control System (MGD)	0.90 *
Current Excess Capacity (%)	31.1%
Expected Excess Capacity after Completion of Project (%)	N/A *
Projected Groundbreaking Date (MM/DD/YYYY)	N/A *
Projected Date of Completion (MM/DD/YYYY)	N/A *

Describe the proposed pollution control project.

There are seven possible pollution control projects included in this model.
• Optimize cycle times and upgrade instrumentation and aeration to meet 5.0 mg/L for TN; Chemical Precipitation to meet 0.5 mg/L for TP
• Retrofit with denitrification filter to meet 3.0 mg/L for TN, No TP Treatment
• Retrofit with denitrification filter to meet 3.0 mg/L for TN; Chemical Precipitation to meet 0.5 mg/L for TP
• Optimize cycle times to meet 7.0 mg/L for TN; Chemical Precipitation and Filtration to meet 0.1 mg/L for TP
• Optimize cycle times and upgrade instrumentation and aeration to meet 5.0 mg/L for TN; Chemical Precipitation and Filtration to meet 0.1 mg/L for TP
• Retrofit with denitrification filter to meet 3.0 mg/L for TN; Chemical Precipitation and Filtration to meet 0.1 mg/L for TP
• Reverse Osmosis to meet WQBELs based derived from the underlying WQS

*

Describe the other pollution control options considered, explaining why each option was rejected.

Pollution control options that were considered, but for which no cost estimates were developed include:
• Addition of membrane bioreactor after optimizing the current ICEAS SBR--denitrification filters assumed to be more cost-effective and provide scaleable flexibility for the treatment system based on projected population estimates and wastewater volume estimates
• Enhanced biological phosphorus removal (EBPR) with tertiary filtration--the Raton WWTF is testing a chemical (alum) precipitation system; chemical precipitation is less complicated than EBPR, provides greater removal efficiencies, and assumed to be more cost-effective
• Alternatives to the existing surface water discharge (e.g., land application, discharge relocation)--assessment requires additional site-specific information and is beyond the scope of this analysis

*

Guidance Documentation

Component	*Section*	*Page*
Verify Project Costs	2.1.a	2-3
Documentation of Other Options Considered	2.1.a	2-3
Annual Cost of Pollution Control (overview)	2.1.b	2-4

Table B-2

Data Needed to Calculate the MPS (Worksheets B and C in the Guidance)
Description: This worksheet contains the information needed to calculate the municipal preliminary screener (MPS). The MPS is the average annualized pollution control cost per household in the affected community. The MPS helps to determine whether or not the community can clearly pay for the project without incurring any substantial impacts. See the Guidance documentation below for additional information.
Instructions: Enter the requested information into the **cells marked with an asterisk (*).** The affected community is the governmental jurisdiction or jurisdictions responsible for paying compliance costs. Current costs of pollution controls can also be considered in addition to the projected annual costs of the proposed pollution control project. The existing cost per household usually can be obtained from municipal records. If project costs are estimated for a prior year, these costs should be adjusted to reflect current year prices using the average annual national Consumer Price Index (CPI) inflation rate for the period available from the Bureau of Labor Statistics.

Capital Cost			
Upgrade Type		Reverse Osmosis	*
Capital Cost of Project ($)		$10,750,800	*
Other One-Time Costs of Project (list below, if any):			
Description of Cost Element		*Cost ($)*	
0	*	$0	*
0	*	$0	*
0	*	$0	*

Capital Costs to be Paid by Grants ($)	$0	*
Type of Financing (e.g., G.O. bond, revenue bond, bank loan)	0	*
Interest Rate for Financing (%)	5.00%	*
Time Period of Financing (years)	20	*

Annual costs of operation and maintenance (including but not limited to: monitoring, inspection, permitting fees, waste disposal charges, repair, administration and replacement; list below.)			
Description of Cost Element		*Cost ($)*	
All O&M Costs	*	$847,916	*
0	*	$0	*
0	*	$0	*
0	*	$0	*
0	*	$0	*

Total Annual Cost of Existing Pollution Control ($)	$665,162		*
Amount of Existing Costs Paid by Households ($)	$665,162	Back-calculated from sewer rates	*
Number of Households (do not use number of hook-ups)	2,890		*

Will households provide revenues for the new pollution control project in the same proportion that they support existing pollution control? (Check a, b or c, below.)				
a) Yes			Assumes households pay 100% of existing and future costs	*
b) No, they will pay a different percentage. Enter to right.		0.00%		*
c) No, they will pay based on flow. Answer three questions to right. (Corresponds to **Worksheet C, Option A**.)	1. Total Usage of Project (e.g., MGD for wastewater treatment)	0		*
	2. Usage Due to Household Use (MGD of household wastewater)	0		*
	3. Industrial Surcharges, if any ($ total per year)	0		*

30803

Median Household Income (from Census)	$29,600	*
Current CPI	242.839	*
CPI for the year of the Census	241.432	*
Adjustment Factor [current CPI / CPI for the year of the Census]	1.006	
Adjusted Median Household Income [Median Household Income x Adjustment Factor]	$29,773	

Guidance Documentation		
Component	***Section***	***Page***
Evaluating Substantial Impacts (overview)	2	2-1
Capital Cost	2.1a	2-2
Annual Cost of Existing Pollution Controls	2.1b	2-3
Financing	2.1b	2-4
Annual Cost of Operations and Maintenance	2.1b	2-4
Median Household Income	2.3	2-7
Adjusting Median Household Income	2.3	2-7

Table B-3

Municipal Preliminary Screener (Worksheet D in the Guidance)
Description: This worksheet calculates and displays the Municipal Preliminary Screener (MPS), which is the total annual pollution control costs per household (existing annual cost per household plus the incremental cost related to the proposed project) as a percentage of median household income.
Total Annual Pollution Control Cost per Household / Adjusted Median Household Income × 100
The MPS indicates if a public entity would clearly not incur substantial economic impacts as a result of the proposed pollution control project.
Instructions: Evaluate the MPS by noting which cell is highlighted in **orange** and **marked with an asterisk (*).** If the MPS is less than 1.0 percent of median household income, the EPA does not expect the pollution control project to impose a substantial economic impact on the community; do not continue to the secondary affordability test. If the MPS is greater than 2.0 percent of median household income, then the pollution control project may result in a substantial economic impact to the community; continue to the secondary affordability test. If the MPS is between 1.0 and 2.0 percent of median household income, the community may incur a mid-range economic impact; continuing to the secondary affordability test is optional. See the Guidance documentation below for more information.

A. Calculation of the MPS

Total Annual Pollution Control Cost per Household [**Worksheet C**, (11) or **Worksheet C: Option A**, (10)]	$822.06	(1)
Adjusted Median Household Income	$29,773	(2)
MPS [[(1) / (2)] × 100]	2.8%	(3)

B. Evaluation of the MPS

Note column of cell highlighted in **orange** and **marked with an asterisk (*)** below:

Little Impact	Mid-Range Impact	Large Impact
Less than 1.0%	1.0% - 2.0%	Greater than 2.0% *
Indication of no substantial economic impacts	--> Proceed to Secondary Test	

Guidance Documentation		
Component	***Section***	***Page***
MPS	2.3	2-6
Annual Pollution Control Cost per Household	2.2	2-5
Median Household Income	2.3	2-7
Census	2.3	2-7
Interpreting MPS	2.3	2-7
Determining Need for Secondary Test	2.3	2-7

Data Needed to Calculate the Secondary Test Score (Worksheet E in the Guidance)

Description: This worksheet contains the numerical data necessary to calculate the secondary test score. The secondary test score characterizes the community's current financial and socioeconomic condition. See the Guidance documentation below for additional information.

Instructions: If the MPS indicates substantial impacts may occur (i.e. it exceeds 1.0%), proceed with the secondary test by entering socioeconomic data for the affected community in the **cells marked with an asterisk (*)**. Additional information on potential sources of data are provided in the tab named: "Potential Data Sources," and example data sources are provided in the tab named: "Example Data Sources." If one or more of the six indicators is not developed, provide an explanation as to why the indicator is not appropriate or not available.

A. Socioeconomic Data

Data	Potential Source	Value		
Direct Net Debt ($)	Community Financial Statements Town, County or State Assessor's Office	$5,073,348	*	(1)
Overlapping Debt ($)	Community Financial Statements Town, County or State Assessor's Office	$0	*	(2)
Market Value of Taxable Property ($)	Community Financial Statements Town, County or State Assessor's Office	$364,990,766	*	(3)
Bond Rating (for uninsured bonds)	Standard and Poor's or Moody's	$0	*	(4)
Community Unemployment Rate (%)	Census of Population Regional Data Centers	6%	*	(5)
National Unemployment Rate (%)	Bureau of Labor Statistics	5%	*	(6)
Community Median Household Income (not adjusted for inflation)	Census of Population	$29,600		(7)
State Median Household Income (for same time period as Community MHI) ($)	Census of Population	$45,674	*	(8)
Property Tax Collection Rate (%)	Community Financial Statements Town, County or State Assessor's Office	99.00	*	(9)
Property Tax Revenues ($)	Community Financial Statements Town, County or State Assessor's Office	$637,160	*	(10)

If any cell above is left blank, explain why the indicator is not appropriate or not available:

The City of Raton does not have a bond rating according to searches on the Moody's and S&P websites. We were unable to calculate overlapping debt based on available data. We were also unable to accurately calculate the property tax collection rate based on available data. *

Some states have statutory limits on property tax collections and/or rates, or data on full-market value of taxable property are not available. If this is the case, select "yes" below and provide the number of people residing in the affected community.

Are there statutory limits on property tax collections and/or rates in the state, or are data on the full-market value of taxable property not available?

- (selected) a) No *
- b) Yes (enter the number of residents in the affected community below) *

Population (#)	Census of Population	6,493	*	(Pop.)

B. Calculated Indicators (for informational purposes only)		
1. Overall Net Debt as a Percent of Full Market Value of Taxable Property		
Overall Net Debt [(1) + (2)]	$5,073,348	(11)
Overall Net Debt as a Percent of Full Market Value of Taxable Property [[(11)/(3)] × 100]	1.39%	(12)
1a. Overall Net Debt Per Capita (Alternative Indicator)		
Overall Net Debt Per Capita [[(11) / (Pop.)] × 100]	$781	(12 Alt.)
2. Property Tax Revenues as a Percent of Full Market Value of Taxable Property		
Property Tax Revenues as a Percent of Full Market Value of Taxable Property [[(10)/(3)] × 100]	0.17%	(13)

Guidance Documentation

Component	***Section***	***Page***
Secondary Test (overview)	2.4	2-7
Net and Overlapping Debt	2.4	2-9
Bond Rating	2.4	2-8
Unemployment Rate	2.4	2-9
Median Household Income	2.4	2-10
Property Tax	2.4	2-10
Alternative Indicators	2.4	2-11
Use of Secondary Test	2.4	2-11

Table B-5

Calculation of the Secondary Test Score (Worksheet F in the Guidance)
Description: This worksheet calculates the secondary test score, which characterizes the affected community's current financial and socioeconomic condition. The secondary test score is used in combination with the MPS to evaluate whether or not substantial economic impacts are likely to occur. See the Guidance documentation below for additional information.
Instructions: Verify that the appropriate cell is selected in each row and in the "Score" column to be summed below (highlighted in **orange** and **marked with an asterisk (*)**).

Indicator	Secondary Indicators			Score
	Weak [a]	Mid-Range [b]	Strong [c]	
Bond Rating **Worksheet T**, (4)	Below BBB (S&P) Below Baa (Moody's)	BBB (S&P) Baa (Moody's)	Above BBB (S&P) Above Baa (Moody's)	N/A
Overall Net Debt as Percent of Full Market Value of Taxable Property **Worksheet T**, (12)	Above 5%	2% - 5%	Below 2% *	3 *
Overall Net Debt Per Capita[1] **Worksheet T**, (12 Alt.)	Greater than $3,000	$1,000 - $3,000	Less than $1,000	N/A
Unemployment[2] **Worksheet T**, (5) & (6)	Above National Average *	National Average	Below National Average	1 *
Median Household Income[3] **Worksheet T**, (7) & (8)	Below State Median *	State Median	Above State Median	1 *
Property Tax Revenues as a Percent of Full Market Value of Taxable Property[4] **Worksheet T**, (13)	Above 4%	2% - 4%	Below 2% *	3 *
Property Tax Collection Rate[4] **Worksheet T**, (9)	< 94%	94% - 98%	> 98% *	3
Average of Financial Management Indicators[4] **Worksheet T**, (13) and (9)				3 *
	a. Weak is a score of 1 point b. Mid-Range is a score of 2 points c. Strong is a score of 3 points		**SUM**	**8**
			AVERAGE	**2.0**

Notes:

[1] If the state has statutory limits on property tax collections and/or rates or data on full-market value of taxable property are not available, "Overall Net Debt as Percent of Full Market Value of Taxable Property" is replaced with "Overall Net Debt Per Capita" and "Property Tax Revenues as a Percent of Full-Market Value of Taxable Property" is dropped.

[2] If the community's employment rate is equal to the national average unemployment rate, plus or minus 1%, then the community's unemployment rate is assessed as being equal to the national rate.

[3] If the community's median household income is equal to the state median, plus or minus 10%, then the community's median household income is assessed as being equal to the state's median household income.

[4] If one of the debt or socioeconomic indicators is not available, the two financial management indicators are averaged and this averaged value is used as a single indicator with the remaining indicators.

Guidance Documentation

Component	***Section***	***Page***
Calculating Secondary Test Score	2.4	2-11
Interpreting Secondary Test Score	2.4	2-11
Missing Indicators	2.4	2-12
Determining Need for Widespread Analysis	2.5; Figure 2-1	2-12; 2-14

Table B-6

Conclusion for Community
Description: This matrix evaluates the likelihood of substantial economic impacts due to implementation of the pollution control costs. See the Guidance documentation below for additional information. **Instructions:** Evaluate the combined results of the MPS and the secondary test by noting which cell in the Substantial Impacts Matrix below is highlighted in **orange** and **marked with an asterisk (*)**. If the matrix indicates the pollution control project is <u>not</u> likely to impose a substantial economic impact on the community, do not continue to the widespread analysis. If the matrix indicates the pollution control project is likely to impose a substantial economic impact on the community, continue to the widespread analysis. If the matrix indicates the pollution control project may or may not impose a substantial economic impact on the community, continuing to the widespread analysis is optional.

Assessment of Substantial Impacts Matrix (Table 5-2 from the Guidance)

MPS: 2.8%
Secondary Test Score: 2.0

Secondary Test Score	MPS		
	Less than 1.0 Percent	Between 1.0 and 2.0 Percent	Greater than 2.0 Percent
Less than 1.5	?	X	X
Between 1.5 and 2.5	✓	?	X *
Greater than 2.5	✓	✓	?

Key:
✓ : Impact is <u>not</u> likely to be substantial
X : Impact is likely to be substantial
? : Impact is unclear

Guidance Documentation		
Component	***Section***	***Page***
Using Substantial Impacts Matrix	2.5	2-12
Determining Need for Widespread Analysis	2.5; Figure 2-1	2-12; 2-14

APPENDIX B

City of Raton and FEI Engineering Technical Memorandum:

City of Raton Wastewater Treatment Facility –
NPDES Permit No. NM0020273
Preliminary Evaluation of Proposed Temporary Standards

PART OF ALAN PLUMMER ASSOCIATES

TECHNICAL MEMORANDUM – DRAFT FINAL FOR NMED REVIEW

TO:	Dan Campbell – General Manager, City of Raton Shelly Lemon – Bureau Chief, Surface Water Quality Bureau, NMED
FROM:	Kee Venkatapathi, CWP Mark Dahm, PE
REVIEWED BY:	Patrick O'Brien, PE
DATE:	February 2, 2019
SUBJECT:	City of Raton Wastewater Treatment Facility (NPDES Permit No. NM0020273) Preliminary Evaluation of Proposed Temporary Standards Under Development
JOB NO.	EAINC-0293

1. INTRODUCTION

The purpose of this Technical Memorandum is to present the results of a conceptual-level evaluation of the City of Raton's (City) Wastewater Treatment Plant (WWTP) focused on the technical feasibility and the associated estimated cost impacts to attain reduced nutrient limits for Total Nitrogen (TN) and Total Phosphorus (TP). The City requested that FEI Engineers (FEI), under subcontract to Engineering Analytics, Inc., assist the City.

Pursuant to the new water quality standards regulations and framework for adopting temporary standards approved by the New Mexico Water Quality Control Commission (WQCC) under 20.6.4 NMAC, the New Mexico Environment Department (NMED) (in collaboration with USEPA) is developing an approach to applying the adopted rule to developing Temporary Standards for nutrient limits.

This memorandum presents the following items:

- Existing WWTP process overview and summary of discharge concentration data
- NMED Highest Attainable Condition (HAC) Analysis Report – Overview and Application to the Existing City of Raton WWTP
- Conceptual level opinion of probable costs - HAC Option A, C, and proposed additional option A1
- Conceptual evaluation of alternate discharge Option
- Schedule addressing the Table 2 of the July 23, 2018 NMED letter

2. EXISTING WWTP PROCESS OVERVIEW AND SUMMARY OF DISCHARGE CONCENTRATION DATA

The existing WWTP was designed for a hydraulic capacity of 0.9 MGD and an organic capacity of 1,989 lbs BOD_5 /day, assuming an estimated influent concentrations of 265 mg/L BOD_5 and 60 mg/L TKN.

The WWTP headworks consists of mechanical screen, grit chamber, and flow measuring flume. Following the grit chamber, the influent flows through the splitter box before reaching the sequencing batch reactor (SBR) secondary treatment process. The SBR process utilized at the Raton WWTP is a Xylem-Sanitaire (Xylem) Intermittent Cycle Extended Air System (ICEAS). The secondary effluent from the SBR process is decanted to an effluent equalization basin. The effluent from the equalization basin flows by gravity to either the reuse facility or to UV Disinfection. The effluent going through the UV Disinfection is discharged to Doggett Creek.

Results of an analysis of the effluent nutrient discharge concentration and reclaim flow TN and TP data from January 2017 through September 2018 are shown in Figures 1 and 2, respectively. The average effluent TN concentration for the analyzed time-period was 7.3 mg/L and effluent TP concentration was 2.37 mg/L.

Figure 1. Effluent TN Concentrations

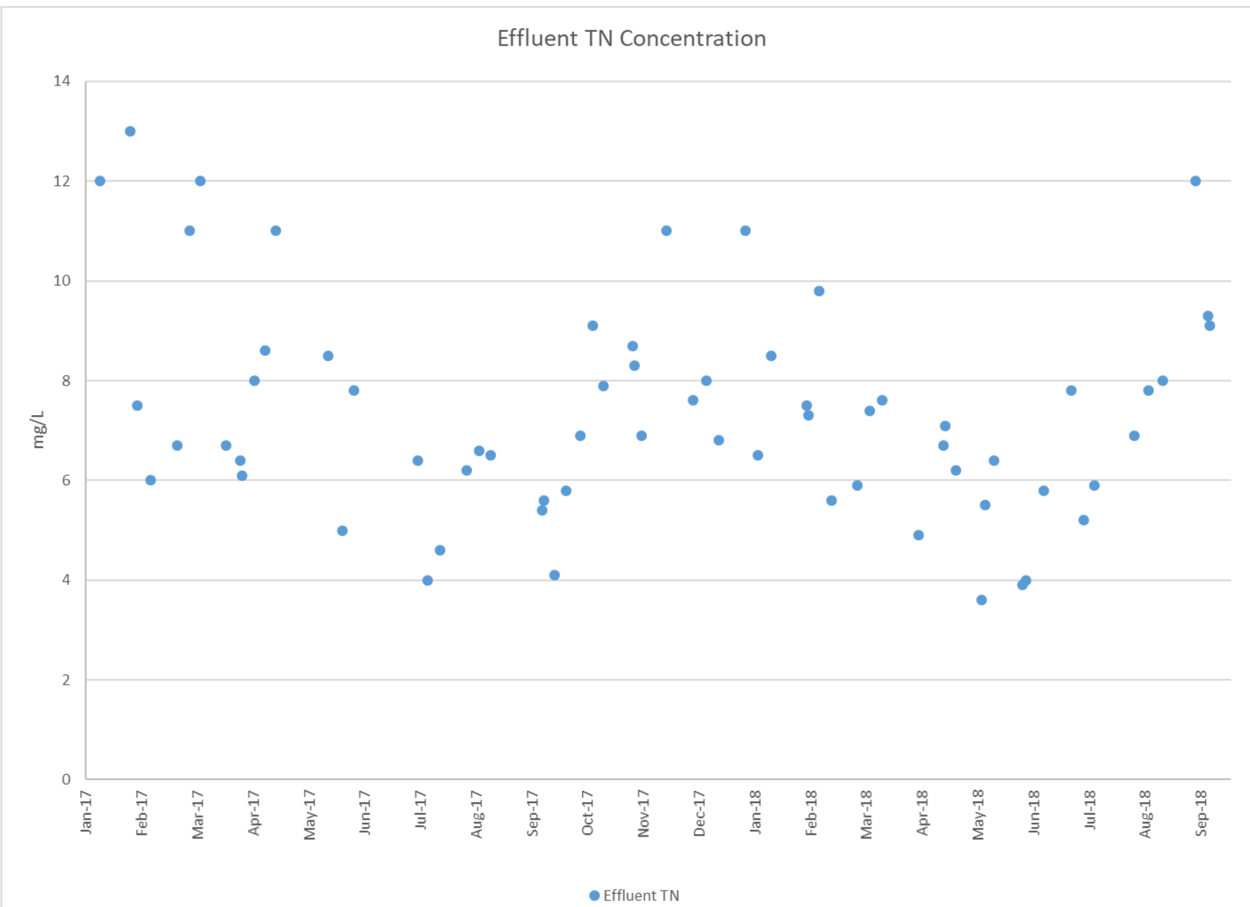
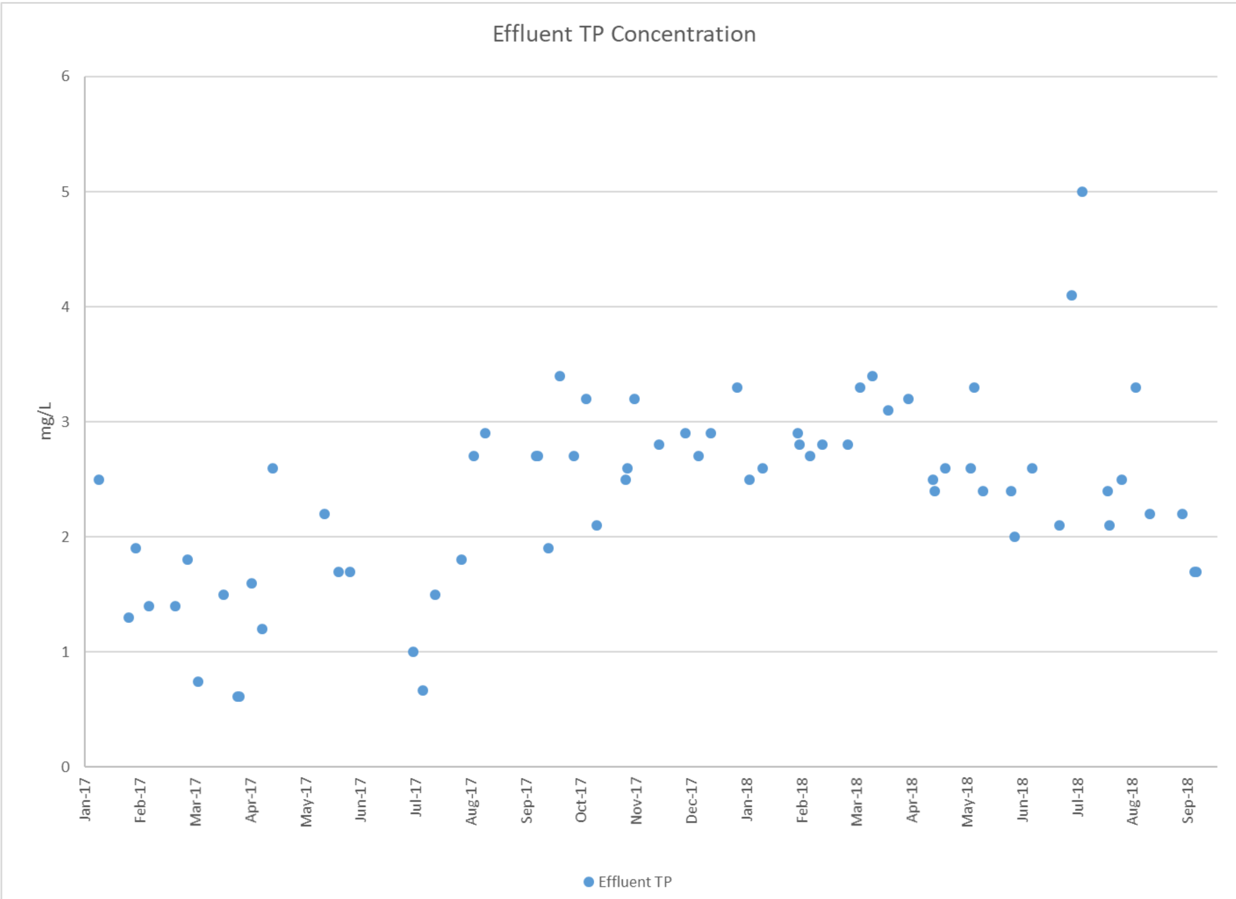


Figure 2. Effluent TP Concentrations



3. NMED HIGHEST ATTAINABLE CONDITION (HAC) ANALYSIS REPORT - OVERVIEW AND APPLICATION

As part of the NMED nutrient Temporary Standards development, several WWTP facilities were selected by NMED as "demonstration facilities". The City was presented with the opportunity to participate as one of five facilities selected and to work with NMED to develop a nutrient Temporary Standard that would eventually become incorporated in a permit. The following section presents a summary of the NMED Temporary Standards development approach.

3.1. NMED FRAMEWORK FOR TEMPORARY STANDARDS DEVELOPMENT – OVERVIEW

NMED has worked with two Contractors to evaluate several sets of proposed TN and TP treatment standards, screen treatment technologies, evaluate the community cost impact of WWTP modifications and increased rates, and to develop a report summarizing a set of proposed Highest Attainable Condition (HAC) treatment limits. The City was provided a copy of the Substantial and Widespread Economic and Social Impact and Highest Attainable Condition (HAC) Analysis Report for the City of Raton, NM by NMED (HAC Analysis Report).

Reverse Osmosis (RO) was found to be the only available technology that would approach attaining the < 1 mg/L TN and < 0.1 mg/L TP nutrient water quality standards; however, implementation of RO was found likely to cause substantial and widespread economic and social impacts to the community. Because of this finding the HAC Analysis Report developed HAC Option that reflect a range of proposed effluent standards and plant improvements treatment technologies. Table 12 of the report (included as Attachment

1) provides several proposed TN and TP HAC Options that identify specific treatment options tied to a specific set of proposed treatment limits (termed Target Effluent Conditions).

The framework for temporary standards development anticipates that the City will review the underlying assumptions for the developed HAC options and that a temporary standards petition would be jointly constructed by the City and NMED for presentation before the WQCC. Subsequent to review and approval by the WQCC and approval by Region 6 USEPA, the temporary standard would be incorporated into the discharge permit.

3.2. DESCRIPTION OF HIGHEST AVAILABLE CONDITION (HAC) OPTIONS

A July 23, 2018 NMED letter to the City (included as Attachment 2) proposed using Options A and C from Table 12 in the HAC Analysis Report as the starting point for options to be evaluated by the City. The selected HAC Option would then be included in a petition for a Temporary Standard to be implemented over a set time period (term) and for subsequent inclusion in the City's WWTP discharge permit. An additional proposed HAC Option with somewhat less stringent nutrient limits than those provided by HAC Options A or C has also been included for evaluation in this Technical Memorandum. For purposes of continuing the nomenclature used in the NMED HAC Analysis Report, this third option will be referred to as Option A1, while HAC Options A and C will remain as defined in the referenced report.

3.2.1. HAC OPTIONS A AND C

As presented in the HAC Analysis Report, both the projected process performance and construction costs for HAC Options A and C are based on a de-rated flow of 0.62 MGD.

Table 1. HAC Options A and C (Shown in Attachment 1 of the HAC Analysis Report)

HAC Option	Description of Treatment Technologies	Target Effluent Concentrations at the De-rated 0.62 MGD Flow	Estimated Cost (As a Percentage of MHI)
Option A	Additional Optimization; Chemical Precipitation	5.0 mg/L TN 0.5 mg/L TP	1.01
Option C	Denitrification Filters; Chemical Precipitation	3.0 mg/L TN 0.5 mg/L TP	1.30

3.2.2. PROPOSED ADDITIONAL HAC OPTION - A1

Table 2. HAC Option A1

HAC Option	Description of Treatment Technologies	Target Effluent Concentrations at the De-rated 0.62 MGD Flow	Estimated Cost (As a Percentage of MHI)
Option A1	Additional Optimization; Chemical Precipitation	7.0 mg/L TN 1.0 mg/L TP	Not Applicable

A conceptual-level evaluation of HAC Options is summarized in the following subsections. Required WWTP modifications applicable to Options A, C, and A1 are discussed and where relevant, technology limitations are identified.

3.3. CONCEPTUAL-LEVEL EVALUATION OF HAC OPTION A

Option A identified in Table 12 of the HAC Analysis Report includes a target TN concentration of 5 mg/L and a TP concentration of 0.5 mg/L. HAC Option A includes modifications to the existing WWTP SBR secondary treatment process to meet the Option A target effluent TN and TP limits.

The existing Xylem ICEAS SBR process was designed for an effluent TN concentration of 10 mg/L and there was no consideration of a design TP effluent limit. FEI has worked with Xylem to identify the level process modifications required to meet Option A nutrient limits.

Observations concerning the existing process and plant performance with relevance to HAC Option A are summarized below:

- Historical effluent TN data in combination with limited influent nitrogen data indicate that complete nitrification may not be occurring due to either insufficient aeration time cycles, insufficient alkalinity, or a combination (reference Attachment 3).
- Historical effluent pH data indicate that sufficient alkalinity for complete nitrification may not be available during certain intervals (reference Attachment 3).
- Based on limited influent nitrogen data, the BOD to TKN ratio is less than the optimum 5:1 ratio for near-complete denitrification.
- The current aeration blowers are each 150 HP without VFD controls. The DO probes in the SBR process basins are not tied to blower operation via control logic.

3.3.1. EQUIPMENT MODIFICATIONS REQUIRED TO MEET TARGET EFFLUENT LIMITS

3.3.1.1. XYLEM RECOMMENDED PROCESS MODIFICATIONS

Xylem has provided the following suggested process and equipment modifications to optimize TN removal to meet HAC Option A limits:

- Replace the existing ICEAS system PLC control logic and upgrade to Xylem's proposed current Biologic Nutrient Removal (BNR) PLC control logic, NURO Controller (reference Attachment 4).
- Install ammonia, nitrate, temperature, and DO sensors and transmitters to provide the necessary data and allow the new NURO control logic to optimize the existing process for nitrification and denitrification, while preventing excess blower run times during low loads.
- Reduce the number of "Air Off-Cycles" in the SBR process to enhance the nitrification process. The justification behind reducing the total amount of off-cycle time is that the denitrification process is faster as compared to nitrification process and the decant cycle time will also contribute to the available denitrification time.
- Installation of a combination ammonium/nitrate probe located approximately two thirds of the distance down the length of the SBR basin (towards the decanter end).
- Installation of an online phosphate probe to allow continuous online monitoring of phosphate in the SBR basins.
- External alkalinity addition will likely be required. (Reference Attachment 5)
- External carbon addition will likely be required to provide the necessary carbon required during the denitrification process. The supplemental carbon should be introduced at the beginning of the last Air OFF period for a given total cycle. (Reference Attachment 7)

The current total cycle is designed for 4.8 hours (5 cycles/24 hours) that includes 4 Air ON cycles (24 minutes each for a total of 96 minutes), 3 Air OFF cycles (24 minutes each for a total of 96 minutes), 1 settle period (60 minutes) and 1 decant period (60 minutes).

The new cycle timing proposed by Xylem for process optimization is 2.4 hours (10 cycles/24 hours) that includes 48 minutes of Air ON, 24 minutes of Air OFF, 36 minutes each for settle and decant. The proposed optimization will reduce the total Air OFF in a 24 hours period from 6 hours to 4 hours. The decreased Air OFF period and increased Air ON period will provide the excess time needed for near complete nitrification (assuming sufficient alkalinity is present).

Xylem is proposing an upgrade to the existing control logic. The proposed controller (NURO Controller) will use a combination of ammonia, nitrate, temperature, and DO sensors to optimize the existing process for nitrification and denitrification while preventing excess blower run times during low loads.

3.3.1.2. ADDITIONAL SUGGESTED PROCESS MODIFICATIONS

- Update the controller logic to operate the aeration blowers based on the dissolved oxygen (DO) input from the SBR basins. Changes to the aeration cycles in response to demand, might require improvements to/retrofits to the existing aeration blowers.
- The addition of VFDs to the aeration blowers will enable the NURO controller to maintain DO setpoints in the SBR basins. The Xylem BioWin modeling indicates that oxygen carryover from aeration the ON periods to the aeration OFF periods will occur inhibiting denitrification.
- If the aeration blower motors are not suitable for VFDs, either the motor or the entire blower will require replacement.
- Installation of a coagulation feed system for chemical removal of TP. (Reference Attachment 6)

3.4. CONCEPTUAL-LEVEL EVALUATION OF HAC OPTION C

HAC Option C identified in Table 12 of the HAC Analysis Report includes a target TN concentration of 3 mg/L and a TP concentration of 0.5 mg/L. Option C includes modifications to the existing WWTP SBR secondary treatment process to meet the Option C target effluent TN and TP limits.

The existing Xylem ICEAS SBR process was designed for an effluent TN concentration of 10 mg/L and there was no consideration of a design TP effluent limit. FEI has worked with Xylem to identify process modifications required to meet HAC Option C nutrient limits.

Observations concerning the existing process and plant performance with relevance to HAC Option C are summarized below:

- Historical annual average effluent TN concentrations are approximately 7 mg/L. The annual average effluent nitrate concentrations are approximately 4 mg/L.
- The proposed target effluent TN concentration for Option C requires a reduction of more than 50 percent below the existing average effluent TN concentrations.
- Historical effluent TN data in combination with limited influent nitrogen data indicate that complete nitrification may not be occurring due to either insufficient aeration time cycles, insufficient alkalinity, or a combination (reference Attachment 3).
- Historical effluent pH data indicate that sufficient alkalinity for complete nitrification may not be available during certain intervals (reference Attachment 3).
- Based on limited influent nitrogen data, the BOD to TKN ratio is less than the optimum 5:1 ratio for denitrification.

3.4.1. EQUIPMENT MODIFICATIONS REQUIRED TO MEET HAC OPTION C TARGET EFFLUENT LIMITS

3.4.1.1. ADDITIONAL RECOMMENDED PROCESS MODIFICATIONS

In addition to the Xylem-provided ICEAS system equipment modification recommendations for the HAC Option A discussed above in Section 3.2 (and repeated below), the following additional process equipment modifications to optimize TN and TP reduction are suggested:

- Installation of tertiary denitrification filters and provision of supplemental carbon addition for nitrate removal.
- Installation of a coagulation feed system and tertiary filtration system for chemical removal of TP. Note: there are treatment equipment options that provide tertiary treatment for both TN and TP in a single tertiary treatment filter equipment system. (Reference Attachment 6)

3.4.1.2. XYLEM RECOMMENDED PROCESS MODIFICATIONS

Similar to the equipment and process modification recommendations listed for HAC Option A, Xylem has provided the following suggested process and equipment modifications to optimize TN removal to meet HAC Option C limits:

- Replace the existing ICEAS system PLC control logic and upgrade to Xylem's proposed current BNR PLC control logic (NURO Controller).
- Install ammonia, nitrate, temperature, and DO sensors and transmitters to allow the new control logic to optimize the existing process for nitrification and denitrification while preventing excess blower run times during low loads.
- Installation of a combination ammonium/nitrate probe located approximately two thirds of the distance down the length of the SBR basin (towards the decanter end).
- Installation of an online phosphate probe to allow continuous online monitoring of phosphate in the SBR basins.
- Reduce the number of "Air Off-Cycles" in the SBR process to enhance the nitrification process. The justification behind reducing the total amount of off-cycle time is that the denitrification process is faster as compared to nitrification process and the decant cycle time will also contribute to the denitrification available time.
- Update the controller logic to operate the aeration blowers based on the DO input from the SBR basins. Changes to the aeration cycles in response to DO demand, might require improvements to/retrofits to the existing aeration blowers.
- External carbon addition will likely be required to provide the necessary carbon required during the denitrification process. The supplemental carbon should be introduced at the beginning of the last Air OFF period for a given total cycle. (Reference Attachment 7)

3.5. CONCEPTUAL-LEVEL EVALUATION OF PROPOSED HAC OPTION A1

Proposed HAC Option A1 includes modifications to the existing WWTP SBR secondary treatment process to meet the Option A1 target effluent limits of TN of 7 mg/L and TP of 1 mg/L. The existing Xylem ICEAS SBR process was designed for an effluent TN concentration of 10 mg/L and there was no consideration of a design TP effluent limit.

FEI has worked with Xylem to identify ICEAS treatment system process modifications required to meet the proposed Option A1 nutrient limits. The following observations concerning the existing process and plant performance are summarized below:

- Historical effluent TN data in combination with limited influent nitrogen data indicate that complete nitrification may not be occurring due to either insufficient aeration time cycles, insufficient alkalinity, or a combination (reference Attachment 3).
- Historical effluent pH data indicate that sufficient alkalinity for complete nitrification may not be

available during certain intervals (reference Attachment 3).

- Based on limited influent nitrogen data, the BOD to TKN ratio is less than the optimum 5:1 ratio for denitrification.

The estimated alum dosage required to achieve 1 mg/L in the effluent is provided in Table 3 below.

Table 3. Coagulant Addition- Option A

Parameter	Current Average Flow	Design Flow
Coagulant Addition Chemical	Alum (Aluminum Sulfate Solution)	
Solution strength	50% by weight	
Daily solution dosing rate at Max. Month flow	23 gal/day (0.95 gal/hr)	37 gal/day (1.5 gal/hr)
Dosing pump operating range	0.5 to 5 gal/hr	

Assumed TP of 3.3 mg/L after biological assimilation to be reduced to 1 mg/L.
Daily dosing rate includes 25 percent safety factor to account for field conditions

3.5.1. WWTP IMPROVEMENTS AND OPTIMIZATION STEPS FOR ATTAINMENT OF PROPOSED OPTION A1 DISCHARGE LIMITS

FEI worked with Xylem to identify process modifications required to meet HAC Option A1 nutrient limits. Both Option A and proposed Option A1 nutrient limits are less stringent than Option C limits. Modifications proposed by Xylem for Option A1 are applicable to Option A and proposed Option A1. The current average effluent TN concentration is fairly close to the proposed effluent TN limit. The following process optimization items are recommended for inclusion in Option A1.

- Upgrades to the existing control logic. The proposed controller upgrade (NURO Controller) will use a combination of ammonia, nitrate, temperature, and DO sensors to optimize the existing process for nitrification and denitrification while preventing excess blower run times during low loads.
- Updates to controller logic to run aeration blowers based on the DO input from the SBR basins. This will add on-line instrumentation for tighter aeration and nutrient control. Changes to the aeration cycles in response to demand, might require improvements to/retrofits to the existing aeration blowers.
- The Xylem BioWin modeling indicates that oxygen carryover from aeration the ON periods to the aeration OFF periods will occur inhibiting denitrification. Adding VFDs to the aeration blowers will enable the NURO controller to maintain a DO setpoint in the SBR basins.
- If the aeration blower motors are not suitable for VFDs, either the motor or the entire blower will require replacement.
- External carbon addition will likely be required to provide the necessary carbon required during the denitrification process. The supplemental carbon should be introduced at the beginning of the last Air OFF period for a given total cycle.

The existing ICEAS treatment system was not designed for enhanced biological phosphorus removal. At present, the difference between the current influent and effluent TP concentrations is due to uptake of orthophosphate for normal cell growth. The remaining effluent TP is a combination of soluble phosphorus, soluble non-reactive phosphorus, and particulate phosphorus.

Option A1 includes chemical phosphorus removal for attainment of the proposed effluent TP concentration of 1 mg/L.

4. CONCEPTUAL LEVEL OPINION OF PROBABLE COSTS - HAC OPTIONS A, C, AND PROPOSED OPTION A1

Section 3 above, presents HAC Options A and C with all components of the options as-presented in the HAC Analysis Report. Section 4 presents the rationale for changing the TP Target Effluent Concentration to 1.0 mg/L as Proposed Option A1; discusses limitations of the technologies included in Options A, C, and Proposed Option A1 for TN and TP reduction; and presents a summary of preliminary estimates of probable cost.

Table 4. HAC Options A, C, and Proposed Option A1 As Modified for this Technical Memorandum (Basis: Chemical Feed Using Totes)

HAC Option	Description of Treatment Technologies	Target Effluent Concentrations At the Current Design Flow of 0.9 MGD	Preliminary Opinion of Probable Cost (As a Percentage of MHI)
Option A, NURO Controller, Instrumentation, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum, Micro C	Additional Optimization; Chemical Precipitation	5.0 mg/L TN 1.0 mg/L TP	1.13
Option C, NURO Controller, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Below Grade Tertiary Filters, Caustic 50%, Ferric Chloride and Micro C	Denitrification Filters; Chemical Precipitation	3.0 mg/L TN 0.5 mg/L TP	1.49
Option A1, NURO Controller, Instrumentation, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum	Additional Optimization; Chemical Precipitation	7.0 mg/L TN 1.0 mg/L TP	1.08

Table 5. HAC Options A, C, and Proposed Option A1 As Modified for this Technical Memorandum (Basis: Chemical Feed Using Bulk Tank Storage)

HAC Option	Description of Treatment Technologies	Target Effluent Concentrations At the Current Design Flow of 0.9 MGD	Preliminary Opinion of Probable Cost (As a Percentage of MHI)
Option A, NURO Controller, Instrumentation, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum, Micro C	Additional Optimization; Chemical Precipitation	5.0 mg/L TN 1.0 mg/L TP	0.92
Option C, NURO Controller, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Below Grade Tertiary Filters, Caustic 50%, Ferric Chloride and Micro C	Denitrification Filters; Chemical Precipitation	3.0 mg/L TN 0.5 mg/L TP	1.20
Option A1, NURO Controller, Instrumentation, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum	Additional Optimization; Chemical Precipitation	7.0 mg/L TN 1.0 mg/L TP	0.90

4.1.1. TREATMENT SYSTEM IMPROVEMENT DESCRIPTIONS

4.1.1.1. XYLEM ICEAS CONTROLLER OPTION

Replacement of the existing PLC controller with a new Xylem NURO Controller would provide a significant expansion in process control of the nitrification/denitrification processes. The NURO controller utilizes a combination of ammonia, nitrate, temperature and DO sensors to optimize the existing process for nitrification and denitrification while preventing excess blower run times during low loads. The controller upgrades package includes YSI IQ SensorNet, DO sensors, ammonia/nitrate sensors, and replacement of the existing PLC with a new PLC with the NURO control algorithm. The NURO controller is designed to utilize the data from the ammonia/nitrate/DO sensors to regulate blower operation and optimize the treatment processes.

4.1.1.2. ALKALINITY ADDITION

At present the WWTP does not add supplemental alkalinity. Analysis of plant data including effluent TN concentration and pH indicate a potential intermittent lack of sufficient alkalinity. To achieve the TN target effluent limits, it is necessary to achieve close to complete nitrification. Nitrification (reduction in alkalinity) and denitrification (gaining alkalinity) netted out consumes 3.64 lb of alkalinity/lb of nitrogen to be nitrified/denitrified. Reduced availability of alkalinity inhibits the nitrification process and subsequently the denitrification process (due to reduced nitrate to denitrify). The proposed modifications described in this section consider 50 percent sodium hydroxide (NaOH) for the alkalinity addition.

4.1.1.3. SUPPLEMENTAL CARBON ADDITION

Nitrification uses oxygen to convert ammonia to nitrite and to nitrate. During the denitrification process, microorganisms use organic carbon to convert nitrate to nitrogen gas. The organic carbon in the influent is used by microorganisms during aeration resulting in reduced carbon available for denitrification. Micro-C has been included in this preliminary assessment as the external carbon addition source. Preliminary stoichiometric calculations were performed to estimate the Micro-C required for denitrification.

4.1.1.4. COAGULANT ADDITION

The existing secondary process was not designed for biological phosphorus removal; however, influent Phosphorus is partially consumed for biological growth of microorganisms. Currently, the calculated 90th percentile effluent TP is 3.3 mg/L. To be conservative, the current 90th percentile effluent TP was used to calculate the coagulant dosage requirement.

The soluble phosphorus in the process can be removed through coagulation, settling solids, and removal through sludge wasting. Particulate phosphorus cannot be removed through coagulation, it comprises a portion of the effluent TSS and contributes to the effluent TP. Alum was utilized in this preliminary evaluation as the coagulant for soluble phosphorus removal.

4.1.2. RATIONALE FOR CHANGING THE HAC OPTION A TARGET EFFLUENT CONCENTRATION FOR TP TO 1.0 MG/L

In a typical municipal WWTP the coagulant is added before the secondary clarifier or alternately, a two-step chemical addition is possible as mentioned in the HAC Analysis Report. For the Sanitaire process in Raton's WWTP, the chemicals would be added before the start of the last Air-On cycle to the mixed liquor before entering the settle phase. Typically, the effluent particulate phosphorus percent in the TSS varies from 1 to 3 percent. This percentage is shifted towards the high end for a WWTP without enhanced phosphorus removal. The Raton WWTP on average has an effluent TSS concentration of 5 mg/L, while the 90th percentile concentration is 10 mg/L.

Since the ICEAS process does not have a clarifier and the solids separation is limited to the efficiency of the settle/decant phases of the SBR cycle, the above estimate of TSS and TP carryover, may not be typically attained. Additional data collection is necessary to determine the TSS and TP effluent concentration relationship.

At an assumed 90th percentile of TSS concentration of 10 mg/L, and using an assumed three (3) percent the particulate phosphorus would comprise approximately 0.3 mg/L of the effluent Total Phosphorus. The current discharge permit has a 30 day average TSS concentration of 30 mg/L. Applying the above assumptions, the particulate phosphorus would contribute 0.9 mg/l of the total phosphorus concentration. This would mean that under a scenario where the effluent TSS concentration might intermittently approach 20 - 30 mg/L, the City would be in jeopardy of not meeting the effluent TP limit of 0.5 mg/L.

4.1.3. PRELIMINARY ESTIMATES OF PROBABLE COST

The following estimates of probable cost include instrumentation upgrades necessary to provide information for the controlling the process; PLC and control programming upgrades; blower system improvements; chemical feed system panels/pumps; and operations costs utilizing either tote storage or bulk storage. The tables below also include operations and cost scenarios tied to both chemical storage scenarios (chemical tote storage and bulk storage) at both the current flowrate, 0.62 MGD, and the design flowrate 0.90 MGD.

4.1.3.1. HAC OPTION A

Option A: TN 5, TP 1. NURO Controller, Instrumentation, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum, Micro C			
	0.62 MGD Chemical Totes	**0.62 MGD Bulk Chemical Storage**	**0.90 MGD Bulk Chemical Storage**
Total Construction Opinion of Probable Cost	$ 349,000	$ 424,000	$ 424,000
Total O&M Cost	$ 328,600	$ 113,300	$ 164,400
New % of MHI as Sewer Cost	1.19%	0.94%	1.00%

Refer to Attachment 11 - Opinion of Probable Cost table.

4.1.3.2. HAC OPTION C

Option C: TN 3, TP 0.5. NURO Controller, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Below Grade Tertiary Filters, Caustic 50%, Ferric Chloride and Micro C				
	0.90 MGD Bulk Chemical Storage	**0.90 MGD Chemical Totes**	**0.62 MGD Bulk Chemical Storage**	**0.62 MGD Chemical Totes**
Total Construction Opinion of Probable Cost	$ 2,778,000	$ 2,704,000	$ 2,778,000	$2,704,000.00
Total O&M Cost	$ 182,000	$ 516,500	$ 127,600	$ 358,200.00
New % of MHI as Sewer Cost	1.19%	1.58%	1.13%	1.39%

Refer to Attachment 12 - Opinion of Probable Cost table.

4.1.3.3. HAC OPTION A1

Option A1: TN 7, TP 1. NURO Controller, Blower VFD, Heat Trace, 3 Chemical Feed Panels, Caustic 50%, Alum			
	0.62 MGD Chemical Totes	**0.62 MGD Bulk Chemical Storage**	**0.90 MGD Bulk Chemical Storage**
Total Construction Opinion of Probable Cost	$ 349,000	$ 413,000	$ 413,000
Total O&M Cost	$ 286,600	$ 91,300	$ 132,600
New % of MHI as Sewer Cost	1.14%	0.91%	0.96%

Refer to Attachment 13 - Opinion of Probable Cost table.

5. DEVELOPMENT OF PROPOSED AVERAGE MONTHLY TARGET EFFLUENT LIMITS – TN AND TP LIMITS FOR PROPOSED OPTION A1

This section presents proposed Average Monthly Target Effluent Limits developed consistent with the HAC Options A and C Estimated Average Monthly Limits (CV = 0.6, sample frequency 4x/month) presented in the October 31, 2018, TS Factor 6 Raton Presentation developed by NMED. The calculations utilized to develop the proposed set of average monthly effluent limits use the methodology and equations presented in the USEPA Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001), March 1991.

The intent behind developing this set of proposed average monthly effluent limits is to identify effluent target limits for a monthly set of effluent samples collected at a frequency of 4 times per month, starting with the proposed Target Effluent Concentrations, TN = 7.0 mg/L and TP = 1.0 mg/L, shown above in Section 4, Table 4. It is believed that a monthly average target effluent limit would better fit plant operations and the pattern of challenging operations periods that the plant experiences, while both attaining the desired Long Term Average and minimizing plant exceedances.

5.1. METHODOLOGY FOR DEVELOPING AVERAGE MONTHLY LIMITS

The calculation procedure assumed a lognormal probability distribution for the effluent limit data set with a relative variation of the data set, or coefficient of variation CV, of 0.6. The calculation uses an upperbound concentration (such as the Waste Load Allocation, WLA) and the CV to calculate the Long Term Average (LTA). Applying this methodology to the Proposed Option A1 limits of TN = 7 mg/L and TP = 1 mg/L, the Maximum Daily Limit (MDL) was calculated to be 13.27 mg/L for TN and 1.90 mg/L for TP. The Average Monthly Limit (AML) was calculated for a sample frequency of 1x, 2x, and 4x per month.

Table 6. Summary of Calculated Maximum Daily Limits, and Average Monthly Limits

HAC Option	TN Proposed Option A1	TP Proposed Option A1
Long Term Average (LTA), mg/L	7.0	1.0
Max. Daily Limit (MDL), mg/L	13.27	1.90
Average Monthly Limit (AML) (1x / month), mg/L	14.94	2.13
Average Monthly Limit (AML) (2x / month), mg/L	12.58	1.80
Average Monthly Limit (AML) (4x / month), mg/L	10.87	1.55

6. CONCEPTUAL EVALUATION OF ALTERNATE DISCHARGE OPTION

The City currently reuses a portion of effluent for non-potable reuse at a golf course during summer and fall months. The reuse varies on average between 40 to 50 percent of the influent flow. The City is collecting data to explore the option of a zero discharge/seasonal discharge permit.

Monthly average of the influent and reclaim flow data for the periods extending from March - November 2017 and from March – September 2018 were analyzed. In 2017, 41 percent of influent flow was directed to reclaim use. In 2018 up to September 55 percent of the influent was direct to reclaim use.

6.1. SEASONAL DISCHARGE PERMIT / ZERO DISCHARGE PERMIT OPTION

The current WWTP process flow diagram is provided in Attachment 8. The secondary effluent from the SBR process flows by gravity to the effluent equalization basin. The effluent from the EQ basin flows by gravity to either UV Disinfection or to effluent polishing filter. There are currently three filters (two duty and one standby). The filtered effluent flows to a wetwell where vertical turbine pumps pump the filtered effluent to the reuse.

The City is evaluating using all of the WWTP flow during the summer/fall months followed by a seasonal effluent nutrient limit for the winter months. This approach would provide the City time required to gradually raise the user rates and secure funding for the WWTP improvements. One approach that is being evaluated for implementing the zero discharge/seasonal permit approach would be to break the work into two phases.

- Phase 1: Upgrade/add a polishing filter, increase the capacity of the reuse pumps, increase the size of pipes to minimize pipe losses for 100 percent effluent reuse. During non-irrigation months, WWTP discharges effluent to Doggett Creek under an interim (10-15 years) less-stringent or current permit
- Phase 2: Based on the final effluent nutrient limit, either Option A or Option C standard of the HAC, WWTP processes will be modified.

At end of Phase 2, the WWTP would continue to use 100 percent of the flows during the summer/fall months and will discharge to the receiving stream during the winter months. This phased approach would reduce financial burden on the City. The cost associated with the Options A, C, and A1 interim nutrient standard upgrades are provided in Section 4.1.4.

Alternatively, the City could send their WWTP entire effluent flows in winter months to a processing facility that has the capacity to use the effluent. This would eliminate the need for a NPDES permit for the WWTP.

7. PROPOSED HAC IMPLEMENTATION SCHEDULE

The City's proposed schedule for implementing the selected HAC Option A1 projects completion of the proposed treatment equipment, installation/construction, startup/commissioning of the WWTP with the upgraded ICEAS controls system by the end of 2030.

It is anticipated that the City will continue to work towards the HAC Option A Target Effluent Limits and would tentatively project implementation of the HAC Option A treatment system equipment upgrades by the end of 2045.

Description of Step	Approximate Time to Complete
1. Implementation of advanced operational strategies to reduce nutrients using existing infrastructure. Evaluate effects of operational changes and fine tune as necessary. Preliminarily assess the feasibility of reuse, etc.	Est. 3 years
2. Hire an engineer to prepare a preliminary engineering report (PER) that evaluates Option for chemical precipitation (and denitrification filters) that lead to further nutrient reductions and build upon developed operational strategies. Begin discussion with funding agencies.	Est. 1 year
3. Go through funding agency timelines and requirements for planning, if necessary. This may involve legislative approval, depending upon the funding sought. Implement minor facility improvements, if appropriate, and fine tune operations for further TN and TP reductions.	Est. 3 years
4. Design capital improvements. Go through the Department (NMED) and/or other funding agency review and approval processes for the design/bidding phase. Bid major capital project.	Est. 2 years
5. Construct project, including reuse, if appropriate. Begin operating new infrastructure and fine tune operations. Continue with advanced operational training with new infrastructure. Evaluate nutrient reductions achieved.	Est. 3 years

8. OBSERVATIONS

Based on the work performed by Xylem/Sanitaire and cost estimating information compiled to evaluate and contrast Options A, C, and Proposed Option A1 the following observations can be made. The primary observation is that required treatment plant improvements necessary to attain TN concentrations of 7 mg/L or less and TP concentrations of 1 mg/L or less require capital equipment expenditures and ongoing operating expenditures. Due to certain process limitations associated with the SBR equipment, it is apparent that the operations expenditures end up comprising the majority of the annual amortized costs, and hence, contributing more to the calculated percentage of MHI increases.

A secondary observation is tied to the relative cost contribution attributable to chemical feed system cost tied to chemical feed/storage costs using chemical totes versus the cost of chemical feed/storage using bulk storage tanks. As can be seen from the cost tables presented in Section 4, as the chemical demand increases, the bulk storage option becomes the most cost effective approach. Note: for this Draft, costs that may be necessary for a chemical storage building to house bulk storage tankage and chemical feed systems have not been included pending an evaluation of available space for bulk storage from the City.

A comparison of MHI impacts outlined in the Section 4 cost tables shows that Option C cost impacts are over 5 times more costly than either Option A or Option A1, resulting in MHI percentage impacts ranging from 1.13 to 1.58 percent, indicating a likely significant impact to the community.

Based on the need to maintain a situation where improvements can be made and impacts to the community can be maintained at a realistic, manageable level it is recommended that Options A and A1 be considered further and Option C not be pursued.

9. ATTACHMENTS

Attachment 1 – Table 12, HAC Analysis Report
Attachment 2 - Tertiary Filter Vendor
Attachment 3 - Effluent TN Concentration and pH
Attachment 4 - NURO Controller
Attachment 5 - Alkalinity Dosage
Attachment 6 - Coagulant Dosage
Attachment 7 - External Carbon Dosage
Attachment 8 - Current PFD
Attachment 9 - Current Sanitaire Design
Attachment 10 - Tertiary Filter Vendor Proposal
Attachment 11 - Option A Opinion of Probable Cost
Attachment 12 - Option C Opinion of Probable Cost
Attachment 13 - Option A1 Opinion of Probable Cost
Attachment 14 - New Drum Filter

ATTACHMENT 1

Table 12 - Annual Pollution Control Cost Per Household

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Table 12. Annual Pollution Control Cost Per Household (January 2017$) of TN and TP Treatment Combination Options for Raton

Cost Element	Option A Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option B Denitrification Filters (TEC = 3.0 mg/L TN) and No additional TP treatment (TEC = 2.2 mg/L TP)	Option C Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation (TEC = 0.5 mg/L TP)	Option D Optimize Cycle Times (TEC = 7.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option E Additional Optimization (TEC = 5.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)	Option F Denitrification Filters (TEC = 3.0 mg/L TN) and Chemical Precipitation Plus Filtration (0.1 mg/L TP)
Capital Cost	$681,360	$1,336,200	$1,557,540	$2,252,160	$2,712,180	$3,588,360
Annual O&M Cost	$150,439	$249,115	$330,001	$472,784	$542,337	$721,899
Total Annualized Cost	$205,113	$356,335	$454,982	$653,503	$759,969	$1,009,838
Incremental Annual Cost Per Household[1]	$70.97	$123.30	$157.43	$226.13	$262.97	$349.42
Existing Annual Pollution Control Costs Per Household	$230.16	$230.16	$230.16	$230.16	$230.16	$230.16
Total Annual Pollution Control Costs Per Household[2]	**$301.13**	**$353.46**	**$387.59**	**$456.29**	**$493.13**	**$579.59**
% of MHI for Pollution Control[3]	**1.01**	**1.19**	**1.30**	**1.53**	**1.66**	**1.95**
% Increase in Annual Sewer Bill	**31**	**54**	**68**	**98**	**114**	**152**

[1]2,890 households
[2]Annualized at 5% over 20 years.
[3]Based on adjusted (January 2017$) MHI of $29,773.

ATTACHMENT 2

Tertiary Filter Vendor

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NEW MEXICO
ENVIRONMENT DEPARTMENT

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Governor

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BUTCH TONGATE
Cabinet Secretary

J. C. BORREGO
Deputy Secretary

July 23, 2018

The Honorable Neil Segotta Jr.
Mayor of Raton
224 Savage Ave., P.O. Box 910
Raton, NM 87740

Subject: Substantial and Widespread Economic and Social Impact and Highest Attainable Condition (HAC) Analysis Report for Raton, New Mexico

Dear Mayor Segotta:

Nutrients are one of the leading causes of water quality impairment in New Mexico surface waters; however, nutrient concentrations necessary to protect aquatic life are very low (<1 mg/L total nitrogen [TN] and <0.1 mg/L total phosphorus [TP]). Most wastewater treatment facilities discharging to surface waters would need water quality based effluent limits ("WQBELs") for nutrients. Moreover, because of the limited available dilution in many receiving waters, many facilities would have WQBELs (whether based on total maximum daily loads or not) that require protective concentrations to be met "end-of-pipe." These required WQBELs might not be economically or technologically achievable for many permittees. A temporary standard for nutrients may help create a clear path to compliance that is achievable and affordable in the short-term and encourages incremental improvements in the medium and longer-terms.

In 2017, the New Mexico Water Quality Control Commission ("Commission") approved a new water quality standards regulation under 20.6.4 NMAC that created a framework for adopting temporary [water quality] standards. A temporary standard is a regulatory tool that allows progress toward standards attainment that is not currently achievable. In short, a temporary standard is a time-limited designated use and criterion for a specific pollutant(s); may be applied to individual permittees; reflects the highest degree of protection that is feasible; and, will not cause the further impairment or loss of an existing use. A temporary standard does not exempt dischargers from complying with all other applicable standards or control technologies, but rather allows time for the permittee to work towards attaining the underlying water quality standard over a defined period of time with established and reasonably achievable water quality goals.

Following the adoption of this rule, the New Mexico Environment Department's ("NMED") Surface Water Quality Bureau ("SWQB") began a collaborative effort with the U.S. Environmental Protection Agency ("EPA") to apply the framework established in the New Mexico temporary standards regulation for potential water quality standards changes related to nutrients, specifically to help demonstrate that the nutrient standard is not currently attainable because, "controls more stringent than those required by sections 301(b) and 306 of the [Clean Water] Act would result in substantial and widespread economic and social impact." [40 CFR 131.10(g)(6)]. A handful of facilities were selected to be "demonstration facilities" based on their economic and wastewater infrastructure characteristics, and receiving water impairment status, including the City of Raton Wastewater Treatment/Reclamation Facility (National Pollutant Discharge Elimination System ("NPDES") Permit No. NM0020273). The five demonstration facilities represent a wide array of communities and treatment technologies with the intent to establish a framework to effectively implement temporary standards for nutrient management and pollutant reductions in New Mexico under a variety of social, economic, and environmental conditions. NMED has been in communication with Raton and the New Mexico Municipal League regarding this project, and would welcome working closely with the City of Raton to pursue a nutrient temporary standard.

Enclosed for your review is the *Substantial and Widespread Economic and Social Impact and Highest Attainable Condition ("HAC") Analysis Report for Raton, New Mexico*. This report was prepared by Tetra Tech, Inc. and ECONorthwest for the EPA and NMED. This report provides (1) a brief characterization of Raton's wastewater treatment facility's current performance and evaluation of the controls that would be required to meet nutrient WQBELs, (2) cost estimates for attaining nutrient WQBELs for total nitrogen and total phosphorus and an analysis of the affordability for the community based on publicly available information, and (3) evaluation of various levels of incremental nutrient reductions that Raton could achieve through upgrades including the estimated costs of these upgrades and analysis of their affordability for the community, again, based on publicly available information.

The **overall outcome** of the analysis was that reverse osmosis ("RO") was the only available technology that would approach the concentrations necessary to meet the nutrient water quality standard (<1 mg/L TN and <0.1 mg/L TP); however, **installation and operation of an RO treatment system would likely cause substantial and widespread economic and social impacts to the community**. *So, the question is, what technology is available for nutrient removal that would not cause substantial and widespread impacts?*

The report details several treatment options for a temporary standard petition, shown below in **Table 1**. As stated previously, a temporary standard creates a path to compliance by encouraging incremental improvements over time. NMED recognizes that the nutrient standard is currently not achievable, but also believes that Raton can make tangible progress towards achieving the standard. NMED views Option A and Option C, highlighted below, as potential goals (i.e., highest attainable condition, "HAC") for the Raton wastewater treatment facility, depending on the term of the temporary standard. For example, a temporary standard with a HAC of 5.0 mg/L TN and 0.5 mg/L TP might be justified for 8 years, whereas a temporary standard with a HAC of 3.0 mg/L TN and 0.5 mg/L TP might be justified for 14 years (**Table 2**). Other options evaluated in the report either do not require additional TP treatment (Option B) or are approaching mid-range to substantial impacts to the community (Options D-F).

The report, as provided, addresses only the substantial and widespread economic and social impact analyses for reverse osmosis ("RO") and several other options for optimizing or modifying existing wastewater treatment processes to achieve greater nutrient reductions.

The report does not consider other options such as pollutant minimization[1], reuse, or land application. If Raton pursues a nutrient temporary standard, the temporary standard petition should consider a full array of options including various treatment options to evaluate which option or combination of options would result in the highest attainable condition or would achieve the underlying standard.

Table 1. Evaluation of Options for Highest Attainable Condition – "HAC"

Option	Description of Technology	Performance	Cost of Option (% MHI)	NMED Interpretation
Option A	Additional Optimization + Chemical Precipitation	5.0 mg/L TN 0.5 mg/L TP	0.9	Likely not substantial impact
Option B	Denitrification Filters + No additional TP treatment	3.0 mg/L TN 2.2 mg/L TP	1.1	Low impact/ impact unclear
Option C	Denitrification Filters + Chemical Precipitation	3.0 mg/L TN 0.5 mg/L TP	1.2	Low impact/ impact unclear
Option D	Optimize Cycle Times + Chemical Precipitation and Filtration	7.0 mg/L TN 0.1 mg/L TP	1.4	Mid-range impact
Option E	Additional Optimization + Chemical Precipitation and Filtration	5.0 mg/L TN 0.1 mg/L TP	1.5	Mid-range impact
Option F	Denitrification Filters + Chemical Precipitation and Filtration	3.0 mg/L TN 0.1 mg/L TP	1.8	Approaching substantial impact

% MHI = percent of median household income spent on sewage bill; current sewage bill is 0.74% MHI.

Table 2. Steps and approximate times for permittee to achieve the treatment requirements.

Description of Step	Approximate Time to Complete
1. Implementation of advanced operational strategies to reduce nutrients using existing infrastructure. Evaluate effects of operational changes and fine tune as necessary. Preliminarily assess the feasibility of reuse, etc.	**2-3 years**
2. Hire an engineer to prepare a preliminary engineering report (PER) that evaluates options for chemical precipitation (and denitrification filters) that lead to further nutrient reductions and build upon developed operational strategies. Begin discussion with funding agencies.	**1-2 years**
3. Go through funding agency timelines and requirements for planning, if necessary. This may involve legislative approval, depending upon the funding sought. Implement minor facility improvements, if appropriate, and fine tune operations for further TN and TP reductions.	**2-3 years**
4. Design capital improvements. Go through the Department (NMED) and/or other funding agency review and approval processes for the design/bidding phase. Bid major capital project.	**1-2 years**
5. Construct project, including reuse, if appropriate. Begin operating new infrastructure and fine tune operations. Continue with advanced operational training with new infrastructure. Evaluate nutrient reductions achieved.	**1-4 years**

1 A pollutant minimization program (PMP) is a structured set of activities to improve processes and pollutant controls that will prevent and reduce pollutant loadings. A permittee shall submit a PMP to NMED once the permittee achieves the identified HAC treatment requirements. Following review and approval, the PMP will be incorporated into the permittee's next NPDES permit. If a permittee achieves the HAC treatment requirement for only one nutrient parameter (i.e., either TN or TP), but not both, then the permittee shall develop and implement a PMP for the achieved nutrient parameter while continuing to work toward the HAC treatment requirement for the other nutrient parameter.

The next step in this process would be to review and refine cost estimates, as necessary, to support a HAC determination and duration for the temporary standard. If desired, NMED will work with the City of Raton to submit a formal nutrient temporary standard petition to the New Mexico Water Quality Control Commission ("Commission") for review and approval. If the Commission adopts the temporary standard, then NMED would submit documentation to EPA for final review and approval. At that point, if EPA approves the temporary standard proposal, then the temporary standard would become effective for Clean Water Act purposes under Section 303(c) of the Act and subsequently would be incorporated into Raton's NPDES permit No. NM0020273.

We appreciate the opportunity to present this report and would like to extend an invitation to follow-up with you and your staff in person or by teleconference at your convenience to discuss any questions or next steps the City may be considering as an outcome of this report. I am available by phone at (505) 827-2819 or by email at shelly.lemon@state.nm.us.

Sincerely,

Shelly Lemon

Shelly Lemon, Bureau Chief
Surface Water Quality Bureau
New Mexico Environment Department

Enclosures

Cc: Scott Berry, Raton City Manager, 224 Savage Ave., P.O. Box 910, Raton, NM 87740
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Kris Barrios, SWQB (via email kristopher.barrios@state.nm.us)

ATTACHMENT 3

Effluent TN Conc. and pH

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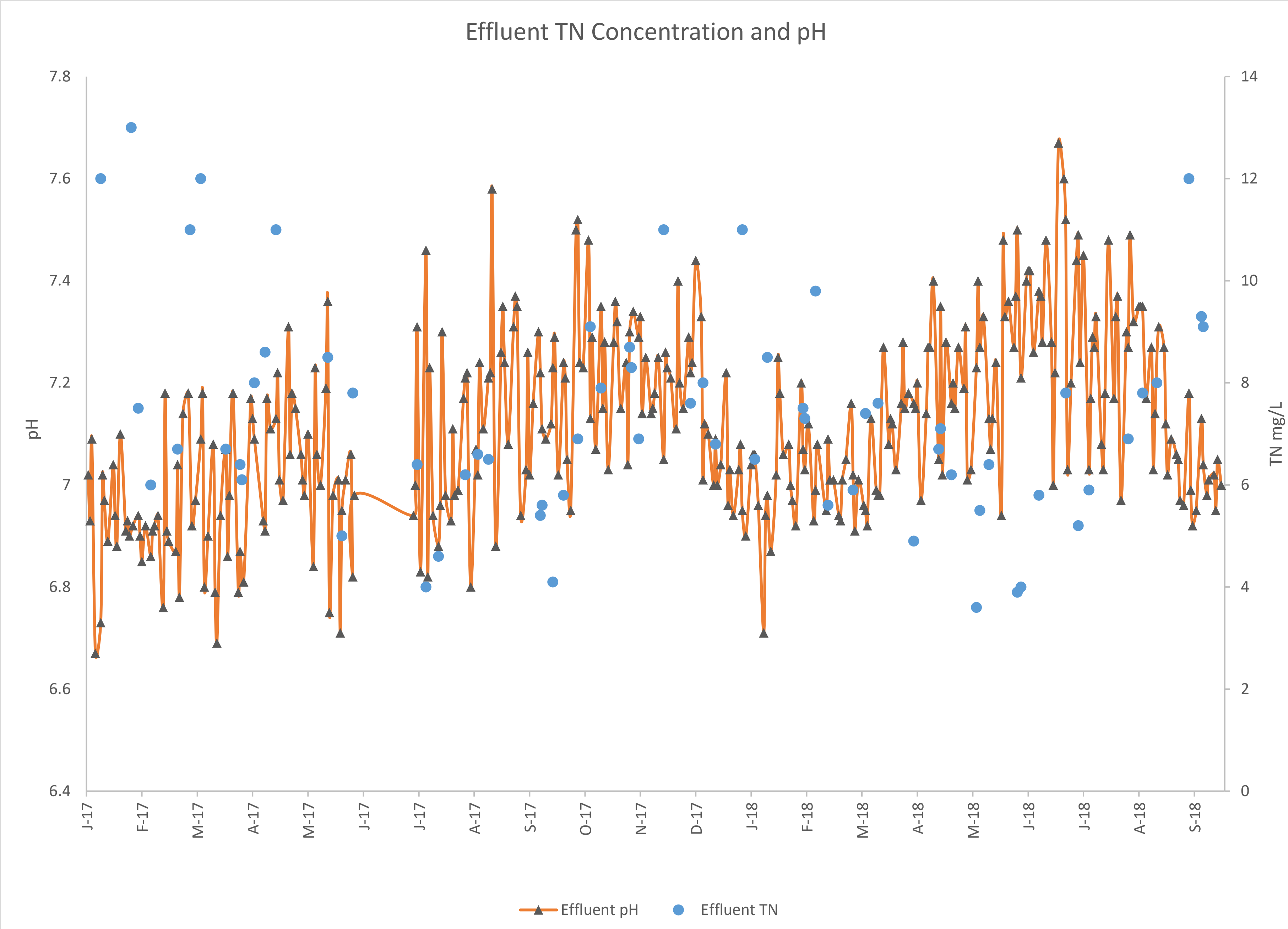

Effluent TN Concentration and pH
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
pH
14
12
10
8
6
4
2
0
TN mg/L
J-17
F-17
M-17
A-17
M-17
J-17
J-17
A-17
S-17
O-17
N-17
D-17
J-18
F-18
M-18
A-18
M-18
J-18
J-18
A-18
S-18
Effluent pH
Effluent TN

ATTACHMENT 4

NURO Controller

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OSCAR Knows ICEAS Nutrient Control

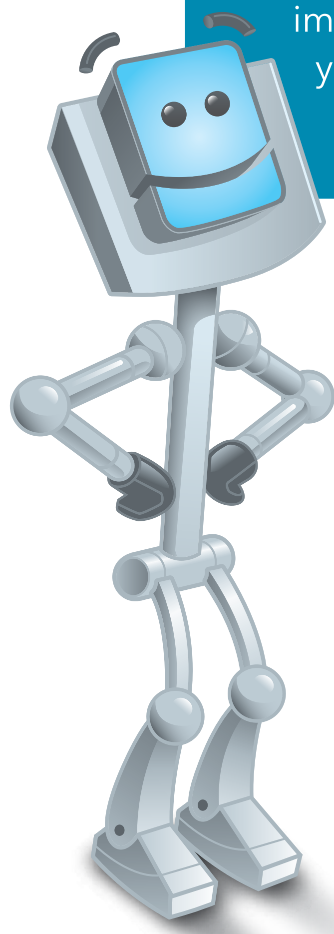
REAL-TIME MONITORING | REAL-TIME CONTROL | REAL-TIME SAVINGS

OSCAR process performance optimizer with NURO controller is a tailor-made control system for the Sanitaire ICEAS advanced SBR. It combines the operational flexibility provided by the ICEAS system with advanced process control to improve the treatment capacity while reducing operational cost.

If you can't measure it, you can't control it. Robust WTW/YSI sensors are used to measure dissolved oxygen, temperature and ammonia. The OSCAR system uses more data from the sensors than just the process variables, because smart sensors should mean smart control.

Keeping plant operations staff in mind. Operator friendly screens enable simple adjustment of setpoints and flexibility to freely adjust cycle operation to a plant's needs.

Is saving energy while ensuring you meet your permit important to you?

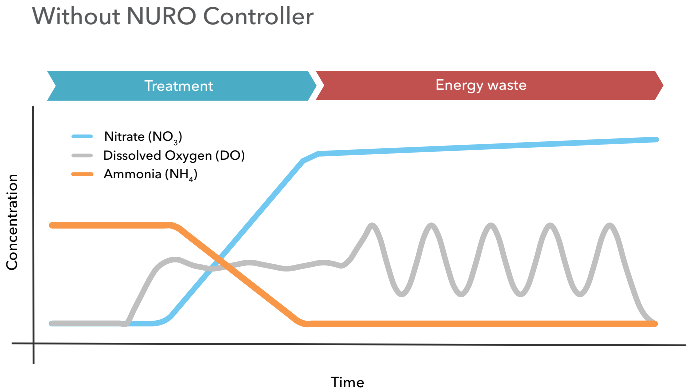


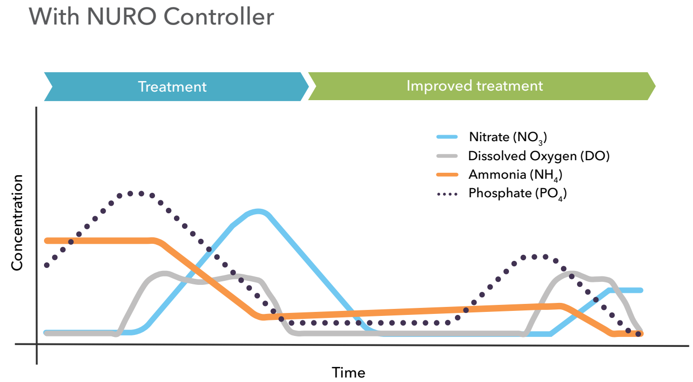
SANITAIRE

a xylem brand

Biological Nutrient Removal Optimized

Most SBR treatment systems use pre-defined aeration and mixing periods. As the load and conditions vary with day, week and season, this pre-defined cycle is seldom optimal for the current conditions. As a result, plants are not only wasting energy but are not using their plants full capacity.





Without nutrient control, low loaded treatment cycles are only partially used for treatment. Once the organic and ammonia load is treated, the remaining aeration time results in unstable aeration control and wasted energy. With the NURO controller, aeration is automatically adjusted to the current cycle need, shifting the previous energy waste to improved treatment.

- **NURO controller stabilizes treatment:** The NURO controller uses online measurements of ammonia and temperature to ensure the effluent ammonia is always in compliance.
- **NURO optimizes nitrogen removal:** Excessive aeration and high oxygen concentrations inhibit denitrification. As influent load varies over the day and season, the NURO controller automatically shuts the blower off when not needed, allowing for anoxic conditions.
- **NURO enables biological phosphorus removal:** The NURO controller automatically optimizes conditions for biological phosphorus removal. With the continuous carbon source of the Sanitaire ICEAS system, the NURO controller uses the full treatment cycle to maximize biological phosphorus release and uptake as the current conditions allow.
- **NURO reduces energy:** Excessive aeration is not only hurting the process but also cost money. With the OSCAR system controlling the ICEAS process, energy savings of 20% can be realized.
- **NURO reduces the need for chemicals:** By optimizing the conditions for removing phosphorus biologically, the OSCAR system can reduce or even eliminate the need to add chemicals.
- **NURO protects equipment:** Excess aeration during underloaded conditions results in unstable oxygen control, often requiring unnecessary starts and stops of the blowers. The NURO controller reduces the blower wear by reducing the starts and stops on the blower by up to 50%.

Backed by Sanitaire biological process expertise and supported by Xylem's suite of premium products, the OSCAR ensures process optimization. Optimal treatment starts with optimized nutrient control. Let one of our process experts show you how the OSCAR system takes the guesswork out of nutrient control.

SB035-2549 • Sanitaire OSCAR NURO Control Sell Sheet • 11/2017 • NACT

Kee Venkatapathi

From:	Marc Hatfield <mhatfield@isiwest.com>
Sent:	Friday, October 26, 2018 2:48 PM
To:	Kee Venkatapathi; Mark Dahm
Subject:	Raton NM - Price for Sanitaire NURO control

Kee and Mark:

I understand you have requested a budget price for Sanitaire's NURO control system.

*Budget price for NURO controller is **$37,200** – which would include:*

- *One (1) YSI IQ SensorNet (IQSN) 2020XT modular water quality system with terminal controller and analyzer capable of controlling up to 20 sensors with communication back to the ICEAS® control panel. Necessary mounting hardware included.*
- *Two (2) YSI FDO 700 IQ dissolved oxygen (DO) sensors, including mounting hardware, to connect to the IQSN system.*
- *Two (2) YSI VARiON 700 IQ ammonia/nitrate sensors, including mounting hardware, to connect to the IQSN system.*
- *NURO control algorithm programmed into the PLC to operate with the blowers and sensors.*

Best,

Marc Hatfield | *isi*WEST Environmental Equipment
cell: 970.231.3699 | office: 970.535.0571
4175 Mulligan Drive | Longmont, CO 80504
www.isiwest.com

ATTACHMENT 5

Alkalinity Dosage

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Alkalinity Addition- Option A

Parameter	Current Average Flow	Design Flow
Alkalinity addition rate	157 mg/L @ 0.62 MGD	157 mg/L @ 0.9 MGD
Alkalinity adjustment chemical	Sodium Hydroxide (Caustic Soda)	
Solution strength	50% by weight	
Daily solution dosing rate at Max. Month flow	83 gal/day (3.5 gal/hr)	121 gal/day (5 gal/hr)
Dosing pump operating range	1 to 8 gal/hr	

1) Based on influent TKN conc. of 55 mg/L, Effluent NO_3 concentration of 3 mg/L and effluent ammonia concentration of 1 mg/L
2) Assumed Influent Alkalinity- 125 mg/L, Effluent Alkalinity-75 mg/L

Alkalinity Addition- Option A1

Parameter	Current Average Flow	Design Flow
Alkalinity addition rate	164 mg/L @ 0.62 MGD	164 mg/L @ 0.9 MGD
Alkalinity adjustment chemical	Sodium Hydroxide (Caustic Soda)	
Solution strength	50% by weight	
Daily solution dosing rate at Max. Month flow	87 gal/day (4 gal/hr)	126 gal/day (5 gal/hr)
Dosing pump operating range	1 to 8 gal/hr	

1) Based on influent TKN conc. of 55 mg/L, Effluent NO_3 concentration of 5 mg/L and effluent ammonia concentration of 1 mg/L
2) Assumed Influent Alkalinity- 125 mg/L, Effluent Alkalinity-75 mg/L

Alkalinity Addition- Option C

Parameter	Current Average Flow	Design Flow
Alkalinity addition rate	171 mg/L @ 0.62 MGD	171 mg/L @ 0.9 MGD
Alkalinity adjustment chemical	Sodium Hydroxide (Caustic Soda)	
Solution strength	50% by weight	
Daily solution dosing rate at Max. Month flow	91 gal/day (3.8 gal/hr)	132 gal/day (5.5 gal/hr)
Dosing pump operating range	1 to 8 gal/hr	

1) Based on influent TKN conc. of 55 mg/L, Effluent NO_3 to tertiary treatment concentration of 7 mg/L and effluent ammonia concentration of 1 mg/L
2) Assumed Influent Alkalinity- 125 mg/L, Effluent Alkalinity-75 mg/L

ATTACHMENT 6

Coagulant Dosage

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Coagulant Addition- Option A and Option A1

Parameter	Current Average Flow	Design Flow
Coagulant Addition Chemical	Alum (Aluminum Sulfate Solution)	
Solution strength	50% by weight	
Daily solution dosing rate	23 gal/day (0.9 gal/hr)	37 gal/day (1.5 gal/hr)
Dosing pump operating range	0.5 to 5 gal/hr	

1) Assumed TP of 3.3 mg/L after biological assimilation to be reduced to 1 mg/L.
2) Daily dosing rate includes 25% safety factor to account for field conditions

Coagulant Addition- Option C

Parameter	Current Average Flow	Design Flow
Coagulant Addition Chemical	Alum (Aluminum Sulfate Solution)	
Solution strength	50% by weight	
Daily solution dosing rate	28 gal/day (1.1 gal/hr)	45 gal/day (1.8 gal/hr)
Dosing pump operating range	0.5 to 5 gal/hr	

3) Assumed TP of 3.3 mg/L after biological assimilation to be reduced to 0.5 mg/L.
4) Daily dosing rate includes 25% safety factor to account for field conditions

ATTACHMENT 7

External Carbon Dosage

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External Carbon Addition- Option A

Parameter	Current Average Flow	Design Flow
External Carbon Chemical	Micro-C 2000	
Current Design Effluent Nitrate	9 mg/L	
Option A Effluent Nitrate	3 mg/L	
Daily solution dosing rate	20 gal/day (0.8 gal/hr)	31.5 gal/day (1.3 gal/hr)
Dosing pump operating range	0.1 to 5 gal/hr	

External Carbon Addition- Option A1

Parameter	Current Average Flow	Design Flow
External Carbon Chemical	Micro-C 2000	
Current Design Effluent Nitrate	9 mg/L	
Option A1 Effluent Nitrate	5 mg/L	
Daily solution dosing rate	13 gal/day (0.5 gal/hr)	21 gal/day (0.8 gal/hr)
Dosing pump operating range	0.1 to 5 gal/hr	

External Carbon Addition- Option C

Parameter	Current Average Flow	Design Flow
External Carbon Chemical	Micro-C 2000	
Current Design Effluent Nitrate	9 mg/L	
Option C Effluent Nitrate	1 mg/L	
Daily solution dosing rate	26 gal/day (1 gal/hr)	42 gal/day (1.7 gal/hr)
Dosing pump operating range	0.2 to 5 gal/hr	

Micro-C dosage calculated based on theoretical nitrate to Micro-C ratio. Tertiary filter Micro-C consumption might vary.

ATTACHMENT 8

Current PFD

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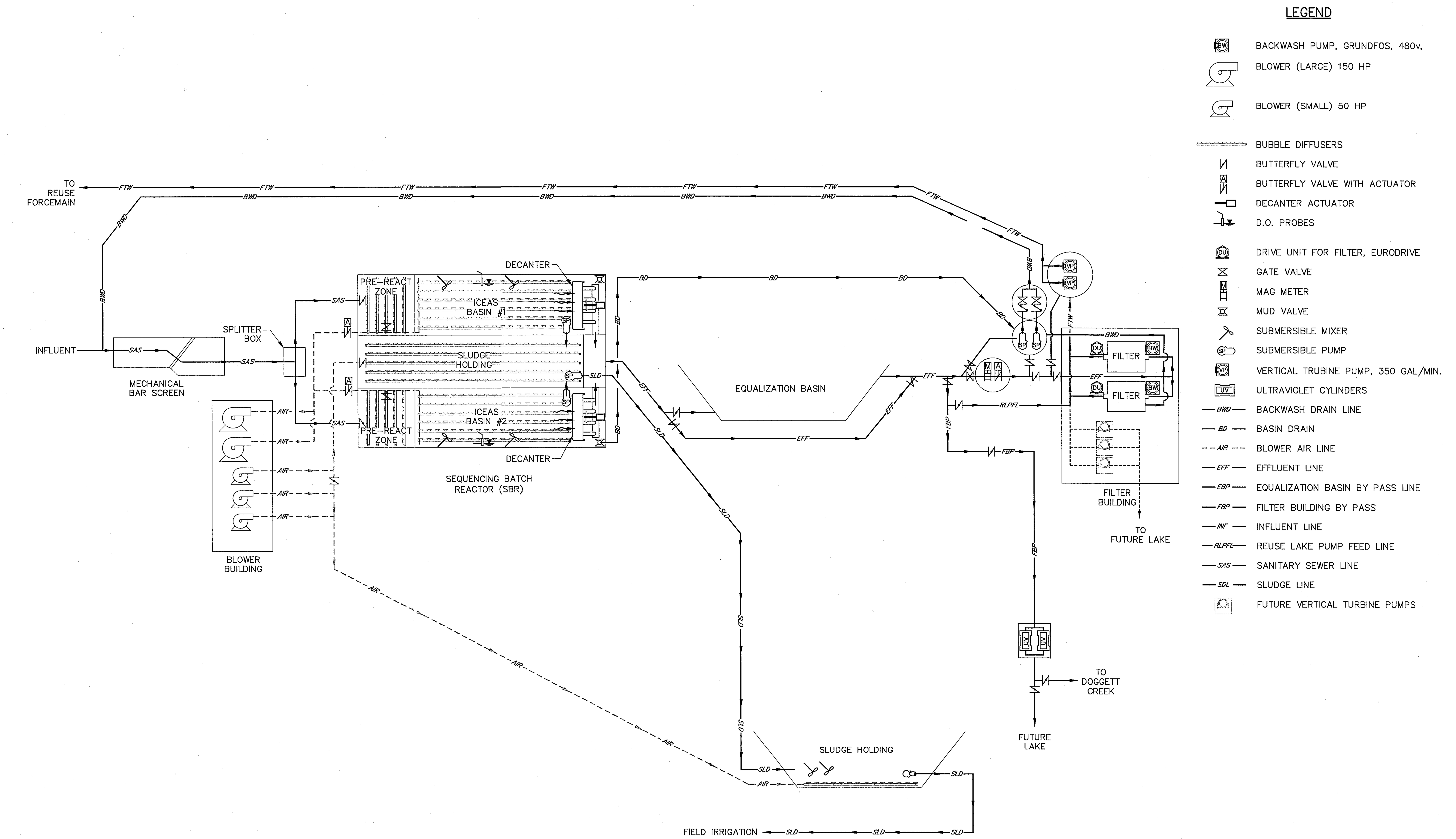

PROCESS FLOW DIAGRAM

NOT TO SCALE

REVISIONS

NO.	DESCRIPTION	DATE	BY

WILSON & COMPANY
4900 LANG AVE. N.E.
ALBUQUERQUE, NM 87109

	INITIALS	DATE
DESIGNED BY	BJA	3/05
DRAWN BY	DAH/ZAS	3/05
CHECKED BY	BJA	3/17
REVIEWED BY	RJP	3/17

CITY OF RATON, NM
WASTEWATER TREATMENT FACILITY IMPROVEMENTS

PROCESS FLOW DIAGRAM

PROJECT NO. X0-210-047

DATE 12/15/04

DRAWING NO. P1

SHEET NO.

ATTACHMENT 9

Current Sanitaire Design

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Project Name: Raton WWTP, NM USA

Sanitaire Number: 06-6275A **Process:** 2-Basin NDN

	US Units		Metric or SI Units	
Influent Wastewater Characteristics and Site Conditions				
ADWF	900,000	gpd	3,407	m^3/day
PDWF	1,800,000	gpd	6,814	m^3/day
PWWF	2,700,000	gpd	10,221	m^3/day
BOD_5 Conc. (at 20°C)	265	mg/L	265	mg/L
BOD Loading	1,989	lb/day	903	kg/day
TSS Conc.	300	mg/L	300	mg/L
TSS Loading	2,252	lb/day	1022	kg/day
NH_3-N Conc.	60	mg/L	60	mg/L
NH_3-N Loading	450	lb/day	204	kg/day
Alkalinity required (minimum)	230	mg/L	230	mg/L
Wastewater Temperature	10 to 20	°C	10 to 20	°C
Ambient Air Temperature	-7 to 33	°C	-7 to 33	°C
Site Elevation	6,600	ft	2,012	m
Effluent Quality Requirements				
BOD_5 Conc. (at 20°C)	10	mg/L	10	mg/L
TSS Conc.	10	mg/L	10	mg/L
Total Nitrogen Conc.	10	mg/L	10	mg/L
Basin Design				
Number of Basins	2	basins	2	basins
Basin Length	129.00	ft	39.32	m
Basin Width	43.00	ft	13.11	m
TWL	15.00	ft	4.57	m
BWL	11.12	ft	3.39	m
Basin Volume at BWL	461,418	gallons	1,747	m^3
Basin Volume at TWL	622,417	gallons	2,356	m^3
Design Parameters per Basin				
F/M Ratio	0.0532	lb BOD/lb MLSS-day	0.0532	kg BOD/kg MLSS-day
SVI (after 30 min settle)	150	mL/gm (max)	150	mL/gm (max)
MLSS (at BWL, design loading)	4,874	mg/L	4,874	mg/L
HRT	1.18	days	1.18	days
SRT	24.78	days	24.78	days
Normal Decant Rate	3,297	gpm	12	m^3/min
Peak Decant Rate	4,500	gpm	17	m^3/min
WAS Produced (mass)	718	lb/day	326	kg/day
WAS Produced @ 0.85% solids	10,125	gpd	38	m^3/day

Project Name: Raton WWTP, NM USA
Sanitaire Number: 06-6275A

ICEAS 2-Basin NDN Normal Cycle 288 mins (4.8 hours)

	0	24	48	72	96	120	144	168	228
Basin #1	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	SETTLE (60 min)	DECANT (60 min)

End: 288

	168	228	288/0	24	48	72	96	120	144
Basin #2	SETTLE (60 min)	DECANT (60 min)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)	AIR OFF (24 min Mix)	AIR ON (0-24 min)

End: 168

ICEAS 2-Basin NDN Storm Cycle 216 mins (3.6 hours)

	0	18	36	54	72	90	108	126	171
Basin #1	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	SETTLE (45 min)	DECANT (45 min)

End: 216

	126	171	216/ 0	18	36	54	72	90	108
Basin #2	SETTLE (45 min)	DECANT (45 min)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)	AIR OFF (18 min Mix)	AIR ON (0-18 min)

End: 126

Notes:
Each basin fills continuously over entire cycle.
"Air On" periods in the react phase are programmable from 0 to 24 minutes.
Sludge wasting occurs during the decant phase, pump run time is programmable.
During the storm cycle, the time segments are reduced by 25% to accommodate additional flow.

ATTACHMENT 10

Tertiary Filter Vendor Proposal

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Nexom™

CITY OF RATON, NM

Design, Supply and Inspection of a Blue Nite® Treatment System
October 24, 2018

BlueNite®

BluePRO®

technologies for cleaner water

323 N. Spokane St. Suite 200 · Post Falls ID · 83854
888·710·2583 • **www.nexom.com**

Project Overview

A Blue PRO® Wastewater Treatment system is proposed for City of Raton, NM. The proposed system design would consist of the following processes and technologies:

- Blue Nite continuous backwash up-flow sand filtration system with carbon source dosing system for nitrate removal and filtration.
- Blue PRO continuous backwash up-flow sand filtration system with ferric dosing system for phosphorus removal and filtration.

Treatment Design Parameters

		Influent	Effluent
Design Average Daily Flow (ADF)	MGD		0.9
Peak Day Flow (PDF)	MGD		1.8
Peak Hour Flow (PHF)	MGD		1.8
Duty Filtration Area	ft^2	384	
Filter Flux at PDF/PHF	gpm/ft^2	3.44	
Alkalinity	mg/l	50 to 120	
pH		6.5 to 8.0	
Total Suspended Solids (TSS)	mg/l	12.5	<5
Total Phosphorus (TP)	mg/l	3	0.5
SNRP	mg/l	0.1	0.1
Dissolved Oxygen (DO)	mg/L	2	
Total Nitrogen (TN)	mg/L	10	3
Nitrate + Nitrite (NO_x-N)	mg/L	8	1

- This design was computed at 48-inches hydraulic head. Other head profiles can be considered.
- The alkalinity and pH envelope is required for design conditions for the chemical regime described.
- The design provides a total of 4 filter cells, including 3 duty filters cells and 1 duty-standby filter cell.
- The Blue Nite system will remove only nitrate-N.

Blue Nite® Biologically Active Filters

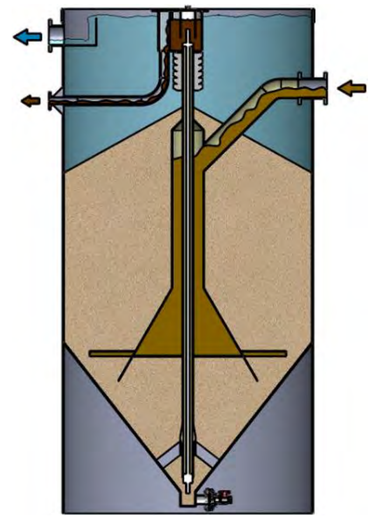
The Blue Nite Biologically Active Filters (BAF) utilizes injected carbon source to accomplish denitrification and polish TSS and other trace contaminants. With an appropriate design envelope and controls Blue Nite can maintain target discharge nitrate nitrogen as low as <1 mg/L NO_x-N.

Continuous backwash filters provide removal of contaminants without the interruption of backwash cleaning cycles. Design hydraulic loading rates in Blue Nite filters are dependent on heterotrophic respiration rates, influent nitrate levels, nitrate variability, dissolved oxygen (DO) levels, and expected range in water temperature. Loading rates can also be dictated by the NPDES permit or local regulatory agencies. Nexom's design parameters coupled with its proprietary control system optimizes system parameters to maintain a healthy, stable biomass for denitrification.

The nitrogen and carbon dioxide gases produced during cellular respiration are primarily released from the process as the media passes through the airlift. Removal of gas in this fashion has several benefits that include: eliminating false readings in headloss, eliminating the need to backwash because of gas entrainment, and eliminating the gas bump or upset gas "burps" due to significant nitrogen bubble accumulation typical in static bed filters.

The Blue Nite system is available in several models and configurations, and can be integrated simultaneously with Nexom's Blue PRO process in many cases. The modular nature of the filters allows ease of system engineering and expansion. The filters are available as freestanding fiberglass or stainless steel tank units or can be configured in multi-module concrete cells. Control systems and smaller filters may be mounted on skid systems for mobility or ease of commissioning.

Blue PRO® Reactive Filtration



The Blue PRO process utilizes injected ferric chemistry to accomplish reactive filtration for treating TSS, phosphorus and many other trace elements. With the efficiency of reactive filtration, Blue PRO uses 30% less chemical than comparative technologies for ultra-low phosphorus, thereby also producing less chemical sludge.

With reactive filtration, inlet water is distributed across the cross-sectional area of the filter near the bottom of the media bed. Water flows upward, carrying chemical that also coats the media with hydrous ferric oxide (HFO). Media receives its coating, captures contaminants and moves downward in countercurrent flow by gravity to an airlift pump. The airlift transports the TSS and contaminants up into the washbox where the scoured HFO coating and adsorbed contaminates are separated from the media. Water velocities in the washbox are carefully controlled to carry away the contaminates while allowing the media to fall to the filter bed. The freshly scrubbed media from the washbox is recoated with HFO (regenerated) as its cycle begins again.

Reactive filtration is described in multiple patents, and has been implemented exemplifying these described benefits by engineering consultants throughout North America.

The Blue PRO reactive filtration process overcomes a critical process obstacles to achieving efficient phosphorus and contaminant capture by providing a very large reactive surface area within the media bed, resulting in guaranteed contact of contaminant with HFO and its high adsorptive capacity.

Operation and Maintenance

The anticipated operation and maintenance costs for the BlueNite and BluePRO filter system are presented in the following table:

OPERATION & MAINTENANCE COSTS

*Electrical Rate: **0.08** $/kW-h

	Quantity	Motor Power bhp	Motor Power kW	Monthly cost	Unit cost	Annual Cost	Operating # months
Duty Compressor Motors	1	15	11.2	$653	-	$4,357	12
FerricChloride, 40%, gal/d	37	-	-	$1,125	$1.25	$16,882	12
MicroCglycerin, gal/d	30	-	-	$904	$2.50	$27,113	12
Filter Airlifts	8	-	-	-	$1,800	$2,057	84
Compressor Maintenance	2	-	-	-	$500	$1,000	12
Total Operation & Materials						$51,409	

*Electrical rate estimated by Nexom Inc

DUTY RUN TIME FOR COMPRESSOR MOTORS

Compressor air capacity @100 PSIG, SCFM	63
Air required for all filters, SCFM	35
Duty factor	56%

OPERATOR LABOUR

The sand filter system will require one operator approximately 0.5 - 1.0 hour per day for routine inspection & maintenance.

Scope of Supply

- Nexom Documentation
    - Process design calculations
    - CAD Drawings, specifications and equipment manuals
- Eight (8) Model CF64-80 FRP Centra-flo filters cones for installation in reinforced concrete cells
- Eight (8) Model CF64-80 filter internals
- Eight (8) HDPE airlifts
- Four (4) effluent cell weir
- Four (4) airlift control panel(s)
- One (1) pneumatic system including duty and duty standby rotary screw compressors, filtration and refrigerated dryers.
- Two (2) chemical feed system(s) with online duty and duty-standby pump
- One (1) lot aluminum covers and supports over filters
- One (1) lot sand media
- Equipment inspection, commissioning, start-up:
    - Two (2) trips including up to eight (8) days onsite

EXCLUSIONS

- Material offloading, storage and equipment installation
- Civil works including power hookup
- Interconnecting process piping, wiring / control wiring of all supplied components and equipment
- Chemicals procurement, storage, injectors and mixing
- Filter tank and access ways
- Filter influent flow signal, required
- Filter isolation valves
- Required PLC for filter system and chemical pump system
- Required process sensors and instruments for biological denitrification controls, unless options added

ADDER CONTROL SYSTEM

- One (1) filter system control panel including Allen-Bradley PLC and PanelView Plus HMI
- One (1) analytical equipment: DO/temp probe and nitrate sensor with controller
- Eight (8) SAM sensors for monitoring filter turnover in the filter bed

Pricing

Price for the design, supply and installation inspection as in the scope described:

$767,800 USD

Shipping allowed to jobsite, before applicable taxes

Prices are valid for 30 days - all prices are subject to final design review

ADDER CONTROL SYSTEM

$120,100 USD

Shipping allowed to jobsite, before applicable taxes

Prices are valid for 30 days - all prices are subject to final design review

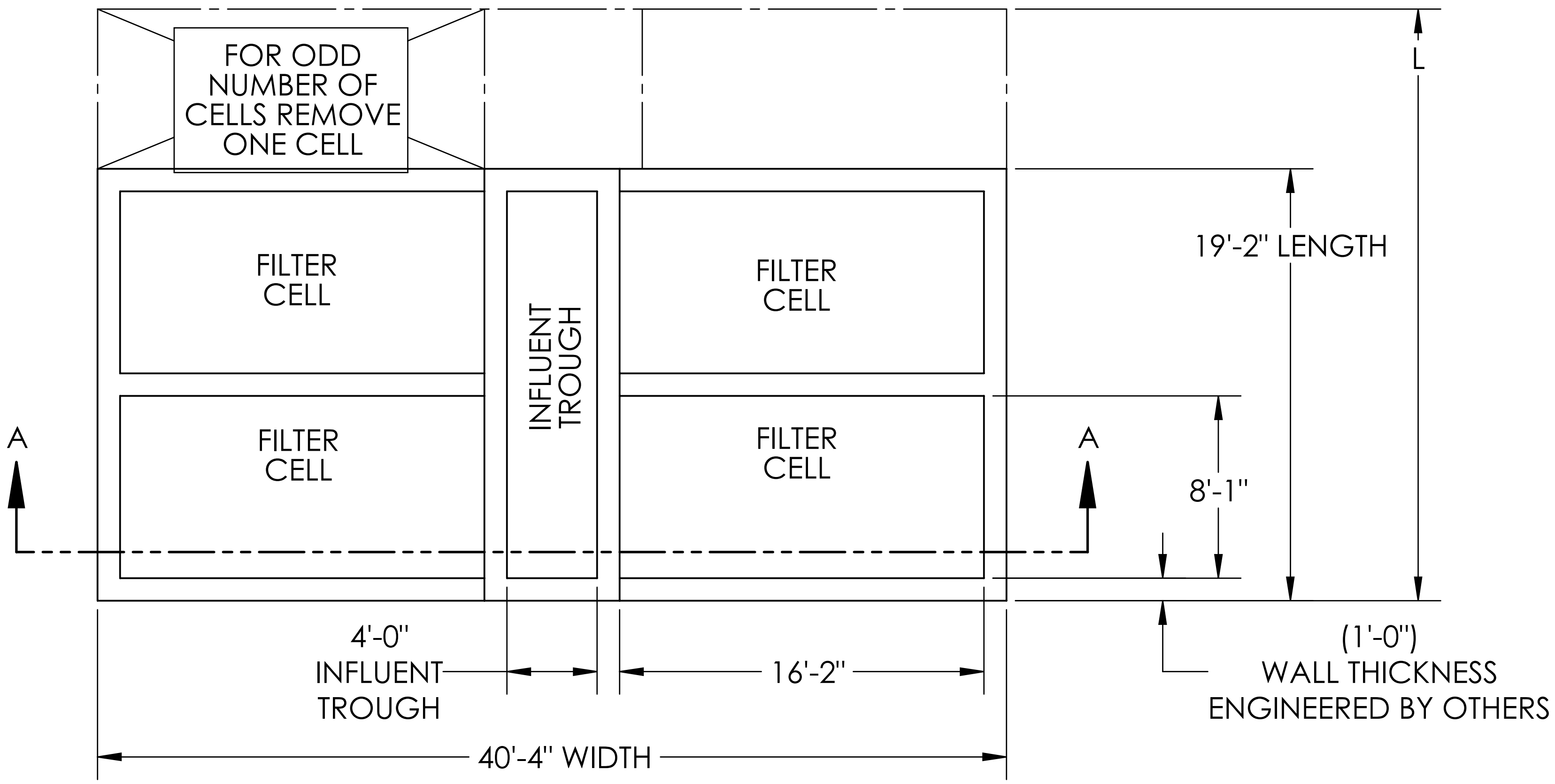
QUESTIONS OR COMMENTS

Any questions or comments can be directed to:

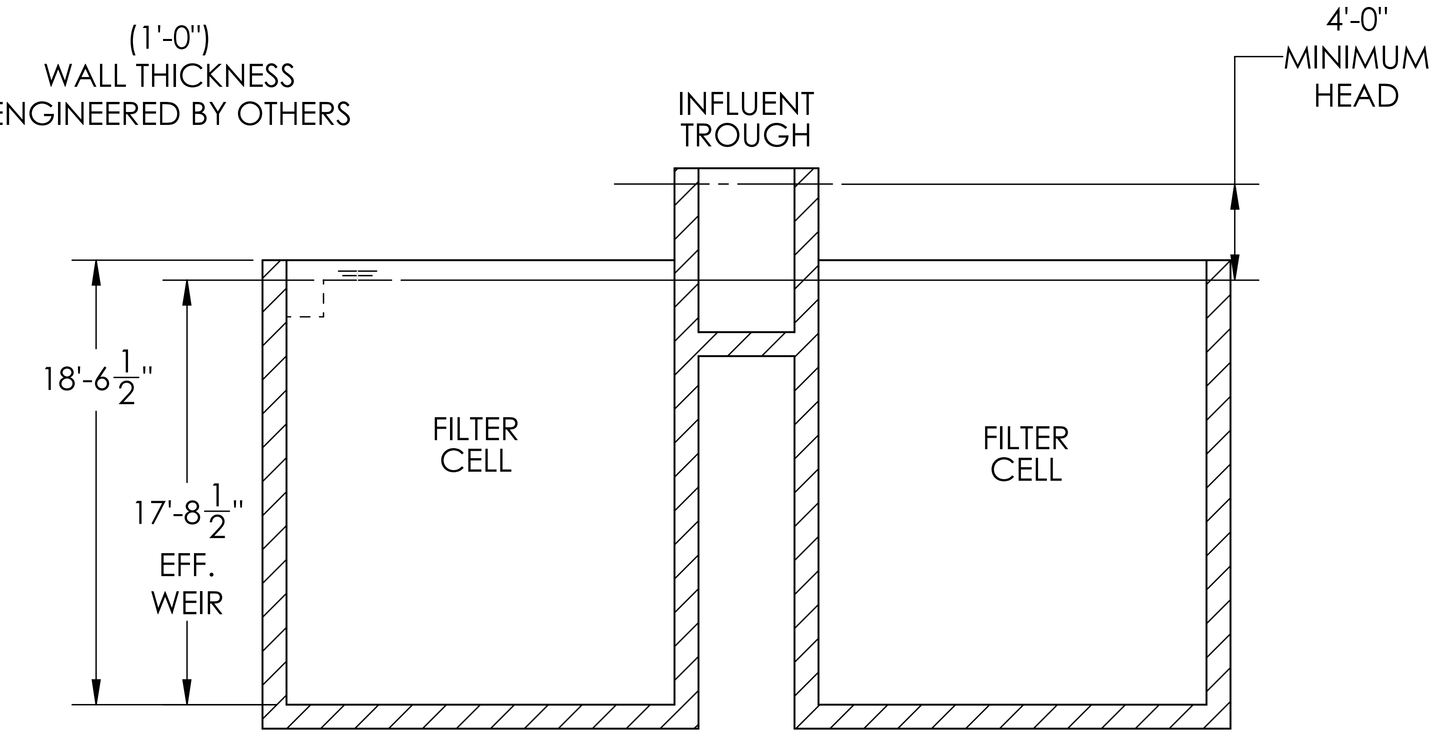
Nexom

323 N. Spokane St. Suite 200
Post Falls ID 83854
262-375-1870
www.nexom.com

REV.	DESCRIPTION	DATE	ECO



PLAN VIEW
4 CELLS SHOWN
OF 2 MODULES EACH



ELEVATION VIEW
SECTION A-A

FOOT PRINT LENGTH L	
NUMBER OF CELLS	OVERALL LENGTH
6	28'3"
8	37'4"
10	46'5"
12	55'6"
14	64'7"
16	73'8"
18	82'9"
20	91'10"

NOTES:

1. DIMENSIONS ARE BASED ON A 1'-0" CONCRETE WALL THICKNESS.
2. DIMENSIONS MAY VARY DEPENDING ON CONCRETE WALL THICKNESS, ENGINEERED BY OTHERS.
3. INFLUENT TROUGH DIMENSIONS MAY VARY DEPENDING ON DESIGN FLOW.
4. FOR ADDITIONAL FOOTPRINT LENGTHS ADD 8'-1" FOR EACH ADDITIONAL CELL.
5. IF AN ODD NUMBER OF CELLS ARE REQUIRED REMOVE ONE CELL AS SHOWN IN THE PLAN VIEW.
6. HEIGHTS MAY VARY DEPENDING ON REQUIRED BED DEPTH AND/OR HYDRAULIC PROFILE.
   - MINIMUM EFFLUENT WEIR HEIGHT = 17' 8 1/2"

DWG SIZE: B
SCALE: 1:96
PAGE: 1 OF 2

PROJECT: Templates
DESCRIPTION: Footprint Drawing, CF64-80BG Dual Center
REV: F
DRAWING NUMBER: CF64-80BG Dual Center

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±1/16"
ONE PLACE DECIMAL ±.125
TWO PLACE DECIMAL ±.030
THREE PLACE DECIMAL ±.010
ANGULAR ±2.0°
THIRD ANGLE PROJECTION

COMPANY CONFIDENTIAL

Nexom
10450 N. AIRPORT RD.
HAYDEN, ID 83835

	NAME:	DATE:
DRAWN BY:	KJennings	7/9/13
CHECKED BY:	BMesserschmidt	7/9/13
PROJECT APPROVAL:	--	--

ATTACHMENT 11

Option A OPC

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Opinion of Proabable Cost- Option A

Division	Description			SUBTOTAL BY DIVISION
1	**GENERAL REQUIREMENTS**			**$ 25,837.50**
7	**THERMAL & MOISTURE PROTECTION**			**$ 22,000.00**
26	**ELECTRICAL**			**$ 141,100.00**
40	**PROCESS INTERCONNECTIONS**			**$ 5,500.00**
46	**WATER AND WASTEWATER EQUIPMENT**			**$ 38,100.00**
			Div 2-Div 49 Subtotal	**$ 206,700.00**
		Subtotal	**SUBTOTAL 1**	**$ 233,000.00**
	CONTRACTOR'S OVERHEAD & PROFIT (See Note 3)	0.0%	of Subtotal 1	$ -
	BONDS AND INSURANCE (See Note 2)	0.0%	of Subtotal 1	$ -
		Subtotal	**SUBTOTAL 2**	**$ 233,000.00**
	CONTINGENCY (See Note 4)	30.0%	of Subtotal 2	$ 69,900.00
		Subtotal	**SUBTOTAL 3**	**$ 303,000.00**
	ENGINEERING COSTS (See Note 5)	15.0%	of Subtotal 3	$ 45,450.00
		Total	**TOTAL**	**$ 349,000.00**

Notes

1	General Requirements includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above	12.5%
2	Payment bond, performance bond, public works bond, general liability & automotive insurance, umbrella coverage, etc.	0%
3	Contractor's overhead and profit include costs for administration, and contractor/subcontractor overhead costs and profits.	0.0%
4	The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.	30.0%
5	Engineering Costs -Costs incurred during Construction	15.0%

ATTACHMENT 12

Option C OPC

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Opinion of Probable Cost - Option C

Division	Description				SUBTOTAL BY DIVISION
1	**GENERAL REQUIREMENTS**				$ 206,300.00
3	**CONCRETE**				$ 135,900.00
5	**METALS**				$ 61,600.00
6	**WOOD, PLASTIC, AND COMPOSITES**				$ 13,200.00
7	**THERMAL & MOISTURE PROTECTION**				$ 22,000.00
9	**FINISHES**				$ 27,500.00
22	**PLUMBING**				$ 12,100.00
26	**ELECTRICAL**				$ 156,200.00
31	**EARTHWORK**				$ 117,500.00
40	**PROCESS INTERCONNECTIONS**				$ 22,000.00
41	**MATERIAL PROCESSING AND HANDLING EQUIPMENT**				$ 3,300.00
43	**PROCESS GAS AND LIQUID HANDLING**				$ 33,000.00
46	**WATER AND WASTEWATER EQUIPMENT**				$ 1,046,100.00
				Div 2-Div 49 Subtotal	**$ 1,650,400.00**
		Subtotal		**SUBTOTAL 1**	**$ 1,857,000.00**
		Subtotal		**SUBTOTAL 2**	**$ 1,857,000.00**
	CONTINGENCY (See Note 4)	30.0%	of Subtotal 2		$ 557,100.00
		Subtotal		**SUBTOTAL 3**	**$ 2,415,000.00**
	ENGINEERING COSTS (See Note 5)	15.0%	of Subtotal 3		$ 362,250.00
		Total		**TOTAL**	**$ 2,778,000.00**

Notes

1	General Requirements includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above	12.5%
2	Payment bond, performance bond, public works bond, general liability & automotive insurance, umbrella coverage, etc.	0%
3	Contractor's overhead and profit include costs for administration, and contractor/subcontractor overhead costs and profits.	0.0%
4	The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.	30.0%
5	Engineering Costs -Costs incurred during Construction	15.0%

ATTACHMENT 13

Option A1 OPC

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Opinion of Probable Cost - Option A1

Division	Description				SUBTOTAL BY DIVISION
1	**GENERAL REQUIREMENTS**				**$ 25,900.00**
7	**THERMAL & MOISTURE PROTECTION**				**$ 22,000.00**
26	**ELECTRICAL**				**$ 141,100.00**
40	**PROCESS INTERCONNECTIONS**				**$ 5,500.00**
46	**WATER AND WASTEWATER EQUIPMENT**				**$ 38,100.00**
				Div 2-Div 49 Subtotal	**$ 206,700.00**
		Subtotal		**SUBTOTAL 1**	**$ 233,000.00**
	CONTRACTOR'S OVERHEAD & PROFIT (See Note 3)	0.0%	of Subtotal 1		$ -
	BONDS AND INSURANCE (See Note 2)	0.0%	of Subtotal 1		$ -
		Subtotal		**SUBTOTAL 2**	**$ 233,000.00**
	CONTINGENCY (See Note 4)	30.0%	of Subtotal 2		$ 69,900.00
		Subtotal		**SUBTOTAL 3**	**$ 303,000.00**
	ENGINEERING COSTS (See Note 5)	15.0%	of Subtotal 3		$ 45,450.00
		Total		**TOTAL**	**$ 349,000.00**

Notes

1	General Requirements includes cost associated with permits, licenses, insurance, environmental safe guards, sediment and drainage control, and special construction practices to maintain continued plant operations. Also includes misc construction materials needed for project not included above	12.5%
2	Payment bond, performance bond, public works bond, general liability & automotive insurance, umbrella coverage, etc.	0%
3	Contractor's overhead and profit include costs for administration, and contractor/subcontractor overhead costs and profits.	0.0%
4	The design continency is added to the subtotal based on the conceptual nature of information developed for this evaluation.	30.0%
5	Engineering Costs -Costs incurred during Construction	15.0%

ATTACHMENT 14

New Drum Filter

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TECHNICAL SPECIFICATION

ROTOFILTER™: RFM 60096

Rotary microscreen drum filters are a cost effective treatment ideal for removal of fine suspended particles from water in many aquaculture, wastewater, and industrial applications.

BENEFITS

- ✓ Manufactured in North America with factory-direct service and support
- ✓ Removes all particles bigger, and a large portion of particles smaller, than the screen aperture.
- ✓ Continuous filtering, even during backwashing.
- ✓ Minimal shearing results in optimal particle removal.
- ✓ Very low operating cost and backwash water consumption.

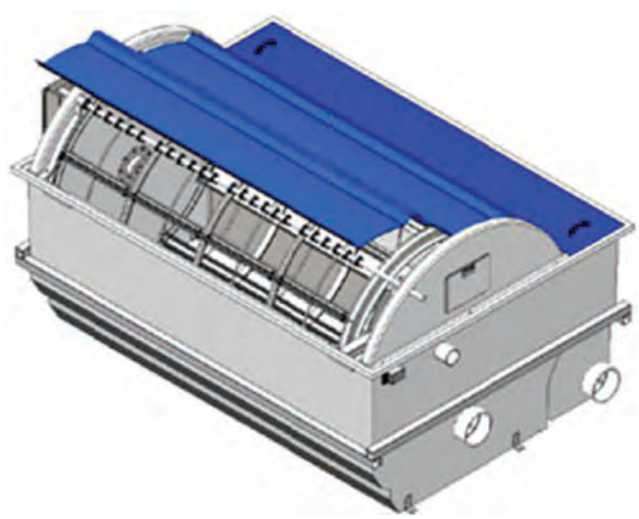
FEATURES

- ✓ Fiberglass enclosure, stainless steel internals, and high quality industrial drive components.
- ✓ Built-in water level control weirs for easy process integration.
- ✓ Injection molded, one-piece screen elements eliminate screen delamination and allows for plugging of small holes with zero down-time.
- ✓ Inlet seal maintains a continuous positive seat against the rotating drum.
- ✓ Elastomeric endplate on drum eliminates fatigue failure.

DESCRIPTION OF OPERATION

Untreated water is gravity fed to the inside of the drum which has fine screens mounted to its periphery. The water flows through the screens while the solids adhere to the screen surface. The filtered water flows out of the filter by gravity.

As particles attach to the screen surface, head loss through the screen increases, causing the water level inside the drum to rise. The rising water contacts a level switch which activates the automatic drum rotation and backwash system. A pressurized spray is used to backwash the solids from the screen into an inclined trough. The solids flow by gravity from the filter for disposal or recovery. Clean screens are rotated into the water, lowering the water level. The backwash system automatically shuts down to save power.



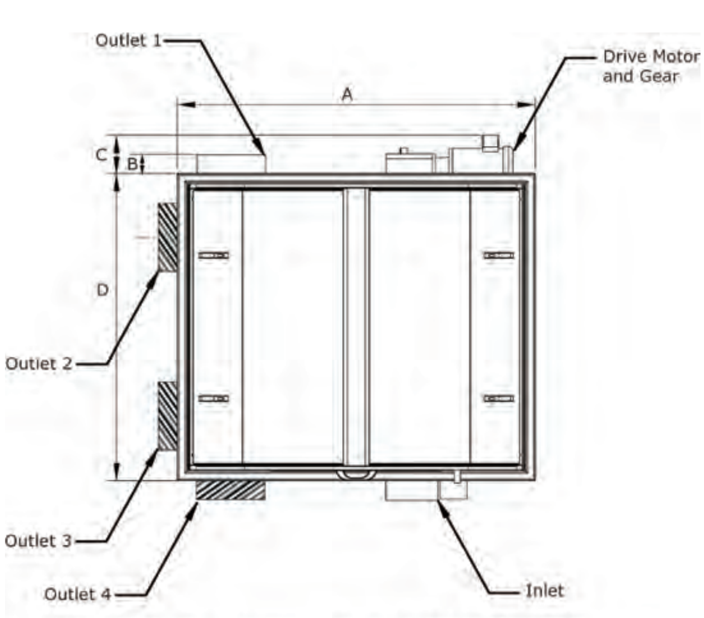
Performance Data					
Maximum Flow Rate (US gpm)[1]	**Mesh Size (microns) - Special Orders Available**				
	21	**30**	**40**	**54**	**80**
Screen Open Area	15%	20%	25%	32%	39%
10 mg/L TSS (intake water, clean flows)	1,829	2,384	4,143	4,867	5,900
15 mg/L TSS (hatchery effluent)	1,649	2,179	3,855	4,545	5,530
25 mg/L TSS (recycle systems – cold water)	519	1,084	2,873	3,610	4,661
25 mg/L TSS (recycle systems – warm water)	343	742	2,007	2,528	3,271
40 mg/L TSS (municipal effluent polishing)	420	453	558	601	663

TECHNICAL SPECIFICATION

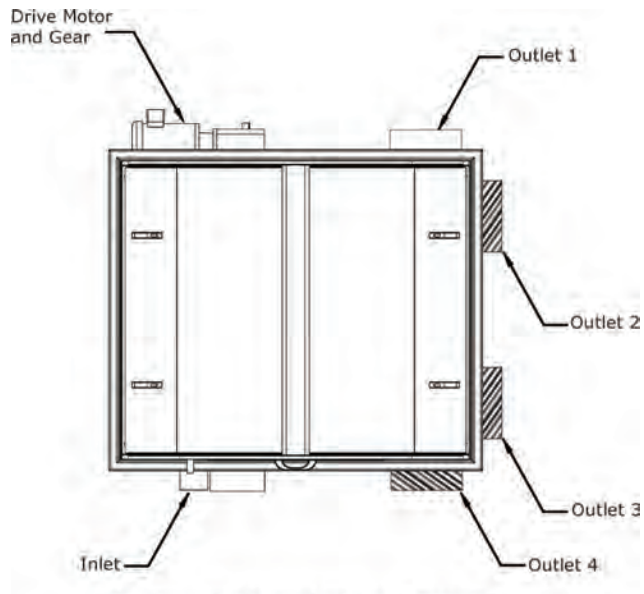
ROTOFILTER™: RFM 60096

Product Information	Standard	Options
Filter Data		
Electrical Supply (V/Ph/Hz)	208/3/60	[120/1/60]; [208/1/60]; [240/1/60]; [240/3/60]; [380/3/60]; [480/3/60]; [575/3/60]
Screen Size (micron)	80	11, 21, 30, 37, 54
Number of Screen Panels	40	
Total Screen Area	102.2 ft²	
Minimum Drum Submergence	40%	
Service Access	Right	Left
Weight Dry/Wet	2500 lbs / 12,200 lbs	
Materials of Construction		
Drum Frame	304 SS	316 SS
Drum Shaft	316 SS	
Metals Passivated	No	Yes
Filter Enclosure	FRP	
Screen Panel	Injection molded polyester fabric embedded in polypropylene grids	
Plumbing	PVC	
Drum Seal	Synthetic elastomer seal	
Plumbing		
Inlet		
Size	20"	8"
Type	Pipe	SOC
Outlet		
Size	20"	8"
Type	Pipe	SOC
Solids Outlet	4" PVC pipe	
Backwash Connection	1.0" NPT	
Drive Motor	Baldor®; 1.0 HP; TEFC	
Running Speed	5 RPM	
Backwash Supply[2]		
Backwash Pump	Goulds®; 2.0 HP; TEFC	
Solenoid	No	Yes
Spray Nozzles	24 at 0.8 Gpm; 100 psi each	
High Level Alarm	Yes	
Control Panel[3]		
Enclosure	NEMA 4X	
Backwash Control	Manual (timer) and Automatic (level control switch)	
Dry Contacts	Run, Trouble, and High Level	
Certification	UL/CSA	

TECHNICAL SPECIFICATION
ROTOFILTER™: RFM 60096

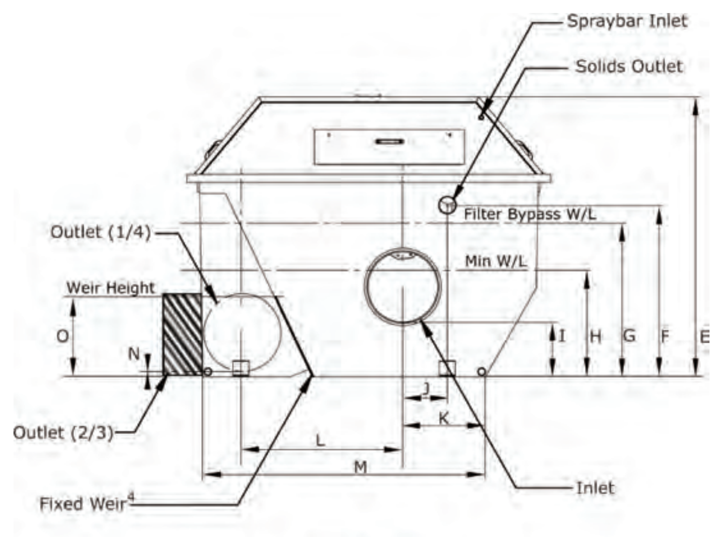


Plan View - Counter Clockwise Rotation (Standard)



Plan View - Clockwise Rotation (Reversed)
Mirror image unit with fitting locations.
All dimensions are same but mirrored around centerline.

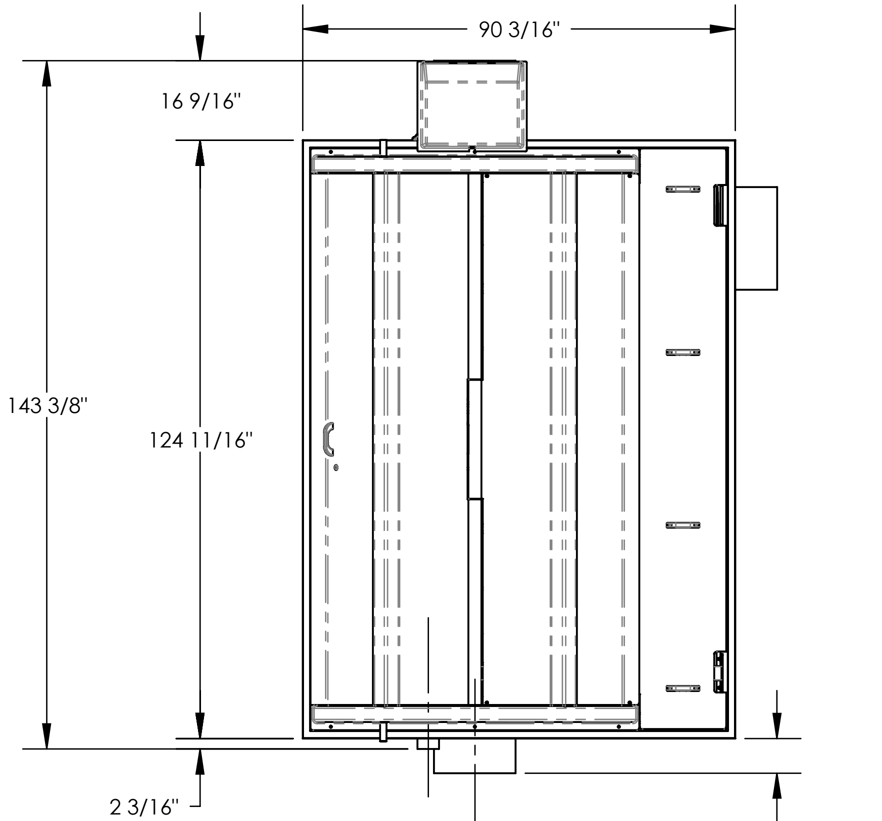
Dimensions	Standard
(A)	91.00"
(B)	N/A
(C)	16.38"
(D)	103.00"
(E)	69.32"
(F)	42.75"
(G)	38.5"
(H)	26"
(I)	13.75"
(J)	10.00"
(K)	35.34"
(L)	39"
(M)	84.75"
(N)	0.58"
(O)	N/A



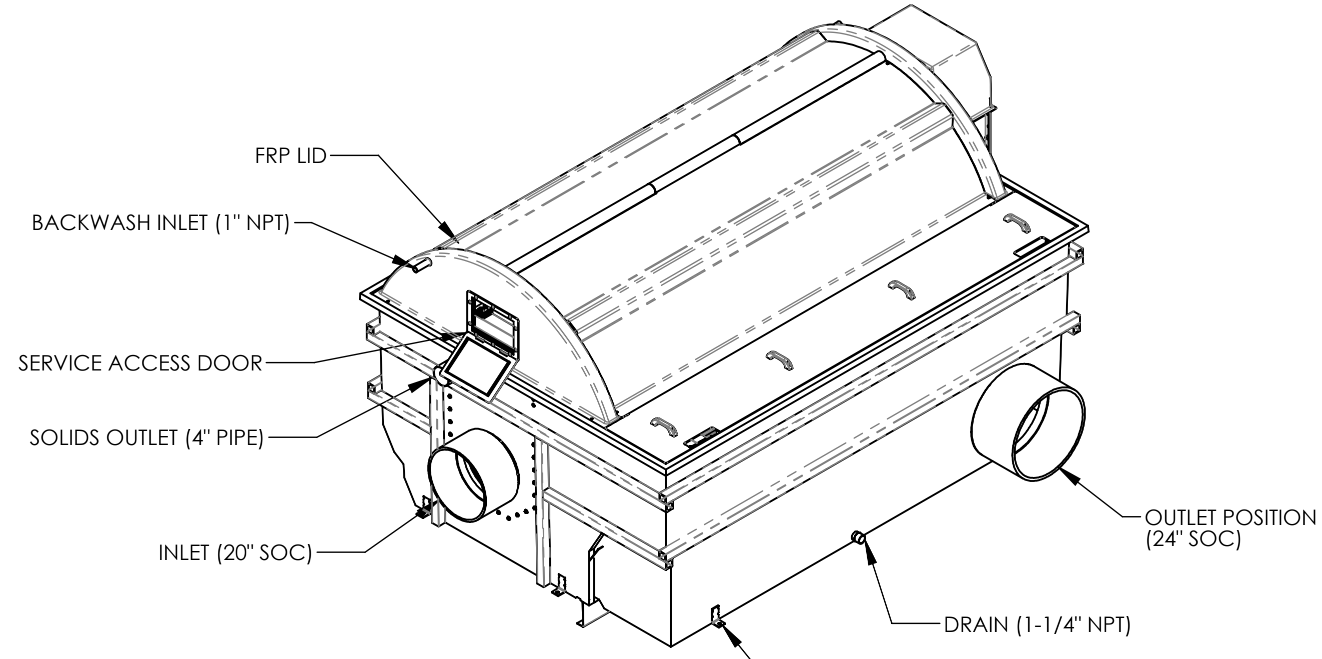
Section View

Notes:
1) Flow rate capacity is highly dependent on the filter application and type of installation; contact PR Aqua for further information.
Flow rates shown are for typical application TSS loadings.
2) Backwash pump and connective plumbing are supplied loose and must be field mounted and connected.
3) Control panel must be field mounted and connected.
4) Minimum water level must be maintained by external means.
5) Dimensions are given only for standard fitting sizes and locations.
6) Outlet fittings larger than 18" diameter must be side mounted (position 2 or 3).

PR Aqua
A PENTAIR AQUATIC ECO-SYSTEMS Division



TOP VIEW



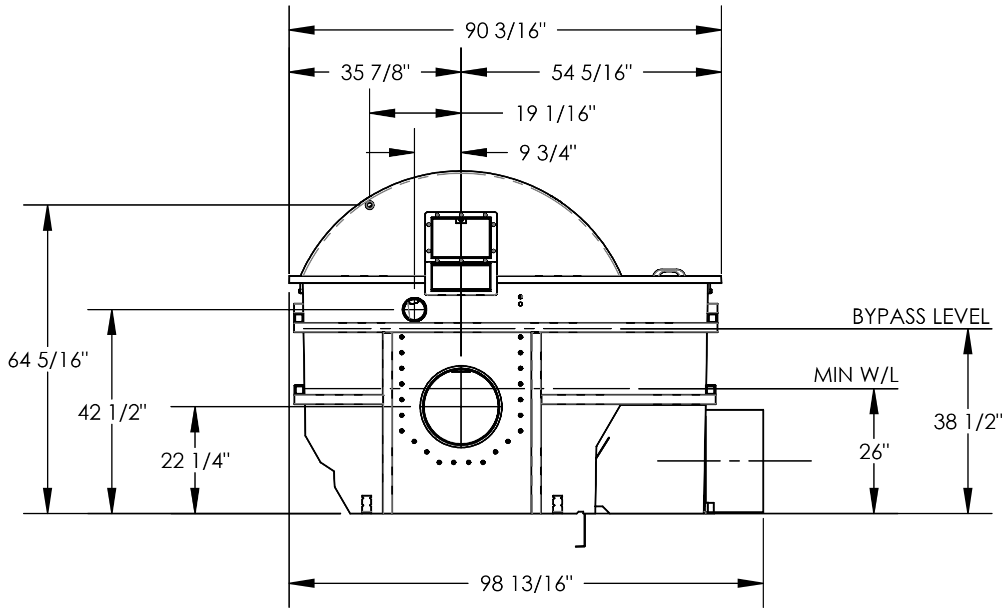
ISO VIEW

NOTES:

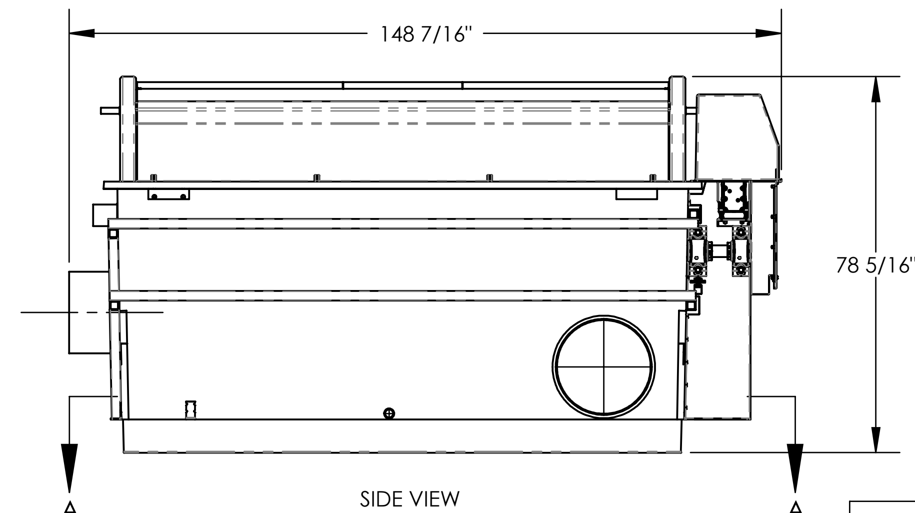
1. ALL DIMENSIONS ARE IN INCHES.
2. APPROXIMATE SHIPPING WEIGHT AND DIMENSIONS, 149" X 99" X 79", 2768LBS.
3. OUTLET WEIR CONSISTS OF A FIXED WEIR SECTION IT IS FACTORY SET BASED ON APPLICATION FLOW RATE TO MAINTAIN MINIMUM WATER LEVEL IN FILTER HOUSING.
4. WATER LEVEL DRIVING TO DOWNSTREAM PROCESSES NOT TO EXCEED TOP OF FIXED WEIR.
5. MIN W/L REFERS TO MINIMUM ACCEPTABLE WATER LEVEL NEEDED INSIDE OF FILTER HOUSING (OUTSIDE OF DRUM) FOR PROPER SUPPORT.
6. RECOMMENDED FLOAT SWITCH HEIGHTS:

FLOAT	HEIGHTS
B/W ON	36-1/2"
HI-LEVEL (OPTIONAL)	37-1/2"

a). FIELD ADJUST AS REQUIRED FOR OPTIMAL PERFORMANCE.
b). HEIGHT FROM TOP OF FLOAT TO INSIDE BOTTOM OF FILTER HOUSING.



FRONT VIEW



SIDE VIEW

REV.	BY	APP'D BY	DESCRIPTION	PCO#	DATE
.01	DS		FOR INFORMATION		9/21/2016

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
.X OR X/X = ±1/64"
.XX = ±.01"
.XXX = ±.005"
ANGULARITY: ±1°

THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

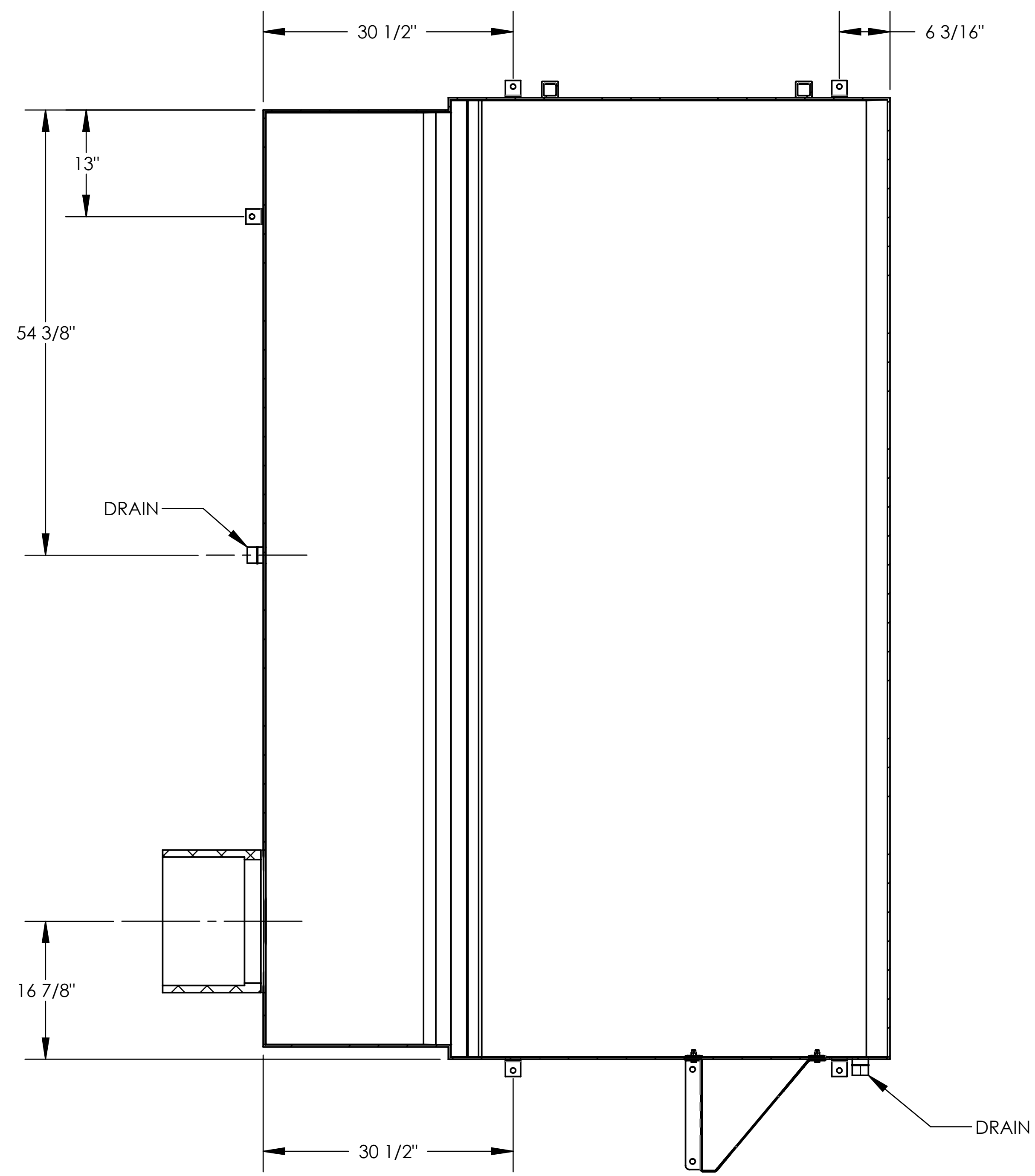
SIGNATURES		DATE
DRAWN:	HM	6/18/2010
DESIGNED:	HM	4/9/2013

SEE PCO FOR APPROVAL SIGNATURES

PENTAIR
AQUATIC ECO-SYSTEMS
711 Poplar Street
Nanaimo, BC
V9S 5L8 / Canada
Ph: (250) 714-0141
Fax: (778) 441-4650

TITLE:
RFM 60096, RR, DIMENSIONAL DATA

SIZE: B | DWG. NO. X018936-01 | REV. -
SCALE: 1:40 | SHEET: 1 OF 2
MATERIAL: | WEIGHT: 2768



SECTION A-A
SCALE 1 : 20

PENTAIR
AQUATIC ECO-SYSTEMS
711 Poplar Street
Nanaimo, BC
V9S 5L8 / Canada
Ph: (250) 714-0141
Fax: (778) 441-4650

TITLE: RFM 60096, RR, DIMENSIONAL DATA

SIZE:	DWG. NO.	REV.
B	X018936-01	-
	SCALE: 1:15	SHEET: 2 OF 2

PENTAIR

AQUATIC ECO-SYSTEMS®

QUOTE SIMULATION

Revision: 0
Page: 1
Quote Number: QTE97656
Quote Date : 11/18/18
Expire Date : 12/31/18

Sold To: QTE-USD
QUOTE USD ACCOUNT
UNITED STATES

Ship To: QTE-USD
QUOTE USD ACCOUNT
UNITED STATES

Attention:
Telephone:

Attention:
Telephone:

Salesperson: 00060001

Credit Terms: PPD
PPD WITH CHECK OR CC
Resale:
Remarks:

Purchase Order:
Ship Via: GRD PPD
FOB Point: DAP-Door ,

Ln	Item	Customer Part	Quoted Qty	Release Qty	UM	Price	Ext. Price
1	RFM60096 PENTAIR ROTOFILTER MODEL 60096 FRP ENCLOSURE 304L SS METALS 11 MICRON SCREENS 8" PVC SOCKET INLET/OUTLET 1.5HP DRUM DRIVE MOTOR, 460V/3PH/60HZ COMPLETE WITH CONTROLS AND BACKWASH PUMP NEMA 4X, 460V/3PH/60HZ		1.0	1.0		87,900.00	87,900.00

Currency : USD
Tax Date : 11/18/18

Line Total	:	87,900.00
0.00% Discount	:	0.00
Freight & Processing Tax 11	:	1,500.00
	:	0.00
	:	0.00
Total Tax	:	0.00
Total	:	89,400.00

If you have questions regarding this order confirmation please contact Customer Service toll-free at Apopka PAES 877-347-4788 Langley PAES - Canada: 800-267-9936

APPENDIX C:

City of Raton/Raton Water Works
Nutrient Removal Schedule

Raton Water Works

Water Department

P.O. Box 99 / Raton, New Mexico 87740 / (575) 445-3861

April 25, 2019

Shelly Lemon
NMED
Surface Water Quality Bureau
PO Box 5469
1190 Saint Francis Drive
Santa Fe, NM 87502-5469

Re: Temporary Standard Schedule

Ms. Lemon,

The Raton Water Board met on April 16, 2019 and approved the attached 20 year implementation schedule for a temporary standard goal of achieving a 30 day average nutrient concentration of 8 mg/l total nitrogen and 1.6 mg/l total phosphorus. This schedule proposes both optimization and modification of our existing treatment facility. The goal will require both, capital and operational expense from the utility budget. The impact upon the utility budget will be difficult to fund due to the poor economic condition of the City. The schedule proposes to evaluate the progress every five years during the NPDES application process.

Raton Water Works will keep NMED updated as the design and funding portions of each project phase progress. Please move the temporary standard process forward and keep us informed of how we can assist. If further information is required or additional changes are needed please contact me.

Sincerely,

Dan Campbell
General Manager

Enclosed – Temporary Standard Implementation Schedule

City of Raton/Raton Water Works (NPDES Permit #NM0020273)
Nutrient Removal Schedule

Goal 2020 – 2040
1.6 MG/L TP
8.0 MG/L TN
30 day average

IMPLEMENTATION SCHEDULE

Task	Target Completion Period
WWTP – Nutrient Removal - NPDES Permit Application/Renewal - Continued Optimization Efforts of Existing system - PER for SBR Upgrades to Achieve Nutrient Removal Goal - Pilot Testing of Coagulation - Design for Phase 1 (Coagulation) - Funding Applications	Jan. 2020 – Jan. 2025
NPDES Permit Application - Evaluate Temporary Standard Progress - Final Design Completion - Bidding & Contract Award - Construction of Phase 1 - Construction Completion & Start Up	Jan. 2025 – Jan. 2029
- Optimization of Facility - Evaluation of Process Changes - Review & Evaluate PER Goals/Objectives and Plans	Jan. 2029 – Jan. 2030
NPDES Permit Application - NPDES Permit Application/Renewal - Evaluate Nutrient Removal Temporary Standard - Design Phase 2 (Aeration Control Upgrade for TN Removal)	Jan. 2030 – Jan. 2031
- Pursue Funding - Complete Final Design	Jan. 2031 – Jan. 2032
- Bidding & Contract Award - Construction - Construction Completion & Start Up	Jan. 2032 – Jan. 2035
NPDES Permit Application - Optimization of New Processes - Evaluation of Temporary Standard Progress	Jan. 2035 – Jan. 2037
- Continued Optimization - Evaluation of Progress	Jan. 2037 – Jan. 2040

Factors Determining Scheduling Compliance:
- Time needed to complete and approve final design of each phase;
- Time needed to successfully obtain financing;
- Successful bidding and construction processes within budget;
- Staff training for complete facility optimization;
- Evaluation of targeted steps to the goals of the temporary standard.

Temporary Standard Timeframe
The temporary standard is subject to review at each WQCC triennial review. At each NPDES permit application the progress will be reviewed and schedule modified if necessary.

City of Raton/Raton Water Works Timeline of Proposed Actions

The term of this proposed temporary standard is 20 years. The 20-year timeline provides for planning, pilot tests, funding efforts, and construction while minimizing the impact to city and utility budgets as well as to ratepayers during a weakened economy. The schedule proposes both operational optimization and modification of the existing treatment facility in two phases (Phase 1: Coagulation for phosphorus removal and Phase 2: Aeration control upgrades for nitrogen removal).

In Phase 1, the City will incorporate chemical addition into its treatment scheme. Pilot testing of coagulant addition for phosphorus removal will determine the type of coagulant to be used. It is anticipated that initial testing will be with aluminum sulfate since it is the coagulant that Raton utilizes for drinking water treatment. Based on the coagulant selected, the existing solids handling system might require additional attention to determine its ability to handle the increased chemical sludge, including the impact to the effective treatment volume of the aeration basins. Any potential modifications to the sludge handling system and aeration basins due to increased chemical sludge will be added to Phase 2 to determine the overall cost. The potential process changes in addition to the time required to plan for the Phase 2 budget prevents concurrent undertaking of Phase 1 and Phase 2.

Phase 2 involves aeration control upgrades for nitrogen removal and refinement of chemical addition for phosphorus removal, as identified in Phase 1. In general, Phase 2 upgrades include the following:

- Replace the existing ICEAS system (SBR) programmable logic controller (PLC) and upgrade to Xylem's proposed current Biologic Nutrient Removal (BNR) PLC control logic, NURO Controller
- Install ammonia, nitrate, temperature, and DO sensors and transmitters to provide the necessary data and allow the new NURO control logic to optimize the existing process for nitrification and denitrification, while preventing excess blower run times during low loads.
- Reduce the number of "Air Off-Cycles" in the SBR process to enhance the nitrification process. The justification behind reducing the total amount of off-cycle time is that the denitrification process is faster as compared to nitrification process and the decant cycle time will also contribute to the available denitrification time.
- Update the controller logic to operate the aeration blowers based on the dissolved oxygen (DO) input from the SBR basins. Changes to the aeration cycles in response to demand, might require improvements to/retrofits to the existing aeration blowers.
- The addition of variable-frequency drives (VFDs) to the aeration blowers will enable the NURO controller to maintain DO setpoints in the SBR basins. The Xylem BioWin modeling indicates that oxygen carryover from the aeration ON periods to the aeration OFF periods will occur inhibiting denitrification.
- If the aeration blower motors are not suitable for VFDs, either the motor or the entire blower will require replacement.
- Installation of a combination ammonium/nitrate probe located approximately two thirds of the distance down the length of the SBR basin (toward the decanter end).
- Installation of an online phosphate probe to allow continuous online monitoring of phosphate in the SBR basins.
- External alkalinity addition, if required
- External carbon addition will likely be required to provide the necessary carbon required during the denitrification process. The supplemental carbon should be introduced at the beginning of the last Air OFF period for a given total cycle.
- Installation of a coagulation feed system for chemical removal of phosphorus.

APPENDIX D

Phased TMDLs & Nutrient Implementation Plan

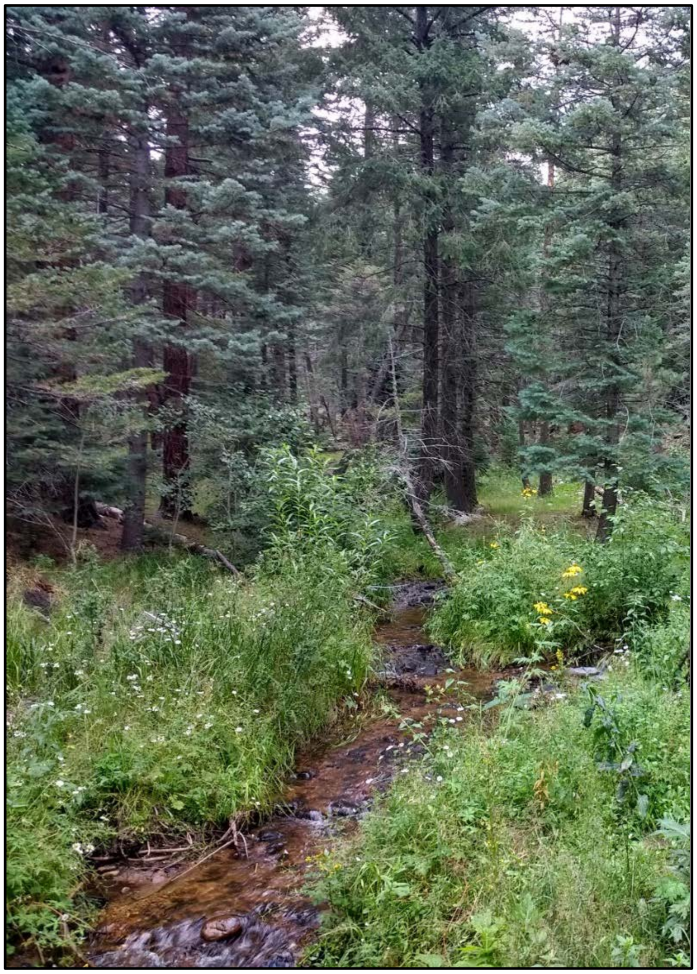
The full TMDL document can be found online at:
https://www.env.nm.gov/wp-content/uploads/2019/09/Canadian-TMDL_EPA-approved_091819.pdf

EPA-Approved

TOTAL MAXIMUM DAILY LOAD (TMDL)

FOR THE

CANADIAN RIVER WATERSHED



SEPTEMBER 18, 2019

Prepared by

New Mexico Environment Department, Surface Water Quality Bureau

Monitoring, Assessments, and Standards Section

Public Draft Released: June 5, 2019

Water Quality Control Commission Approval Date: August 13, 2019

U.S. EPA Approval Date: September 18, 2019

Effective Date: September 18, 2019

Revision Date(s): ______________________________

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For Additional Information please visit:

https://www.env.nm.gov/surface-water-quality/

~or~

1190 St. Francis Drive

Santa Fe, New Mexico 87505

Cover photo: Rito de Gascon, August 20, 2016

Table of Contents

The full TMDL document can be found online at:
https://www.env.nm.gov/wp-content/uploads/2019/09/Canadian-TMDL_EPA-approved_091819.pdf

List of Abbreviations

4Q3	4-Day, 3-year low-flow frequency
6T3	Temperature not to be exceeded for 6 or more consecutive hours on more than 3 consecutive days
AU	Assessment Unit
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general storm water permit
CoolWAL	Cool Water Aquatic Life
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
^{o}C	Degrees Celsius
DMR	Discharge Monitoring Report
^{o}F	Degrees Fahrenheit
HUC	Hydrologic unit code
j/m^2/s	Joules per square meter per second
km^2	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
MCWAL	Marginal Coldwater Aquatic Life
MOS	Margin of safety
MOU	Memorandum of Understanding
MS4	Municipal separate storm sewer system
MSGP	Multi-sector general storm water permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SEE	Standard Error of the Estimate
SLO	State Land Office
SSTEMP	Stream Segment Temperature Model
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WBP	Watershed-based plan
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (20.6.4 NMAC as amended through 2/28/18)

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act, 33 U.S.C. § 1313(CWA), requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL is defined as "*a written plan and analysis established to ensure that a water body will attain and maintain water quality standards including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA, 1999). A TMDL defines the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. It further identifies potential methods, actions, or limitations that could be implemented to achieve water quality standards. TMDLs are defined in 40 Code of Federal Regulations Part 130 (40 C.F.R. § 130.2(i)) as the sum of individual Waste Load Allocations (WLAs) for point sources, and Load Allocations (LAs) for nonpoint source and background conditions, and a Margin of Safety (MOS) in acknowledgement of various sources of uncertainty in the analysis.

The New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) conducted a water quality survey of the Dry Cimarron and Upper and Lower Canadian basins in 2015-2016. Water quality monitoring stations were located so as to evaluate the impact of tributary streams and ambient water quality conditions. Assessment of data generated during the 2015 and 2016 monitoring efforts was conducted according to the 2016-2018 SWQB Assessment Protocols (NMED/SWQB, 2015). This TMDL document addresses the documented impairments as summarized in Table ES-1, below. Additional information regarding these impairments can be reviewed in the current Clean Water Act §303(d)/§305(b) Integrated Report and List (IR) (NMED/SWQB, 2018a). Previous TMDL documents were completed for the same geographic area in 2007, 2009, 2011 and 2015 (details can be seen at https://www.env.nm.gov/surface-water-quality/tmdl/). No new TMDLs were addressed in this document for the Cimarron HUC (11080002) as SWQB plans to develop an alternate TMDL planning document for the Cimarron HUC.

The next scheduled water quality monitoring date for the Dry Cimarron and Upper and Lower Canadian basins is 2023-2024, at which time TMDL targets will be re-examined and potentially revised, as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reaches will be moved to the appropriate category in the IR.

Table ES-5. TMDL for Doggett Creek (Raton Creek to headwaters)	
New Mexico Standards Segment	20.6.4.99
Assessment Unit Identifier	NM-2305.A_255
NPDES Permit(s)	NM0020273
Segment Length	3 miles
Parameters of Concern	*E. coli,* plant nutrients
Designated Uses Affected	Primary Contact, Warmwater Aquatic Life
USGS Hydrologic Unit Code	11080001 - Canadian Headwaters
Scope/size of Watershed	2.9 square miles
Land Type	26l - Upper Canadian Plateau
Land Use/Cover	49% grassland, 31% evergreen forest, 15% shrub/scrub and 2% deciduous forest
Probable Sources	Bridges/culverts/RR crossings; Channelization; Gravel or dirt roads; Municipal point source discharge; On-site treatment systems; Paved roads; Pavement/impervious surface; Residences/buildings; Site clearance (land development); Urban runoff/storm sewers; Wildlife other than waterfowl
Land Management	93% private, 6% State, and less than 1% USFS, USFWS, BLM, and BOR
IR Category	5
Priority Ranking	High
	WLA + LA + MOS = TMDL
E. coli	See Raton Creek NM-2305.A_253
Plant nutrients	See Raton Creek NM-2305.A_253

Table ES-13. TMDL for Raton Creek (Chicorica Creek to headwaters)	
New Mexico Standards Segment	20.6.4.305
Assessment Unit Identifier	NM-2305.A_253
NPDES Permit(s)	NM0029891 and NM0020273
Segment Length	17.6 miles
Parameters of Concern	Plant nutrients, *E. coli*
Designated Uses Affected	Marginal warmwater aquatic life use
USGS Hydrologic Unit Code	11080001 - Canadian Headwaters
Scope/size of Watershed	45 square miles
Land Type	21f - Sedimentary Mid-Elevation Forests, 21d - Foothill Shrublands, 26l - Upper Canadian Plateau
Land Use/Cover	49% grassland, 31% evergreen forest, 15% shrub/scrub and 2% deciduous forest
Probable Sources	Bridges/culverts/RR crossings; Gravel or dirt roads; Mass wasting; Rangeland grazing; Stream channel incision
Land Management	93% private, 6% State, and less than 1% USFS, USFWS, BLM, and BOR
IR Category	5
Priority Ranking	High
WLA + LA + MOS = TMDL	
Plant nutrients Total phosphorus Total nitrogen	 0.46 + 0.07 + 0.06 = 0.59 lbs/day 4.88 + 0.78 + 0.63 = 6.29 lbs/day
E. coli	$4.30 \times 10^9 + 6.86 \times 10^8 + 5.54 \times 10^8 = 5.54 \times 10^9$

4.0 PLANT NUTRIENTS

Nutrient assessments were conducted on data collected during the 2015-2016 Canadian River water quality survey. Detailed assessment of various water quality parameters indicated plant nutrient impairment in nine assessment units. The nutrient impairments are addressed through the four watershed TMDLs listed in **Table 4.1**. The Cimarron River in Oklahoma is downstream of the Dry Cimarron River in New Mexico. The Oklahoma portion is impaired for dissolved oxygen, but the State of Oklahoma does not have nutrient criteria for this waterbody and is therefore not listed as impaired for plant nutrients.

A previous TMDL for plant nutrients was developed for Pajarito Creek (Canadian River to headwaters) that included a WLA for the Tucumcari WWTP (NM0020711). A revision of that TMDL is planned before the end of the current permit term (September 30, 2020). The Maxwell WWTP (NM0029149) discharges to Canadian River (Cimarron River to Chicorica Creek), however, no nutrient WLA is assigned as the facility has reported no discharge since 2006 and may not renew their NPDES permit (June 30, 2019 expiration).

Table 4.1 Nutrient impaired watersheds and assessment units

AU_ID	Assessment Unit	WQS Segment	HUC
Conchas River (Conchas Reservoir to Salitre Creek)			
NM-2305.A_010	Conchas River (Conchas Reservoir to Salitre Creek)	20.6.4.305	11080005
Coyote Creek (Mora River to headwaters)			
NM-2306.A_020	Coyote Creek (Mora River to Amola Ridge)	20.6.4.309	11080004
NM-2306.A_023	Coyote Creek (Amola Ridge to Williams Canyon) *	20.6.4.309	11080004
NM-2306.A_022	Coyote Creek (Williams Canyon to Black Lake)	20.6.4.309	11080004
NM-2306.A_021	Coyote Creek (Black Lake to headwaters) *	20.6.4.309	11080004
Dry Cimarron River (Perennial reaches OK boundary to headwaters)			
NM-2701_00	Dry Cimarron River (Perennial reaches OK bnd to Long Cyn)	20.6.4.702	11040001
NM-2701_01	Dry Cimarron River (Oak Creek to headwaters)	20.6.4.701	11040001
NM-2701_02	Dry Cimarron River (Long Canyon to Oak Creek)	20.6.4.702	11040001
NM-2701_20	Long Canyon (Perennial reaches abv Dry Cimarron)	20.6.4.702	11040001
Raton Creek (Chicorica Creek to headwaters)			
NM-2305.A_255	Doggett Creek (Raton Creek to headwaters)	20.6.4.99	11080001
NM-2305.A_253	Raton Creek (Chicorica Creek to headwaters)	20.6.4.305	11080001

**unimpaired assessment unit*

4.1 Target Loading Capacity

There are two potential causes of nutrient enrichment in a given stream: excessive phosphorus and/or nitrogen. Phosphorous is found in water primarily as orthophosphate. In contrast nitrogen may be found as several dissolved species, all of which must be considered in nutrient loading. Total nitrogen is defined as the sum of nitrate+nitrite (N+N), and Total Kjeldahl Nitrogen (TKN). At the present time, there is no USEPA-approved method to test for total nitrogen, however adding the results of USEPA methods 351.2 (TKN) and 353.2 (N+N) is appropriate for estimating total nitrogen (APHA 1989). While not an EPA-approved method, Method SM4500-N for Total Nitrogen using a persulfate digest, is an approved method in the SWQB QAPP (NMED/SWQB 2019) and is used in cases where a lower detection limit is needed.

The intent of nutrient criteria, whether numeric or narrative, is to limit nutrient inputs in order to control the excessive growth of attached algae and higher aquatic plants. Controlling algae and plant growth preserves aesthetic and ecologic characteristics along the waterway. While conceptually there may be a number of possible combinations of total nitrogen (TN) and total phosphorus (TP) concentrations that are protective of water quality, the application of simple chemical limitation concepts to a complex biologic system to determine these combinations is challenging. One of the primary reasons for this is that different species of algae and higher aquatic plants will have different nutritional needs. Some species will thrive in nitrogen limited environments while others will thrive in phosphorous limited environments. Because of the diversity of nutritional needs amongst organisms, numeric thresholds for both TN and TP are required to preserve the aesthetic and ecologic characteristics along a waterway. Focusing on one nutrient or trading a decrease in one for an increase in the other may simply favor a particular species without achieving water quality standards (USEPA 2012).

New Mexico has a narrative criterion for plant nutrients set forth in Subsection E of 20.6.4.13 NMAC:

> ***Plant Nutrients:*** *Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in the dominance of nuisance species in surface waters of the state.*

This narrative criterion can be challenging to assess because the relationships between nutrient levels and impairment of designated uses are not defined, and distinguishing nutrients from “other than natural causes” is difficult. Numeric thresholds are necessary to establish targets for TMDLs, to develop water quality-based permit limits and source control plans, and to support designated uses within the watershed. Therefore, SWQB, with the assistance from EPA and the USGS, developed nutrient-related thresholds, or *narrative translators*, to address both cause (TN and TP) and response variables (dissolved oxygen [DO], pH, and periphyton chlorophyll *a*). Water quality assessments for nutrients are based on quantitative measurements of these causal and response indicators. If these measurements exceed the numeric nutrient threshold values, indicate excessive primary production, and/or demonstrate an unhealthy biological community, the reach is considered impaired (NMED/SWQB 2018a).

The applicable threshold values for cause and response variables for three of the four watershed TMDLs are in the Flat TN site class (0.65 mg/L) and the Flat-moderate TP site class (0.061 mg/L), whereas Coyote Creek is in the Moderate TN site class (0.37 mg/L) and the Flat-moderate TP site class (0.061 mg/L). These threshold values were used for water quality assessments and as a starting point for TMDL development.

4.2 Flow

40 CFR 130.7(c)(1) requires states to calculate a TMDL using the critical conditions for stream flow. The presence of plant nutrients in a stream can vary as a function of flow, however, higher nutrient concentrations typically occur during low-flow conditions because there is reduced stream capacity to assimilate nutrients. In other words, as flow decreases, the stream cannot dilute its constituents causing the concentration of plant nutrients to increase. Higher flows typically do not represent impairment as high flows can quickly move the TN and TP through the assessment unit not allowing for the growth of nuisance algae.

A climatic year starting April 1 of the prior year and ending March 31 is often used when examining critical low flow conditions in the United States. This choice reduces the likelihood of splitting low flow periods - typically found in the summer or fall - across different years and thereby affecting the results of Log Pearson Type III analysis of series of annual low flows. A different climatic year or shorter season may be used if low flow periods occur at other times of the year or overlap the boundaries of the climatic year.

When available, USGS gages are used to estimate flow. The 4Q3 flow for Coyote Creek (07218000) was estimated using gage data and DFLOW software, Version 3.1b (USEPA 2006). DFLOW 3.1b is a Windows-based tool developed to estimate user selected design stream flows for low flow analysis by utilizing algorithms based on Log Pearson Type III distribution.

It is often necessary to estimate a critical flow for a portion of a watershed where there is no active USGS flow gage. 4Q3 derivations for ungauged streams were based on analysis methods described by Waltemeyer (2002). In Waltemeyer's analysis, two regression equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 feet in elevation). The following statewide regression equation (**Equation 4.1**) is based on data from 50 streamflow-gaging stations that had non-zero 4Q3 low-flow frequency (Waltemeyer, 2002). Parameters used in the calculation were determined using StreamStats, an online GIS application developed by the US Geological Survey. The critical flow was converted from cfs to million gallons per day (MGD) using a conversion factor of 0.646. Flows used for TMDL development are listed in **Table 4.2.**

Equation 4.1

$$4Q3 = 1.2856 \times 10^{-4} DA^{0.42} {P_w}^{3.16}$$

Where:

4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area (mi^2)
P_w = Average basin mean winter precipitation (inches)

Table 4.2 Flow summaries for nutrient-impaired watersheds

Watershed	Flow Method	Average Elevation (ft)	DA (mi^2)	P_w (in)	4Q3
Conchas River (Conchas Reservoir to Salitre Creek)	Waltemeyer-statewide	5590	514	4.4	0.19 cfs 0.12 mgd
Coyote Creek (Mora River to headwaters)	DFLOW 07218000 [a]	n/a	n/a	n/a	0.46 cfs 0.30 mgd
Dry Cimarron River (Perennial reaches OK boundary to headwaters)	Waltemeyer - statewide	5840	905	4.87	0.33 cfs 0.21 mgd
Raton Creek (Chicorica Creek to headwaters)	Waltemeyer-statewide	7150	45	6.85	0.28 cfs 0.18 mgd

(a) period of record 1929-2018

It is important to remember that in this case, the TMDL itself is a value calculated at a defined critical flow condition and is calculated as part of the planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will also vary.

4.3 TMDL Calculation

This subsection describes the relationship between the numeric nutrient targets and the allowable pollutant-level by determining the total assimilative capacity of the waterbody, or loading capacity, for the pollutant. The loading capacity is the maximum amount of pollutant loading that a waterbody can receive while meeting its water quality objectives.

As a river flows downstream it has a specific carrying capacity for nutrients. This carrying capacity, or TMDL, is defined as the mass of pollutant that can be carried under critical flow conditions without violating the target concentration for that constituent. These TMDLs were developed based on simple dilution calculations using critical flows, the numeric target, and a conversion factor. The specific carrying capacity of a receiving water for a given pollutant, was estimated using **Equation 4.2**. The calculated daily carrying capacities (i.e. TMDLs) for TP and TN are summarized in **Table 4.3**.

Critical flow (4Q3) x WQS x Conversion Factor = TMDL **(Eq. 4.2)**

Table 4.3 Daily target loads for TP & TN

TMDL Watershed	Parameter	Critical Flow (mgd)[(a)]	In-Stream Target (mg/L)	Conversion Factor	TMDL (lbs/day)
Conchas River (Conchas Reservoir to Salitre Creek)	Total Phosphorus Total Nitrogen	0.12	0.061 0.65	8.34	0.06 0.65
Coyote Creek (Mora River to headwaters)	Total Phosphorus Total Nitrogen	0.30	0.061 0.37	8.34	0.15 0.93
Dry Cimarron River (Perennial reaches OK boundary to headwaters)	Total Phosphorus Total Nitrogen	0.33	0.061 0.65	8.34	0.17 1.79
Raton Creek (Chicorica Creek to headwaters)	Total Phosphorus Total Nitrogen	1.16 [(b)]	0.061 0.65	8.34	0.59 6.29

Notes: *(a)* See Section 4.2 for details about critical flow calculations.
(b) The design flows of NM0020273 (0.9 mgd) and NM0029891 (0.08 mgd) were added to the calculated 4Q3.

This total TMDL for the Raton Creek watershed is then allocated as follows: first the MOS is subtracted as described in Section 4.4, then the Waste Load Allocation is subtracted as described in Section 4.5.1, and the remainder is the Load Allocation as described in Section 4.5.2 and Equation 4.3.

Table 4.4 Plant Nutrient TMDLs

Assessment Unit	Parameter	MOS (lbs/day)	LA (lbs/day)	WLA (lbs/day)	TMDL (lbs/day)
Conchas River (Conchas Reservoir to Salitre Creek)	Total Phosphorus Total Nitrogen	0.01 0.07	0.05 0.59	0 0	0.06 0.65
Coyote Creek (Mora River to headwaters)	Total Phosphorus Total Nitrogen	0.02 0.09	0.14 0.83	0 0	0.15 0.93
Dry Cimarron River (Perennial reaches OK boundary to headwaters)	Total Phosphorus Total Nitrogen	0.01 0.11	0.1 1.02	0 0	0.11 1.14
Raton Creek (Chicorica Creek to headwaters)	Total Phosphorus Total Nitrogen	0.06 0.63	0.07 0.78	0.46 [a] 4.88 [a]	0.59 6.29

Notes: *(a)* WLA for NM0020273. See Secton 4.5.1.

4.4 Margin of Safety

TMDLs should reflect a MOS based on the uncertainty or variability in the data, the point and nonpoint source load estimates, and the modeling analysis. The MOS can be expressed either implicitly or explicitly. An implicit MOS is incorporated by making conservative assumptions in the TMDL analysis, such as allocating a conservative load to background sources. An explicit MOS is applied by reserving a portion of the TMDL and not allocating it to any other sources.

For these nutrient TMDLs, the margin of safety was developed using a combination of conservative assumptions and explicit recognition of potential errors. Therefore, this margin of safety is the sum of the following two elements:

- *Conservative Assumptions*
  - Treating phosphorus and nitrogen as pollutants that do not readily degrade in the environment.

- *Explicit Recognition of Potential Errors*
  - Uncertainty exists in sampling nonpoint sources of pollution. A conservative MOS for this element is therefore **5 %**.
  - There is inherent error in all flow values, both measured and calculated; a conservative MOS for this element in gaged streams is **5 %**.

4.5 Waste Load Allocations and Load Allocations

4.5.1 Waste Load Allocation

There are no National Pollutant Discharge Elimination System (NPDES) individual permits that discharge to the Conchas River, Coyote Creek, or Dry Cimarron River watersheds. However, the City of Raton WWTP (NM0020273) discharges into Doggett Creek thence to Raton Creek and the City of Raton WTP (NM0029891) discharges to Raton Creek. Phased WLAs for NM0020273 are listed in **Table 4.5**; no WLA was assigned for NM0029891. The EPA Technical Support Document for Water Quality Based Toxics Control (EPA 1991) strongly recommends that the WLA is not directly implemented in the permit as it is an overly conservative estimate, but the document provides a methodology for translation of the WLA into appropriate permit limitations. See Chapter 7.4.3 in the 1991 TSD for an example calculation. Per Chapter 5.3.1 of the TSD:

> *"Direct use of a WLA as a permit limit creates a significant risk that the WLA will be enforced incorrectly, since effluent variability and the probability basis for the limit are not considered specifically. For example, the use of a steady state WLA typically establishes a level of effluent quality with the assumption that it is a value never to be exceeded. The same value used directly as a permit limit could allow the WLA to be exceeded without observing permit violations if compliance monitoring was infrequent. Confusion can also result in translating a longer duration WLA requirement (e.g. for chronic protection) into maximum daily and average monthly permit limits. The permit writer must ensure that permit limits are derived to implement a WLA requirement correctly."*

Further discussion of these permits as well as nutrient TMDL implementation are discussed in **Section 7.1**.

Table 4.5 Wasteload Allocation for NM0020273

Phase	Parameter	Target limit (mg/L)	WLA (lbs/day)
0 (Current permit)	Total Phosphorus Total Nitrogen	3.0 [(a)] 10.0 [(a)]	14 [(a)] 46.7 [(a)]
1st	Total Phosphorus Total Nitrogen	3.0 [(b)] 9.4 [(b)]	13.3 [(b)] 41.5 [(b)]
2nd	Total Phosphorus Total Nitrogen	TBD [(c)]	TBD [(c)]
n^{th}	Total Phosphorus Total Nitrogen	0.061 [(d)] 0.65 [(d)]	0.46 [(e)] 4.88 [(e)]

TBD = to be determined.

[(a)] The 2015 permit effluent limits were based on the 85th percentile of 2009-2014 concentration data. The loading limit was based on the maximum 30-day average flow (0.56 mgd) from the previous two years of data. See fact sheet for NPDES permit issued in 2015.

[b] Targets and WLA based on 85th percentile of DMR chemistry data and maximum 30-day flow (0.53 mgd) for the July 2015-March 2019 time period.

[c] To be evaluated next permit cycle and TMDL revised if necessary. See Section 7.1.

[d] Targets based on in-stream nutrient targets discussed in Section 4.1.

[e] TMDL calculated using Equation 4.2 and 0.9 mgd design flow.

There are no Municipal Separate Storm Sewer System (MS4) permits in these AUs. However, excess nutrient loading may be a component of some storm water discharges covered under general NPDES permits. There may be storm water discharges from construction activities covered under the NPDES Construction General Permit (CGP). Permitted sites require preparation of a SWPPP that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (BMPs) and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that WLAs or applicable water quality standards, including the antidegradation policy, are met. Compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Storm water discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by these General Permits at this time using available tools. Loads that are in compliance with the General Permits are therefore currently included as part of the LA.

4.5.2 Load Allocation

The load allocation (LA) accounts for the non-point sources (NPS) of pollution in the respective watersheds. Nonpoint sources include all other categories not classified as point sources (i.e., WLAs). In order to calculate the LA, the WLAs and MOS were subtracted from the TMDL using **Equation 4.3**:

$$\text{TMDL} = \Sigma\ \text{WLA} + \Sigma\ \text{LA} + \text{MOS} \qquad \textbf{(Eq. 4.3)}$$

therefore,

$$\Sigma\ \text{LA} = \text{TMDL} - \text{MOS} - \Sigma\ \text{WLA}$$

4.5.3 Load Reductions

The load reductions necessary to meet the target loads were calculated as the difference between the calculated daily target load (**Table 4.5**) and the measured load as shown in **Table 4.6**.

Table 4.6 Calculation of load reduction for TP and TN

TMDL Watershed	Parameter	Target Load[(a)] (lbs/day)	Measured Load[(b)] (lbs/day)	Load Reduction (lbs/day)	Percent Reduction[(c)]
Conchas River (Conchas Reservoir to Salitre Creek)	Total Phosphorus	0.05	0.50	0.45	89%
	Total Nitrogen	0.59	5.20	4.61	89%
Coyote Creek (Mora River to headwaters)	Total Phosphorus	0.14	32.89	32.75	100%
	Total Nitrogen	0.83	348.28	347.45	100%
Dry Cimarron River (Perennial reaches OK boundary to headwaters)	Total Phosphorus	0.10	0.73	0.63	87%
	Total Nitrogen	1.02	6.91	5.89	85%
Raton Creek (Chicorica Creek to headwaters)	Total Phosphorus	0.53	5.70	5.18	91%
	Total Nitrogen	5.66	11.73	6.07	52%

Notes: *(a)* Target Load = TMDL – MOS. The MOS is not included in the load reduction calculations because it is a set aside value, which accounts for any uncertainty or variability in TMDL calculations and therefore should not be subtracted from the measured load.

(b) The measured load is the magnitude of point and nonpoint sources. It is calculated using mean measured exceedance values (Appendix A) and the mean measured flow at exceedances.

(c) Percent reduction is the percent the existing measured load must be reduced to achieve the target load and is calculated as follows: (Measured Load – Target Load) / Measured Load x 100.

4.5 Identification and Description of Pollutant Sources

SWQB fieldwork includes an assessment of the probable sources of impairment (Appendix B). The approach for identifying "Probable Sources of Impairment" was modified by SWQB to include additional input from a variety of stakeholders including landowners, watershed groups, and local, state, tribal and federal agencies. Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The draft probable source list (**Table 4.7**) will be reviewed and modified, as necessary, with watershed group/ stakeholder input during the TMDL public meeting and comment period.

Table 4.7 Pollutant source summary for plant nutrients

TMDL Watershed	NPDES permits	Probable Sources
Conchas River (Conchas Reservoir to Salitre Creek)	None	Bridges/culverts/RR crossings, gravel or dirt roads, low water crossing, on-site treatment systems (septic), rangeland grazing, residences/buildings, stream channel incision, waterfowl, wildlife other than waterfowl
Coyote Creek (Mora River to headwaters)	None	Angling pressure, campgrounds, channelization, crop production, dams/diversions, fish stocking, flow alterations, gravel or dirt roads, highways/road/bridge runoff, hiking trails, irrigated crop production, legacy logging, on-site treatment systems (septic), rangeland grazing, residences/buildings, site clearance (land development), stream channel incision, waterfowl, wildlife other than waterfowl
Dry Cimarron River (Perennial reaches OK boundary to headwaters)	None	Bridges/culverts/RR crossings, channelization, crop production, dams/diversions, dumping/garbage/trash/litter, flow alterations, gravel/dirt roads, irrigated crop production, legacy logging, low water crossing, mass wasting, on-site treatment systems (septic), paved roads, rangeland grazing, recent bankfull/overbank flows, residences/buildings, stream channel incision, storm runoff due to construction, waterfowl, wildlife other than waterfowl.
Raton Creek (Chicorica Creek to headwaters)	NM0020273 NM0029891	Bridges/culverts/RR crossings, channelization, crop production, dams/diversions, dumping/garbage/trash/litter, flow alterations, gravel/dirt roads, highway/road/bridge runoff, hiking trails, inappropriate waste disposal, irrigated crop production, legacy logging, low water crossing, mass wasting, municipal point source discharge, on-site treatment systems (septic), paved roads, pavement/impervious surfaces, rangeland grazing, recent bankfull/overbank flows, residences/buildings, site clearance, stream channel incision, urban runoff/storm sewers, waste from pets, waterfowl, watershed runoff following forest fire, wildlife other than waterfowl.

The Probable Source Identification Sheets in Appendix B provide an approach for a visual analysis of a pollutant source along an impaired reach. Although this procedure is qualitative, SWQB feels that it provides the best available information for the identification of probable sources of impairment in a watershed. The list of “Probable Sources” is not intended to single out any particular land owner or single land management activity and has therefore been labeled “Probable” and generally includes several sources for each impairment. Probable sources of impairment along each reach as determined by field reconnaissance and assessment are listed in **Table 4.8**. Probable sources of nutrients will be evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

4.6 Linkage between Water Quality and Pollutant Sources

The source assessment phase of TMDL development identifies sources of nutrients that may contribute to both elevated nutrient concentrations and the stimulation of algal growth in a waterbody (**Figure 4.3**). Where data gaps exist or the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

Figure 4.3: Canadian River at NM 120, October 13, 2016

Phosphorus and nitrogen generally drive the productivity of algae and macrophytes in aquatic ecosystems, therefore they are regarded as the primary limiting nutrients in freshwaters. The main reservoirs of natural phosphorus are rocks and natural phosphate deposits. Weathering, leaching, and erosion are all processes that breakdown rock and mineral deposits allowing phosphorus to be transported to aquatic systems via water or wind. The breakdown of mineral phosphorus produces inorganic phosphate ions ($H_2PO_4^-$, HPO_4^{2-}, and PO_4^{3-}) that can be absorbed by plants from soil or water (USEPA 1999). Phosphorus primarily moves through the food web as organic phosphorus (after it has been incorporated into plant or algal tissue) where it may be released as phosphate in urine or other waste by heterotrophic consumers and reabsorbed by plants or algae to start another cycle (Nebel and Wright 2000).

The largest reservoir of nitrogen is the atmosphere. About 80% of the atmosphere by volume consists of nitrogen gas (N_2). Although nitrogen is plentiful in the environment, it is not readily available for biological uptake. Nitrogen gas must be converted to other forms, such as ammonia (NH_3 and NH_4^+), nitrate (NO_3^-), or nitrite (NO_2^-) before plants and animals can use it. Conversion of gaseous nitrogen into usable mineral forms occurs through three biologically mediated processes of the nitrogen cycle: nitrogen fixation, nitrification, and ammonification (USEPA 1999). Mineral forms of nitrogen can be taken up by plants and algae and incorporated into their tissue. Nitrogen follows the same pattern of food web incorporation as phosphorus and is released in waste primarily as ammonium compounds. The ammonium compounds are usually converted to nitrates by nitrifying bacteria, making it available again for uptake, starting the cycle anew (Nebel and Wright 2000).

Rain, overland runoff, groundwater, drainage networks, and industrial and residential waste effluents transport nutrients to receiving waterbodies. Once nutrients have been transported into a waterbody they can be taken up by algae, macrophytes, and microorganisms either in the water column or in the benthos; they can sorb to organic or inorganic particles in the water column and/or sediment; they can accumulate or be recycled in the sediment; or they can be transformed and released as a gas from the waterbody (**Figure 4.4**).

As noted above, phosphorus and nitrogen are essential for proper functioning of ecosystems. However, excess nutrients cause conditions unfavorable for the proper functioning of aquatic ecosystems. Nuisance levels of algae and other aquatic vegetation (macrophytes) can develop rapidly in response to nutrient enrichment when other factors (e.g., light, temperature, substrate) are not limiting (**Figure 4.4**). The relationship between nuisance algal growth and nutrient enrichment in stream systems has been well documented in the literature (Welch 1992; Van Nieuwenhuyse and Jones 1996; Dodds *et al.* 1997; Chetelat *et al.* 1999). Unfortunately, the magnitude of nutrient concentration that constitutes an "excess" is difficult to determine and varies by ecoregion. The recommended level of total phosphorus to avoid algal blooms in nitrogen-limited ecosystems is 0.01 to 0.1 mg/L and 0.1 mg/L to 1 mg/L of total nitrogen. The upper end of these ranges also support less biological diversity (NOAA/USEPA 1988).

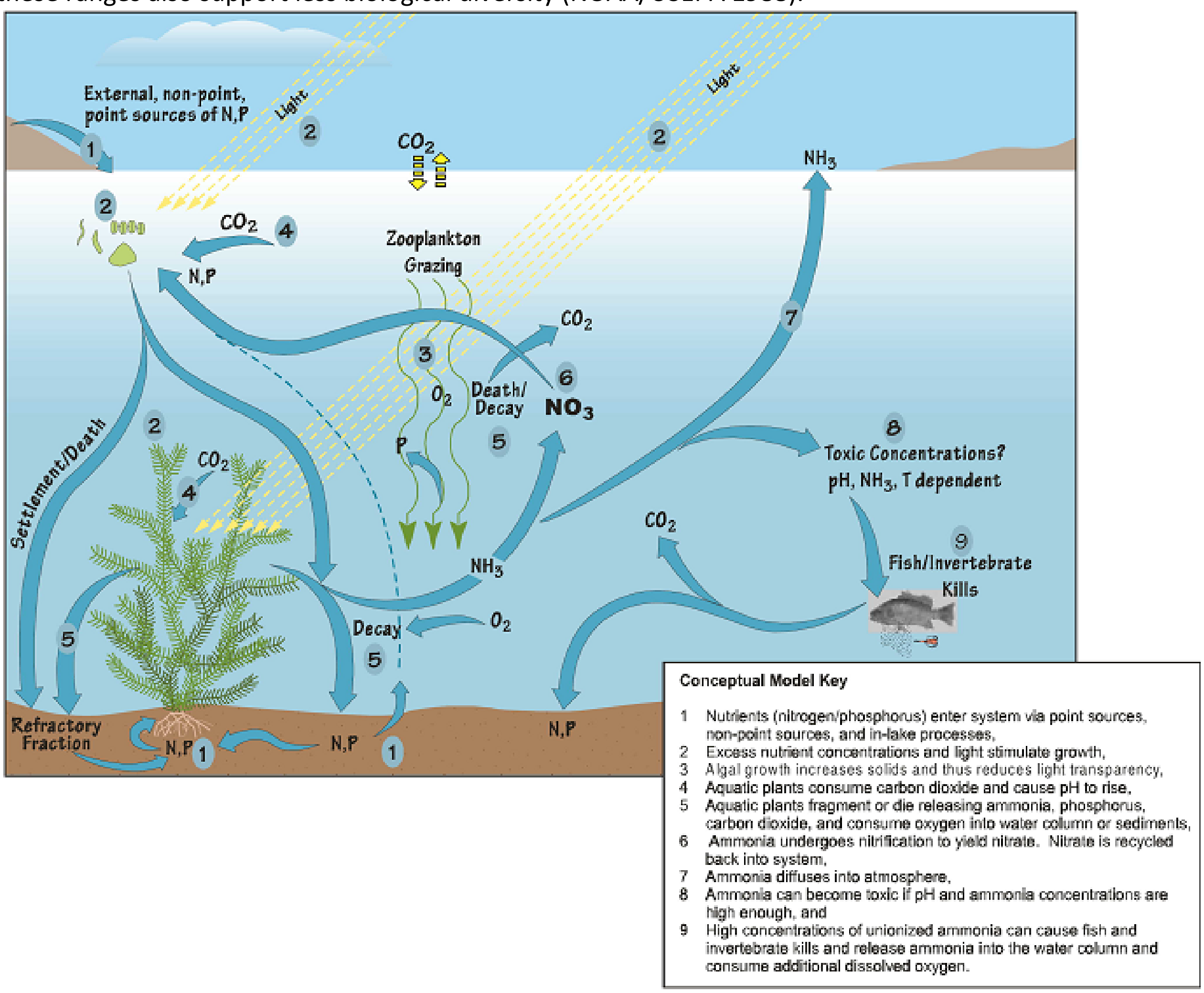

Figure 4.4 Nutrient conceptual model (USEPA 1999)

As described in Section 4.2, the presence of plant nutrients in a stream can vary as a function of flow. As flow decreases through water diversions and/or drought-related stressors, the stream cannot effectively dilute its constituents, which causes the concentration of plant nutrients to increase. Nutrients generally reach a waterbody from land uses that are in close proximity to the stream because the hydrological pathways are shorter and have fewer obstacles than land uses located away from the riparian corridor. During the growing season (i.e. in agricultural return flow) and in storm water runoff, distant land uses can become hydrologically connected to the stream, thus transporting nutrients from the hillslopes to the stream during these time periods.

In addition to agriculture, there are several other human-related activities that influence nutrient concentrations in rivers and streams. Residential areas contribute nutrients from septic tanks, landscape maintenance, as well as backyard livestock (e.g., cattle, horses) and pet wastes. Urban development contributes nutrients by disturbing the land and consequently increasing soil erosion, by increasing the impervious area within the watershed, and by directly applying nutrients to the landscape. Recreational activities such as hiking and biking can also contribute nutrients to the stream by reducing plant cover and increasing soil erosion (e.g., trail network, streambank destabilization), direct application of human waste, campfires and/or wildfires, and dumping trash near the riparian corridor.

Undeveloped, or natural, landscapes also can deliver nutrients to a waterbody through decaying plant material, soil erosion, and wild animal waste. Another geographically occurring nutrient source is atmospheric deposition, which adds nutrients directly to the waterbody through dryfall and rainfall. Atmospheric phosphorus and nitrogen can be found in both organic and inorganic particles, such as pollen and dust as well as anthropogenic sources such as combustion and agriculture. The contributions from these natural sources are generally considered to represent background levels.

Water pollution caused by on-site septic systems is a widespread problem in New Mexico (McQuillan 2004). Septic system effluents have contaminated more water supply wells, and more acre-feet of ground water, than all other sources in the state combined. Groundwater contaminated by septic system effluent can discharge into streams gaining from groundwater inflow. Nutrients such as phosphorous and nitrogen released into gaining streams from aquifers contaminated by septic systems can contribute to eutrophic conditions.

4.7 Consideration of Seasonal Variability

Section 303(d)(1) of the CWA requires TMDLs to be "established at a level necessary to implement the applicable WQS with seasonal variation." Data used in the calculation of this TMDL were collected during the spring, summer, and fall to ensure coverage of any potential seasonal variation in the system. Exceedences were observed during all seasons, which captured flow alterations related to snowmelt, the growing season, and summer monsoonal rains. The critical condition used for calculating the TMDL is considered to be conservative and protective of the water quality standard under all flow conditions. Calculations made at the critical flow, in addition to using other conservative assumptions as described in the previous section on MOS, should be protective of the water quality standards designed to preserve aquatic life in the stream. It was assumed that if critical conditions were met during this time, coverage of any potential seasonal variation would also be met. Flow considerations are discussed in Section 4.2.

4.8 Future Growth

Growth estimates by county and Water Planning Region (WPR) are available from the New Mexico Bureau of Business and Economic Research (http://bber.unm.edu/data). These estimates project growth to the year 2060. The nutrient TMDLs fall within the Northeast New Mexico, Colfax and Mora/San Miguel/Guadalupe WPRs, as detailed on **Table 4.9**. BBER projects continuing slow growth for the Colfax and Mora/SanMiguel/Guadalupe WPRs, and "relatively very slow" growth in the Northeast New Mexico WPR, with slight negative growth in the 2050-2060 decade.

Table 4.8 TMDL Study Area Water Planning Region Population Estimates

WPR	2015*	2030	2040	2050	2060	% Increase (2015-2060)
Northeast New Mexico	84,987	88,338	89,654	89,772	89,216	5.0
Colfax	15,323	16,480	16,976	17,484	18,129	18.3
Mora/San Miguel/Guadalupe	44,545	48,488	50,894	52,855	54,681	22.8

**most recent estimate available*

Estimates of future growth are not anticipated to lead to a significant increase in nutrients that cannot be controlled with BMPs. However, it is imperative that BMPs continue to be utilized to improve road conditions and grazing allotments and adhere to SWPPP requirements related to construction and industrial activities covered under the general permit. Any future growth would be considered part of the existing load allocation, assuming persistence of the hydrologic conditions used to develop these TMDLs.

7.0 IMPLEMENTATION OF TMDLs

When approving TMDL documents, USEPA takes action on the TMDL, LA, WLA, and other components of the TMDL as needed (e.g., MOS and future growth). USEPA does not take action on the implementation section of the TMDL, and USEPA is not bound to implement any recommendations found in this section, in particular if they are found to be inconsistent with CWA and NPDES regulations, guidance, or policy.

7.1 Point Sources – NPDES permitting

There are four individual NPDES permits that discharge to the assessment units addressed in this document.

Table 7.1 Individual NPDES permits

NPDES permit/ expiration date	Assessment Unit	Impairment	WLA	Current permit limit
NM0024996 - Mora Mutual Domestic Water & Sewerage (September 30, 2022)	Mora River (USGS gage east of Shoemaker to Hwy 434)	*E.coli*	2.48×10^{8} cfu/day	126 MPN/100mL 30-day average and 410 MPN/100 mL daily maximum
NM0029891 - City of Raton Water Filtration Facility (August 31, 2021)	Raton Creek (Chicorica Creek to headwaters)	Plant nutrients	Zero	None
NM0020273 – City of Raton WWTP (June 30, 2020)	Raton Creek (Chicorica Creek to headwaters)	Plant nutrients *E.coli*	Phased TMDL. See Table 4.5 4.30×10^{9} cfu/day	TN 10mg/L and 46.7 lbs/day (30-day avg) TP 3mg/L and 14 lbs/day (30-day avg) 126 MPN/100mL 30-day average and 410 MPN/100 mL daily maximum
NM0020711 – City of Tucumcari WWTP (September 30, 2020)	Pajarito Creek (Perennial portions Canadian River to Vigil Canyon)	Temperature	Zero	None

7.1.2 Plant nutrients

A previous TMDL for plant nutrients was developed for Pajarito Creek (Canadian River to headwaters) that included a WLA for the Tucumcari WWTP (NM0020711). A revision of that TMDL is planned before the end of the current permit term (September 30, 2020). The Maxwell WWTP (NM0029149) discharges to Canadian River (Cimarron River to Chicorica Creek), however, no nutrient WLA is assigned as the facility has reported no discharge since 2006 and may not renew their NPDES permit (June 30, 2019 expiration).

The Raton Water Filtration Facility (NM0029891) discharges into the Raton Creek (Chicorica Creek to headwaters) assessment unit and has no permit limit for either total nitrogen or total phosphorus. No plant nutrient data from either DMR documents or MASS staff are available for this facility. The reasonable potential analysis conducted during the 2015 permit renewal process indicated that the facility discharge has no reasonable potential to exceed the applicable WQS for nitrite+nitrate. The facility has reported “no discharge” since at least January 2010. The Raton WTP is not expected to cause or contribute to the plant nutrient impairment, therefore no WLA is assigned. The permit expires in August 2021.

The Raton WWTP (NM0020273) discharges into the Doggett Creek (Raton Creek to headwaters) assessment unit and then into Raton Creek. The Raton WWTP has both total nitrogen and total phosphorus permit limits: total nitrogen 10mg/L and 46.7 lbs/day (30-day average) and total phosphorus 3mg/L and 14 lbs/day (30-day average). Thirty-six monthly DMR samples were collected for the July 2015-June 2018 period and during that time, two total nitrogen samples exceeded the 10 mg/L permit limit and two total phosphorus samples exceeded the 3 mg/L permit limit. No samples exceeded either 30-day average loading permit limit. The permit expires in June 2020.

If the TS (temporary standard) Proposal is not approved by the time of the next permit renewal, it is the policy of the Water Quality Control Commission and EPA to allow schedules of compliance in NPDES permits in order for the facility modifications necessary to meet new water quality-based requirements. The target threshold values for the WWTP discharging to Raton Creek of 0.65 mg/L TN and 0.061 mg/L TP are not achievable with current technology. NMED-SWQB proposes a multiphase approach that will provide incremental progress towards the highest attainable condition (see Table 4.5). Phase 0 is the current permit limits. Phase 1 is a reduction from the current permit limits and is based on the 85th percentile of what the facility is currently achieving. Phase 2 through the final phase (n), will be re-evaluated as additional data about the receiving waters and the facility’s capabilities is collected and technology improves. In any case, the WLAs should be translated into discrete permrit limits using the approach in EPA’s Technical Support Document. The TSD specifically states that implementing a WLA directly as limitations in a permit is overly conservative. The compliance schedule for the next Permit renewal should be set for the facility to meet Phase 1 (a reduction from 10 mg/L TN to 9.4 mg/L and 3 mg/L TP to 3.0 mg/L) at the end of that permit cycle with the current phase 0 limits retained for the balance of the permit cycle. If the TS proposal is still not approved by the end of the permit term that will include Phase 1 limits, the TMDL may be revised to include Phase 2 limits or other appropriate measures.

9.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL. The draft TMDL was first made available for a 30-day comment period beginning June 5, 2019 and ending on July 5, 2019. The draft document notice of availability was advertised via email distribution lists and webpage postings. A public meeting was held on June 13, 2019, at the Raton City Council chambers from 5:30 to 7:30 pm. A response to comments was added to the TMDL document as Appendix E. The TMDL was approved by the WQCC on August 13, 2019 and EPA on September 18, 2019.

The next step for public participation will be development of WBPs and watershed protection projects, including those that may be funded by CWA Section 319(h) grants managed by SWQB.

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APPENDIX E

Calculation of Highest Attainable Interim Effluent Conditions

Raton WWTP (NPDES Permit No. NM0020273)—Calculation of Highest Attainable Interim Effluent Conditions

Background, Assumptions, and Observations

- Calculations based on Table 5-2 (Calculation of Permit Limits) from the USEPA *Technical Support Document for Water Quality-based Toxics Control* to set an average monthly effluent limitation (AML) based on the target effluent concentration (TEC) presented.
    - TECs are performance-based levels of effluent quality representing average effluent concentrations and could potentially represent a highest attainable condition (HAC).
    - The TEC is assumed to be the long-term average (LTA) in the WQBEL calculation.
    - WQBEL calculations assume that effluent concentrations of TN and TP are lognormally distributed with a coefficient of variation (CV) of 0.6.
    - Calculations assume that the AML is set at the 95th percentile.
    - Calculations assume that the sampling frequency for TN and TP would be set at 2x/month.

Table 5-2 Calculation of Permit Limits

$$AML = LTA \times e^{[LTA\ Multiplier]}$$

Where,

AML = average monthly limit,
LTA = long-term average (TEC), and
$e^{[LTA\ Multiplier]}$ is based on a coefficient of variation of 0.6, the 95th percentile of occurrence probability, and a sampling frequency of n=2 times per month = 1.60.

Identified Highest Attainable Interim Effluent Condition		
Treatment Combination for Raton (TECs)	**Treatment Option Description**	**Estimated 30-Day Average Effluent Limits 2x/month**
5.0 mg/L TN 1.0 mg/L TP	• Optimize existing SBR (ICEAS) process to promote nitrification/denitrification • Upgrade SCADA system, install new mixers and blowers • Chemical precipitation	8.0 mg/L TN 1.6 mg/L TP