

West Basin Facility Plan Project 7054

PART 2 – TECHNICAL MEMORANDUM 3

Flow and Load Projection Updates and Summary

FINAL / October 2025

Jacobs

Produced by: **carollo**





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Abbreviations

AA	Annual Average
AAF	Annual Average Flow
AC	Acre
ADW	Average Dry Weather
ADWF	Average Dry Weather Flow
AWW	Average Wet Weather
AWWF	Average Wet Weather Flow
Baseflow	Base Flow
CFS	Cubic Feet per Second
COD	Chemical Oxygen Demand
DEQ	Oregon Department of Environmental Quality
GPCD	Gallons per Capita per Day
GPCPD	Gallons per Capita per Day
GPD/AC	Gallons per Day per Acre
GPEPD	Gallons per Employee per Day
GPNAD	Gallons per Net Acre per Day
GWI	Groundwater Infiltration
MDDW	Maximum Day Dry Weather
MDWW	Maximum Day Wet Weather
MG	Million Gallons
MGD	Million Gallons per Day
MHDW	Maximum Hour Dry Weather
MHWW	Maximum Hour Wet Weather
MMA	Maximum Month Annual
MMDW	Maximum Month Dry Weather
MMWW	Maximum Month Wet Weather
MWDW	Maximum Week Dry Weather
MWWW	Maximum Week Wet Weather
NH4	Ammonium
PH	Peak Hour
RDI/I	Rainfall Derived Infiltration/Inflow
SCADA	Supervisory Control and Data Acquisition
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids
UGB	Urban Growth Boundary
WRRF	Wastewater Resource Recovery Facility
cBOD	Carbonaceous Biochemical Oxygen Demand
lbs/d	Pounds per Day

lbs/day	Pounds per Day
mg/L	Milligrams per Liter
oP	Orthophosphate
psi	Pounds per Square Inch
µg/L	Micrograms per Liter

Flow and Load Projection Updates and Summary

3.1 Objective

This technical memorandum (TM) summarizes flow and load projections used for the treatment and conveyance systems analysis for Clean Water Services' (District's) West Basin Master Plan. In 2022, Jacobs Engineering assisted the District with preliminary tasks for the West Basin Master Plan in developing population projections, employment projections, and industrial growth assumptions including associated flow and load projections. A report documenting the approach, assumptions, and results is entitled, "*West Basin Master Plan Preliminary Work: Flow and Load Projections* (Jacobs, February 2022)" and is included as Appendix 3A. Projections were adjusted for the West Basin Master Plan Phases 1 and 2 between 2022 and 2023. This TM summarizes the changes and provides a final tabular summary of the flows and loads used in the West Basin Master Plan. The report documenting the preliminary work (Appendix 3A) remains relevant and should be referenced for approach, historic data inputs, and development of most assumptions including per capita rates and peaking factors used for the flow and load projections. The objective of this TM is to summarize the following:

- Summary approach for flow and load projections.
- Adjustments to flow and load assumptions after completion of preliminary planning work.
- Tabular summaries of flow and load projections.

3.2 References

This TM references the following:

- *West Basin Master Plan Preliminary Work: Flow and Load Projections* (Jacobs, February 2022, attached as Appendix 3A)
- PHASE 1 - CAMP Documentation
- PART 2 - TM2 – Study Area Characteristics

3.3 Definitions

The following definitions apply to flow and load terminology in this document.

- **Base Flow and Load:** The average flow and loads for the base period from July 1st through September 30th which are assumed to have limited rainfall derived infiltration and inflow (RDI/I) and limited groundwater infiltration (GWI).
- **Average Annual (AA) Flow and Load:** The average daily flow and loads for the seasonal year from November 1st of the previous year to October 31st of the same year.
- **Maximum Month Annual (MMA) Load:** The maximum average month (from a 30-day running average) observed in the seasonal year from November 1st of the previous year to October 31st of the same year. The MMA Load will be the larger of the maximum month dry weather or maximum month wet weather load.

- Maximum Month Dry Weather (MMDW) Flow and Load: The maximum average month observed (from a 30-day running average) in the dry weather period that includes May 1st through October 31st.
- Maximum Week Dry Weather (MWDW) Flow and Load: The maximum average week (from a 7-day running average) observed in the dry weather period that includes May 1st through October 31st.
- Maximum Day Dry Weather (MDDW) Flow and Load: The maximum average day observed in the dry weather period that includes May 1st through October 31st.
- Maximum Hour Dry Weather (MHDW) Flow: The maximum average hour observed during the maximum day dry weather.
- Maximum Month Wet Weather (MMWW) Flow and Load: The maximum average month observed (from a 30-day running average) in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.
- Maximum Week Wet Weather (MWWW) Flow and Load: The maximum average week observed (from a 7-day running average) in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.
- Maximum Day Wet Weather (MDWW) Flow and Load: The maximum average day observed in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.
- Maximum Hour Wet Weather (MHWW) Flow or Peak Hour (PH) Flow: The maximum average hour observed during the maximum day wet weather.
- Non-industrial Flow/Load: Flow rate or load based on residential and commercial customers. Future non-industrial flow is based on future population and employment projections. Future non-industrial loads are based on future population projections.
- Wet Industrial Flow/Load: Flow rate or load based on metered wet industry customers.
- Intel Flow/Load: Includes wet industry flows and loads exclusively from Intel.
- Constituent Loading Parameters
 - » cBOD: Carbonaceous Biological Oxygen Demand
 - » COD: Chemical Oxygen Demand
 - » TSS: Total Suspended Solids
 - » TP: Total Phosphorus
 - » oP: Orthophosphate
 - » NH₄: Ammonium
 - » TKN: Total Kjeldahl Nitrogen
- Units of Measurement
 - » mgd: million gallons per day - flow rate
 - » lbs/d or lbs/day: pounds per day - loading rate
 - » gpnad: gallons per net acre per day - unit flow per area
 - » gpcpd: gallons per capita per day – unit flow per person
 - » gpepd: gallons per employee per day - unit flow per employee

3.4 Summary Approach for Flow and Load Projections (Preliminary Work)

The following summarizes the flow and load projections approach documented in detail in Appendix 3A:

3.4.1 Planning

- First, planning data for historic and future population and employment projections was assembled within the West Basin from the Portland State University, Population Research Center and Metro (see *PART 2, TM2, Study Area Characteristics* for sources and specifics).
- Second, growth potential for wet industrial discharge was discussed with large existing wet industry customers and partner cities. Where information was not available from existing and future industries, permitted wet industry flows and loads were assumed to increase at the rate of the employment growth projection.

3.4.2 Historic Data Review

- Historic data from 2015 to 2019 was reviewed as influent to the Rock Creek, Hillsboro, and Forest Grove wastewater resource recovery facilities (WRRFs) including wastewater flows and constituent loads. Large industry flows and loads were also reviewed from permit monitoring. Data was summarized into several categories including non-industrial (residential/commercial), wet industrial, and wet industrial specific to Intel.

3.4.3 Per Capita Rates, Per Employee Rates, and Flow Peaking Factor Development

- From the historical data, the following parameters were calculated associated with system flows:
 - » Base flow per capita (57.5 gpcpd)
 - » Base flow per employee (30 gpepd)
 - » Flow peaking factors (relative to base flow and for non-industrial, wet industrial, and Intel categories) for AA, ADWF MMDW, MWDW, MDDW, Average wet weather (AWW), MMWW, MWWW, MDWW, and MHWW (also referred to as peak hour, PH).
- The Oregon Department of Environmental Quality (DEQ) outlines a methodology to determine flow associated with ADW, AWW, MMDW, MMWW, MDWW, and MHWW (DEQ, Revision IV, 1996¹). Flow peaking factors were calculated using the DEQ method for comparison to historical peaking factors.
- The District's Collection System models were used to calculate flow peaking factors associated with MMWW, MWWW, MDWW, and MHWW associated with the 5-year design storm for comparison to historical peaking factors.
- From the three methods, peaking factors were selected (relative to base flow) and for non-industrial, wet industrial, and Intel industrial categories for each WRRF.
 - » Non-industrial (residential/commercial)

¹ DEQ, Rev IV, 1996. State of Oregon Department of Environmental Quality Guidelines, *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon: MMDWF, MMWWF, PDAF, and PIF*

- AA: average historic
- MMDW, MWDW, MDDW, MMWW, MWWW: maximum historic
- MDWW, MHWW: collection system modeling with 5-year design storm
- » Wet Industrial and Intel
 - AA: average historic
 - All other flow categories: maximum historic
 - For the Forest Grove WRRF, wet industry MDWW and MHWW were replaced with MMWW and MWWW peaking factors respectively
- For future conditions wet weather peaking factors were reduced to account for lower RDI/I associated with the portion of flow from new development based on current material and construction standards (plastic piping materials and sealed manhole joints).
- Future North Hillsboro (currently undeveloped) industrial flows assumed a 65-percent light industry component (typical of data centers) and 35-percent heavy industry component (typical of existing wet industry customers).
- Where future information was not available from existing permitted wet industries, flows were assumed to increase at the rate of the employment growth projection.
- Future Intel base flows were provided by the customer at 9.2 mgd by 2025 and assumed to increase to a maximum of 14.2 mgd by 2045.

3.4.4 Per Capita Rates, Per Employee Rates, and Constituent Load Peaking Factor Development

- From the historical data, the following parameters were calculated associated with system loads for cBOD and TSS.
 - » AA load per capita including employment
 - Rock Creek WRRF, cBOD = 0.15 lbs/d
 - Rock Creek WRRF, TSS = 0.21 lbs/d
 - Hillsboro WRRF, cBOD = 0.16 lbs/d
 - Hillsboro WRRF, TSS = 0.19 lbs/d
 - Forest Grove WRRF, cBOD = 0.25 lbs/d
 - Forest Grove WRRF, TSS = 0.27 lbs/d
 - » Load peaking factors (relative to AA loading) for MMDW, MWDW, MDDW, MMWW, MWWW, and MDWW.
 - Rock Creek WRRF AA loading and peaking factors were tracked separately for non-industrial (residential/commercial), metered wet industry, and Intel sources.
 - Hillsboro WRRF and Forest Grove WRRF average annual loading and peaking factors were evaluated separately for non-industrial (residential/commercial) and metered wet industries for cBOD and TSS. Because the metered wet industry data was highly variable, the total influent loadings were used instead of separate non-industrial and meter industry components in developing peaking factors.
- The preliminary documentation (Appendix 3A) also considered COD, NH₄, TKN, oP, and TP loads which were not revised for the Phase 1 and Phase 2 work.

- From the historic data, peaking factors were selected (relative to AA loading) for cBOD and TSS.
 - » Non-industrial, Rock Creek WRRF (residential/commercial): All loading, Hillsboro WRRF and Forest Grove WRRF
 - MMDW, MMWW: average historic
 - MWDW, MDDW, MMWW, MWWW: maximum historic
 - » Wet Industrial and Intel, Rock Creek WRRF
 - MMDW, MMWW: average historic
 - MWDW, MDDW, MMWW, MWWW: maximum historic
- For future North Hillsboro (currently undeveloped) annual load projections assumed a 65-percent light industry flow component (typical of data centers) and 35-percent heavy industry flow (typical of existing wet industry customers). Data center constituent concentrations were estimated at 50 milligrams per liter (mg/L) for cBOD and 10 mg/L for TSS.
- Intel annual load increases were based on maintaining existing constituent concentrations and applying these concentrations to the flow projections provided by the customer. Existing constituent concentrations were calculated at 255 mg/L for cBOD and 124 mg/L for TSS.
- Where future information was not available from existing permitted wet industries, loads were assumed to increase at the rate of the employment growth projection.

3.4.5 Flow Projections

- Base flow projections were developed by applying per capita and per employee base flows to the growth portion of population and employment projections. Wet industry base flows were projected by increasing the existing wet industry flows by the employment growth rate and applying specific growth assumptions for Intel and North Hillsboro.
- The remaining flow categories were projected by multiplying the selected peaking factors by the projected base flows. Peaking factors were applied to base flow components as described below.
 - » Non-industrial (residential/commercial) peaking factors applied to population and employment component base flows (all basins).
 - » Metered industrial peaking factors applied to metered industrial component base flows (all basins).
 - » Intel industrial peaking factors applied to Intel component base flows (Rock Creek Basin).
 - » Metered industrial peaking factors applied to North Hillsboro component base flows (Rock Creek Basin).
 - » Basin-wide peaking factors applied to North Hillsboro Area component base flows (Rock Creek Basin).

3.4.6 Load Projections

- Average annual load projections were developed by applying per capita average annual loads to the growth portion of population projections. Wet industry loads were projected by increasing the existing wet industry flows by the employment growth rate and applying specific growth assumptions for Intel and North Hillsboro.

- The remaining load categories were projected by multiplying the selected peaking factors by the projected average annual loads. Peaking factors were applied to average annual loads as described below.
 - » Rock Creek Basin (including North Hillsboro)
 - Non-industrial peaking factors were applied to non-industrial loading components based on population projections.
 - Intel peaking factors were applied to Intel loading components.
 - Metered wet industry peaking factors were applied to metered wet industry loading components.
 - The Intel peaking factors were applied to the North Hillsboro and North Hillsboro expansion area loading components.
 - » Hillsboro and Forest Grove Basins
 - Influent peaking factors were applied to all loading components based on population projections.

3.5 Updated Flow and Load Projections (West Basin Master Plan, Phase 1 and Phase 2)

3.5.1 Peaking Factor and Intel Flow and Load Adjustments

During the West Basin Master Plan Phase 1, several of the flow and load assumptions were adjusted to reflect updated coordination with customers and partner cities. The following adjustments were applied.

- Flow peaking factors for the North Hillsboro area (including areas east and west of Jackson School Road) were reduced from the basin-wide values for Rock Creek to the historic wet industry peaking factors reducing projections in most flow categories (AA, ADWF, MMDW, AWW, MMWW, MWWW).
- Flow peaking factors for the North Hillsboro area (including areas east and west of Jackson School Road) were increased for MDWW and PH to be greater than MWWW and consistent with existing peak RDI/I in North Hillsboro of 2,000 gpnad.
- Intel flow peaking factors were reduced for MDDW, MMWW, MWWW, MDWW, and PH to avoid use of maximum outliers from the historic record.
- Intel AA flow (also equal to base flow) and AA cBOD were adjusted based on customer input as shown in Figures 3.1 and 3.2 below (adjustments from 3/2024).

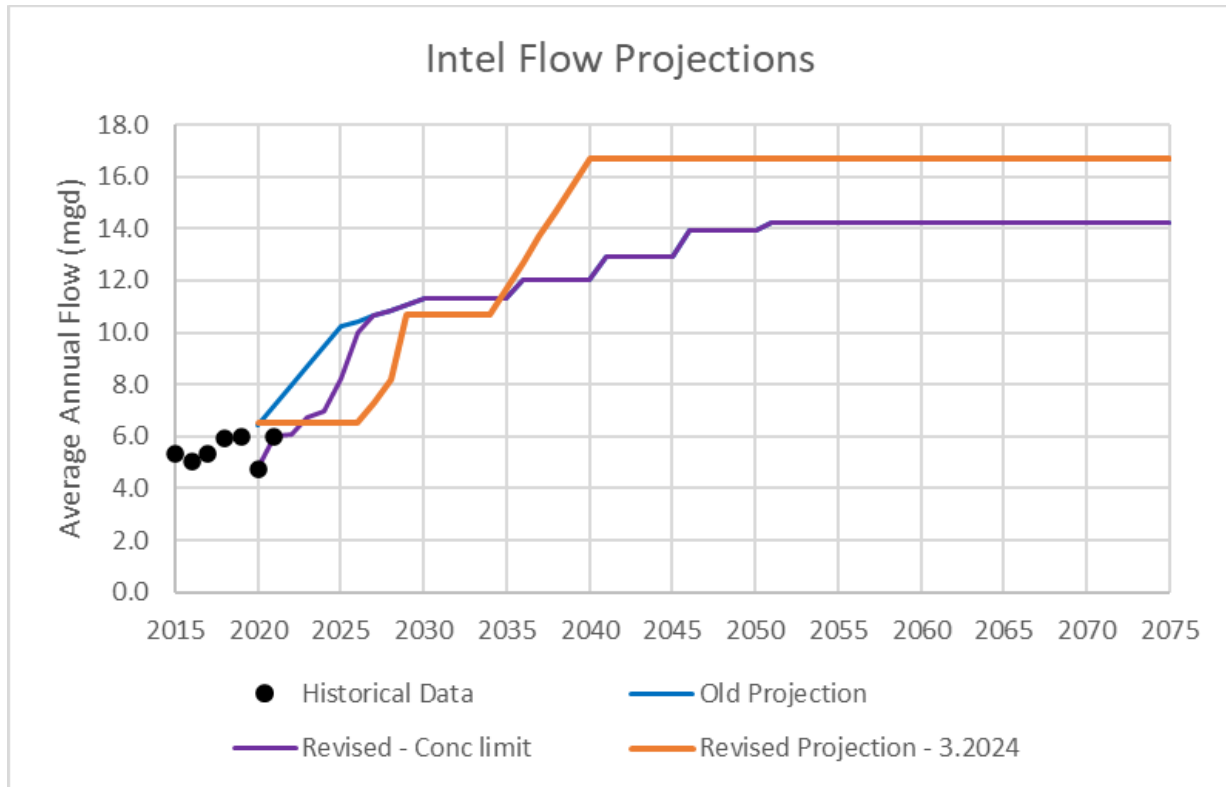


Figure 3.1 Intel Average Annual Flow Projections (03/2024)

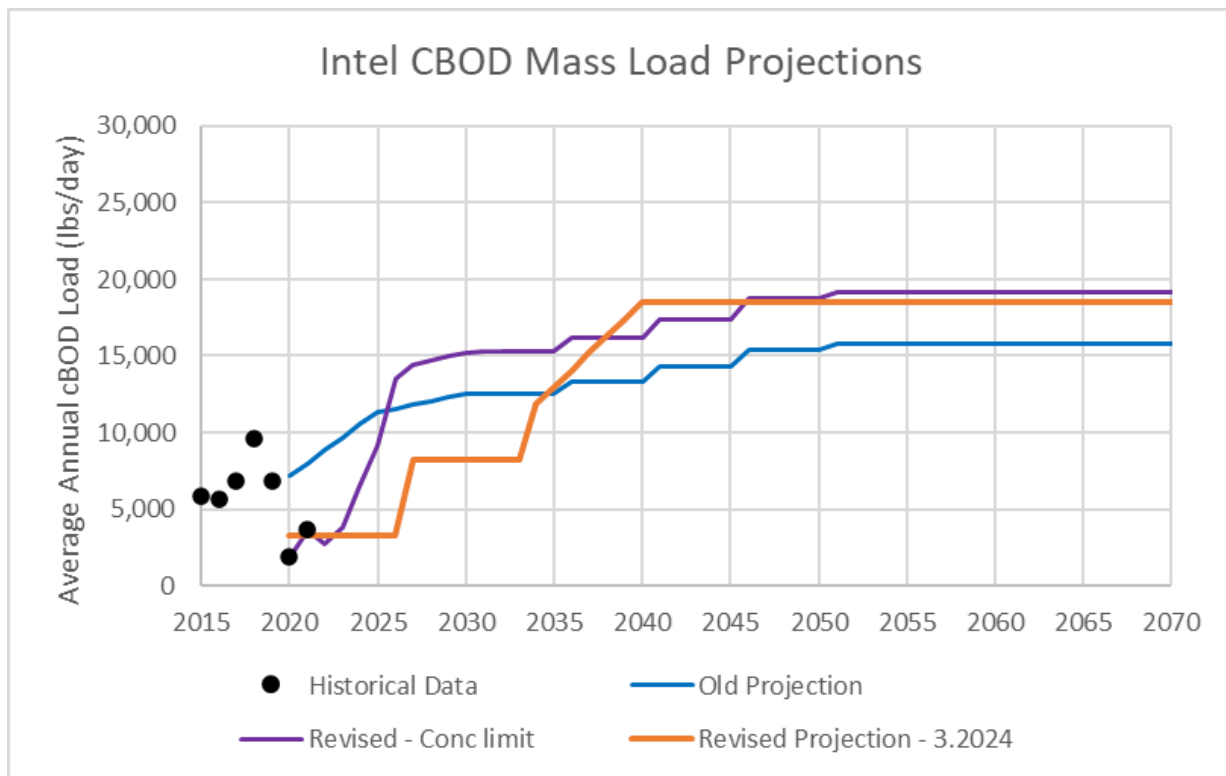


Figure 3.2 Intel Average Annual cBOD Mass Load Projections (03/2024)

3.5.2 Schematic Approach

A schematic approach was used to accumulate flows and loads by service area into the three treatment and collection basins (as shown in Figure 3.3). During the West Basin Master Plan Phase 1, the service area for each treatment basin was being considered and the schematic approach was used to develop flow and load scenarios (see *PHASE 1 - CAMP Documentation*). A spreadsheet tool was developed to generate the flow and load scenarios and was provided to the District as an electronic deliverable (WBasin_Diversion_Flow_Load_Update 2024.03.28.xlsm).

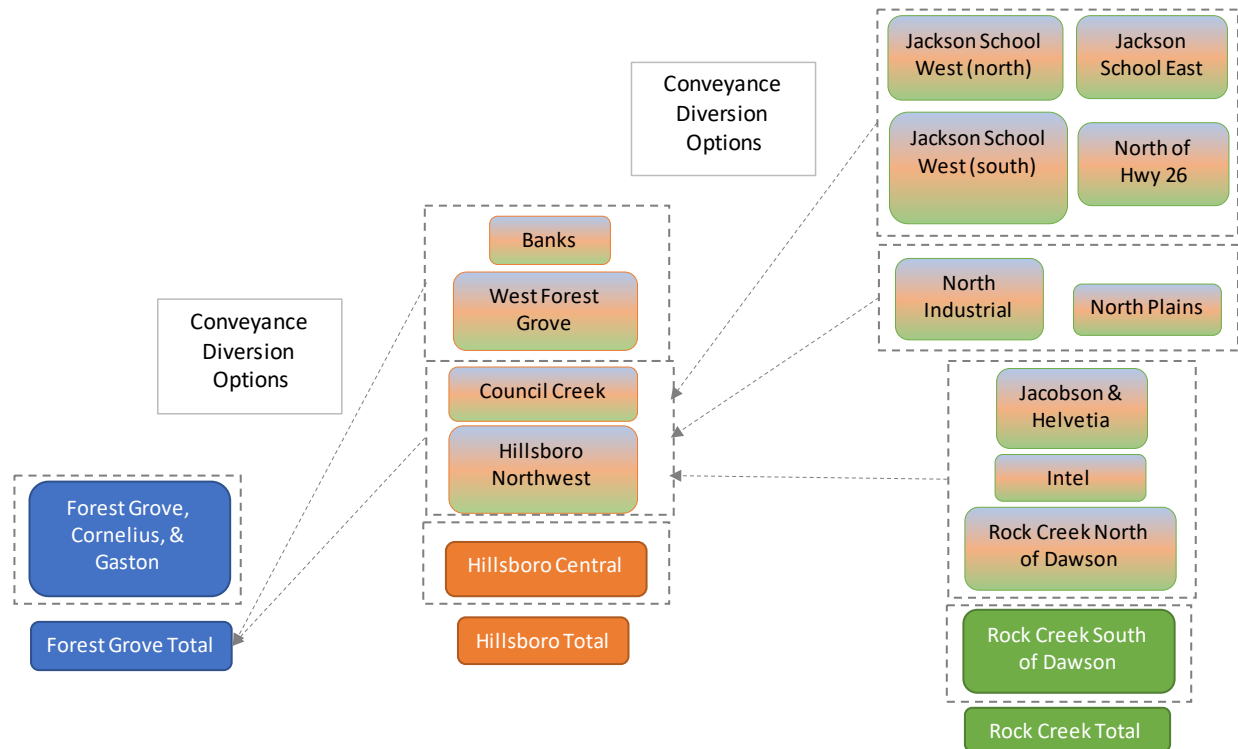


Figure 3.3 Schematic Approach to Flow and Load Scenarios (Options for Some Service Areas to be Diverted)

The outcome of the West Basin Master Plan Phase 1 work was a decision to implement a scenario where Banks and West Forest Grove are diverted to the Forest Grove WRRF; while North Hillsboro (east and west of Jackson School Road) and North Plains are diverted the Rock Creek Basin and served by the Rock Creek WRRF (see Figure 3.4).

During most of the West Basin Master Plan, areas west of Jackson School Road and north of Highway 26 immediately outside of the City of Hillsboro were being considered for UGB expansion as part of the CHIPS and Science Act of 2022. These areas were eliminated from the study area and associated flow and load projections late in the master planning process. Additionally, the City of North Plains City Council approved expansion of the City's UGB in 2023. They are currently doing a new round of review on the expansion and engaging in public opinion. The original approved expansion for North Plains was remanded and removed from this study. See Figure 3.5 for the flow and load schematic for the final study area.

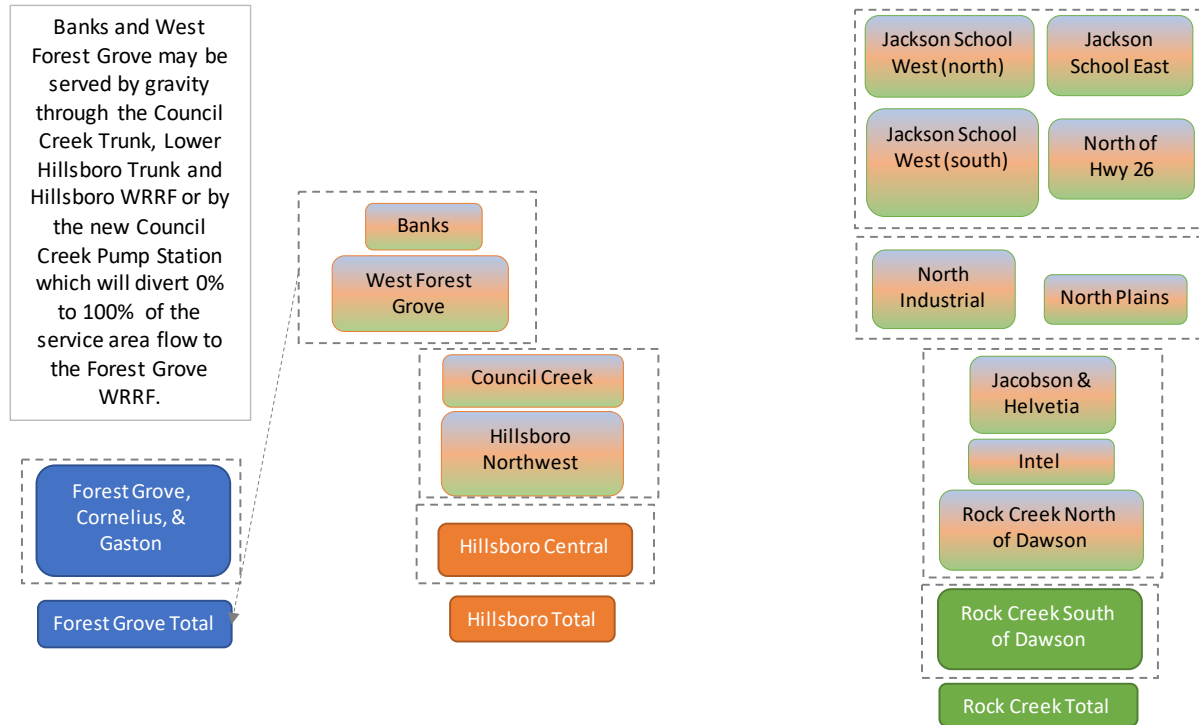


Figure 3.4 Selected Scenario from the West Basin Phase 1 with Banks and Forest Grove diversion to the Forest Grove WRRF)

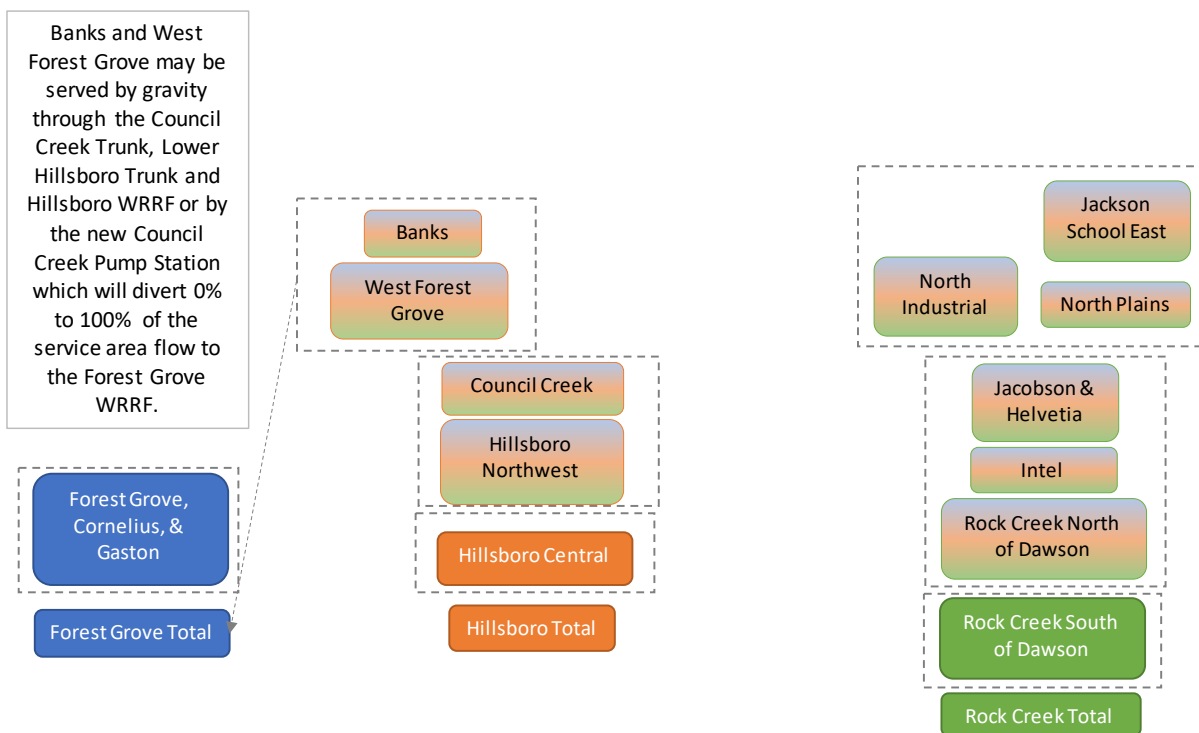


Figure 3.5 Selected Scenario from West Basin Phase 1 with Banks and Forest Grove diversion to the Forest Grove WRRF; Eliminated UGB Expansion Lands West of Jackson School Road and North of Highway 26

3.5.3 Application of Peaking Factors

Peaking factors from the preliminary work and based on the adjustments documented in Section 3.5.1 were applied to each service area in the schematic model for the preferred flow and load scenario. These peaking factors are documented in Table 3.1.

Flow and load projections are summarized for the Forest Grove WRRF (including 100-percent flow and load diversion of West Forest Grove and Banks) in Tables 3.2, 3.3 and 3.4 for flow, cBOD, and TSS respectively.

Flow and load projections are summarized for the Hillsboro WRRF (excluding 100-percent flow and load diversion of West Forest Grove and Banks) in Tables 3.5, 3.6 and 3.7 for flow, cBOD, and TSS respectively.

The actual flows and loads to the Forest Grove WRRF may be lower seasonally if West Forest Grove and Banks are partially diverted to the Forest Grove WRRF. The actual flows and loads to the Hillsboro WRRF may be higher seasonally for a partial diversion. The flow and load spreadsheet tool may be used to adjust flow and load summaries based on seasonal operations to each WRRF.

Flow and load projections are summarized for the Rock Creek WRRF (excluding expansion areas west of Jackson School Road and north of Highway 26) in Tables 3.8, 3.9 and 3.10 for flow, cBOD, and TSS respectively. The flow and load spreadsheet tool may be used to review early work with the expansion area flows and loads included.

Table 3.1 Peaking Factors by Flow and Load Component and Service Area Application

Flow or Load	Flow or Load Category	Years	Peaking Factor by Service Area and Flow/Load Categories								
			Rock Creek non-industrial	Rock Creek Industrial	Rock Creek Intel	North Hillsboro	North Hillsboro Expansion	Hillsboro non-industrial	Hillsboro Industrial	Forest Grove non-industrial	Forest Grove Industrial
Flow	AAF	2020-2075	1.4	1.0	1.0	1.0	1.0	1.5	1.5	1.9	0.9
	ADWF	2020-2075	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.1	0.9
	MMDW	2020-2075	1.3	1.15	1.12	1.15	1.15	1.6	1.1	2.0	1.0
	MWDW	2020-2075	1.6	1.1	1.2	1.1	1.1	2.1	1.1	2.8	1.0
	MDDW	2020-2075	2.0	1.0	1.21	1.0	1.0	2.3	1.3	3.8	1.0
	AWWF	2020-2075	1.7	1.1	1.0	1.1	1.1	2.0	1.0	2.8	0.8
	MMWW	2020	3.0	1.2	1.05	1.2	1.2	4.1	1.1	5.3	1.0
		2025	2.9	1.2	1.05	1.2	1.2	4.0	1.1	5.1	1.0
		2030	2.8	1.2	1.05	1.2	1.2	3.8	1.1	5.0	1.0
		2035	2.7	1.2	1.05	1.2	1.2	3.7	1.1	4.9	1.0
		2040	2.6	1.2	1.05	1.2	1.2	3.6	1.1	4.8	1.0
		2045	2.6	1.2	1.05	1.2	1.2	3.6	1.1	4.7	1.0
		2050	2.6	1.2	1.05	1.2	1.2	3.5	1.1	4.6	1.0
		2055	2.5	1.2	1.05	1.2	1.2	3.5	1.1	4.5	1.0
		2060	2.5	1.2	1.05	1.2	1.2	3.4	1.1	4.3	1.0
		2065	2.4	1.2	1.05	1.2	1.2	3.3	1.1	4.2	1.0
		2070	2.4	1.2	1.05	1.2	1.2	3.3	1.1	4.1	1.0
		2075	2.4	1.2	1.05	1.2	1.2	3.2	1.1	4.0	1.0
	MWWW	2020	4.1	1.2	1.09	1.2	1.2	5.4	1.1	7.4	1.0
		2025	4.0	1.2	1.09	1.2	1.2	5.3	1.1	7.2	1.0
		2030	3.8	1.2	1.09	1.2	1.2	5.1	1.1	7.0	1.0
		2035	3.7	1.2	1.09	1.2	1.2	5.0	1.1	6.9	1.0
		2040	3.6	1.2	1.09	1.2	1.2	4.8	1.1	6.7	1.0
		2045	3.6	1.2	1.09	1.2	1.2	4.7	1.1	6.5	1.0
		2050	3.5	1.2	1.09	1.2	1.2	4.7	1.1	6.4	1.0
		2055	3.5	1.2	1.09	1.2	1.2	4.6	1.1	6.2	1.0
		2060	3.4	1.2	1.09	1.2	1.2	4.5	1.1	6.1	1.0
		2065	3.4	1.2	1.09	1.2	1.2	4.4	1.1	5.9	1.0
		2070	3.3	1.2	1.09	1.2	1.2	4.4	1.1	5.8	1.0
		2075	3.3	1.2	1.09	1.2	1.2	4.3	1.1	5.6	1.0
	MDWW	2020	5.2	1.1	1.12	1.3	1.3	6.4	1.1	9.1	1.0
		2025	5.0	1.1	1.12	1.3	1.3	6.2	1.1	8.9	1.0
		2030	4.9	1.1	1.12	1.3	1.3	6.1	1.1	8.7	1.0
		2035	4.8	1.1	1.12	1.3	1.3	5.9	1.1	8.5	1.0
		2040	4.6	1.1	1.12	1.3	1.3	5.7	1.1	8.2	1.0
		2045	4.5	1.1	1.12	1.3	1.3	5.6	1.1	8.1	1.0

Flow or Load	Flow or Load Category	Years	Peaking Factor by Service Area and Flow/Load Categories								
			Rock Creek non-industrial	Rock Creek Industrial	Rock Creek Intel	North Hillsboro	North Hillsboro Expansion	Hillsboro non-industrial	Hillsboro Industrial	Forest Grove non-industrial	Forest Grove Industrial
		2050	4.5	1.1	1.12	1.3	1.3	5.5	1.1	7.9	1.0
		2055	4.4	1.1	1.12	1.3	1.3	5.5	1.1	7.7	1.0
		2060	4.4	1.1	1.12	1.3	1.3	5.4	1.1	7.5	1.0
		2065	4.3	1.1	1.12	1.3	1.3	5.3	1.1	7.3	1.0
		2070	4.2	1.1	1.12	1.3	1.3	5.2	1.1	7.1	1.0
		2075	4.2	1.1	1.12	1.3	1.3	5.1	1.1	6.9	1.0
	PH	2020	6.8	1.2	1.25	1.40	1.40	7.2	1.3	13.3	1.0
		2025	6.6	1.2	1.25	1.40	1.40	7.0	1.3	13.0	1.0
		2030	6.4	1.2	1.25	1.40	1.40	6.8	1.3	12.7	1.0
		2035	6.2	1.2	1.25	1.40	1.40	6.6	1.3	12.4	1.0
		2040	6.0	1.2	1.25	1.40	1.40	6.4	1.3	12.1	1.0
		2045	6.0	1.2	1.25	1.40	1.40	6.3	1.3	11.8	1.0
		2050	5.9	1.2	1.25	1.40	1.40	6.3	1.3	11.5	1.0
		2055	5.8	1.2	1.25	1.40	1.40	6.2	1.3	11.3	1.0
		2060	5.7	1.2	1.25	1.40	1.40	6.1	1.3	11.0	1.0
		2065	5.6	1.2	1.25	1.40	1.40	6.0	1.3	10.7	1.0
		2070	5.5	1.2	1.25	1.40	1.40	5.9	1.3	10.4	1.0
		2075	5.4	1.2	1.25	1.40	1.40	5.8	1.3	10.2	1.0
cBOD	ADW	2020-2075	1.01	1.2	1.0	1.0	1.0	1.0	1.0	1.1	1.1
	MMDW	2020-2075	1.2	1.2	1.1	1.1	1.1	1.2	1.2	1.4	1.4
	MWDW	2020-2075	1.4	1.4	1.3	1.3	1.3	2.0	2.0	1.8	1.8
	MDDW	2020-2075	2.0	1.9	1.8	1.8	1.8	2.7	2.7	2.3	2.3
	AWW	2020-2075	1.0	0.8	1.0	1.0	1.0	1.0	1.0	0.9	0.9
	MMWW	2020-2075	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.3	1.3
	MWWW	2020-2075	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4
	MDWW	2020-2075	2.1	2.0	1.8	1.8	1.8	2.3	2.3	1.5	1.5
TSS	ADW	2020-2075	1.0	1.2	1.0	1.0	1.0	1.0	1.0	1.1	1.1
	MMDW	2020-2075	1.2	1.1	1.1	1.1	1.1	1.2	1.2	1.4	1.4
	MWDW	2020-2075	1.6	1.5	1.6	1.6	1.6	1.4	1.4	2.2	2.2
	MDDW	2020-2075	2.0	2.0	2.0	2.0	2.0	2.5	2.5	4.2	4.2
	AWW	2020-2075	1.0	0.9	1.0	1.0	1.0	1.0	1.0	0.9	0.9
	MMWW	2020-2075	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	MWWW	2020-2075	1.5	1.5	1.5	1.5	1.5	2.1	2.1	1.8	1.8
	MDWW	2020-2075	2.7	2.7	2.7	2.7	2.7	3.6	3.6	3.4	3.4

Table 3.2 Forest Grove WRRF Flow Projections (including 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent Flow (mgd)											
Year	Baseflow	AAF	ADWF	MMDW	MWDW	MDDW	AWWF	MMWW	MWWW	MDWW	PH
2020	3.3	5.7	3.7	6.0	8.1	10.5	7.9	15.3	21.0	25.7	35.5
2021	3.4	5.8	3.7	6.1	8.2	10.6	8.0	15.4	21.2	25.9	35.8
2022	3.4	5.8	3.8	6.2	8.3	10.7	8.1	15.5	21.3	26.0	36.0
2023	3.5	5.9	3.8	6.2	8.4	10.8	8.2	15.6	21.5	26.2	36.2
2024	3.5	6.0	3.9	6.3	8.5	11.0	8.3	15.7	21.6	26.4	36.4
2025	3.5	6.1	3.9	6.4	8.6	11.1	8.4	15.9	21.8	26.6	36.7
2026	3.6	6.1	3.9	6.4	8.7	11.2	8.5	15.9	21.9	26.6	36.8
2027	3.6	6.2	4.0	6.5	8.7	11.2	8.5	15.9	21.9	26.7	36.9
2028	3.6	6.2	4.0	6.5	8.8	11.3	8.6	16.0	22.0	26.8	37.0
2029	3.6	6.2	4.0	6.6	8.9	11.4	8.7	16.0	22.0	26.9	37.0
2030	3.7	6.3	4.1	6.6	8.9	11.5	8.7	16.1	22.1	26.9	37.1
2031	3.7	6.3	4.1	6.7	9.0	11.6	8.8	16.1	22.1	27.0	37.2
2032	3.7	6.4	4.1	6.7	9.0	11.6	8.8	16.1	22.2	27.0	37.2
2033	3.7	6.4	4.1	6.8	9.1	11.7	8.9	16.1	22.2	27.0	37.3
2034	3.8	6.4	4.2	6.8	9.1	11.8	8.9	16.2	22.2	27.1	37.3
2035	3.8	6.5	4.2	6.8	9.2	11.9	9.0	16.2	22.3	27.1	37.3
2036	3.8	6.6	4.2	6.9	9.3	12.0	9.1	16.3	22.4	27.3	37.6
2037	3.9	6.7	4.3	7.0	9.4	12.2	9.2	16.4	22.6	27.5	37.9
2038	4.0	6.8	4.4	7.1	9.6	12.3	9.4	16.6	22.8	27.7	38.1
2039	4.0	6.8	4.4	7.2	9.7	12.5	9.5	16.7	22.9	27.9	38.4
2040	4.1	6.9	4.5	7.3	9.8	12.6	9.6	16.8	23.1	28.1	38.7
2041	4.1	7.0	4.5	7.4	9.9	12.8	9.7	16.9	23.2	28.3	38.9
2042	4.2	7.1	4.6	7.5	10.0	12.9	9.8	17.0	23.4	28.5	39.2
2043	4.2	7.2	4.6	7.6	10.1	13.0	9.9	17.2	23.6	28.7	39.4
2044	4.2	7.2	4.7	7.6	10.3	13.2	10.0	17.3	23.7	28.9	39.7
2045	4.3	7.3	4.7	7.7	10.4	13.3	10.1	17.4	23.9	29.1	39.9
2046	4.3	7.4	4.8	7.8	10.5	13.5	10.2	17.5	24.0	29.2	40.1
2047	4.4	7.5	4.8	7.9	10.6	13.6	10.3	17.6	24.1	29.4	40.3
2048	4.4	7.5	4.9	8.0	10.7	13.7	10.4	17.7	24.3	29.5	40.5
2049	4.5	7.6	4.9	8.0	10.8	13.8	10.5	17.8	24.4	29.7	40.7
2050	4.5	7.7	5.0	8.1	10.9	14.0	10.6	17.9	24.5	29.9	40.9
2051	4.6	7.8	5.0	8.2	11.0	14.1	10.7	18.0	24.6	30.0	41.1
2052	4.6	7.8	5.1	8.3	11.1	14.2	10.8	18.1	24.8	30.2	41.4
2053	4.7	7.9	5.1	8.4	11.2	14.4	10.9	18.2	24.9	30.3	41.6
2054	4.7	8.0	5.2	8.4	11.3	14.5	11.0	18.3	25.0	30.5	41.8
2055	4.8	8.1	5.2	8.5	11.4	14.7	11.2	18.4	25.2	30.7	42.0
2056	4.8	8.1	5.3	8.6	11.5	14.8	11.3	18.5	25.3	30.8	42.2
2057	4.8	8.2	5.3	8.7	11.6	14.9	11.4	18.6	25.4	31.0	42.4
2058	4.9	8.3	5.4	8.8	11.8	15.1	11.5	18.6	25.6	31.1	42.6
2059	4.9	8.4	5.4	8.8	11.9	15.2	11.6	18.7	25.7	31.3	42.8
2060	5.0	8.5	5.5	8.9	12.0	15.4	11.7	18.8	25.8	31.4	43.0
2061	5.0	8.5	5.5	9.0	12.1	15.5	11.8	18.9	25.9	31.6	43.2
2062	5.1	8.6	5.6	9.1	12.2	15.6	11.9	19.0	26.0	31.7	43.3
2063	5.1	8.7	5.6	9.2	12.3	15.8	12.0	19.1	26.1	31.8	43.5
2064	5.2	8.8	5.7	9.2	12.4	15.9	12.1	19.1	26.2	31.9	43.6
2065	5.2	8.8	5.7	9.3	12.5	16.0	12.2	19.2	26.3	32.0	43.8
2066	5.3	8.9	5.8	9.4	12.6	16.1	12.3	19.3	26.4	32.1	43.9
2067	5.3	9.0	5.8	9.5	12.7	16.3	12.4	19.3	26.5	32.2	44.0
2068	5.3	9.0	5.9	9.5	12.8	16.4	12.5	19.4	26.6	32.3	44.2
2069	5.4	9.1	5.9	9.6	12.9	16.5	12.6	19.5	26.7	32.4	44.3
2070	5.4	9.2	6.0	9.7	13.0	16.7	12.7	19.5	26.7	32.5	44.4
2071	5.5	9.3	6.0	9.8	13.1	16.8	12.8	19.6	26.8	32.6	44.5
2072	5.5	9.3	6.1	9.8	13.2	16.9	12.9	19.6	26.9	32.7	44.7
2073	5.6	9.4	6.1	9.9	13.3	17.0	13.0	19.7	27.0	32.8	44.8
2074	5.6	9.5	6.2	10.0	13.4	17.2	13.1	19.8	27.0	32.9	44.9
2075	5.6	9.5	6.2	10.1	13.5	17.3	13.2	19.8	27.1	33.0	45.0

Table 3.3 Forest Grove WRRF cBOD Load Projections (including 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent cBOD (lbs/day)										
Year	PH	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	35.5	8,204	9,172	11,377	15,400	19,710	7,230	10,482	11,279	13,904
2021	35.8	8,316	9,296	11,530	15,611	19,982	7,330	10,623	11,433	14,101
2022	36.0	8,428	9,420	11,684	15,823	20,254	7,430	10,764	11,586	14,299
2023	36.2	8,541	9,544	11,837	16,035	20,527	7,530	10,905	11,740	14,497
2024	36.4	8,653	9,668	11,990	16,246	20,799	7,630	11,046	11,894	14,694
2025	36.7	8,765	9,792	12,144	16,458	21,071	7,730	11,187	12,048	14,892
2026	36.8	8,857	9,895	12,270	16,631	21,295	7,812	11,303	12,174	15,053
2027	36.9	8,949	9,997	12,396	16,805	21,518	7,894	11,420	12,301	15,214
2028	37.0	9,041	10,099	12,522	16,978	21,741	7,976	11,536	12,427	15,374
2029	37.0	9,133	10,201	12,649	17,152	21,964	8,057	11,652	12,553	15,535
2030	37.1	9,225	10,303	12,775	17,325	22,187	8,139	11,769	12,680	15,696
2031	37.2	9,306	10,393	12,887	17,479	22,385	8,212	11,871	12,792	15,840
2032	37.2	9,388	10,484	12,998	17,633	22,584	8,285	11,974	12,904	15,984
2033	37.3	9,470	10,574	13,110	17,788	22,782	8,358	12,077	13,016	16,128
2034	37.3	9,551	10,664	13,222	17,942	22,981	8,430	12,180	13,128	16,272
2035	37.3	9,633	10,755	13,333	18,096	23,179	8,503	12,282	13,240	16,416
2036	37.6	9,744	10,881	13,492	18,302	23,440	8,599	12,429	13,393	16,590
2037	37.9	9,855	11,008	13,650	18,509	23,701	8,695	12,575	13,547	16,764
2038	38.1	9,967	11,135	13,808	18,715	23,963	8,791	12,721	13,700	16,937
2039	38.4	10,078	11,262	13,967	18,922	24,224	8,886	12,867	13,854	17,111
2040	38.7	10,189	11,389	14,125	19,128	24,485	8,982	13,013	14,007	17,285
2041	38.9	10,327	11,543	14,317	19,388	24,817	9,104	13,189	14,197	17,518
2042	39.2	10,466	11,698	14,508	19,647	25,149	9,226	13,366	14,387	17,752
2043	39.4	10,604	11,852	14,700	19,906	25,481	9,347	13,543	14,577	17,986
2044	39.7	10,742	12,007	14,892	20,166	25,812	9,469	13,719	14,767	18,220
2045	39.9	10,880	12,161	15,083	20,425	26,144	9,591	13,896	14,957	18,454
2046	40.1	11,007	12,303	15,259	20,662	26,447	9,702	14,058	15,131	18,666
2047	40.3	11,133	12,445	15,435	20,899	26,750	9,813	14,220	15,304	18,879
2048	40.5	11,259	12,586	15,611	21,136	27,053	9,924	14,382	15,478	19,091
2049	40.7	11,386	12,728	15,787	21,373	27,356	10,035	14,544	15,652	19,303
2050	40.9	11,512	12,869	15,962	21,610	27,658	10,146	14,706	15,826	19,515
2051	41.1	11,647	13,020	16,149	21,862	27,981	10,265	14,878	16,011	19,742
2052	41.4	11,781	13,171	16,336	22,114	28,303	10,383	15,050	16,196	19,968
2053	41.6	11,916	13,321	16,523	22,366	28,626	10,501	15,222	16,380	20,195
2054	41.8	12,050	13,472	16,710	22,618	28,948	10,619	15,394	16,565	20,421
2055	42.0	12,184	13,622	16,896	22,870	29,270	10,738	15,567	16,750	20,647
2056	42.2	12,323	13,777	17,089	23,130	29,603	10,860	15,744	16,941	20,881
2057	42.4	12,462	13,933	17,282	23,391	29,936	10,982	15,922	17,131	21,115
2058	42.6	12,600	14,088	17,474	23,651	30,268	11,104	16,099	17,322	21,349
2059	42.8	12,739	14,243	17,667	23,911	30,601	11,226	16,277	17,513	21,582
2060	43.0	12,878	14,398	17,860	24,171	30,933	11,348	16,454	17,704	21,816
2061	43.2	13,004	14,540	18,035	24,408	31,236	11,459	16,616	17,877	22,028
2062	43.3	13,131	14,682	18,211	24,645	31,539	11,570	16,778	18,051	22,241
2063	43.5	13,257	14,823	18,387	24,882	31,842	11,681	16,940	18,225	22,453
2064	43.6	13,383	14,965	18,563	25,119	32,145	11,792	17,102	18,399	22,665
2065	43.8	13,510	15,107	18,739	25,356	32,448	11,903	17,264	18,573	22,878
2066	43.9	13,632	15,243	18,908	25,584	32,740	12,010	17,420	18,740	23,082
2067	44.0	13,753	15,379	19,077	25,812	33,031	12,117	17,576	18,907	23,287
2068	44.2	13,875	15,516	19,247	26,040	33,323	12,224	17,732	19,075	23,491
2069	44.3	13,997	15,652	19,416	26,268	33,615	12,331	17,888	19,242	23,695
2070	44.4	14,118	15,788	19,585	26,497	33,906	12,438	18,044	19,410	23,900
2071	44.5	14,240	15,925	19,754	26,725	34,198	12,545	18,200	19,577	24,104
2072	44.7	14,362	16,061	19,924	26,953	34,489	12,652	18,356	19,744	24,308
2073	44.8	14,484	16,198	20,093	27,181	34,781	12,759	18,512	19,912	24,513
2074	44.9	14,605	16,334	20,262	27,409	35,073	12,866	18,668	20,079	24,717
2075	45.0	14,727	16,470	20,432	27,637	35,364	12,973	18,824	20,246	24,921

Table 3.4 Forest Grove WRRF TSS Load Projections (including 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent TSS (lbs/day)									
Year	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	8,323	9,168	11,389	16,321	30,729	7,487	10,065	15,486	28,920
2021	8,428	9,281	11,529	16,515	31,089	7,584	10,192	15,686	29,285
2022	8,532	9,393	11,669	16,709	31,450	7,680	10,319	15,886	29,650
2023	8,637	9,506	11,809	16,903	31,811	7,776	10,446	16,085	30,014
2024	8,741	9,619	11,949	17,097	32,171	7,873	10,572	16,285	30,379
2025	8,846	9,731	12,088	17,291	32,532	7,969	10,699	16,484	30,744
2026	8,952	9,848	12,234	17,498	32,920	8,066	10,828	16,684	31,115
2027	9,059	9,965	12,379	17,704	33,307	8,162	10,957	16,884	31,486
2028	9,166	10,082	12,524	17,911	33,695	8,259	11,087	17,084	31,857
2029	9,272	10,199	12,669	18,117	34,082	8,355	11,216	17,283	32,228
2030	9,379	10,316	12,814	18,324	34,470	8,452	11,345	17,483	32,599
2031	9,478	10,424	12,949	18,515	34,828	8,542	11,465	17,669	32,943
2032	9,577	10,532	13,084	18,706	35,187	8,631	11,584	17,854	33,287
2033	9,676	10,641	13,218	18,897	35,545	8,721	11,704	18,040	33,632
2034	9,775	10,749	13,353	19,088	35,904	8,811	11,824	18,226	33,976
2035	9,874	10,857	13,487	19,279	36,262	8,900	11,944	18,411	34,321
2036	9,971	10,967	13,624	19,482	36,651	8,984	12,060	18,585	34,655
2037	10,067	11,077	13,760	19,686	37,039	9,069	12,177	18,758	34,989
2038	10,164	11,186	13,896	19,889	37,428	9,153	12,293	18,932	35,323
2039	10,261	11,296	14,032	20,092	37,816	9,237	12,410	19,105	35,657
2040	10,358	11,405	14,168	20,296	38,205	9,321	12,526	19,279	35,992
2041	10,497	11,559	14,359	20,569	38,720	9,446	12,695	19,538	36,476
2042	10,636	11,713	14,550	20,843	39,235	9,571	12,863	19,797	36,960
2043	10,776	11,866	14,740	21,116	39,750	9,697	13,032	20,057	37,444
2044	10,915	12,020	14,931	21,389	40,264	9,822	13,200	20,316	37,928
2045	11,055	12,173	15,122	21,663	40,779	9,947	13,369	20,575	38,413
2046	11,179	12,310	15,292	21,908	41,241	10,059	13,519	20,805	38,844
2047	11,303	12,447	15,462	22,152	41,702	10,170	13,669	21,036	39,275
2048	11,427	12,584	15,633	22,397	42,163	10,282	13,819	21,266	39,706
2049	11,551	12,721	15,803	22,642	42,624	10,393	13,969	21,496	40,137
2050	11,675	12,858	15,973	22,886	43,085	10,504	14,119	21,727	40,568
2051	11,808	13,005	16,155	23,148	43,579	10,624	14,280	21,974	41,031
2052	11,942	13,152	16,338	23,411	44,073	10,743	14,441	22,221	41,493
2053	12,075	13,299	16,520	23,673	44,567	10,863	14,602	22,469	41,956
2054	12,208	13,446	16,703	23,935	45,061	10,983	14,763	22,716	42,418
2055	12,341	13,593	16,885	24,197	45,555	11,102	14,924	22,963	42,881
2056	12,479	13,745	17,074	24,468	46,066	11,226	15,091	23,219	43,360
2057	12,617	13,897	17,263	24,739	46,577	11,350	15,258	23,475	43,839
2058	12,755	14,049	17,452	25,011	47,088	11,474	15,424	23,732	44,318
2059	12,893	14,201	17,641	25,282	47,599	11,598	15,591	23,988	44,797
2060	13,031	14,353	17,830	25,553	48,110	11,722	15,758	24,244	45,276
2061	13,155	14,490	18,000	25,798	48,571	11,833	15,908	24,474	45,707
2062	13,279	14,627	18,170	26,043	49,033	11,944	16,058	24,705	46,138
2063	13,403	14,764	18,341	26,287	49,494	12,056	16,208	24,935	46,570
2064	13,527	14,901	18,511	26,532	49,955	12,167	16,358	25,166	47,001
2065	13,651	15,038	18,681	26,777	50,417	12,279	16,508	25,396	47,432
2066	13,771	15,170	18,845	27,012	50,860	12,386	16,652	25,617	47,847
2067	13,890	15,302	19,008	27,247	51,304	12,493	16,797	25,839	48,261
2068	14,009	15,434	19,172	27,483	51,747	12,600	16,941	26,060	48,676
2069	14,129	15,565	19,336	27,718	52,191	12,707	17,085	26,282	49,090
2070	14,248	15,697	19,499	27,953	52,634	12,814	17,230	26,503	49,505
2071	14,367	15,829	19,663	28,189	53,078	12,921	17,374	26,725	49,919
2072	14,487	15,961	19,827	28,424	53,522	13,028	17,518	26,946	50,334
2073	14,606	16,092	19,990	28,659	53,965	13,135	17,662	27,168	50,748
2074	14,726	16,224	20,154	28,895	54,409	13,242	17,807	27,389	51,163
2075	14,845	16,356	20,318	29,130	54,852	13,349	17,951	27,611	51,577

Table 3.5 Hillsboro WRRF Flow Projections (excluding 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent Flow (mgd)											
Year	Baseflow	AAF	ADWF	MMDW	MWDW	MDDW	AWWF	MMWW	MWWW	MDWW	PH
2020	2.3	3.4	2.4	3.6	4.6	5.2	4.4	9.0	11.9	14.1	15.9
2021	2.3	3.4	2.5	3.6	4.6	5.3	4.4	9.0	11.9	14.2	16.0
2022	2.3	3.5	2.5	3.7	4.7	5.3	4.5	9.0	12.0	14.2	16.0
2023	2.3	3.5	2.5	3.7	4.7	5.4	4.5	9.1	12.0	14.3	16.1
2024	2.4	3.5	2.5	3.7	4.8	5.4	4.5	9.1	12.1	14.3	16.1
2025	2.4	3.6	2.5	3.8	4.8	5.5	4.6	9.1	12.1	14.4	16.2
2026	2.4	3.6	2.6	3.8	4.9	5.5	4.6	9.2	12.2	14.4	16.3
2027	2.4	3.7	2.6	3.9	4.9	5.6	4.7	9.3	12.3	14.5	16.4
2028	2.5	3.7	2.6	3.9	5.0	5.7	4.7	9.3	12.3	14.6	16.5
2029	2.5	3.7	2.7	4.0	5.1	5.7	4.8	9.4	12.4	14.7	16.6
2030	2.5	3.8	2.7	4.0	5.1	5.8	4.9	9.4	12.5	14.8	16.7
2031	2.6	3.8	2.7	4.0	5.2	5.9	4.9	9.5	12.6	14.9	16.8
2032	2.6	3.9	2.8	4.1	5.2	5.9	5.0	9.5	12.6	15.0	16.9
2033	2.6	3.9	2.8	4.1	5.3	6.0	5.0	9.6	12.7	15.1	17.0
2034	2.6	4.0	2.8	4.2	5.3	6.1	5.1	9.6	12.8	15.1	17.1
2035	2.7	4.0	2.9	4.2	5.4	6.1	5.1	9.7	12.8	15.2	17.2
2036	2.8	4.1	3.0	4.4	5.6	6.3	5.3	9.9	13.2	15.6	17.6
2037	2.9	4.3	3.1	4.5	5.8	6.6	5.5	10.2	13.5	16.0	18.0
2038	2.9	4.4	3.2	4.7	5.9	6.8	5.6	10.4	13.8	16.4	18.5
2039	3.0	4.6	3.3	4.8	6.1	7.0	5.8	10.7	14.2	16.8	18.9
2040	3.1	4.7	3.4	4.9	6.3	7.2	6.0	11.0	14.5	17.2	19.4
2041	3.2	4.8	3.4	5.0	6.4	7.3	6.1	11.1	14.6	17.4	19.6
2042	3.2	4.8	3.4	5.1	6.5	7.4	6.2	11.2	14.8	17.5	19.8
2043	3.3	4.9	3.5	5.1	6.6	7.5	6.2	11.3	15.0	17.7	20.0
2044	3.3	5.0	3.5	5.2	6.7	7.6	6.3	11.4	15.1	17.9	20.2
2045	3.3	5.0	3.6	5.3	6.7	7.7	6.4	11.5	15.3	18.1	20.4
2046	3.4	5.1	3.6	5.3	6.8	7.8	6.5	11.6	15.4	18.3	20.6
2047	3.4	5.1	3.7	5.4	6.9	7.9	6.6	11.8	15.5	18.4	20.8
2048	3.5	5.2	3.7	5.5	7.0	8.0	6.7	11.9	15.7	18.6	21.0
2049	3.5	5.3	3.8	5.5	7.1	8.1	6.7	12.0	15.8	18.8	21.2
2050	3.6	5.3	3.8	5.6	7.2	8.2	6.8	12.1	16.0	19.0	21.4
2051	3.6	5.4	3.9	5.7	7.3	8.3	6.9	12.2	16.1	19.1	21.6
2052	3.7	5.5	3.9	5.8	7.4	8.4	7.0	12.3	16.3	19.3	21.8
2053	3.7	5.5	4.0	5.8	7.4	8.5	7.1	12.4	16.4	19.5	22.0
2054	3.7	5.6	4.0	5.9	7.5	8.6	7.2	12.5	16.6	19.6	22.1
2055	3.8	5.7	4.1	6.0	7.6	8.7	7.2	12.6	16.7	19.8	22.3
2056	3.8	5.7	4.1	6.0	7.7	8.8	7.3	12.8	16.9	20.0	22.5
2057	3.9	5.8	4.2	6.1	7.8	8.9	7.4	12.9	17.0	20.2	22.7
2058	3.9	5.9	4.2	6.2	7.9	9.0	7.5	13.0	17.1	20.3	22.9
2059	4.0	5.9	4.2	6.3	8.0	9.1	7.6	13.1	17.3	20.5	23.1
2060	4.0	6.0	4.3	6.3	8.1	9.2	7.7	13.2	17.4	20.7	23.3
2061	4.1	6.1	4.3	6.4	8.2	9.3	7.8	13.3	17.6	20.8	23.5
2062	4.1	6.1	4.4	6.5	8.2	9.4	7.8	13.4	17.7	21.0	23.6
2063	4.1	6.2	4.4	6.5	8.3	9.5	7.9	13.5	17.8	21.1	23.8
2064	4.2	6.3	4.5	6.6	8.4	9.6	8.0	13.6	17.9	21.3	24.0
2065	4.2	6.3	4.5	6.7	8.5	9.7	8.1	13.7	18.1	21.4	24.1
2066	4.3	6.4	4.6	6.7	8.6	9.8	8.2	13.8	18.2	21.6	24.3
2067	4.3	6.5	4.6	6.8	8.7	9.9	8.2	13.8	18.3	21.7	24.5
2068	4.4	6.5	4.7	6.9	8.8	10.0	8.3	13.9	18.4	21.8	24.6
2069	4.4	6.6	4.7	6.9	8.8	10.1	8.4	14.0	18.5	22.0	24.8
2070	4.4	6.6	4.8	7.0	8.9	10.1	8.5	14.1	18.6	22.1	24.9
2071	4.5	6.7	4.8	7.1	9.0	10.2	8.6	14.2	18.8	22.2	25.1
2072	4.5	6.8	4.8	7.1	9.1	10.3	8.6	14.3	18.9	22.4	25.2
2073	4.6	6.8	4.9	7.2	9.2	10.4	8.7	14.4	19.0	22.5	25.3
2074	4.6	6.9	4.9	7.3	9.3	10.5	8.8	14.4	19.1	22.6	25.5
2075	4.6	7.0	5.0	7.3	9.3	10.6	8.9	14.5	19.2	22.7	25.6

Table 3.6 Hillsboro WRRF cBOD Load Projections (excluding 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent cBOD (lbs/day)									
Year	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	4,976	5,078	6,097	9,818	13,191	4,847	5,568	6,764	11,431
2021	5,008	5,110	6,136	9,880	13,275	4,878	5,603	6,807	11,503
2022	5,039	5,142	6,174	9,942	13,358	4,909	5,638	6,849	11,575
2023	5,070	5,174	6,213	10,004	13,441	4,939	5,673	6,892	11,648
2024	5,102	5,206	6,251	10,066	13,524	4,970	5,709	6,935	11,720
2025	5,133	5,238	6,290	10,128	13,608	5,000	5,744	6,978	11,792
2026	5,196	5,303	6,367	10,252	13,775	5,062	5,814	7,063	11,937
2027	5,259	5,367	6,444	10,377	13,942	5,123	5,885	7,149	12,081
2028	5,322	5,431	6,522	10,501	14,109	5,185	5,955	7,235	12,226
2029	5,385	5,496	6,599	10,626	14,276	5,246	6,026	7,320	12,371
2030	5,448	5,560	6,676	10,750	14,443	5,307	6,096	7,406	12,516
2031	5,507	5,620	6,748	10,866	14,599	5,365	6,162	7,486	12,651
2032	5,566	5,680	6,820	10,982	14,755	5,422	6,228	7,566	12,786
2033	5,625	5,740	6,892	11,098	14,911	5,479	6,294	7,646	12,921
2034	5,684	5,800	6,964	11,214	15,067	5,537	6,360	7,726	13,056
2035	5,743	5,860	7,036	11,330	15,223	5,594	6,425	7,806	13,191
2036	5,852	5,972	7,171	11,546	15,513	5,701	6,548	7,955	13,443
2037	5,962	6,084	7,305	11,763	15,804	5,807	6,671	8,104	13,695
2038	6,071	6,196	7,439	11,979	16,095	5,914	6,793	8,253	13,947
2039	6,181	6,308	7,574	12,195	16,385	6,021	6,916	8,402	14,199
2040	6,291	6,420	7,708	12,412	16,676	6,128	7,039	8,551	14,451
2041	6,376	6,507	7,813	12,581	16,903	6,211	7,135	8,667	14,647
2042	6,462	6,594	7,918	12,750	17,130	6,295	7,230	8,784	14,844
2043	6,548	6,682	8,023	12,919	17,357	6,378	7,326	8,900	15,041
2044	6,633	6,769	8,128	13,088	17,584	6,461	7,422	9,016	15,237
2045	6,719	6,857	8,233	13,256	17,811	6,545	7,518	9,133	15,434
2046	6,798	6,937	8,330	13,413	18,021	6,622	7,607	9,241	15,616
2047	6,877	7,018	8,427	13,569	18,231	6,699	7,695	9,348	15,799
2048	6,957	7,099	8,524	13,726	18,441	6,777	7,784	9,456	15,981
2049	7,036	7,180	8,621	13,882	18,652	6,854	7,873	9,564	16,163
2050	7,115	7,261	8,719	14,039	18,862	6,931	7,962	9,672	16,345
2051	7,199	7,347	8,821	14,204	19,085	7,013	8,056	9,786	16,538
2052	7,283	7,433	8,924	14,370	19,307	7,095	8,150	9,900	16,731
2053	7,367	7,518	9,027	14,536	19,530	7,177	8,244	10,014	16,924
2054	7,451	7,604	9,130	14,702	19,753	7,258	8,338	10,128	17,117
2055	7,535	7,690	9,233	14,867	19,975	7,340	8,432	10,243	17,310
2056	7,622	7,778	9,339	15,038	20,205	7,424	8,528	10,360	17,508
2057	7,708	7,866	9,445	15,209	20,434	7,509	8,625	10,478	17,707
2058	7,795	7,954	9,551	15,379	20,663	7,593	8,722	10,595	17,906
2059	7,881	8,043	9,657	15,550	20,892	7,677	8,819	10,713	18,104
2060	7,968	8,131	9,763	15,721	21,121	7,761	8,915	10,830	18,303
2061	8,047	8,212	9,860	15,877	21,332	7,839	9,004	10,938	18,485
2062	8,126	8,293	9,957	16,033	21,542	7,916	9,093	11,046	18,667
2063	8,206	8,374	10,054	16,190	21,752	7,993	9,181	11,154	18,849
2064	8,285	8,454	10,151	16,346	21,962	8,070	9,270	11,261	19,031
2065	8,364	8,535	10,249	16,502	22,172	8,147	9,359	11,369	19,213
2066	8,440	8,613	10,342	16,653	22,374	8,222	9,444	11,473	19,389
2067	8,517	8,691	10,436	16,804	22,577	8,296	9,530	11,577	19,564
2068	8,593	8,769	10,529	16,954	22,779	8,371	9,615	11,680	19,740
2069	8,669	8,847	10,623	17,105	22,982	8,445	9,700	11,784	19,915
2070	8,746	8,925	10,716	17,256	23,184	8,519	9,786	11,888	20,090
2071	8,822	9,003	10,810	17,406	23,386	8,594	9,871	11,992	20,266
2072	8,898	9,081	10,903	17,557	23,589	8,668	9,957	12,095	20,441
2073	8,975	9,159	10,997	17,707	23,791	8,742	10,042	12,199	20,616
2074	9,051	9,237	11,090	17,858	23,993	8,817	10,128	12,303	20,792
2075	9,128	9,314	11,184	18,009	24,196	8,891	10,213	12,407	20,967

Table 3.7 Hillsboro WRRF TSS Load Projections (excluding 100-percent flow and load diversion from West Forest Grove and Banks)

Raw Influent TSS (lbs/day)									
Year	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	5,911	5,820	7,229	8,469	14,608	6,012	7,286	12,524	21,036
2021	5,945	5,854	7,271	8,518	14,694	6,047	7,329	12,597	21,159
2022	5,980	5,888	7,313	8,568	14,779	6,082	7,371	12,671	21,282
2023	6,014	5,922	7,356	8,617	14,864	6,117	7,414	12,744	21,405
2024	6,049	5,956	7,398	8,667	14,950	6,152	7,457	12,817	21,528
2025	6,083	5,990	7,440	8,716	15,035	6,187	7,499	12,890	21,651
2026	6,158	6,063	7,531	8,823	15,219	6,263	7,591	13,048	21,915
2027	6,232	6,137	7,622	8,930	15,403	6,339	7,683	13,206	22,180
2028	6,307	6,210	7,713	9,036	15,587	6,414	7,774	13,363	22,445
2029	6,381	6,283	7,804	9,143	15,770	6,490	7,866	13,521	22,709
2030	6,455	6,356	7,895	9,249	15,954	6,566	7,958	13,678	22,974
2031	6,525	6,425	7,980	9,349	16,126	6,636	8,043	13,825	23,221
2032	6,594	6,493	8,065	9,448	16,297	6,707	8,129	13,972	23,468
2033	6,663	6,561	8,150	9,548	16,469	6,777	8,214	14,119	23,715
2034	6,733	6,630	8,235	9,647	16,640	6,848	8,300	14,266	23,962
2035	6,802	6,698	8,319	9,746	16,812	6,919	8,385	14,413	24,209
2036	6,920	6,814	8,464	9,916	17,104	7,039	8,531	14,664	24,629
2037	7,038	6,930	8,608	10,085	17,396	7,159	8,677	14,914	25,050
2038	7,157	7,047	8,753	10,254	17,687	7,279	8,822	15,164	25,470
2039	7,275	7,163	8,897	10,423	17,979	7,399	8,968	15,414	25,890
2040	7,393	7,279	9,042	10,592	18,271	7,519	9,113	15,665	26,310
2041	7,493	7,378	9,164	10,736	18,519	7,621	9,237	15,877	26,668
2042	7,594	7,477	9,287	10,880	18,767	7,723	9,361	16,090	27,025
2043	7,694	7,576	9,410	11,024	19,015	7,825	9,485	16,303	27,382
2044	7,794	7,675	9,533	11,168	19,264	7,928	9,608	16,516	27,740
2045	7,895	7,774	9,655	11,312	19,512	8,030	9,732	16,728	28,097
2046	7,987	7,864	9,768	11,444	19,740	8,123	9,846	16,924	28,425
2047	8,079	7,955	9,881	11,576	19,968	8,217	9,959	17,119	28,753
2048	8,171	8,046	9,994	11,708	20,196	8,311	10,073	17,314	29,082
2049	8,264	8,137	10,107	11,840	20,423	8,405	10,187	17,510	29,410
2050	8,356	8,228	10,219	11,972	20,651	8,499	10,300	17,705	29,738
2051	8,454	8,324	10,339	12,113	20,893	8,598	10,421	17,913	30,087
2052	8,552	8,420	10,459	12,253	21,135	8,698	10,542	18,120	30,435
2053	8,650	8,517	10,579	12,393	21,378	8,798	10,663	18,328	30,784
2054	8,748	8,613	10,699	12,534	21,620	8,897	10,783	18,535	31,132
2055	8,846	8,710	10,818	12,674	21,862	8,997	10,904	18,743	31,481
2056	8,946	8,809	10,942	12,819	22,111	9,099	11,029	18,957	31,840
2057	9,047	8,909	11,065	12,963	22,361	9,202	11,153	19,171	32,199
2058	9,148	9,008	11,189	13,108	22,610	9,305	11,277	19,385	32,559
2059	9,249	9,107	11,312	13,252	22,860	9,407	11,402	19,599	32,918
2060	9,350	9,207	11,436	13,397	23,109	9,510	11,526	19,812	33,277
2061	9,442	9,298	11,548	13,529	23,337	9,604	11,640	20,008	33,605
2062	9,535	9,388	11,661	13,661	23,565	9,698	11,754	20,203	33,933
2063	9,627	9,479	11,774	13,793	23,792	9,791	11,867	20,398	34,261
2064	9,719	9,570	11,887	13,925	24,020	9,885	11,981	20,594	34,589
2065	9,811	9,661	11,999	14,057	24,248	9,979	12,094	20,789	34,917
2066	9,900	9,748	12,108	14,185	24,467	10,069	12,204	20,977	35,233
2067	9,989	9,835	12,216	14,312	24,687	10,159	12,313	21,165	35,549
2068	10,077	9,923	12,325	14,439	24,906	10,250	12,423	21,353	35,865
2069	10,166	10,010	12,433	14,566	25,126	10,340	12,532	21,541	36,181
2070	10,255	10,098	12,542	14,693	25,345	10,430	12,642	21,729	36,497
2071	10,344	10,185	12,651	14,820	25,564	10,520	12,751	21,917	36,812
2072	10,432	10,272	12,759	14,948	25,783	10,611	12,860	22,105	37,128
2073	10,521	10,360	12,868	15,075	26,003	10,701	12,970	22,293	37,444
2074	10,610	10,447	12,976	15,202	26,222	10,791	13,079	22,481	37,760
2075	10,699	10,534	13,085	15,329	26,441	10,881	13,188	22,669	38,076

Table 3.8 [Rock Creek WRRF Flow Projections \(excluding expansion areas west of Jackson School Road and north of Highway 26\)](#)

Raw Influent Flow (mgd)											
Year	Baseflow	AAF	ADWF	MMDW	MWDW	MDDW	AWWF	MMWW	MWWW	MDWW	PH
2020	30.3	38.7	31.8	38.5	44.4	52.9	46.1	73.7	97.9	122.2	158.2
2021	30.7	39.3	32.2	39.1	45.0	53.7	46.8	74.4	98.7	123.2	159.4
2022	31.2	39.8	32.7	39.7	45.7	54.4	47.5	75.0	99.6	124.1	160.7
2023	31.7	40.4	33.2	40.2	46.3	55.1	48.1	75.7	100.4	125.1	161.9
2024	32.1	41.0	33.7	40.8	47.0	55.9	48.8	76.3	101.2	126.1	163.1
2025	32.6	41.6	34.2	41.4	47.6	56.6	49.5	77.0	102.0	127.0	164.3
2026	34.0	43.1	35.7	43.1	49.5	58.6	51.2	78.7	103.9	129.2	166.9
2027	35.5	44.7	37.2	44.8	51.3	60.5	52.9	80.4	105.8	131.3	169.4
2028	37.0	46.3	38.7	46.5	53.2	62.4	54.6	82.1	107.8	133.4	171.9
2029	38.4	47.9	40.1	48.2	55.1	64.4	56.3	83.9	109.7	135.5	174.4
2030	39.9	49.5	41.6	49.9	56.9	66.3	58.0	85.6	111.6	137.7	177.0
2031	40.6	50.3	42.4	50.8	57.9	67.3	58.9	86.4	112.6	138.8	178.4
2032	41.3	51.2	43.1	51.7	58.9	68.4	59.8	87.3	113.6	139.9	179.8
2033	42.0	52.0	43.9	52.5	59.8	69.4	60.8	88.2	114.6	141.1	181.1
2034	42.8	52.9	44.6	53.4	60.8	70.5	61.7	89.0	115.6	142.2	182.5
2035	43.5	53.7	45.4	54.3	61.7	71.5	62.7	89.9	116.6	143.4	183.9
2036	44.8	55.1	46.7	55.8	63.5	73.3	64.2	91.3	118.2	145.1	186.0
2037	46.1	56.6	48.1	57.4	65.2	75.1	65.7	92.7	119.7	146.8	188.0
2038	47.4	58.0	49.4	58.9	66.9	77.0	67.3	94.1	121.3	148.5	190.0
2039	48.8	59.4	50.7	60.4	68.6	78.8	68.8	95.5	122.9	150.3	192.1
2040	50.1	60.9	52.1	62.0	70.3	80.6	70.3	97.0	124.5	152.0	194.1
2041	50.5	61.4	52.5	62.5	71.0	81.4	71.0	97.8	125.6	153.4	196.0
2042	50.9	62.0	53.0	63.1	71.6	82.2	71.8	98.7	126.8	154.9	197.9
2043	51.4	62.6	53.5	63.7	72.3	83.0	72.5	99.5	127.9	156.3	199.7
2044	51.8	63.2	53.9	64.2	72.9	83.8	73.2	100.3	129.0	157.7	201.6
2045	52.2	63.8	54.4	64.8	73.6	84.6	73.9	101.2	130.2	159.2	203.5
2046	52.6	64.3	54.8	65.3	74.2	85.4	74.6	102.0	131.2	160.5	205.1
2047	53.1	64.9	55.2	65.9	74.9	86.1	75.2	102.7	132.2	161.7	206.8
2048	53.5	65.4	55.7	66.4	75.5	86.9	75.9	103.5	133.3	163.0	208.5
2049	53.9	66.0	56.1	66.9	76.1	87.7	76.6	104.3	134.3	164.3	210.2
2050	54.3	66.5	56.6	67.5	76.7	88.4	77.3	105.0	135.3	165.6	211.8
2051	54.7	67.1	57.0	68.0	77.4	89.2	78.0	105.8	136.4	166.9	213.5
2052	55.2	67.7	57.5	68.6	78.0	90.1	78.7	106.6	137.4	168.2	215.3
2053	55.6	68.3	57.9	69.2	78.7	90.9	79.4	107.4	138.5	169.6	217.0
2054	56.0	68.8	58.4	69.7	79.3	91.7	80.1	108.2	139.5	170.9	218.7
2055	56.5	69.4	58.8	70.3	80.0	92.5	80.8	109.0	140.6	172.2	220.4
2056	56.9	70.0	59.3	70.9	80.7	93.3	81.5	109.7	141.6	173.5	222.2
2057	57.3	70.6	59.8	71.5	81.3	94.1	82.3	110.5	142.7	174.9	223.9
2058	57.8	71.2	60.3	72.0	82.0	94.9	83.0	111.3	143.7	176.2	225.6
2059	58.2	71.8	60.7	72.6	82.7	95.8	83.7	112.1	144.8	177.5	227.3
2060	58.7	72.4	61.2	73.2	83.4	96.6	84.4	112.9	145.9	178.8	229.0
2061	59.1	72.9	61.6	73.7	84.0	97.4	85.1	113.6	146.8	180.0	230.5
2062	59.5	73.5	62.1	74.3	84.6	98.1	85.8	114.2	147.7	181.1	232.0
2063	59.9	74.0	62.5	74.8	85.2	98.9	86.5	114.9	148.6	182.2	233.5
2064	60.3	74.6	62.9	75.4	85.8	99.7	87.1	115.6	149.5	183.4	235.0
2065	60.7	75.1	63.4	75.9	86.5	100.4	87.8	116.3	150.4	184.5	236.4
2066	61.1	75.7	63.8	76.4	87.1	101.2	88.5	116.9	151.2	185.5	237.8
2067	61.5	76.2	64.2	76.9	87.7	101.9	89.1	117.5	152.1	186.6	239.1
2068	61.9	76.7	64.6	77.5	88.3	102.6	89.8	118.1	152.9	187.6	240.5
2069	62.3	77.3	65.1	78.0	88.9	103.4	90.4	118.8	153.7	188.7	241.8
2070	62.7	77.8	65.5	78.5	89.5	104.1	91.1	119.4	154.6	189.7	243.2
2071	63.1	78.3	65.9	79.0	90.1	104.8	91.7	120.0	155.4	190.7	244.5
2072	63.5	78.9	66.3	79.5	90.7	105.6	92.4	120.6	156.2	191.7	245.8
2073	63.9	79.4	66.7	80.1	91.3	106.3	93.0	121.2	156.9	192.7	247.0
2074	64.3	79.9	67.2	80.6	91.9	107.1	93.7	121.8	157.7	193.7	248.3
2075	64.7	80.5	67.6	81.1	92.5	107.8	94.3	122.4	158.5	194.7	249.6

Table 3.9 [Rock Creek WRRF cBOD Load Projections \(excluding expansion areas west of Jackson School Road and north of Highway 26\)](#)

Raw Influent cBOD (lbs/day)									
Year	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	55,918	57,060	64,452	79,629	108,793	55,096	63,101	74,733	115,028
2021	56,664	57,830	65,309	80,678	110,218	55,823	63,938	75,724	116,519
2022	57,410	58,599	66,167	81,728	111,642	56,550	64,774	76,715	118,010
2023	58,157	59,369	67,024	82,777	113,067	57,277	65,610	77,705	119,501
2024	58,903	60,139	67,881	83,827	114,491	58,004	66,447	78,696	120,991
2025	59,649	60,908	68,738	84,876	115,915	58,730	67,283	79,687	122,482
2026	61,630	62,931	70,995	87,594	119,580	60,680	69,483	82,304	126,239
2027	63,611	64,953	73,253	90,312	123,244	62,629	71,682	84,921	129,995
2028	65,591	66,975	75,510	93,030	126,908	64,579	73,882	87,538	133,751
2029	67,572	68,998	77,767	95,748	130,572	66,529	76,081	90,154	137,508
2030	69,553	71,020	80,025	98,466	134,237	68,478	78,281	92,771	141,264
2031	71,364	72,870	82,088	100,950	137,586	70,258	80,291	95,163	144,698
2032	73,174	74,720	84,151	103,434	140,935	72,039	82,301	97,554	148,132
2033	74,984	76,570	86,215	105,919	144,284	73,819	84,311	99,945	151,566
2034	76,795	78,420	88,278	108,403	147,633	75,599	86,321	102,337	155,000
2035	78,605	80,269	90,341	110,888	150,983	77,380	88,331	104,728	158,433
2036	80,366	82,064	92,350	113,311	154,255	79,116	90,289	107,057	161,797
2037	82,127	83,858	94,358	115,734	157,527	80,852	92,247	109,387	165,160
2038	83,888	85,652	96,366	118,158	160,799	82,589	94,205	111,716	168,524
2039	85,648	87,447	98,374	120,581	164,071	84,325	96,163	114,045	171,888
2040	87,409	89,241	100,383	123,004	167,343	86,061	98,122	116,374	175,251
2041	88,298	90,151	101,408	124,274	169,079	86,934	99,126	117,563	177,090
2042	89,187	91,061	102,434	125,544	170,814	87,808	100,130	118,751	178,929
2043	90,076	91,972	103,460	126,814	172,549	88,681	101,134	119,940	180,768
2044	90,966	92,882	104,486	128,083	174,285	89,554	102,138	121,128	182,607
2045	91,855	93,792	105,512	129,353	176,020	90,427	103,143	122,317	184,446
2046	92,668	94,627	106,450	130,514	177,606	91,223	104,061	123,403	186,126
2047	93,480	95,461	107,388	131,675	179,191	92,019	104,978	124,488	187,805
2048	94,293	96,296	108,326	132,836	180,777	92,815	105,896	125,574	189,485
2049	95,106	97,131	109,264	133,997	182,362	93,611	106,814	126,660	191,165
2050	95,919	97,966	110,202	135,157	183,947	94,407	107,732	127,746	192,844
2051	96,783	98,852	111,199	136,391	185,633	95,253	108,707	128,900	194,630
2052	97,647	99,739	112,196	137,625	187,319	96,100	109,683	130,055	196,416
2053	98,511	100,625	113,193	138,859	189,004	96,947	110,659	131,209	198,203
2054	99,375	101,511	114,190	140,093	190,690	97,794	111,634	132,363	199,989
2055	100,239	102,398	115,187	141,327	192,375	98,640	112,610	133,518	201,775
2056	101,130	103,311	116,215	142,599	194,114	99,514	113,616	134,708	203,616
2057	102,021	104,225	117,243	143,871	195,852	100,387	114,622	135,898	205,458
2058	102,912	105,138	118,271	145,144	197,590	101,261	115,628	137,088	207,300
2059	103,803	106,051	119,299	146,416	199,328	102,134	116,634	138,279	209,142
2060	104,693	106,965	120,327	147,688	201,066	103,007	117,640	139,469	210,984
2061	105,506	107,800	121,265	148,849	202,652	103,803	118,558	140,555	212,663
2062	106,319	108,634	122,203	150,010	204,237	104,599	119,475	141,641	214,343
2063	107,132	109,469	123,141	151,171	205,823	105,395	120,393	142,727	216,023
2064	107,945	110,304	124,079	152,331	207,408	106,191	121,311	143,812	217,703
2065	108,758	111,139	125,017	153,492	208,993	106,987	122,229	144,898	219,382
2066	109,541	111,943	125,921	154,611	210,521	107,754	123,113	145,944	221,001
2067	110,325	112,748	126,825	155,729	212,048	108,520	123,998	146,991	222,619
2068	111,108	113,552	127,728	156,848	213,576	109,287	124,882	148,037	224,237
2069	111,891	114,357	128,632	157,966	215,103	110,054	125,766	149,083	225,855
2070	112,675	115,161	129,536	159,085	216,631	110,821	126,651	150,129	227,474
2071	113,458	115,966	130,440	160,203	218,158	111,587	127,535	151,175	229,092
2072	114,241	116,770	131,344	161,322	219,686	112,354	128,419	152,222	230,710
2073	115,025	117,575	132,248	162,440	221,213	113,121	129,304	153,268	232,329
2074	115,808	118,380	133,152	163,559	222,741	113,888	130,188	154,314	233,947
2075	116,591	119,184	134,056	164,677	224,269	114,654	131,072	155,360	235,565

Table 3.10 [Rock Creek WRRF TSS Load Projections \(excluding expansion areas west of Jackson School Road and north of Highway 26\)](#)

Raw Influent TSS (lbs/day)									
Year	AA	ADW	MMDW	MWDW	MDDW	AWW	MMWW	MWWW	MDWW
2020	63,813	61,793	73,468	101,162	129,784	65,379	74,949	95,787	171,669
2021	64,522	62,487	74,284	102,283	131,227	66,101	75,784	96,851	173,576
2022	65,231	63,180	75,100	103,404	132,671	66,824	76,619	97,914	175,483
2023	65,941	63,873	75,916	104,525	134,114	67,546	77,454	98,978	177,390
2024	66,650	64,566	76,732	105,645	135,557	68,269	78,289	100,041	179,297
2025	67,360	65,259	77,549	106,766	137,001	68,991	79,124	101,105	181,204
2026	68,246	66,122	78,568	108,166	138,804	69,896	80,167	102,434	183,586
2027	69,132	66,985	79,588	109,566	140,607	70,801	81,211	103,762	185,969
2028	70,019	67,848	80,607	110,966	142,410	71,706	82,255	105,091	188,352
2029	70,905	68,710	81,627	112,366	144,213	72,611	83,298	106,420	190,734
2030	71,791	69,573	82,646	113,766	146,016	73,516	84,342	107,748	193,117
2031	72,573	70,335	83,545	115,001	147,606	74,312	85,262	108,920	195,218
2032	73,354	71,097	84,444	116,235	149,196	75,109	86,181	110,091	197,318
2033	74,136	71,859	85,343	117,470	150,785	75,906	87,101	111,263	199,419
2034	74,917	72,621	86,242	118,705	152,375	76,702	88,020	112,434	201,519
2035	75,698	73,383	87,141	119,939	153,965	77,499	88,940	113,606	203,620
2036	76,482	74,144	88,043	121,181	155,558	78,300	89,860	114,782	205,727
2037	77,265	74,905	88,945	122,423	157,152	79,102	90,780	115,958	207,835
2038	78,049	75,665	89,848	123,666	158,746	79,903	91,700	117,134	209,943
2039	78,832	76,426	90,750	124,908	160,339	80,704	92,620	118,310	212,050
2040	79,616	77,187	91,652	126,150	161,933	81,505	93,540	119,486	214,158
2041	80,664	78,203	92,858	127,810	164,064	82,577	94,771	121,059	216,976
2042	81,711	79,219	94,064	129,471	166,194	83,649	96,001	122,631	219,794
2043	82,759	80,236	95,270	131,131	168,325	84,721	97,231	124,204	222,612
2044	83,806	81,252	96,476	132,792	170,456	85,793	98,461	125,776	225,430
2045	84,854	82,268	97,682	134,453	172,587	86,865	99,692	127,349	228,248
2046	85,798	83,186	98,769	135,949	174,507	87,829	100,800	128,766	230,787
2047	86,742	84,104	99,856	137,445	176,427	88,793	101,909	130,183	233,326
2048	87,686	85,021	100,943	138,941	178,347	89,758	103,017	131,599	235,865
2049	88,630	85,939	102,029	140,437	180,267	90,722	104,126	133,016	238,404
2050	89,574	86,856	103,116	141,933	182,187	91,687	105,235	134,433	240,943
2051	90,582	87,836	104,277	143,531	184,238	92,718	106,419	135,947	243,656
2052	91,591	88,816	105,438	145,129	186,290	93,748	107,603	137,461	246,369
2053	92,599	89,796	106,600	146,728	188,341	94,779	108,788	138,974	249,081
2054	93,608	90,776	107,761	148,326	190,392	95,810	109,972	140,488	251,794
2055	94,617	91,755	108,922	149,925	192,444	96,841	111,157	142,002	254,507
2056	95,659	92,768	110,122	151,577	194,564	97,907	112,381	143,566	257,311
2057	96,701	93,780	111,322	153,229	196,684	98,972	113,605	145,131	260,114
2058	97,744	94,792	112,522	154,881	198,804	100,038	114,829	146,696	262,918
2059	98,786	95,805	113,722	156,533	200,925	101,104	116,053	148,260	265,722
2060	99,828	96,817	114,922	158,185	203,045	102,169	117,277	149,825	268,526
2061	100,772	97,735	116,009	159,681	204,965	103,134	118,386	151,242	271,065
2062	101,716	98,652	117,096	161,177	206,885	104,098	119,495	152,658	273,604
2063	102,660	99,570	118,183	162,673	208,805	105,063	120,603	154,075	276,143
2064	103,604	100,488	119,269	164,169	210,725	106,027	121,712	155,492	278,682
2065	104,548	101,405	120,356	165,665	212,645	106,992	122,820	156,909	281,221
2066	105,457	102,288	121,402	167,105	214,493	107,919	123,887	158,272	283,664
2067	106,365	103,171	122,447	168,544	216,340	108,847	124,954	159,635	286,107
2068	107,273	104,054	123,493	169,983	218,187	109,775	126,020	160,999	288,550
2069	108,181	104,937	124,539	171,422	220,035	110,703	127,087	162,362	290,992
2070	109,090	105,820	125,584	172,862	221,882	111,631	128,153	163,725	293,435
2071	109,998	106,703	126,630	174,301	223,730	112,558	129,220	165,088	295,878
2072	110,906	107,586	127,676	175,740	225,577	113,486	130,287	166,451	298,321
2073	111,814	108,469	128,721	177,180	227,424	114,414	131,353	167,814	300,764
2074	112,723	109,352	129,767	178,619	229,272	115,342	132,420	169,178	303,207
2075	113,631	110,235	130,813	180,058	231,119	116,270	133,487	170,541	305,650

APPENDIX 3A

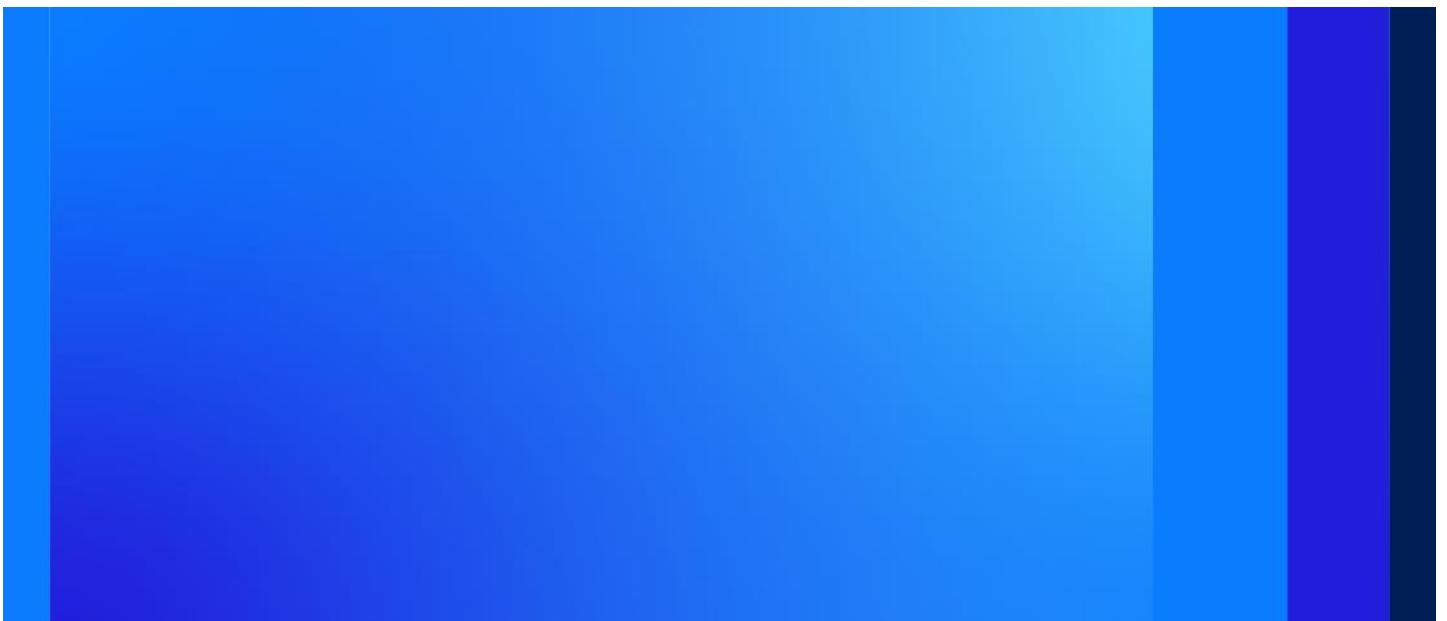
FLOW AND LOAD PROJECTIONS PRELIMINARY REPORT (JACOBS, FEBRUARY 2022)



Clean Water Services
West Basin Master Plan Preliminary Work

Flow and Load Projections

FINAL | February 8, 2022



Subject	West Basin Flow and Load Projections	Project Name	West Basin Master Planning Preliminary Work
Attention	Peter Schauer / Clean Water Services	Project No.	D3372600
From	Shad Roundy / Jacobs Todd Greeley / Jacobs Corey Klibert / Jacobs		
Date	February 8, 2022		
Copies to	Rick Shanley/ Clean Water Services		

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1 Introduction

This memorandum presents an updated analysis of historical flows and loads at the Clean Water Services (District) West Basin Facilities, including the Rock Creek Water Resource Recovery Facility (WRRF), Hillsboro WRRF, and Forest Grove WRRF. The memorandum also presents a projection of flows and loads for use in planning future facilities including methodology and assumptions for future projections. The detailed calculations and application of the methodologies and assumptions are presented in the companion spreadsheets included as **Appendix A**.

1.1 Definitions

The following definitions apply to flow and load terminology in this document.

- **Measured Flow:** The measured flow into each facility or from an individual source.
- **Calculated Flow:** Influent flows or flows from an individual source which are not measured are calculated from other measured flows.
- **Measured Load:** The measured load is calculated using the measured flow and measured concentration of each load constituent. The measured load includes contributions from in-plant recycles.
- **Base Flow and Load:** The average flow and loads for the base period from July 1st through September 30th which are assumed to have limited inflow and infiltration.
- **Average Annual (AA) Flow and Load:** The average daily flow and loads for the seasonal year from November 1st of the previous year to October 31st of the same year.
- **Maximum Month Annual (MMA) Load:** The maximum average month (from a 30-day running average) observed in the seasonal year from November 1st of the previous year to October 31st of the same year. The MMA Load will be the larger of the maximum month dry weather or maximum month wet weather load.
- **Maximum Month Dry Weather (MMDW) Flow and Load:** The maximum average month observed (from a 30-day running average) in the dry weather period that includes May 1st through October 31st.
- **Maximum Week Dry Weather (MWDW) Flow and Load:** The maximum average week (from a 7-day running average) observed in the dry weather period that includes May 1st through October 31st.
- **Maximum Day Dry Weather (MDDW) Flow and Load:** The maximum average day observed in the dry weather period that includes May 1st through October 31st.
- **Maximum Hour Dry Weather (MHDW) Flow:** The maximum average hour observed during the maximum day dry weather.
- **Maximum Month Wet Weather (MMWW) Flow and Load:** The maximum average month observed (from a 30-day running average) in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.

- **Maximum Week Wet Weather (MWW) Flow and Load:** The maximum average week observed (from a 7-day running average) in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.
- **Maximum Day Wet Weather (MDWW) Flow and Load:** The maximum average day observed in the wet weather period that includes November 1st of the previous year through April 30th of the seasonal year.
- **Maximum Hour Wet Weather (MHWW) Flow or Peak Hour (PH) Flow:** The maximum average hour observed during the maximum day wet weather.
- **Non-industrial Flow/Load:** Flow rate or load based on residential and commercial customers. Future non-industrial flow is based on future population and employment projections. Future non-industrial loads are based on future population projections.
- **Wet Industrial Flow/Load:** Flow rate or load based on metered wet industry customers.
- **Intel Flow/Load:** Includes wet industry flows and loads exclusively from Intel.
- **Constituent Loading Parameters**
 - cBOD: Carbonaceous Biological Oxygen Demand
 - COD: Chemical Oxygen Demand
 - TSS: Total Suspended Solids
 - TP: Total Phosphorus
 - oP: Orthophosphate
 - NH₄: Ammonium
 - TKN: Total Kjeldahl Nitrogen
- **Units of Measurement**
 - mgd: million gallons per day - flow rate
 - lbs/d or lbs/day: pounds per day - loading rate
 - gpnad: gallons per net acre per day - unit flow per area
 - gpcpd: gallons per capita per day – unit flow per person
 - gpepd: gallons per employee per day - unit flow per employee

2 Summary Flows and Loads

A summary of the influent flow and load projections to be used as a basis of planning for each treatment facility for 2020, 2025, 2030, 2035, 2040, and 2075 (buildout) are presented in **Tables 2.1a through**

2.3e. Sections 3 through 5 of this document present the detailed approach and assumptions for developing the flow and load projections.

2.1 Rock Creek WRRF, Summary Flows and Loads

Table 2.1a Flow and Load Projection 2020, Rock Creek WRRF

Condition	2020							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	30.2	--	--	--	--	--	--	--
Average Annual	38.6	61,455	163,114	70,748	1,584	745	7,914	12,224
MMDW	46.6	68,900	193,897	80,972	1,842	867	8,451	13,054
MWDW	48.8	85,747	241,339	111,325	2,367	1,114	9,087	14,035
MDDW	60.1	112,372	329,362	142,626	3,282	1,544	10,523	16,253
MHDW	81.7	--	--	--	--	--	--	--
MMWW	74.2	68,889	193,070	82,688	1,829	861	8,417	13,001
MWWW	99.2	83,971	285,005	106,778	2,609	1,228	9,462	14,615
MDWW	125.4	125,183	370,042	193,758	2,866	1,349	11,197	17,294
MHWW	160.6	--	--	--	--	--	--	--

Table 2.1b Flow and Load Projection 2025, Rock Creek WRRF

Condition	2025							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	35.3	--	--	--	--	--	--	--
Average Annual	44.3	68,335	176,264	74,805	1,657	780	8,281	12,790
MMDW	53.2	75,791	208,324	85,280	1,927	907	8,843	13,658
MWDW	55.7	94,475	258,613	117,102	2,476	1,165	9,508	14,685
MDDW	67.7	121,726	351,451	149,939	3,434	1,616	11,010	17,006
MHDW	90.8	--	--	--	--	--	--	--
MMWW	80.6	76,355	211,670	87,163	1,914	900	8,807	13,603
MWWW	106.9	94,060	324,100	113,292	2,730	1,285	9,900	15,292
MDWW	134.6	138,198	417,371	207,226	2,999	1,411	11,715	18,095
MHWW	171.1	--	--	--	--	--	--	--

Table 2.1c Flow and Load Projection 2030, Rock Creek WRRF

Condition	2030							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	40.1	--	--	--	--	--	--	--
Average Annual	50.0	75,731	193,372	80,588	1,761	828	8,796	13,586
MMDW	59.8	83,380	227,207	91,329	2,047	963	9,393	14,509
MWDW	62.5	104,049	281,240	125,178	2,630	1,238	10,099	15,599
MDDW	75.6	132,496	380,504	160,125	3,647	1,716	11,695	18,064
MHDW	100.9	--	--	--	--	--	--	--
MMWW	87.7	84,436	235,676	93,468	2,033	956	9,355	14,450
MWWW	115.6	104,756	373,906	122,680	2,900	1,365	10,517	16,244
MDWW	145.0	152,412	477,816	227,052	3,185	1,499	12,444	19,222
MHWW	183.8	--	--	--	--	--	--	--

Table 2.1d Flow and Load Projection 2035, Rock Creek WRRF

Condition	2035							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	44.8	--	--	--	--	--	--	--
Average Annual	55.5	82,746	209,490	86,014	1,857	874	9,279	14,333
MMDW	66.3	90,577	245,003	97,013	2,160	1016	9,909	15,306
MWDW	69.2	113,129	302,579	132,771	2,775	1,306	10,654	16,457
MDDW	83.4	142,707	407,919	169,706	3,848	1,811	12,338	19,057
MHDW	111.0	--	--	--	--	--	--	--
MMWW	94.3	92,101	258,260	99,392	2,144	1009	9,869	15,244
MWWW	123.8	114,901	420,665	131,481	3,059	1,439	11,095	17,136
MDWW	154.8	165,891	534,581	245,601	3,360	1,581	13,128	20,278
MHWW	195.9	--	--	--	--	--	--	--

Table 2.1e Flow and Load Projection 2040, Rock Creek WRRF

Condition	2040							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	48.7	--	--	--	--	--	--	--
Average Annual	60.5	89,316	225,377	91,778	1,967	926	9,830	15,183
MMDW	72.2	97,445	262,834	103,178	2,288	1077	10,497	16,214
MWDW	75.4	121,769	324,104	141,067	2,939	1,383	11,286	17,433
MDDW	91.0	152,780	435,950	180,209	4,076	1,918	13,070	20,187
MHDW	121.3	--	--	--	--	--	--	--
MMWW	100.3	99,319	279,849	105,786	2,272	1069	10,455	16,149
MWWW	131.7	124,299	463,161	140,684	3,241	1,525	11,753	18,153
MDWW	164.6	178,679	586,644	264,422	3,560	1,675	13,907	21,481
MHWW	208.2	--	--	--	--	--	--	--

Table 2.1f Flow and Load Projection 2075 (Buildout), Rock Creek WRRF

Condition	2075							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	68.2	--	--	--	--	--	--	--
Average Annual	85.7	125,594	321,976	131,779	2,823	1328	14,105	21,786
MMDW	102.6	137,693	376,060	148,273	3,283	1545	15,062	23,265
MWDW	107.0	171,930	464,338	202,762	4,218	1,985	16,195	25,014
MDDW	130.0	217,374	625,491	259,081	5,849	2,752	18,754	28,967
MHDW	174.8	--	--	--	--	--	--	--
MMWW	132.6	139,840	397,839	151,991	3,259	1534	15,002	23,172
MWWW	174.2	174,191	651,484	201,851	4,650	2,188	16,864	26,048
MDWW	217.6	251,995	826,925	378,781	5,108	2,404	19,955	30,823
MHWW	276.1	--	--	--	--	--	--	--

2.2 Hillsboro WRRF, Summary Flows and Loads

Table 2.2a Flow and Load Projection 2020, Hillsboro WRRF

Condition	2020							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	3.2	--	--	--	--	--	--	--
Average Annual	4.8	6,968	16,927	8,329	175	91	857	1,292
MMDW	5.8	8,538	21,837	10,187	217	112	970	1,462
MWDW	6.5	13,747	26,950	11,934	316	163	1,079	1,626
MDDW	7.4	18,470	42,821	20,586	463	240	1,309	1,974
MHDW	11.9	--	--	--	--	--	--	--
MMWW	12.7	7,796	20,012	10,268	219	113	919	1,385
MWWW	16.8	9,471	24,821	17,649	383	198	1,031	1,555
MDWW	20.0	16,006	43,723	29,644	592	306	1,381	2,081
MHWW	22.5	--	--	--	--	--	--	--

Table 2.2b Flow and Load Projection 2025, Hillsboro WRRF

Condition	2025							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	3.4	--	--	--	--	--	--	--
Average Annual	5.1	7,309	17,759	8,726	183	95	897	1,352
MMDW	6.2	8,956	22,909	10,672	227	118	1,015	1,530
MWDW	7.0	14,421	28,274	12,503	330	171	1,129	1,702
MDDW	7.9	19,375	44,924	21,566	484	251	1,370	2,065
MHDW	12.7	--	--	--	--	--	--	--
MMWW	13.2	8,178	20,994	10,757	229	119	961	1,449
MWWW	17.4	9,935	26,040	18,490	401	207	1,079	1,627
MDWW	20.7	16,790	45,870	31,055	620	321	1,445	2,178
MHWW	23.3	--	--	--	--	--	--	--

Table 2.2c Flow and Load Projection 2030, Hillsboro WRRF

Condition	2030							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	3.7	--	--	--	--	--	--	--
Average Annual	5.5	7,766	18,870	9,271	195	101	953	1,436
MMDW	6.7	9,516	24,343	11,338	241	125	1,078	1,625
MWDW	7.4	15,323	30,043	13,283	351	182	1,199	1,808
MDDW	8.4	20,587	47,736	22,912	515	266	1,455	2,193
MHDW	13.6	--	--	--	--	--	--	--
MMWW	13.7	8,690	22,308	11,428	244	126	1,021	1,539
MWWW	18.1	10,557	27,670	19,644	426	220	1,146	1,728
MDWW	21.5	17,840	48,741	32,993	658	340	1,535	2,313
MHWW	24.2	--	--	--	--	--	--	--

Table 2.2d Flow and Load Projection 2035, Hillsboro WRRF

Condition	2035							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	3.9	--	--	--	--	--	--	--
Average Annual	5.8	8,195	19,912	9,781	205	106	1,005	1,515
MMDW	7.1	10,042	25,688	11,963	255	132	1,137	1,714
MWDW	7.9	16,169	31,703	14,015	370	192	1,265	1,907
MDDW	8.9	21,724	50,372	24,174	543	281	1,535	2,314
MHDW	14.4	--	--	--	--	--	--	--
MMWW	14.1	9,170	23,541	12,058	257	133	1,077	1,624
MWWW	18.6	11,139	29,198	20,726	449	232	1,209	1,823
MDWW	22.1	18,826	51,433	34,811	694	359	1,619	2,440
MHWW	24.9	--	--	--	--	--	--	--

Table 2.2e Flow and Load Projection 2040, Hillsboro WRRF

Condition	2040							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	4.5	--	--	--	--	--	--	--
Average Annual	6.7	8,784	21,355	10,421	217	112	1,064	1,604
MMDW	8.1	10,763	27,548	12,746	270	140	1,205	1,816
MWDW	9.0	17,331	33,999	14,932	392	203	1,340	2,020
MDDW	10.2	23,286	54,021	25,756	575	297	1,626	2,451
MHDW	16.5	--	--	--	--	--	--	--
MMWW	15.6	9,829	25,246	12,847	272	141	1,141	1,720
MWWW	20.6	11,940	31,313	22,082	476	246	1,281	1,931
MDWW	24.5	20,178	55,159	37,089	736	380	1,715	2,585
MHWW	27.6	--	--	--	--	--	--	--

Table 2.2f Flow and Load Projection 2075 (Buildout), Hillsboro WRRF

Condition	2075							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	6.5	--	--	--	--	--	--	--
Average Annual	9.8	12,655	30,770	14,983	312	161	1,527	2,302
MMDW	11.9	15,506	39,694	18,324	387	200	1,729	2,606
MWDW	13.3	24,968	48,990	21,468	563	291	1,923	2,899
MDDW	15.0	33,546	77,839	37,030	825	427	2,334	3,517
MHDW	24.2	--	--	--	--	--	--	--
MMWW	20.5	14,160	36,377	18,470	391	202	1,638	2,468
MWWW	27.1	17,201	45,119	31,747	683	353	1,838	2,771
MDWW	32.1	29,070	79,479	53,323	1,055	546	2,461	3,709
MHWW	36.2	--	--	--	--	--	--	--

2.3 Forest Grove, Summary Flows and Loads

Table 2.3a Flow and Load Projection 2020, Forest Grove WRRF

Condition	2020							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	2.4	--	--	--	--	--	--	--
Average Annual	4.3	6,220	14,086	5,913	146	66	574	920
MMDW	6.0	8,946	20,842	8,441	184	83	697	1,118
MWDW	6.6	11,485	33,168	12,868	273	124	847	1,358
MDDW	8.9	14,449	48,874	24,772	327	148	1,077	1,726
MHDW	13.3	--	--	--	--	--	--	--
MMWW	11.6	8,261	15,947	7,094	175	79	631	1,012
MWWW	16.1	8,581	22,967	10,379	230	104	772	1,238
MDWW	19.8	9,345	40,335	20,342	277	126	921	1,476
MHWW	29.0	--	--	--	--	--	--	--

Table 2.3b Flow and Load Projection 2025, Forest Grove WRRF

Condition	2025							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	2.5	--	--	--	--	--	--	--
Average Annual	4.5	6,596	14,894	6,212	153	69	600	962
MMDW	6.3	9,486	22,037	8,867	192	87	730	1,169
MWDW	6.9	12,179	35,070	13,517	286	129	887	1,421
MDDW	9.3	15,323	51,677	26,022	342	155	1,127	1,806
MHDW	13.9	--	--	--	--	--	--	--
MMWW	11.9	8,761	16,862	7,452	183	83	660	1,058
MWWW	16.5	9,100	24,284	10,903	241	109	808	1,295
MDWW	20.3	9,910	42,648	21,369	290	131	964	1,545
MHWW	29.6	--	--	--	--	--	--	--

Table 2.3c Flow and Load Projection 2030, Forest Grove WRRF

Condition	2030							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	2.6	--	--	--	--	--	--	--
Average Annual	4.7	6,914	15,658	6,572	162	74	638	1,022
MMDW	6.5	9,944	23,167	9,382	204	93	775	1,242
MWDW	7.1	12,766	36,868	14,303	303	137	942	1,510
MDDW	9.6	16,062	54,326	27,533	363	165	1,197	1,918
MHDW	14.4	--	--	--	--	--	--	--
MMWW	11.9	9,183	17,726	7,885	194	88	701	1,124
MWWW	16.6	9,539	25,529	11,536	256	116	858	1,376
MDWW	20.4	10,388	44,835	22,610	308	139	1,024	1,641
MHWW	29.8	--	--	--	--	--	--	--

Table 2.3d Flow and Load Projection 2035, Forest Grove WRRF

Condition	2035							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	2.6	--	--	--	--	--	--	--
Average Annual	4.8	7,188	16,330	6,904	171	78	673	1,078
MMDW	6.6	10,337	24,161	9,855	215	98	818	1,311
MWDW	7.2	13,271	38,450	15,024	320	145	994	1,592
MDDW	9.9	16,697	56,658	28,922	383	174	1,262	2,023
MHDW	14.7	--	--	--	--	--	--	--
MMWW	11.9	9,546	18,487	8,283	205	93	740	1,186
MWWW	16.6	9,916	26,624	12,118	270	122	905	1,451
MDWW	20.4	10,799	46,758	23,750	325	147	1,080	1,731
MHWW	29.7	--	--	--	--	--	--	--

Table 2.3e Flow and Load Projection 2040, Forest Grove WRRF

Condition	2040							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	2.8	--	--	--	--	--	--	--
Average Annual	5.1	7,703	17,456	7,338	181	82	713	1,142
MMDW	7.0	11,079	25,828	10,475	228	103	866	1,388
MWDW	7.6	14,223	41,103	15,969	339	154	1,053	1,687
MDDW	10.4	17,895	60,567	30,742	406	184	1,337	2,143
MHDW	15.5	--	--	--	--	--	--	--
MMWW	12.3	10,231	19,762	8,804	217	98	784	1,256
MWWW	17.1	10,628	28,461	12,881	286	129	959	1,537
MDWW	21.0	11,574	49,985	25,245	344	156	1,144	1,834
MHWW	30.6	--	--	--	--	--	--	--

Table 2.3f Flow and Load Projection 2075 (Buildout), Forest Grove WRRF

Condition	2075							
	Flow (mgd)	cBOD (lbs/d)	COD (lbs/d)	TSS (lbs/d)	TP (lbs/d)	oP (lbs/d)	NH4 (lbs/d)	TKN (lbs/d)
Base	3.8	--	--	--	--	--	--	--
Average Annual	6.8	11,210	25,326	10,573	260	118	1,023	1,639
MMDW	9.4	16,122	37,471	15,093	327	148	1,243	1,992
MWDW	10.3	20,699	59,632	23,010	486	220	1,510	2,421
MDDW	14.0	26,041	87,871	44,295	583	264	1,919	3,076
MHDW	20.8	--	--	--	--	--	--	--
MMWW	13.9	14,889	28,671	12,685	312	141	1,125	1,803
MWWW	19.3	15,466	41,292	18,559	410	186	1,376	2,206
MDWW	23.7	16,843	72,518	36,375	494	224	1,642	2,631
MHWW	34.5	--	--	--	--	--	--	--

3 Flow Analysis

Historical flows were evaluated to determine the flow peaking factors, per capita rates, and per employee rates to be applied for future flow projections. The flow projections were obtained using the following procedure:

1. Historic daily flow data from 2015-2019 was extracted from the Hach WIMS database including historic base, average annual, MMWD, MMWW, MWDW, MWWW, MDDW, and MDWW flows. Transfer flows were subtracted from or added to each WRRF such that flow rates represented influent flow contributions to each treatment facility. The Hach WIMS variables used as of April 9th, 2020 can be found in **Appendix B**. The historical data was evaluated to exclude atypical events and irregularities.
2. Hourly data was obtained from the SCADA system for observed peak days to calculate the MHDW and MHWW flows.
3. The historical base flow from 2015 to 2019 was selected to determine peaking factors for seasonal and diurnal conditions per three methods: Historical conditions, collection system peak modeled flows, and Oregon State Department of Environmental Quality (DEQ) flow methodology (DEQ, Revision IV, 1996).
 - a) Historical peaking factors from 2015 to 2019 were determined for all flow categories.
 - b) The DEQ methodology was used to determine the average annual, MMDW, MMWW, MDWW, MHWW flow peaking factors.
 - c) Peaking factors were developed using the District collection system models utilizing the 5-year design storm for MWWW, MDWW, and MHWW flows, and historical wintertime precipitation to generate MMWW flow.
4. Flow categories and peaking factors were separated into non-industrial (residential/commercial), wet industry, and Intel components. The non-industrial flow component was calculated by subtracting metered monthly industry flow from total influent flow.
5. The developed peaking factors per the three methods were compared. The peaking factors for each flow category and method that best reflected historical observations and DEQ design storm standards were selected to project future flows.
6. Per capita and per employee base flow rates were established for the entire West Basin from population and employment estimates for 2015 to 2019.
7. Average per capita rates from the historic period were applied to future population and employment projects to project future base flows.
8. Existing wet industry base flows were assumed to increase at the employment growth rate for each treatment basin over time.
9. Intel base flow increases were based on projections provided by the customer.
10. North Hillsboro and North Hillsboro expansion area wet industry base flow projections assumed a 65-percent light industry flow component (typical of data centers) and 35-percent heavy industry flow (typical of existing wet industry customers).
11. The selected peaking factors were applied to base flow projections to calculate the flow rates of future conditions. The Rock Creek Basin utilized peaking factors for non-industrial (residential/commercial), metered wet industrial, and Intel components for all flow categories.

The Hillsboro and Forest Grove Basins utilized non-industrial and metered wet industrial peaking factor for all flow categories.

12. Future peaking factors were applied to the component of future flow associated with new development which assumes lower new development impacts from infiltration and inflow (I/I).

3.1 Flow Peaking Factor Development

Flow peaking factors were developed by dividing flow categories by the historical base flow. Wet industry customers and Intel were removed as a flow source to develop the non-industrial flow peaking factors for each treatment basin. Specific wet industry and Intel peaking factors were then developed and applied to wet industry (non-Intel) and Intel specific base flows in each treatment basin.

Flow peaking factors were developed using three methods:

- Historical data for all flow categories
- DEQ methodology for average annual, MMDW, MMWW, MDWW, MHWW flow categories.
- Collection system model utilizing the 5-year design storm for MWWW, MDWW, and MHWW flow categories, and historical wintertime precipitation to generate MMWW flow.

3.1.1 Historical Flow Summary and Historical Peaking Factors

A data set that includes plant influent flow data from 2015 to 2019 was used for the historic flow analysis. The five- year period was selected as representative of the recent influent flow conditions for developing historic base flows and historic peaking factors. Plots of historical data are provided in **Appendix C**. The historic flow conditions and peaking factors are presented in **Tables 3.1 through 3.3**.

Table 3.1 Historical Flows and Peaking Factors for Rock Creek WRRF

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Residential, Non-residential, Wet Industry, and Intel																
Base Flow	27.60	26.90	27.65	27.67	28.19	27.60	26.90	28.19	-	-	-	-	-	-	-	-
Avg Annual	33.54	37.81	40.03	34.64	32.81	35.77	32.81	40.03	1.22	1.41	1.45	1.25	1.16	1.30	1.16	1.45
ADWF	28.43	29.23	29.55	28.72	29.06	29.00	28.43	29.55	-	-	-	-	-	-	-	-
MMDW	33.32	35.80	42.42	40.09	38.91	38.11	33.32	42.42	1.21	1.33	1.53	1.45	1.38	1.38	1.21	1.53
MWDW	31.45	42.29	40.33	33.92	33.97	36.39	31.45	42.29	1.14	1.57	1.46	1.23	1.21	1.32	1.14	1.57
MDDW	41.09	51.21	54.72	37.64	38.40	44.61	37.64	54.72	1.49	1.90	1.98	1.36	1.36	1.62	1.36	1.98
MHDW	47.24	66.73	75.59	49.74	50.64	57.99	47.24	75.59	1.71	2.48	2.73	1.80	1.80	2.10	1.71	2.73
AWWF	38.72	46.47	50.68	40.66	36.63	42.63	36.63	50.68	-	-	-	-	-	-	-	-
MMWW	48.75	66.78	65.43	49.22	42.73	54.58	42.73	66.78	1.77	2.48	2.37	1.78	1.52	1.98	1.52	2.48
MWWW	66.60	88.67	83.58	58.05	55.19	70.42	55.19	88.67	2.41	3.30	3.02	2.10	1.96	2.56	1.96	3.30
MDWW	83.80	106.09	119.03	68.19	85.05	92.43	68.19	119.03	3.04	3.94	4.30	2.46	3.02	3.35	2.46	4.30
MHWW	104.28	142.91	135.03	81.31	103.98	113.50	81.31	142.91	3.78	5.31	4.88	2.94	3.69	4.12	2.94	5.31
Non-Industrial (residential/commercial)																
Base Flow	20.82	20.24	20.86	20.3	20.79	20.60	20.24	20.86	-	-	-	-	-	-	-	-
Avg Annual	25.62	31.23	33.15	27.25	25.11	28.47	25.11	33.15	1.23	1.54	1.59	1.34	1.21	1.38	1.21	1.59
ADWF	21.45	22.61	22.72	21.31	21.57	21.93	21.31	22.72	-	-	-	-	-	-	-	-
MMDW	26.19	29.06	35.61	32.71	30.85	30.88	26.19	35.61	1.26	1.44	1.71	1.61	1.48	1.50	1.26	1.71
MWDW	24.93	35.88	33.69	26.55	25.88	29.39	24.93	35.88	1.20	1.77	1.62	1.31	1.24	1.43	1.20	1.77
MDDW	34.22	44.42	47.81	30.13	31.23	37.56	30.13	47.81	1.64	2.19	2.29	1.48	1.50	1.82	1.48	2.29
MHDW	39.43	59.59	68.40	41.15	41.63	50.04	39.43	68.40	1.89	2.94	3.28	2.03	2.00	2.43	1.89	3.28
AWWF	31.97	39.94	43.75	33.28	28.71	35.53	28.71	43.75	-	-	-	-	-	-	-	-
MMWW	42.12	60.08	58.53	41.69	34.64	47.41	34.64	60.08	2.02	2.97	2.81	2.05	1.67	2.30	1.67	2.97

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
MWWW	60.89	82.49	78.47	50.68	48.66	64.24	48.66	82.49	2.92	4.08	3.76	2.50	2.34	3.12	2.34	4.08
MDWW	77.11	99.08	111.98	60.45	76.87	85.10	60.45	111.98	3.70	4.90	5.37	2.98	3.70	4.13	2.98	5.37
MHWW	96.90	135.82	127.78	73.32	92.74	105.31	73.32	135.82	4.65	6.71	6.13	3.61	4.46	5.11	3.61	6.71
Intel																
Base Flow	5.28	5.02	5.36	5.83	5.95	5.49	5.02	5.95	-	-	-	-	-	-	-	-
Avg Annual	5.39	4.97	5.33	5.81	6.16	5.53	4.97	6.16	1.02	0.99	0.99	1.00	1.04	1.01	0.99	1.04
ADWF	5.43	5.01	5.36	5.84	5.99	5.53	5.01	5.99	-	-	-	-	-	-	-	-
MMDW	5.91	5.18	5.5	6.14	6.65	5.88	5.18	6.65	1.12	1.03	1.03	1.05	1.12	1.07	1.03	1.12
MWDW	6.04	5.35	5.58	6.76	7.33	6.21	5.35	7.33	1.14	1.07	1.04	1.16	1.23	1.13	1.04	1.23
MDDW	6.26	5.58	5.71	7.06	7.61	6.44	5.58	7.61	1.19	1.11	1.07	1.21	1.28	1.17	1.07	1.28
MHDW ¹	6.26	5.58	5.90	7.06	7.61	6.48	5.58	7.61	1.19	1.11	1.10	1.21	1.28	1.18	1.10	1.28
AWWF	5.32	4.92	5.31	5.77	6.34	5.53	4.92	6.34	-	-	-	-	-	-	-	-
MMWW	5.56	5.12	5.48	6.01	6.7	5.77	5.12	6.70	1.05	1.02	1.02	1.03	1.13	1.05	1.02	1.13
MWWW	5.75	5.17	5.58	6.15	7.67	6.06	5.17	7.67	1.09	1.03	1.04	1.05	1.29	1.10	1.03	1.29
MDWW	5.91	5.39	5.68	6.37	9.66	6.60	5.39	9.66	1.12	1.07	1.06	1.09	1.62	1.19	1.06	1.62
MHWW ¹	5.91	5.41	5.84	6.37	9.66	6.64	5.41	9.66	1.12	1.08	1.09	1.09	1.62	1.20	1.08	1.62
Wet Industry (non-Intel)																
Base Flow	1.50	1.64	1.43	1.54	1.44	1.51	1.43	1.64	-	-	-	-	-	-	-	-
Avg Annual	1.53	1.61	1.54	1.59	1.54	1.56	1.53	1.61	1.02	0.98	1.08	1.03	1.07	1.04	0.98	1.08
ADWF	1.54	1.62	1.47	1.57	1.49	1.54	1.47	1.62	-	-	-	-	-	-	-	-
MMDW	1.57	1.56	1.62	1.63	1.65	1.61	1.56	1.65	1.05	0.95	1.13	1.06	1.15	1.07	0.95	1.15
MWDW	1.54	1.55	1.62	1.63	1.58	1.58	1.54	1.63	1.03	0.95	1.13	1.06	1.10	1.05	0.95	1.13
MDDW	1.55	1.56	1.48	1.53	1.40	1.50	1.40	1.56	1.03	0.95	1.03	0.99	0.97	1.00	0.95	1.03
MHDW ¹	1.69	1.78	1.62	1.73	1.64	1.69	1.62	1.78	1.13	1.09	1.13	1.12	1.14	1.12	1.09	1.14

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
AWWF	1.52	1.61	1.62	1.61	1.58	1.59	1.52	1.62	-	-	-	-	-	-	-	-
MMWW	1.49	1.7	1.73	1.61	1.58	1.62	1.49	1.73	0.99	1.04	1.21	1.05	1.10	1.08	0.99	1.21
MWWW	1.46	1.7	1.74	1.61	1.58	1.62	1.46	1.74	0.97	1.04	1.22	1.05	1.10	1.07	0.97	1.22
MDWW	1.47	1.7	1.57	1.62	1.58	1.59	1.47	1.70	0.98	1.04	1.10	1.05	1.10	1.05	0.98	1.10
MHWW ¹	1.67	1.77	1.78	1.77	1.74	1.75	1.67	1.78	1.11	1.08	1.25	1.15	1.21	1.16	1.08	1.25
Notes:																
(1) Maximum hour flows for wet industry and Intel assume the greater of maximum daily flow or 1.1 times x average daily flow.																

Table 3.2 Historical Flows and Peaking Factors for Hillsboro WRRF

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Residential, Non-residential, and Wet Industry																
Base Flow	2.98	3.05	3.16	3.07	2.85	3.02	2.85	3.16	-	-	-	-	-	-	-	-
Avg Annual	4.07	5.25	5.45	4.15	3.77	4.54	3.77	5.45	1.37	1.72	1.72	1.35	1.32	1.50	1.32	1.72
ADWF	3.05	3.44	3.5	3.17	3.05	3.24	3.05	3.50	-	-	-	-	-	-	-	-
MMDW	3.97	4.88	5.79	5.04	4.83	4.90	3.97	5.79	1.33	1.60	1.83	1.64	1.69	1.62	1.33	1.83
MWDW	3.56	6.25	5.42	4.02	4.29	4.71	3.56	6.25	1.19	2.05	1.72	1.31	1.51	1.55	1.19	2.05
MDDW	3.74	6.98	7.31	4.29	5.05	5.47	3.74	7.31	1.26	2.29	2.31	1.40	1.77	1.81	1.26	2.31
MHDW	20.14	10.00	12.13	9.15	8.69	12.02	8.69	20.14	6.76	3.28	3.84	2.98	3.05	3.29	2.98	3.84
AWWF	5.11	7.08	7.42	5.14	4.51	5.85	4.51	7.42	-	-	-	-	-	-	-	-
MMWW	7.44	12.16	10.26	6.42	6.05	8.47	6.05	12.16	2.50	3.99	3.25	2.09	2.12	2.79	2.09	3.99
MWWW	11.99	16.12	13.33	8.33	9.78	11.91	8.33	16.12	4.02	5.29	4.22	2.71	3.43	3.93	2.71	5.29
MDWW	15.00	17.52	17.47	9.21	16.56	15.15	9.21	17.52	5.03	5.74	5.53	3.00	5.81	5.02	3.00	5.81
MHWW	16.73	19.76	20.80	17.60	19.31	18.84	16.73	20.80	5.62	6.48	6.58	5.73	6.77	6.24	5.62	6.77

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Non-Industrial (residential/commercial)																
Base Flow	2.91	2.97	3.09	2.97	2.77	2.94	2.77	3.09	-	-	-	-	-	-	-	-
Avg Annual	3.83	5.17	5.37	4.06	3.69	4.42	3.69	5.37	1.32	1.74	1.74	1.37	1.33	1.50	1.32	1.74
ADWF	2.97	3.36	3.43	3.07	2.97	3.16	2.97	3.43	-	-	-	-	-	-	-	-
MMDW	3.89	4.79	5.71	4.95	4.75	4.82	3.89	5.71	1.34	1.61	1.85	1.67	1.71	1.64	1.34	1.85
MWDW	3.49	6.16	5.34	3.93	4.22	4.63	3.49	6.16	1.20	2.07	1.73	1.32	1.52	1.57	1.20	2.07
MDDW	3.65	6.89	7.24	4.19	4.98	5.39	3.65	7.24	1.25	2.32	2.34	1.41	1.80	1.83	1.25	2.34
MHDW	20.05	9.91	12.06	9.05	8.62	11.94	8.62	20.05	6.89	3.25	3.82	2.95	3.03	3.26	2.95	3.82
AWWF	5.15	6.99	7.34	5.06	4.42	5.79	4.42	7.34	-	-	-	-	-	-	-	-
MMWW	7.37	12.07	10.18	6.33	5.97	8.38	5.97	12.07	2.53	4.06	3.29	2.13	2.16	2.84	2.13	4.06
MWWW	11.91	16.03	13.25	8.24	9.70	11.83	8.24	16.03	4.09	5.40	4.29	2.77	3.50	4.01	2.77	5.40
MDWW	14.92	17.43	17.40	9.12	16.48	15.07	9.12	17.43	5.13	5.87	5.63	3.07	5.95	5.13	3.07	5.95
MHWW	16.65	19.67	20.73	17.51	19.23	18.76	16.65	20.73	5.72	6.62	6.71	5.90	6.94	6.38	5.72	6.94
Wet Industry																
Base Flow	0.07	0.08	0.07	0.10	0.08	0.08	0.07	0.10	-	-	-	-	-	-	-	-
Avg Annual	0.24	0.08	0.08	0.09	0.08	0.11	0.08	0.24	3.43	1.00	1.14	0.90	1.00	1.49	0.90	3.43
ADWF	0.08	0.08	0.07	0.10	0.08	0.08	0.07	0.10	-	-	-	-	-	-	-	-
MMDW	0.08	0.09	0.08	0.09	0.08	0.08	0.08	0.09	1.14	1.13	1.14	0.90	1.00	1.06	0.90	1.14
MWDW	0.07	0.09	0.08	0.09	0.07	0.08	0.07	0.09	1.00	1.13	1.14	0.90	0.88	1.01	0.88	1.14
MDDW	0.09	0.09	0.07	0.10	0.07	0.08	0.07	0.10	1.29	1.13	1.00	1.00	0.87	1.06	0.87	1.29
MHDW ¹	0.09	0.09	0.08	0.11	0.09	0.09	0.08	0.11	1.29	1.13	1.10	1.10	1.10	1.14	1.10	1.29
AWWF	-0.04	0.09	0.08	0.08	0.09	0.06	-0.04	0.09	-	-	-	-	-	-	-	-
MMWW	0.07	0.09	0.08	0.09	0.08	0.08	0.07	0.09	1.00	1.13	1.14	0.90	1.00	1.03	0.90	1.14
MWWW	0.08	0.09	0.08	0.09	0.08	0.08	0.08	0.09	1.14	1.13	1.14	0.90	1.00	1.06	0.90	1.14

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
MDWW	0.08	0.09	0.07	0.09	0.08	0.08	0.07	0.09	1.14	1.13	1.00	0.90	1.00	1.03	0.90	1.14
MHWW ¹	0.08	0.10	0.09	0.09	0.10	0.09	0.08	0.10	1.14	1.24	1.26	0.90	1.24	1.16	0.90	1.26

Notes:

(1) Maximum hour flows for wet industry assume the greater of maximum daily flow or 1.1 times x average daily flow.

Red highlight indicates data anomaly. Value excluded from average, min, and max calculations.

Table 3.3 Historical Flows and Peaking Factors for Forest Grove WRRF

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Residential, Non-residential, and Wet Industry																
Base Flow	2.25	2.35	2.41	2.21	2.50	2.34	2.21	2.50	-	-	-	-	-	-	-	-
Avg Annual	3.81	4.86	5.21	3.93	3.58	4.28	3.58	5.21	1.69	2.07	2.16	1.78	1.43	1.83	1.43	2.16
ADWF	2.45	2.83	2.79	2.41	2.6	2.62	2.41	2.83	-	-	-	-	-	-	-	-
MMDW	3.58	4.69	5.86	5.39	4.66	4.84	3.58	5.86	1.59	2.00	2.43	2.44	1.86	2.06	1.59	2.44
MWDW	3.51	6.52	5.42	3.76	3.48	4.54	3.48	6.52	1.56	2.77	2.25	1.70	1.39	1.94	1.39	2.77
MDDW	4.54	7.78	9.01	3.54	3.76	5.73	3.54	9.01	2.02	3.31	3.74	1.60	1.50	2.43	1.50	3.74
MHDW	6.42	13.19	13.10	7.64	6.70	9.41	6.42	13.19	2.85	5.61	5.43	3.46	2.68	4.01	2.68	5.61
AWWF	5.2	6.92	7.67	5.48	4.58	5.97	4.58	7.67	-	-	-	-	-	-	-	-
MMWW	8.04	11.42	10.25	7.30	6.73	8.75	6.73	11.42	3.57	4.86	4.25	3.30	2.69	3.74	2.69	4.86
MWWW	13.80	15.90	14.38	10.44	11.84	13.27	10.44	15.90	6.13	6.77	5.97	4.72	4.74	5.67	4.72	6.77
MDWW	20.25	20.70	22.52	12.18	21.49	19.43	12.18	22.52	9.00	8.81	9.34	5.51	8.60	8.25	5.51	9.34
MHWW	24.02	30.11	28.26	14.40	33.46	26.05	14.40	33.46	10.68	12.81	11.73	6.52	13.39	11.02	6.52	13.39

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Non-Industrial (residential/commercial)																
Base Flow	1.99	2.13	2.18	1.95	2.26	2.10	1.95	2.26	-	-	-	-	-	-	-	-
Avg Annual	3.32	4.67	5.01	3.71	3.37	4.02	3.32	5.01	1.67	2.19	2.30	1.90	1.49	1.91	1.49	2.30
ADWF	2.22	2.61	2.58	2.16	2.37	2.39	2.16	2.61	-	-	-	-	-	-	-	-
MMDW	3.39	4.41	5.67	5.2	4.43	4.62	3.39	5.67	1.70	2.07	2.60	2.67	1.96	2.20	1.70	2.67
MWDW	3.3	6.24	5.24	3.57	3.25	4.32	3.25	6.24	1.66	2.93	2.40	1.83	1.44	2.05	1.44	2.93
MDDW	4.33	7.5	8.79	3.34	3.54	5.50	3.34	8.79	2.18	3.52	4.03	1.71	1.57	2.60	1.57	4.03
MHDW	6.21	12.91	12.88	7.44	6.48	9.18	6.21	12.91	3.12	6.06	5.91	3.82	2.87	4.35	2.87	6.06
AWWF	5.01	6.74	7.48	5.28	4.38	5.78	4.38	7.48	-	-	-	-	-	-	-	-
MMWW	7.84	11.23	10.03	7.09	6.52	8.54	6.52	11.23	3.94	5.27	4.60	3.64	2.88	4.07	2.88	5.27
MWWW	13.59	15.71	14.16	10.23	11.63	13.06	10.23	15.71	6.83	7.38	6.50	5.25	5.15	6.22	5.15	7.38
MDWW	20.04	20.51	22.33	11.97	21.28	19.23	11.97	22.33	10.07	9.63	10.24	6.14	9.42	9.10	6.14	10.24
MHWW	23.81	29.92	28.07	14.19	33.25	25.85	14.19	33.25	11.97	14.05	12.88	7.28	14.71	12.18	7.28	14.71
Wet Industry																
Base Flow	0.26	0.22	0.23	0.26	0.24	0.24	0.22	0.26	-	-	-	-	-	-	-	-
Avg Annual	0.49	0.19	0.20	0.22	0.21	0.26	0.19	0.49	1.88	0.86	0.87	0.85	0.87	0.86	0.85	0.87
ADWF	0.23	0.22	0.21	0.25	0.23	0.23	0.21	0.25	-	-	-	-	-	-	-	-
MMDW	0.19	0.28	0.19	0.19	0.23	0.22	0.19	0.28	0.73	1.27	0.83	0.73	0.96	0.81	0.73	0.96
MWDW	0.21	0.28	0.18	0.19	0.23	0.22	0.18	0.28	0.81	1.27	0.78	0.73	0.96	0.82	0.73	0.96
MDDW	0.21	0.28	0.22	0.20	0.22	0.23	0.20	0.28	0.81	1.27	0.96	0.77	0.92	0.86	0.77	0.96
MHDW ¹	0.25	0.28	0.23	0.28	0.25	0.26	0.23	0.28	0.97	1.27	1.00	1.06	1.05	1.02	0.97	1.06
AWWF	0.19	0.18	0.19	0.20	0.20	0.19	0.18	0.20	-	-	-	-	-	-	-	-
MMWW	0.20	0.19	0.22	0.21	0.21	0.21	0.19	0.22	0.77	0.86	0.96	0.81	0.88	0.85	0.77	0.96
MWWW	0.21	0.19	0.22	0.21	0.21	0.21	0.19	0.22	0.81	0.86	0.96	0.81	0.87	0.86	0.81	0.96

	Flows (million gallons per day, mgd)								Peaking Factor							
Year	2015	2016	2017	2018	2019	Avg.	Min.	Max.	2015	2016	2017	2018	2019	Avg.	Min.	Max.
MDWW	0.21	0.19	0.19	0.21	0.21	0.20	0.19	0.21	0.81	0.86	0.83	0.81	0.87	0.84	0.81	0.87
MHWW ¹	0.21	0.20	0.21	0.22	0.22	0.21	0.20	0.22	0.81	0.90	0.91	0.85	0.92	0.88	0.81	0.92
Notes:																
(1) Maximum hour flows for wet industry assume the greater of maximum daily flow or 1.1 times x average daily flow.																
Red highlight indicates data anomaly. Value excluded from average, min, and max calculations.																

3.1.2 Oregon DEQ Peak Flow Methodology

DEQ outlines a methodology to determine average dry weather flow (ADWF), Average wet weather flow (AWWF), MMDW flow, MMWW flow, MDWW flow and MHWW flow (DEQ, Revision IV, 1996). The DEQ approach, with the exception of MHWW flow, involve comparing the recent influent plant flow during periods of high groundwater to local precipitation records. Long-term local precipitation records were used from the Portland Airport Precipitation Gage or the National Oceanic and Atmospheric Administration Atlas 2 (NOAA, 2022 and NOAA, 1973).

A description of the approach is provided below. Flow estimates and associated peaking factors are presented in **Table 3.4 through Table 3.6**. Correlation charts applying the DEQ methodology are presented in **Appendix D**. Peaking factors were generated using the DEQ flows and dividing by the historic base flow average from 2015 to 2019.

Average Dry Weather Flow

- ADWF corresponds to the intersection of the average long-term dry weather precipitation and the trendline for the ADWF historic 2015 through 2019 data.
- The total dry weather season (May through October) mean precipitation is 10.6 inches over the past 12 years (2008 through 2019).

Average Wet Weather Flow

- AWWF corresponds to the intersection of the average long-term wet weather precipitation and the trendline for the AWWF historic 2015 through 2019 data.
- The total wet weather season mean rainfall (November through April) is 28.6 inches over the past 12 years (2008 through 2019).

Maximum Month Dry Weather Flow

- MMDW flow is estimated by comparing monthly average plant flow for the months of January through May to the corresponding monthly precipitation over that same period. The maximum month dry weather flow is defined as the flow that would be expected during the 1-in-10-year precipitation event for the wettest month of the dry weather season.
- Dry weather flows are typically highest in May due to high spring period groundwater levels. The 1-in-10-year precipitation event for May (4.7 inches) was used to determine the MMDW flow.

Maximum Month Wet Weather Flow

- MMWW flow corresponds to the intersection of the 1-in-5-year January accumulated precipitation and the trendline for the MMWW flow historic 2015 through 2019 data.
- The 1-in-5-year January accumulated precipitation is 7-inches.

Maximum Day Wet Weather Flow

- MDWW flow corresponds to the intersection of 1-in-5 year 24-hour precipitation event and the trendline for the MDWW historic 2015 through 2019 data. The 1-in-5-year 24-hour precipitation event is 3 inches based on the NOAA Atlas 2 (NOAA, 1973).

Maximum Hour Wet Weather Flow

- MHWW flow during a 1-in-5-year precipitation event corresponds to a 0.011-percent annual probability. The average flow (50-percent probability), MMWW flow (8.3-percent probability), and MDWW flow (0.27-percent probability) are plotted on a log-normal plot and extrapolated to the 0.011-percent probability to calculate MHWW. The approach yields a conservative estimate of MHWW.

Table 3.4 DEQ Methodology Flows and Peaking Factors, Rock Creek WRRF

	DEQ Method Flow (mgd)	DEQ Peaking Factor
Residential, Non-residential, Wet Industry, and Intel		
ADWF	29.15	-
MMDW	44.67	1.62
AWWF	42.12	-
MMWW	52.37	1.90
MDWW	115.74	4.19
MHWW	237.07	8.59
Non-Industrial (residential/commercial)		
ADWF	22.20	-
MMDW	37.57	1.82
AWWF	35.50	-
MMWW	45.43	2.21
MDWW	108.62	5.27
MHWW	243.93	11.84
Red highlight indicates high level of conservatism in estimate.		

Table 3.5 DEQ Methodology Flows and Peaking Factors, Hillsboro WRRF

	DEQ Method Flow (mgd)	DEQ Peaking Factor
Residential, Non-residential and Wet Industry		
ADWF	3.37	-
MMDW	6.38	2.11
AWWF	5.89	-
MMWW	7.94	2.63
MDWW	19.15	6.34
MHWW	45.79	15.15
Non-Industrial (residential/commercial)		
ADWF	3.30	-
MMDW	6.30	2.14
AWWF	5.83	-
MMWW	7.86	2.67
MDWW	19.07	6.48
MHWW	45.89	15.60
Red highlight indicates high level of conservatism in estimate.		

Table 3.6 DEQ Methodology Flows and Peaking Factors, Forest Grove WRRF

	DEQ Method Flow (mgd)	DEQ Peaking Factor
Residential, Non-residential and Wet Industry		
ADWF	2.78	-
MMDW	6.40	2.73
AWWF	6.01	-
MMWW	8.14	3.47
MDWW	25.48	10.87
MHWW	74.56	31.81
Non-Industrial (residential/commercial)		
ADWF	2.57	-
MMDW	6.20	2.95
AWWF	5.81	-
MMWW	7.94	3.78
MDWW	25.29	12.03
MHWW	75.92	36.12
Red highlight indicates high level of conservatism in estimate.		

3.1.3 Collection System Model Peaking Factors

Flows and peaking factors were generated in the District's collection system models for each treatment basin for MMWW, MWWW, MDWW, and MHWW. The collection system models were calibrated in 2021-2022 utilizing local flow meter data. Once calibrated, historic precipitation data and the West Basin 5-year design storm were modeled as described below.

- *5-year Design Storm* - For the West Basin, the District utilizes a 1-in-5-year design storm with 3.3-inch accumulation over 72-hours. The maximum hourly precipitation during the design storm is 0.26 inches per hour and the maximum 24-hour accumulation is 2.38 inches. In 2012, the District developed the design storm specifically for the Rock Creek Basin. The analysis considered large storm events over a 50-year period and evaluated the frequency of overflow within the system caused by each storm event. The final design storm was a composite of historical events that generated the 1-in-5-year frequency of system flow rates.
- *January to March 2017* (three months historic precipitation) - The maximum precipitation accumulation is similar to the design storm over 24-hours (2.4 inches) and greater for the maximum 72-hour accumulation (3.8 inches). Historic storms periods were considered for flow categories exceeding 72-hours in duration (MWWW, MHWW). This period of historic precipitation approximates the 1-in-5-year storm event within a full month of high precipitation accumulation.
- *December 2015 to January 2016* (two months historic precipitation) - The maximum precipitation accumulation is greater than the design storm over 24-hours (3.0 inches) and greater for the maximum 72-hour accumulation (5.4 inches). This period of historic precipitation exceeds the 1-in-5-year storm event within a full month of higher precipitation accumulation.
- *January 11 – 13, 2021* (recent historic and intense storm event) – The maximum precipitation accumulation is similar to the design storm over 24-hours (2.6 inches) and similar to the maximum design storm 72-hour accumulation (3.5 inches). This period reflects existing system conditions with implementation of recent I/I reduction work and was used in recent collection system model calibrations to refine model wet weather response. The metered flow into each treatment facility is reported to compare against the modeled design storm.

The flows and associated peaking factors from the collection system modeling for the design storm and historic storm events is presented in **Table 3.7 through Table 3.9**.

Table 3.7 Collection System Modeling Flows and Peaking Factors, Rock Creek WRRF

	Flows (million gallons per day, mgd)				Peaking Factor			
	5-year Design Storm (modeled)	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)	5-year Design Storm	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)
Residential, Non-residential, Wet Industry, and Intel								
MMWW		63.7	55.9	57.6		2.26	1.98	2.04
MWWW		86.7	73.3	71.5		3.07	2.60	2.54
MDWW	115.4	114.9	93.2	116.6	4.09	4.08	3.31	4.14
MHWW	149.7	154.5	116.4	146.4	5.31	5.48	4.13	5.19
Non-Industrial (residential/commercial)								
MMWW		56.6	48.8	50.4		2.72	2.34	2.43
MWWW		80.5	67.1	65.3		3.87	3.23	3.14
MDWW	108.0	107.6	85.9	109.3	5.19	5.17	4.13	5.25
MHWW	141.5	146.3	108.3	138.2	6.80	7.04	5.21	6.65

Table 3.8 Collection System Modeling Flows and Peaking Factors, Hillsboro WRRF

	Flows (million gallons per day, mgd)				Peaking Factor			
	5-year Design Storm (modeled)	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)	5-year Design Storm	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)
Residential, Non-residential and Wet Industry								
MMWW		9.5	7.9	8.6		2.71	2.27	2.46
MWWW		15.1	12.1	10.7		4.33	3.47	3.07
MDWW	21.9	20.7	19.3	17.1	6.29	5.95	5.55	4.90
MHWW	24.7	31.5	28.0	19.4	7.09	9.04	8.03	5.57
Non-Industrial (residential/commercial)								
MMWW		9.4	7.8	8.5		2.75	2.29	2.49
MWWW		15.0	12.0	10.6		4.41	3.53	3.12
MDWW	21.8	20.6	19.3	17.0	6.41	6.06	5.66	4.99
MHWW	24.6	31.4	27.9	19.3	7.23	9.23	8.20	5.68

Table 3.9 Collection System Modeling Flows and Peaking Factors, Forest Grove WRRF

	Flows (million gallons per day, mgd)				Peaking Factor			
	5-year Design Storm (modeled)	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)	5-year Design Storm	2015-2016 Historic Storm (modeled)	2017 Historic Storm (modeled)	Jan 2021 Storm (metered)
Residential, Non-residential, and Wet Industry								
MMWW		12.6	8.6	9.7		5.08	3.48	3.90
MWWW		22.4	17.2	11.9		9.03	6.93	4.81
MDWW	20.19	33.7	24.9	21.7	8.15	13.61	10.04	8.77
MHWW	29.50	42.9	34.9	28.4	11.90	17.30	14.07	11.44
Non-Industrial (residential/commercial)								
MMWW		12.4	8.4	9.5		5.63	3.83	4.30
MWWW		22.2	17.0	11.7		10.08	7.72	5.32
MDWW	20.0	33.5	24.7	21.5	9.09	15.26	11.23	9.79
MHWW	29.3	42.7	34.7	28.1	13.33	19.41	15.78	12.81

3.1.4 Comparison and Selection of Peaking Factors

A comparison of the peaking factors developed using historical data, the DEQ methodology and the collections system models and selected flow peaking factors are presented in **Table 3.11 through Table 3.13**. Flow peaking factors are presented for total influent, non-industrial (residential/commercial), Intel wet industry, and other metered wet industry.

The final selection of existing flow peaking factors for total influent flow and non-industrial (residential /commercial) was based on the following:

- Historical peaking factors were selected for average annual flows, all dry weather flow conditions and wet weather maximum month and maximum week. The historical peaking factors were typically more conservative than the peaking factors generated using the DEQ methodology for these flow categories. Average historic values were used to define the average annual peaking factors. Maximum historic values were used to define all other peaking factors. Data outliers were removed in determining the maximum historic values as highlighted in **Tables 2.1 through 2.3**.
- The peaking factors developed using the collection system models and the 5-year design storm were selected for wet weather maximum day and maximum hour. These peaking factors were selected over the more conservative peaking factors estimated using the DEQ methodology. Generally, the modeled design storm produces wet weather flows consistent with recent historic events or lower than recent historic storm events (since 2015). The collection system models were used in place of the historic events because the modeled wet weather response reflects recent targeted I/I reduction projects particularly in the Forest Grove and Hillsboro Basins and system aging. The I/I reduction projects for Forest Grove, for example, were completed after large storm events occurring in 2015 and 2017. A summary of changes in wet weather peaking factors for each treatment basin is described below. The changes reflect adjusted wet weather response between models calibrated in 2012 and models calibrated in 2021.
 - Rock Creek (aging system with limited I/I reduction work)
 - MDWW increased from 3.55 to 4.09 (15-percent increase)
 - MHWW increased from 4.84 to 5.19 (7-percent increase)
 - Hillsboro (targeted I/I reduction work)
 - MDWW reduced from 6.55 to 6.29 (4-percent decrease)
 - MHWW reduced from 8.25 to 7.09 (14-percent decrease)
 - Forest Grove (targeted I/I reduction work)
 - MDWW reduced from 10.67 to 8.15 (24-percent decrease)
 - MHWW reduced from 12.83 to 11.90 (7-percent decrease)

The final selection of peaking factors for metered wet industry and Intel for all flow categories were based on historic metered data excluding outliers as highlighted in **Tables 3.1 through 3.3**. Average historic values were used to define the average annual peaking factors. Maximum historic values were used to define all other peaking factors. Where maximum hour meter data was unavailable, the maximum hour flows for wet industry assume the greater of maximum daily flow or 110-percent of average daily flow. The 110-percent multiplier is based on available hourly metered data at Intel.

Table 3.11 through Table 3.13 also summarize the new development peaking factors and composite (new + existing) peaking factors at 2040 and 2075 (buildout) based on projected residential/commercial growth. To develop residential/commercial (non-industrial) peaking factors for future customers during wet weather flow, a sampling of recently developed areas with I/I rates below 4,000 gallons per net acre per day were evaluated from the East Basin where new development areas are more easily isolated in the modeled system. The results of the analysis and the associated MHHW peaking factors are presented in **Table 3.10**.

Table 3.10 Maximum Hour Wet Weather Flow Peaking Factor Development for New Residential & Commercial Customers

Peaking Factor Development for Low I/I (2,500 gpnad - 4,000 gpnad) New Residential/Commercial Development			
New Development Location (East Basin)	Base Flow (mgd)	MHHW Flow (mgd)	MHHW Peaking Factor
1 - Sherwood (Sherwood Trunk)	0.7	3.2	4.8
2 - Sherwood (Onion Flats Trunk)	0.5	1.7	3.6
3 - King City (Bull Mountain Trunk)	1.1	4.7	4.4
4 - Tualatin (Lower Tualatin Interceptor)	1.2	4.9	4.2
5 - Beaverton (Summer Creek Trunk)	1.8	7.1	4.0
TOTAL	5.1	21.5	4.2

Other wet weather flow category peaking factors for new development were generated by the following:

- (1) Calculating the ratio of MHHW peaking factors for new development vs existing system
- (2) Applying the ratio to the flow category peaking factor for the existing system

An example is provided below for MDWW:

$$MDWW\ PF\ (new) = \frac{MDWW\ PF\ (existing) \times MHHW\ PF\ (new)}{MHHW\ PF\ (existing)}$$

Where: *PF* = Peaking Factor, *new* = new development, *existing* = existing system

New development wet weather flow peaking factors were applied to the portion of the base flow attributed to population and employment growth to calculate new residential/commercial flows. New development dry weather flow peaking factors were assumed to be equal to existing dry weather peaking factors for residential/commercial flows.

Table 3.11 Comparison and Selection of Flow Peaking Factors, Rock Creek WRRF

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Development Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
Residential, Non-residential, Wet Industry, and Intel															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.30	1.16	1.45	-	-	-	-	-	1.30	average historic	1.30	38%	1.30	56%	1.30
MMDW	1.38	1.21	1.53	1.62	1.44	-	-	-	1.53	maximum historic	1.53	38%	1.53	56%	1.53
MWDW	1.32	1.14	1.57	-	-	-	-	-	1.57	maximum historic	1.57	38%	1.57	56%	1.57
MDDW	1.62	1.36	1.98	-	-	-	-	-	1.98	maximum historic	1.98	38%	1.98	56%	1.98
MHDW	2.10	1.71	2.73	-	1.57	-	-	-	2.73	maximum historic	2.73	38%	2.73	56%	2.73
MMWW	1.98	1.52	2.48	1.90	-	2.26	1.98	2.04	2.48	maximum historic	1.54	38%	2.12	56%	1.96
MWWW	2.56	1.96	3.30	-	-	3.07	2.60	2.54	3.30	maximum historic	2.04	38%	2.82	56%	2.60
MDWW	3.35	2.46	4.30	4.19	4.09	4.08	3.31	4.14	4.09	collection system model design storm	2.53	38%	3.50	56%	3.22
MHWW	4.12	2.94	5.31	8.59	5.31	5.48	4.13	5.19	5.31	collection system model design storm	3.29	38%	4.54	56%	4.18
Non-Industrial (residential/commercial)															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.38	1.21	1.59	-	-	-	-	-	1.38	average historic	1.38	29%	1.38	52%	1.38
MMDW	1.50	1.26	1.71	1.82	1.60	-	-	-	1.71	maximum historic	1.71	29%	1.71	52%	1.71
MWDW	1.43	1.20	1.77	-	-	-	-	-	1.77	maximum historic	1.77	29%	1.77	52%	1.77
MDDW	1.82	1.48	2.29	-	-	-	-	-	2.29	maximum historic	2.29	29%	2.29	52%	2.29
MHDW	2.43	1.89	3.28	-	1.74	-	-	-	3.28	maximum historic	3.28	29%	3.28	52%	3.28
MMWW	2.30	1.67	2.97	2.21	-	2.72	2.34	2.43	2.97	maximum historic	1.84	29%	2.64	52%	2.37
MWWW	3.12	2.34	4.08	-	-	3.87	3.23	3.14	4.08	maximum historic	2.52	29%	3.62	52%	3.26
MDWW	4.13	2.98	5.37	5.27	5.19	5.17	4.13	5.25	5.19	collection system model design storm	3.21	29%	4.62	52%	4.16
MHWW	5.11	3.61	6.71	11.84	6.80	7.04	5.21	6.65	6.80	collection system model design storm	4.21	29%	6.05	52%	5.44
Intel															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.01	0.99	1.04	-	-	-	-	-	1.01	average historic	1.01	46%	1.01	55%	1.01
MMDW	1.07	1.03	1.12	-	-	-	-	-	1.12	maximum historic	1.12	46%	1.12	55%	1.12
MWDW	1.13	1.04	1.23	-	-	-	-	-	1.23	maximum historic	1.23	46%	1.23	55%	1.23
MDDW	1.17	1.07	1.28	-	-	-	-	-	1.28	maximum historic	1.28	46%	1.28	55%	1.28
MHDW ¹	1.18	1.10	1.28	-	-	-	-	-	1.28	maximum historic	1.28	46%	1.28	55%	1.28
MMWW	1.05	1.02	1.13	-	-	-	-	-	1.13	maximum historic	1.13	46%	1.13	55%	1.13
MWWW	1.10	1.03	1.29	-	-	-	-	-	1.29	maximum historic	1.29	46%	1.29	55%	1.29
MDWW	1.19	1.06	1.62	-	-	-	-	-	1.62	maximum historic	1.62	46%	1.62	55%	1.62

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Development Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
MHWW ¹	1.20	1.08	1.62	-	-	-	-	-	1.62	maximum historic	1.62	46%	1.62	55%	1.62
Wet Industry (non-Intel)															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.04	0.98	1.08	-	-	-	-	-	1.04	average historic	1.04	65%	1.04	75%	1.04
MMDW	1.07	0.95	1.15	-	-	-	-	-	1.15	maximum historic	1.15	65%	1.15	75%	1.15
MWDW	1.05	0.95	1.13	-	-	-	-	-	1.13	maximum historic	1.13	65%	1.13	75%	1.13
MDDW	1.00	0.95	1.03	-	-	-	-	-	1.03	maximum historic	1.03	65%	1.03	75%	1.03
MHDW ¹	1.12	1.09	1.14	-	-	-	-	-	1.14	maximum historic	1.14	65%	1.14	75%	1.14
MMWW	1.08	0.99	1.21	-	-	-	-	-	1.21	maximum historic	1.21	65%	1.21	75%	1.21
MWWW	1.07	0.97	1.22	-	-	-	-	-	1.22	maximum historic	1.22	65%	1.22	75%	1.22
MDWW	1.05	0.98	1.10	-	-	-	-	-	1.10	maximum historic	1.10	65%	1.10	75%	1.10
MHWW ¹	1.16	1.08	1.25	-	-	-	-	-	1.25	maximum historic	1.25	65%	1.25	75%	1.25
Notes:															
(1) Maximum hour flows for wet industry and Intel assume the greater of maximum daily flow or 1.1 times x average daily flow.															

Table 3.12 Comparison and Selection of Flow Peaking Factors, Hillsboro WRRF

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Development Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
Residential, Non-residential, and Wet Industry															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.50	1.32	1.72	-	-	-	-	-	1.50	average historic	1.50	29%	1.50	51%	1.50
MMDW	1.62	1.33	1.83	2.11	1.79	-	-	-	1.83	maximum historic	1.83	29%	1.83	51%	1.83
MWDW	1.55	1.19	2.05	-	-	-	-	-	2.05	maximum historic	2.05	29%	2.05	51%	2.05
MDDW	1.81	1.26	2.31	-	-	-	-	-	2.31	maximum historic	2.31	29%	2.31	51%	2.31
MHDW	3.29	2.98	3.84	-	1.22	-	-	-	3.84	maximum historic	3.84	29%	3.84	51%	3.84
MMWW	2.79	2.09	3.99	2.63	-	2.71	2.27	2.46	3.99	maximum historic	2.37	29%	3.52	51%	3.16
MWWW	3.93	2.71	5.29	-	-	4.33	3.47	3.07	5.29	maximum historic	3.14	29%	4.67	51%	4.19
MDWW	5.02	3.00	5.81	6.34	6.29	5.95	5.55	4.90	6.29	collection system model design storm	3.74	29%	5.56	51%	4.98
MHWW	6.24	5.62	6.77	15.15	7.09	9.04	8.03	5.57	7.09	collection system model design storm	4.21	29%	6.26	51%	5.61

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Develoment Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
Non-Industrial (residential/commercial)															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.50	1.32	1.74	-	-	-	-	-	1.50	average historic	1.50	27%	1.50	50%	1.50
MMDW	1.64	1.34	1.85	2.14	1.81	-	-	-	1.85	maximum historic	1.85	27%	1.85	50%	1.85
MWDW	1.57	1.20	2.07	-	-	-	-	-	2.07	maximum historic	2.07	27%	2.07	50%	2.07
MDDW	1.83	1.25	2.34	-	-	-	-	-	2.34	maximum historic	2.34	27%	2.34	50%	2.34
MHDW	3.26	2.95	3.82	-	1.22	-	-	-	3.82	maximum historic	3.82	27%	3.82	50%	3.82
MMWW	2.84	2.13	4.06	2.67	-	2.75	2.29	2.49	4.06	maximum historic	2.42	27%	3.62	50%	3.24
MWWW	4.01	2.77	5.40	-	-	4.41	3.53	3.12	5.40	maximum historic	3.21	27%	4.81	50%	4.30
MDWW	5.13	3.07	5.95	6.48	6.41	6.06	5.66	4.99	6.41	collection system model design storm	3.81	27%	5.72	50%	5.11
MHWW	6.38	5.72	6.94	15.60	7.23	9.23	8.20	5.68	7.23	collection system model design storm	4.30	27%	6.45	50%	5.76
Wet Industry															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.49	0.90	3.43	-	-	-	-	-	1.49	average historic	1.49	64%	1.49	74%	1.49
MMDW	1.06	0.90	1.14	-	-	-	-	-	1.14	maximum historic	1.14	64%	1.14	74%	1.14
MWDW	1.01	0.88	1.14	-	-	-	-	-	1.14	maximum historic	1.14	64%	1.14	74%	1.14
MDDW	1.06	0.87	1.29	-	-	-	-	-	1.29	maximum historic	1.29	64%	1.29	74%	1.29
MHDW ¹	1.14	1.10	1.29	-	-	-	-	-	1.29	maximum historic	1.29	64%	1.29	74%	1.29
MMWW	1.03	0.90	1.14	-	-	-	-	-	1.14	maximum historic	1.14	64%	1.14	74%	1.14
MWWW	1.06	0.90	1.14	-	-	-	-	-	1.14	maximum historic	1.14	64%	1.14	74%	1.14
MDWW	1.03	0.90	1.14	-	-	-	-	-	1.14	maximum historic	1.14	64%	1.14	74%	1.14
MHWW ¹	1.16	0.90	1.26	-	-	-	-	-	1.26	maximum historic	1.26	64%	1.26	74%	1.26
Notes:															
(1) Maximum hour flows for wet industry assume the greater of maximum daily flow or 1.1 times x average daily flow.															

Table 3.13 Comparison and Selection of Flow Peaking Factors, Forest Grove WRRF

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Develoment Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
Residential, Non-residential, and Wet Industry															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.83	1.43	2.16	-	-	-	-	-	1.83	average historic	1.83	14%	1.83	37%	1.83
MMDW	2.06	1.59	2.44	2.73	2.18	-	-	-	2.44	maximum historic	2.44	14%	2.44	37%	2.44

	2015 - 2019 Historic Avg.	2015 - 2019 Historic Min.	2015 - 2019 Historic Max.	DEQ Methodology	Collection System Model Design Storm	Collection System Model 2017 Storm	Collection System Model 2015 Storm	Flow Metering January 2021 Storm	Selected Peaking Factor 2020	Selection Comment	New Develoment Peaking Factor	% New Development, 2040	Composite Selected Peaking Factor, 2040	% New Development, 2075	Composite Selected Peaking Factor, 2075
MWDW	1.94	1.39	2.77	-	-	-	-	-	2.77	maximum historic	2.77	14%	2.77	37%	2.77
MDDW	2.43	1.50	3.74	-	-	-	-	-	3.74	maximum historic	3.74	14%	3.74	37%	3.74
MHDW	4.01	2.68	5.61	-	2.45	-	-	-	5.61	maximum historic	5.61	14%	5.61	37%	5.61
MMWW	3.74	2.69	4.86	3.47	-	5.08	3.48	3.90	4.86	maximum historic	1.63	14%	4.39	37%	3.66
MWWW	5.67	4.72	6.77	-	-	9.03	6.93	4.81	6.77	maximum historic	2.27	14%	6.11	37%	5.09
MDWW	8.25	5.51	9.34	10.87	8.15	13.61	10.04	8.77	8.15	collection system model design storm	2.73	14%	7.36	37%	6.13
MHWW	11.02	6.52	13.39	31.81	11.90	17.30	14.07	11.44	11.90	collection system model design storm	3.99	14%	10.76	37%	8.96
Non-Industrial (residential/commercial)															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	1.91	1.49	2.30	-	-	-	-	-	1.91	average historic	1.91	14%	1.91	36%	1.91
MMDW	2.20	1.70	2.67	2.95	2.36	-	-	-	2.67	maximum historic	2.67	14%	2.67	36%	2.67
MWDW	2.05	1.44	2.93	-	-	-	-	-	2.93	maximum historic	2.93	14%	2.93	36%	2.93
MDDW	2.60	1.57	4.03	-	-	-	-	-	4.03	maximum historic	4.03	14%	4.03	36%	4.03
MHDW	4.35	2.87	6.06	-	2.66	-	-	-	6.06	maximum historic	6.06	14%	6.06	36%	6.06
MMWW	4.07	2.88	5.27	3.78	-	5.63	3.83	4.30	5.27	maximum historic	1.77	14%	4.78	36%	4.02
MWWW	6.22	5.15	7.38	-	-	10.08	7.72	5.32	7.38	maximum historic	2.47	14%	6.69	36%	5.62
MDWW	9.10	6.14	10.24	12.03	9.09	15.26	11.23	9.79	9.09	collection system model design storm	3.05	14%	8.24	36%	6.93
MHWW	12.18	7.28	14.71	36.12	13.33	19.41	15.78	12.81	13.33	collection system model design storm	4.47	14%	12.08	36%	10.16
Wet Industry															
Base Flow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg Annual	0.86	0.85	0.87	-	-	-	-	-	0.86	average historic	0.86	18%	0.86	48%	0.86
MMDW	0.81	0.73	0.96	-	-	-	-	-	0.96	maximum historic	0.96	18%	0.96	48%	0.96
MWDW	0.82	0.73	0.96	-	-	-	-	-	0.96	maximum historic	0.96	18%	0.96	48%	0.96
MDDW	0.86	0.77	0.96	-	-	-	-	-	0.96	maximum historic	0.96	18%	0.96	48%	0.96
MHDW ¹	1.02	0.97	1.06	-	-	-	-	-	1.06	maximum historic	1.06	18%	1.06	48%	1.06
MMWW	0.85	0.77	0.96	-	-	-	-	-	0.96	maximum historic	0.96	18%	0.96	48%	0.96
MWWW	0.86	0.81	0.96	-	-	-	-	-	0.96	maximum historic	0.96	18%	0.96	48%	0.96
MDWW	0.84	0.81	0.87	-	-	-	-	-	0.96	maximum historic, replaced with same factor as MMWW and MWWW	0.96	18%	0.96	48%	0.96
MHWW ¹	0.88	0.81	0.92	-	-	-	-	-	0.96	maximum historic, replaced with same factor as MMWW and MWWW	0.96	18%	0.96	48%	0.96

(1) Maximum hour flows for wet industry assume the greater of maximum daily flow or 1.1 times x average daily flow.

3.2 Flow Per Capita and Per Employee

Base flows in each treatment basin are allocated into three areas: (1) residential, (2) non-residential (commercial/non-metered industrial) and (3) metered wet industrial. Metered wet industrial flows are permitted and measured on a monthly basis. Allocation of the remaining base flow between residential and non-residential is done using per capita and per employee base flows applied to population and employment. The following steps were performed to develop per capita and per employee base flows:

- Per employee flows were estimated at 30 gallons per employee per day (gpepd) based on industry standards (Metcalf & Eddy, 2014) and confirmed with local flow meter during the collection system model calibrations. Documented historical employment numbers were multiplied by the per employee rate to estimate non-residential base flows.
- The per capita base flows were calculated by subtracting the measured wet industrial base flows and estimated non-residential base flows from influent base flows measured at each treatment facility and dividing by historical population. For reference to previous planning efforts, per capita base flows were also calculated with the non-residential (employment) component included.

The per capita and per employee base flow calculations are presented in **Tables 3.14 through 3.17** for 2015 through 2019. Average base per capita flows for the five- year period are 55.5 gallons per capita per day (gpcpd), 57.3 gpcpd, and 90 gpcpd for Rock Creek WRRF, Hillsboro WRRF, and Forest Grove WRRF respectively. The West Basin overall base per capita flow is estimated at 57.5 gpcpd. The Forest Grove per capita flow for the existing system is due to elevated groundwater in older areas of the collection system. For consistency, the overall base per capita flow of 57.5 gpcpd was selected to develop future growth residential base flows for all treatment basins. The base per employee flow of 30 gpepd was selected to develop future growth non-residential base flows for all treatment basins.

The average per capita rates for the five-year period with the non-residential (employment) component included are 65.8 gpcpd, 70.9 gpcpd, and 104.6 gpcpd for Rock Creek WRRF, Hillsboro WRRF, and Forest Grove WRRF respectively. The West Basin overall base per capita flow with the non-residential component included is estimated at 68.4 gpcpd. This represents a 17-percent decrease from the 2013 West Basin Facility Plan (Carollo, 2013) which documented base per capital flow between 82-83 gpcpd.

A high-level review of base flows was performed for 2020 which was heavily influenced by at-home-work due to shutdowns associated with COVID-19. Per capita flows are approximately 10-percent greater for the 2020 period.

Table 3.14 Per Capita and Per Employee Base Flows, Rock Creek WRRF

Year	Base Flow, mgd	Measured Wet Industry Flow, mgd	Intel Flow, mgd	Employees	Per Employee Flow, gpcpd	Non-residential (employment) Flow, mgd	Residential Flow, mgd	Population	Per Capita Flow, gpcpd	Per Capita Flow includes Non-Residential, gpcpd
2015	27.6	1.5	5.3	101,526	30.0	3.0	17.8	300,363	59.2	69.3
2016	26.9	1.6	5.0	104,424	30.0	3.1	17.1	307,525	55.6	65.8
2017	27.6	1.4	5.4	107,322	30.0	3.2	17.6	314,571	56.1	66.3
2018	27.7	1.5	5.8	110,220	30.0	3.3	17.0	320,779	53.0	63.3
2019	28.2	1.4	6.0	113,118	30.0	3.4	17.4	324,119	53.7	64.2
Average	27.6	1.5	5.5	107,322	30.0	3.2	17.4	313,471.3	55.5	65.8

Table 3.15 Per Capita and Per Employee Base Flows, Hillsboro WRRF

Year	Base Flow, mgd	Measured Wet Industry Flow, mgd	Employees	Per Employee Flow, gpcpd	Non-residential (employment) Flow, mgd	Residential Flow, mgd	Population	Per Capita Flow, gpcpd	Per Capita Flow includes Non-Residential, gpcpd
2015	3.0	0.07	17,862	30.0	0.5	2.4	39,766	59.6	73.1
2016	3.1	0.08	18,372	30.0	0.6	2.4	40,715	59.4	73.0
2017	3.2	0.08	18,882	30.0	0.6	2.5	41,647	60.5	74.1
2018	3.1	0.10	19,392	30.0	0.6	2.4	42,469	56.2	69.9
2019	2.9	0.08	19,902	30.0	0.6	2.2	42,912	50.7	64.6
Average	3.0	0.08	18,882	30.0	0.6	2.4	41,501.9	57.3	70.9

Table 3.16 Per Capita and Per Employee Base Flows, Forest Grove WRRF

Year	Base Flow, mgd	Measured Wet Industry Flow, mgd	Employees	Per Employee Flow, gpcpd	Non-residential (employment) Flow, mgd	Residential Flow, mgd	Population	Per Capita Flow, gpcpd	Per Capita Flow includes Non-Residential, gpcpd
2015	2.3	0.3	8,771	30.0	0.3	1.7	18,854	91.8	105.8
2016	2.1	0.2	9,021	30.0	0.3	1.6	19,304	85.1	99.2
2017	2.4	0.2	9,272	30.0	0.3	1.9	19,746	96.3	110.3
2018	2.2	0.3	9,522	30.0	0.3	1.7	20,136	82.5	96.7
2019	2.5	0.2	9,772	30.0	0.3	2.0	20,345	96.6	111.0
Average	2.3	0.2	9,272	30.0	0.3	1.8	19,676.9	90.5	104.6

Table 3.17 Per Capita and Per Employee Base Flows, West Basin Total

Year	Base Flow, mgd	Measured Wet Industry Flow, mgd	Intel Flow, mgd	Employees	Per Employee Flow, gpcpd	Non-residential (employment) Flow, mgd	Residential Flow, mgd	Population	Per Capita Flow, gpcpd	Per Capita Flow includes Non-Residential, gpcpd
2015	32.8	1.8	5.3	128,158	30.0	3.8	21.9	358,983	60.9	71.6
2016	32.1	1.9	5.0	131,817	30.0	4.0	21.2	367,544	57.6	68.4
2017	33.2	1.7	5.4	135,475	30.0	4.1	22.1	375,964	58.7	69.5
2018	32.9	1.9	5.8	139,133	30.0	4.2	21.0	383,383	54.9	65.8
2019	33.5	1.8	6.0	142,792	30.0	4.3	21.5	387,376	55.6	66.7
Average	32.9	1.8	5.5	135,475	30.0	4.1	21.5	374,650.0	57.5	68.4

4 Load Analysis

Historical loads were evaluated to determine the load peaking factors and per capita rates to be applied for future load projections. The load projections were obtained using the following procedure:

1. The influent load analysis was performed for cBOD, COD, TSS, NH₄, TKN, oP, and TP based on requirements for the District NPDES permit. Historical daily data from 2015-2019 was extracted from Hach WIMS. Transfer loads were subtracted from or added to each WRRF such that loading represented influent contributions to each treatment facility. The Hach WIMS variables used to develop the historical loads as of May 5th, 2020 can be found in **Appendix B**. A standard ratio of COD to cBOD (1.9 – 2.3 range typical) was used when limited data was available for industrial customers.
2. The historical average annual loading was selected to determine peaking factors for MMDW, MWDW, MDDW, MMWW, MWWW, and MDWW loads for each constituent. Loading per capita was developed for average annual loading.
3. The historic data set was evaluated for outlier events and unreliable data characterized by a low number of sampling points (< 50 sampling points). If deemed appropriate, these events were removed from consideration in the historical load analysis.
4. Where metered industrial loading data was available, non-industrial (residential/commercial) loading was calculated by subtracting the monthly industrial loading from the plant influent loading for each treatment facility.
 - Rock Creek WRRF average annual loading and peaking factors were tracked separately for non-industrial (residential/commercial), metered wet industry, and Intel sources for cBOD, COD, and TSS. Metered wet industry and Intel loading information was not available for NH₄, TKN, oP and TP and industry loads for these constituents were assumed to be negligible based on review of per capita loading rates compared to industry standards.
 - Hillsboro WRRF and Forest Grove WRRF average annual loading and peaking factors were evaluated separately for non-industrial (residential/commercial) and metered wet industries for cBOD, COD, and TSS. Because the metered wet industry data was highly variable, the total influent loadings were used instead of separate non-industrial and meter industry components in developing peaking factors and per capita rates. Metered wet industry loading information was not available for NH₄, TKN, oP and TP and industry loads for these constituents were assumed to be negligible based on review of per capita loading rates compared to industry standards.
8. The average annual estimated wet industrial load to each facility was projected to increase proportional to growth in employment.
9. Population projections were used to project future non-industrial (residential/commercial) average annual loading rates using the loading per capita. The projected industrial annual loading rates of TSS, COD, and cBOD were added to the projected non-industrial annual loadings.
10. Intel annual load increases were based on maintaining existing constituent concentrations and applying these concentrations to the flow projections provided by the customer. Existing constituent concentrations were calculated at 255 milligrams per liter (mg/L) for cBOD, 648 mg/L for COD, and 124 mg/L for TSS.

11. North Hillsboro and North Hillsboro expansion areas annual load projections assumed a 67-percent light industry flow component (typical of data centers) and 33-percent heavy industry flow (typical of existing wet industry customers). Data center constituent concentrations were estimated at 50 milligrams per liter (mg/L) for cBOD, 50 mg/L for COD, and 10 mg/L for TSS.
12. The non-industrial and industrial peaking factors were then applied to the future average annual loading rates to generate future loads for each constituent and load category to develop load projections as follows:
 - a. Rock Creek WRRF
 - (1) cBOD, COD, and TSS
 - (a) Non-industrial peaking factors were applied to non-industrial loading component based on population projections.
 - (b) Intel peaking factors were applied to Intel loading component.
 - (c) Metered wet industry peaking factors applied to metered wet industry loading component.
 - (d) The Intel peaking factors were applied to the North Hillsboro and North Hillsboro expansion area loading components.
 - (2) TP, oP, TKN, NH₄
 - (a) Metered industrial load components were not available.
 - (b) Influent peaking factors were applied to all load components based on population projections.
 - (c) Additional loading not identified above population projections for the North Hillsboro and North Hillsboro expansion areas.
 - b. Hillsboro and Forest Grove WRRFs
 - (1) cBOD, COD, and TSS
 - (a) Influent peaking factors were applied to all loading component based on population projections.
 - (b) Metered industrial peaking factors were highly variable and were not used..
 - (2) TP, oP, TKN, NH₄
 - (a) Metered industrial load components were not available.
 - (b) Influent peaking factors were applied to all loading components based on population projections.

4.1 Historic Load Summary and Peaking Factors

Historical data from 2015 to 2019 was used to develop mass load peaking factors. The historic loads and selected peaking factors are presented in this section. Plots of historical loading data are provided in **Appendix C**.

4.1.1 cBOD Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for cBOD load projections are presented in **Tables 4.1 through 4.3** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015-2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - The historical peaking factors for metered wet industry are somewhat variable for wet weather. The selected maximum peaking factors for MWWW and MDWW are 30-percent greater than the average historical peaking factors.
 - The historical peaking factors for Intel are somewhat variable for dry weather. The selected maximum peaking factor for MWDW is 30-percent greater than the average historical peaking factor.
 - The historical peaking factors for Intel are significantly variable for wet weather. The selected maximum peaking factors for MWWW and MDWW are 60-percent and 90-percent greater than the average historical peaking factors respectively.
 - For the load projections, the Intel peaking factors are applied to new industrial customers in North Hillsboro and North Hillsboro expansion areas. The assumption to utilize the maximum Intel peaking factor for wet weather loading should be reviewed considering the variability of the maximum historical loading event.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - The historical peaking factors are somewhat variable for MWDW and MDWW. The selected maximum peaking factors are 25-percent greater than the average historical peaking factors.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
 - Dry weather peaking factors may be impacted by seasonal (summer) spikes in wet industry discharges. In the Forest Grove Basin, data was not available to accurately isolate the industry component from the total influent loading.

Table 4.1 Historic cBOD Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Non-industrial (residential/commercial), lbs/d									Peaking Factor										
Avg Annual	51,755	47,115	49,973	44,747	45,611	47,840	44,747	51,755		1.14	1.18	1.17	1.18	1.09	1.15	1.09	1.18	1.15	Avg.
MMDW	59,259	55,700	58,594	52,614	49,848	55,203	49,848	59,259		1.32	1.28	1.29	1.43	1.16	1.30	1.16	1.43	1.43	Max.
MWDW	68,255	60,375	64,439	63,996	53,101	62,033	53,101	68,255		1.96	1.85	1.63	1.55	1.23	1.65	1.23	1.96	1.96	Max.
MDDW	101,489	87,118	81,531	69,446	56,265	79,170	56,265	101,489		1.14	1.16	1.06	1.09	1.21	1.13	1.06	1.21	1.13	Avg.
MMWW	58,750	54,473	53,070	48,850	55,392	54,107	48,850	58,750		1.30	1.31	1.25	1.28	1.34	1.30	1.25	1.34	1.34	Max.
MWWWW	67,313	61,887	62,308	57,090	61,180	61,956	57,090	67,313		1.37	1.92	2.08	2.08	1.53	1.80	1.37	2.08	2.08	Max.
MDWW	70,985	90,490	103,919	93,109	69,698	85,640	69,698	103,919		Peaking Factor									
Intel, lbs/d																			
Avg Annual	6,427	5,569	6,217	9,426	4,381	6,404	4,381	9,426		0.94	0.80	1.22	0.87	0.66	0.90	0.66	1.22	0.90	Avg.
MMDW	6,014	4,460	7,569	8,245	2,886	5,835	2,886	8,245		0.77	0.82	1.16	0.90	0.72	0.87	0.72	1.16	1.16	Max.
MWDW	4,975	4,589	7,204	8,470	3,144	5,676	3,144	8,470		0.96	0.70	0.94	0.95	0.55	0.82	0.55	0.96	0.96	Max.
MDDW	6,162	3,909	5,856	8,919	2,393	5,448	2,393	8,919		1.24	0.99	0.88	0.77	1.40	1.06	0.77	1.40	1.06	Avg.
MMWW	7,993	5,510	5,493	7,223	6,116	6,467	5,493	7,993		0.94	0.89	0.58	0.72	1.56	0.94	0.58	1.56	1.56	Max.
MWWWW	6,027	4,955	3,611	6,806	6,821	5,644	3,611	6,821		1.07	0.89	0.14	0.71	1.77	0.92	0.14	1.77	1.77	Max.
MDWW	6,875	4,946	848	6,711	7,761	5,428	848	7,761		Peaking Factor									
Wet Industry, lbs/d																			
Avg Annual	3,981	2,598	3,401	3,665	3,401	3,409	2,598	3,981		1.05	1.24	1.49	1.41	1.16	1.27	1.05	1.49	1.27	Avg.
MMDW	4,165	3,226	5,051	5,185	3,937	4,313	3,226	5,185		0.84	1.24	1.35	1.44	1.27	1.23	0.84	1.44	1.44	Max.
MWDW	3,338	3,226	4,601	5,288	4,333	4,157	3,226	5,288		1.08	1.24	0.98	1.44	1.20	1.19	0.98	1.44	1.44	Max.
MDDW	4,305	3,226	3,320	5,288	4,082	4,044	3,226	5,288		0.82	1.38	0.75	0.83	0.49	0.85	0.49	1.38	0.85	Avg.
MMWW	3,268	3,583	2,538	3,058	1,670	2,823	1,670	3,583		1.04	0.48	0.84	0.86	0.64	0.77	0.48	1.04	1.04	Max.
MWWWW	4,144	1,243	2,862	3,167	2,187	2,721	1,243	4,144		1.04	0.48	0.97	0.88	0.46	0.77	0.46	1.04	1.04	Max.
MDWW	4,144	1,243	3,285	3,243	1,551	2,693	1,243	4,144		selected PF 30% > avg									
										selected PF 30% > avg									

Table 4.2 Historic cBOD Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	6,185	6,612	6,757	6,613	7,140	6,662	6,185	7,140												
MMDW	6,981	9,534	7,637	7,515	9,207	8,175	6,981	9,534		1.13	1.44	1.13	1.14	1.29	1.23	1.13	1.44	1.23	Avg.	
MWDW	7,829	13,046	8,607	9,949	11,925	10,272	7,829	13,046		1.27	1.97	1.27	1.50	1.67	1.54	1.27	1.97	1.97	Max.	selected PF 25% > avg
MDDW	12,261	14,981	10,078	17,531	17,724	14,515	10,078	17,724		1.98	2.27	1.49	2.65	2.48	2.17	1.49	2.65	2.65	Max.	
MMWW	6,897	6,781	8,531	7,095	7,986	7,458	6,781	8,531		1.12	1.03	1.26	1.07	1.12	1.12	1.03	1.26	1.12	Avg.	
MWWW	8,267	7,404	9,123	7,795	9,706	8,459	7,404	9,706		1.34	1.12	1.35	1.18	1.36	1.27	1.12	1.36	1.36	Max.	
MDWW	10,451	8,333	15,522	10,040	14,895	11,848	8,333	15,522	1.69	1.26	2.30	1.52	2.09	1.77	1.26	2.30	2.30	Max.	selected PF 25% > avg	

Table 4.3 Historic cBOD Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	6,579	5,798	6,156	5,792	5,462	5,957	5,462	6,579												
MMDW	13,381	7,413	8,526	8,909	8,472	9,340	7,413	13,381		2.03	1.28	1.39	1.54	1.55	1.44	1.28	1.55	1.44	Avg.	
MWDW	16,117	8,000	9,191	10,694	9,995	10,799	8,000	16,117		2.45	1.38	1.49	1.85	1.83	1.64	1.38	1.85	1.85	Max.	
MDDW	18,256	10,402	12,300	13,454	10,360	12,954	10,360	18,256		2.78	1.79	2.00	2.32	1.90	2.00	1.79	2.32	2.32	Max.	
MMWW	6,304	8,366	7,089	7,482	7,792	7,406	6,304	8,366		0.96	1.44	1.15	1.29	1.43	1.33	1.15	1.44	1.33	Avg.	
MWWW	6,334	8,000	7,035	7,048	6,789	7,041	6,334	8,000		0.96	1.38	1.14	1.22	1.24	1.25	1.14	1.38	1.38	Max.	
MDWW	8,175	8,618	8,856	8,263	8,207	8,424	8,175	8,856		1.24	1.49	1.44	1.43	1.50	1.46	1.43	1.50	1.50	Max.	
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations. For Forest Grove, operation has changed for some high strength food industrial customers since 2015. These customers transport food waste directly to the Rock Creek WRRF. 2015 was excluded from peaking factor consideration for Forest Grove.																				

4.1.2 COD Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for COD load projections are presented in **Tables 4.4 through 4.6** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015-2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - The historical peaking factors for metered wet industry are somewhat variable for wet weather. The selected maximum peaking factors for MWWW is 40-percent greater than the average historical peaking factor.
 - The historical peaking factors for Intel are significantly variable for wet weather. The selected maximum peaking factors for MWWW and MDWW are 160-percent and 170-percent greater than the average historical peaking factors respectively.
 - For the load projections, the Intel peaking factors are applied to new industrial customers in North Hillsboro and North Hillsboro expansion areas. The assumption to utilize the maximum Intel peaking factor for wet weather loading should be further reviewed considering the variability of the maximum historical loading events.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - The historical peaking factor is somewhat variable for MDWW. The selected maximum peaking factor is 25-percent greater than the average historical peaking factor.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - The historical peaking factors are somewhat variable for MWDW, MDDW, MWWW, and MDWW. The selected maximum peaking factors are 25-percent to 60-percent greater than the average historical peaking factors. This variability may be due to occasional discharge spikes from wet industrial customers.
 - For the load projections, the maximum peaking factors are applied to future customers. The assumption to utilize the maximum peaking factors should be further reviewed considering the variability of the maximum historical loading events.

Table 4.4 Historic COD Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Non-industrial (residential/commercial), lbs/d										Peaking Factor										
Avg Annual	128,855	132,268	130,378	161,766		138,317	128,855	161,766		1.18	1.12	1.32			1.21	1.12	1.32	1.21	Avg.	
MMDW	152,532	148,408	171,621	157,520		148,408	171,621	1.36	1.34	1.51	1.40	1.34			1.51	1.51	Max.			
MWDW	174,614	177,575	196,449	182,879		174,614	196,449	1.59	1.69	2.08	1.79	1.59			2.08	2.08	Max.			
MDDW	205,113	223,602	270,540	233,085		205,113	270,540	1.01	1.22	1.00	1.37	1.15			1.00	1.37	1.15	Avg.		
MMWW	130,069	160,981	130,565	221,134		160,687	130,069	221,134		1.07	1.42	1.13	1.56		1.29	1.07	1.56	1.56	Max.	
MWWW	138,185	187,269	147,706	251,903	181,266	138,185	251,903	1.23	2.06	1.45	2.01	1.69	1.23		2.06	2.06	Max.			
MDWW	158,908	273,076	188,876	324,831		236,423	158,908	324,831		Peaking Factor										
Intel, lbs/d																				
Avg Annual	7,246	5,771	6,478	7,413		6,727	5,771	7,413		0.73	0.94	1.18	1.01		0.97	0.73	1.18	0.97	Avg.	
MMDW	5,290	5,452	7,636	7,519		6,474	5,290	7,636	0.84	0.94	1.03		0.94		0.84	1.03	1.03	Max.		
MWDW	6,114	5,444	6,663			6,074	5,444	6,663	0.62	1.10	1.05		0.92		0.62	1.10	1.10	Max.		
MDDW	4,473	6,332	6,818			5,874	4,473	6,818	4.74	0.78	0.82	0.95	1.82		0.78	4.74	1.82	Avg.		
MMWW	34,312	4,507	5,286	7,025		12,782	4,507	34,312		5.11	0.85	0.89	0.91		1.94	0.85	5.11	5.11	Max.	highly variable data, selected PF 160% > avg
MWWW	37,045	4,888	5,762	6,744	13,610	4,888	37,045	5.93	0.88	0.86	1.05	2.18	0.86		5.93	5.93	Max.	highly variable data, selected PF 170% > avg		
MDWW	42,958	5,100	5,565	7,773		15,349	5,100	42,958		Peaking Factor										
Wet Industry, lbs/d																				
Avg Annual	10,054	6,659	8,897	7,697		8,327	6,659	10,054		1.09	0.90	1.09	1.24		1.08	0.90	1.24	1.08	Avg.	
MMDW	10,935	6,016	9,686	9,509		9,036	6,016	10,935	1.09	1.03	1.03		1.05		1.03	1.09	1.09	Max.		
MWDW	10,935	6,866	9,148			8,983	6,866	10,935	0.96	0.85	1.03		0.94		0.85	1.03	1.03	Max.		
MDDW	9,614	5,662	9,148			8,141	5,662	9,614	0.71	1.17	0.59	0.87	0.84		0.59	1.17	0.84	Avg.		
MMWW	7,123	7,809	5,233	6,716		6,720	5,233	7,809		1.48	1.16	0.47	0.94		1.01	0.47	1.48	1.48	Max.	selected PF 40% > avg
MWWW	14,928	7,718	4,209	7,217	8,518	4,209	14,928	1.05	1.07	0.70	0.94	0.94	0.70		1.07	1.07	Max.			
MDWW	10,525	7,126	6,192	7,217		7,765	6,192	10,525												

Table 4.5 Historic COD Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d										Peaking Factor									
Avg Annual	15,702	15,019			16,389	15,703	15,019	16,389		1.16	1.42			1.30	1.29	1.16	1.42	1.29	Avg.
MMDW	18,139	21,315			21,235	20,230	18,139	21,315		1.59	1.54				1.57	1.54	1.59	1.59	Max.
MWDW	25,000	23,125				24,063	23,125	25,000		2.53	1.84				2.18	1.84	2.53	2.53	Max.
MDDW	39,722	27,562				33,642	27,562	39,722		1.11	1.08			1.35	1.18	1.08	1.35	1.18	Avg.
MMWW	17,416	16,290			22,172	18,626	16,290	22,172		1.47	1.47			1.35	1.43	1.35	1.47	1.47	Max.
MWWW	23,024	22,006			22,172	22,401	22,006	23,024		2.12	2.58			1.35	2.02	1.35	2.58	2.58	Max.
MDWW	33,228	38,794			22,172	31,398	22,172	38,794											selected PF 25% > avg

Table 4.6 Historic COD Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	14,266	12,195	14,198	13,453	10,787	12,980	10,787	14,266												
MMDW	24,949	14,760	17,128			18,945	14,760	24,949		1.75	1.21	1.21			1.48	1.21	1.75	1.48	Avg.	
MWDW	33,590	14,760	17,128			21,826	14,760	33,590		2.35	1.21	1.21			1.78	1.21	2.35	2.35	Max.	selected PF 30% > avg
MDDW	49,497	17,025	18,261			28,261	17,025	49,497		3.47	1.40	1.29			2.43	1.40	3.47	3.47	Max.	selected PF 40% > avg
MMWW	14,392	14,760		15,768	12,267	14,297	12,267	15,768		1.01	1.21		1.17	1.14	1.13	1.01	1.21	1.13	Avg.	
MWWW	17,095	19,883		15,768	13,002	16,437	13,002	19,883		1.20	1.63		1.17	1.21	1.30	1.17	1.63	1.63	Max.	selected PF 25% > avg
MDWW	22,147	34,920		15,768	13,002	21,459	13,002	34,920		1.55	2.86		1.17	1.21	1.70	1.17	2.86	2.86	Max.	selected PF 60% > avg
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																				

4.1.3 TSS Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for TSS load projections are presented in **Tables 4.7 through 4.9** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015-2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - The historical peaking factors for metered wet industry are variable. The selected maximum peaking factors for MWDW, MDDW, MWWW, and MDWW are 50-percent to 110-percent greater than the average historical peaking factors.
 - The historical peaking factor for Intel is somewhat variable for dry weather. The selected maximum peaking factor for MWDW is 40-percent greater than the average historical peaking factor.
 - The historical peaking factors for Intel are significantly variable for wet weather. The selected maximum peaking factors for MWWW and MDWW are 140-percent and 160-percent greater than the average historical peaking factors respectively.
 - For the load projections, the Intel peaking factors are applied to new industrial customers in North Hillsboro and North Hillsboro expansion areas. The assumption to utilize the maximum Intel peaking factor for wet weather loading should be further reviewed considering the variability of the maximum historical loading events.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - The historical peaking factors are somewhat variable for MDDW and MDWW. The selected maximum peaking factors are 30-percent and 25-percent greater than the average historical peaking factors respectively. This variability may be due to occasional discharge spikes from wet industrial customers.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.

Table 4.7 Historic TSS Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Non-industrial (residential/commercial), lbs/d								
Avg Annual	63,824	68,675	60,115	68,190	64,900	65,141	60,115	68,675
MMDW	79,969	79,773	65,150	81,072	69,452	75,083	65,150	81,072
MWDW	101,279	93,032	82,158	96,501	78,712	90,336	78,712	101,279
MDDW	127,995	117,699	91,188	138,664	98,642	114,838	91,188	138,664
MMWW	66,135	91,592	71,431	74,260	79,457	76,575	66,135	91,592
MWWW	77,395	101,875	81,919	83,088	97,452	88,346	77,395	101,875
MDWW	93,582	184,816	138,766	133,979	141,210	138,471	93,582	184,816
Intel, lbs/d								
Avg Annual		464	226	422	1,390	626	226	1,390
MMDW		205	259	116	825	351	116	825
MWDW		281	141	116	316	213	116	316
MDDW		286	145	116	699	312	116	699
MMWW		191	179	114	2,101	646	114	2,101
MWWW		189	162	118	2,957	857	118	2,957
MDWW		3,004	169	122	3,077	1,593	122	3,077
Wet Industry, lbs/d								
Avg Annual	3,392	981	1,299	1,607	1,374	1,730	981	3,392
MMDW	2,572	627	907	3,731	1,294	1,826	627	3,731
MWDW	2,572	789	2,313	4,142	3,269	2,617	789	4,142
MDDW	2,572	1,000	2,313	4,142	1,102	2,226	1,000	4,142
MMWW	3,962	1,553	1,637	1,372	485	1,802	485	3,962
MWWW	4,995	1,831	595	1,298	410	1,826	410	4,995
MDWW	4,995	313	595	1,298	410	1,522	313	4,995

	2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Peaking Factor										
	1.25	1.16	1.08	1.19	1.07	1.15	1.07	1.25	1.15	Avg.
	1.59	1.35	1.37	1.42	1.21	1.39	1.21	1.59	1.59	Max.
	2.01	1.71	1.52	2.03	1.52	1.76	1.52	2.03	2.03	Max.
	1.04	1.33	1.19	1.09	1.22	1.17	1.04	1.33	1.17	Avg.
	1.21	1.48	1.36	1.22	1.50	1.36	1.21	1.50	1.50	Max.
	1.47	2.69	2.31	1.96	2.18	2.12	1.47	2.69	2.69	Max.
Peaking Factor										
		0.44	1.15	0.27	0.59	0.61	0.27	1.15	0.61	Avg.
		0.61	0.62	0.27	0.23	0.43	0.23	0.62	0.62	Max. selected PF 40% > avg
		0.62	0.64	0.27	0.50	0.51	0.27	0.64	0.64	Max.
		0.41	0.79	0.27	1.51	0.75	0.27	1.51	0.75	Avg.
		0.41	0.72	0.28	2.13	0.88	0.28	2.13	2.13	Max. highly variable data, selected PF 140% > avg
		6.47	0.75	0.29	2.21	2.43	0.29	6.47	6.47	Max. highly variable data, selected PF 160% > avg
Peaking Factor										
	0.76	0.64	0.70	2.32	0.94	1.07	0.64	2.32	1.07	Avg.
	0.76	0.80	1.78	2.58	2.38	1.66	0.76	2.58	2.58	Max. selected PF 50% > avg
	0.76	1.02	1.78	2.58	0.80	1.39	0.76	2.58	2.58	Max. highly variable data, selected PF 80% > avg
	1.17	1.58	1.26	0.85	0.35	1.04	0.35	1.58	1.04	Avg.
	1.47	1.87	0.46	0.81	0.30	0.98	0.30	1.87	1.87	Max. highly variable data, selected PF 90% > avg
	1.47	0.32	0.46	0.81	0.30	0.67	0.30	1.47	1.47	Max. highly variable data, selected PF 110% > avg

Table 4.8 Historic TSS Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	7,228	8,167	8,507	7,708	8,127	7,948	7,228	8,507												
MMDW	7,764	13,033	9,718	8,576	9,674	9,753	7,764	13,033		1.07	1.60	1.14	1.11	1.19	1.22	1.07	1.60	1.22	Avg.	
MWDW	9,346	18,439	11,483	11,044	10,993	12,261	9,346	18,439		1.29	2.26	1.35	1.43	1.35	1.36	1.29	1.43	1.43	Max.	
MDDW	17,864	23,118	15,466	13,736	17,237	17,484	13,736	23,118		2.47	2.83	1.82	1.78	2.12	2.05	1.78	2.47	2.47	Max.	
MMWW	8,592	9,310	12,209	8,816	10,209	9,827	8,592	12,209		1.19	1.14	1.44	1.14	1.26	1.23	1.14	1.44	1.23	Avg.	
MWWW	11,648	13,854	17,650	9,674	17,221	14,009	9,674	17,650		1.61	1.70	2.07	1.26	2.12	1.75	1.26	2.12	2.12	Max.	
MDWW	25,725	25,149	28,690	15,047	26,640	24,250	15,047	28,690		3.56	3.08	3.37	1.95	3.28	3.05	1.95	3.56	3.56	Max.	
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																				

Table 4.9 Historic TSS Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d										Peaking Factor									
Avg Annual	5,552	5,641	5,858	5,984	5,419	5,691	5,419	5,984											
MMDW	7,299	7,955	7,115	8,972	9,207	8,109	7,115	9,207		1.31	1.41	1.21	1.50	1.70	1.43	1.21	1.70	1.43	Avg.
MWDW	7,598	11,185	10,746	12,054	11,794	10,675	7,598	12,054		1.37	1.98	1.83	2.01	2.18	1.88	1.37	2.18	2.18	Max.
MDDW	12,025	23,633	21,526	15,915	17,697	18,159	12,025	23,633		2.17	4.19	3.67	2.66	3.27	3.19	2.17	4.19	4.19	Max. selected PF 30% > avg
MMWW	6,710	6,573	7,550	7,417	5,943	6,839	5,943	7,550		1.21	1.17	1.29	1.24	1.10	1.20	1.10	1.29	1.20	Avg.
MWWW	8,586	8,204	10,283	8,999	7,837	8,782	7,837	10,283		1.55	1.45	1.76	1.50	1.45	1.54	1.45	1.76	1.76	Max.
MDWW	12,689	14,904	20,153	15,516	13,330	15,318	12,689	20,153		2.29	2.64	3.44	2.59	2.46	2.68	2.29	3.44	3.44	Max. selected PF 25% > avg

4.1.4 TP Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for TP load projections are presented in **Tables 4.10 through 4.12** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015-2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - The historical peaking factors are somewhat variable for MDDW, MWWW, and MDWW. The selected maximum peaking factors are 25-percent greater than the average historical peaking factors.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - The historical peaking factors are somewhat variable for MDDW and MDWW. The selected maximum peaking factor are 25-percent to 35-percent greater than the average historical peaking factors.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.

Table 4.10 Historic TP Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d									Peaking Factor										
Avg Annual	1,542	1,444	1,455	1,601	1,525	1,514	1,444	1,601											
MMDW	1,860	1,724	1,878	1,688	1,631	1,756	1,631	1,878		1.21	1.19	1.29	1.05	1.07	1.16	1.05	1.29	1.16	Avg.
MWDW	2,042	2,157	2,081	1,929	1,930	2,028	1,929	2,157		1.32	1.49	1.43	1.20	1.27	1.34	1.20	1.49	1.49	Max.
MDDW	2,243	2,423	3,014	2,304	2,133	2,423	2,133	3,014		1.45	1.68	2.07	1.44	1.40	1.61	1.40	2.07	2.07	Max.
MMWW	1,703	1,868	1,491	2,091	1,728	1,776	1,491	2,091		1.10	1.29	1.02	1.31	1.13	1.15	1.02	1.31	1.15	Avg.
MWWW	1,741	1,888	1,594	2,637	1,879	1,948	1,594	2,637		1.13	1.31	1.10	1.65	1.23	1.28	1.10	1.65	1.65	Max.
MDWW	1,741	2,320	1,792	2,897	2,048	2,160	1,741	2,897		1.13	1.61	1.23	1.81	1.34	1.42	1.13	1.81	1.81	Max.
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																			

Table 4.11 Historic TP Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d									Peaking Factor										
Avg Annual	159	163	180	165	169	167	159	180											
MMDW	183	221	234	189	213	208	183	234		1.15	1.35	1.30	1.14	1.26	1.24	1.14	1.35	1.24	Avg.
MWDW	264	295	278	234	256	265	234	295		1.66	1.80	1.54	1.42	1.51	1.59	1.42	1.80	1.80	Max.
MDDW	420	413	315	280	300	346	280	420		2.65	2.53	1.75	1.70	1.77	2.08	1.70	2.65	2.65	Max.
MMWW	189	229	250	187	221	215	187	250		1.19	1.40	1.39	1.13	1.30	1.25	1.13	1.39	1.25	Avg.
MWWW	280	478	388	207	371	344	207	478		1.76	2.92	2.15	1.25	2.19	1.84	1.25	2.19	2.19	Max.
MDWW	280	569	582	260	573	453	260	582		1.76	3.48	3.23	1.58	3.38	2.49	1.58	3.38	3.38	Max.
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																			

Table 4.12 Historic TP Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d									Peaking Factor										
Avg Annual	163	134	138	124	136	139	124	163											
MMDW	209	178	179	152	168	177	152	209		1.29	1.33	1.30	1.22	1.23	1.26	1.22	1.30	1.26	Avg.
MWDW	264	219	242	182	255	232	182	264		1.62	1.63	1.76	1.47	1.87	1.68	1.47	1.87	1.87	Max.
MDDW	365	235	265	194	255	263	194	365		2.24	1.75	1.92	1.56	1.87	1.90	1.56	2.24	2.24	Max.
MMWW	216	180	157	150	171	175	150	216		1.33	1.34	1.14	1.20	1.25	1.20	1.14	1.25	1.20	Avg.
MWWW	324	268	194	196	186	234	186	324		1.99	2.00	1.41	1.58	1.37	1.45	1.37	1.58	1.58	Max.
MDWW	324	268	252	218	259	264	218	324		1.99	2.00	1.83	1.75	1.90	1.83	1.75	1.90	1.90	Max.
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																			

4.1.5 oP Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for oP load projections are presented in **Tables 4.13 through 4.15** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015-2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - The historical peaking factor is somewhat variable for MWWW. The selected maximum peaking factor is 30-percent greater than the average historical peaking factor.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - The historical peaking factors are somewhat variable for MWDW and MDWW. The selected maximum peaking factor are 25-percent to 30-percent greater than the average historical peaking factors.
 - Other maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.

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Table 4.13 Historic oP Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.
Influent, lbs/d								
Avg Annual	644	656	735	750	783	713	644	783
MMDW	708	709	860	811	847	787	708	860
MWDW	758	744	998	890	985	875	744	998
MDDW	1,038	829	1,141	1,167	1,055	1,046	829	1,167
MMWW	760	707	756	782	879	777	707	879
MWWW	1,102	801	861	849	956	914	801	1,102
MDWW	1,102	904	922	1,060	1,162	1,030	904	1,162

2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor		Comment
Peaking Factor										
1.10	1.08	1.17	1.08	1.08	1.10	1.08	1.17	1.10	Avg.	
1.18	1.13	1.36	1.19	1.26	1.22	1.13	1.36	1.36	Max.	
1.61	1.26	1.55	1.56	1.35	1.47	1.26	1.61	1.61	Max.	
1.18	1.08	1.03	1.04	1.12	1.09	1.03	1.18	1.09	Avg.	
1.71	1.22	1.17	1.13	1.22	1.29	1.13	1.71	1.71	Max.	selected PF 30% > avg
1.71	1.38	1.26	1.41	1.49	1.45	1.26	1.71	1.71	Max.	

Table 4.14 Historic oP Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	81	84	90	87	91	87	81	91												
MMDW	113	117	137	98	109	115	98	137		1.39	1.40	1.52	1.12	1.19	1.31	1.12	1.52	1.31	Avg.	
MWDW	172	184	173	105	118	150	105	184		2.11	2.20	1.92	1.21	1.29	1.63	1.21	2.11	2.11	Max.	selected PF 25% > avg
MDDW	172	184	173	130	148	161	130	184		2.11	2.20	1.92	1.50	1.62	1.79	1.50	2.11	2.11	Max.	
MMWW	91	90	95	93	101	94	90	101		1.11	1.08	1.06	1.07	1.10	1.09	1.06	1.11	1.09	Avg.	
MWWW	107	104	126	107	126	114	104	126		1.32	1.25	1.39	1.23	1.38	1.31	1.23	1.39	1.39	Max.	
MDWW	154	104	126	143	203	146	104	203		1.89	1.25	1.39	1.65	2.22	1.68	1.25	2.22	2.22	Max.	selected PF 30% > avg
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																				

Table 4.15 Historic oP Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	60	64	65	62	65	63	60	65												
MMDW	94	73	78	73	78	79	73	94		1.55	1.14	1.20	1.19	1.20	1.18	1.14	1.20	1.18	Avg.	
MWDW	97	73	92	83	86	86	73	97		1.60	1.15	1.41	1.34	1.33	1.31	1.15	1.41	1.41	Max.	
MDDW	97	89	105	104	90	97	89	105		1.60	1.40	1.62	1.69	1.39	1.52	1.39	1.69	1.69	Max.	
MMWW	68	71	70	74	69	70	68	74		1.13	1.11	1.07	1.20	1.06	1.11	1.06	1.20	1.11	Avg.	
MWWW	76	78	77	70	80	76	70	80		1.27	1.21	1.18	1.14	1.23	1.21	1.14	1.27	1.27	Max.	
MDWW	76	86	89	88	100	88	76	100		1.27	1.34	1.37	1.42	1.54	1.39	1.27	1.54	1.54	Max.	
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																				

4.1.6 TKN Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for TKN load projections are presented in **Tables 4.16 through 4.18** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015–2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - The historical peaking factors are somewhat variable for MWWW and MDWW. The selected maximum peaking factor are 30-percent greater than the average historical peaking factors.
- Forest Grove
 - Peaking factors were replaced with peaking factors for NH₄ because of limited sampling data.

Table 4.16 Historic TKN Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor		Comment	
Influent, lbs/d										Peaking Factor											
Avg Annual	11,853	11,397	12,254	11,452	11,412	11,674	11,397	12,254													
MMDW	11,853	11,397	12,254	11,452	11,412	11,674	11,397	12,254		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Avg.	
MWDW	11,674	13,487	14,766	14,274	12,460	13,332	11,674	14,766		0.98	1.18	1.20	1.25	1.09	1.14	0.98	1.25	1.25	1.25	Max.	
MDDW	11,674	13,487	14,766	14,274	12,460	13,332	11,674	14,766		0.98	1.18	1.20	1.25	1.09	1.14	0.98	1.25	1.25	1.25	Max.	
MMWW	12,733	12,639	12,944	13,208	13,733	13,051	12,639	13,733		1.07	1.11	1.06	1.15	1.20	1.12	1.06	1.20	1.12	1.12	Avg.	
MWWW	13,328	12,787	12,944	13,208	15,374	13,528	12,787	15,374		1.12	1.12	1.06	1.15	1.35	1.16	1.06	1.35	1.35	1.35	Max.	
MDWW	13,706	12,787	12,944	13,208	15,374	13,604	12,787	15,374	1.16	1.12	1.06	1.15	1.35	1.17	1.06	1.35	1.35	1.35	Max.		

Table 4.17 Historic TKN Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	1,197	1,154	1,278	1,194	1,352	1,235	1,154	1,352												
MMDW	1,438	1,347	1,452	1,337	1,896	1,494	1,337	1,896		1.20	1.17	1.14	1.12	1.40	1.21	1.12	1.40	1.21	Avg.	
MWDW	1,852	1,347	1,582	1,441	1,896	1,624	1,347	1,896		1.55	1.17	1.24	1.21	1.40	1.31	1.17	1.55	1.55	Max.	
MDDW	1,852	1,347	1,582	1,441	1,896	1,624	1,347	1,896		1.55	1.17	1.24	1.21	1.40	1.31	1.17	1.55	1.55	Max.	
MMWW	1,384	1,237	1,480	1,415	1,428	1,389	1,237	1,480		1.16	1.07	1.16	1.18	1.06	1.13	1.06	1.18	1.13	Avg.	
MWWW	1,742	1,297	2,323	1,491	1,606	1,692	1,297	2,323		1.46	1.12	1.82	1.25	1.19	1.37	1.12	1.82	1.82	Max.	selected PF 30% > avg
MDWW	1,742	1,297	2,323	1,491	1,606	1,692	1,297	2,323		1.46	1.12	1.82	1.25	1.19	1.37	1.12	1.82	1.82	Max.	selected PF 30% > avg

Table 4.18 Historic TKN Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment	
Influent, lbs/d										Peaking Factor										
Avg Annual	939	922	873	793	859	877	793	939												
MMDW	1,213	1,011	1,034	1,010	1,152	1,084	1,010	1,213		1.29	1.10	1.18	1.27	1.34	1.24	1.10	1.34	1.22	Avg.	PF replaced with NH4 PF based on limited sampling for TKN
MWDW	1,396	1,070	1,184	1,083	1,243	1,195	1,070	1,396		1.49	1.16	1.36	1.37	1.45	1.36	1.16	1.49	1.10	Max.	
MDDW	1,396	1,070	1,184	1,083	1,243	1,195	1,070	1,396		1.49	1.16	1.36	1.37	1.45	1.36	1.16	1.49	1.48	Max.	
MMWW	1,036	1,057	1,058	1,070	979	1,040	979	1,070		1.10	1.15	1.21	1.35	1.14	1.19	1.10	1.35	1.35	Avg.	
MWWW	1,300	1,133	1,365	1,151	965	1,183	965	1,365		1.38	1.23	1.56	1.45	1.12	1.35	1.12	1.56	1.88	Max.	
MDWW	1,300	1,133	1,365	1,151	965	1,183	965	1,365		1.38	1.23	1.56	1.45	1.12	1.35	1.12	1.56	1.61	Max.	
Red highlight indicates data anomaly or data with less than 50 sampling points. Value excluded from average, min, and max calculations.																				

4.1.7 NH₄ Historical Load Summary and Peaking Factors

The historical loading, calculated peaking factors, and selected peaking factors for NH₄ load projections are presented in **Tables 4.19 through 4.21** for the Rock Creek, Hillsboro, and Forest Grove Basins. The following apply to the selection of peaking factors.

- The average or maximum peaking factors from 2015–2019 were selected. The average peaking factors were selected for average annual, MMDW, and MMWW loadings. Average peak factors were selected for maximum month load conditions so as not to develop overly conservative projections. Maximum peaking factors were selected for MWDW, MWWW, MDDW, and MDWW loadings.
- Rock Creek
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Hillsboro
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.
- Forest Grove
 - Maximum peaking factors are consistent within 25-percent of the average historic peaking factors.

Table 4.19 Historic NH4 Loads and Peaking Factor Selection, Rock Creek WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d										Peaking Factor									
Avg Annual	7,308	7,418	7,667	7,973	7,452	7,564	7,308	7,973											
MMDW	7,967	8,266	8,337	8,362	7,443	8,075	7,443	8,362		1.09	1.11	1.09	1.05	1.00	1.07	1.00	1.11	1.07	Avg.
MWDW	8,222	8,459	8,803	8,704	7,913	8,420	7,913	8,803		1.13	1.14	1.15	1.09	1.06	1.11	1.06	1.15	1.15	Max.
MDDW	9,558	9,007	10,194	9,264	8,615	9,327	8,615	10,194		1.31	1.21	1.33	1.16	1.16	1.23	1.16	1.33	1.33	Max.
MMWW	7,792	7,982	8,037	8,038	8,341	8,038	7,792	8,341		1.07	1.08	1.05	1.01	1.12	1.06	1.01	1.12	1.06	Avg.
MWWWW	8,738	8,559	8,311	8,694	8,784	8,617	8,311	8,784		1.20	1.15	1.08	1.09	1.18	1.14	1.08	1.20	1.20	Max.
MDWW	9,282	10,153	10,847	8,955	9,230	9,693	8,955	10,847		1.27	1.37	1.41	1.12	1.24	1.28	1.12	1.41	1.41	Max.

Table 4.20 Historic NH4 Loads and Peaking Factor Selection, Hillsboro WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d										Peaking Factor									
Avg Annual	779	789	835	845	849	819	779	849											
MMDW	819	972	986	924	935	927	819	986		1.05	1.23	1.18	1.09	1.10	1.13	1.05	1.23	1.13	Avg.
MWDW	873	994	1,023	968	988	969	873	1,023		1.12	1.26	1.23	1.14	1.16	1.18	1.12	1.26	1.26	Max.
MDDW	931	1,148	1,276	1,033	1,210	1,120	931	1,276		1.20	1.45	1.53	1.22	1.43	1.37	1.20	1.53	1.53	Max.
MMWW	824	837	899	910	924	879	824	924		1.06	1.06	1.08	1.08	1.09	1.07	1.06	1.09	1.07	Avg.
MWWWW	869	876	871	909	1,022	910	869	1,022		1.12	1.11	1.04	1.08	1.20	1.11	1.04	1.20	1.20	Max.
MDWW	990	1,002	1,111	934	1,368	1,081	934	1,368		1.27	1.27	1.33	1.11	1.61	1.32	1.11	1.61	1.61	Max.

Table 4.21 Historic NH4 Loads and Peaking Factor Selection, Forest Grove WRRF

	2015	2016	2017	2018	2019	Avg.	Min.	Max.		2015	2016	2017	2018	2019	Avg.	Min.	Max.	Selected Peaking Factor	Comment
Influent, lbs/d										Peaking Factor									
Avg Annual	546	564	527	533	571	548	527	571											
MMDW	636	658	705	651	677	665	636	705		1.17	1.17	1.34	1.22	1.19	1.22	1.17	1.34	1.22	Avg.
MWDW	734	705	778	674	727	724	674	778		1.35	1.25	1.48	1.26	1.27	1.32	1.25	1.48	1.48	Max.
MDDW	880	851	988	904	881	901	851	988		1.61	1.51	1.88	1.69	1.54	1.65	1.51	1.88	1.88	Max.
MMWW	573	653	545	637	606	603	545	653		1.05	1.16	1.03	1.19	1.06	1.10	1.03	1.19	1.10	Avg.
MWWWW	623	658	552	652	769	651	552	769		1.14	1.17	1.05	1.22	1.35	1.18	1.05	1.35	1.35	Max.
MDWW	746	761	782	856	917	812	746	917		1.37	1.35	1.49	1.60	1.61	1.48	1.35	1.61	1.61	Max.

4.2 Loading Per Capita

Average annual loads in each treatment basin are allocated into non-industrial (residential/commercial) and industrial components for cBOD, COD, and TSS. Average annual loads are allocated as total influent loads for TP, oP, TKN, and NH₄. The non-industrial and total influent average annual loads projections are calculated by apply per capita loading to population projections. The following steps were performed to develop per capita loading rates for the projections:

- The per capita average annual loading rates were calculated by subtracting the measured wet industrial average annual loads for cBOD, COD, and TSS from influent average annual loads at each treatment facility and dividing by historical population. A ratio of COD to cBOD was applied to calculate cBOD for wet industrial loads.
- The per capita average annual loading rates were calculated for TP, oP, TKN, and NH₄ from influent average annual loads at each treatment facility divided by historical population.

The per capita average annual loading rates are presented in **Tables 4.22 through 4.24** for each treatment basin and for each constituent between 2015 and 2019. The average per capita rates from the historic five-year period were selected for the load projections. The selected rates are compared to engineering industry standards as referenced in the tables (Metcalf & Eddy, 2014). Some anomalies in per capita loading rates are described below and should be reviewed further.

- Forest Grove had higher per capita loading which may be partially influenced by wet industry discharge which may not be fully isolated from non-industrial loading (cBOD, 56-percent greater; TSS, 29-percent greater).
- All treatment facilities had higher than typical per capita NH₄ loads by 18 to 65-percent.
- Rock Creek and Hillsboro facilities had higher than typical per capita TP loads by 29 to 43-percent.

Table 4.22 Historical Average Annual Load and Per Capital Loading, Rock Creek WRRF

	2015	2016	2017	2018	2019	Average	Engineering Industry Standards Reference ⁽⁴⁾
Population	300,363	307,525	314,571	320,779	324,119	313,471	
cBOD AA Non-industrial Load (lbs/d) ⁽¹⁾	51,755	47,115	49,973	44,747	45,610	47,840	
cBOD per capita loading (lbs/d)	0.17	0.15	0.16	0.14	0.14	0.15	0.15-0.16 ⁽⁵⁾
COD AA Non-industrial Load (lbs) ⁽²⁾	128,854	132,268	130,378	161,766	-	138,317	

	2015	2016	2017	2018	2019	Average	Engineering Industry Standards Reference ⁽⁴⁾
COD per capita loading (lbs/d)	0.43	0.43	0.41	0.50	-	0.44	
TSS AA Non-industrial Load (lbs) ⁽³⁾	66,861	70,119	61,639	70,219	67,663	65,141	
TSS per capita loading (lbs/d)	0.22	0.23	0.20	0.22	0.21	0.21	0.21
TP AA Influent Load (lbs)	1,542	1,443	1,454	1,601	1,525	1,514	
TP per capita loading (lbs/d)	0.005	0.005	0.005	0.005	0.005	0.005	0.007
oP AA Influent Load (lbs)	643	656	734	750	782	713	
oP per capita loading (lbs/d)	0.002	0.002	0.002	0.002	0.002	0.002	
NH4 AA Influent Load (lbs)	7,308	7,417	7,666	7,973	7,451	7,564	
NH4 per capita loading (lbs/d)	0.024	0.024	0.024	0.025	0.023	0.024	0.017
TKN AA Influent Load (lbs)	11,852	11,397	12,254	11,451	11,412	11,674	
TKN per capita loading	0.039	0.037	0.039	0.036	0.035	0.037	

Note: Green highlighted values are the selected per capita loading for each constituent which corresponds to the average per capita loading of 2015 to 2019.

- (1) Non-industrial cBOD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (2) Non-industrial COD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (3) Non-industrial TSS loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (4) Reference value from Metcalf and Eddy, 5th Edition (Metcalf and Eddy, 2014)
- (5) Average value from Metcalf and Eddy (5th Edition) cited for BOD at 0.19 lbs per capita per day. Assuming a typical cBOD/BOD ratio of between 0.85 and 0.9, this equates to an equivalent cBOD per capita load of between 0.15 and 0.16 lbs per capita per day.

Table 4.23 Historical Average Annual Load and Per Capital Loading, Hillsboro WRRF

	2015	2016	2017	2018	2019	Average	Engineering Industry Standards Reference ⁽⁴⁾
Population	39,766	40,715	41,647	42,469	42,912	41,502	
cBOD AA Non-industrial Load (lbs/d) ⁽¹⁾	6,087	6,411	6,518	6,296	6,991	6,460	
cBOD per capita loading (lbs/d)	0.15	0.16	0.16	0.15	0.16	0.16	0.15-0.16 ⁽⁵⁾
COD AA Non-industrial Load (lbs) ⁽²⁾	15,659	14,695	-	-	16,219	15,525	
COD per capita loading (lbs/d)	0.39	0.36	-	-	0.38	0.38	
TSS AA Non-industrial Load (lbs) ⁽³⁾	7,215	7,968	8,319	7,617	8,107	7,845	
TSS per capita loading (lbs/d)	0.18	0.20	0.20	0.18	0.19	0.19	0.21
TP AA Influent Load (lbs)	159	163	180	165	169	167	
TP per capita loading (lbs/d)	0.004	0.004	0.004	0.004	0.004	0.004	0.007
oP AA Influent Load (lbs)	81	84	90	87	91	87	
oP per capita loading (lbs/d)	0.002	0.002	0.002	0.002	0.002	0.002	
NH4 AA Influent Load (lbs)	779	789	835	845	849	819	
NH4 per capita loading (lbs/d)	0.020	0.019	0.020	0.020	0.020	0.020	0.017
TKN AA Influent Load (lbs)	1,197	1,154	1,278	1,194	1,352	1,235	
TKN per capita loading	0.030	0.028	0.031	0.028	0.031	0.030	

Note: Green highlighted values are the selected per capita loading for each constituent which corresponds to the average per capita loading of 2015 to 2019.

(1) Non-industrial cBOD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.

(2) Non-industrial COD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.

- (3) Non-industrial TSS loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (4) Reference value from Metcalf and Eddy, 5th Edition (Metcalf and Eddy, 2014)
- (5) Average value from Metcalf and Eddy (5th Edition) cited for BOD at 0.19 lbs per capita per day. Assuming a typical cBOD/BOD ratio of between 0.85 and 0.9, this equates to an equivalent cBOD per capita load of between 0.15 and 0.16 lbs per capita per day.

Table 4.24 Historical Average Annual Load and Per Capital Loading, Forest Grove WRRF

	2015	2016	2017	2018	2019	Average	Engineering Industry Standards Reference ⁽⁴⁾
Population	18,854	19,304	19,746	20,136	20,345	19,677	
cBOD AA Non-industrial Load (lbs/d) ⁽¹⁾	5,459	4,801	5,163	4,923	4,565	4,982	
cBOD per capita loading (lbs/d)	0.29	0.25	0.26	0.24	0.22	0.25	0.15-0.16 ⁽⁵⁾
COD AA Non-industrial Load (lbs) ⁽²⁾	12,661	11,009	12,914	12,359	9,831	11,755	
COD per capita loading (lbs/d)	0.67	0.57	0.65	0.61	0.48	0.60	
TSS AA Non-industrial Load (lbs) ⁽³⁾	5,128	5,345	5,484	5,761	5,207	5,385	
TSS per capita loading (lbs/d)	0.27	0.28	0.28	0.29	0.26	0.27	0.21
TP AA Influent Load (lbs)	163	134	138	124	136	139	
TP per capita loading (lbs/d)	0.009	0.007	0.007	0.006	0.007	0.007	0.007
oP AA Influent Load (lbs)	60	64	65	62	65	63	
oP per capita loading (lbs/d)	0.003	0.003	0.003	0.003	0.003	0.003	
NH4 AA Influent Load (lbs)	546	564	527	533	571	548	
NH4 per capita loading (lbs/d)	0.029	0.029	0.027	0.026	0.028	0.028	0.017
TKN AA Influent Load (lbs)	939	922	873	793	859	877	

	2015	2016	2017	2018	2019	Average	Engineering Industry Standards Reference ⁽⁴⁾
TKN per capita loading	0.050	0.048	0.044	0.039	0.042	0.045	

Note: Green highlighted values are the selected per capita loading for each constituent which corresponds to the average per capita loading of 2015 to 2019.

- (1) Non-industrial cBOD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (2) Non-industrial COD loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (3) Non-industrial TSS loads calculated by subtracting the metered industrial loads and Intel loads from 2015 through 2019 from the influent load for each year.
- (4) Reference value from Metcalf and Eddy, 5th Edition (Metcalf and Eddy, 2014)
- (5) Average value from Metcalf and Eddy (5th Edition) cited for BOD at 0.19 lbs per capita per day. Assuming a typical cBOD/BOD ratio of between 0.85 and 0.9, this equates to an equivalent cBOD per capita load of between 0.15 and 0.16 lbs per capita per day.

5 Flow and Load Projections

The following section describes the approach, assumptions, and results to develop flow and load projections utilizing population and employment forecasts. Specific wet industry growth assumptions are also documented.

5.1 Population and Employment Forecasts

Population data was provided by Portland State University (PSU), Population Research Center (PRC). The PRC develops models and annually certifies population estimates between census years for all Oregon counties. The models consider annual adjustment to population from natural increase (registered births minus deaths) and net migration (school enrollments, income tax exemptions, driver license issuances, and voter registration). For the District planning work, certified population estimates were used from 2015-2019.

The PRC also models 50-year population forecasts in 5-year increments. The forecast model was recently updated between 2020 and 2070 (release date March 31, 2020). The future forecast model also considers birth, death, and migration trends. For smaller areas, the forecast model uses housing unit estimates and average persons per household (PRC, 2020). For the District planning work, published forecasts were used from 2020-2070. Incremental population increases from 2065-2070 were applied to the 2070-2075 period.

Oregon Metro is required by state law to update 20-year population and employment forecasts on a minimum six-year cycle. The forecasts are coordinated with local governments in Washington, Clackamas, and Multnomah Counties and other planning agencies. Forecasts are subdivided into 2,162 small zones for transportation planning (Transportation Analysis Zones, TAZ). Forecasts adopted in 2015 were used for this analysis (Metro, 2020) which include forecasts through 2040 and reference to census data from 2010. For the District planning work, Metro employment and population forecasts were used at the TAZ level through 2040.

In 2021 (after the completion of the population and employment projections for the West Basin), Metro published a forecast through 2045 including reference to census data from 2020. The population and employment projections have not been updated in this document based on Metro's 2045 forecast (Metro, 2021).

The combination of PRC data and Metro TAZ data were required to complete the full forecast of population and employment within each treatment plant basin using the following methodology:

- County-wide population data from Metro TAZ were compared to county-wide PRC population data to ensure consistency.
- Metro TAZ data were intersected with the treatment basins utilizing ESRI Geographical Information Systems (GIS) to summarize percentages of county-wide population and employment within each treatment basin. Small areas of Multnomah County within the District service area were also considered.
- Growth rate trends showing percentage of county-wide population and employment by treatment basin were plotted using TAZ data from 2010, 2025, 2035, and 2040.
- The population growth trends were used to subdivide the county-wide PRC population certified estimates between 2015-2019 and modeled forecasts between 2020 and 2075 by treatment basin.
- The employment growth trends were used to extrapolate employment growth between 2015 and 2040 by treatment basin. A long-term employment growth trend was applied between 2040 to 2075 to estimate employment.

Population and employment forecasts for each treatment basin are summarized in **Table 5.1** and shown in **Figures 5.1 through 5.4**. A significant increase in employment growth rate is observed in the Metro TAZ data for the Hillsboro Basin between 2035 and 2040 due to variability in Metro published forecasts between the 2010 and 2016. This sudden employment growth introduces some uncertainty for the employment projections and associated base flow projections. The District may want to consider a more linear employment growth trend between 2020 and 2040 for application of flow and load projections to facility planning.

Table 5.1 Population and Employment Estimates (2015-2019) and Forecasts (2020-2075)

Year	West Basin					
	Rock Creek		Hillsboro		Forest Grove	
	Population	Employment	Population	Employment	Population	Employment
2015	300,363	101,526	39,766	17,862	18,854	8,771
2016	307,525	104,424	40,715	18,372	19,304	9,021
2017	314,571	107,322	41,647	18,882	19,746	9,272
2018	320,779	110,220	42,469	19,392	20,136	9,522
2019	324,119	113,118	42,912	19,902	20,345	9,772
2020	327,918	116,016	43,414	20,411	20,584	10,023
2025	343,107	131,607	45,425	23,154	21,537	11,370
2030	364,462	146,361	48,253	24,829	22,878	11,149
2035	384,488	161,455	50,904	26,399	24,135	10,692
2040	407,298	171,566	53,924	37,912	25,566	12,223
2045	434,730	184,108	57,556	40,684	27,288	13,116
2050	459,260	198,264	60,804	43,812	28,828	14,124
2055	485,541	212,419	64,283	46,940	30,478	15,133
2060	512,738	226,574	67,884	50,068	32,185	16,141
2065	537,268	240,729	71,131	53,196	33,725	17,150
2070	560,849	254,521	74,253	56,243	35,205	18,132
2075	584,431	268,312	77,375	59,291	36,685	19,115

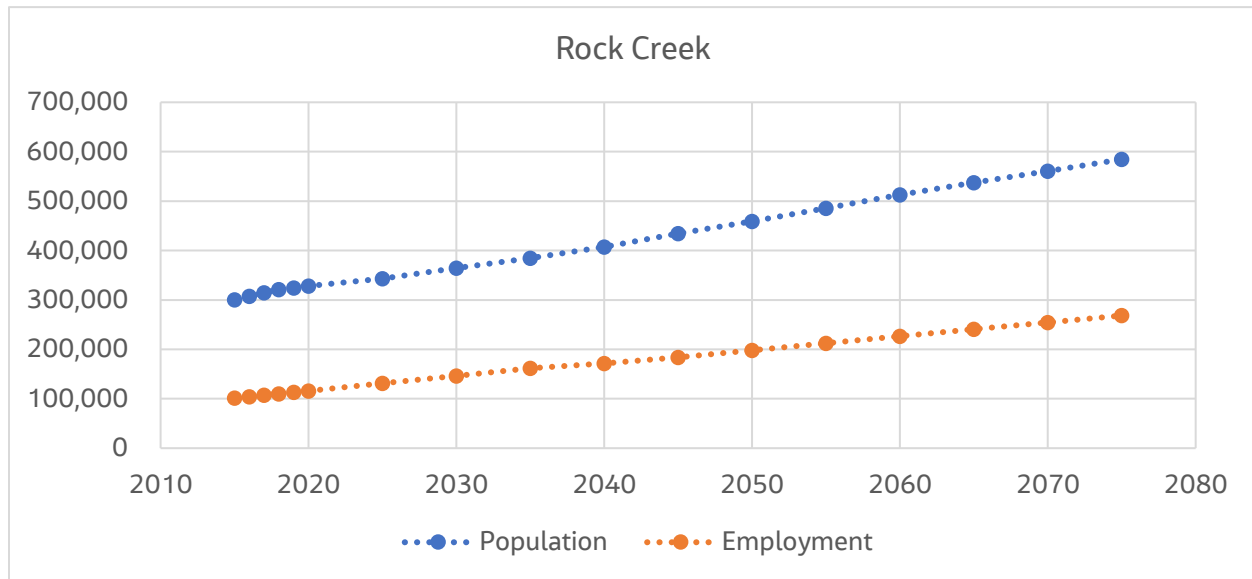


Figure 5.1 Population and Employment Estimates (2015-2019) and Forecasts (2020-2075), Rock Creek Basin

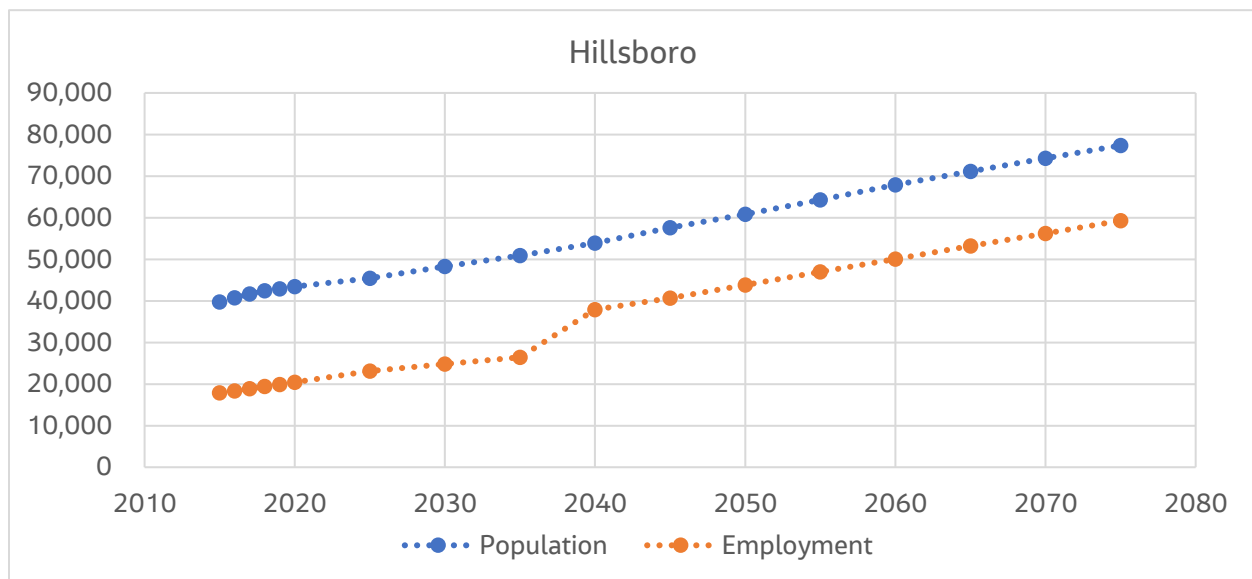


Figure 5.2 Population and Employment Estimates (2015-2019) and Forecasts (2020-2075), Hillsboro Basin

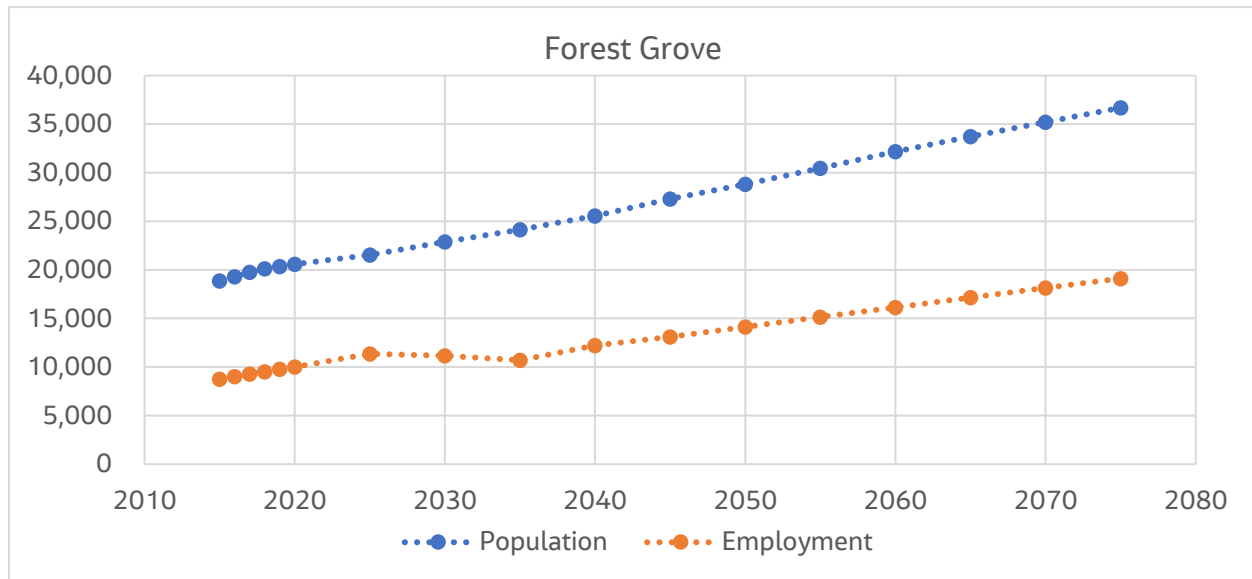


Figure 5.3 Population and Employment Estimates (2015-2019) and Forecasts (2020-2075), Forest Grove Basin

5.2 Wet Industry Growth Assumptions

Wet industry growth assumptions were developed for the following categories:

- Existing Metered Industrial Customers** – Base flows were averaged from 2015-2019 and increased annually using the employment growth rate for each treatment basin between 2020 and 2075. Average annual loads were averaged from 2015-2019 and increased annually using the employment growth rate for cBOD, COD, and TSS for each treatment basin between 2020 and 2075. For other constituent loads (TP, oP, TKN, NH₄), specific industry data was unavailable, and growth was based on load per capita multiplied by population projections.
- Intel**- Planned base flows were provided by the customer from 2020-2025 as shown in **Table 5.2**. A maximum rate of 14.2 mgd was assumed based on previous planning efforts. Base flows were increased up to the maximum between 2025 and 2075 using the annual employment growth rate. Intel average annual load increases were based on maintaining existing constituent concentrations and applying these concentrations to the base flow projections provided by the customer. Base and average annual loads were assumed equal. Existing constituent concentrations were calculated at 255 mg/L for cBOD, 648 mg/L for COD, and 124 mg/L for TSS. Intel base flows and loads were applied to the Rock Creek Basin.
- North Hillsboro Industrial Area (including Jacobson and Helvetia)** - Planned base flows were a combination of known industrial development and base flow per net acre assuming a mix of heavy industrial land use (wet industry) and light industrial land use (warehouses and data centers). The mixed rate assumes 65-percent light industry and 35-percent heavy industry with per acre base flow of 2,600 gallons-per-net-acre-per-day (gpnad). Timing of growth was estimated from information gathered in discussions with the City of Hillsboro by District staff with 50-percent of flow contributions occurring by 2030 and 80-percent of flow contribution occurring by 2040. The North Hillsboro Industrial Area impacts both the Rock Creek and Hillsboro Basins with approximately 98-percent of the flow contributing to Rock Creek.

North Hillsboro annual load projections assumed a 67-percent light industry flow component (typical of data centers) and 33-percent heavy industry flow (typical of existing wet industry customers). Data center constituent concentrations were estimated at 50 milligrams per liter (mg/L) for cBOD, 50 mg/L for COD, and 10 mg/L for TSS. Additional loading beyond the loading associated with population projections was not applied for TP, oP, TKN, and NH₄.

- North Hillsboro Expansion Area** – The areas immediately west and north of the North Hillsboro Industrial Area were formerly urban reserves and were historically considered for urban growth expansion by the City of Hillsboro. Within the planning horizon, it is assumed that the City of Hillsboro will request that the lands be reconsidered for urban growth expansion. The lands were assumed to contribute the same base flow and exhibit the same rate of growth as the North Hillsboro Industrial Area; however, timing was delayed by ten years. Most of the growth is assumed to occur between 2030 and 2050. The expansion area was assumed to impact the Rock Creek Basin; however, future planning efforts may determine that service is more cost effective through the Hillsboro or Forest Grove Basins. The future base flows will likely be a combination of industrial and non-industrial (residential/commercial). The 2,600 gpnad unit base flow applied to the expansion area has an equivalent residential density of 15 to 20 units per net acre which correlates to high-density single family residential zoning, low-density multi-family residential zoning, and low-density mixed-use zoning.

North Hillsboro expansion area annual load projections assumed a 67-percent light industry flow component (typical of data centers) and 33-percent heavy industry flow (typical of existing wet industry customers) similar to the North Hillsboro Industrial Area. Additional loading beyond the loading associated with population projections was not applied for TP, oP, TKN, and NH₄.

Table 5.2 Intel Base Flow Assumptions

Year	Base Flow (mgd)
2019	6.0
2021	6.9
2022	7.7
2025	9.2
maximum	14.2

5.3 Flow Projections

Base flow projections were developed by applying per capita and per employee base flows to the growth portion of population and employment projections. Wet industry bases flows were projected by increasing the existing wet industry flows by the employment growth rate and applying specific growth assumptions described in **Section 5.2** for Intel and North Hillsboro.

The remaining flow categories were projected by multiplying the selected peaking factors by the projected base flows. Peaking factors were applied to base flow components as described below.

- Non-industrial (residential/commercial) peaking factors applied to population and employment component base flows (all basins).
- Metered industrial peaking factors applied to metered industrial component base flows (all basins).

- Intel industrial peaking factors applied to Intel component base flows (Rock Creek Basin).
- Metered industrial peaking factors applied to North Hillsboro component base flows (Rock Creek and Hillsboro Basins).
- Basin-wide peaking factors applied to North Hillsboro Expansion Area component base flows (Rock Creek Basin).

Flow projections are summarized in **Tables 5.3 through 5.5**. Charts of flow projections are presented in **Appendix E**.

Table 5.3 Historic Flow and Flow Projections, Rock Creek WRRF

Year	Residential Base Flow (mgd)	Non- residential Base Flow (mgd)	Wet Industry Base Flow (mgd)	Intel Base Flow (mgd)	North Hillsboro Industrial Base Flow (mgd)	North Hillsboro Expansion Base Flow (mgd)	Total Base Flow (mgd)		Average Annual (mgd)	MMDW Flow (mgd)	MWDW Flow (mgd)	MDDW Flow (mgd)	MHDW Flow (mgd)	MMWW Flow (mgd)	MWWW Flow (mgd)	MDWW Flow (mgd)	MHWW Flow (mgd)
2015	17.77	3.05	1.50	5.28	0.00	0.00	27.60		32.54	33.67	32.51	42.03	47.38	49.16	68.09	84.48	104.47
2016	17.11	3.13	1.64	5.02	0.00	0.00	26.90		37.81	35.80	42.78	51.56	66.94	66.90	89.35	106.16	142.99
2017	17.64	3.22	1.43	5.36	0.00	0.00	27.65		40.02	42.73	40.89	55.00	75.91	65.74	85.79	119.22	135.40
2018	16.99	3.31	1.55	5.83	0.00	0.00	27.67		34.65	40.48	34.94	38.72	49.94	49.31	58.44	68.43	81.45
2019	17.40	3.39	1.44	5.95	0.00	0.00	28.19		32.82	39.16	34.80	40.25	50.89	42.93	57.92	88.13	104.16
2020	18.21	3.48	1.55	6.43	0.55	0.00	30.22		38.64	46.63	48.75	60.11	81.73	74.16	99.24	125.41	160.62
2025	19.08	3.95	1.76	9.20	1.33	0.00	35.32		44.31	53.15	55.66	67.74	90.80	80.55	106.86	134.62	171.10
2030	20.31	4.39	1.96	10.23	2.69	0.55	40.13		49.99	59.79	62.53	75.61	100.89	87.65	115.60	144.98	183.82
2035	21.46	4.84	2.16	11.29	3.67	1.33	44.75		55.51	66.26	69.23	83.39	110.97	94.26	123.79	154.80	195.89
2040	22.77	5.15	2.29	11.99	3.78	2.73	48.71		60.51	72.23	75.44	91.02	121.27	100.28	131.65	164.56	208.22
2045	24.35	5.52	2.46	12.87	3.93	3.75	52.89		65.76	78.48	81.95	98.97	131.96	107.77	141.47	176.83	223.74
2050	25.76	5.95	2.65	13.86	4.08	3.85	56.15		69.77	83.27	86.97	105.00	139.91	113.00	148.24	185.27	234.24
2055	27.28	6.37	2.84	14.20	4.23	4.00	58.92		73.34	87.58	91.44	110.52	147.50	117.71	154.45	193.03	244.15
2060	28.84	6.80	3.03	14.20	4.38	4.15	61.40		76.64	91.59	95.59	115.73	154.82	122.01	160.21	200.20	253.47
2065	30.25	7.22	3.22	14.20	4.53	4.31	63.73		79.73	95.35	99.47	120.59	161.64	125.79	165.23	206.43	261.57
2070	31.61	7.64	3.40	14.20	4.68	4.46	65.98		82.72	98.99	103.22	125.29	168.24	129.25	169.82	212.13	268.97
2075	32.97	8.05	3.59	14.20	4.83	4.61	68.24		85.71	102.62	106.98	129.99	174.84	132.58	174.23	217.59	276.05

Table 5.4 Historic Flow and Flow Projections, Hillsboro WRRF

Year	Residential Base Flow (mgd)	Non- residential Base Flow (mgd)	Wet Industry Base Flow (mgd)	Intel Base Flow (mgd)	North Hillsboro Industrial Base Flow (mgd)	North Hillsboro Expansion Base Flow (mgd)	Total Base Flow (mgd)		Average Annual (mgd)	MMDW Flow (mgd)	MWDW Flow (mgd)	MDDW Flow (mgd)	MHDW Flow (mgd)	MMWW Flow (mgd)	MWWW Flow (mgd)	MDWW Flow (mgd)	MHWW Flow (mgd)
2015	2.37	0.54	0.07	0.00	0.00	0.00	2.98		4.08	3.97	3.56	3.74	20.11	7.43	11.98	14.98	16.71
2016	2.42	0.55	0.08	0.00	0.00	0.00	3.05		5.26	4.89	6.26	6.99	9.74	12.17	16.13	17.53	19.78
2017	2.52	0.57	0.08	0.00	0.00	0.00	3.16		5.45	5.79	5.42	7.31	11.87	10.26	13.32	17.46	20.80
2018	2.39	0.58	0.10	0.00	0.00	0.00	3.07		4.15	5.04	4.02	4.29	8.86	6.42	8.33	9.21	17.60
2019	2.18	0.60	0.08	0.00	0.00	0.00	2.85		3.77	4.83	4.29	5.05	8.48	6.05	9.79	16.57	19.34
2020	2.49	0.61	0.08	0.00	0.00	0.00	3.18		4.77	5.82	6.53	7.37	11.94	12.69	16.83	19.97	22.52
2025	2.60	0.69	0.10	0.00	0.00	0.00	3.39		5.09	6.20	6.95	7.85	12.71	13.15	17.43	20.68	23.32
2030	2.77	0.74	0.10	0.00	0.04	0.00	3.65		5.47	6.65	7.44	8.41	13.59	13.66	18.08	21.45	24.19
2035	2.92	0.79	0.11	0.00	0.08	0.00	3.90		5.84	7.07	7.91	8.93	14.41	14.07	18.61	22.07	24.88

Year	Residential Base Flow (mgd)	Non- residential Base Flow (mgd)	Wet Industry Base Flow (mgd)	Intel Base Flow (mgd)	North Hillsboro Industrial Base Flow (mgd)	North Hillsboro Expansion Base Flow (mgd)	Total Base Flow (mgd)		Average Annual (mgd)	MMDW Flow (mgd)	MWDW Flow (mgd)	MDDW Flow (mgd)	MHDW Flow (mgd)	MMWW Flow (mgd)	MWWW Flow (mgd)	MDWW Flow (mgd)	MHWW Flow (mgd)
2040	3.09	1.14	0.16	0.00	0.08	0.00	4.46		6.69	8.08	9.04	10.21	16.45	15.60	20.62	24.45	27.57
2045	3.30	1.22	0.17	0.00	0.08	0.00	4.77		7.14	8.64	9.66	10.91	17.58	16.42	21.71	25.74	29.02
2050	3.49	1.31	0.18	0.00	0.08	0.00	5.06		7.58	9.17	10.26	11.58	18.67	17.17	22.70	26.92	30.35
2055	3.69	1.41	0.19	0.00	0.08	0.00	5.37		8.04	9.73	10.88	12.29	19.81	17.94	23.72	28.12	31.70
2060	3.90	1.50	0.21	0.00	0.08	0.00	5.68		8.51	10.30	11.52	13.01	20.97	18.69	24.72	29.31	33.04
2065	4.08	1.60	0.22	0.00	0.08	0.00	5.98		8.95	10.83	12.12	13.69	22.06	19.35	25.59	30.33	34.19
2070	4.26	1.69	0.23	0.00	0.08	0.00	6.26		9.38	11.35	12.69	14.34	23.11	19.94	26.37	31.26	35.24
2075	4.44	1.78	0.24	0.00	0.08	0.00	6.54		9.80	11.86	13.27	14.99	24.16	20.51	27.11	32.14	36.23

Table 5.5 Historic Flow and Flow Projections, Forest Grove WRRF

Year	Residential Base Flow (mgd)	Non- residential Base Flow (mgd)	Wet Industry Base Flow (mgd)	Intel Base Flow (mgd)	North Hillsboro Industrial Base Flow (mgd)	North Hillsboro Expansion Base Flow (mgd)	Total Base Flow (mgd)		Average Annual (mgd)	MMDW Flow (mgd)	MWDW Flow (mgd)	MDDW Flow (mgd)	MHDW Flow (mgd)	MMWW Flow (mgd)	MWWW Flow (mgd)	MDWW Flow (mgd)	MHWW Flow (mgd)
2015	1.73	0.26	0.26	0.00	0.00	0.00	2.25		3.81	3.59	3.52	4.55	6.47	8.06	13.83	20.29	24.08
2016	1.64	0.27	0.22	0.00	0.00	0.00	2.13		4.39	4.24	5.89	7.02	11.88	10.28	14.31	18.62	27.08
2017	1.90	0.28	0.23	0.00	0.00	0.00	2.41		5.20	5.85	5.41	9.00	13.10	10.24	14.37	22.50	28.26
2018	1.66	0.29	0.26	0.00	0.00	0.00	2.21		3.93	5.38	3.76	3.54	7.71	7.29	10.43	12.17	14.39
2019	1.96	0.29	0.24	0.00	0.00	0.00	2.50		3.58	4.65	3.48	3.76	6.72	6.72	11.83	21.47	33.44
2020	1.85	0.30	0.25	0.00	0.00	0.00	2.40		4.33	5.98	6.55	8.93	13.33	11.60	16.13	19.84	28.96
2025	1.91	0.34	0.28	0.00	0.00	0.00	2.53		4.54	6.27	6.86	9.34	13.94	11.85	16.48	20.26	29.56
2030	1.99	0.33	0.27	0.00	0.00	0.00	2.60		4.67	6.45	7.06	9.62	14.36	11.93	16.58	20.38	29.75
2035	2.06	0.32	0.26	0.00	0.00	0.00	2.64		4.77	6.60	7.22	9.85	14.70	11.92	16.57	20.38	29.74
2040	2.14	0.37	0.30	0.00	0.00	0.00	2.81		5.05	6.98	7.63	10.40	15.52	12.27	17.06	20.96	30.59
2045	2.24	0.39	0.32	0.00	0.00	0.00	2.96		5.31	7.33	8.02	10.93	16.31	12.61	17.52	21.53	31.40
2050	2.33	0.42	0.35	0.00	0.00	0.00	3.10		5.56	7.67	8.40	11.43	17.05	12.89	17.90	22.00	32.08
2055	2.42	0.45	0.37	0.00	0.00	0.00	3.25		5.82	8.03	8.79	11.96	17.84	13.17	18.29	22.47	32.75
2060	2.52	0.48	0.40	0.00	0.00	0.00	3.40		6.09	8.40	9.19	12.50	18.64	13.44	18.65	22.91	33.40
2065	2.61	0.51	0.42	0.00	0.00	0.00	3.55		6.33	8.74	9.56	13.00	19.39	13.64	18.93	23.24	33.87
2070	2.70	0.54	0.45	0.00	0.00	0.00	3.69		6.57	9.07	9.92	13.49	20.11	13.80	19.14	23.50	34.23
2075	2.78	0.57	0.47	0.00	0.00	0.00	3.82		6.81	9.40	10.28	13.97	20.83	13.93	19.31	23.71	34.53

5.4 Load Projections

Average annual load projections were developed by applying per capita average annual loads to the growth portion of population projections. Wet industry loads were projected by increasing the existing wet industry flows by the employment growth rate and applying specific growth assumptions described in **Section 5.2** for Intel and North Hillsboro.

The remaining load categories were projected by multiplying the selected peaking factors by the projected average annual loads. Peaking factors were applied to average annual loads as described below.

- *Rock Creek Basin (including North Hillsboro and North Hillsboro Expansion Areas)*
 - (1) cBOD, COD, and TSS
 - (a) Non-industrial peaking factors were applied to non-industrial loading component based on population projections.
 - (b) Intel peaking factors were applied to Intel loading component.
 - (c) Metered wet industry peaking factors were applied to metered wet industry loading component.
 - (d) The Intel peaking factors were applied to the North Hillsboro and North Hillsboro expansion area loading components.
 - (2) TP, oP, TKN, NH₄
 - (a) Influent peaking factors were applied to all load components based on population projections.
 - (b) Additional loading not identified above population projections for the North Hillsboro and North Hillsboro expansion areas.
- *Hillsboro and Forest Grove Basins*
 - (1) cBOD, COD, and TSS
 - (a) Influent peaking factors were applied to all loading component based on population projections.
 - (2) TP, oP, TKN, NH₄
 - (a) Influent peaking factors were applied to all loading components based on population projections.

Load projections are summarized in **Tables 5.3 through 5.5**. Charts of load projections are presented in **Appendix F**.

Table 5.6 Historic Load and Load Projections, cBOD, Rock Creek WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Intel Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015						62,163		69,438	76,568	111,956	70,011	77,485	82,004
2016						55,283		63,387	68,191	94,253	63,566	68,084	96,680
2017						59,591		71,214	76,245	90,708	61,101	68,780	108,053
2018						57,838		66,045	77,754	83,654	59,131	67,063	103,063
2019						53,394		56,671	60,577	62,740	63,177	70,188	79,010
2020	50,145	3,404	7,170	737	0	61,455		68,900	85,747	112,372	68,889	83,971	125,183
2025	52,468	3,861	10,242	1,765	0	68,335		75,791	94,475	121,726	76,355	94,060	138,198
2030	55,733	4,294	11,390	3,577	737	75,731		83,380	104,049	132,496	84,436	104,756	152,412
2035	58,796	4,737	12,565	4,885	1,765	82,746		90,577	113,129	142,707	92,101	114,901	165,891
2040	62,284	5,033	13,352	5,019	3,629	89,316		97,445	121,769	152,780	99,319	124,299	178,679
2045	66,479	5,401	14,328	5,219	4,988	96,414		104,988	131,233	164,135	107,153	134,348	192,638
2050	70,230	5,816	15,429	5,419	5,122	102,017		111,086	138,856	173,656	113,376	142,152	203,821
2055	74,249	6,232	15,808	5,619	5,322	107,230		116,905	146,100	183,072	119,209	149,293	214,397
2060	78,407	6,647	15,808	5,819	5,523	112,205		122,544	153,107	192,399	124,801	156,032	224,595
2065	82,159	7,062	15,808	6,020	5,723	116,772		127,714	159,530	200,927	129,931	162,224	233,944
2070	85,765	7,467	15,808	6,220	5,923	121,183		132,703	165,730	209,150	134,886	168,207	242,969
2075	89,371	7,871	15,808	6,420	6,123	125,594		137,693	171,930	217,374	139,840	174,191	251,995

Table 5.7 Historic Load and Load Projections, COD, Rock Creek WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Intel Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015						146,155		168,756	191,662	219,200	171,503	190,158	212,392
2016						144,698		159,876	189,885	235,596	173,297	199,875	285,302
2017						145,754		188,943	212,260	286,505	141,085	157,677	200,633
2018						176,877		154,274			234,875	265,864	339,821
2019													
2020	145,748	8,645	7,170	1,551	0	163,114		193,897	241,339	329,362	193,070	285,005	370,042

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Intel Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2025	152,499	9,807	10,242	3,716	0	176,264		208,324	258,613	351,451	211,670	324,100	417,371
2030	161,991	10,906	11,390	7,534	1,551	193,372		227,207	281,240	380,504	235,676	373,906	477,816
2035	170,892	12,031	12,565	10,286	3,716	209,490		245,003	302,579	407,919	258,260	420,665	534,581
2040	181,030	12,784	13,352	10,568	7,643	225,377		262,834	324,104	435,950	279,849	463,161	586,644
2045	193,222	13,719	14,328	10,990	10,505	242,764		282,647	348,237	467,801	302,663	505,380	638,954
2050	204,125	14,774	15,429	11,412	10,787	256,527		298,704	368,079	494,524	319,666	533,229	674,294
2055	215,806	15,828	15,808	11,833	11,208	270,484		315,144	388,493	522,221	336,501	559,309	707,782
2060	227,894	16,883	15,808	12,255	11,630	284,471		331,716	409,132	550,348	353,114	584,087	739,866
2065	238,797	17,938	15,808	12,677	12,052	297,272		346,857	427,984	576,015	368,366	607,019	769,502
2070	249,278	18,966	15,808	13,098	12,473	309,624		361,459	446,161	600,753	383,102	629,251	798,213
2075	259,759	19,993	15,808	13,520	12,895	321,976		376,060	464,338	625,491	397,839	651,484	826,925

Table 5.8 Historic Load and Load Projections, TSS, Rock Creek WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Intel Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015						66,862		82,626	103,938	130,655	77,684	82,500	99,601
2016						70,120		80,605	94,102	118,985	93,336	103,895	188,134
2017						61,639		66,315	84,612	93,647	73,247	82,676	139,529
2018						70,219		84,918	100,758	142,921	75,746	84,503	135,398
2019						67,664		71,571	82,297	100,443	82,043	100,819	144,697
2020	68,188	1,655	606	299	0	70,748		80,972	111,325	142,626	82,688	106,778	193,758
2025	71,347	1,877	865	716	0	74,805		85,280	117,102	149,939	87,163	113,292	207,226
2030	75,788	2,088	962	1,451	299	80,588		91,329	125,178	160,125	93,468	122,680	227,052
2035	79,952	2,303	1,062	1,981	716	86,014		97,013	132,771	169,706	99,392	131,481	245,601
2040	84,695	2,447	1,128	2,035	1,472	91,778		103,178	141,067	180,209	105,786	140,684	264,422
2045	90,399	2,626	1,211	2,117	2,023	98,376		110,391	150,840	192,634	113,228	151,037	284,874
2050	95,500	2,828	1,304	2,198	2,077	103,908		116,636	159,389	203,566	119,625	159,484	300,617
2055	100,965	3,030	1,336	2,279	2,159	109,769		123,280	168,494	215,217	126,424	168,404	317,119
2060	106,621	3,232	1,336	2,360	2,240	115,789		130,124	177,882	227,235	133,423	177,542	333,926

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Intel Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	North Hillsboro Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2065	111,721	3,434	1,336	2,441	2,321	121,254		136,329	186,389	238,125	139,771	185,848	349,241
2070	116,625	3,631	1,336	2,523	2,402	126,517		142,301	194,576	248,603	145,881	193,849	364,011
2075	121,529	3,828	1,336	2,604	2,483	131,779		148,273	202,762	259,081	151,991	201,851	378,781

Table 5.9 Historic Load and Load Projections, TP, Rock Creek WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	1,444	1,860	2,042	2,243	1,703	1,741	1,741
2016	1,455	1,724	2,157	2,423	1,868	1,888	2,320
2017	1,601	1,878	2,081	3,014	1,491	1,594	1,792
2018	1,525	1,688	1,929	2,304	2,091	2,637	2,897
2019	1,566	1,631	1,930	2,133	1,728	1,879	2,048
2020	1,584	1,842	2,367	3,282	1,829	2,609	2,866
2025	1,657	1,927	2,476	3,434	1,914	2,730	2,999
2030	1,761	2,047	2,630	3,647	2,033	2,900	3,185
2035	1,857	2,160	2,775	3,848	2,144	3,059	3,360
2040	1,967	2,288	2,939	4,076	2,272	3,241	3,560
2045	2,100	2,442	3,137	4,351	2,425	3,459	3,800
2050	2,219	2,580	3,314	4,596	2,561	3,654	4,014
2055	2,345	2,728	3,504	4,859	2,708	3,863	4,244
2060	2,477	2,880	3,700	5,131	2,860	4,080	4,481
2065	2,595	3,018	3,877	5,377	2,996	4,275	4,696
2070	2,709	3,151	4,048	5,613	3,128	4,462	4,902
2075	2,823	3,283	4,218	5,849	3,259	4,650	5,108

Table 5.10 Historic Load and Load Projections, oP, Rock Creek WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	644	708	758	1,038	760	1,102	1,102
2016	656	709	744	829	707	801	904
2017	735	860	998	1,141	756	861	922
2018	750	811	890	1,167	782	849	1,060
2019	783	847	985	1,055	879	956	1,162
2020	745	867	1,114	1,544	861	1,228	1,349
2025	780	907	1,165	1,616	900	1,285	1,411
2030	828	963	1,238	1,716	956	1,365	1,499
2035	874	1,016	1,306	1,811	1,009	1,439	1,581
2040	926	1,077	1,383	1,918	1,069	1,525	1,675
2045	988	1,149	1,476	2,047	1,141	1,628	1,788
2050	1,044	1,214	1,560	2,163	1,205	1,719	1,889
2055	1,104	1,283	1,649	2,286	1,274	1,818	1,997
2060	1,165	1,355	1,741	2,414	1,346	1,920	2,109
2065	1,221	1,420	1,825	2,530	1,410	2,011	2,210
2070	1,275	1,483	1,905	2,641	1,472	2,100	2,307
2075	1,328	1,545	1,985	2,752	1,534	2,188	2,404

Table 5.11 Historic Load and Load Projections, TKN, Rock Creek WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	11,853	11,853	11,674	11,674	12,733	13,328	13,706
2016	11,397	11,397	13,487	13,487	12,639	12,787	12,787
2017	12,254	12,254	14,766	14,766	12,944	12,944	12,944
2018	11,452	11,452	14,274	14,274	13,208	13,208	13,208
2019	11,412	11,412	12,460	12,460	13,733	15,374	15,374
2020	12,224	13,054	14,035	16,253	13,001	14,615	17,294
2025	12,790	13,658	14,685	17,006	13,603	15,292	18,095
2030	13,586	14,509	15,599	18,064	14,450	16,244	19,222
2035	14,333	15,306	16,457	19,057	15,244	17,136	20,278
2040	15,183	16,214	17,433	20,187	16,149	18,153	21,481
2045	16,206	17,306	18,607	21,547	17,236	19,376	22,927
2050	17,120	18,282	19,657	22,763	18,209	20,469	24,221
2055	18,100	19,329	20,782	24,065	19,251	21,640	25,607
2060	19,114	20,411	21,946	25,413	20,329	22,852	27,042
2065	20,028	21,388	22,996	26,629	21,302	23,946	28,335
2070	20,907	22,326	24,005	27,798	22,237	24,997	29,579
2075	21,786	23,265	25,014	28,967	23,172	26,048	30,823

Table 5.12 Historic Load and Load Projections, NH₄, Rock Creek WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	7,308	7,967	8,222	9,558	7,792	8,738	9,282
2016	7,418	8,266	8,459	9,007	7,982	8,559	10,153
2017	7,667	8,337	8,803	10,194	8,037	8,311	10,847
2018	7,973	8,362	8,704	9,264	8,038	8,694	8,955
2019	7,452	7,443	7,913	8,615	8,341	8,784	9,230
2020	7,914	8,451	9,087	10,523	8,417	9,462	11,197
2025	8,281	8,843	9,508	11,010	8,807	9,900	11,715
2030	8,796	9,393	10,099	11,695	9,355	10,517	12,444
2035	9,279	9,909	10,654	12,338	9,869	11,095	13,128
2040	9,830	10,497	11,286	13,070	10,455	11,753	13,907
2045	10,492	11,204	12,047	13,950	11,159	12,544	14,844
2050	11,084	11,836	12,726	14,737	11,789	13,252	15,681
2055	11,718	12,514	13,455	15,580	12,463	14,010	16,579
2060	12,375	13,215	14,208	16,453	13,161	14,795	17,507
2065	12,967	13,847	14,888	17,240	13,791	15,503	18,345
2070	13,536	14,455	15,541	17,997	14,396	16,183	19,150
2075	14,105	15,062	16,195	18,754	15,002	16,864	19,955

Table 5.13 Historic Load and Load Projections, cBOD, Hillsboro WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			6,185		6,981	7,829	12,261	6,897	8,267	10,451
2016			6,612		9,534	13,046	14,981	6,781	7,404	8,333
2017			6,757		7,637	8,607	10,078	8,531	9,123	15,522
2018			6,613		7,515	9,949	17,531	7,095	7,795	10,040
2019			7,140		9,207	11,925	17,724	7,986	9,706	14,895
2020	6,757	211	6,968		8,538	13,747	18,470	7,796	9,471	16,006
2025	7,070	239	7,309		8,956	14,421	19,375	8,178	9,935	16,790
2030	7,510	257	7,766		9,516	15,323	20,587	8,690	10,557	17,840
2035	7,922	273	8,195		10,042	16,169	21,724	9,170	11,139	18,826
2040	8,392	392	8,784		10,763	17,331	23,286	9,829	11,940	20,178
2045	8,958	420	9,378		11,491	18,503	24,860	10,493	12,747	21,543
2050	9,463	453	9,916		12,150	19,564	26,285	11,095	13,478	22,778
2055	10,005	485	10,490		12,853	20,696	27,807	11,737	14,258	24,096
2060	10,565	517	11,082		13,579	21,866	29,378	12,400	15,064	25,458
2065	11,071	550	11,620		14,238	22,927	30,803	13,002	15,795	26,693
2070	11,556	581	12,137		14,872	23,947	32,175	13,581	16,498	27,882
2075	12,042	613	12,655		15,506	24,968	33,546	14,160	17,201	29,070

Table 5.14 Historic Load and Load Projections, COD, Hillsboro WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			15,702		18,139	25,000	39,722	17,416	23,024	33,228
2016			15,019		21,315	23,125	27,562	16,290	22,006	38,794
2017										
2018										
2019			16,389		21,235			22,172	22,172	22,172
2020	16,392	536	16,927		21,837	26,950	42,821	20,012	24,821	43,723
2025	17,151	608	17,759		22,909	28,274	44,924	20,994	26,040	45,870
2030	18,219	652	18,870		24,343	30,043	47,736	22,308	27,670	48,741
2035	19,220	693	19,912		25,688	31,703	50,372	23,541	29,198	51,433
2040	20,360	995	21,355		27,548	33,999	54,021	25,246	31,313	55,159
2045	21,731	1,068	22,799		29,411	36,298	57,674	26,953	33,430	58,889
2050	22,957	1,150	24,107		31,099	38,381	60,983	28,499	35,349	62,268
2055	24,271	1,232	25,503		32,899	40,603	64,514	30,150	37,395	65,873
2060	25,630	1,314	26,944		34,759	42,899	68,161	31,854	39,509	69,597
2065	26,857	1,396	28,253		36,447	44,981	71,471	33,401	41,427	72,976
2070	28,035	1,476	29,511		38,071	46,986	74,655	34,889	43,273	76,228
2075	29,214	1,556	30,770		39,694	48,990	77,839	36,377	45,119	79,479

Table 5.15 Historic Load and Load Projections, TSS, Hillsboro WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			7,228		7,764	9,346	17,864	8,592	11,648	25,725
2016			8,167		13,033	18,439	23,118	9,310	13,854	25,149
2017			8,507		9,718	11,483	15,466	12,209	17,650	28,690
2018			7,708		8,576	11,044	13,736	8,816	9,674	15,047
2019			8,127		9,674	10,993	17,237	10,209	17,221	26,640
2020	8,207	123	8,329		10,187	11,934	20,586	10,268	17,649	29,644
2025	8,587	139	8,726		10,672	12,503	21,566	10,757	18,490	31,055
2030	9,121	149	9,271		11,338	13,283	22,912	11,428	19,644	32,993
2035	9,622	159	9,781		11,963	14,015	24,174	12,058	20,726	34,811
2040	10,193	228	10,421		12,746	14,932	25,756	12,847	22,082	37,089
2045	10,880	245	11,124		13,606	15,939	27,494	13,713	23,572	39,591
2050	11,494	263	11,757		14,379	16,846	29,058	14,493	24,913	41,843
2055	12,151	282	12,434		15,207	17,815	30,730	15,327	26,346	44,251
2060	12,832	301	13,133		16,062	18,817	32,458	16,190	27,828	46,740
2065	13,446	320	13,766		16,836	19,724	34,022	16,970	29,169	48,992
2070	14,036	338	14,374		17,580	20,596	35,526	17,720	30,458	51,158
2075	14,626	356	14,983		18,324	21,468	37,030	18,470	31,747	53,323

Table 5.16 Historic Load and Load Projections, TP, Hillsboro WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	163	183	264	420	189	280	280
2016	180	221	295	413	229	478	569
2017	165	234	278	315	250	388	582
2018	169	189	234	280	187	207	260
2019	173	213	256	300	221	371	573
2020	175	217	316	463	219	383	592
2025	183	227	330	484	229	401	620
2030	195	241	351	515	244	426	658
2035	205	255	370	543	257	449	694
2040	217	270	392	575	272	476	736
2045	232	288	419	614	291	508	785
2050	245	304	442	648	307	536	829
2055	259	322	468	686	325	567	877
2060	274	340	494	724	343	599	926
2065	287	356	517	759	359	628	970
2070	299	372	540	792	375	655	1,013
2075	312	387	563	825	391	683	1,055

Table 5.17 Historic Load and Load Projections, oP, Hillsboro WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	81	113	172	172	91	107	154
2016	84	117	184	184	90	104	104
2017	90	137	173	173	95	126	126
2018	87	98	105	130	93	107	143
2019	91	109	118	148	101	126	203
2020	91	112	163	240	113	198	306
2025	95	118	171	251	119	207	321
2030	101	125	182	266	126	220	340
2035	106	132	192	281	133	232	359
2040	112	140	203	297	141	246	380
2045	120	149	217	318	150	263	406
2050	127	157	229	335	159	277	429
2055	134	166	242	355	168	293	454
2060	142	176	255	374	177	310	479
2065	148	184	268	392	186	325	502
2070	155	192	279	410	194	339	524
2075	161	200	291	427	202	353	546

Table 5.18 Historic Load and Load Projections, TKN, Hillsboro WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	1,197	1,438	1,852	1,852	1,384	1,742	1,742
2016	1,154	1,347	1,347	1,347	1,237	1,297	1,297
2017	1,278	1,452	1,582	1,582	1,480	2,323	2,323
2018	1,194	1,337	1,441	1,441	1,415	1,491	1,491
2019	1,352	1,896	1,896	1,896	1,428	1,606	1,606
2020	1,292	1,462	1,626	1,974	1,385	1,555	2,081
2025	1,352	1,530	1,702	2,065	1,449	1,627	2,178
2030	1,436	1,625	1,808	2,193	1,539	1,728	2,313
2035	1,515	1,714	1,907	2,314	1,624	1,823	2,440
2040	1,604	1,816	2,020	2,451	1,720	1,931	2,585
2045	1,712	1,938	2,156	2,616	1,836	2,061	2,759
2050	1,809	2,048	2,278	2,764	1,940	2,177	2,915
2055	1,913	2,165	2,408	2,922	2,051	2,302	3,082
2060	2,020	2,286	2,543	3,086	2,165	2,431	3,254
2065	2,116	2,395	2,665	3,233	2,269	2,547	3,410
2070	2,209	2,500	2,782	3,375	2,369	2,659	3,560
2075	2,302	2,606	2,899	3,517	2,468	2,771	3,709

Table 5.19 Historic Load and Load Projections, NH4, Hillsboro WRRF

Year	Total Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	779	819	873	931	824	869	990
2016	789	972	994	1,148	837	876	1,002
2017	835	986	1,023	1,276	899	871	1,111
2018	845	924	968	1,033	910	909	934
2019	849	935	988	1,210	924	1,022	1,368
2020	857	970	1,079	1,309	919	1,031	1,381
2025	897	1,015	1,129	1,370	961	1,079	1,445
2030	953	1,078	1,199	1,455	1,021	1,146	1,535
2035	1,005	1,137	1,265	1,535	1,077	1,209	1,619
2040	1,064	1,205	1,340	1,626	1,141	1,281	1,715
2045	1,136	1,286	1,431	1,736	1,218	1,367	1,831
2050	1,200	1,358	1,511	1,834	1,287	1,445	1,934
2055	1,269	1,436	1,598	1,939	1,360	1,527	2,045
2060	1,340	1,517	1,687	2,047	1,437	1,613	2,159
2065	1,404	1,589	1,768	2,145	1,505	1,690	2,262
2070	1,466	1,659	1,846	2,239	1,572	1,764	2,362
2075	1,527	1,729	1,923	2,334	1,638	1,838	2,461

Table 5.20 Historic Load and Load Projections, cBOD, Forest Grove WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			6,579		13,381	16,117	18,256	6,304	6,334	8,175
2016			5,798		7,413	8,000	10,402	8,366	8,000	8,618
2017			6,156		8,526	9,191	12,300	7,089	7,035	8,856
2018			5,792		8,909	10,694	13,454	7,482	7,048	8,263
2019			5,462		8,472	9,995	10,360	7,792	6,789	8,207
2020	5,222	998	6,220		8,946	11,485	14,449	8,261	8,581	9,345
2025	5,464	1,132	6,596		9,486	12,179	15,323	8,761	9,100	9,910
2030	5,804	1,110	6,914		9,944	12,766	16,062	9,183	9,539	10,388
2035	6,123	1,064	7,188		10,337	13,271	16,697	9,546	9,916	10,799
2040	6,487	1,216	7,703		11,079	14,223	17,895	10,231	10,628	11,574
2045	6,924	1,305	8,229		11,835	15,194	19,116	10,929	11,353	12,364
2050	7,314	1,406	8,720		12,541	16,101	20,257	11,582	12,031	13,101
2055	7,733	1,506	9,239		13,287	17,059	21,462	12,271	12,746	13,881
2060	8,166	1,607	9,772		14,055	18,044	22,702	12,979	13,482	14,683
2065	8,557	1,707	10,263		14,761	18,951	23,842	13,632	14,160	15,420
2070	8,932	1,805	10,737		15,442	19,825	24,942	14,260	14,813	16,132
2075	9,308	1,902	11,210		16,122	20,699	26,041	14,889	15,466	16,843

Table 5.21 Historic Load and Load Projections, COD, Forest Grove WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			14,266		24,949	33,590	49,497	14,392	17,095	22,147
2016			12,195		14,760	14,760	17,025	14,760	19,883	34,920
2017			14,198		17,128	17,128	18,261			
2018			13,453					15,768	15,768	15,768
2019			10,787		9,786			12,267	13,002	13,002
2020	12,321	1,766	14,086		20,842	33,168	48,874	15,947	22,967	40,335
2025	12,891	2,003	14,894		22,037	35,070	51,677	16,862	24,284	42,648
2030	13,694	1,964	15,658		23,167	36,868	54,326	17,726	25,529	44,835
2035	14,446	1,884	16,330		24,161	38,450	56,658	18,487	26,624	46,758
2040	15,303	2,153	17,456		25,828	41,103	60,567	19,762	28,461	49,985
2045	16,334	2,311	18,644		27,586	43,900	64,689	21,107	30,399	53,387
2050	17,255	2,488	19,744		29,212	46,489	68,503	22,352	32,191	56,534
2055	18,243	2,666	20,909		30,936	49,232	72,545	23,671	34,090	59,870
2060	19,265	2,844	22,108		32,711	52,056	76,707	25,029	36,046	63,305
2065	20,186	3,021	23,207		34,337	54,645	80,521	26,273	37,839	66,453
2070	21,072	3,194	24,267		35,904	57,138	84,196	27,472	39,565	69,486
2075	21,958	3,367	25,326		37,471	59,632	87,871	28,671	41,292	72,518

Table 5.22 Historic Load and Load Projections, TSS, Forest Grove WRRF

Year	Non-industrial (residential/ commercial) Average Annual Load (lbs/d)	Metered Wet Industry Average Annual Load (lbs/d)	Total Average Annual Load (lbs/d)		MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015			5,552		7,299	7,598	12,025	6,710	8,586	12,689
2016			5,641		7,955	11,185	23,633	6,573	8,204	14,904
2017			5,858		7,115	10,746	21,526	7,550	10,283	20,153
2018			5,984		8,972	12,054	15,915	7,417	8,999	15,516
2019			5,419		9,207	11,794	17,697	5,943	7,837	13,330
2020	5,634	279	5,913		8,441	12,868	24,772	7,094	10,379	20,342
2025	5,895	316	6,212		8,867	13,517	26,022	7,452	10,903	21,369
2030	6,262	310	6,572		9,382	14,303	27,533	7,885	11,536	22,610
2035	6,606	297	6,904		9,855	15,024	28,922	8,283	12,118	23,750
2040	6,998	340	7,338		10,475	15,969	30,742	8,804	12,881	25,245
2045	7,470	365	7,834		11,184	17,049	32,821	9,399	13,752	26,952
2050	7,891	393	8,284		11,825	18,027	34,704	9,939	14,541	28,499
2055	8,343	421	8,764		12,510	19,071	36,713	10,514	15,383	30,149
2060	8,810	449	9,259		13,217	20,149	38,788	11,108	16,252	31,853
2065	9,232	477	9,708		13,859	21,127	40,671	11,648	17,041	33,399
2070	9,637	504	10,141		14,476	22,068	42,483	12,166	17,800	34,887
2075	10,042	531	10,573		15,093	23,010	44,295	12,685	18,559	36,375

Table 5.23 Historic Load and Load Projections, TP, Forest Grove WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	163	209	264	365	216	324	324
2016	134	178	219	235	180	268	268
2017	138	179	242	265	157	194	252
2018	124	152	182	194	150	196	218
2019	136	168	255	255	171	186	259
2020	146	184	273	327	175	230	277
2025	153	192	286	342	183	241	290
2030	162	204	303	363	194	256	308
2035	171	215	320	383	205	270	325
2040	181	228	339	406	217	286	344
2045	193	244	362	433	232	305	367
2050	204	257	382	458	245	322	388
2055	216	272	404	484	259	340	410
2060	228	287	427	511	273	359	433
2065	239	301	447	536	287	377	454
2070	250	314	467	559	299	393	474
2075	260	327	486	583	312	410	494

Table 5.24 Historic Load and Load Projections, oP, Forest Grove WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	60	94	97	97	68	76	76
2016	64	73	73	89	71	78	86
2017	65	78	92	105	70	77	89
2018	62	73	83	104	74	70	88
2019	65	78	86	90	69	80	100
2020	66	83	124	148	79	104	126
2025	69	87	129	155	83	109	131
2030	74	93	137	165	88	116	139
2035	78	98	145	174	93	122	147
2040	82	103	154	184	98	129	156
2045	88	110	164	196	105	138	166
2050	93	117	173	208	111	146	176
2055	98	123	183	219	117	154	186
2060	103	130	193	232	124	163	196
2065	108	136	203	243	130	171	206
2070	113	142	212	253	136	178	215
2075	118	148	220	264	141	186	224

Table 5.25 Historic Load and Load Projections, TKN, Forest Grove WRRF

Year	Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	939	1,213	1,396	1,396	1,036	1,300	1,300
2016	922	1,011	1,070	1,070	1,057	1,133	1,133
2017	873	1,034	1,184	1,184	1,058	1,365	1,365
2018	793	1,010	1,083	1,083	1,070	1,151	1,151
2019	859	1,152	1,243	1,243	979	965	965
2020	920	1,118	1,358	1,726	1,012	1,238	1,476
2025	962	1,169	1,421	1,806	1,058	1,295	1,545
2030	1,022	1,242	1,510	1,918	1,124	1,376	1,641
2035	1,078	1,311	1,592	2,023	1,186	1,451	1,731
2040	1,142	1,388	1,687	2,143	1,256	1,537	1,834
2045	1,219	1,482	1,801	2,288	1,341	1,641	1,957
2050	1,288	1,565	1,902	2,417	1,417	1,733	2,068
2055	1,362	1,655	2,011	2,555	1,498	1,832	2,186
2060	1,438	1,748	2,124	2,698	1,582	1,935	2,308
2065	1,507	1,831	2,225	2,827	1,657	2,028	2,419
2070	1,573	1,912	2,323	2,951	1,730	2,117	2,525
2075	1,639	1,992	2,421	3,076	1,803	2,206	2,631

Table 5.26 Historic Load and Load Projections, NH4, Forest Grove WRRF

Year	Total Average Annual Load (lbs/d)	MMDW Load (lbs/d)	MWDW Load (lbs/d)	MDDW Load (lbs/d)	MMWW Load (lbs/d)	MWWW Load (lbs/d)	MDWW Load (lbs/d)
2015	546	636	734	880	573	623	746
2016	564	658	705	851	653	658	761
2017	527	705	778	988	545	552	782
2018	533	651	674	904	637	652	856
2019	571	677	727	881	606	769	917
2020	574	697	847	1,077	631	772	921
2025	600	730	887	1,127	660	808	964
2030	638	775	942	1,197	701	858	1,024
2035	673	818	994	1,262	740	905	1,080
2040	713	866	1,053	1,337	784	959	1,144
2045	761	925	1,123	1,427	837	1,024	1,221
2050	804	977	1,187	1,508	884	1,082	1,290
2055	850	1,033	1,255	1,594	935	1,143	1,364
2060	897	1,090	1,325	1,684	987	1,207	1,440
2065	940	1,143	1,388	1,764	1,034	1,265	1,509
2070	981	1,193	1,449	1,842	1,079	1,321	1,576
2075	1,023	1,243	1,510	1,919	1,125	1,376	1,642

6 References

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7 Appendix A: Flow and Load Spreadsheets

Flow and Load spreadsheets include:

- "FLOW_LOAD_Population_Employment_WBasin_20220126_v2.xlsm": this spreadsheet includes the calculation of loading projections and the figures and tables included in this memorandum.
- "FLOW_Population_Employment_WBasin_20211207_v2.xlsm": this spreadsheet includes the calculation of flow projections and the figures and tables included in this memorandum.
- "Rock Creek Data_Per-Capita Loading - Revised 2021-01-26_v2.xlsm": this spreadsheet includes historical data and the determination of base loads and load peaking factors for Rock Creek WRRF.
- "Hillsboro Data Revised_Per-Capita Loading 2021-01-26_v2.xlsx": this spreadsheet includes historical data and the determination of base loads and load peaking factors for Hillsboro WRRF.
- "Forest Grove Data_Per-Capita Loading Revised 2022-01-26_v2.xlsx": this spreadsheet includes historical data and the determination of base loads and load peaking factors for Forest Grove WRRF.
- "Rock Creek Data_Per-Capita Loading - 2021-12-07_v2.xlsm": this spreadsheet includes historical data and the determination of base flows and flow peaking factors for Rock Creek WRRF.
- "Hillsboro Data Revised_Per-Capita Loading 2021-12-07_v2.xlsm": this spreadsheet includes historical data and the determination of base flows and flow peaking factors for Hillsboro WRRF.
- "Forest Grove Data_Per-Capita Loading Revised 2021-12-07_v2.xlsx": this spreadsheet includes historical data and the determination of base flows and flow peaking factors for Forest Grove WRRF.

Additional detail related to the flow and load spreadsheets is described below.

- A. FLOW_Population_Employment_WBasin_20211207_v2.xlsm – This spreadsheet is specifically for the flow projections and links to the following input data spreadsheets located in the "RECENT_CONSTITUENT" subfolder as input into peaking factor selection.
 1. RECENT_CONSTITUENT/Rock Creek Data_Per-Capital Loading – Revised 2021-12-07_v2.xlsm
 2. RECENT_CONSTITUENT/Hillsboro Data_Per-Capital Loading – Revised 2021-12-07_v2.xlsm
 3. RECENT_CONSTITUENT/Forest Grove Data_Per-Capital Loading – Revised 2021-12-07_v2.xlsx
 - The selected flow peaking factors are referenced in the "PF_REFERENCE" tab.
 - The base flow projections are located in the "KEY+SUMMARY" tab.
 - The application of peaking factors to the base flow for all flow categories projections are located in the "PF_APPLICATION_SUMMARY" tab. Toggle between the different flow categories to update charts using Cell B5.
- B. FLOW_LOAD_Population_Employment_WBasin_20220126.xlsm – This spreadsheet is specifically for the load projections and links to the following input data spreadsheets located in the "RECENT_CONSTITUENT" subfolder as input into the constituent peaking factor selection.

1. RECENT_CONSTITUENT/Rock Creek Data_Per-Capital Loading – Revised 2022-01-26.xlsm
 2. RECENT_CONSTITUENT/Hillsboro Data_Per-Capital Loading – Revised 2022-01-26.xlsx
 3. RECENT_CONSTITUENT/Forest Grove Data_Per-Capital Loading – Revised 2022-01-26.xlsx
- The selected constituent peaking factors are referenced in the “PF_ROCKCREEK”, “PF_HILLSBORO”, “PF_FORESTGROVE” tabs.
 - The application of peaking factors for all constituent category projections are located in the “ROCKCREEK_LOAD KEY+SUMMARY”, “HILLSBORO_LOAD KEY+SUMMARY”, “FORESTGROVE_LOAD KEY+SUMMARY” tabs. Toggle between the different constituent categories to update charts using Cell C5. Toggle between dry weather and wet weather seasons using Cell C7.
 - The application of constituent peaking factors in Rock Creek varies by constituent. For TP, OP, TKN, and NH3 – use the information below as input into Cells C10→C13 (y=yes, n=no)

TOGGLE PEAKING FACTORS (TP, OP, TKN, and NH3 – Rock Creek)

Use Lumped PF for Population?	y
Use Lumped PF for Intel?	n
Use Lumped PF for Non-Intel?	n
Use Lumped PF for New Industrial?	n

- For cBOD, COD, and TSS in Rock Creek – use the information below as input into Cells C10→13 (y=yes, n=no)

TOGGLE PEAKING FACTORS (cBOD, COD, TSS – Rock Creek)

Use Lumped PF for Population?	n
Use Lumped PF for Intel?	n
Use Lumped PF for Non-Intel?	n
Use Lumped PF for New Industrial?	n

- For Hillsboro and Forest Grove, the spreadsheets are set to defaults for application of peaking factors (total system peaking factors are applied to all flow/constituent elements).
-

8 Appendix B: HACH WIMS Variables and SCADA Tags

Tables B.1 through B.3 summarize the Hach WIMS variables that were used in the facility planning work to generate historical averages and peaking factors for the West Basin Facilities as of June of 2020.

Table B.1. Hach WIMS variables for the Rock Creek WRRF historical flows and loads

Parameter	Daily Value	30 Day MovAve	7 day MovAve
Rock Creek Collection System {mgd}	8030		
Non Intel Flow {mgd}	8050	8060	8070
Rock Creek {mgd}	1	10000	10001
Rock Creek Collection System CBOD {lbs/day}	8031	10002	10003
Rock Creek Collection System COD {lbs/day}	8032	10014	10015
Non Intel CBOD {lbs/day}	8053	8063	8073
Non-Intel COD {lbs/day}	8051	8061	8071
Residential Flow {mgd}	8150	8160	8170
Residential CBOD {lbs/day}	8153	8163	8173
Residential COD {lbs/day}	8151	8161	8171
Residential TSS {lbs/day}	8152	8162	8172
Rock Creek Collection System TP {lbs/day}	8036	10010	10011
Rock Creek Collection System OP {lbs/day}	8037	10012	10013
Rock Creek Collection System TKN {lbs/day}	8034	10008	10009
Rock Creek Collection System NH3 {lbs/day}	8035	10006	10007
Other Industrial Flow {mgd}	8100		
Other Industry CBOD {lbs/day}	8103		
Other Industry COD {lbs/day}	8101		
Other Industry TSS {lbs/day}	8102		
INdustry Effluent Flow {mgd}	8000	8010	8020
INdustry Effluent CBOD {lbs/day}	8003		
INdustry Effluent COD {lbs/day}	8001		
INdustry Effluent TSS {lbs/day}	8002		

Table B.2 Hach WIMS variables for the Hillsboro WRRF historical flows and loads

Parameter	Daily Value	30 Day MovAve	7 day MovAve
Hillsboro Inf (rev) {mgd}	2910	2912	2914
Hillsboro Inf CBOD (rev) {ppd}	2900	2500	2510
Hillsboro Inf COD (rev) {ppd}	2901	2501	2511
Hillsboro Inf TSS (rev) {ppd}	2902	2502	2512
Hillsboro Inf TP (rev) {ppd}	2905	2505	2515
Hillsboro Inf OP (rev) {ppd}	2906	2506	2516
Hillsboro Inf TKN (rev) {ppd}	2904	2504	2514

West Basin Flow and Load Projections

Parameter	Daily Value	30 Day MovAve	7 day MovAve
Hillsboro Inf Ammonia (rev) {ppd}	2903	2503	2513
Hillsboro Residential Inf CBOD {ppd}	2920	2925	
Hillsboro Residential Inf COD {ppd}	2921	2926	
Hillsboro Residential Inf TSS {ppd}	2922	2927	
Industry Flow {mgd}	2600	2913	2915

Table B.3 Hach WIMS variables for the Forest Grove WRRF historical flows and loads

Parameter	Daily Value	30 Day MovAve	7 day MovAve
Transferred Flow to Forest Grove {mgd}	2000	2041	2021
Forest Grove Collection System (Calc'd) {mgd}	2001	2042	2022
Forest Grove Total Inf (Calc'd) {mgd}	2002	2055	2035
CBOD from Collection System (Calc) {ppd}	2200	2220	2230
TSS from Collection System (Calc) {ppd}	2202	2222	2232
COD from Collection System (Calc) {ppd}	2201	2221	2231
TP from Collection System (Calc) {ppd}	2206	2226	2236
OP from Collection System (Calc) {ppd}	2205	2225	2235
TKN from Collection System (Calc) {ppd}	2204	2224	2234
NH3 from Collection System (Calc) {ppd}	2203	2223	2233
Residential CBOD Load {ppd}	2403	2413	2423
Residential TSS Load {ppd}	2402	2412	2422
Residential COD Load {ppd}	2401	2411	2421
Industry Flow {mgd}	2300		
Industry COD {ppd}	2301		
Industry TSS {ppd}	2302		
Industry CBOD {ppd}	2303		

9 Appendix C: Historic Flow and Load Plots (all plots are prior to flow or load transfers between facilities)

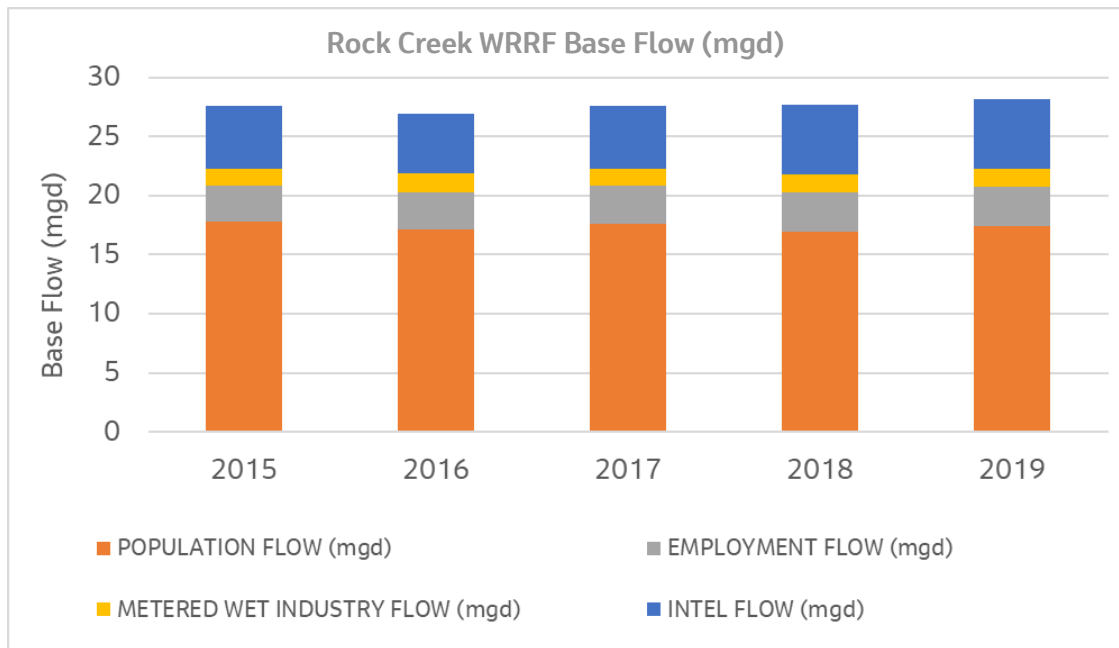


Figure C1. Rock Creek WRRF Base Flow (Population Flow = flow associated with residential services and associated population; Employment Flow = flow associated with commercial and non-metered industrial services and associated number of employees)

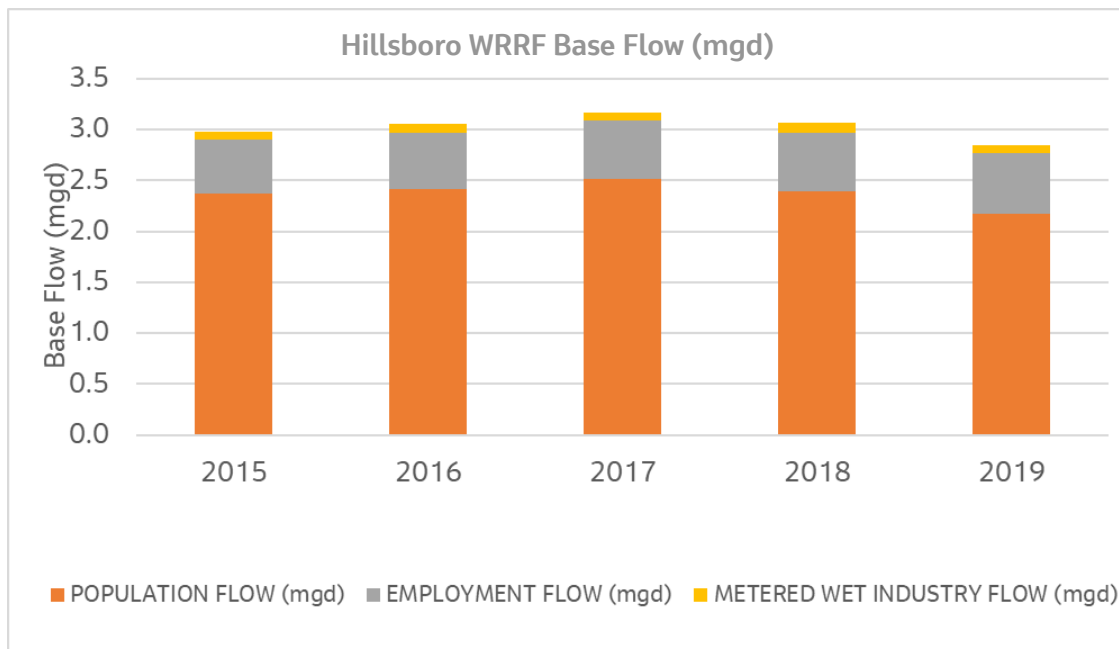


Figure C2. Hillsboro WRRF Base Flow

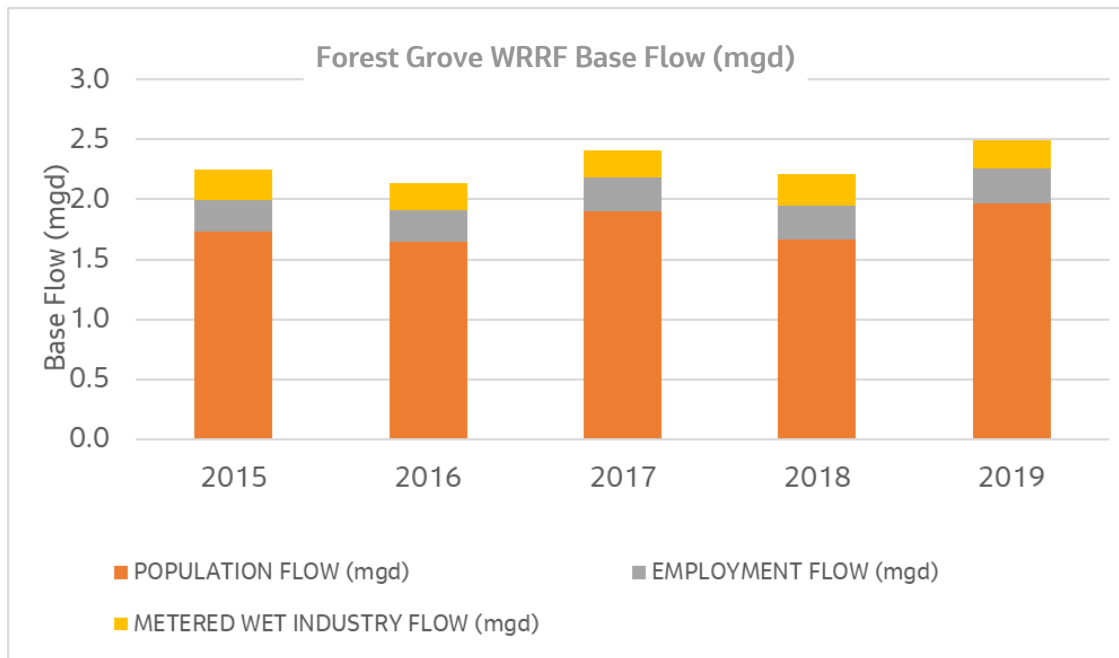


Figure C3. Forest Grove WRRF Base Flow

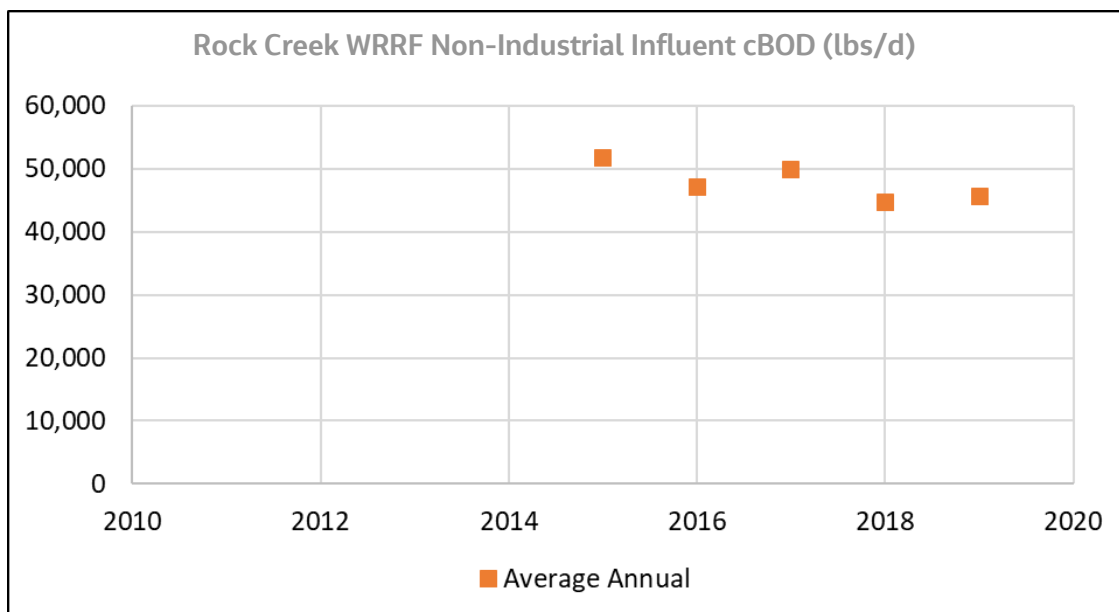


Figure C4. Rock Creek WRRF Non-Industrial Influent cBOD Average Annual Load (pounds/day→ lbs/d, Non-Industrial Load = total load minus metered wet industries)

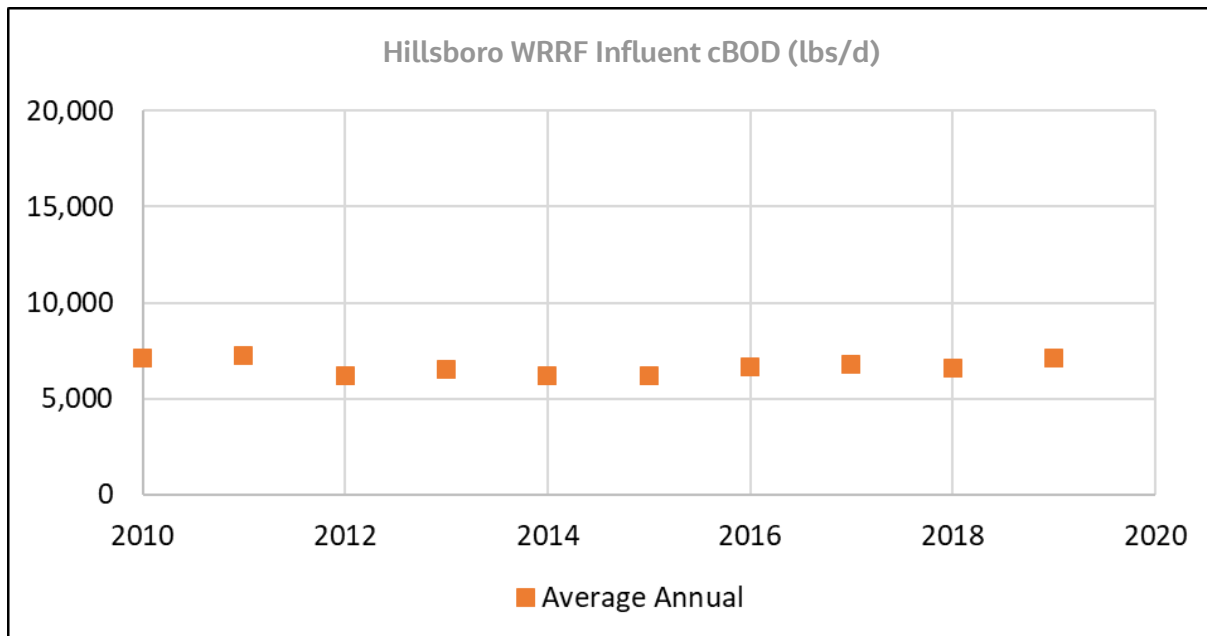


Figure C5. Hillsboro WRRF Influent cBOD Average Annual Load (lbs/d, Influent Load = total load from all services both industry and non-industry)

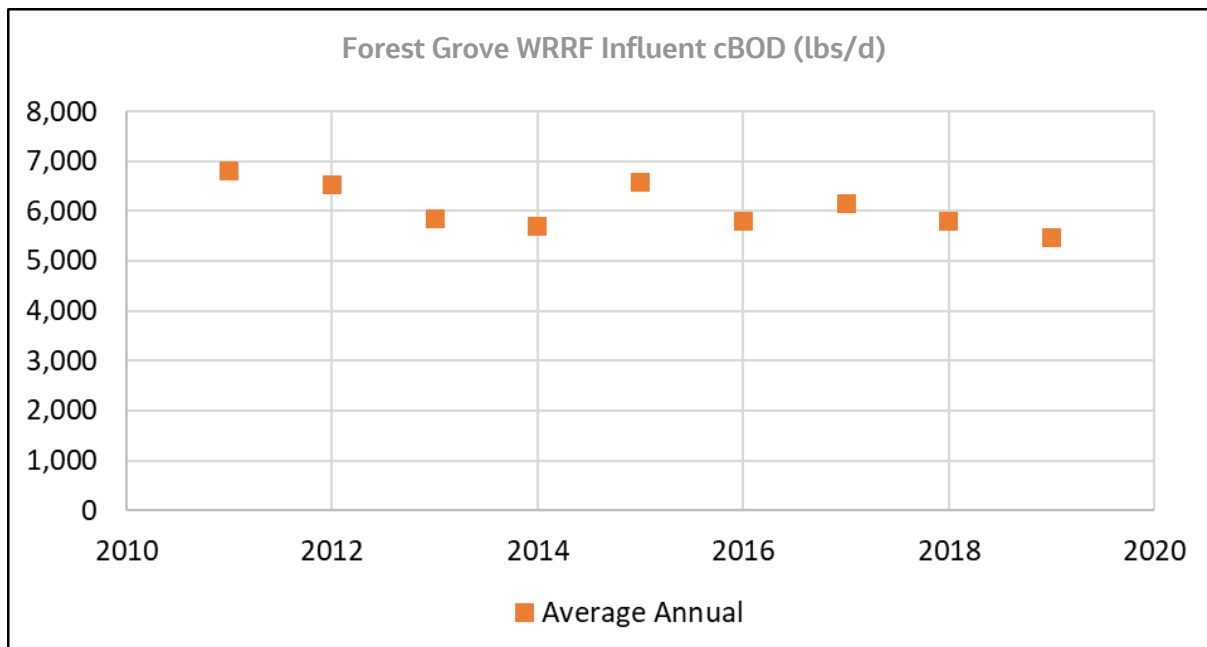


Figure C6. Forest Grove WRRF Influent cBOD Average Annual Load (lbs/d)

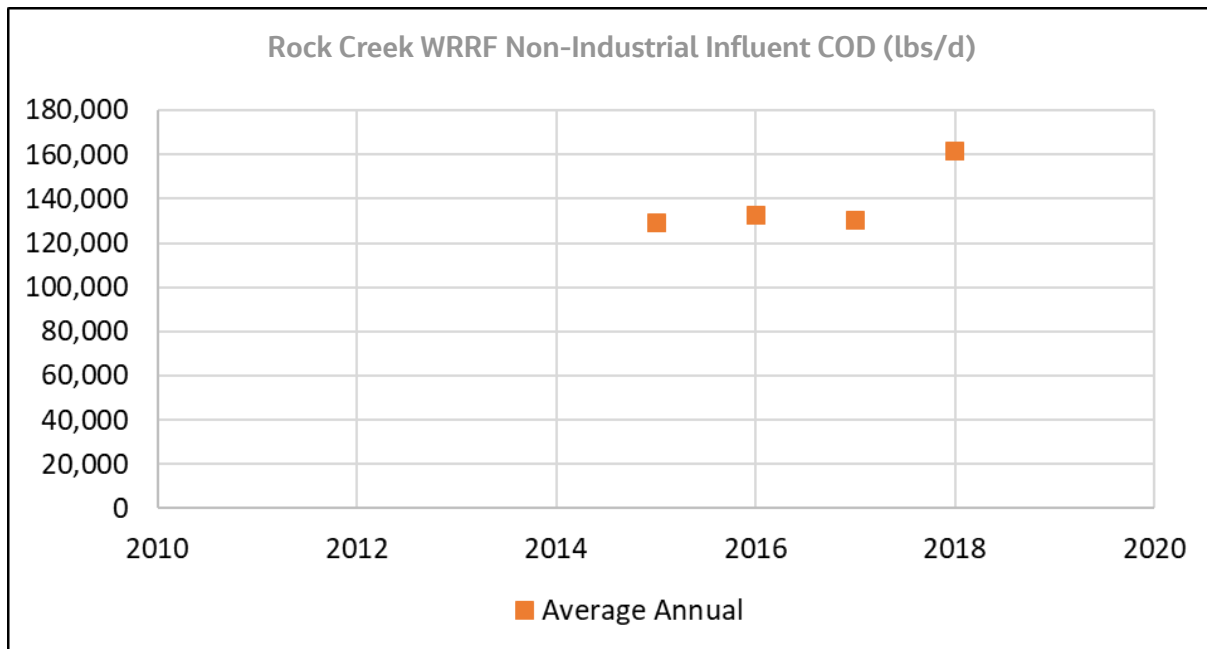


Figure C7. Rock Creek WRRF Non-Industrial Influent COD Average Annual Load (lbs/d)

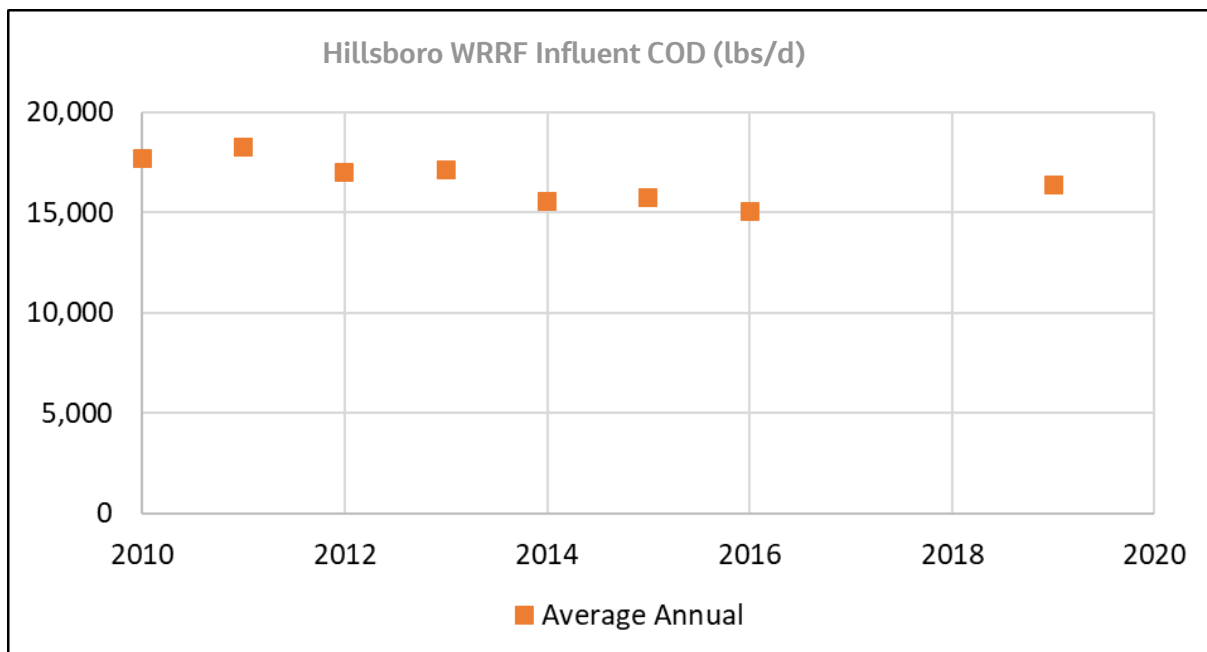


Figure C8. Hillsboro WRRF Influent COD Average Annual Load (lbs/d)

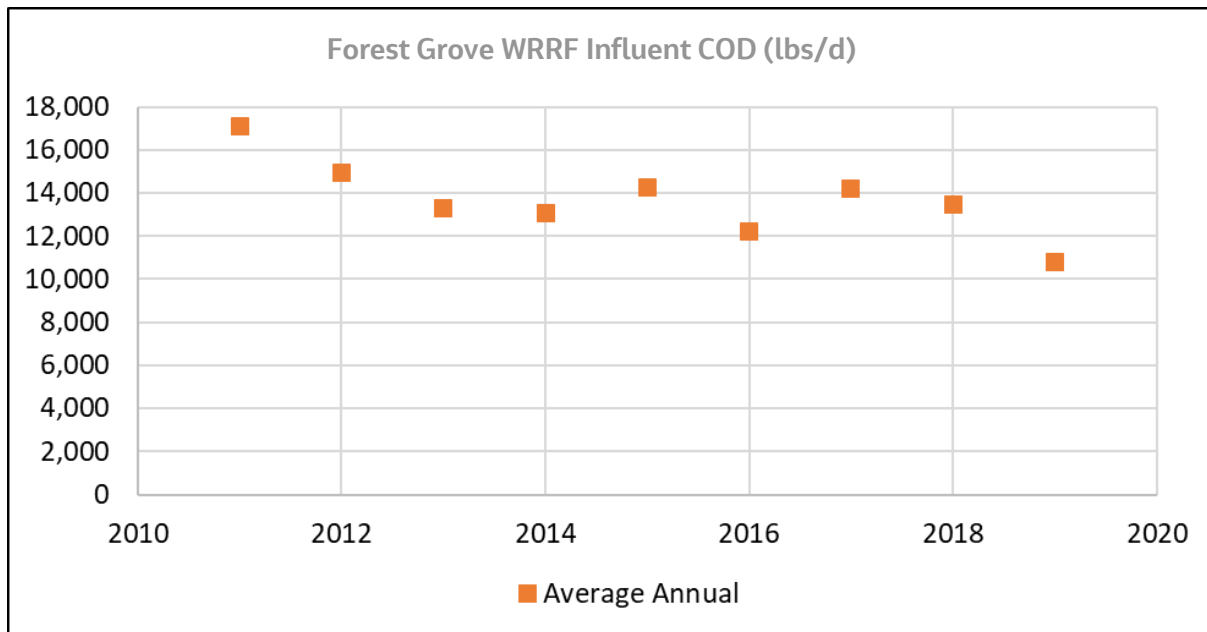


Figure C9. Forest Grove WRRF Influent COD Average Annual Load (lbs/d)

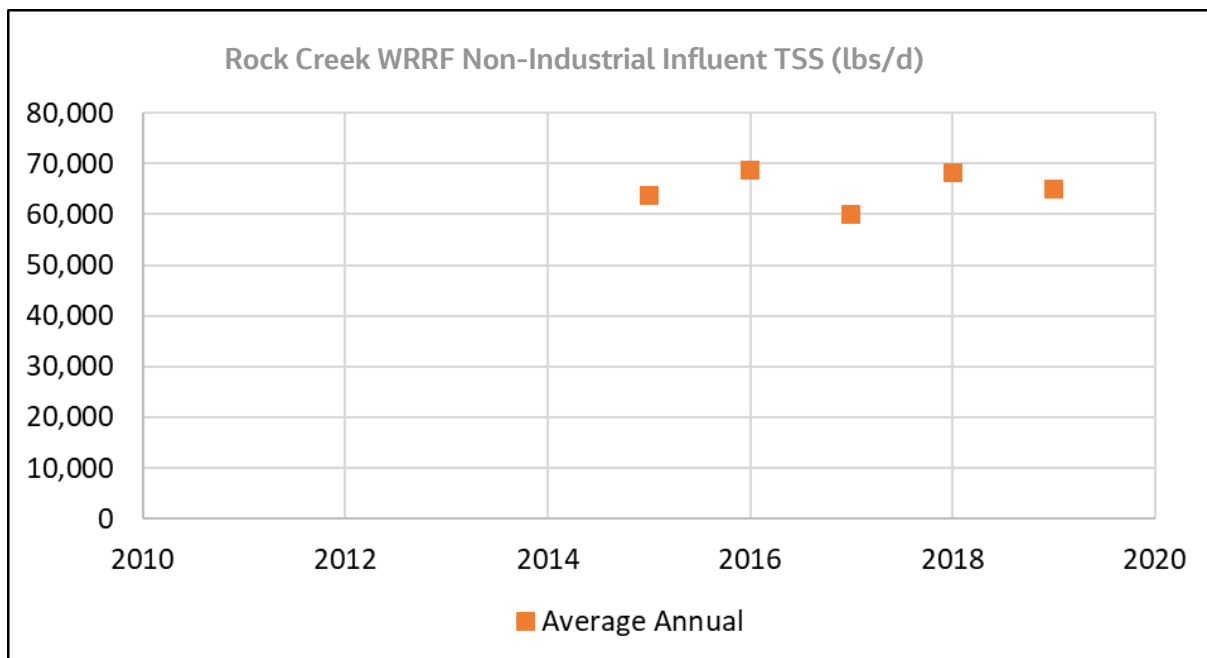


Figure C10. Rock Creek WRRF Non-Industrial Influent TSS Average Annual Load (lbs/d)

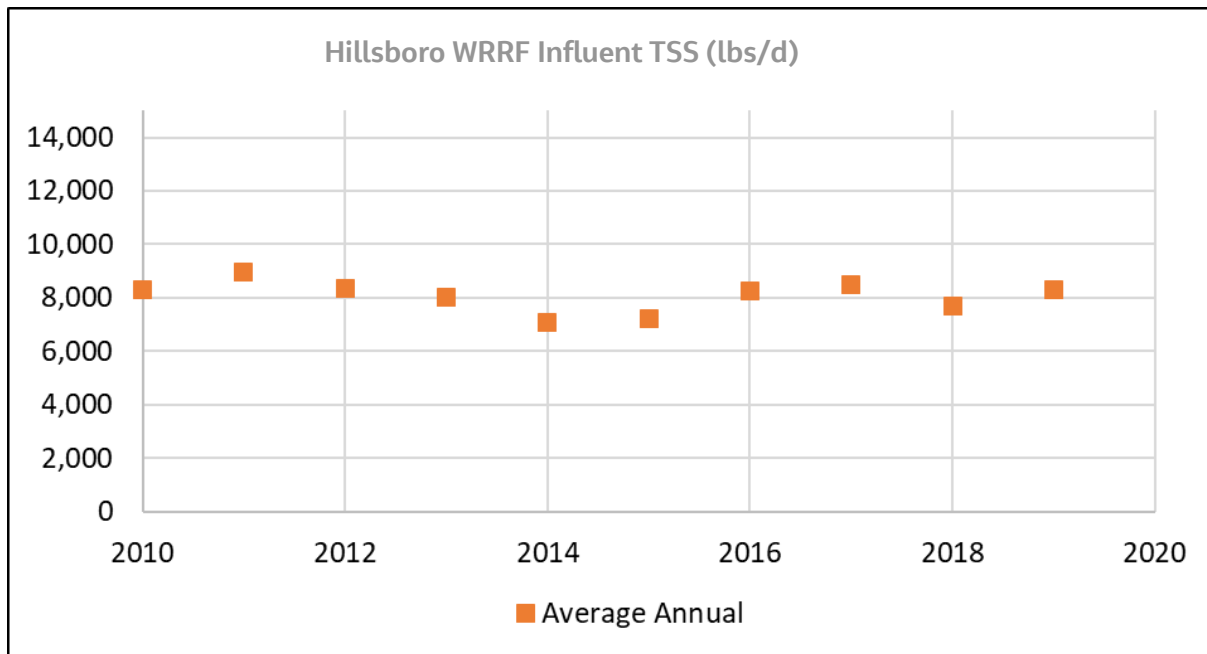


Figure C11. Hillsboro WRRF Influent TSS Average Annual Load (lbs/d)

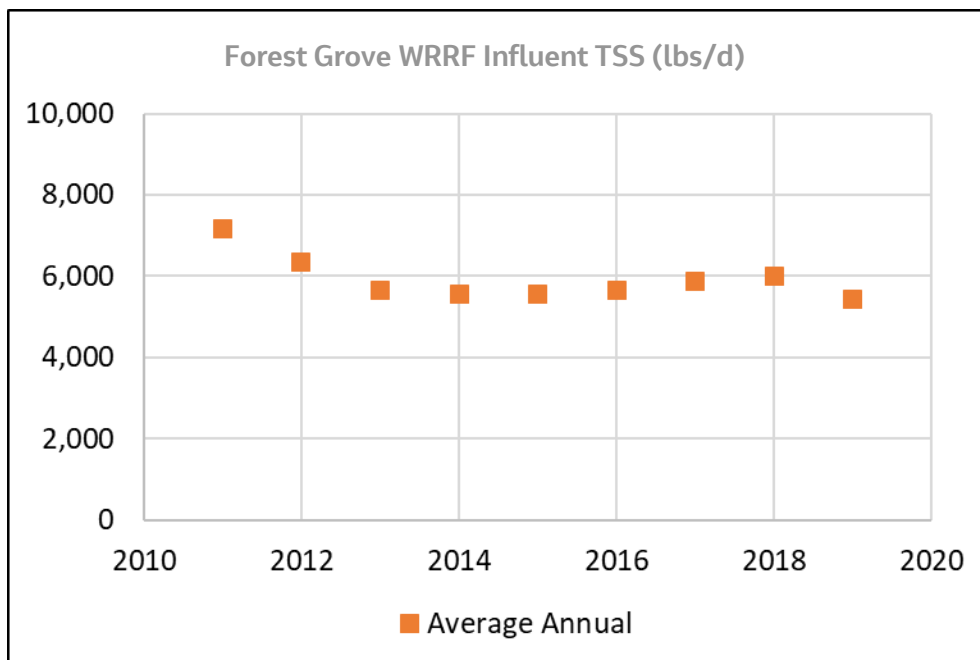


Figure C12. Forest Grove WRRF Influent TSS Average Annual Load (lbs/d)

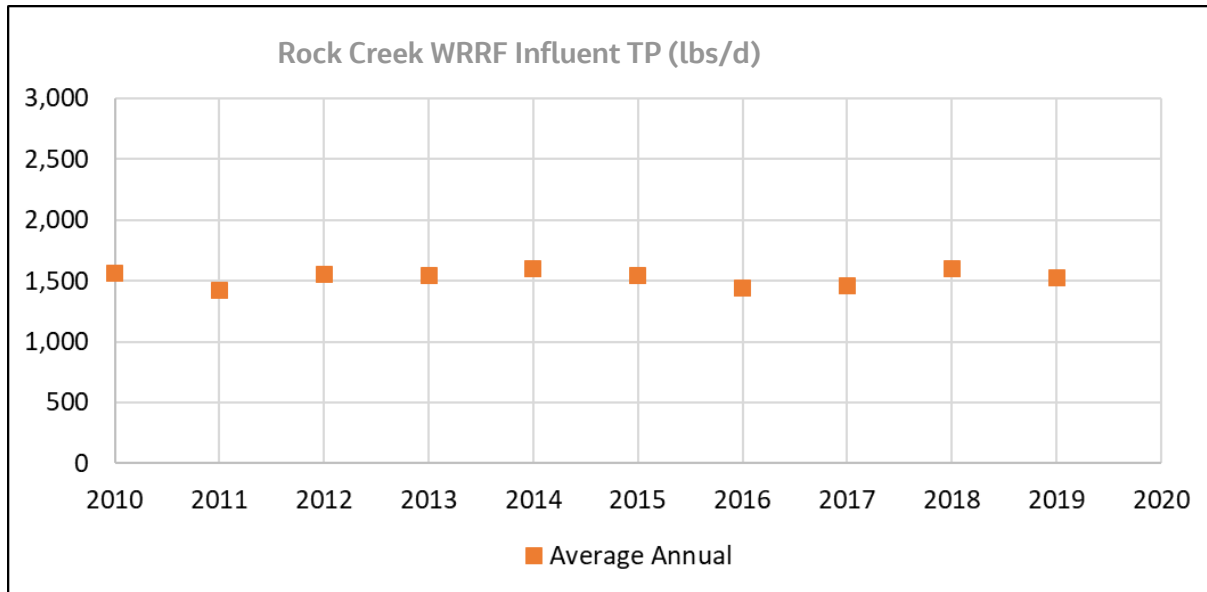


Figure C13. Rock Creek WRRF Influent TP Average Annual Load (lbs/d)

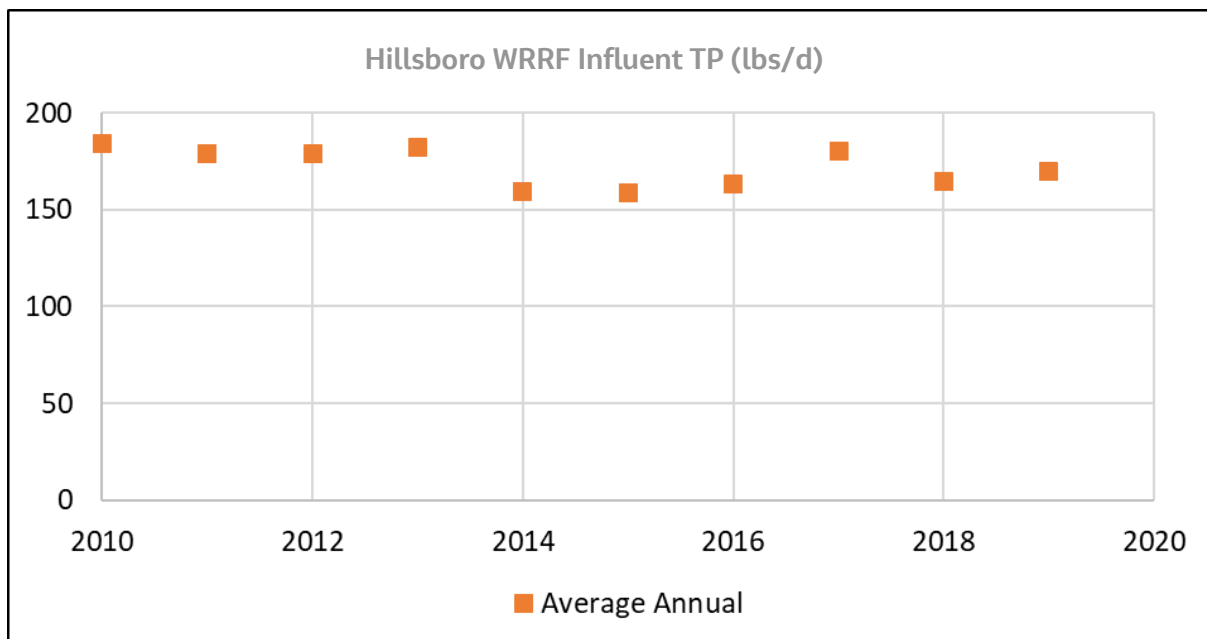


Figure C14. Hillsboro WRRF Influent TP Average Annual Load (lbs/d)

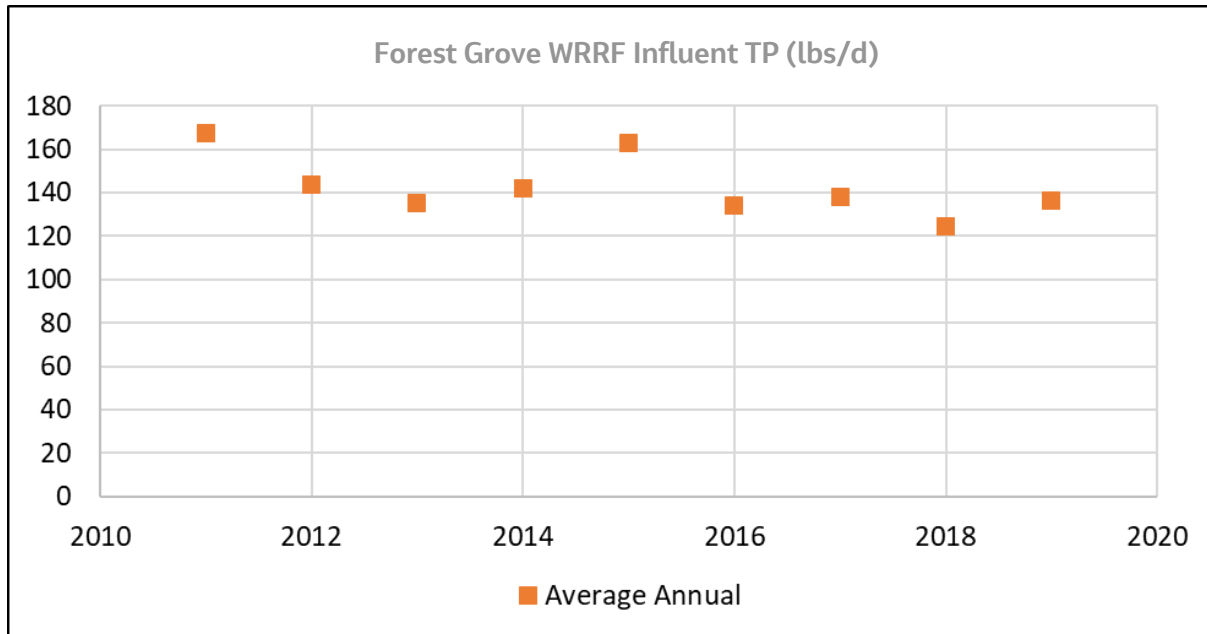


Figure C15. Forest Grove WRRF Influent TP Average Annual Load (lbs/d)

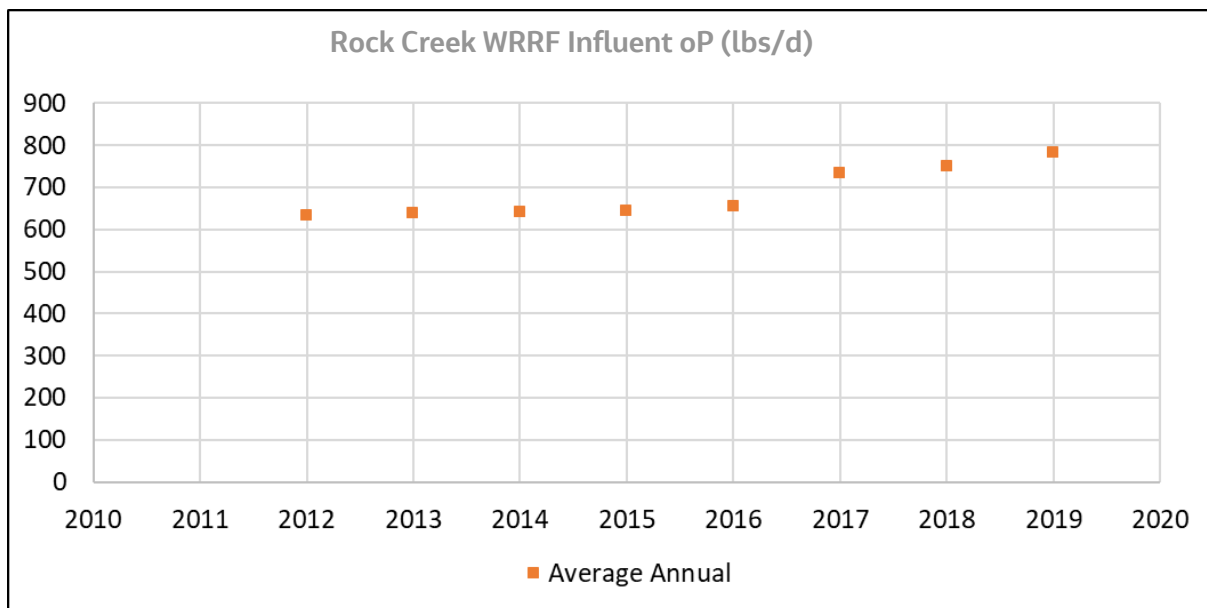


Figure C16. Rock Creek WRRF Influent oP Average Annual Load (lbs/d)

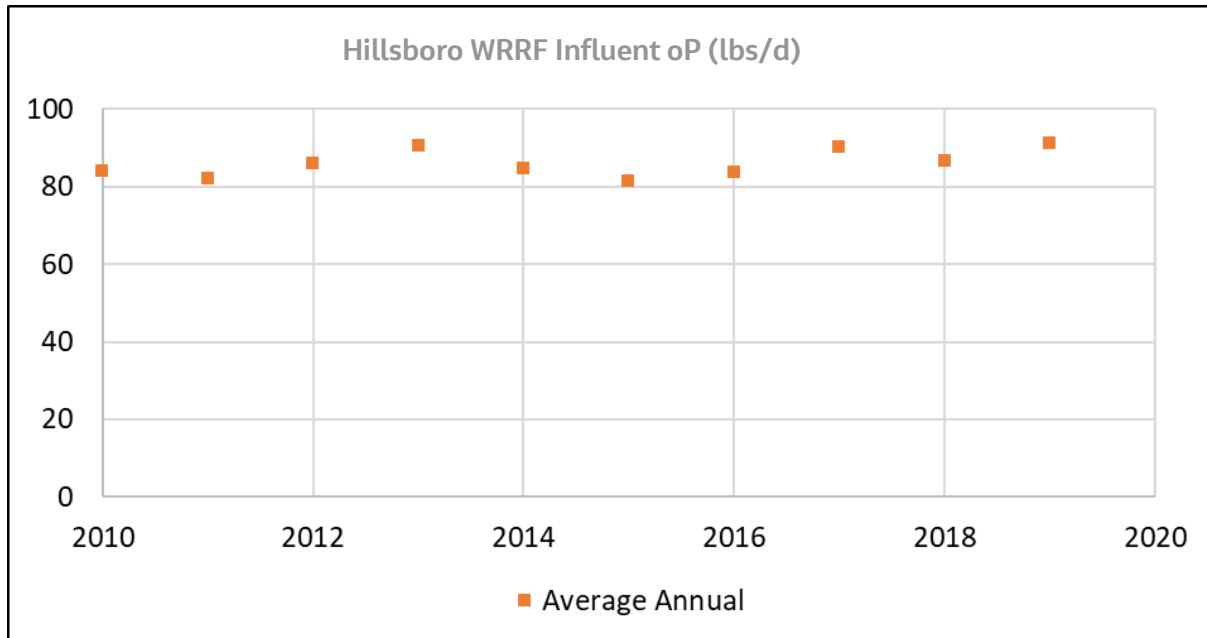


Figure C17. Hillsboro WRRF Influent oP Average Annual Load (lbs/d)

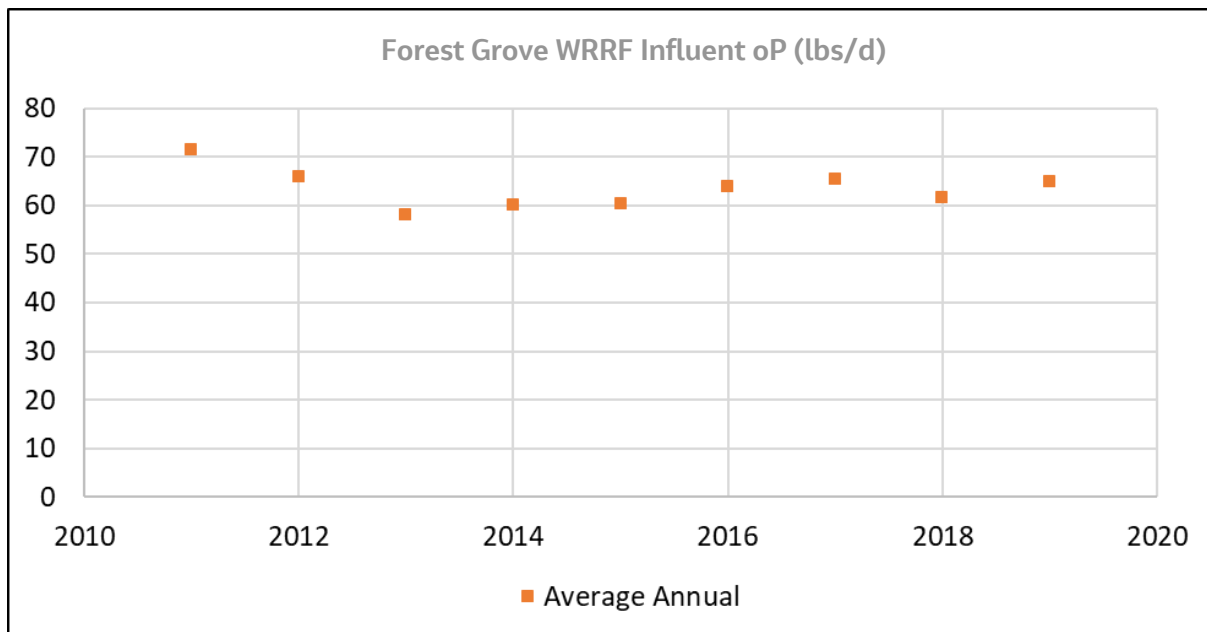


Figure C17. Forest Grove WRRF Influent oP Average Annual Load (lbs/d)

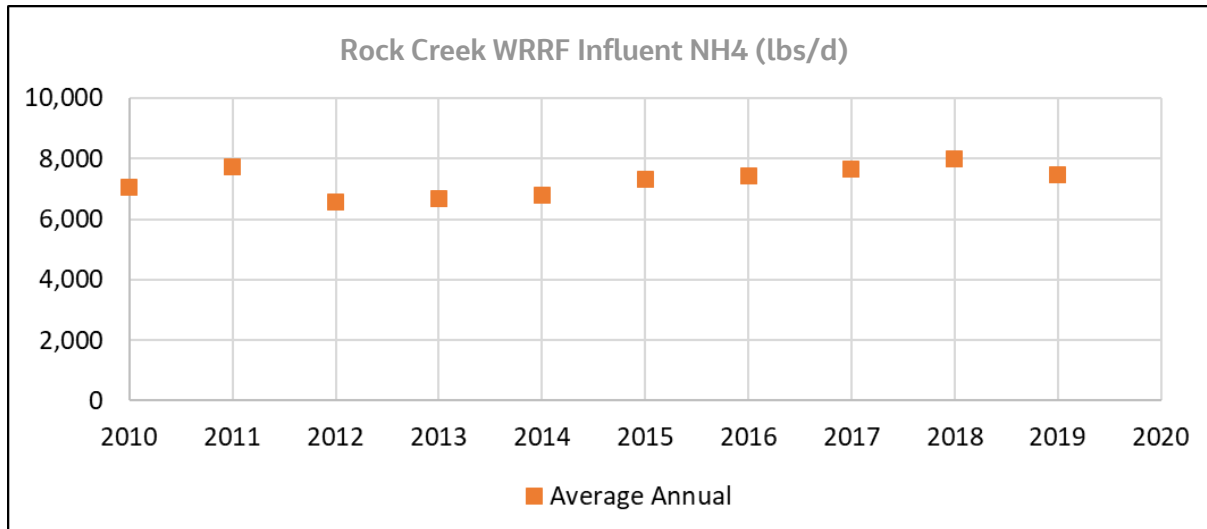


Figure C18. Rock Creek WRRF Influent NH₄ Average Annual Load (lbs/d)

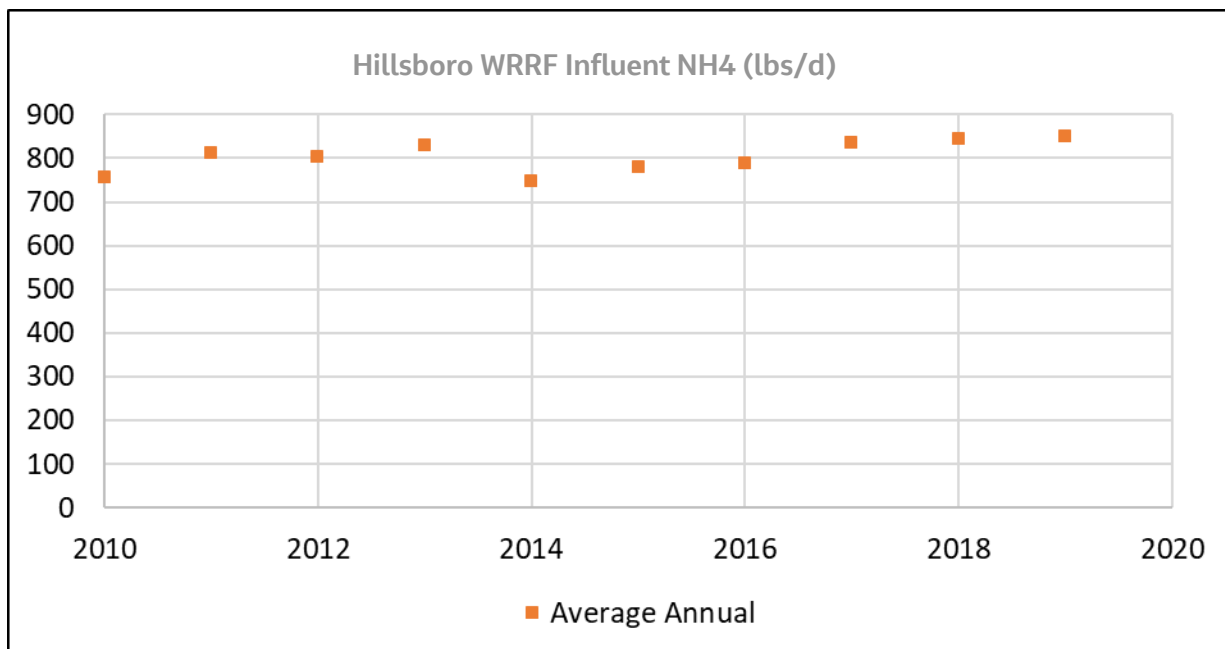


Figure C19. Hillsboro WRRF Influent NH₄ Average Annual Load (lbs/d)

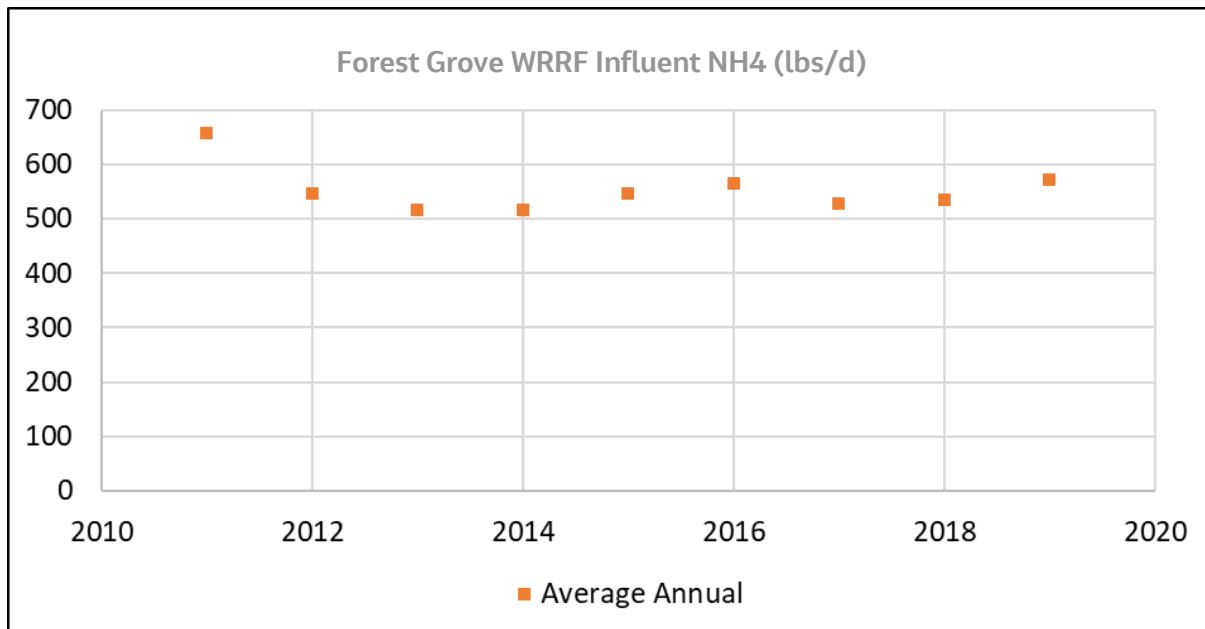


Figure C20. Forest Grove WRRF Influent NH₄ Average Annual Load (lbs/d)

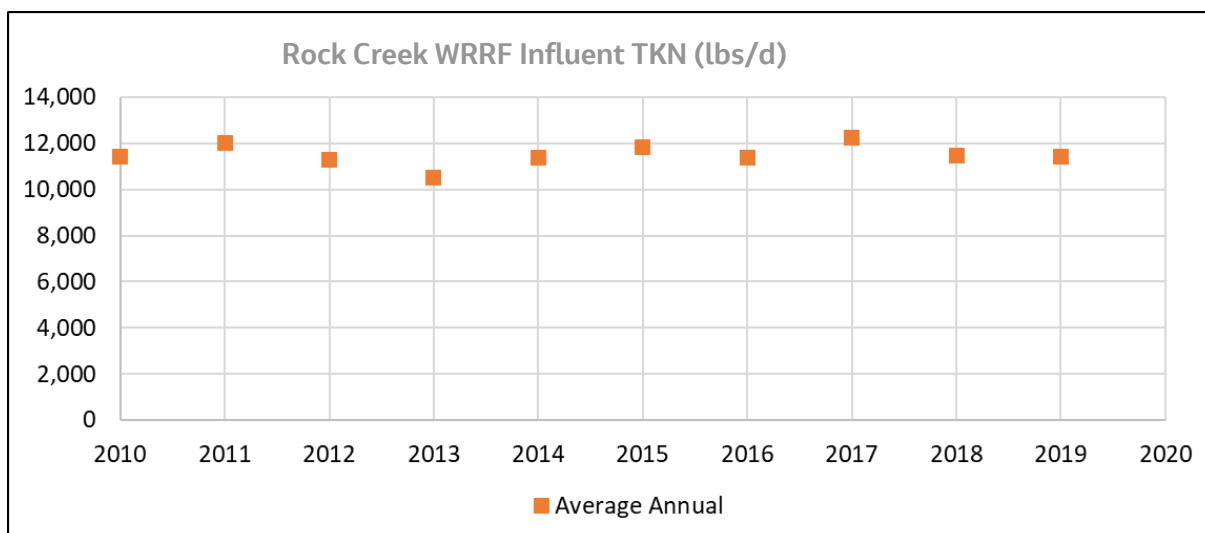


Figure C21. Rock Creek WRRF Influent TKN Average Annual Load (lbs/d)

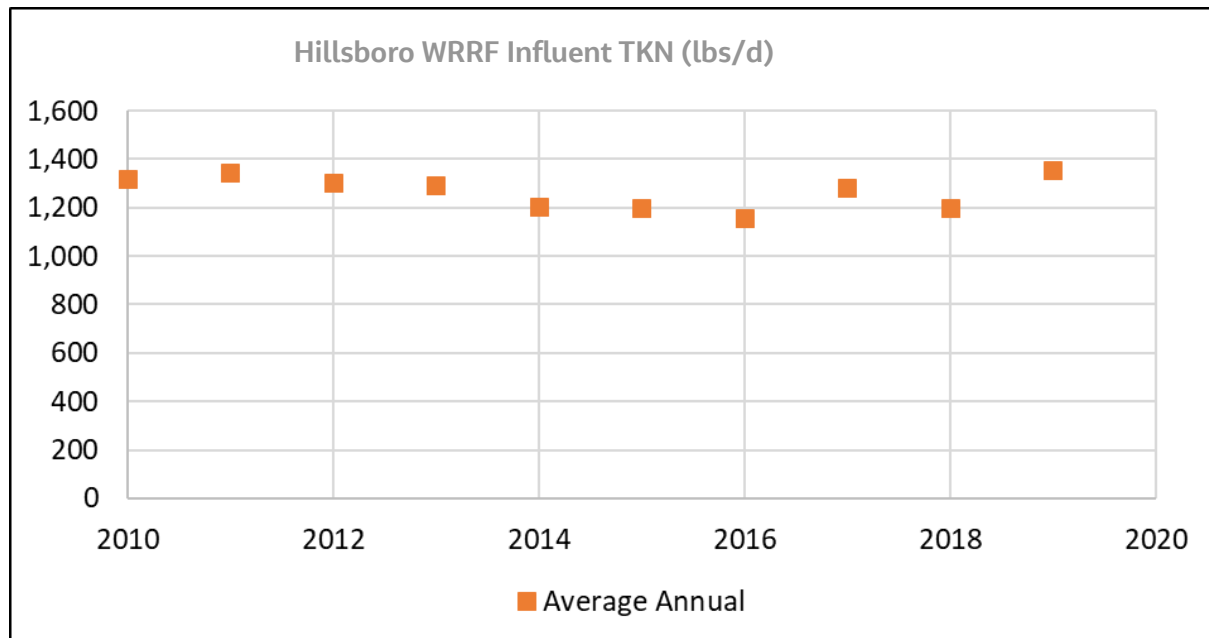


Figure C22. Hillsboro WRRF Influent TKN Average Annual Load (lbs/d)

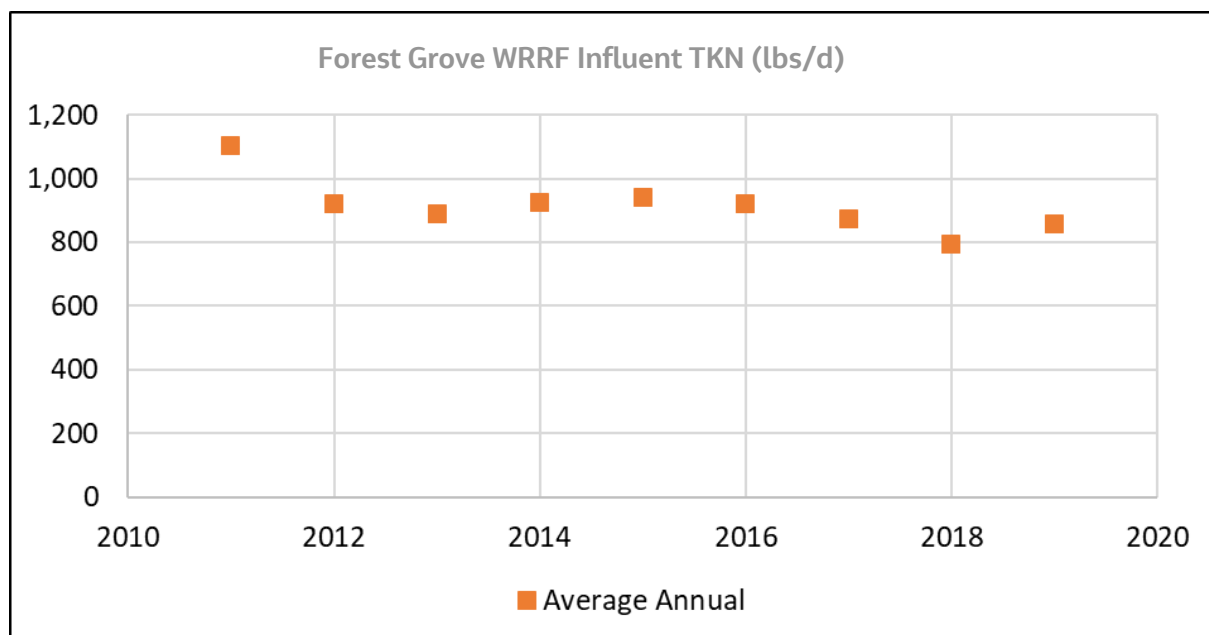


Figure C23. Forest Grove WRRF Influent TKN Average Annual Load (lbs/d)

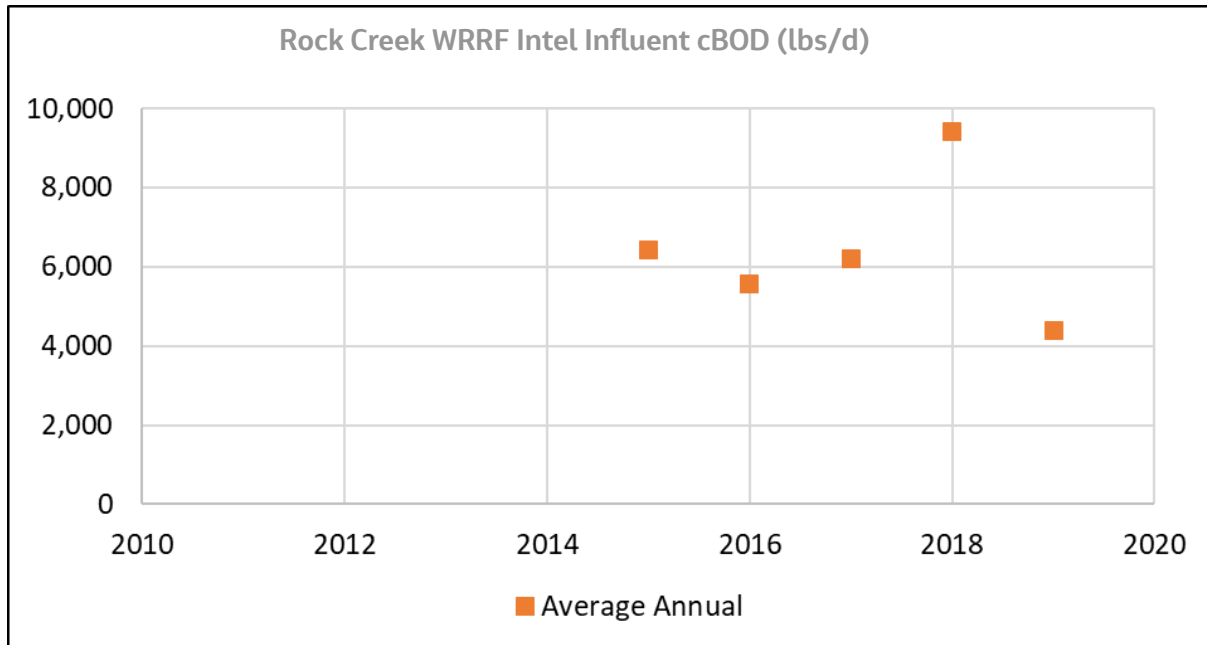


Figure C24. Rock Creek WRRF Intel Influent cBOD Average Annual Load (lbs/d)

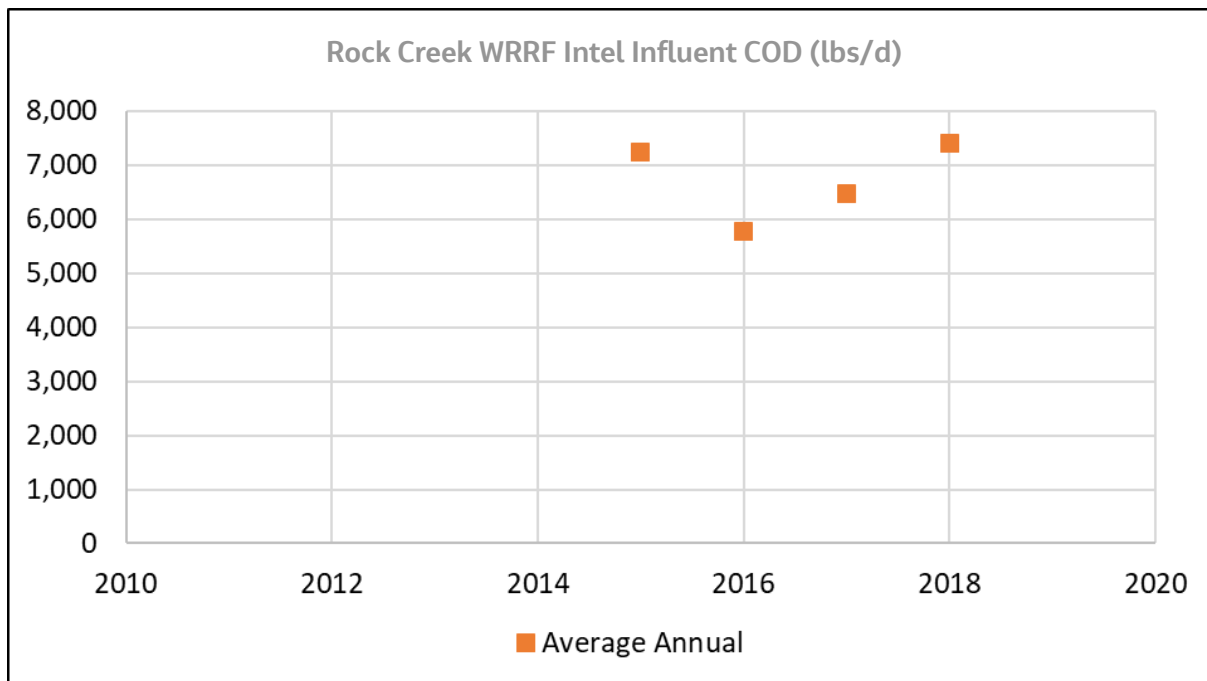


Figure C25. Rock Creek WRRF Intel Influent COD Average Annual Load (lbs/d)

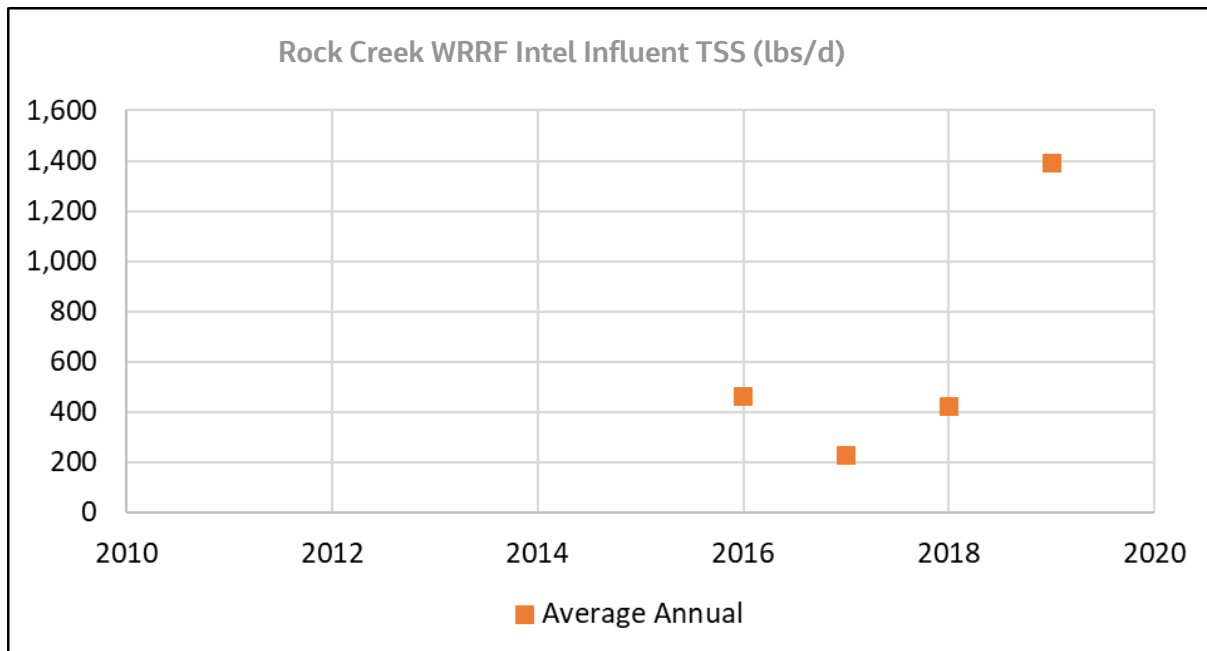


Figure C26. Rock Creek WRRF Intel Influent TSS Average Annual Load (lbs/d)

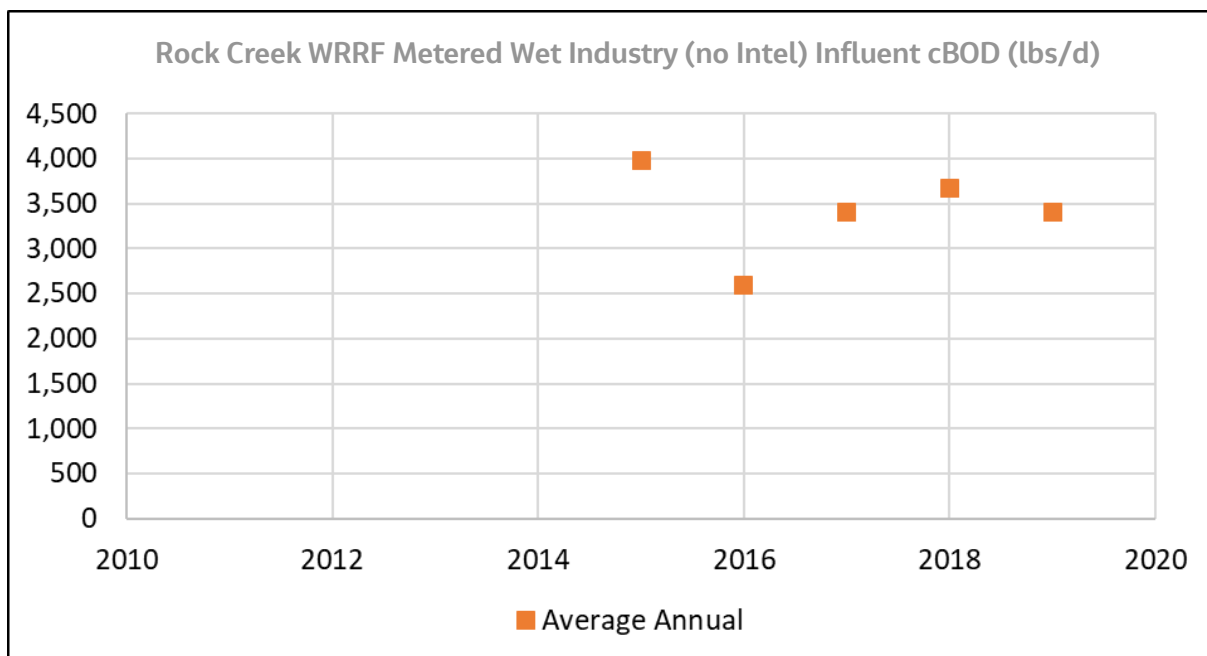


Figure C27. Rock Creek WRRF Metered Wet Industry (excludes Intel) Influent cBOD Average Annual Load (lbs/d)

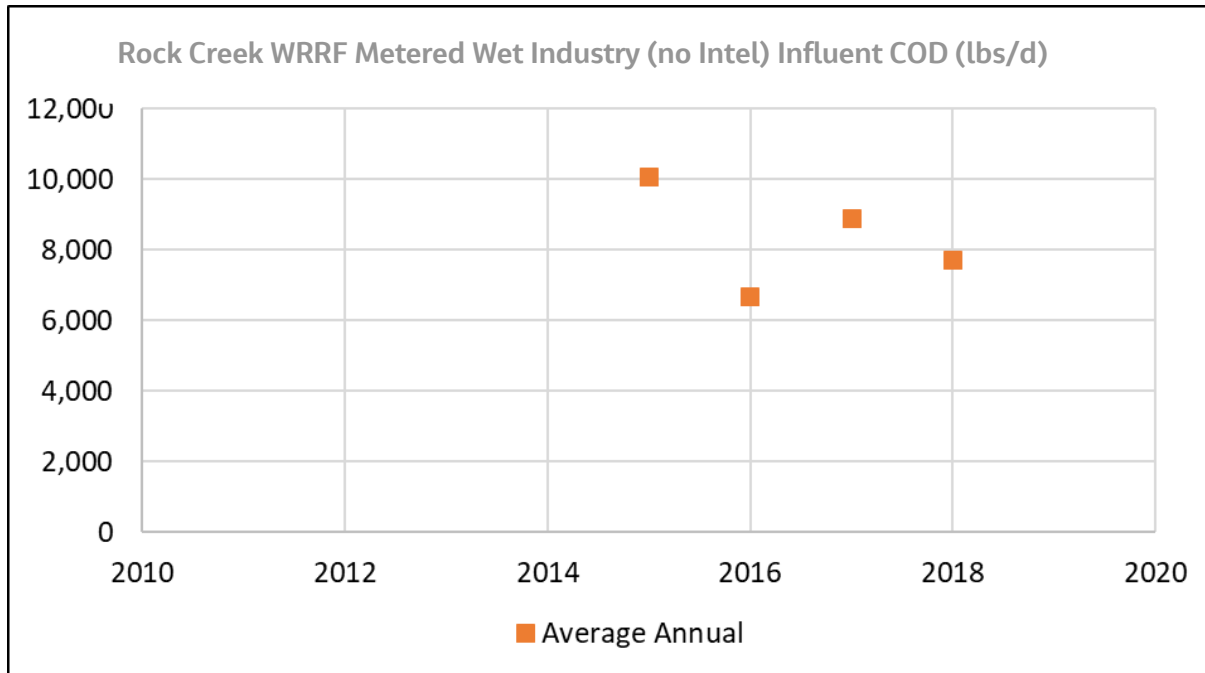


Figure C28. Rock Creek WRRF Metered Wet Industry (excludes Intel) Influent COD Average Annual Load (lbs/d)

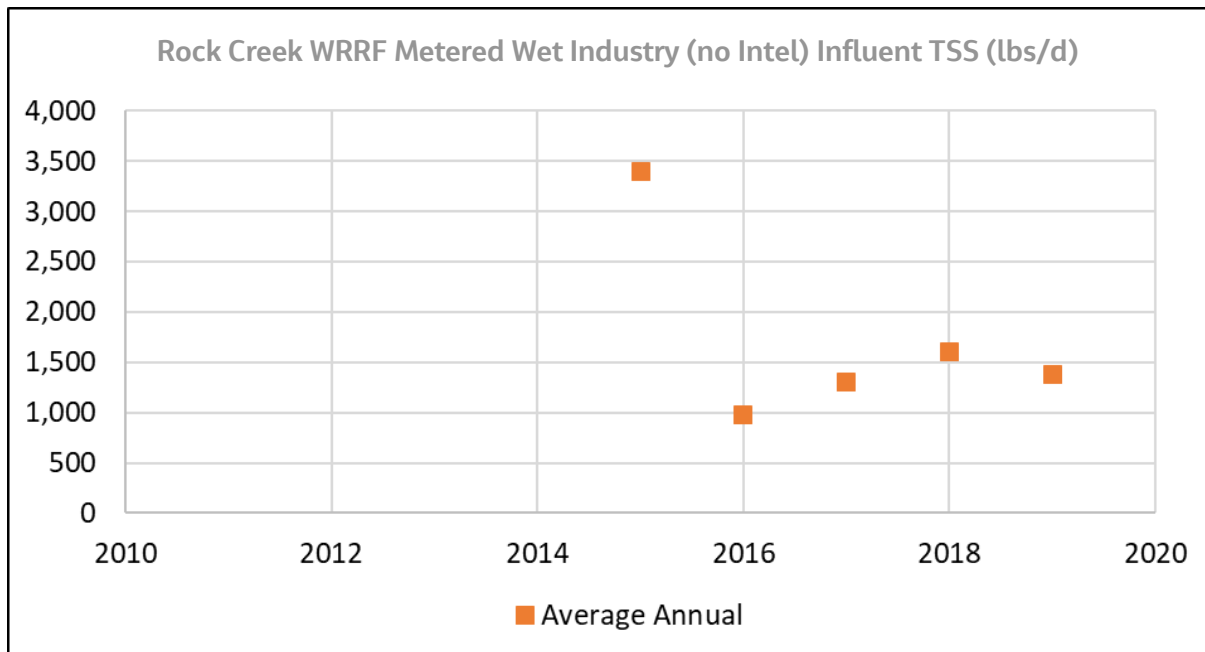


Figure C29. Rock Creek WRRF Metered Wet Industry (excludes Intel) Influent TDD Average Annual Load (lbs/d)

10 Appendix D: Oregon DEQ Wet Weather Flow Projection Methodology Charts

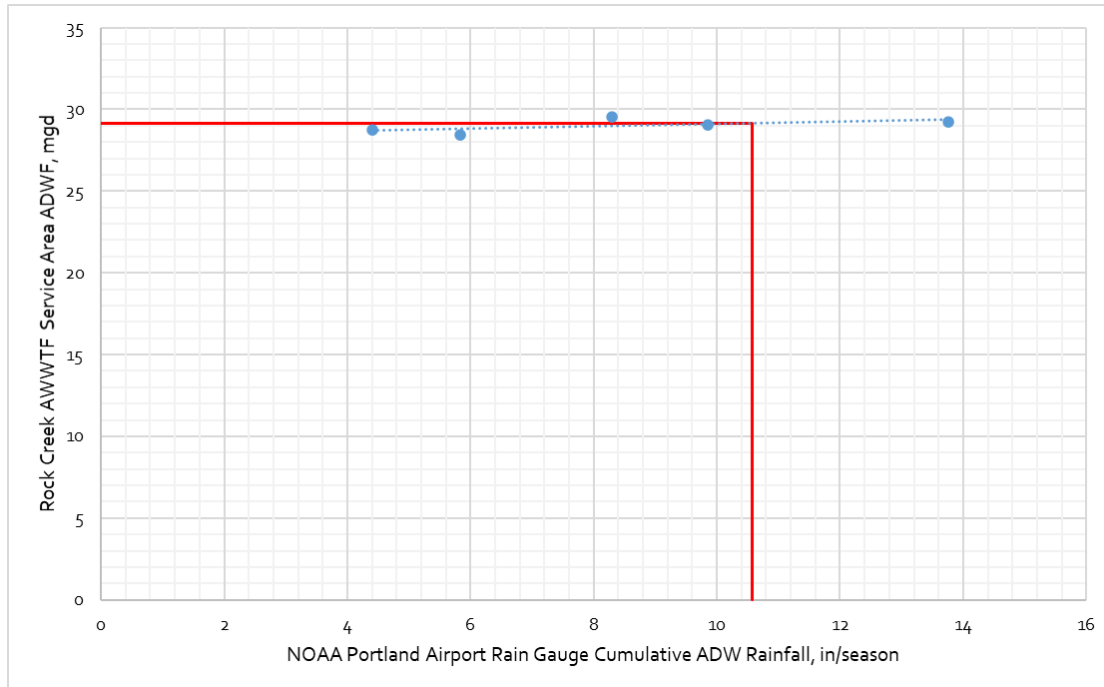


Figure D1. Rock Creek WRRF ADWF and Precipitation (29.15 mgd ADWF)

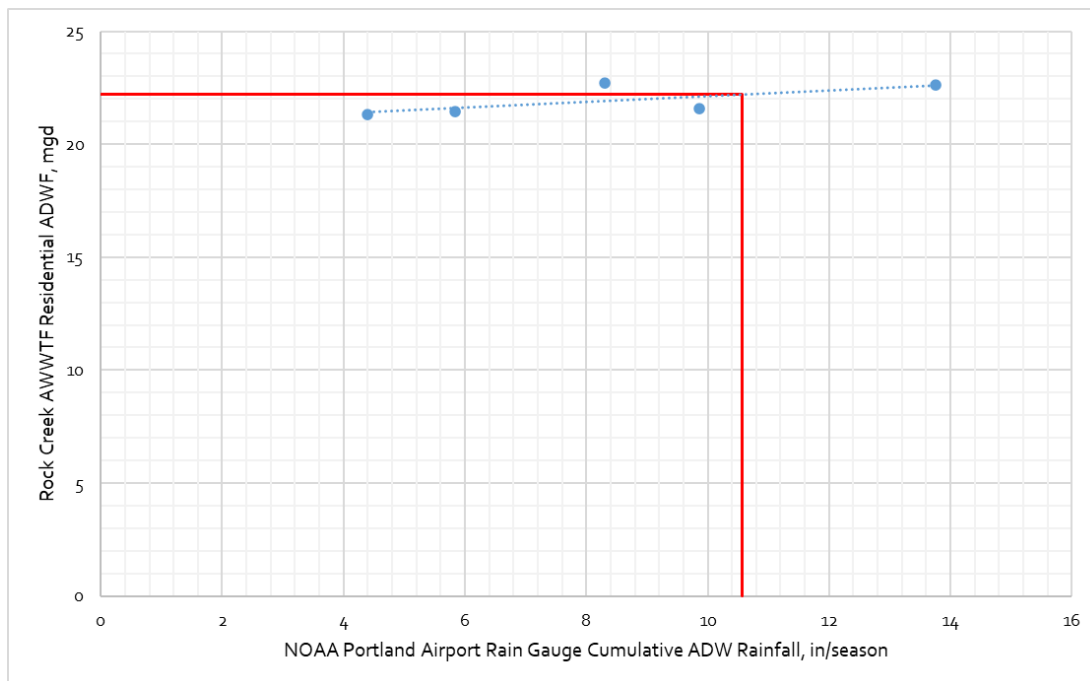


Figure D2. Rock Creek WRRF Non-Industrial ADWF and Precipitation (22.2 mgd ADWF)

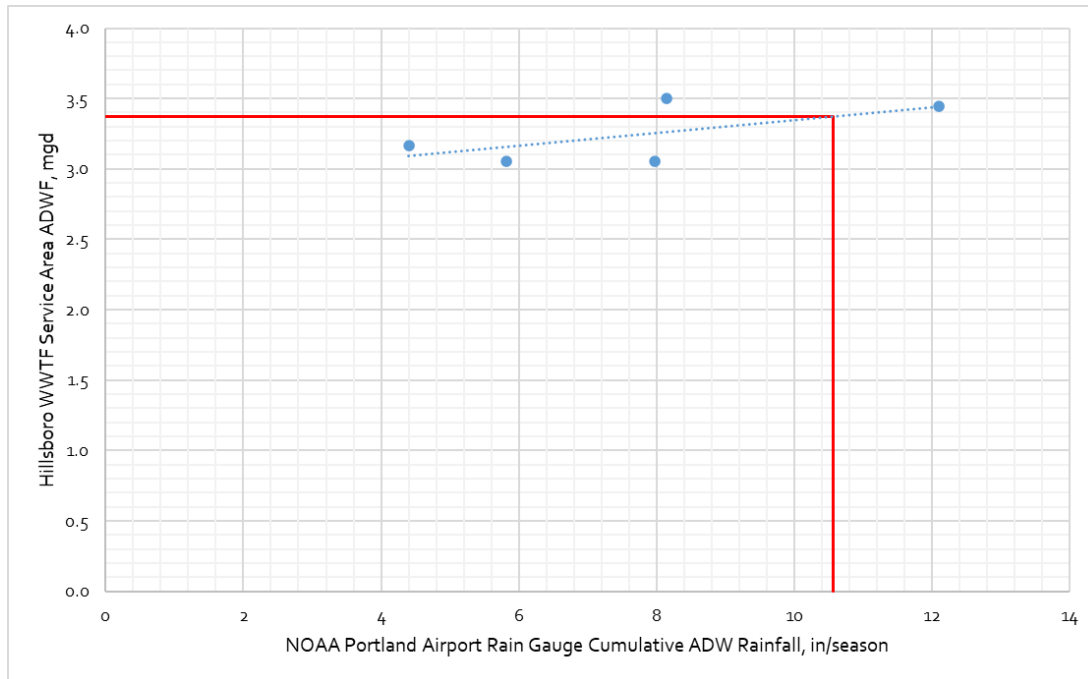


Figure D3. Hillsboro WRRF ADWF and Precipitation (3.37 mgd ADWF)

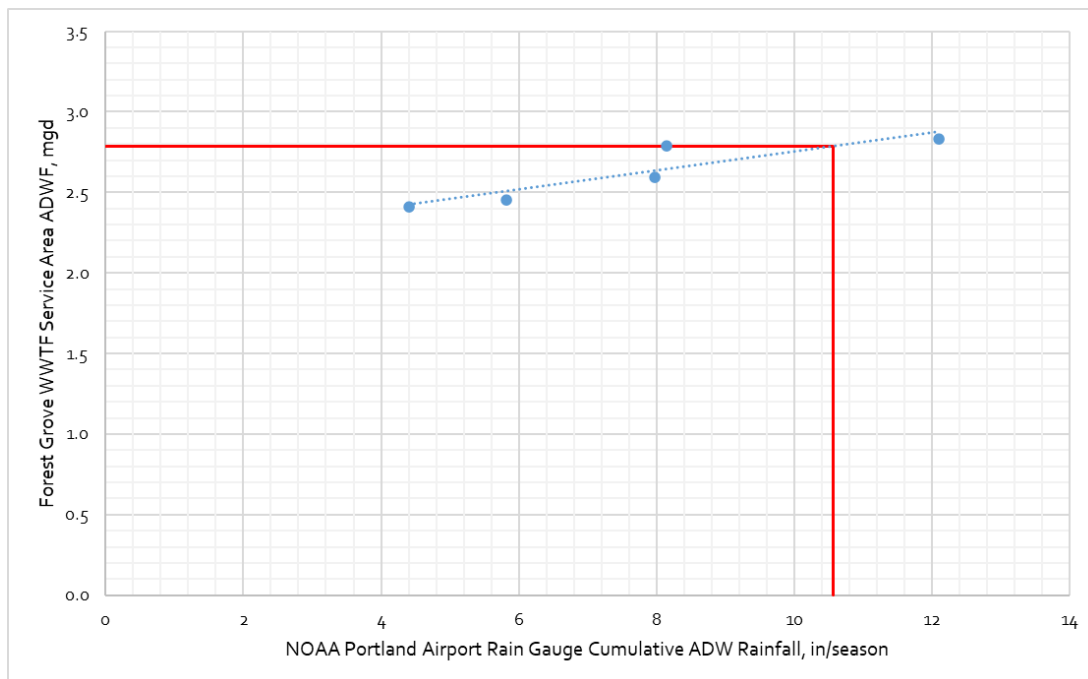


Figure D4. Forest Grove WRRF ADWF and Precipitation (2.78 mgd ADWF)

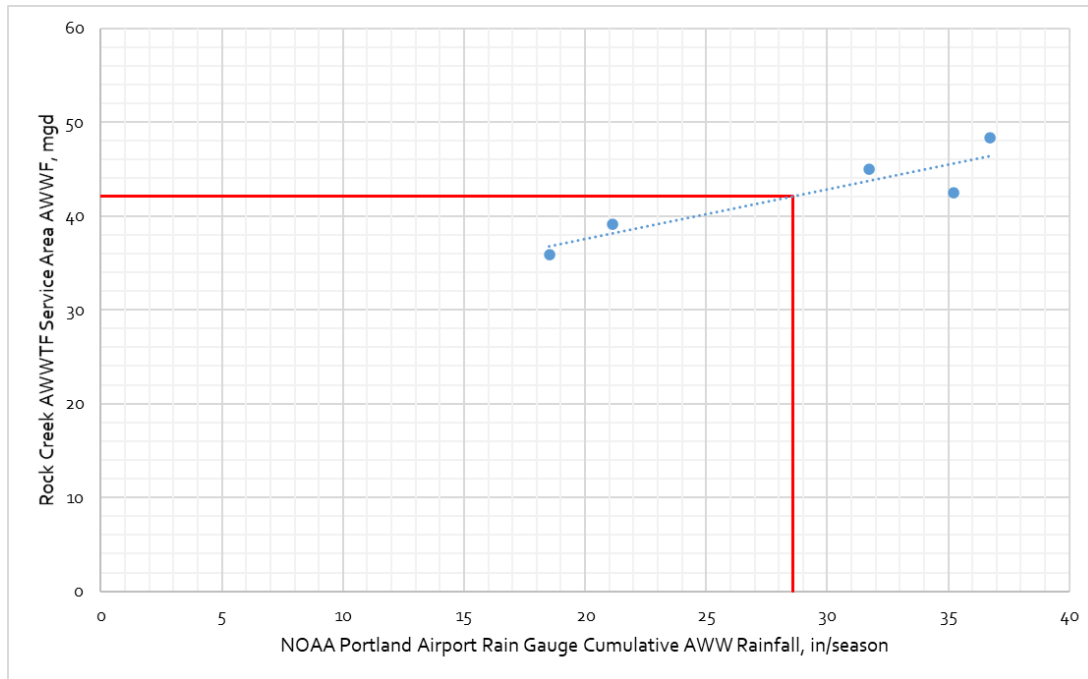


Figure D5. Rock Creek WRRF AWWF and Precipitation (42.12 mgd AWWF)

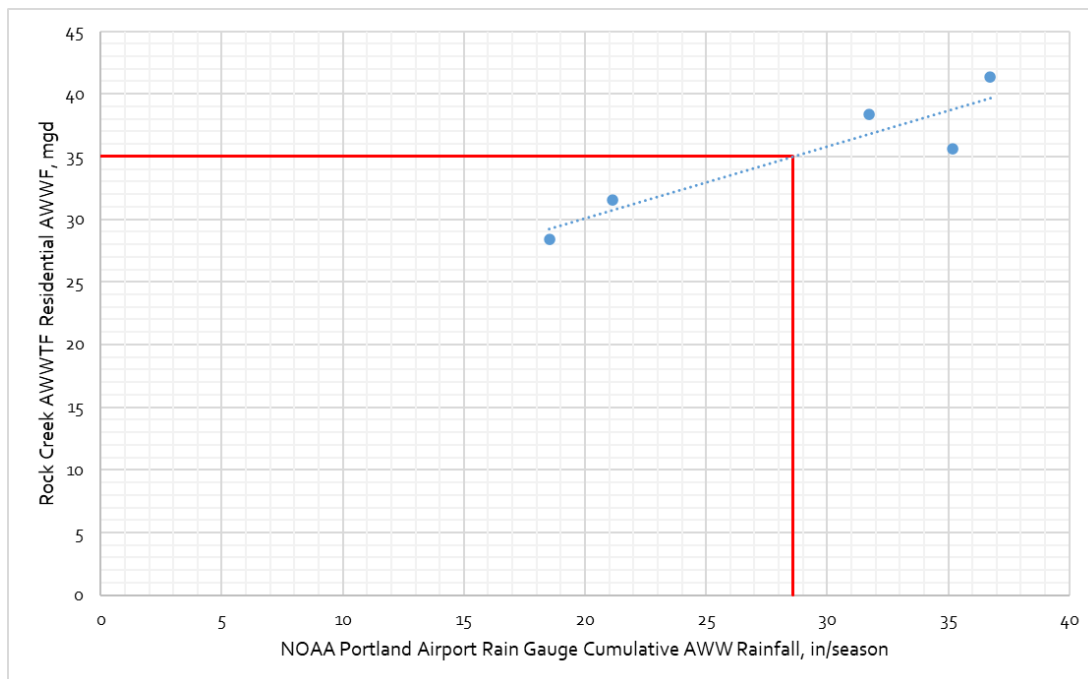


Figure D6. Rock Creek WRRF Non-Industrial AWWF and Precipitation (35.5 mgd AWWF)

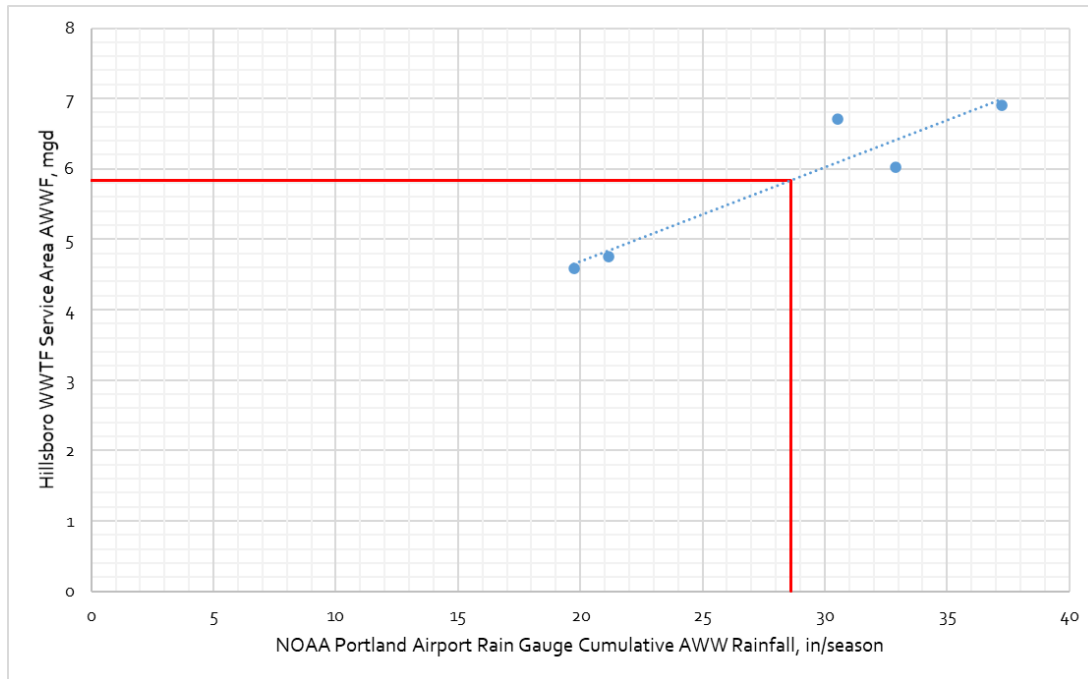


Figure D7. Hillsboro WRRF AWWF and Precipitation (5.89 mgd AWWF)

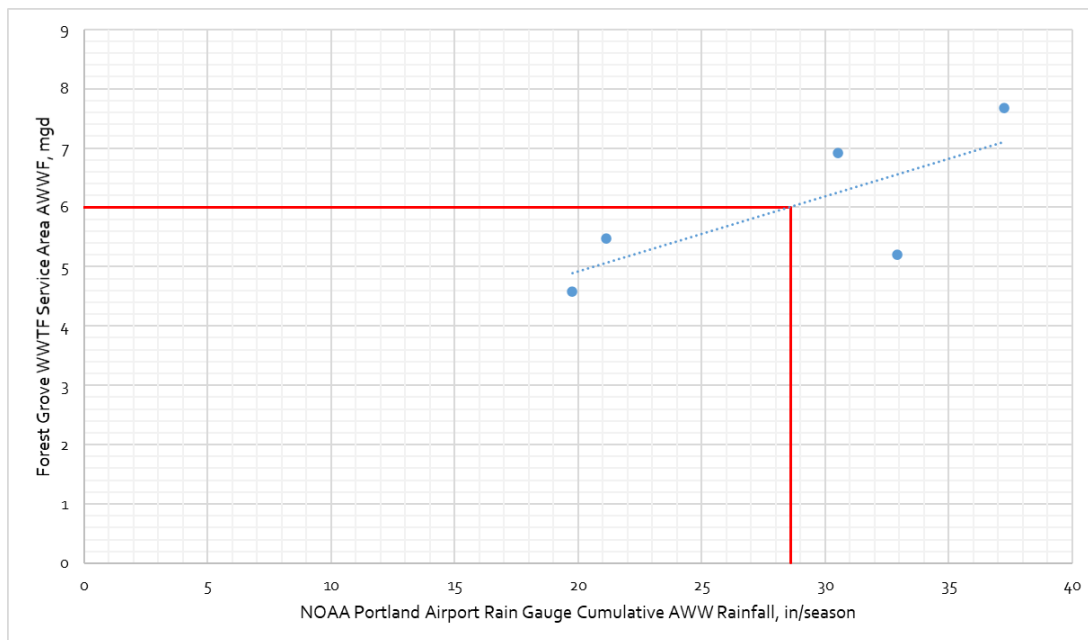


Figure D8. Forest Grove WRRF AWWF and Precipitation (6.01 mgd AWWF)

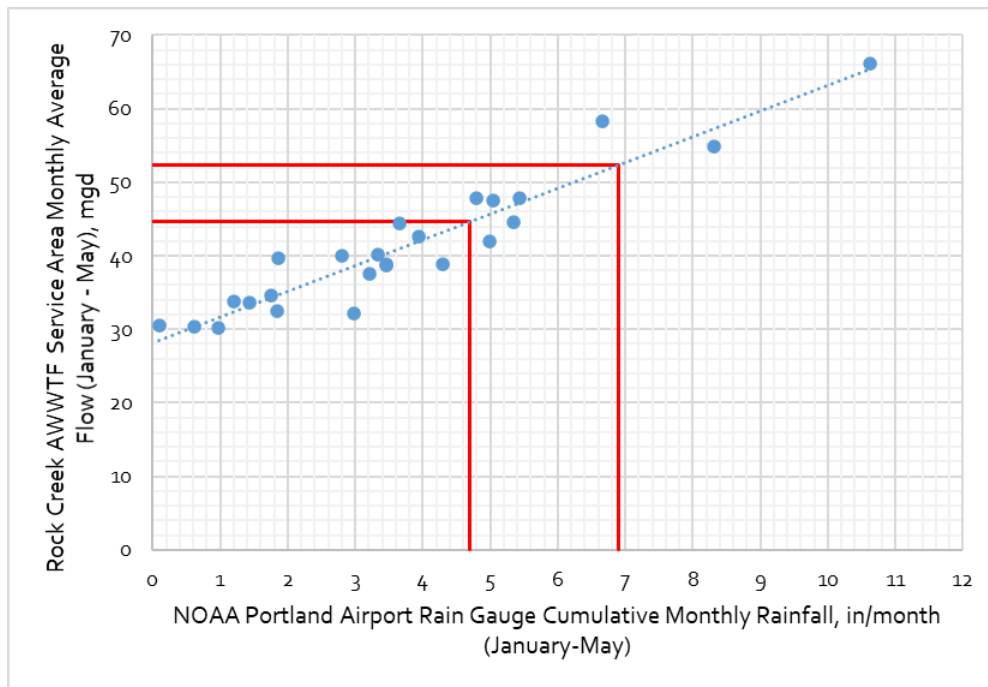


Figure D9. Rock Creek WRRF MMDW and MMWW Flow and Precipitation (44.67 mgd MMDW and 52.37 mgd MMWW)

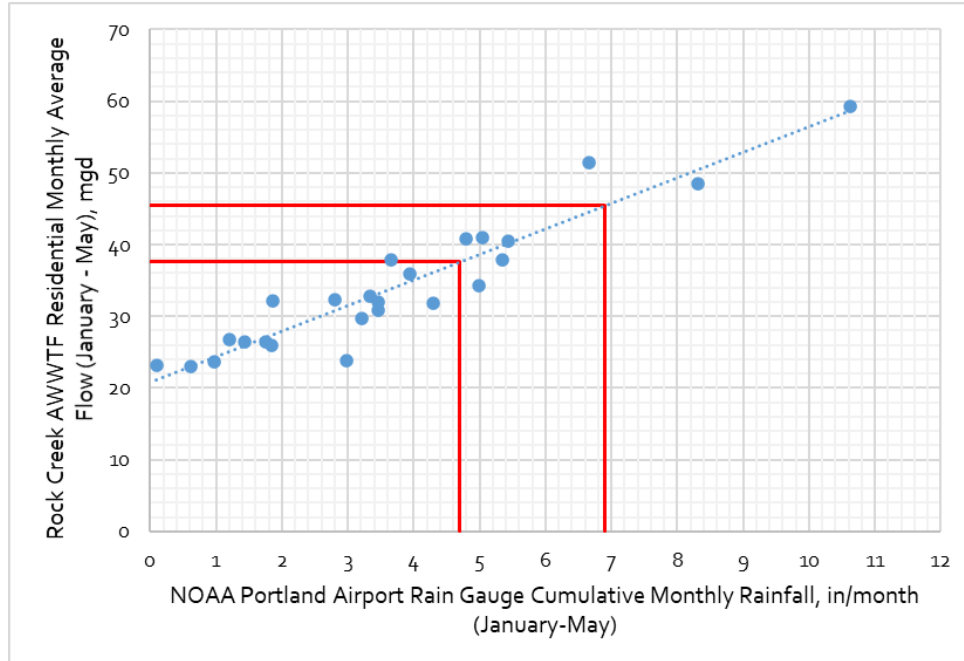


Figure D10. Rock Creek WRRF Non-Industrial MMDW and MMWW Flow and Precipitation (37.57 mgd MMDW and 45.43 mgd MMWW)

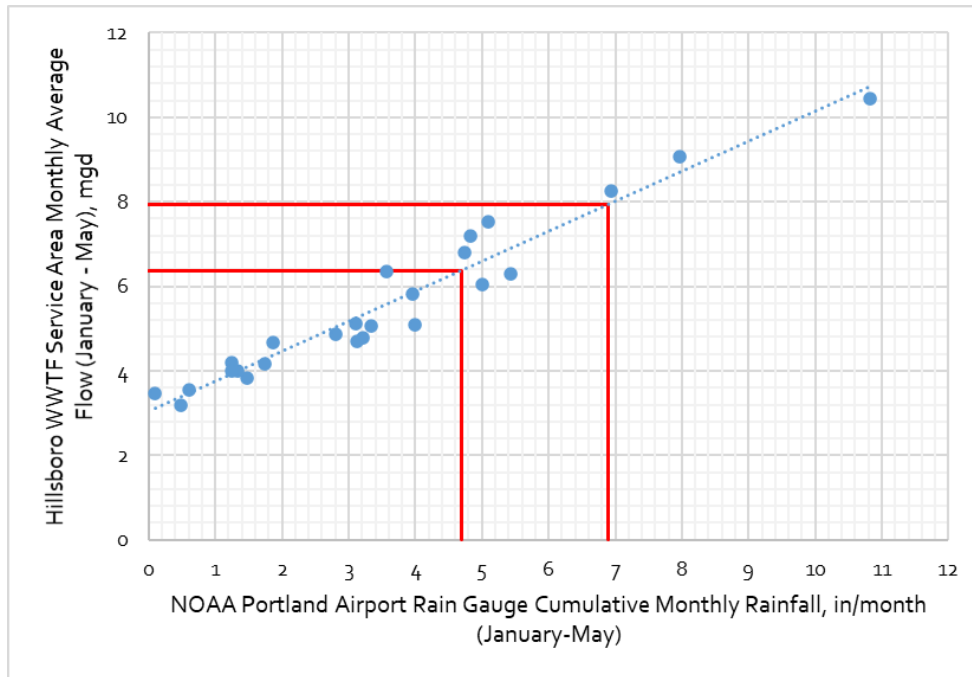


Figure D11. Hillsboro WRRF MMDW and MMWW Flow and Precipitation (6.38 mgd MMDW and 7.94 mgd MMWW)

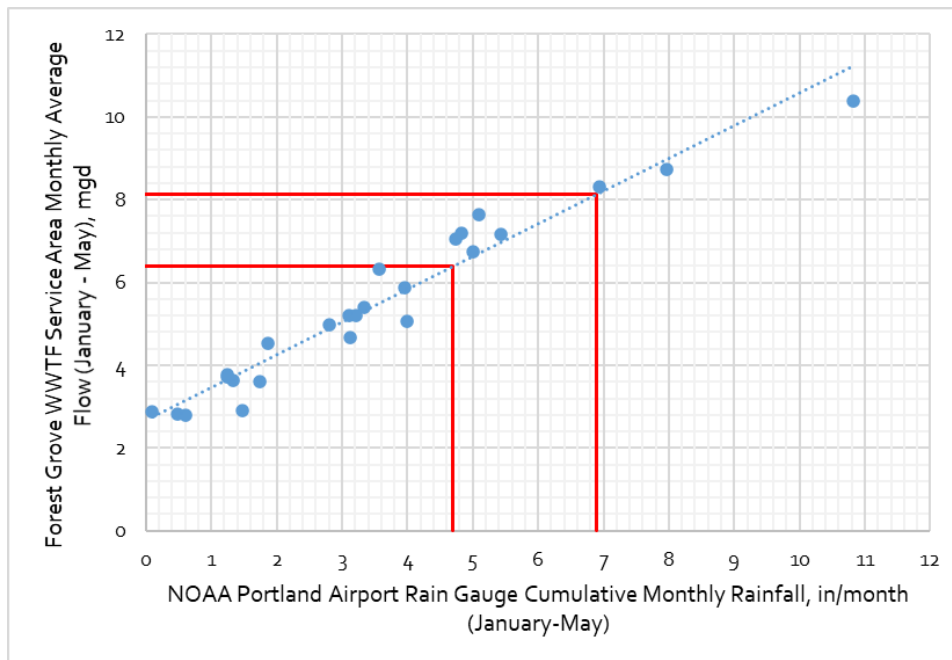


Figure D12. Forest Grove WRRF MMDW and MMWW Flow and Precipitation (6.40 mgd MMDW and 8.14 mgd MMWW)

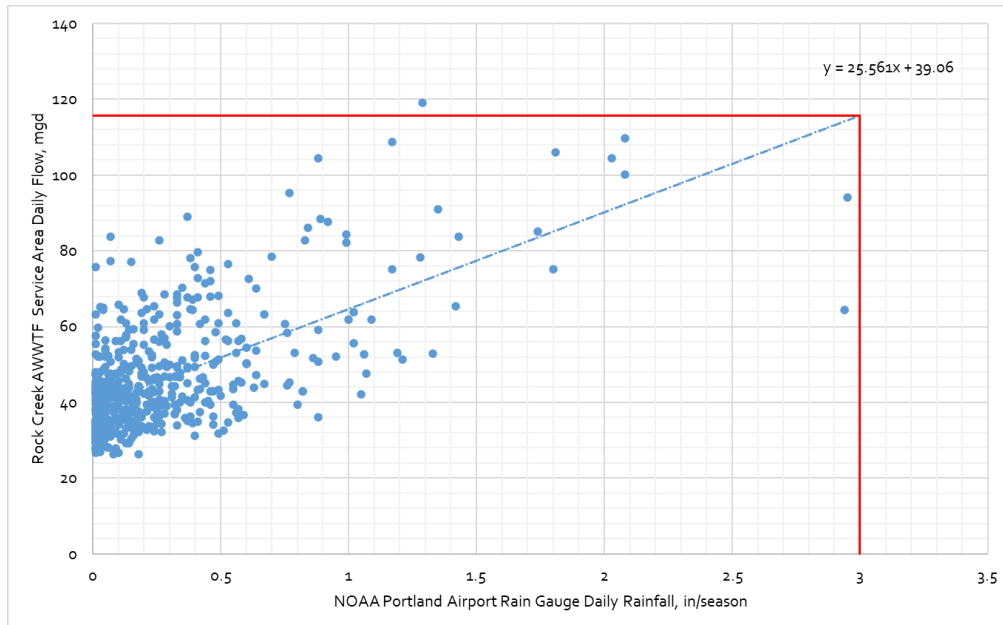


Figure D13. Rock Creek WRRF MDWW Flow and Precipitation (115.74 mgd MDWW)

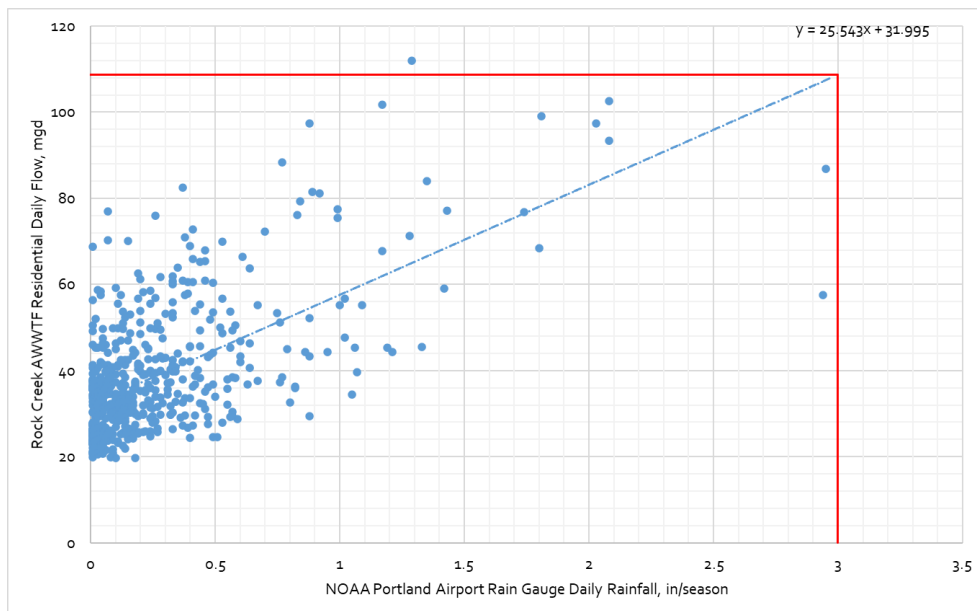


Figure D14. Rock Creek WRRF Non-industrial MDWW Flow and Precipitation (108.62 mgd MDWW)

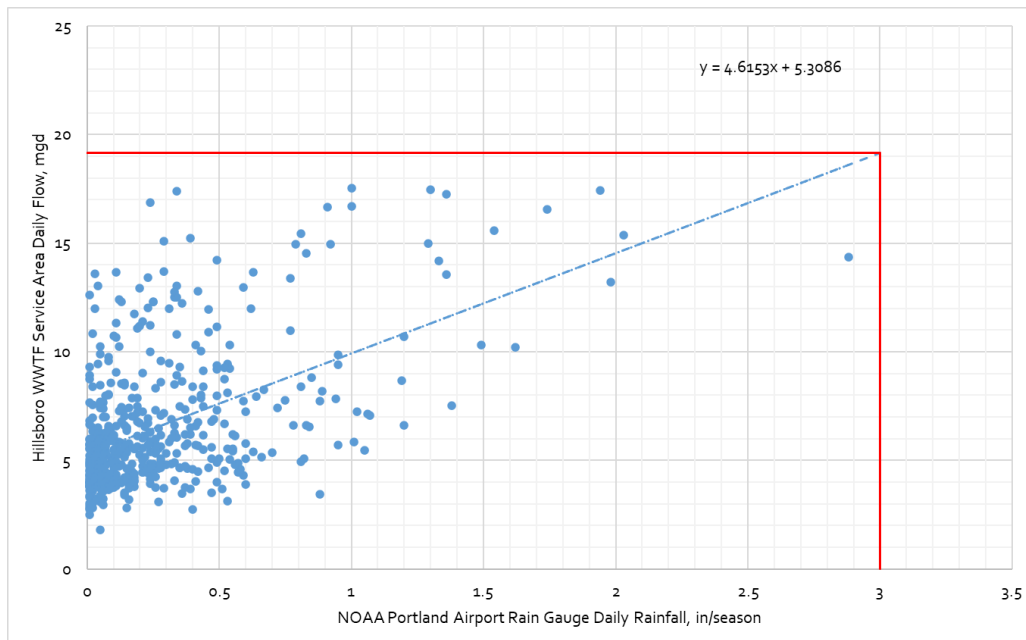


Figure D15. Hillsboro WRRF MDWW Flow and Precipitation (19.15 mgd MDWW)

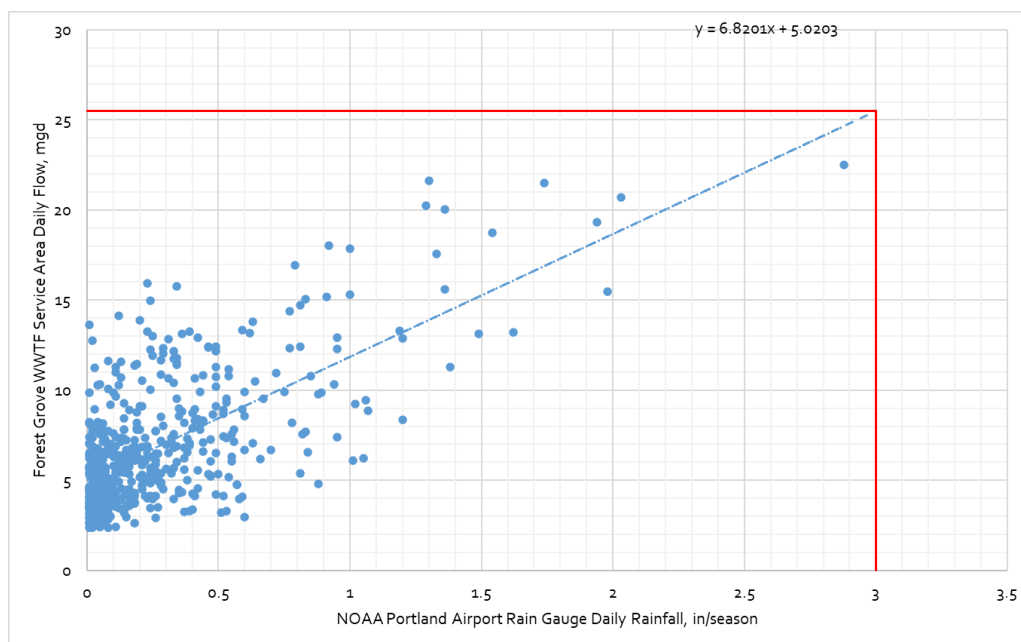


Figure D16. Forest Grove WRRF MDWW Flow and Precipitation (25.48 mgd MDWW)

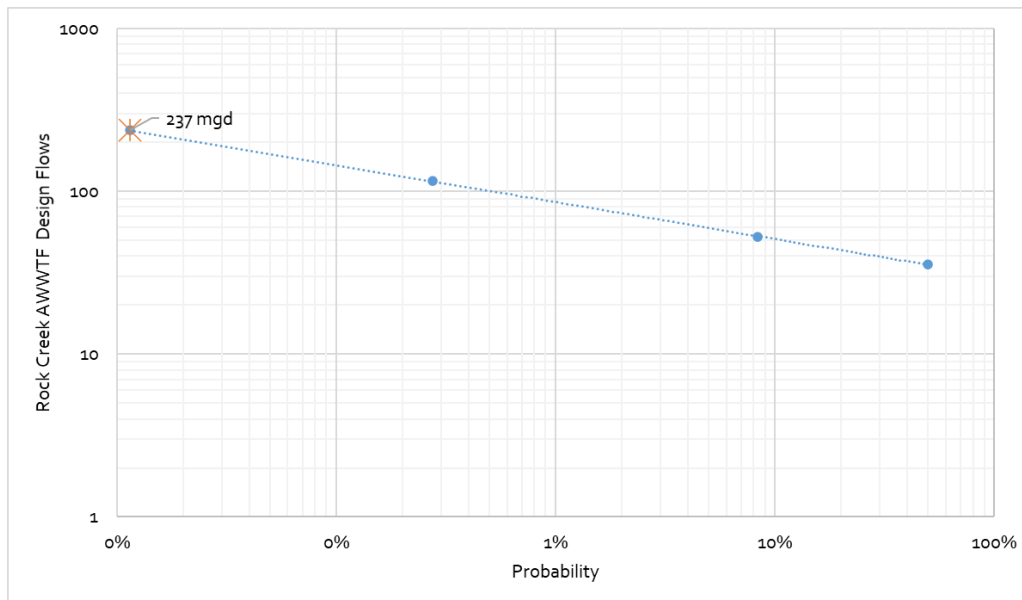


Figure D17. Rock Creek WRRF MHHW Flow and Probability (237.07 mgd MHHW)

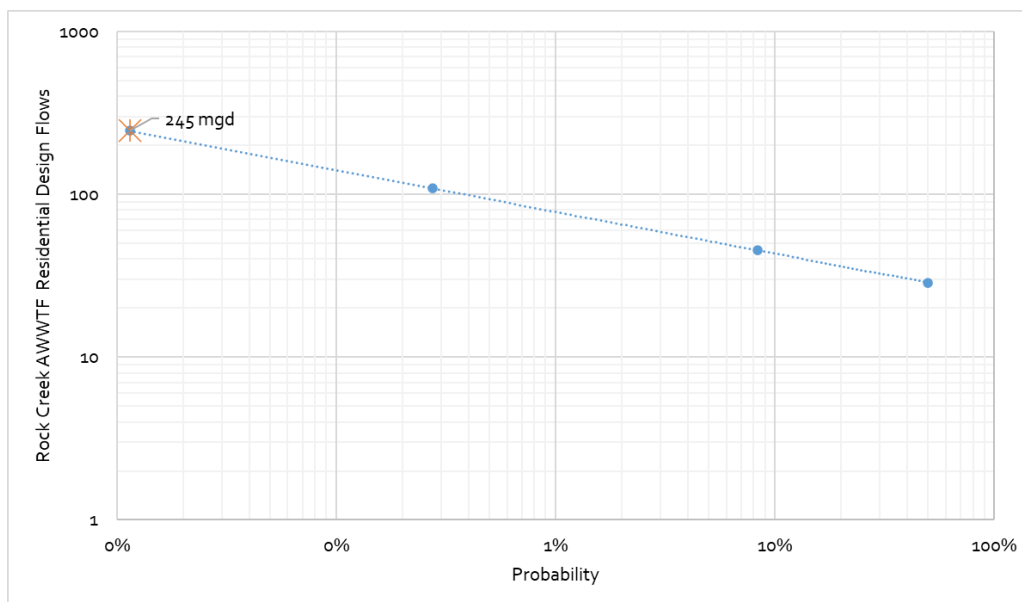


Figure D18. Rock Creek WRRF Non-industrial MHHW Flow and Probability (243.93 mgd MHHW)

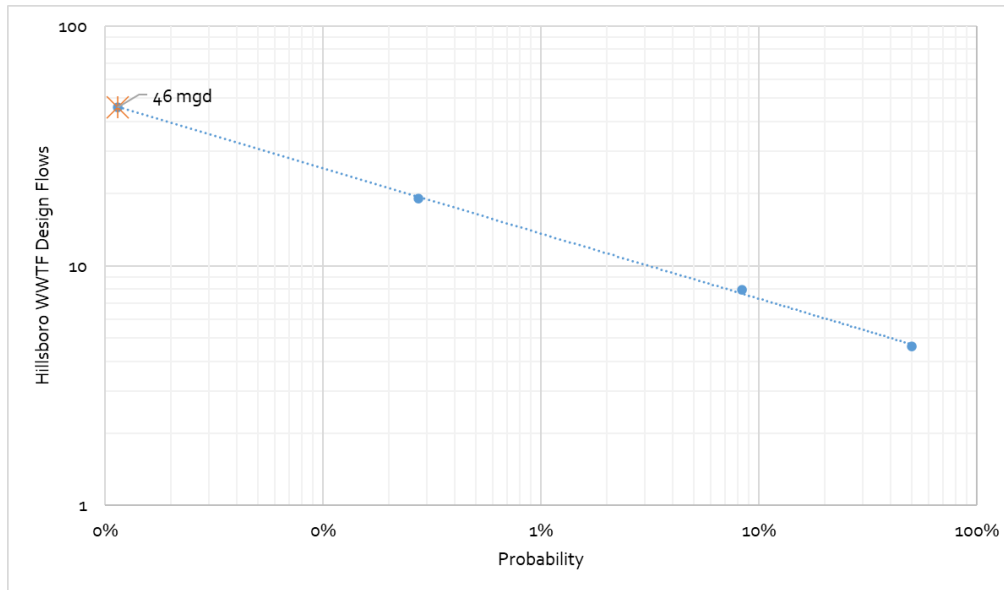


Figure D19. Hillsboro WRRF MHHW Flow and Probability (45.79 mgd MHHW)

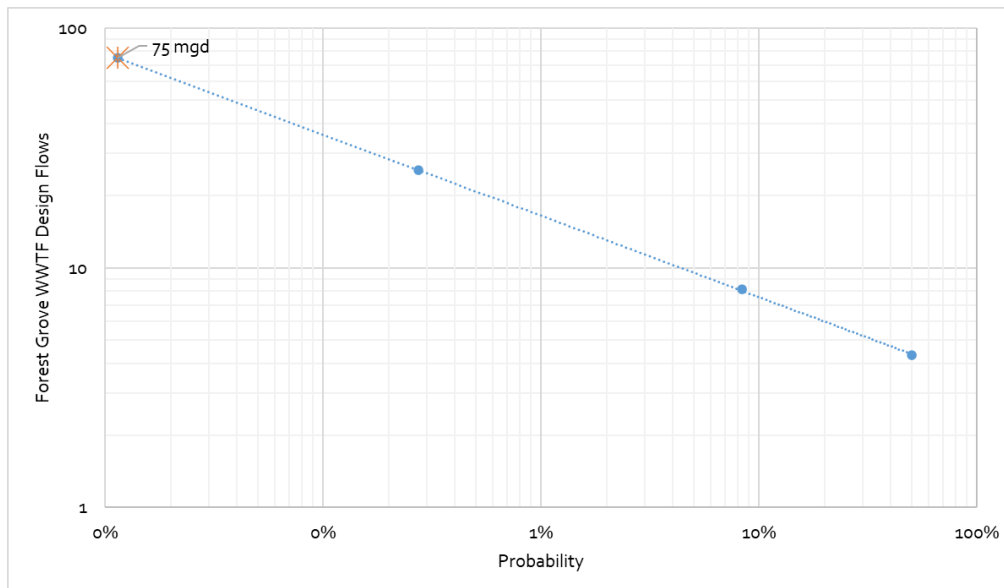


Figure D20. Forest Grove WRRF MHHW Flow and Probability (74.56 mgd MHHW)

11 Appendix E: Flow Projections

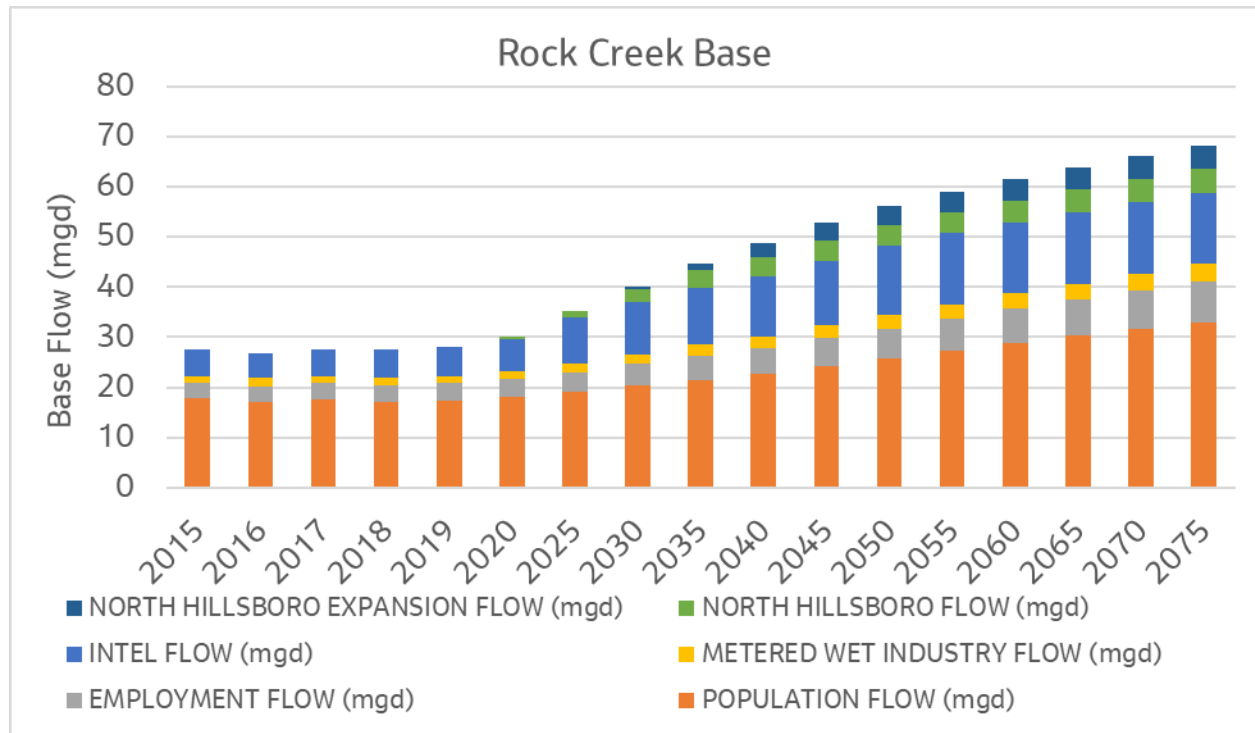


Figure E1. Base Flow Projection, Rock Creek WRRF

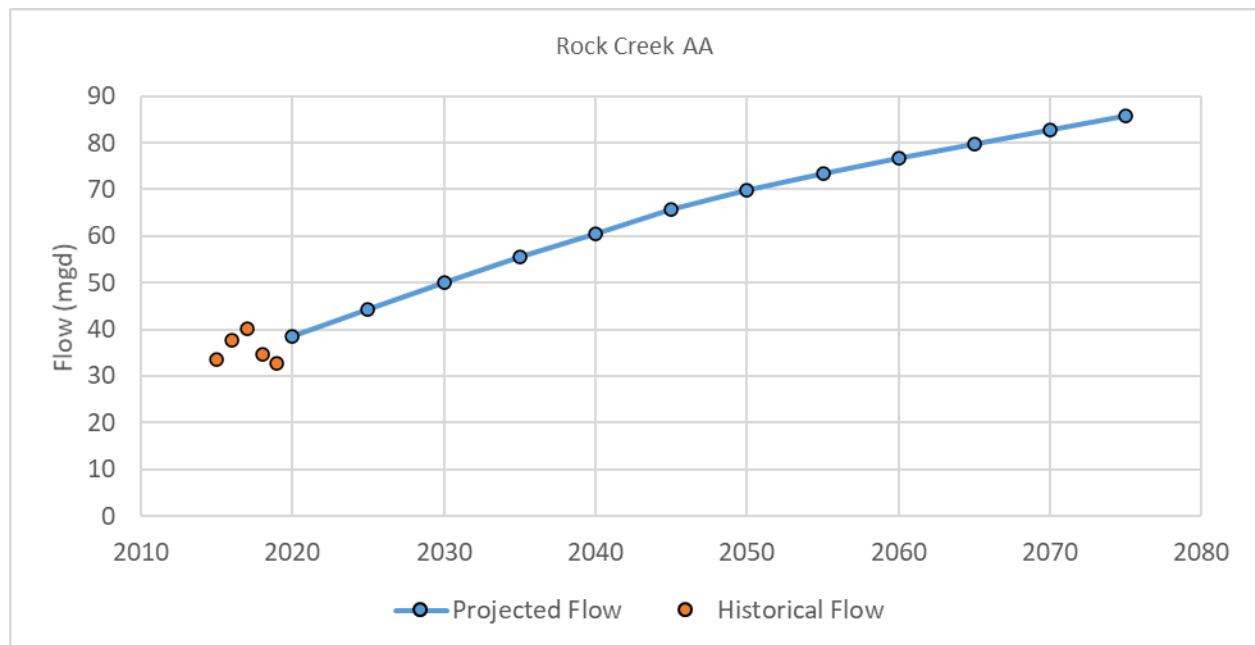


Figure E2. AA Flow Projection, Rock Creek WRRF

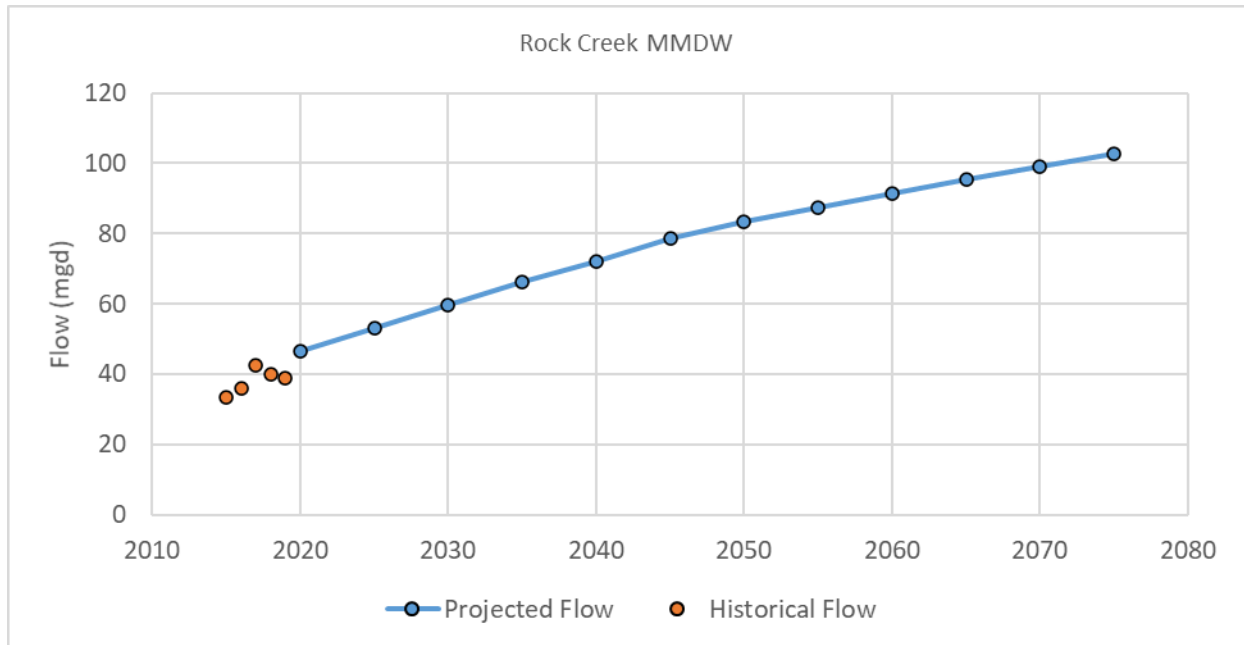


Figure E3. MMDW Flow Projection, Rock Creek WRRF

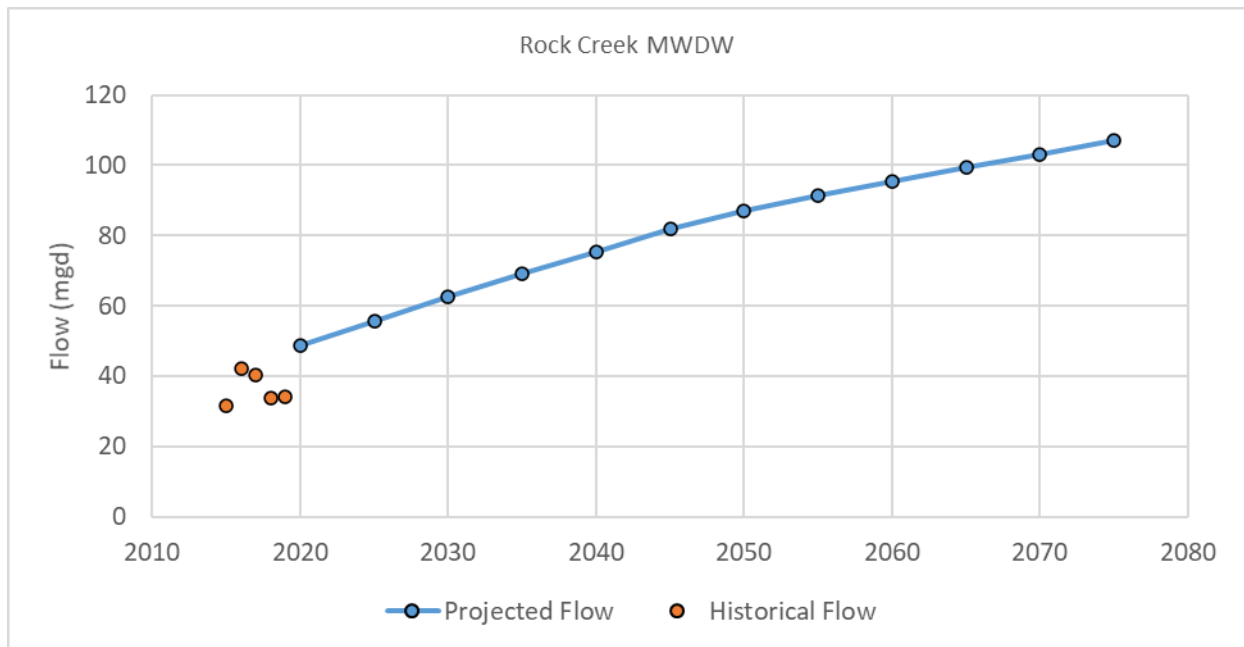


Figure E4. MWDW Flow Projection, Rock Creek WRRF

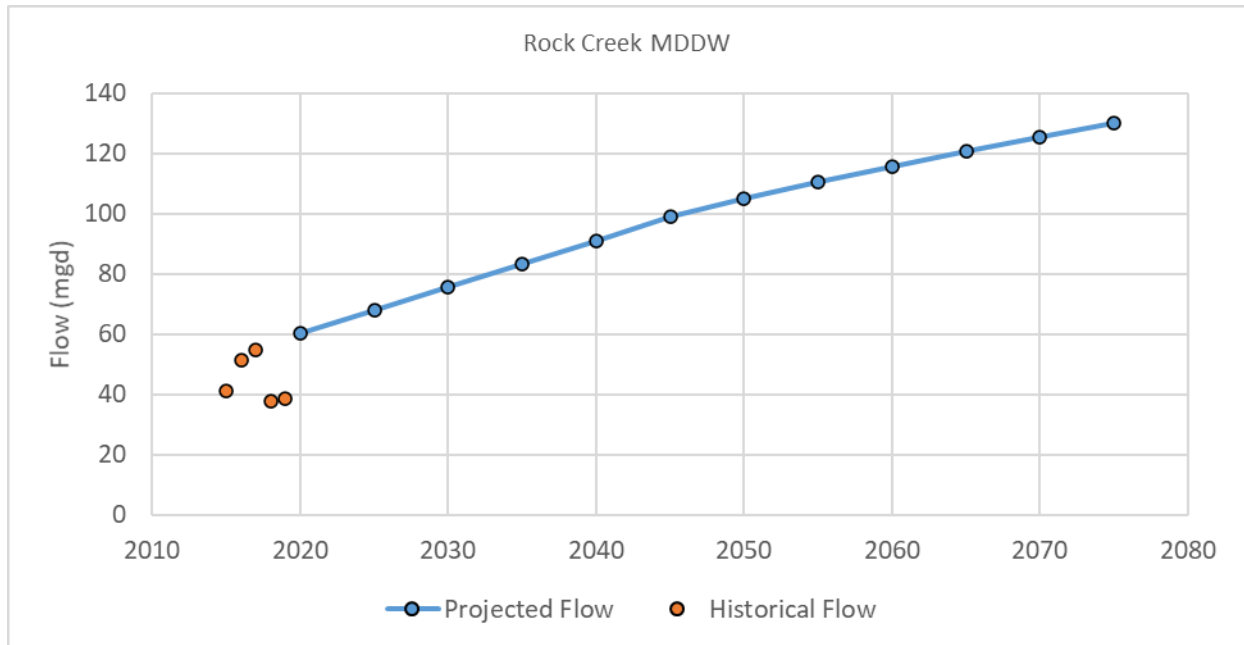


Figure E5. MDDW Flow Projection, Rock Creek WRRF

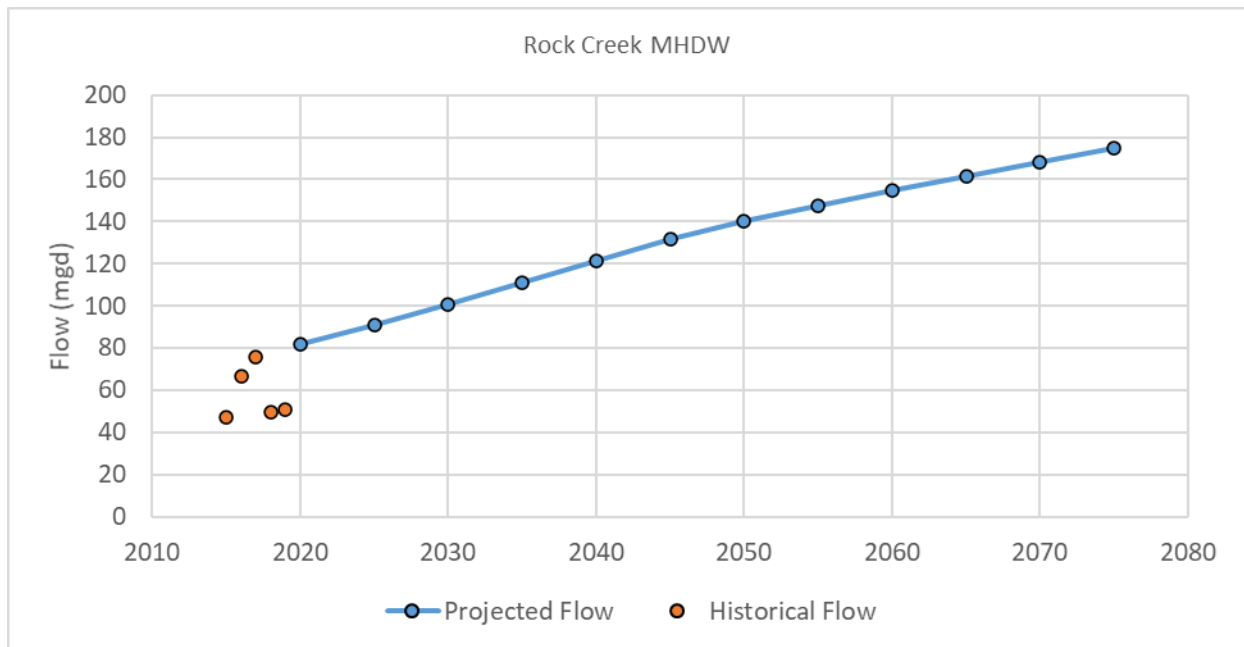


Figure E6. MHDW Flow Projection, Rock Creek WRRF

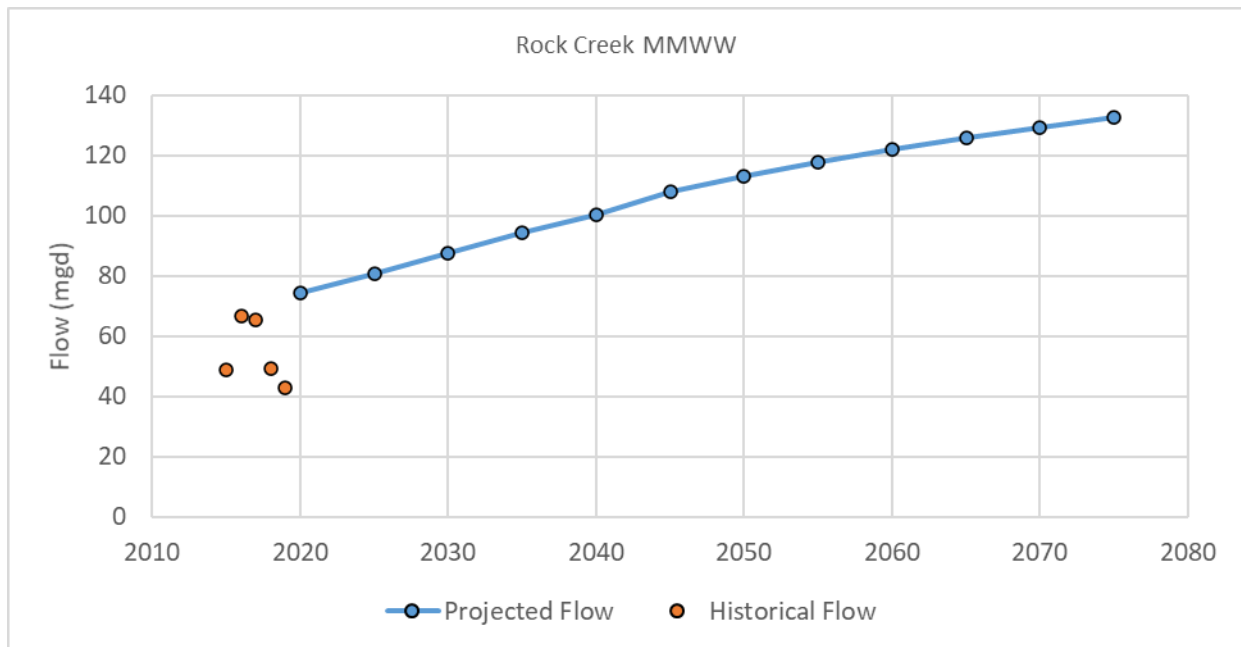


Figure E7. MMWW Flow Projection, Rock Creek WRRF

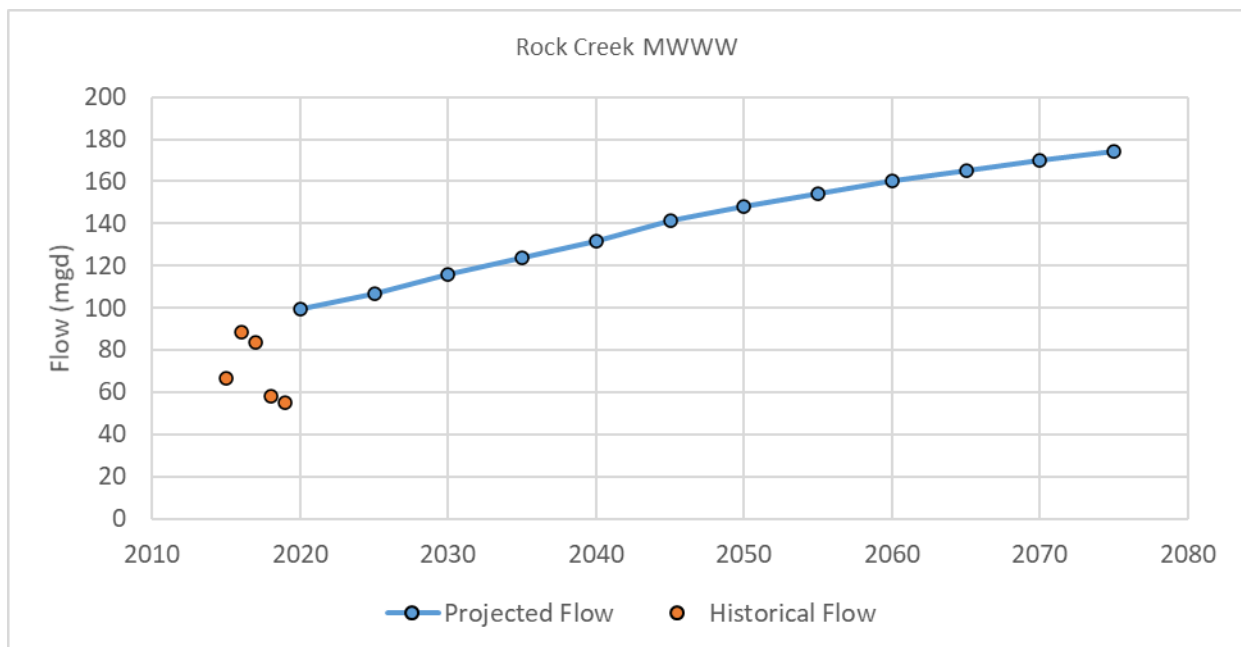


Figure E8. MWWW Flow Projection, Rock Creek WRRF

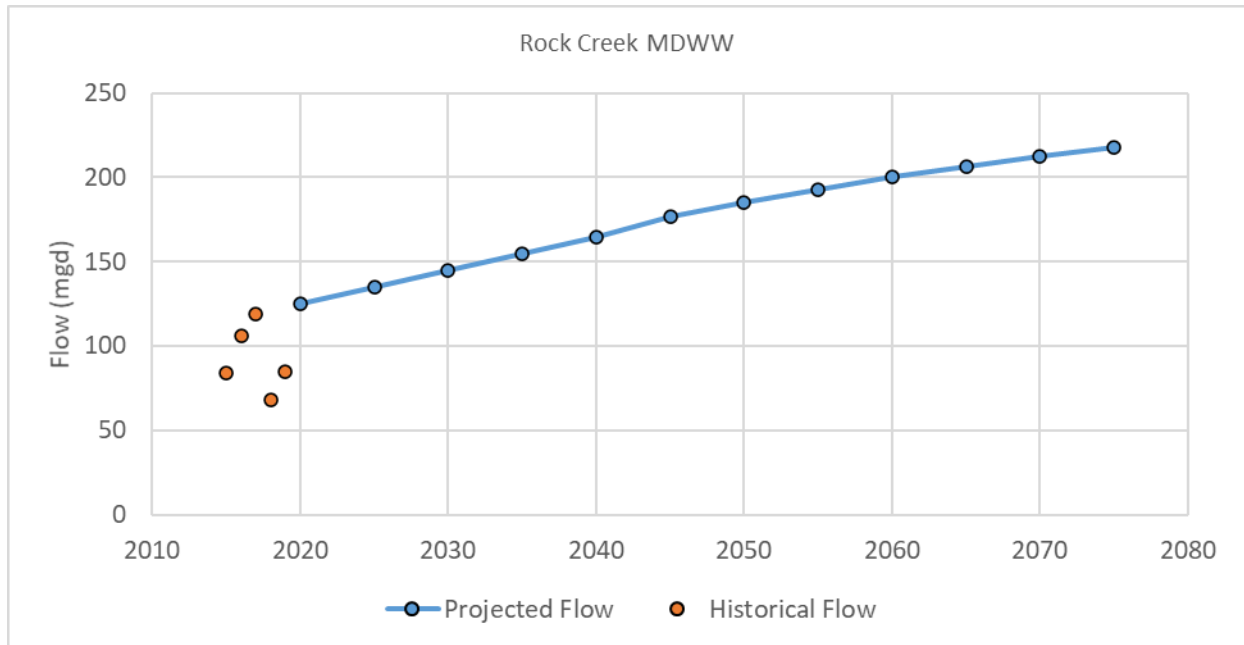


Figure E9. MDWW Flow Projection, Rock Creek WRRF

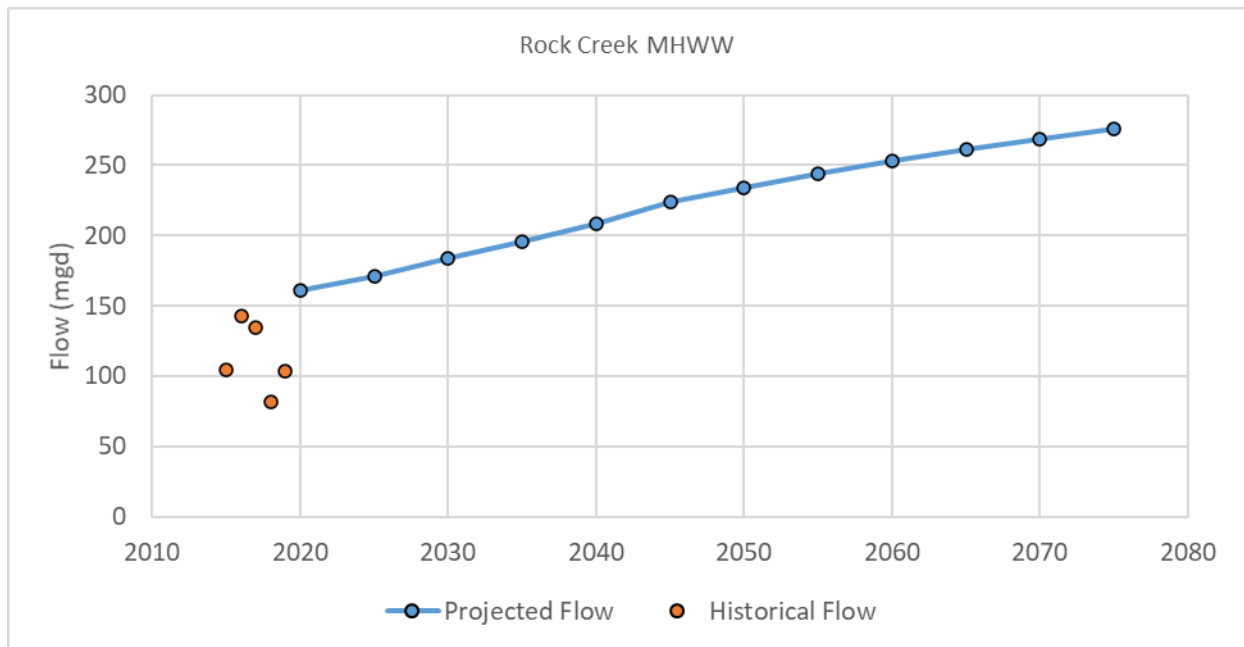


Figure E10. MHWW Flow Projection, Rock Creek WRRF

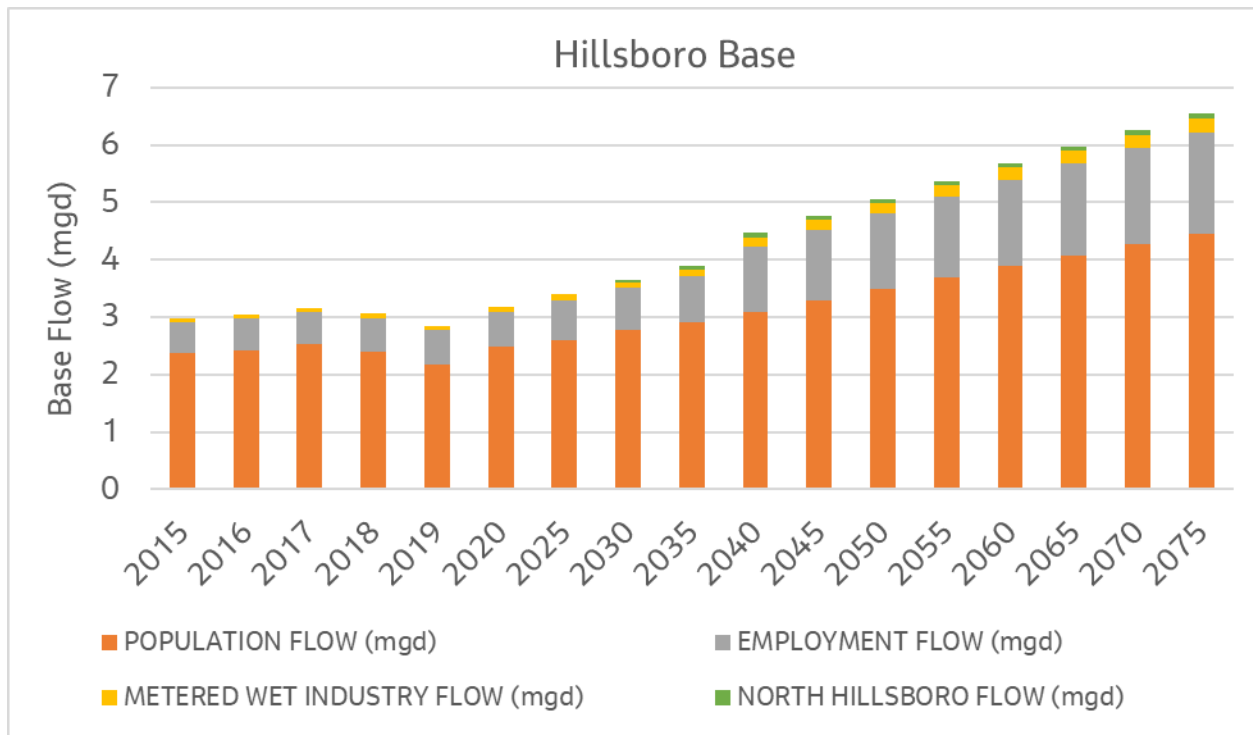


Figure E11. Base Flow Projection, Hillsboro WRRF

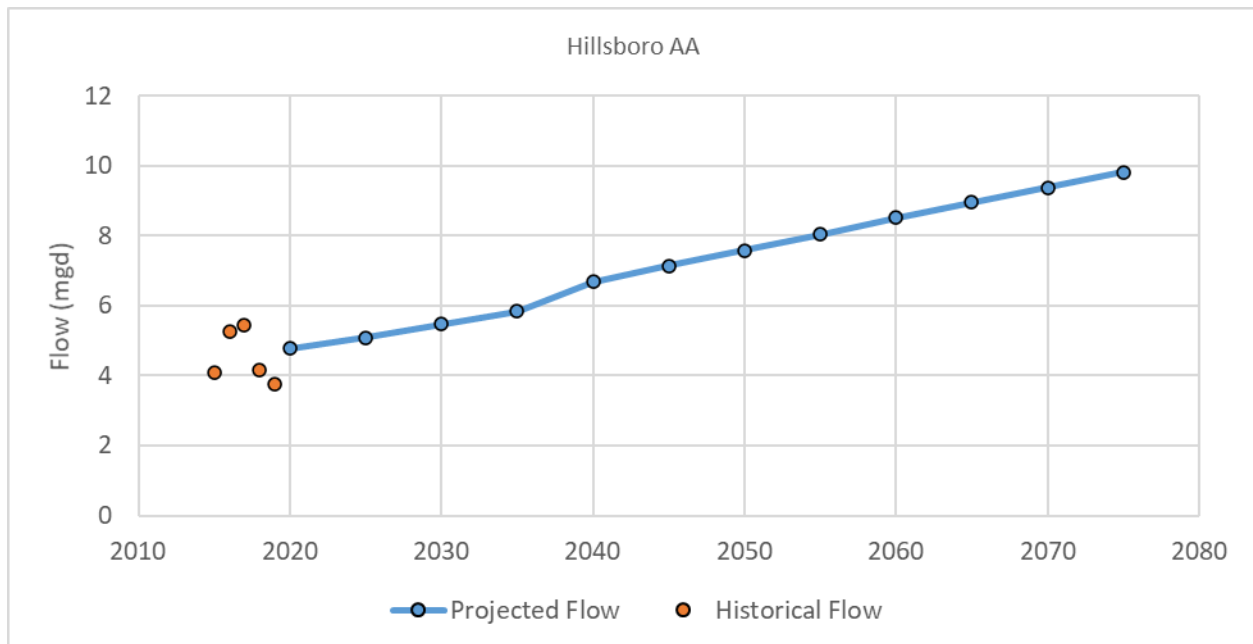


Figure E12. AA Flow Projection, Hillsboro WRRF

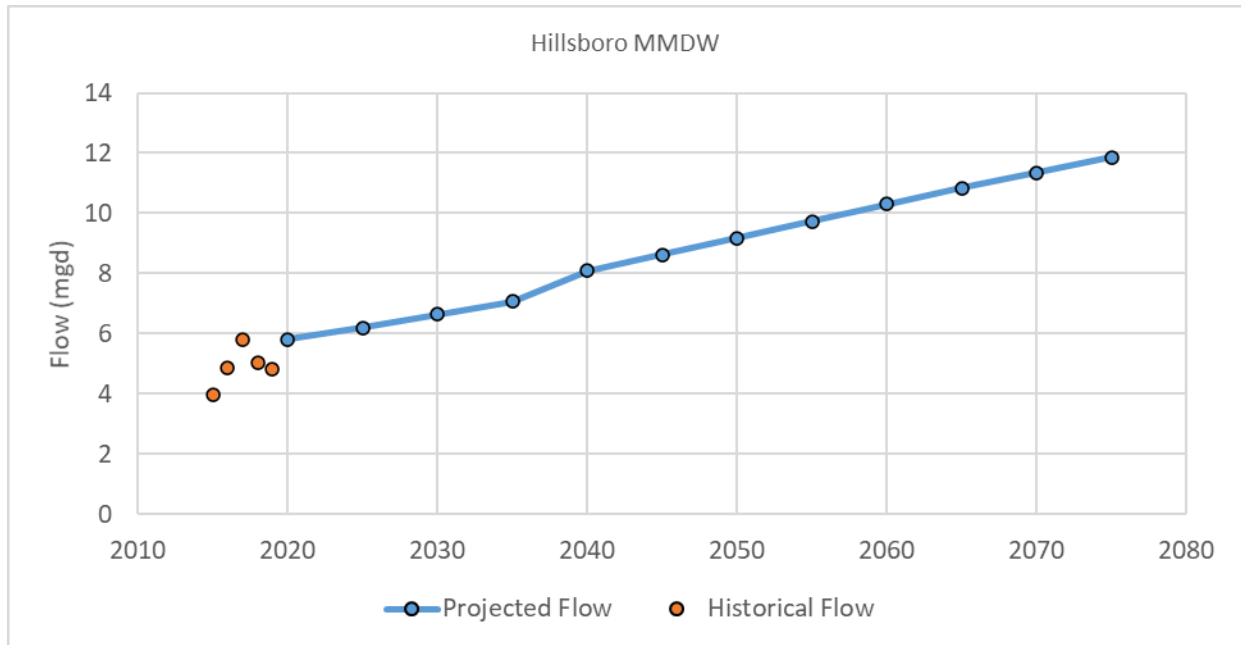


Figure E13. MMDW Flow Projection, Hillsboro WRRF

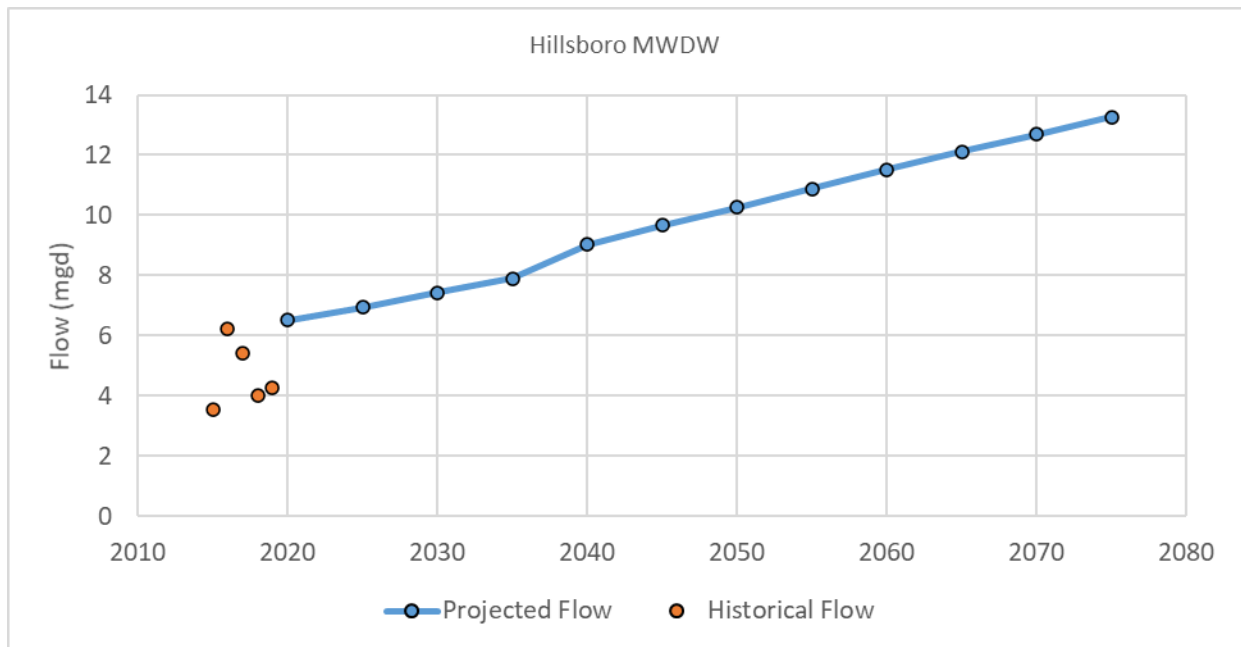


Figure E14. MWDW Flow Projection, Hillsboro WRRF

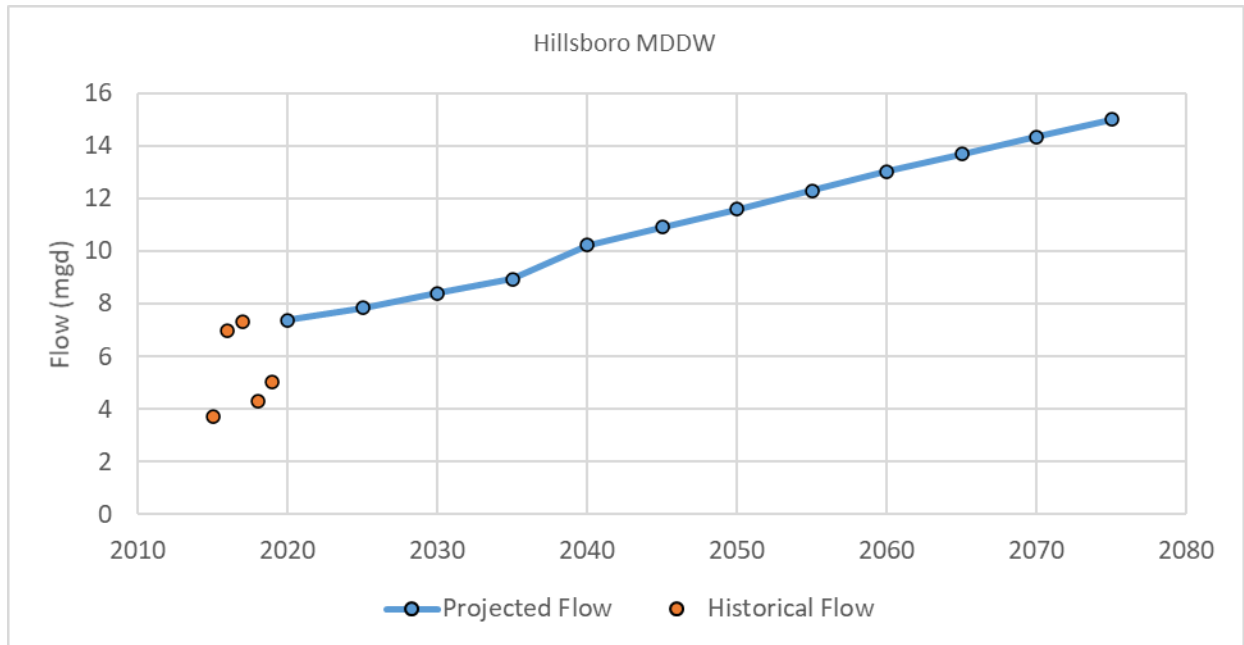


Figure E15. MDDW Flow Projection, Hillsboro WRRF

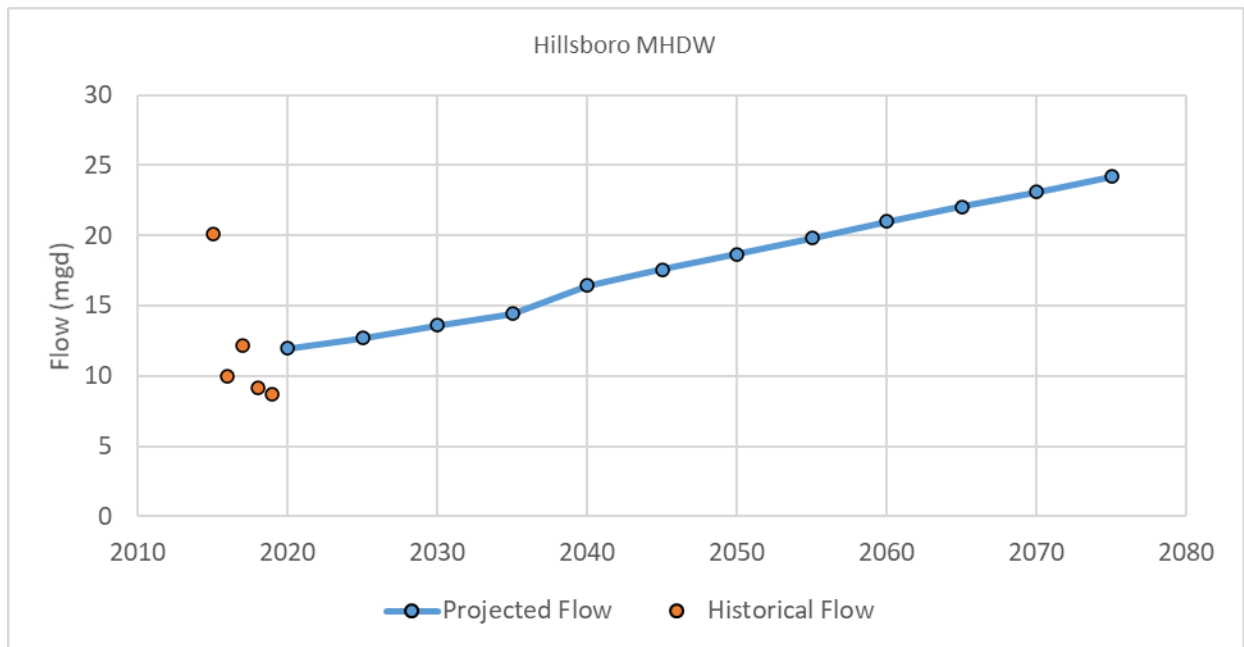


Figure E16. MHDW Flow Projection, Hillsboro WRRF

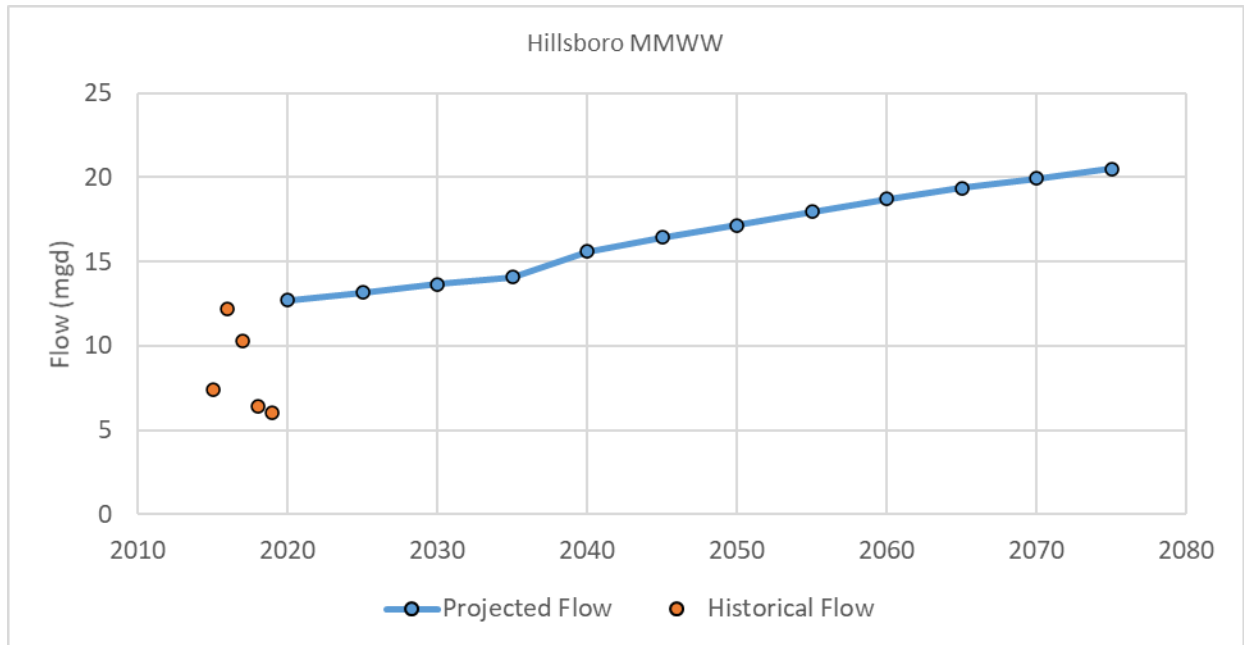


Figure E17. MMWW Flow Projection, Hillsboro WRRF

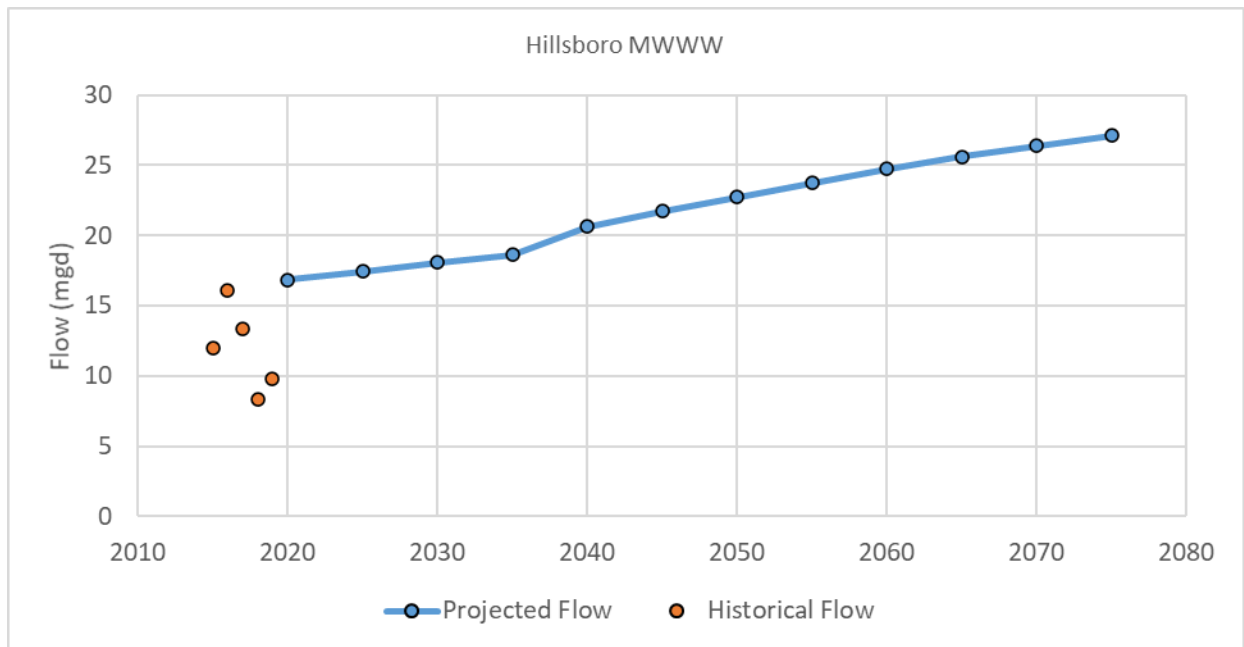


Figure E18. MWWW Flow Projection, Hillsboro WRRF

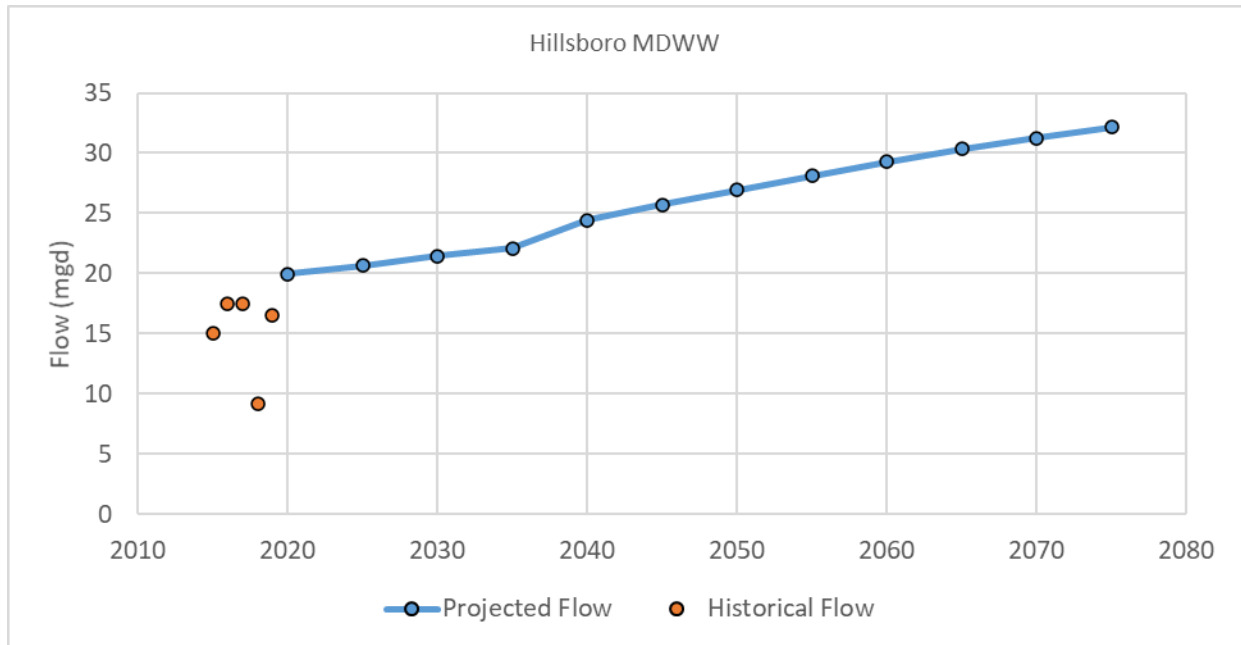


Figure E19. MDWW Flow Projection, Hillsboro WRRF

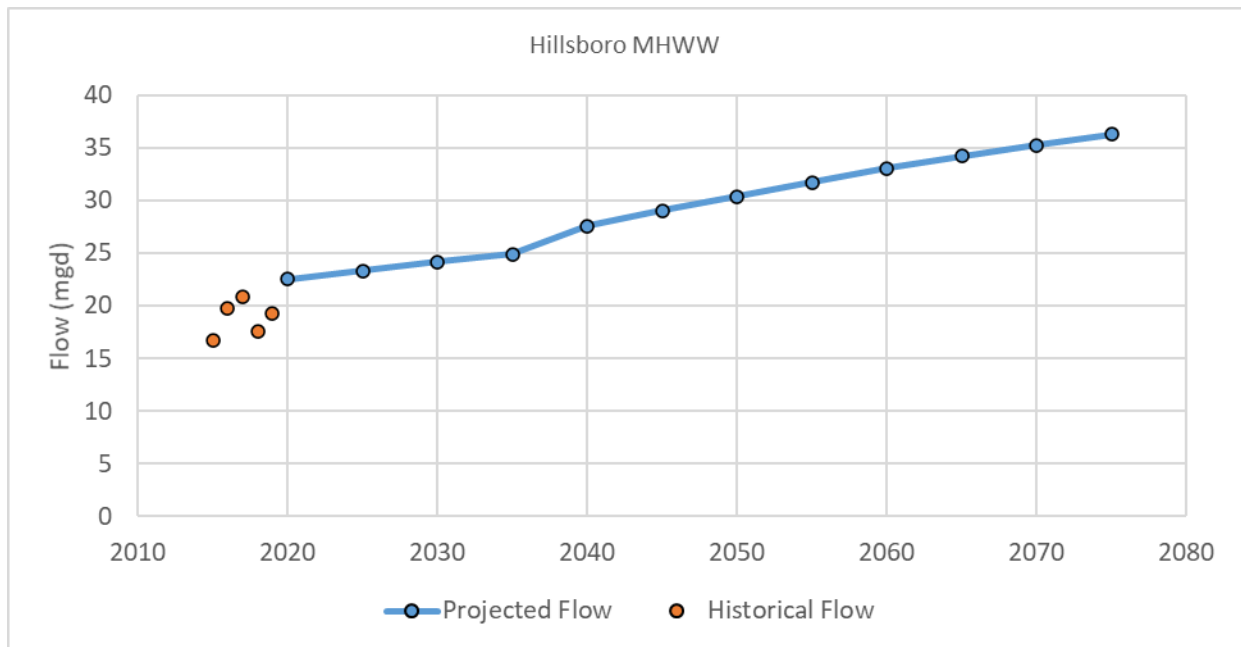


Figure E20. MHWW Flow Projection, Hillsboro WRRF

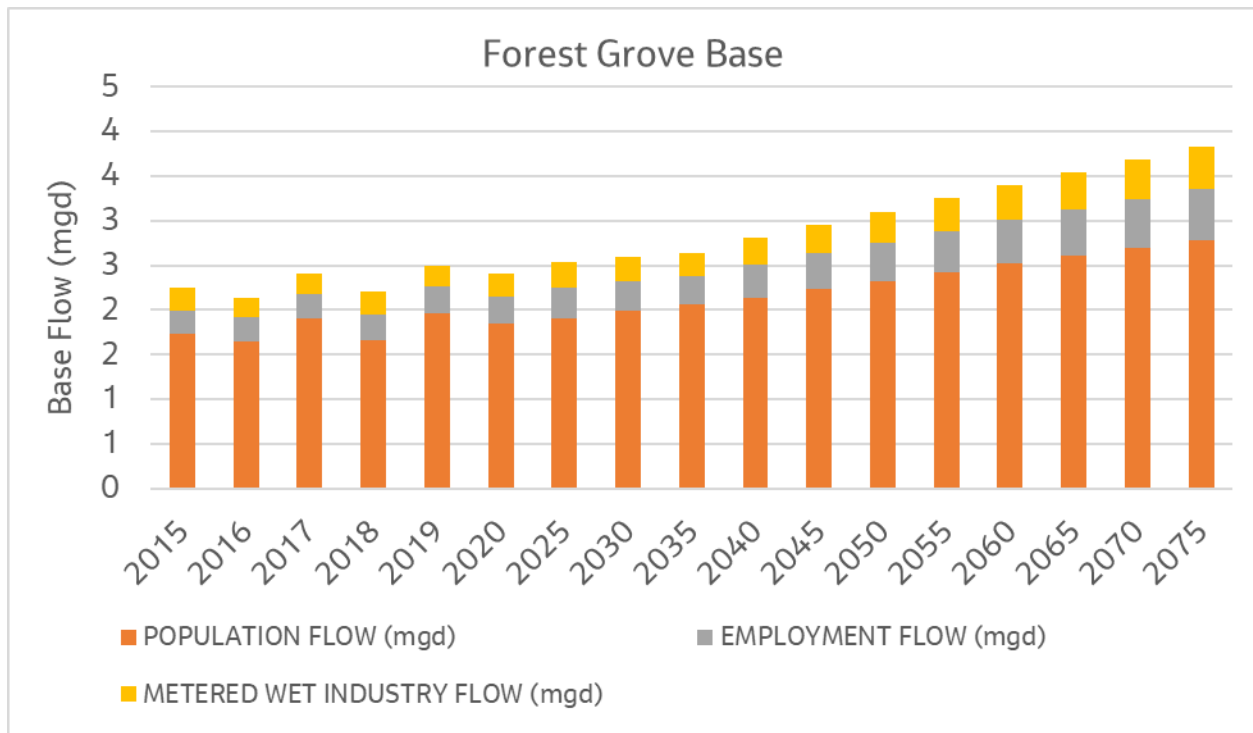


Figure E21. Base Flow Projection, Forest Grove WRRF

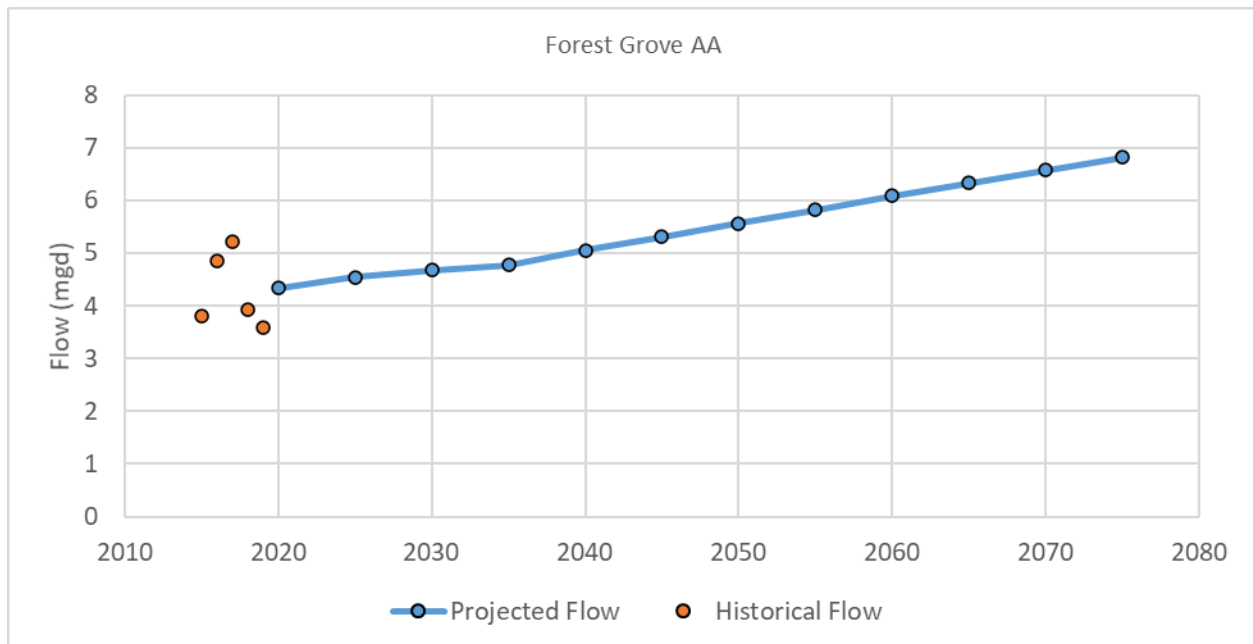


Figure E22. AA Flow Projection, Forest Grove WRRF

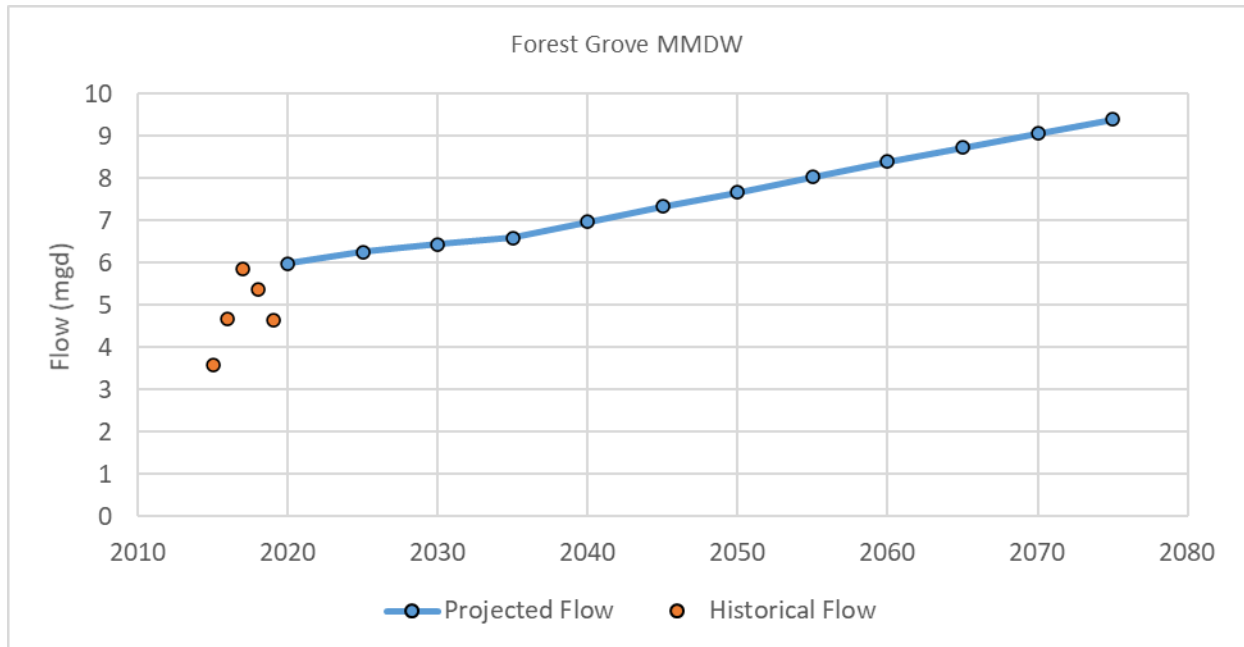


Figure E23. MMDW Flow Projection, Forest Grove WRRF

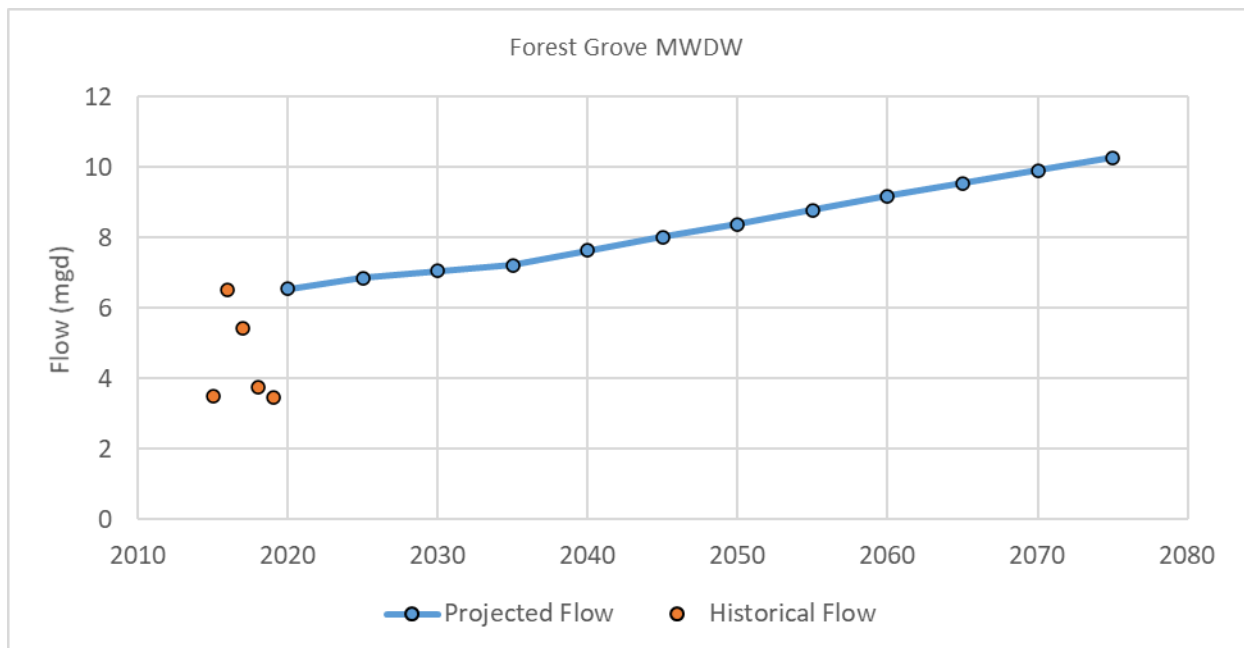


Figure E24. MWDW Flow Projection, Forest Grove WRRF

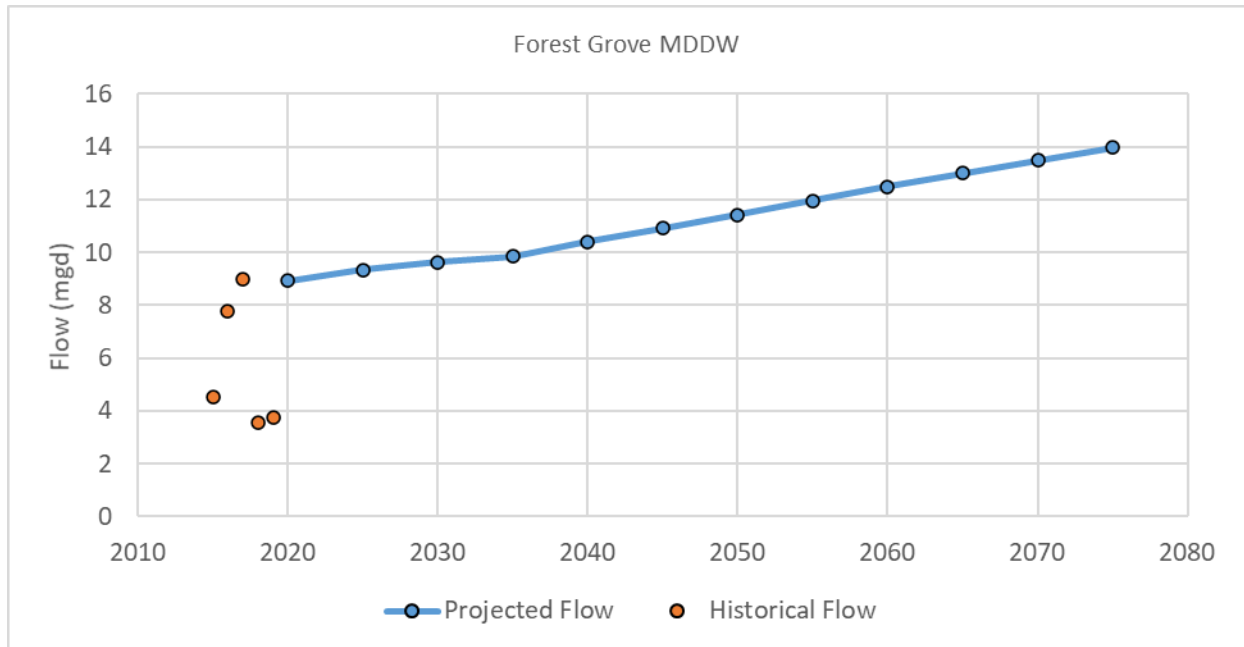


Figure E25. MDDW Flow Projection, Forest Grove WRRF

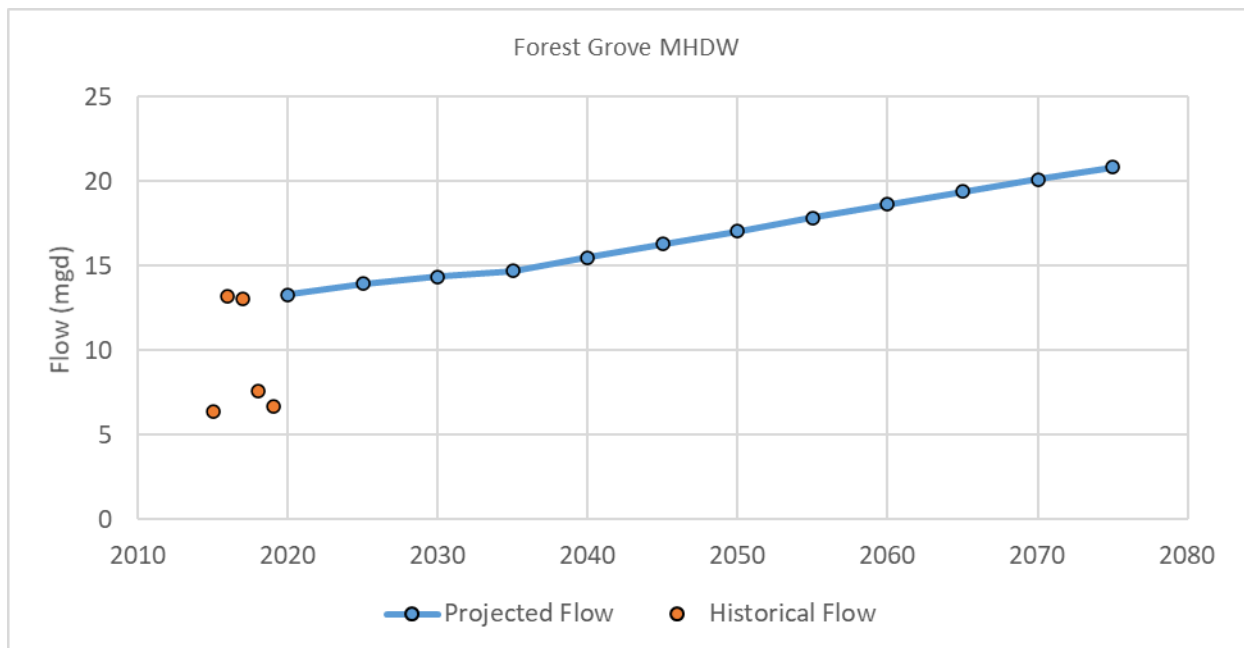


Figure E26. MHDW Flow Projection, Forest Grove WRRF

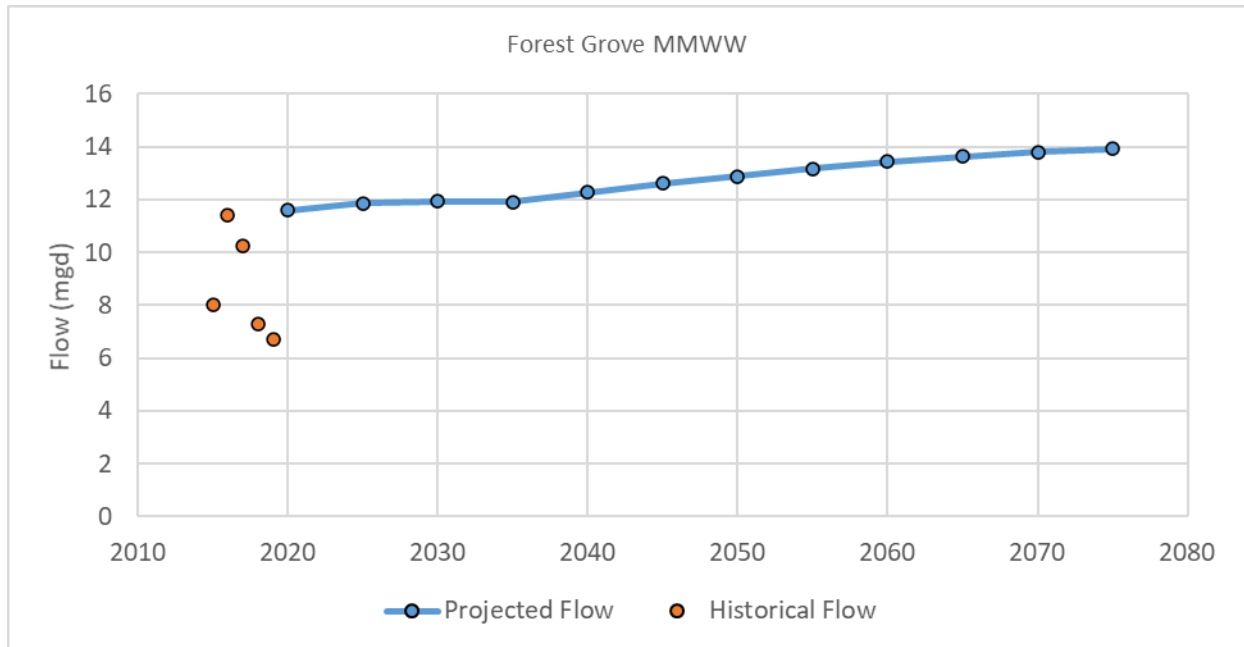


Figure E27. MMWW Flow Projection, Forest Grove WRRF

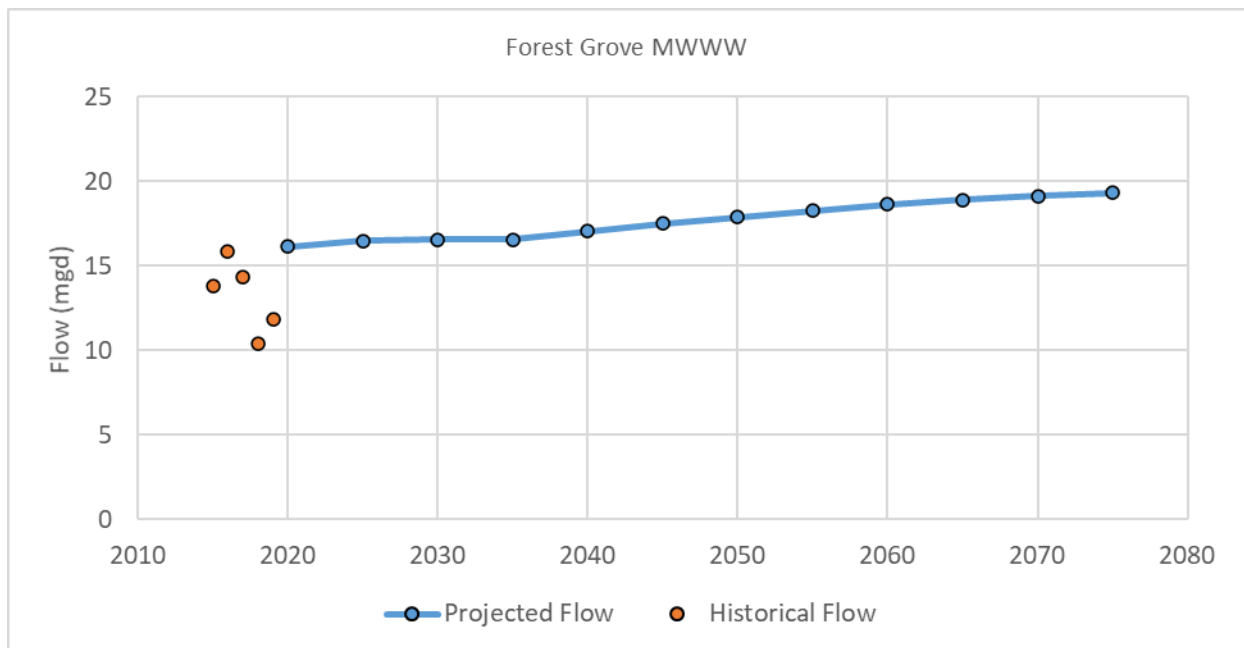


Figure E28. MWWW Flow Projection, Forest Grove WRRF

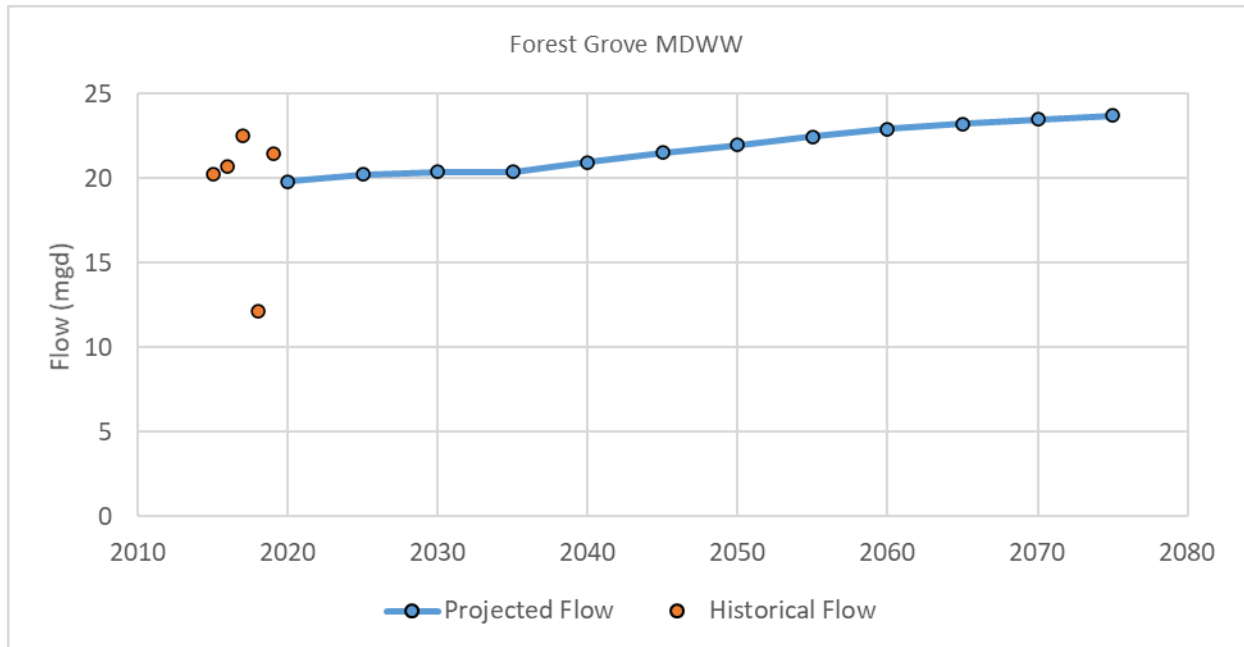


Figure E29. MDWW Flow Projection, Forest Grove WRRF

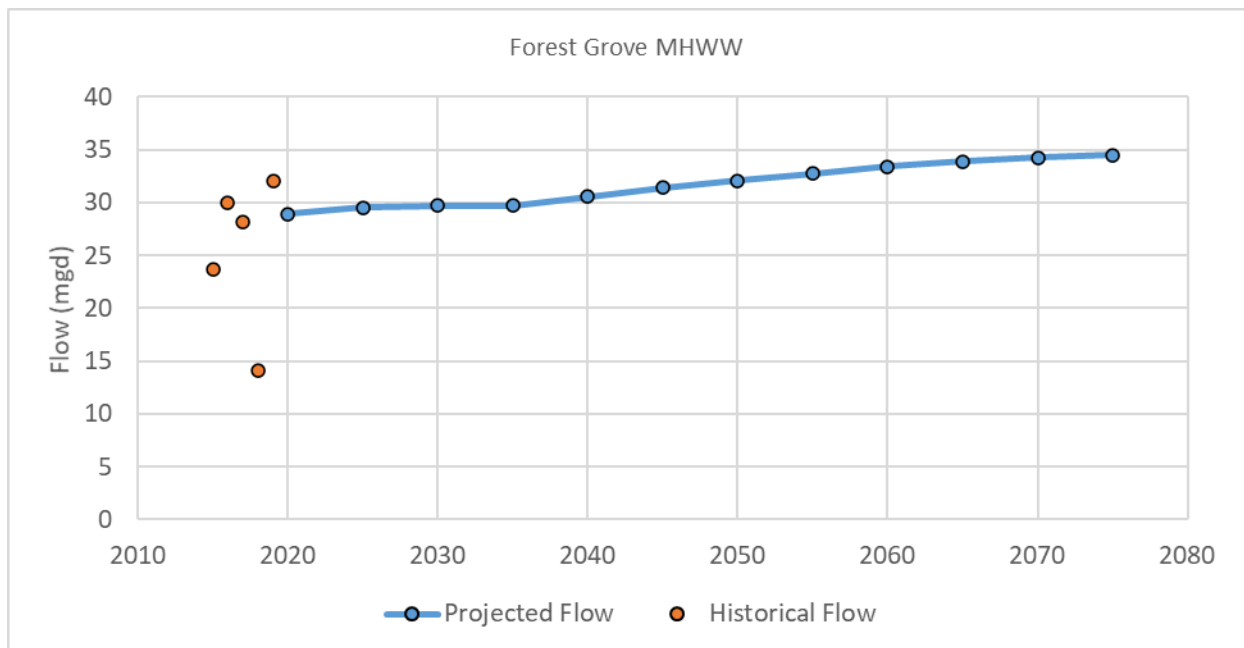


Figure E30. MHHW Flow Projection, Forest Grove WRRF

12 Appendix F: Load Projections

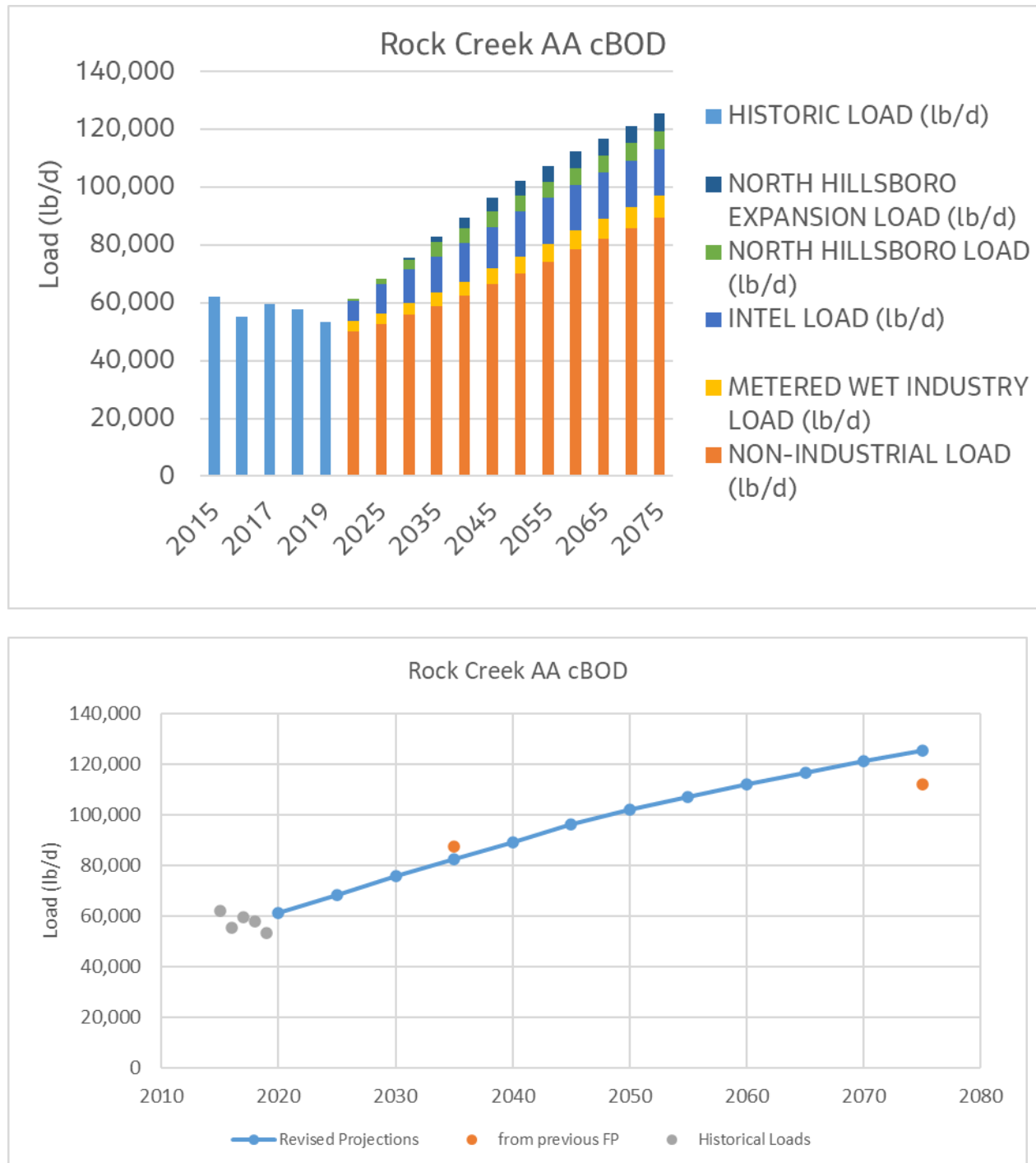


Figure F1. AA Load Projection, cBOD, Rock Creek WRRF

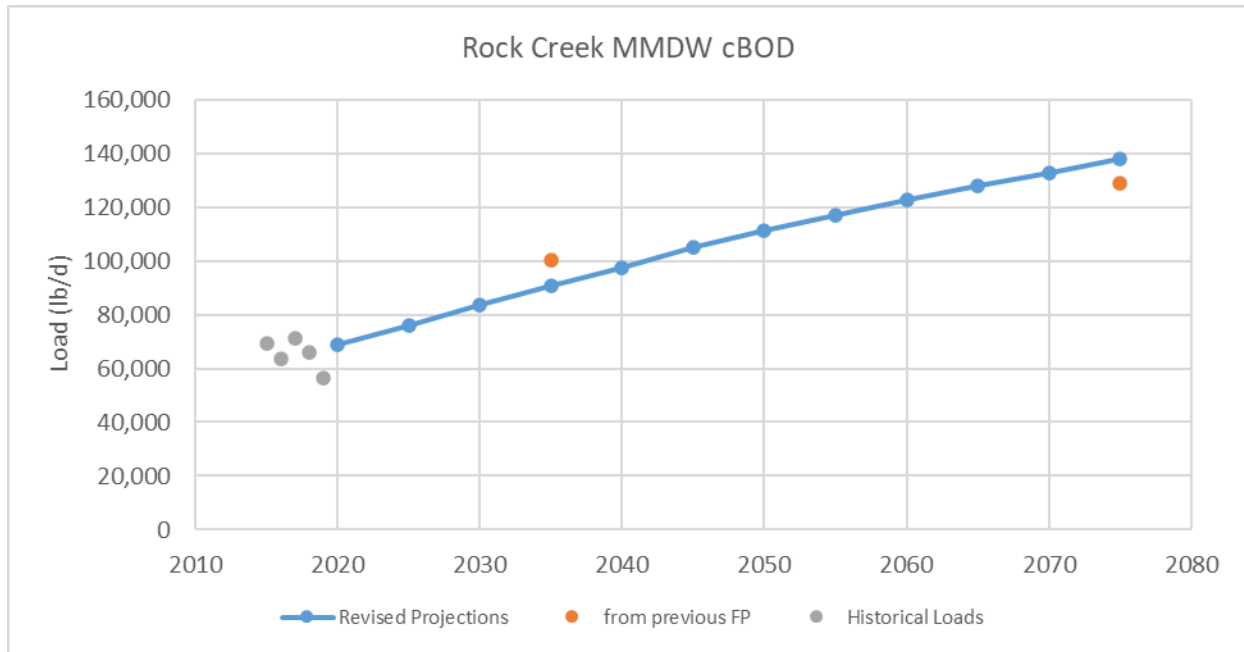


Figure F2. MMDW Load Projection, cBOD, Rock Creek WRRF

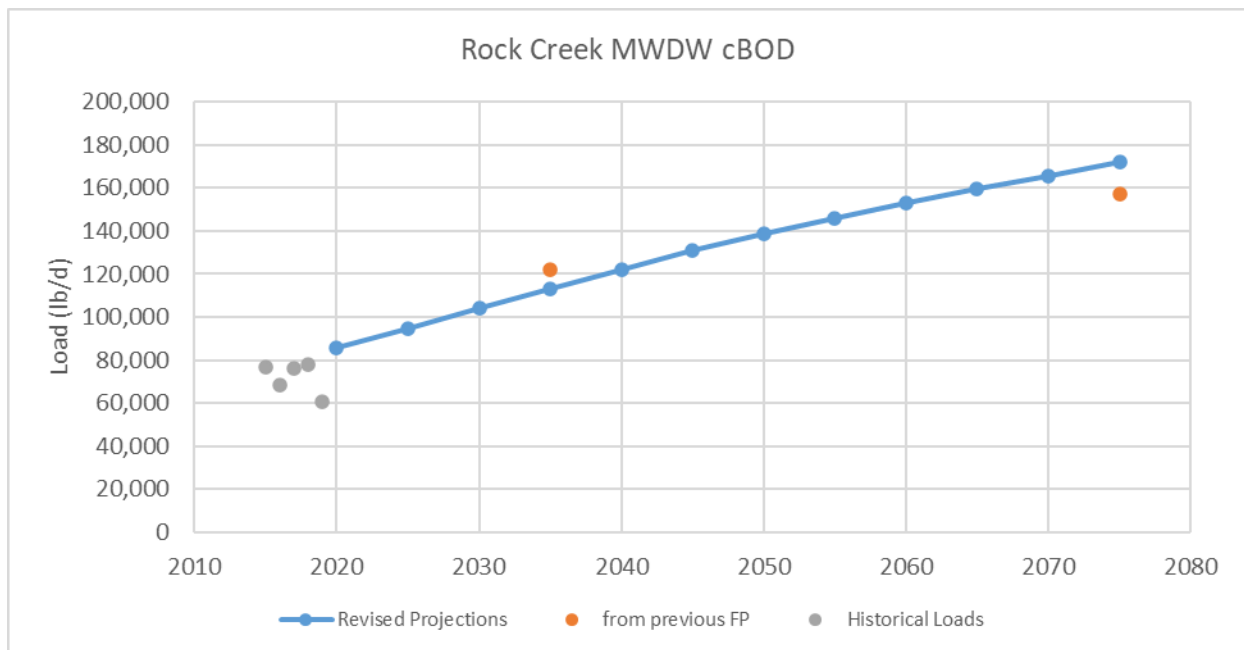


Figure F3. MWDW Load Projection, cBOD, Rock Creek WRRF

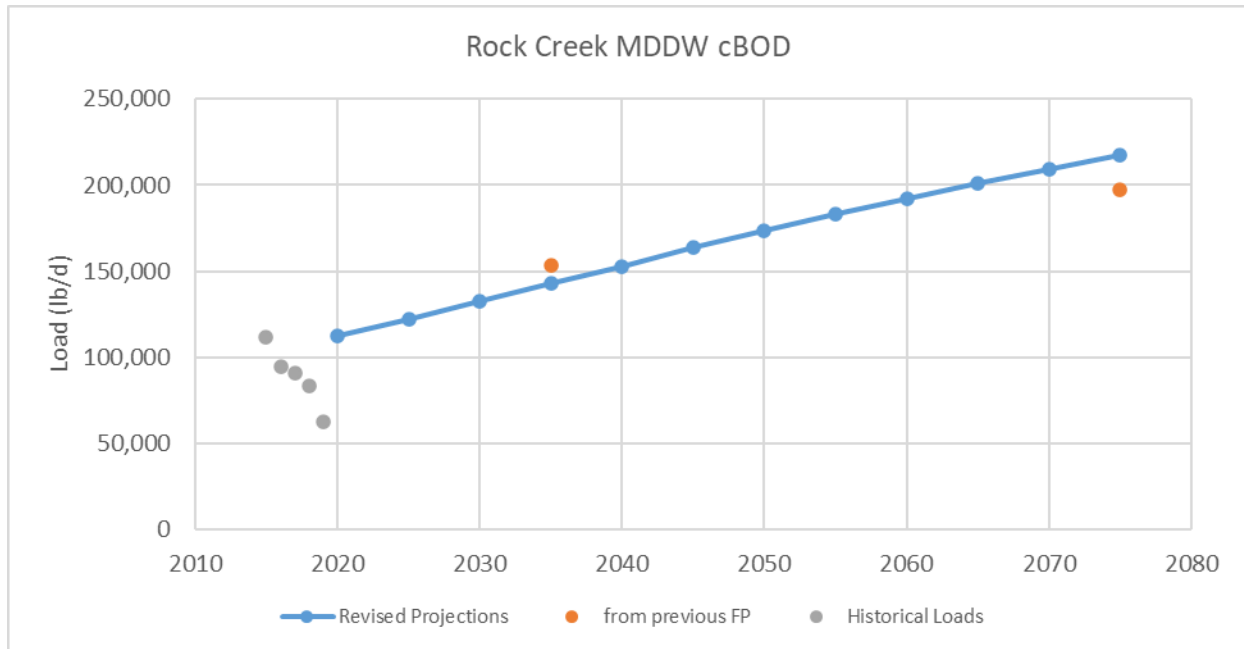


Figure F4. MDDW Load Projection, cBOD, Rock Creek WRRF

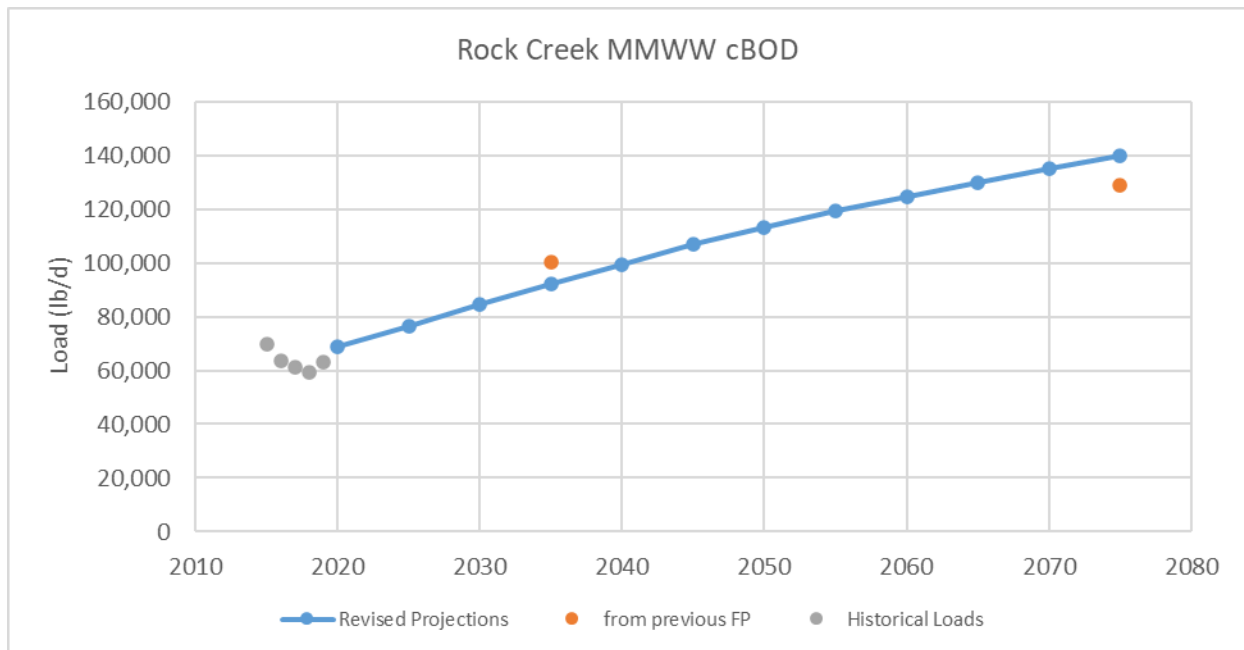


Figure F5. MMWW Load Projection, cBOD, Rock Creek WRRF

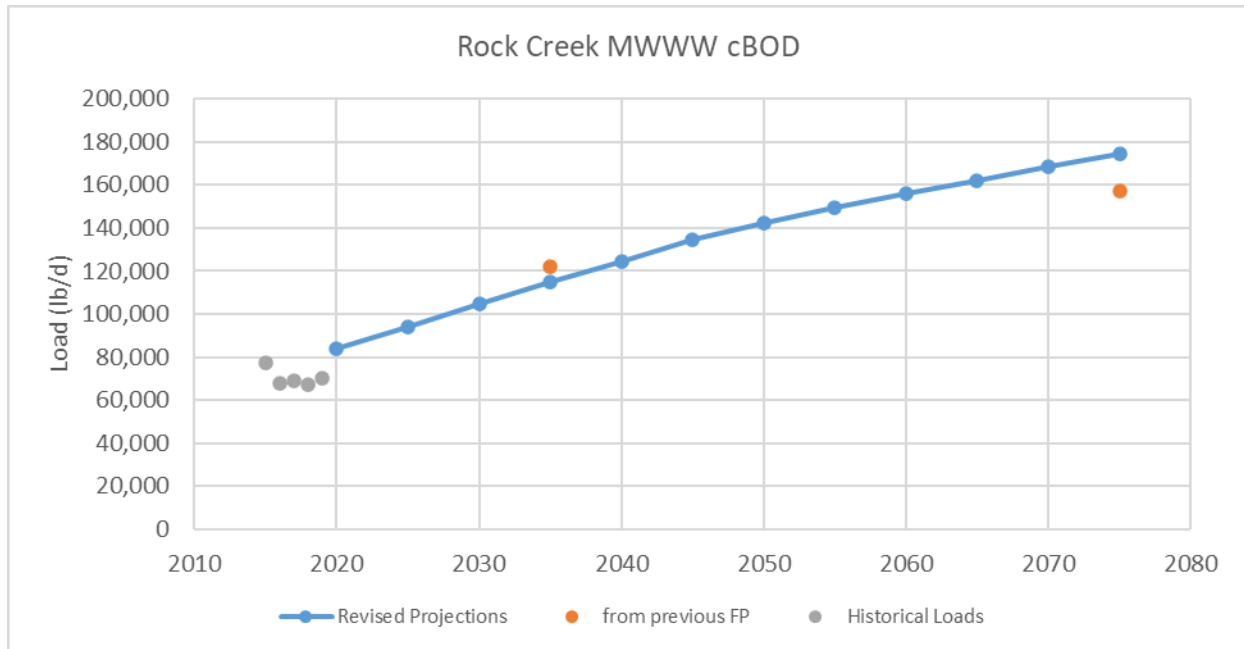


Figure F6. MWWW Load Projection, cBOD, Rock Creek WRRF

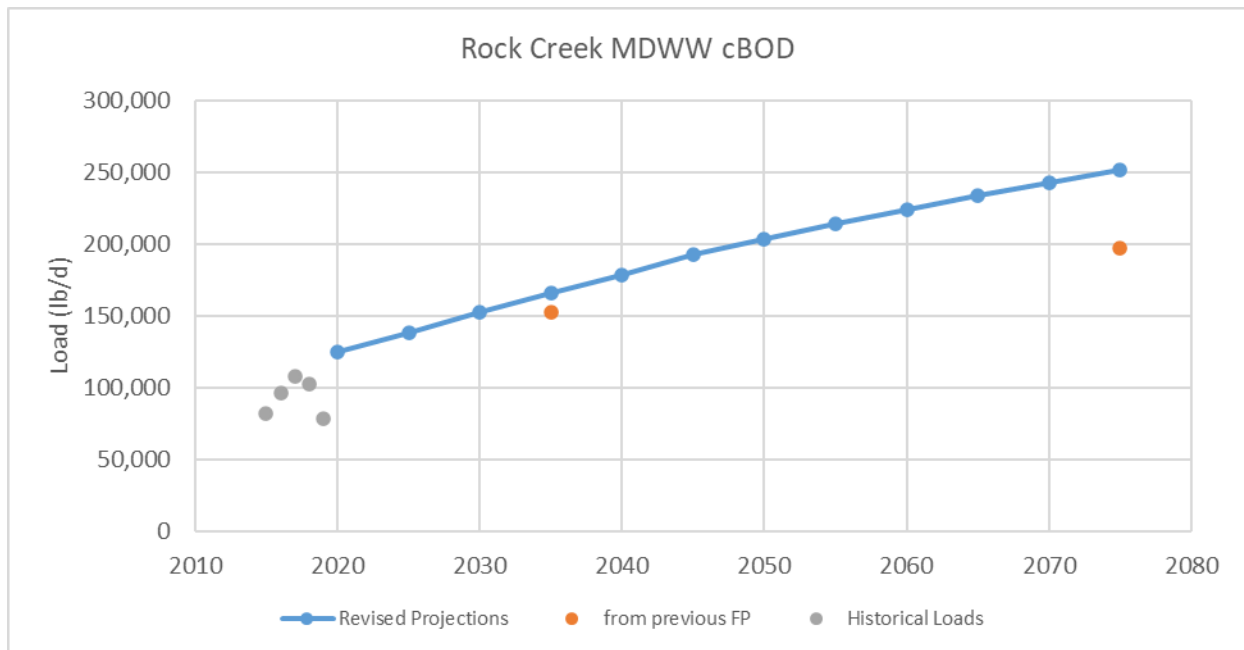


Figure F7. MDWW Load Projection, cBOD, Rock Creek WRRF

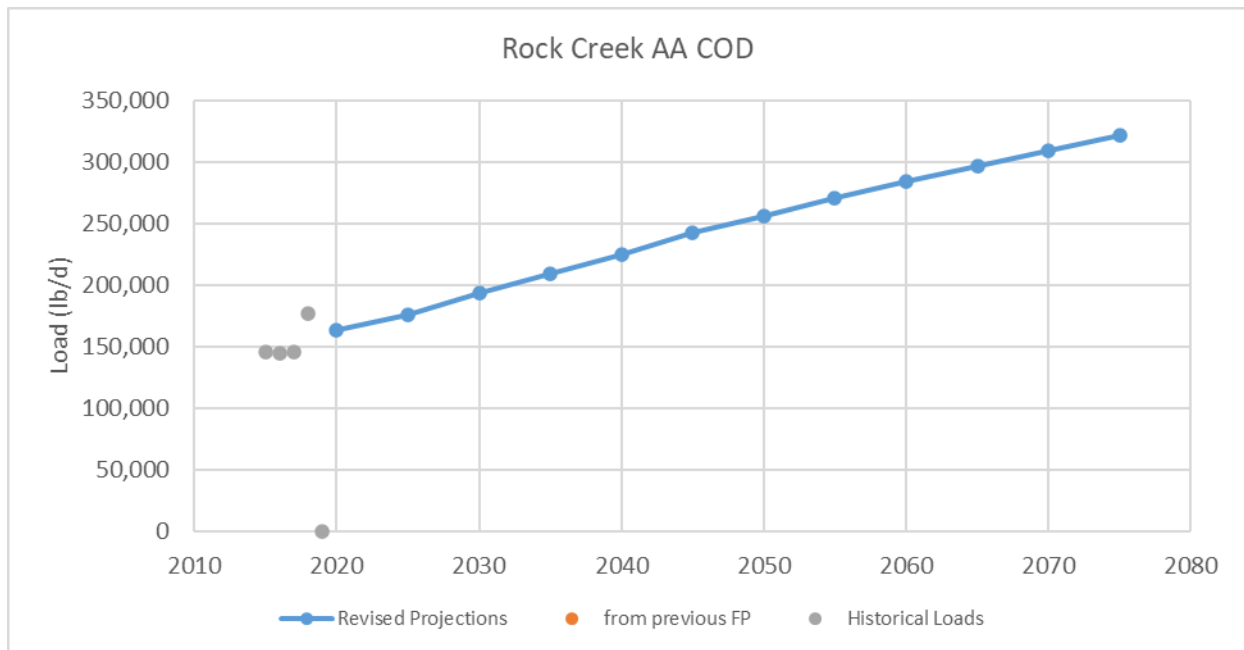
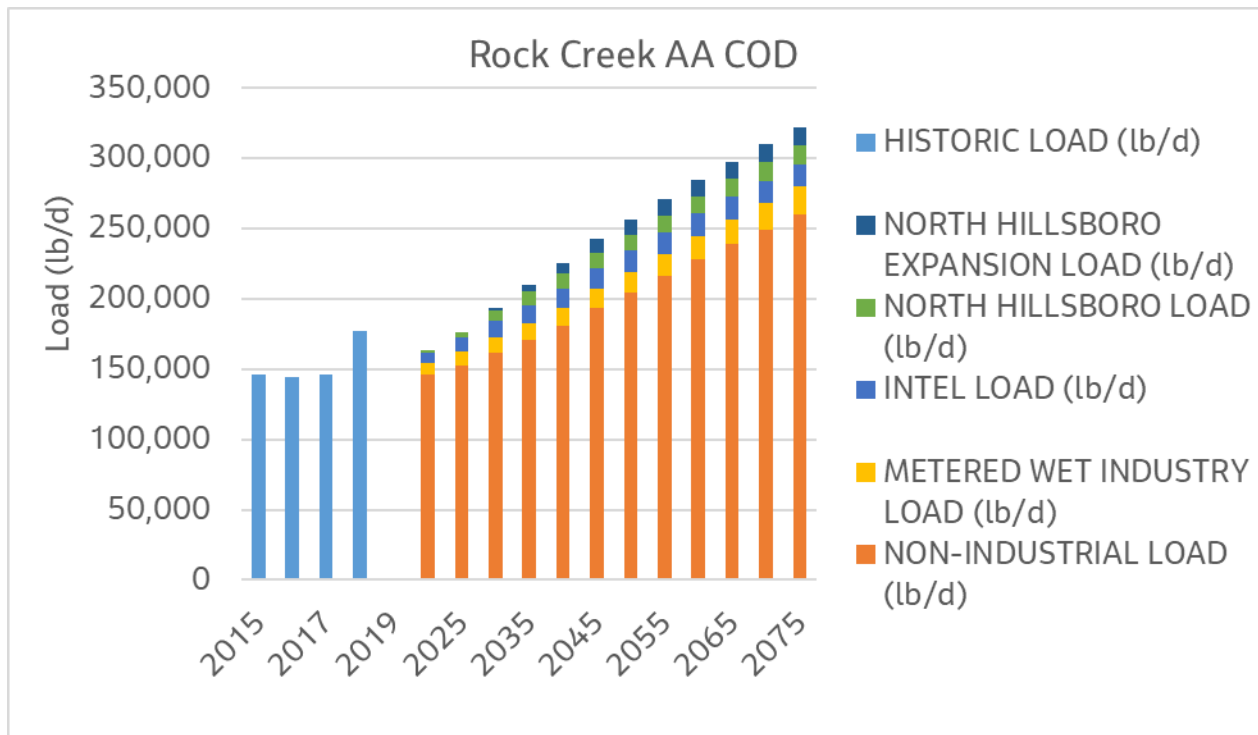


Figure F8. AA Load Projection, COD, Rock Creek WRRF

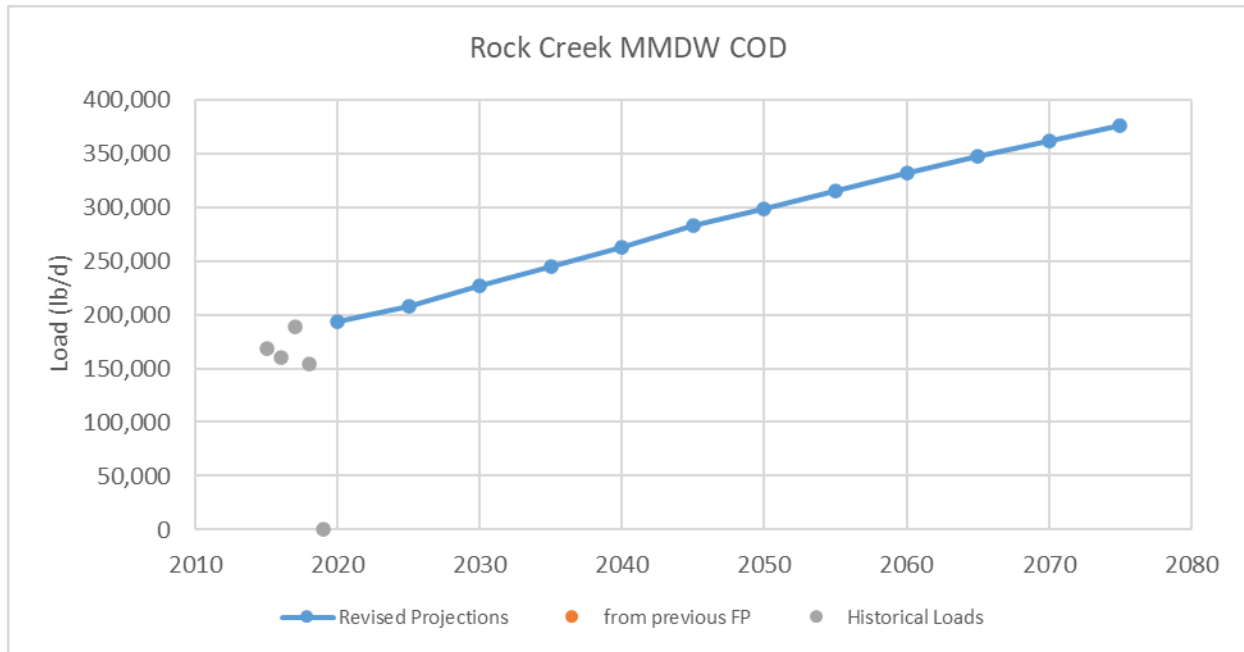


Figure F9. MMDW Load Projection, COD, Rock Creek WRRF

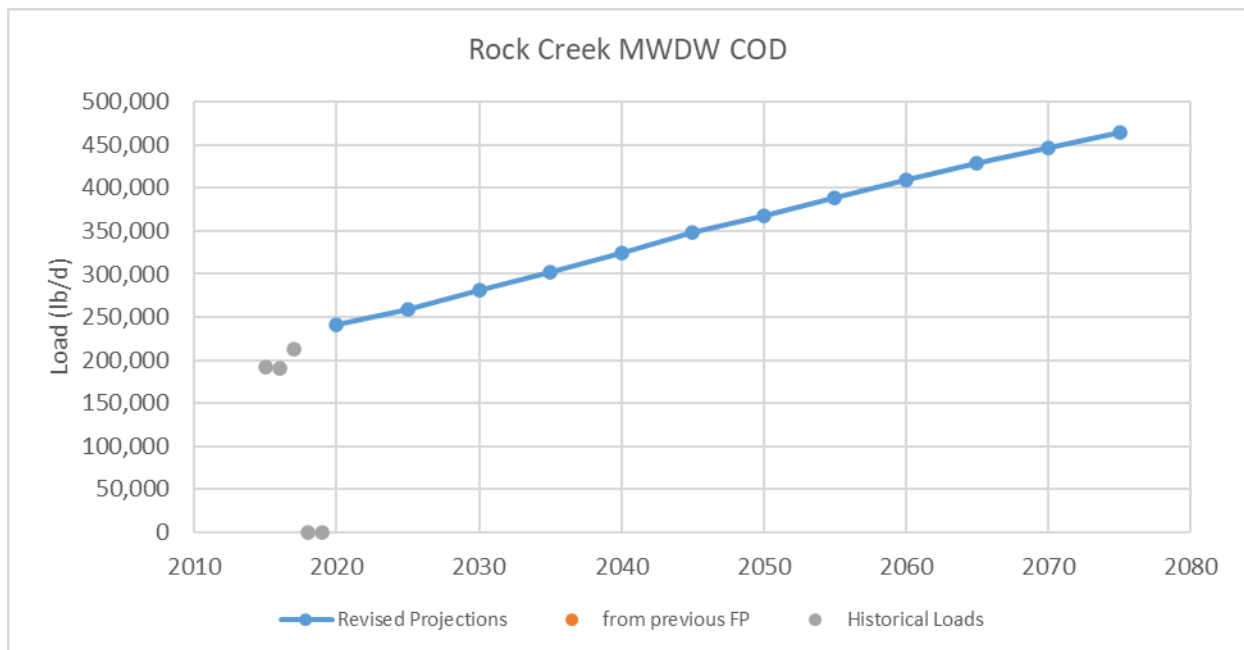


Figure F10. MWDW Load Projection, COD, Rock Creek WRRF

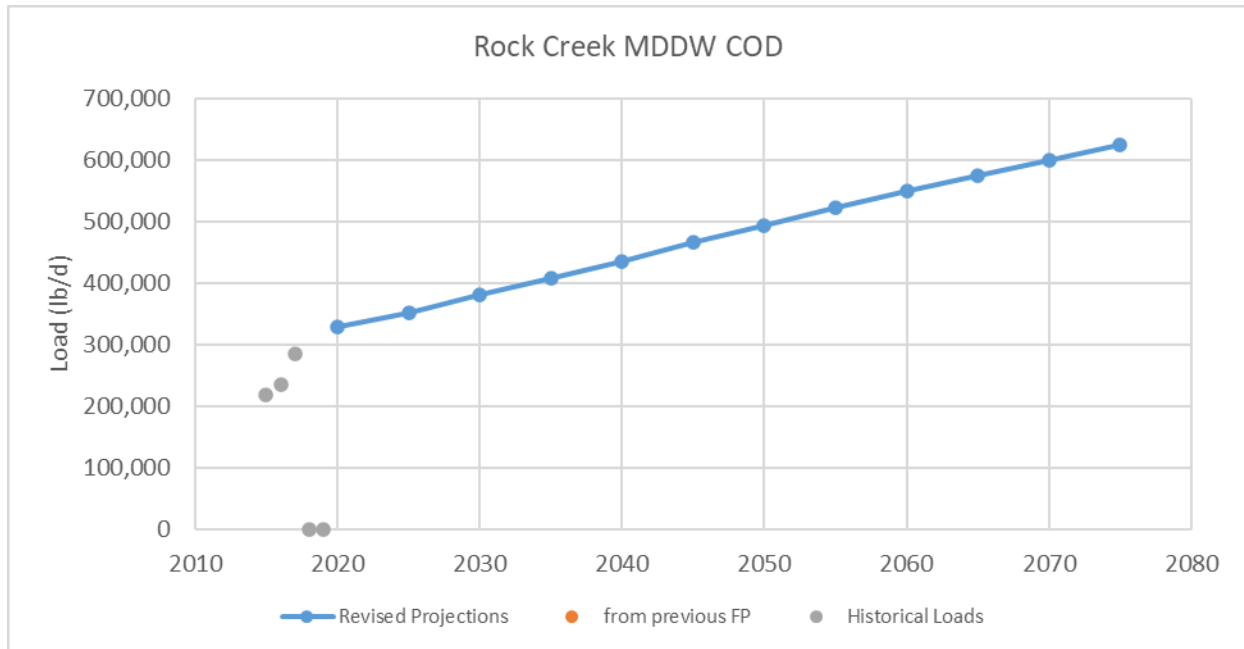


Figure F11. MDDW Load Projection, COD, Rock Creek WRRF

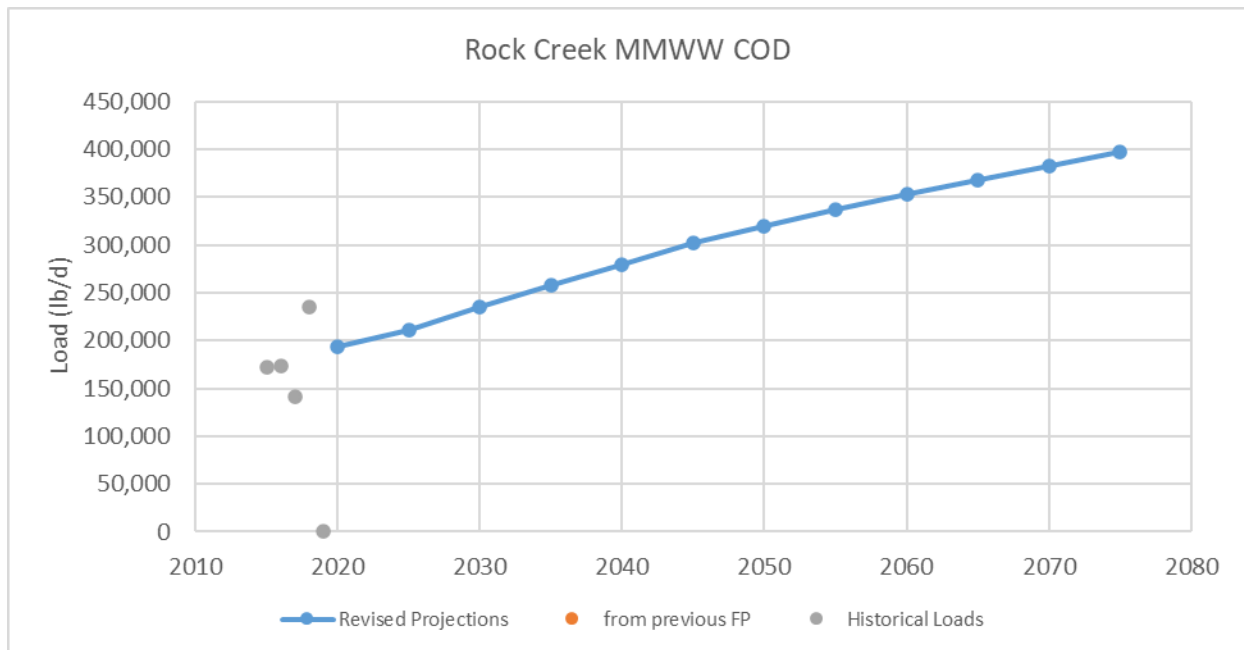


Figure F12. MMWW Load Projection, COD, Rock Creek WRRF

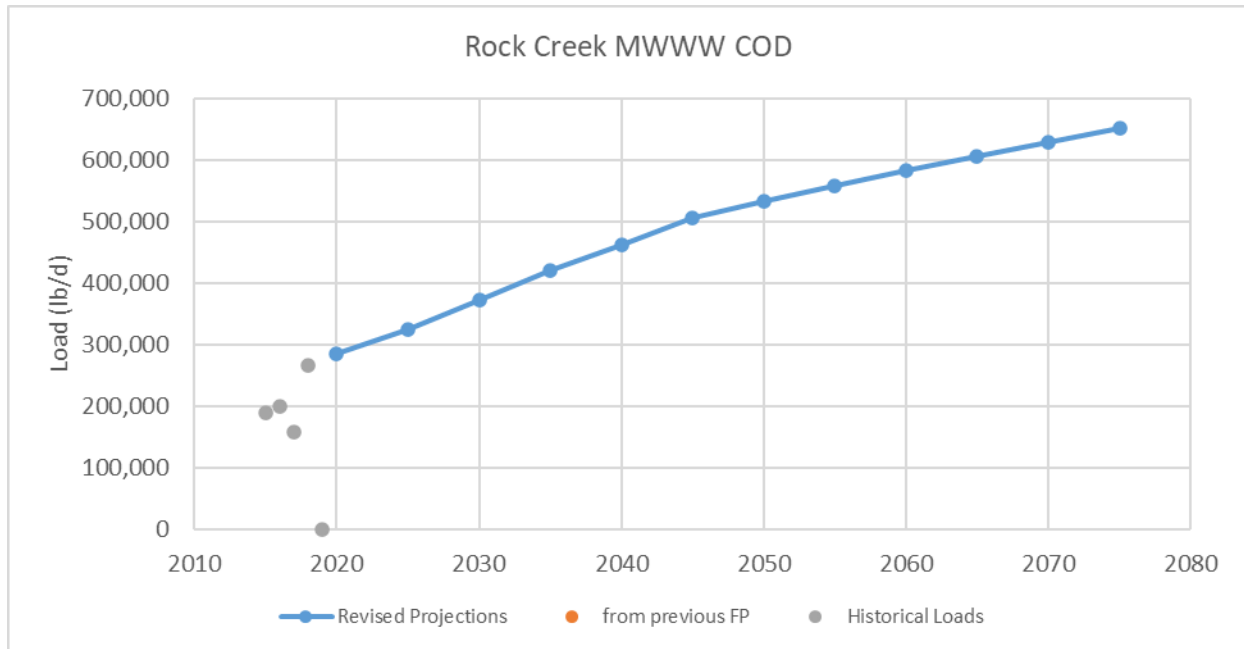


Figure F13. MWWW Load Projection, COD, Rock Creek WRRF

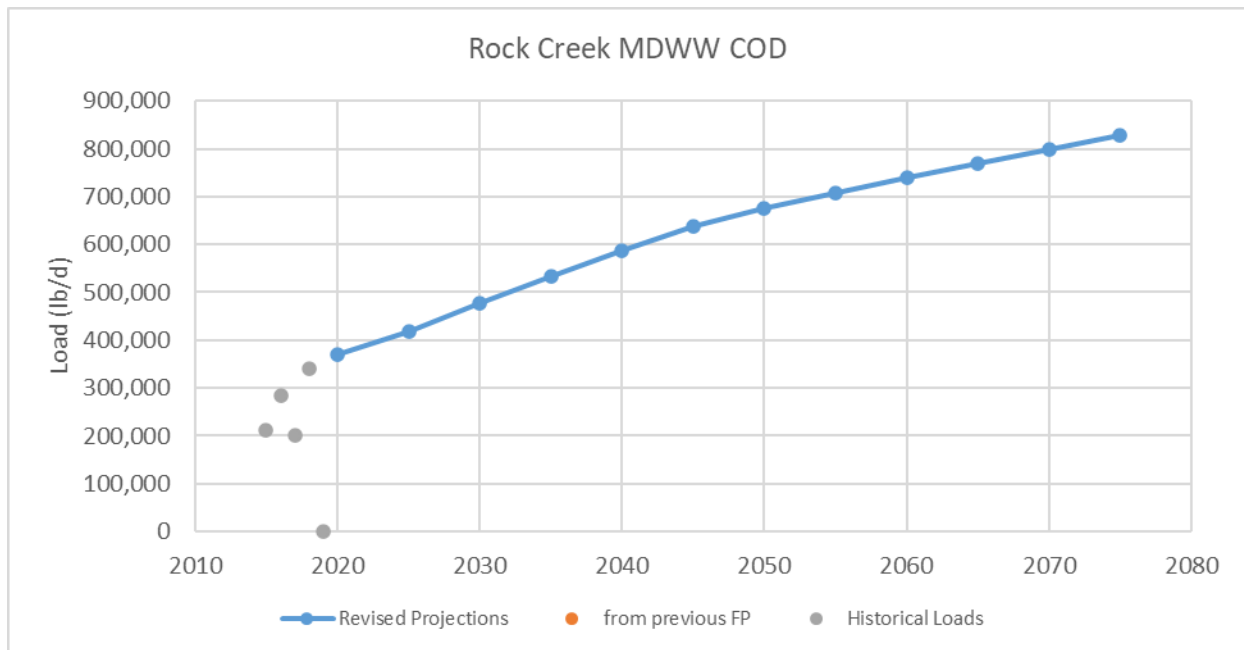


Figure F14. MDWW Load Projection, COD, Rock Creek WRRF

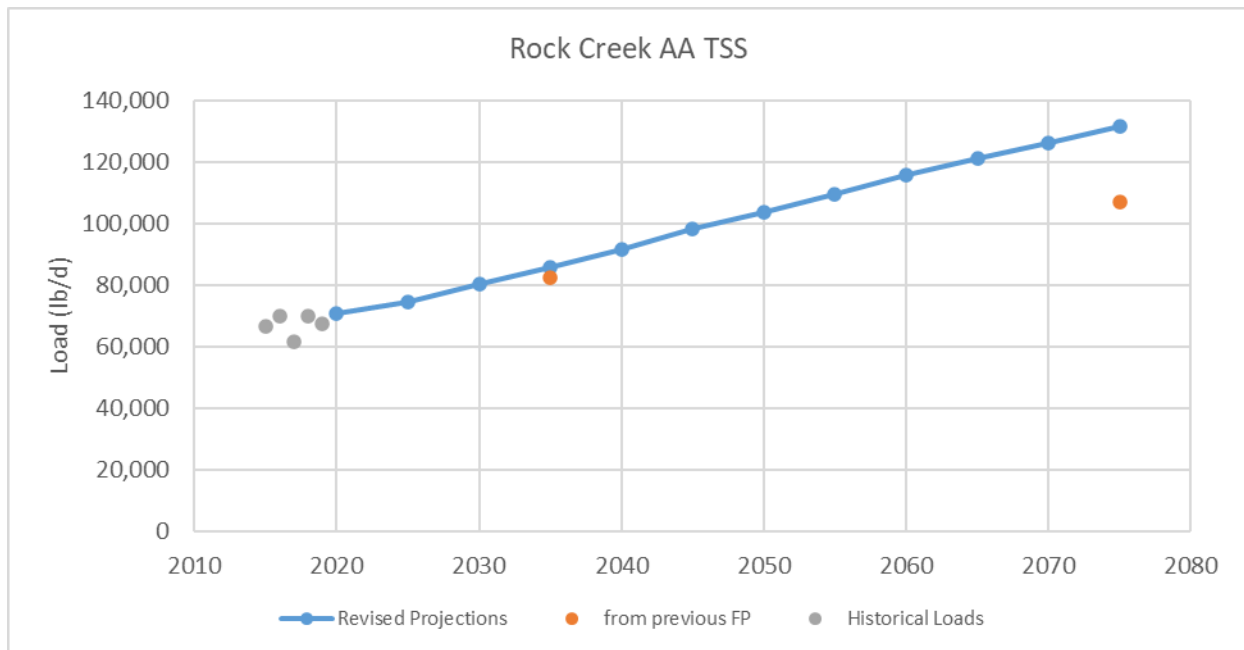
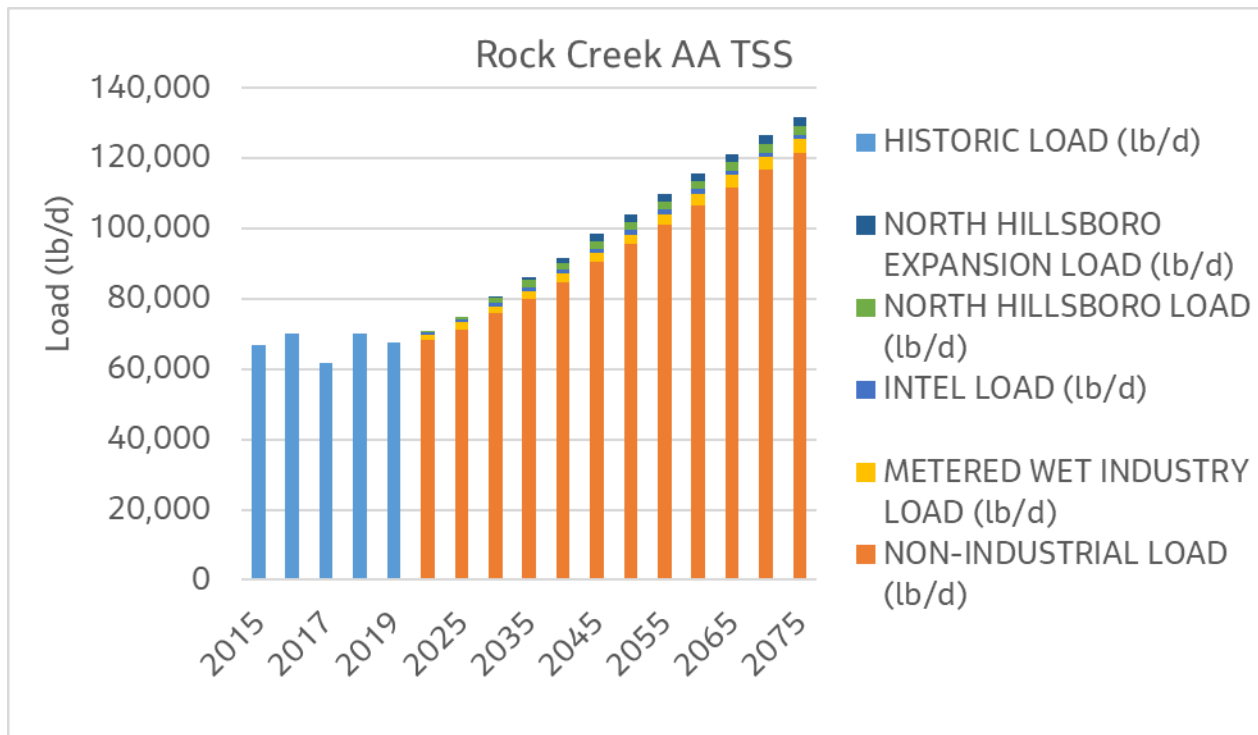


Figure F15. AA Load Projection, TSS, Rock Creek WRRF

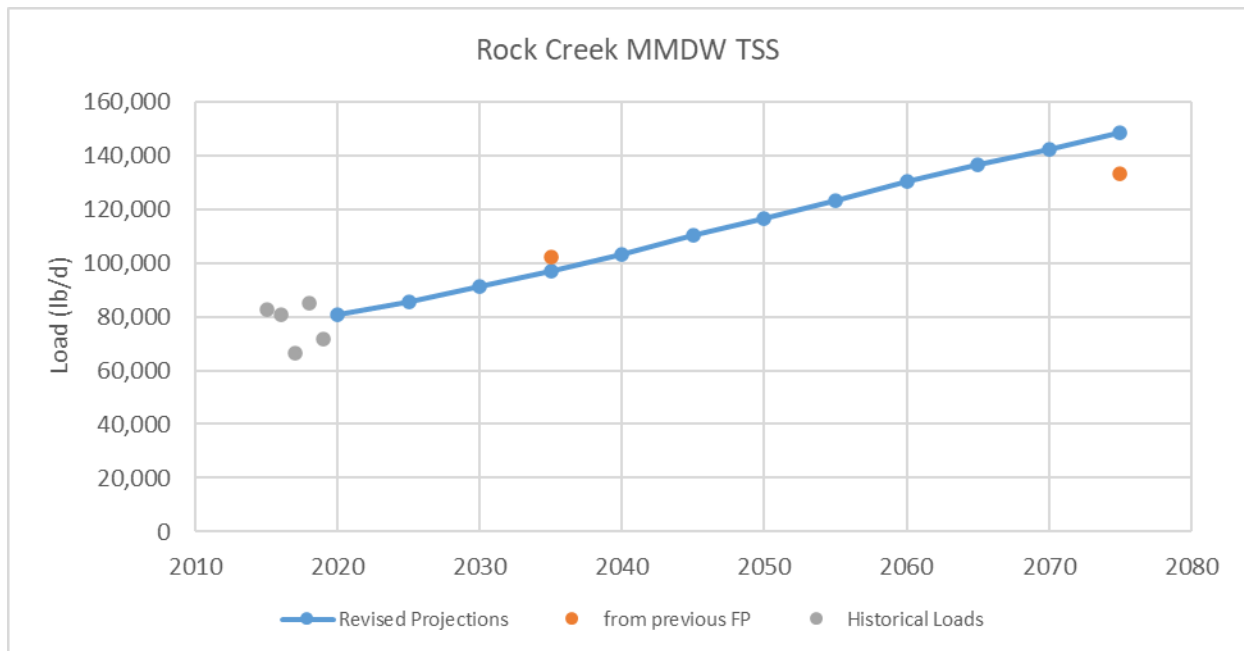


Figure F16. MMDW Load Projection, TSS, Rock Creek WRRF

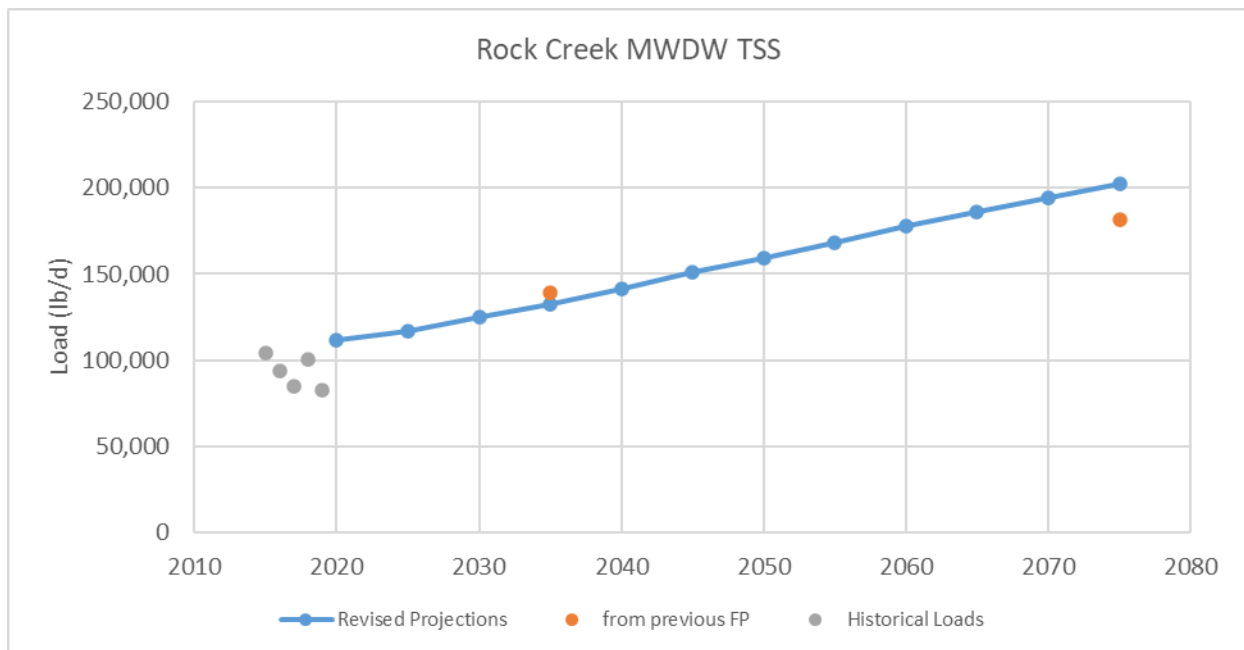


Figure F17. MWDW Load Projection, TSS, Rock Creek WRRF

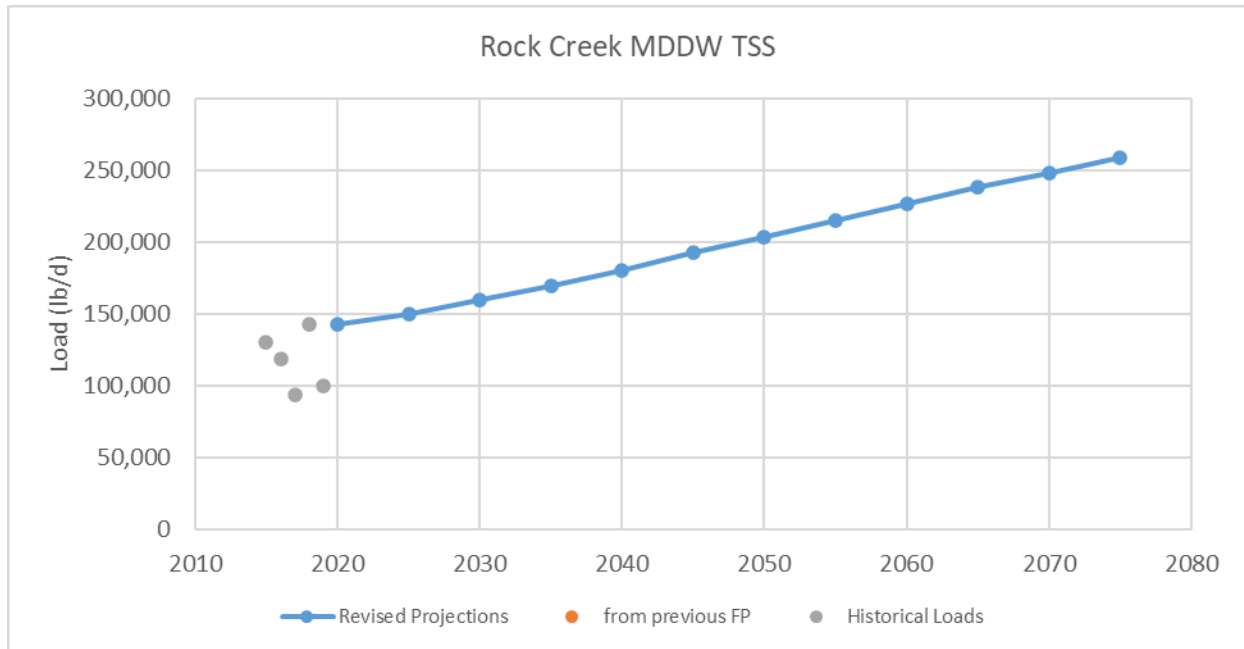


Figure F18. MDDW Load Projection, TSS, Rock Creek WRRF

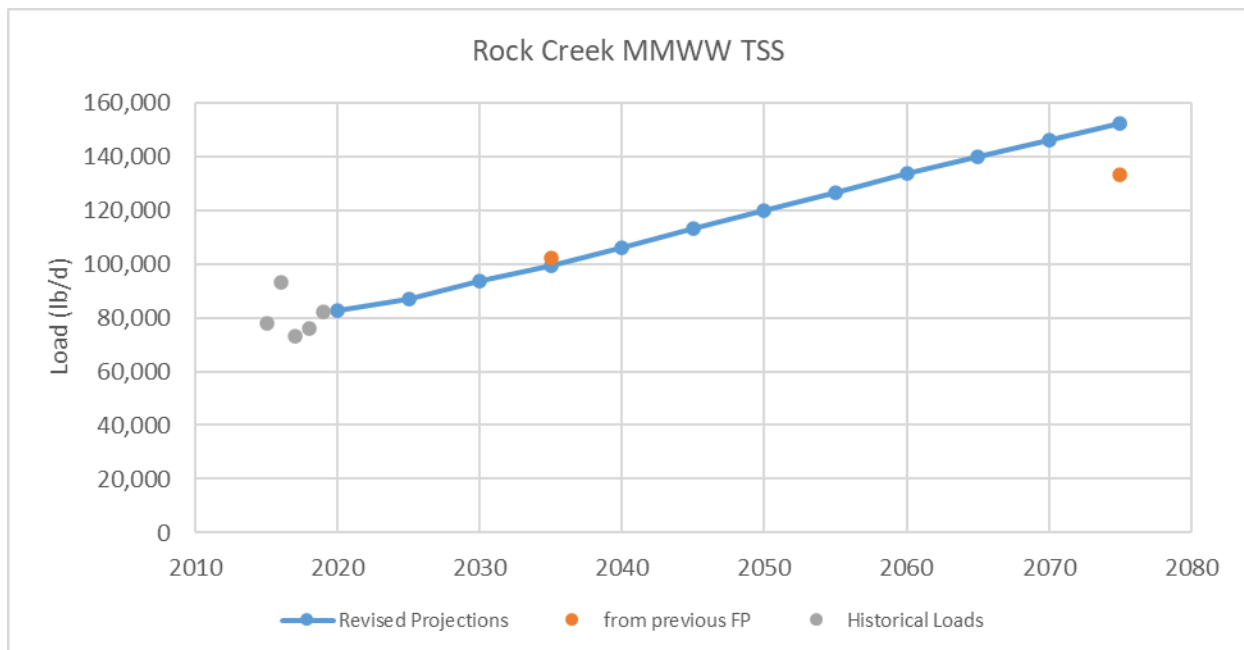


Figure F19. MMWW Load Projection, TSS, Rock Creek WRRF

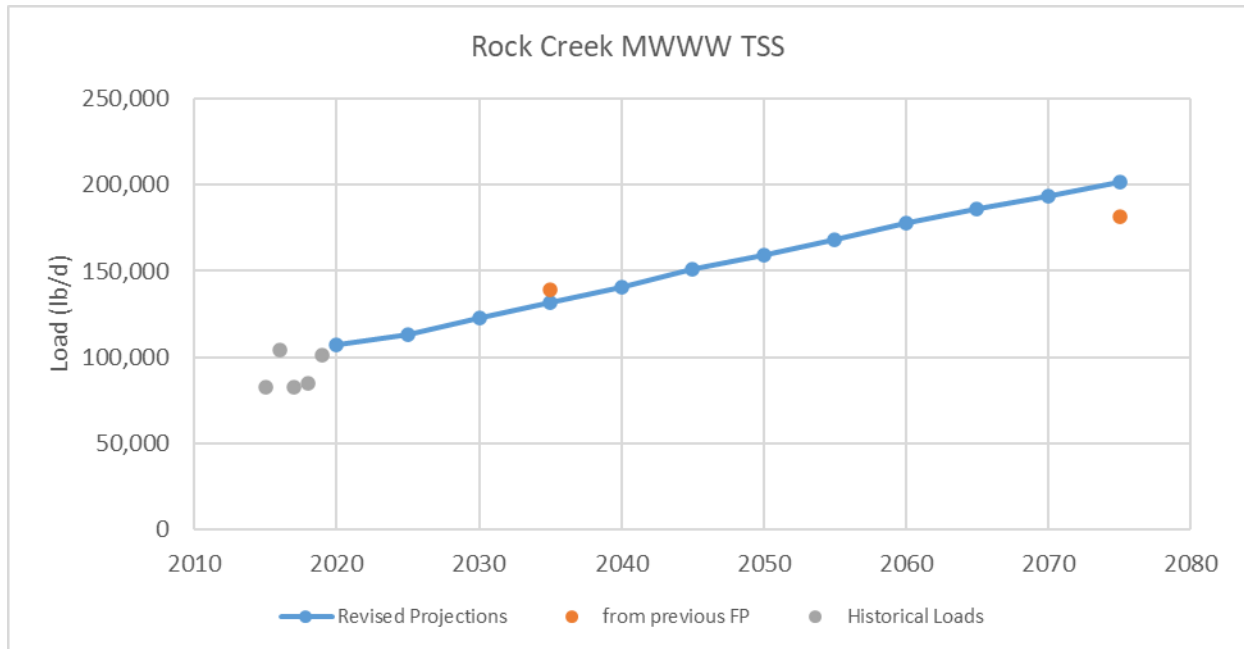


Figure F20. MWWW Load Projection, TSS, Rock Creek WRRF

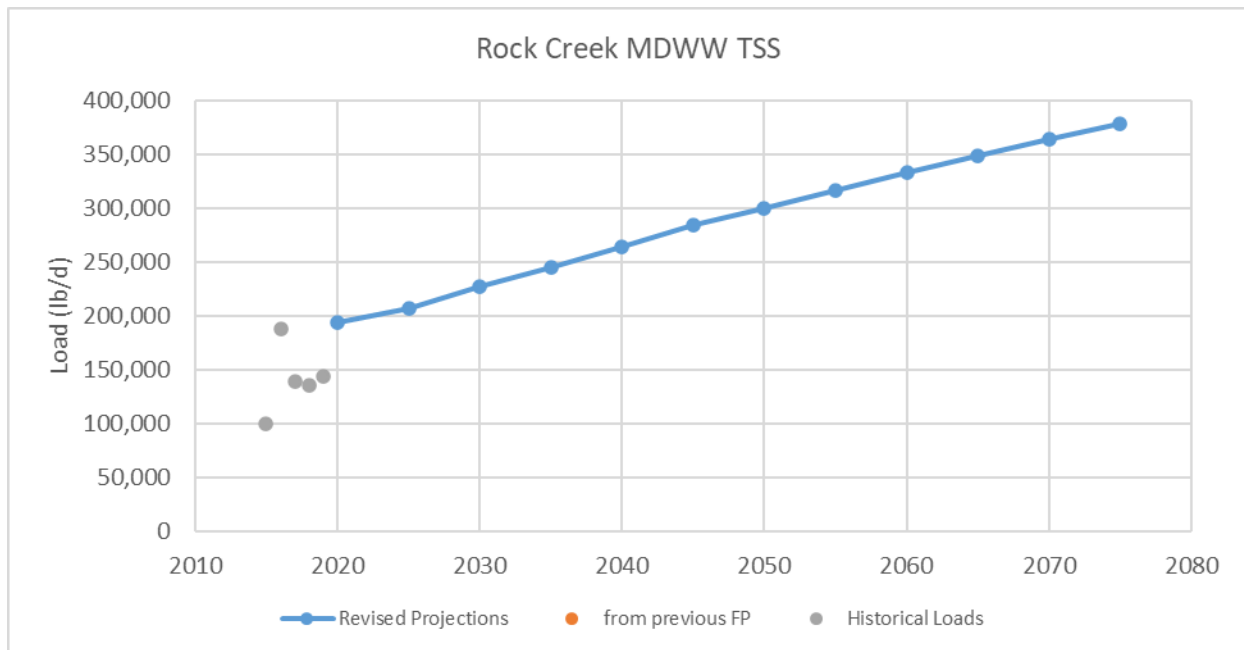


Figure F21. MDWW Load Projection, TSS, Rock Creek WRRF

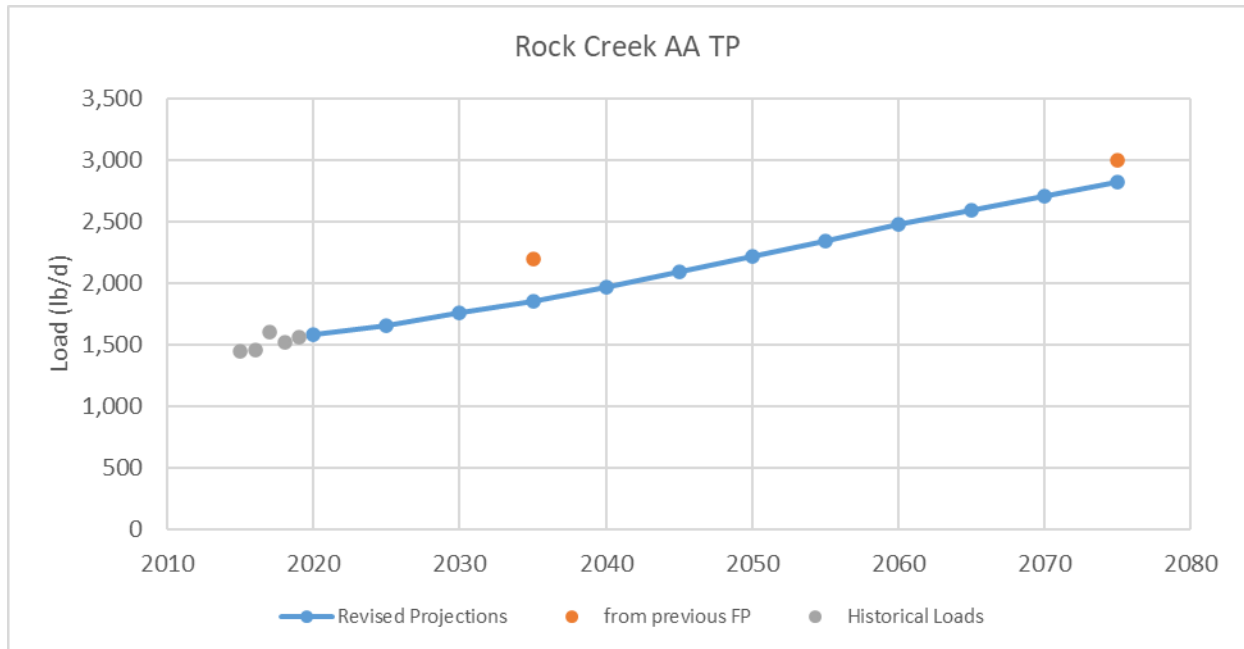


Figure F22. AA Load Projection, TP, Rock Creek WRRF

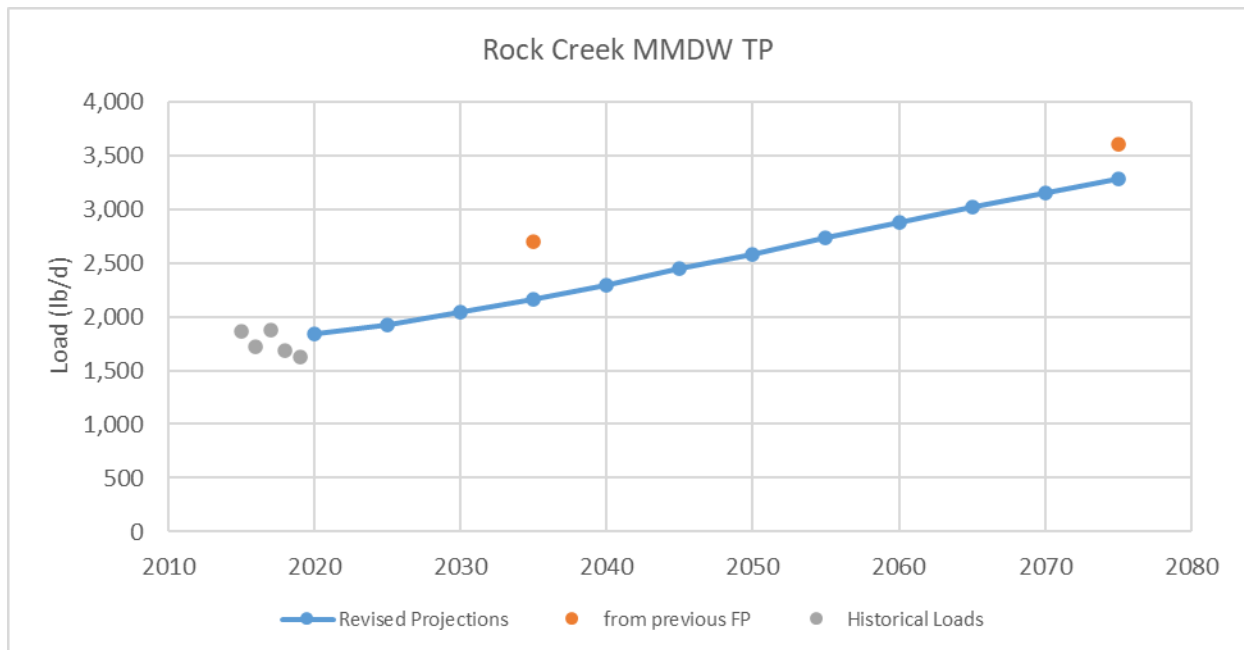


Figure F23. MMDW Load Projection, TP, Rock Creek WRRF

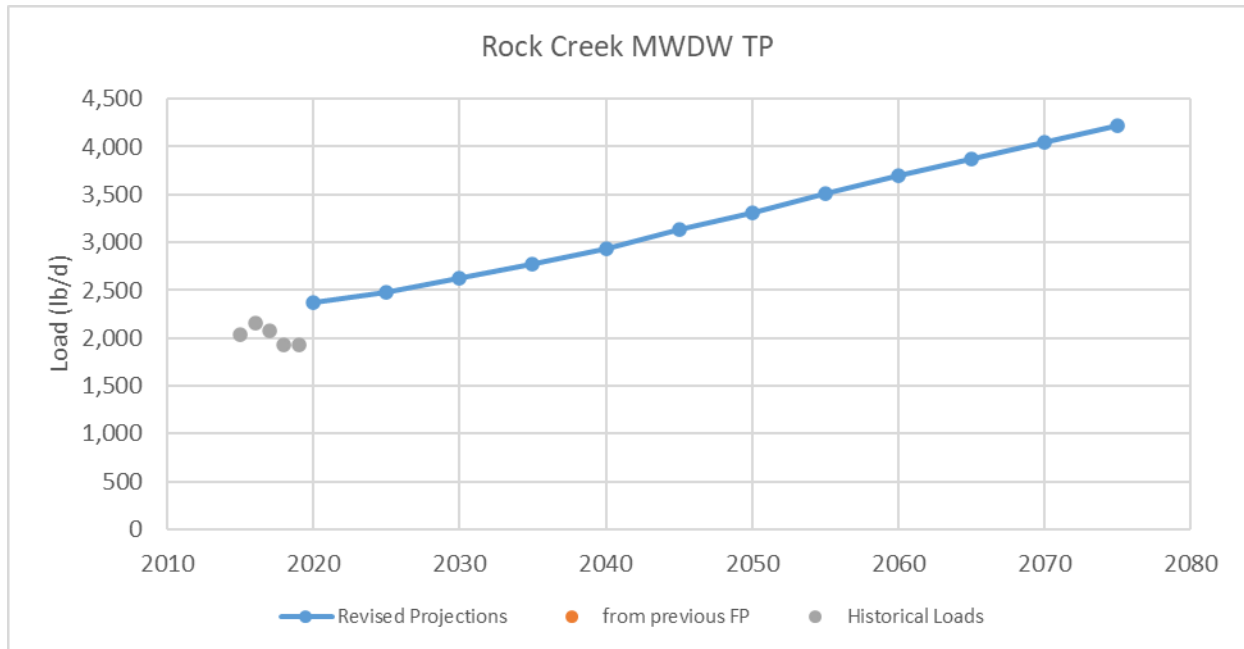


Figure F24. MWDW Load Projection, TP, Rock Creek WRRF

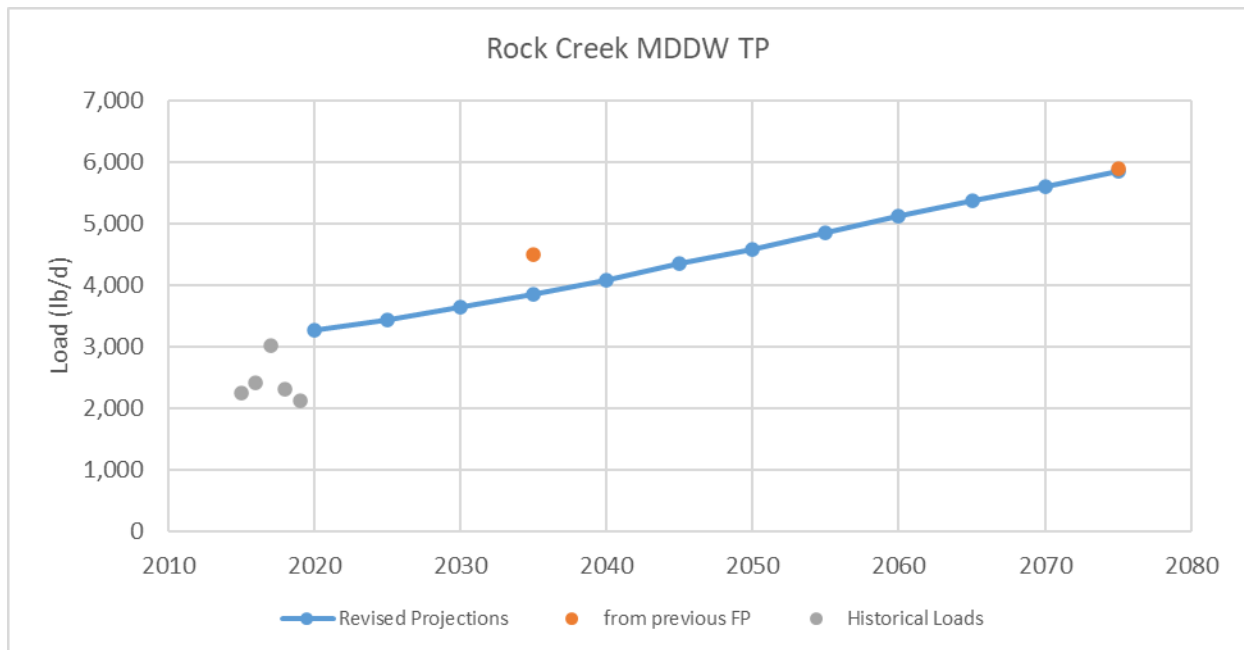


Figure F25. MDDW Load Projection, TP, Rock Creek WRRF

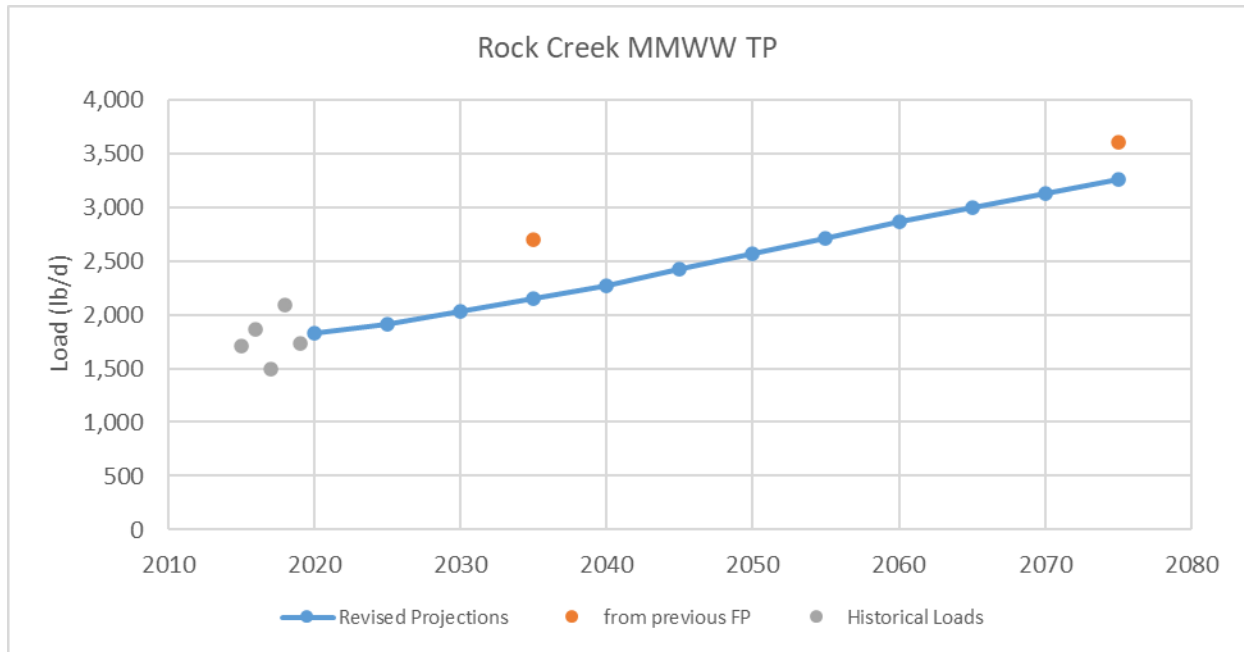


Figure F26. MMWW Load Projection, TP, Rock Creek WRRF

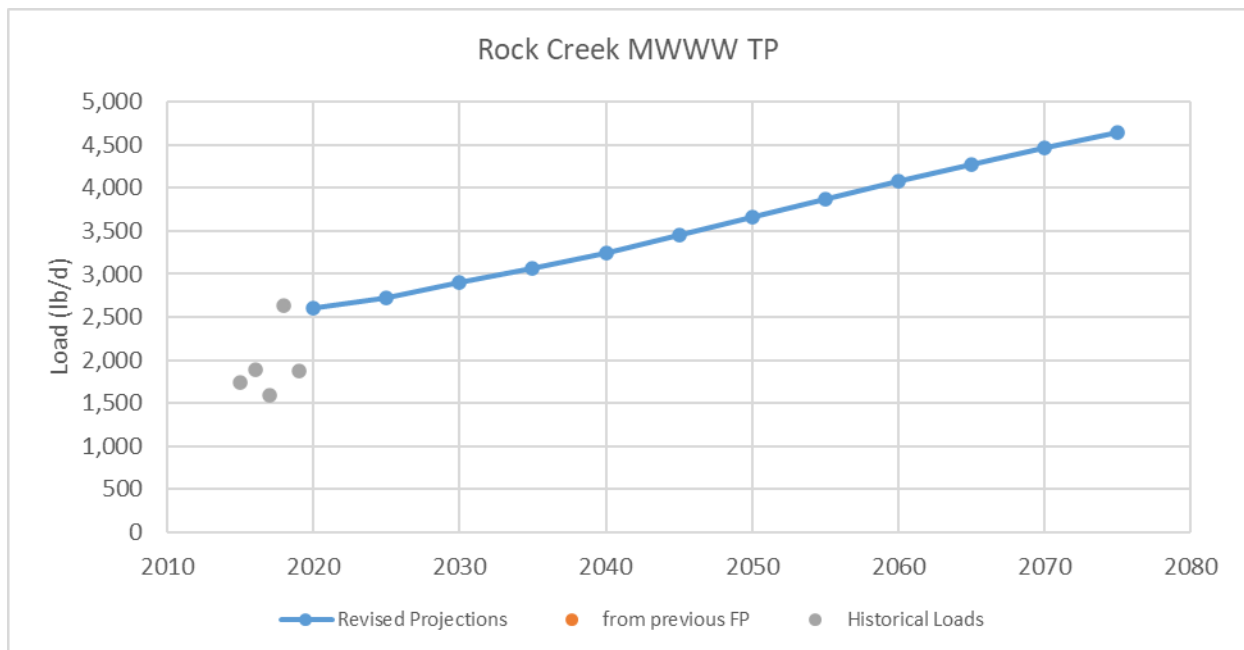


Figure F27. MWWW Load Projection, TP, Rock Creek WRRF

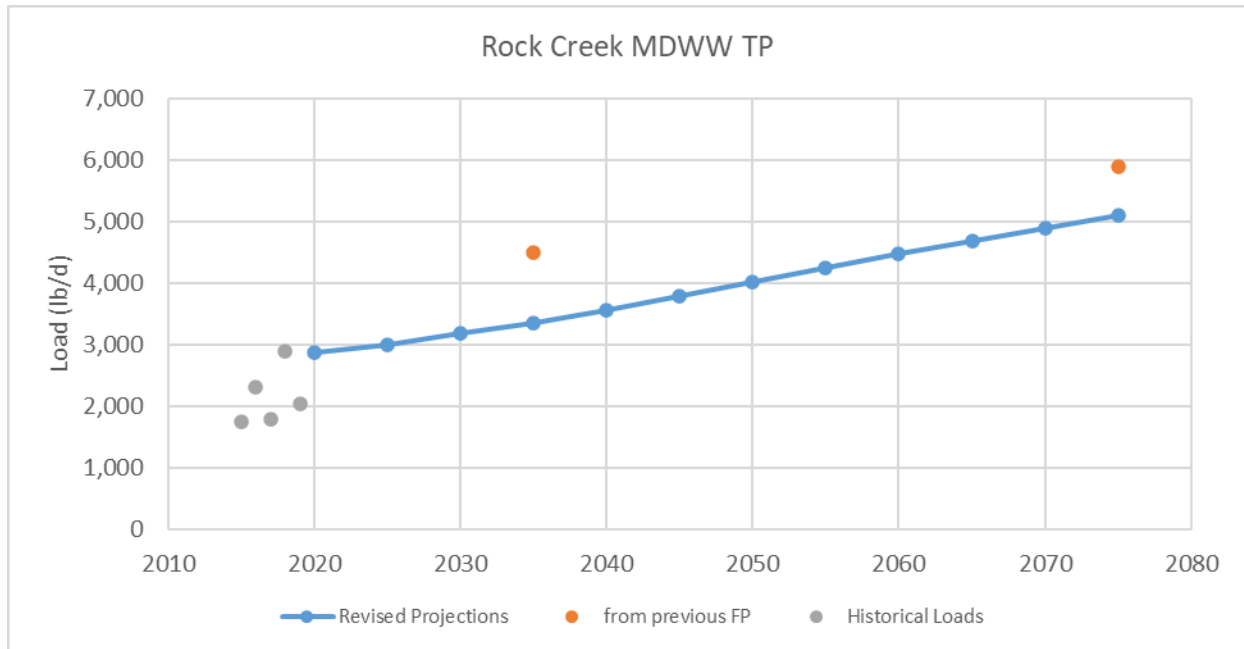


Figure F28. MDWW Load Projection, TP, Rock Creek WRRF

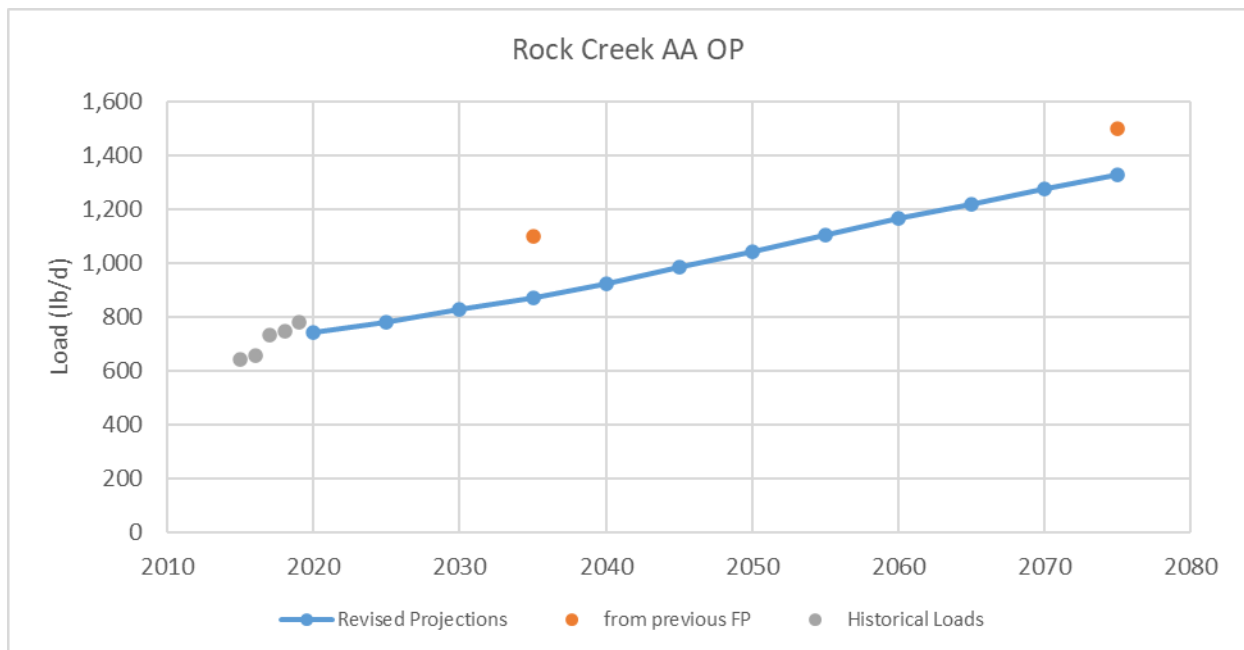


Figure F29. AA Load Projection, oP, Rock Creek WRRF

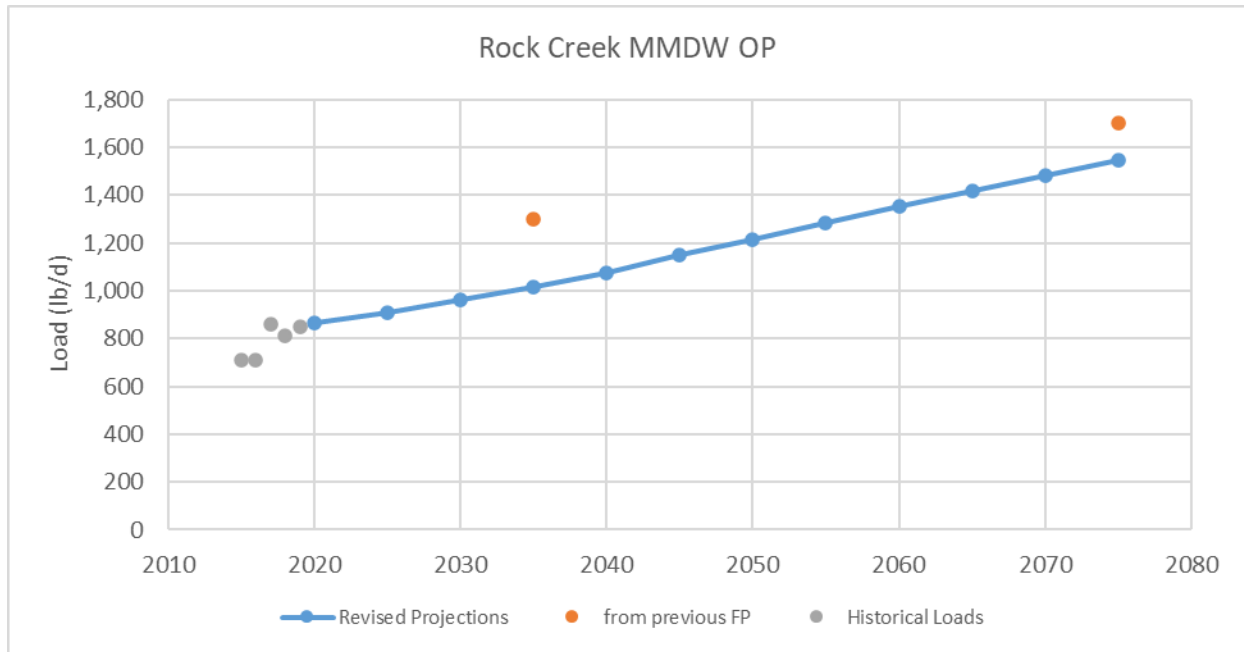


Figure F30. MMDW Load Projection, oP, Rock Creek WRRF

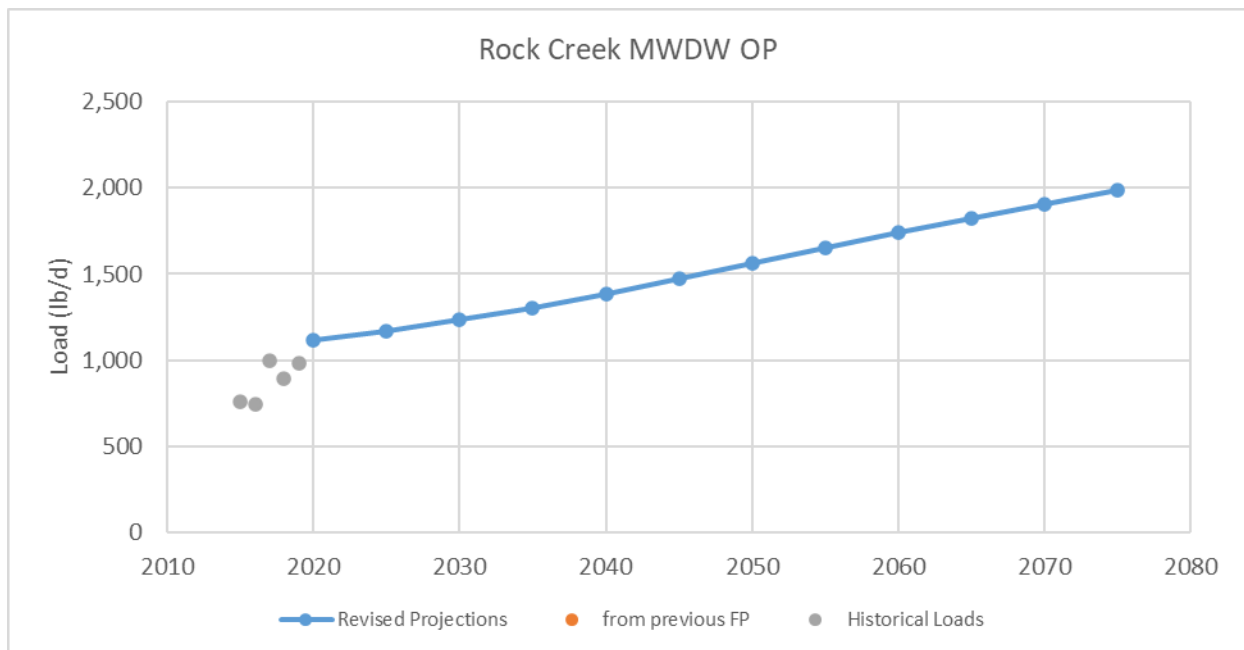


Figure F31. MWDW Load Projection, oP, Rock Creek WRRF

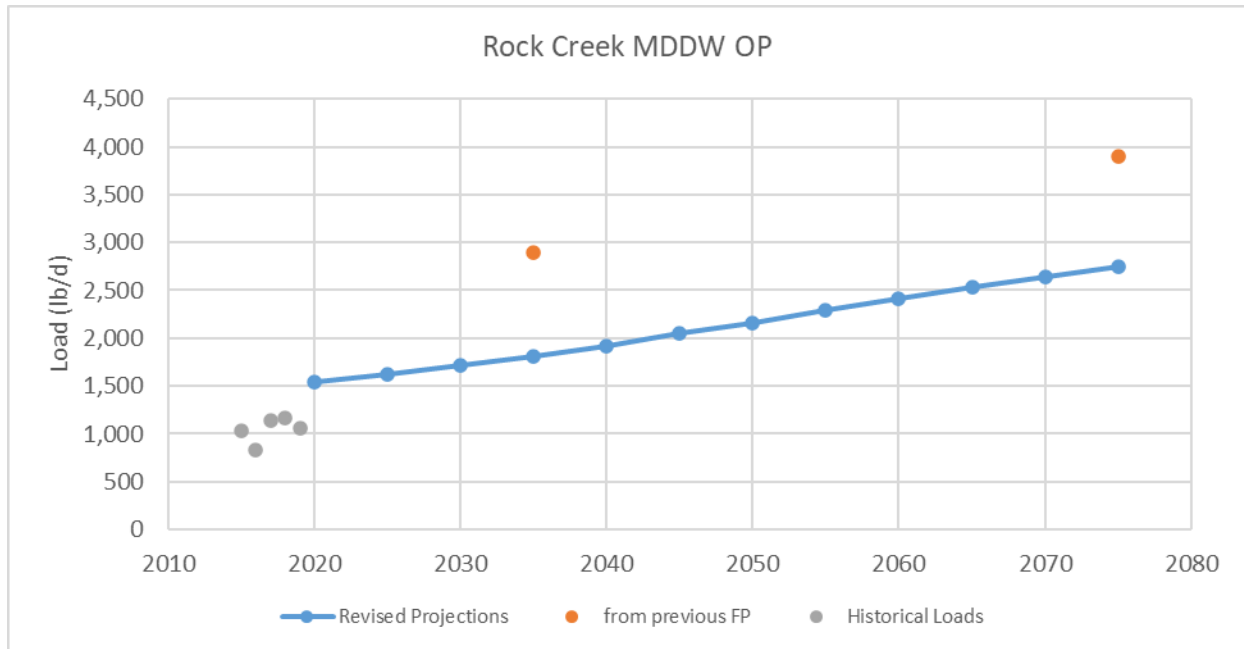


Figure F32. MDDW Load Projection, oP, Rock Creek WRRF

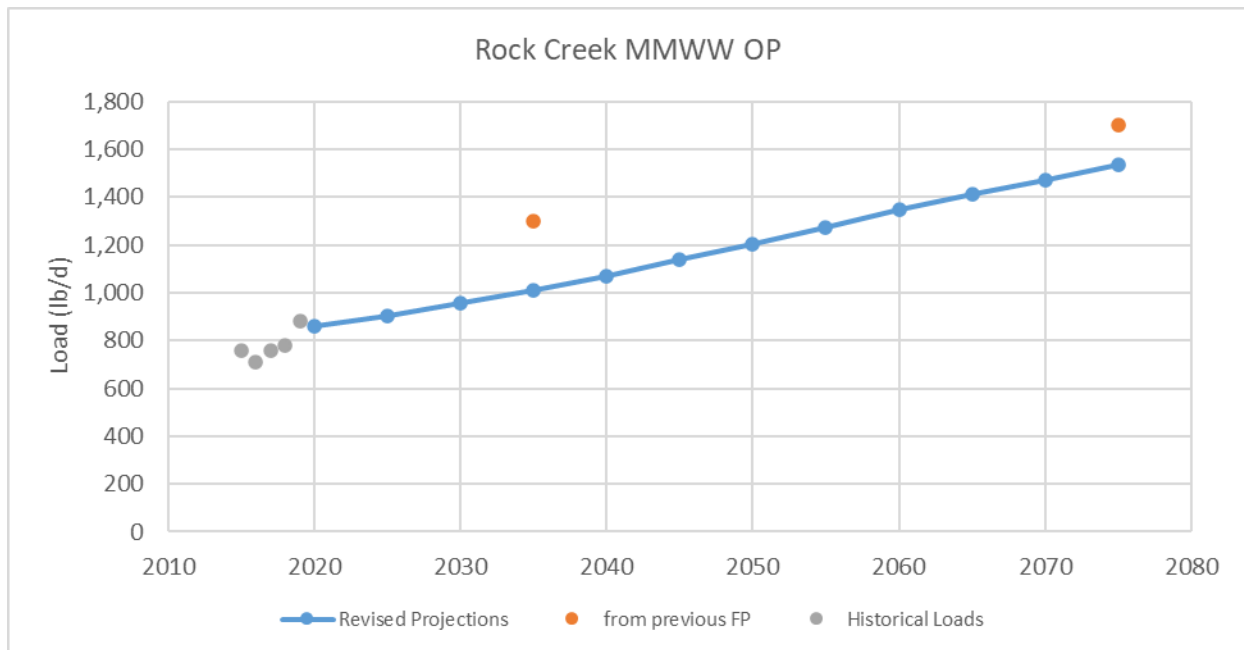


Figure F33. MMWW Load Projection, oP, Rock Creek WRRF

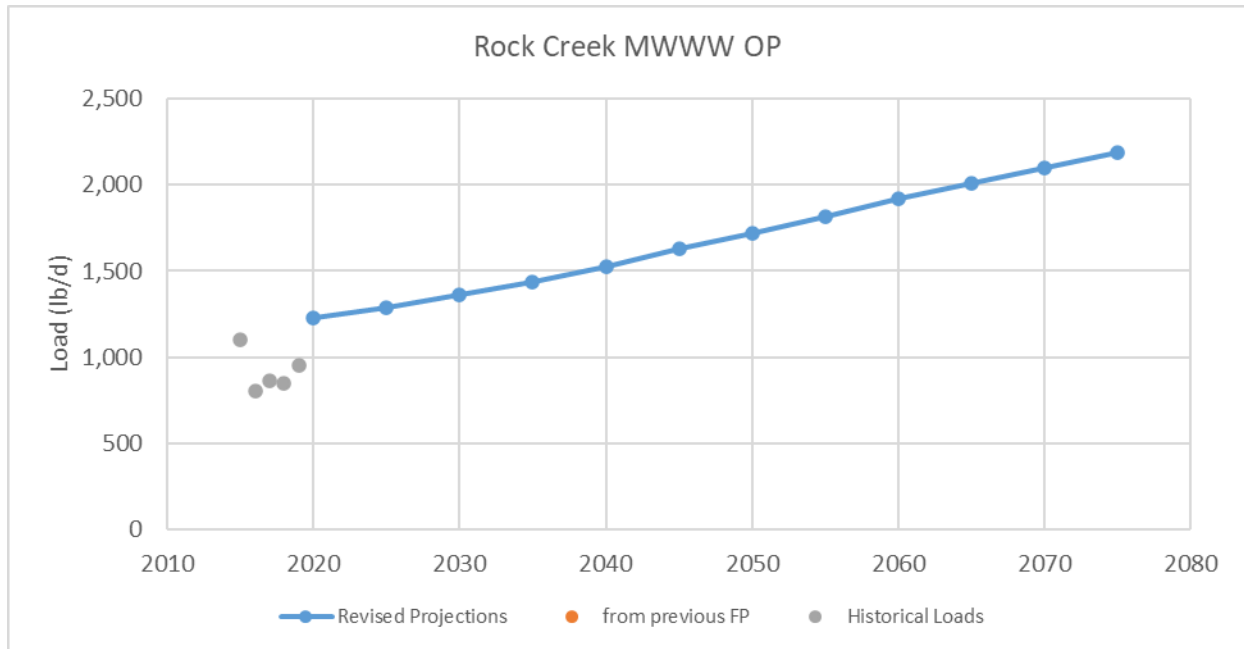


Figure F34. MWWW Load Projection, oP, Rock Creek WRRF

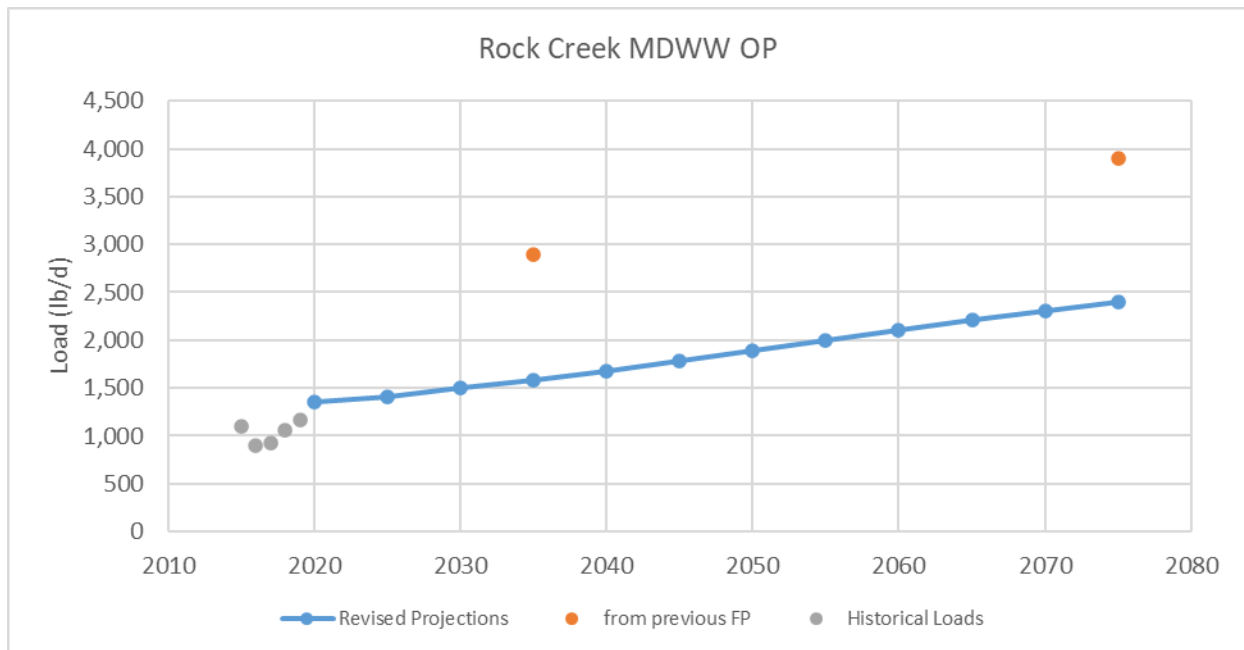


Figure F35. MDWW Load Projection, oP, Rock Creek WRRF

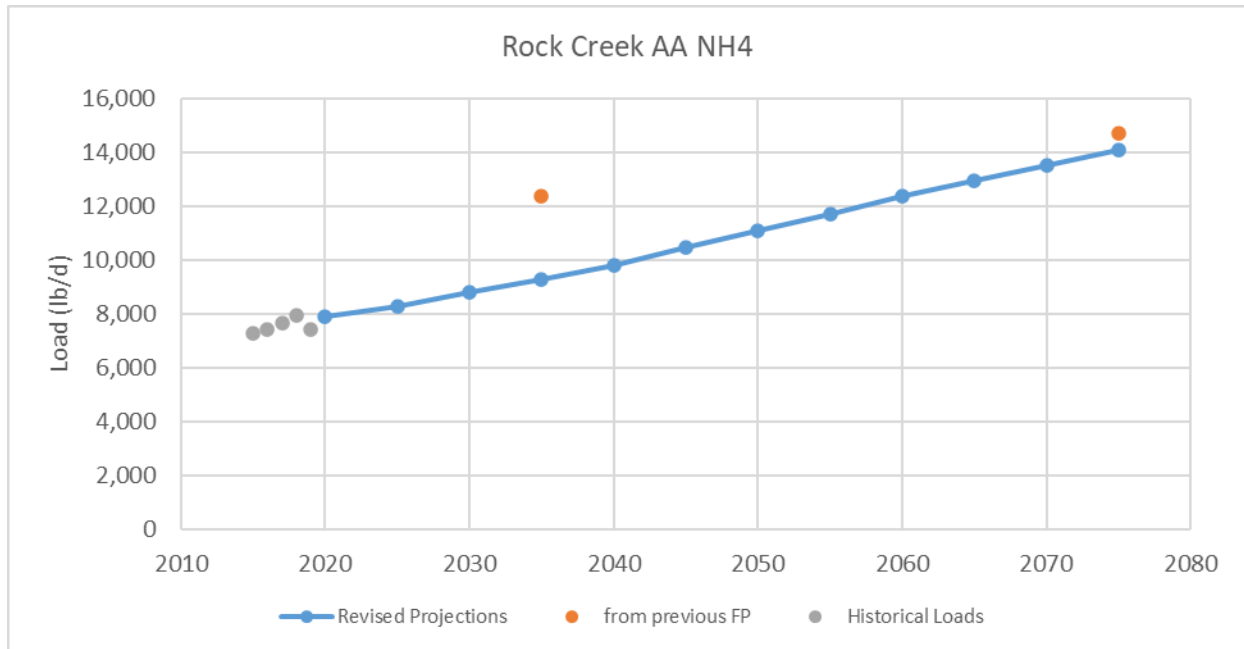


Figure F36. AA Load Projection, NH4, Rock Creek WRRF

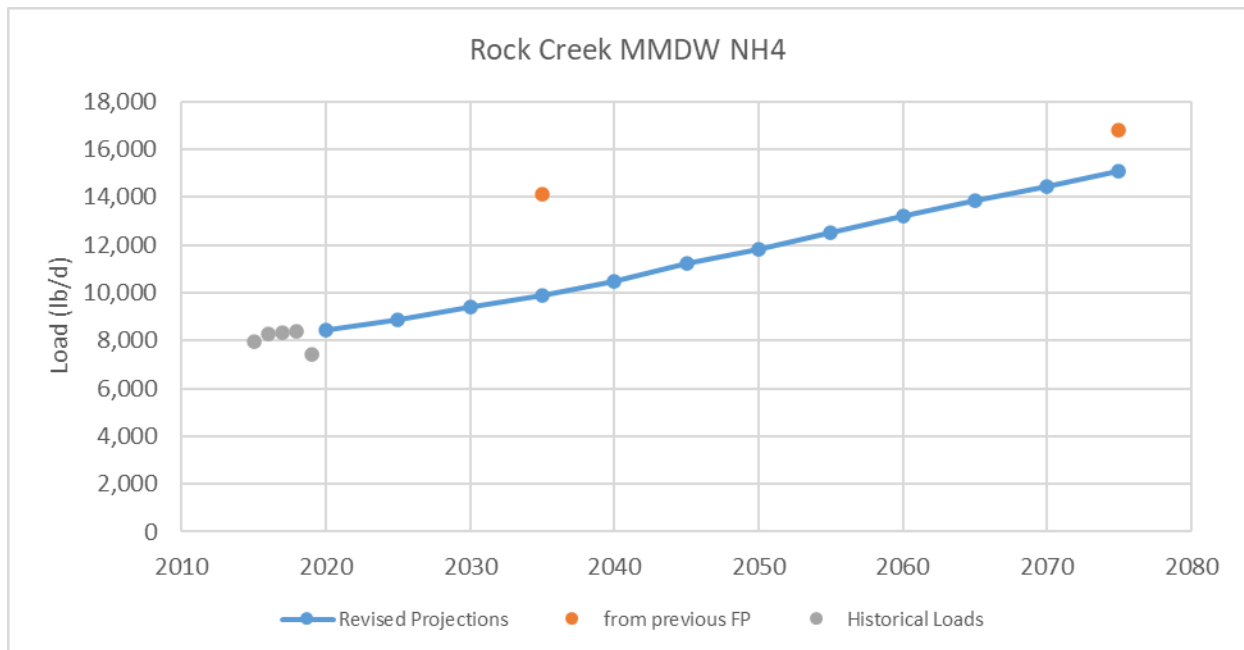


Figure F37. MMDW Load Projection, NH4, Rock Creek WRRF

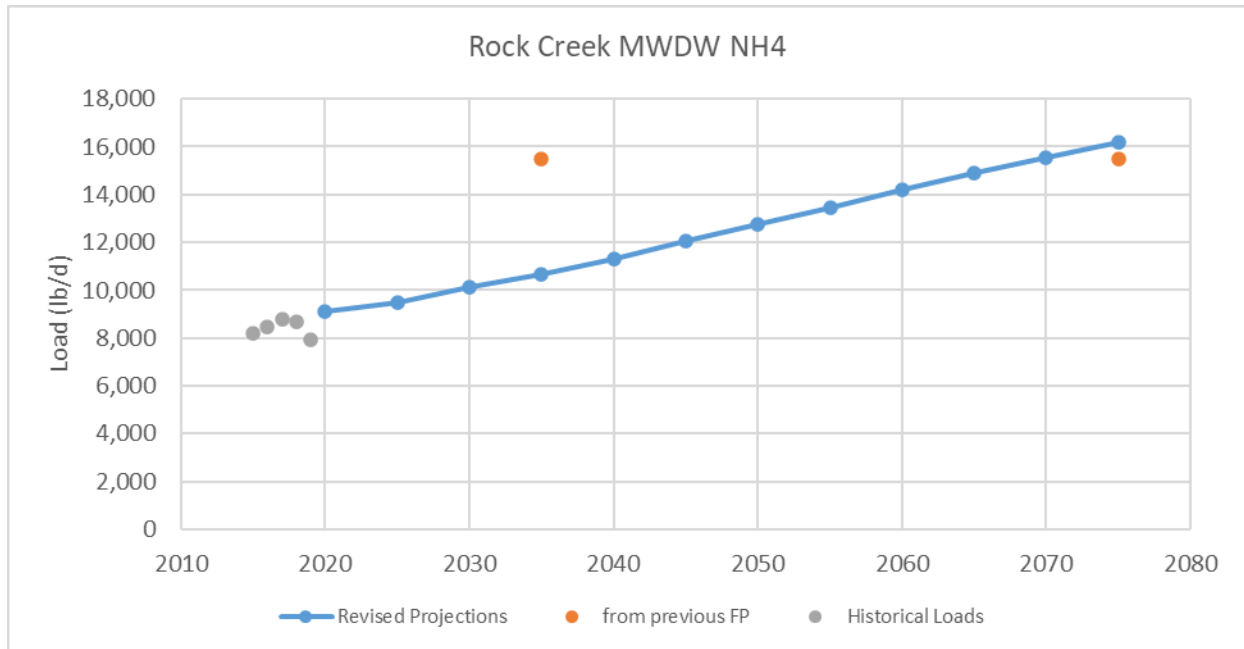


Figure F38. MWDW Load Projection, NH4, Rock Creek WRRF

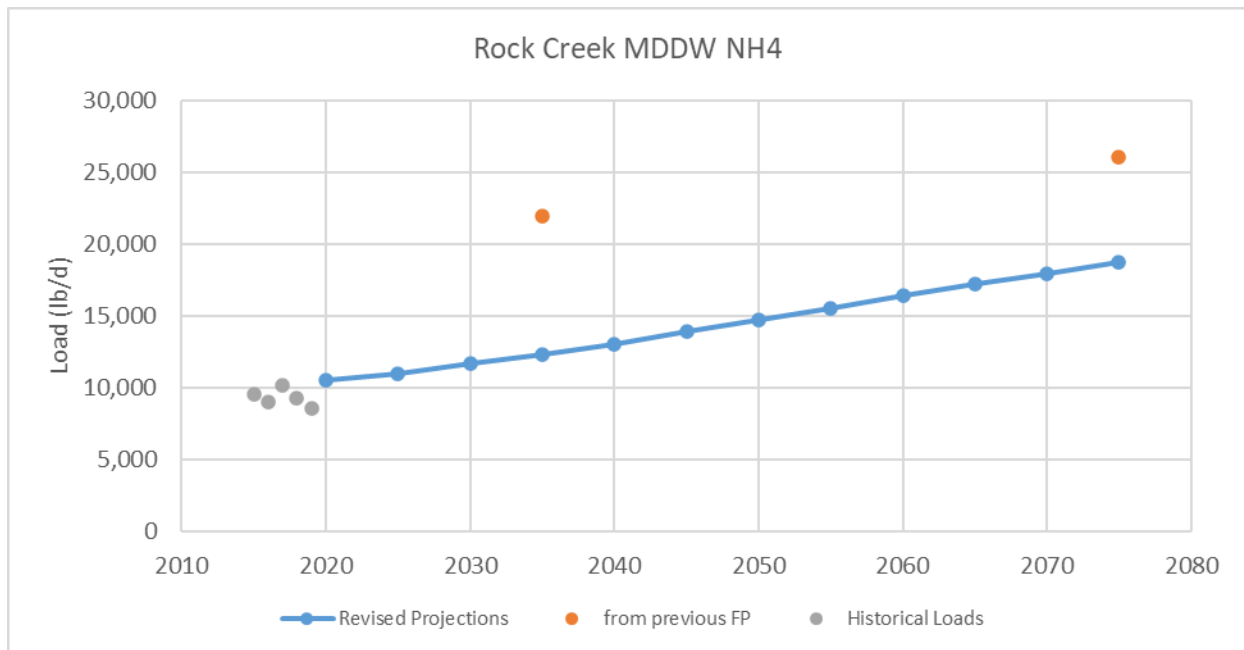


Figure F39. MDDW Load Projection, NH4, Rock Creek WRRF

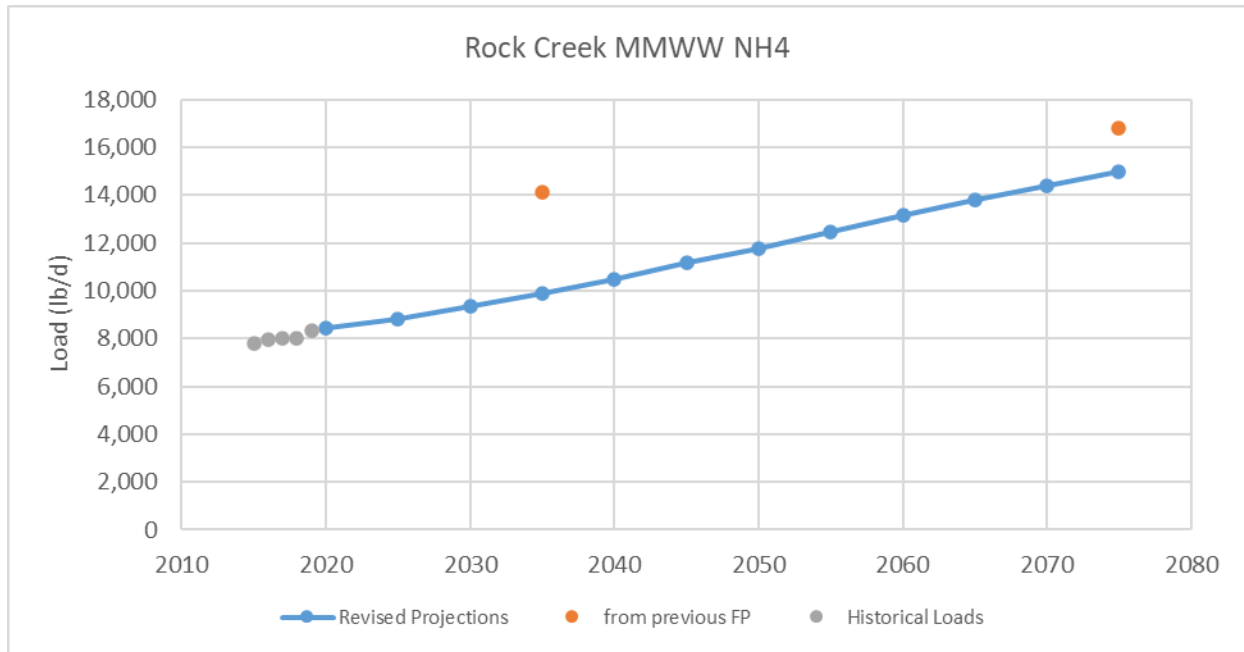


Figure F40. MMWW Load Projection, NH4, Rock Creek WRRF

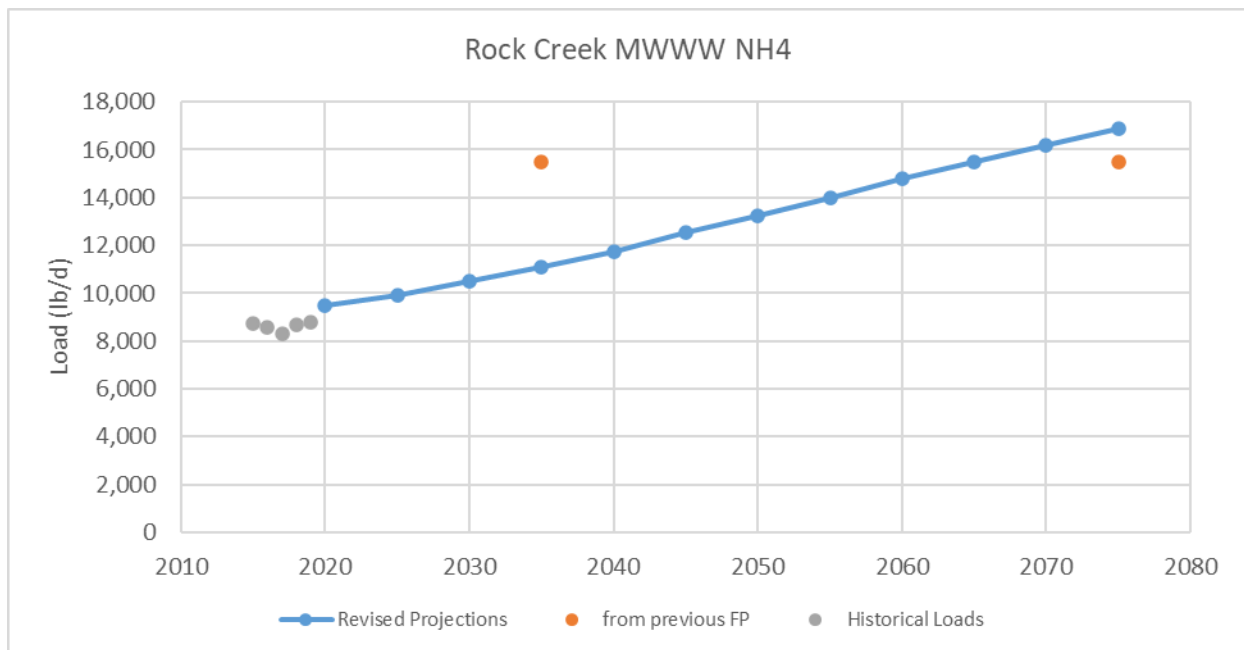


Figure F41. MWW Load Projection, NH4, Rock Creek WRRF

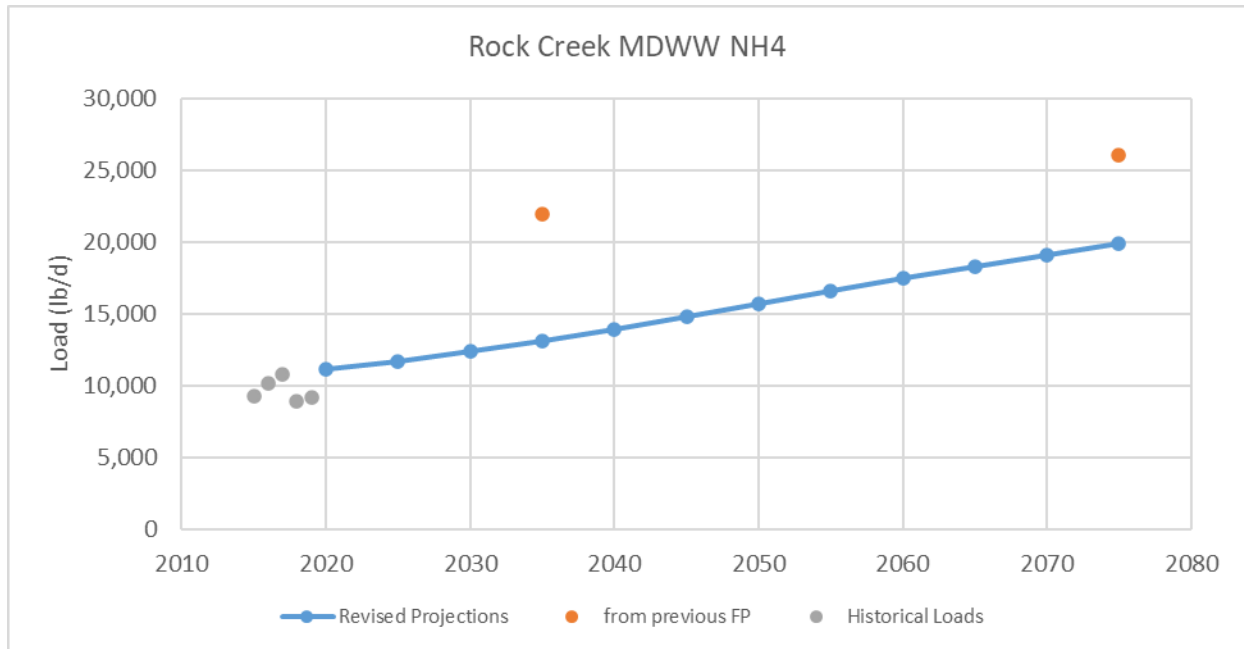


Figure F42. MDWW Load Projection, NH4, Rock Creek WRRF

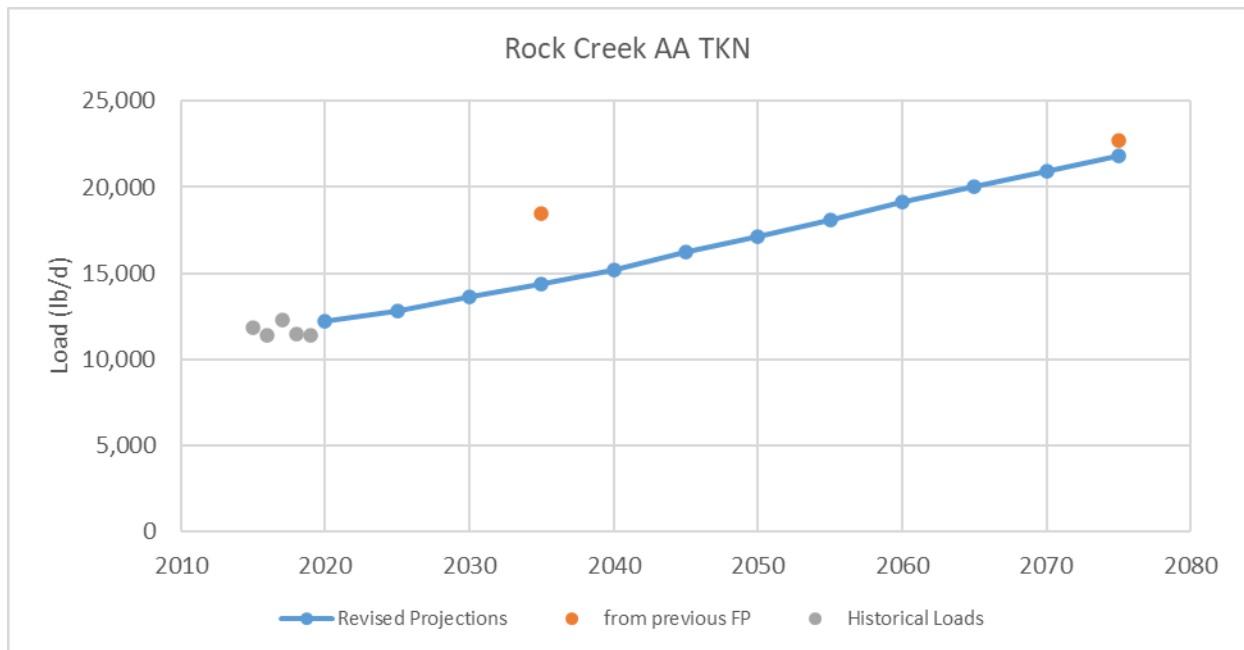


Figure F43. AA Load Projection, TKN, Rock Creek WRRF

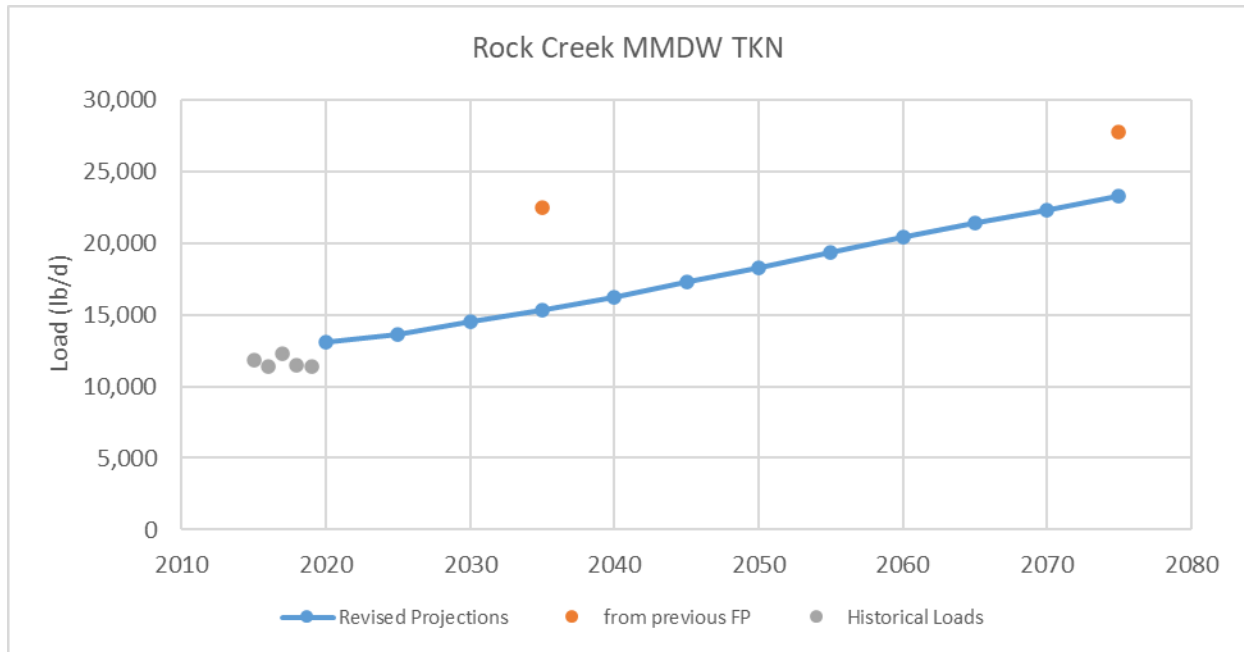


Figure F44. MMDW Load Projection, TKN, Rock Creek WRRF

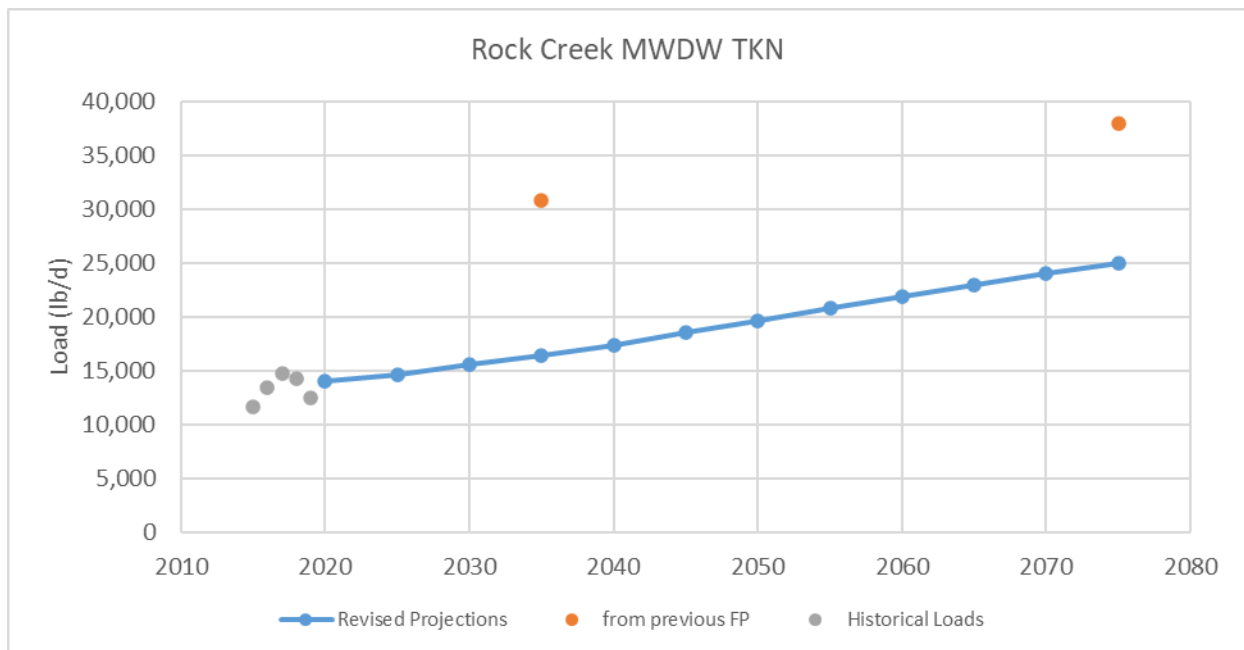


Figure F45. MWDW Load Projection, TKN, Rock Creek WRRF

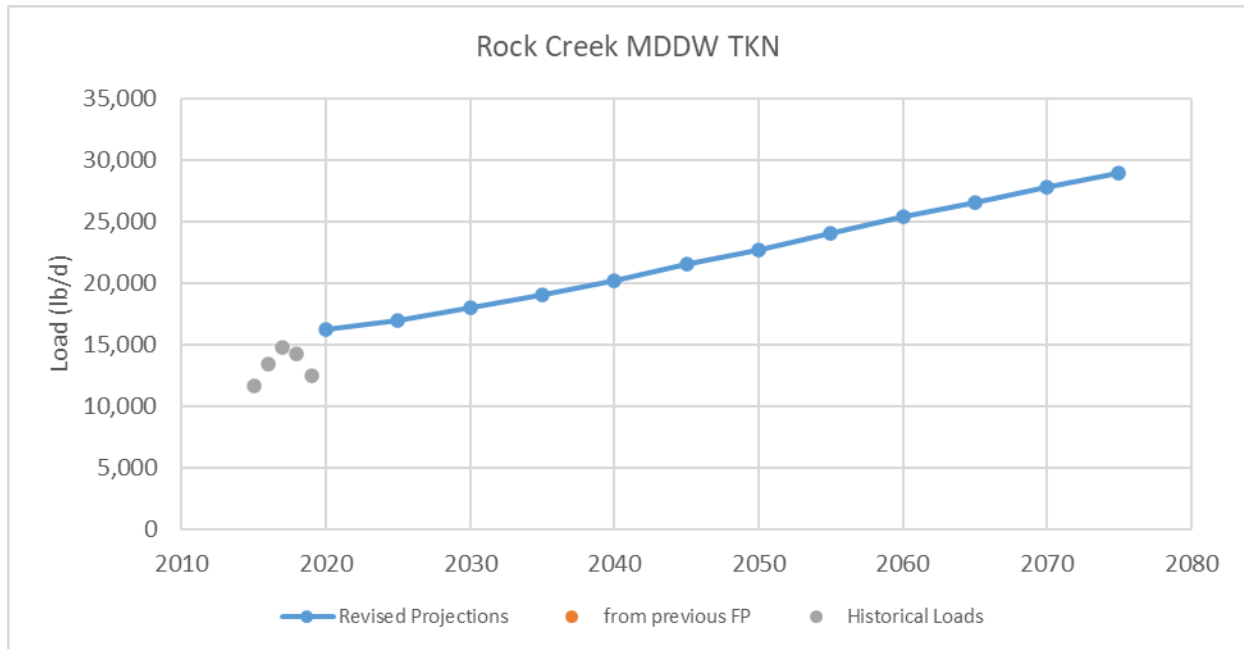


Figure F46. MDDW Load Projection, TKN, Rock Creek WRRF

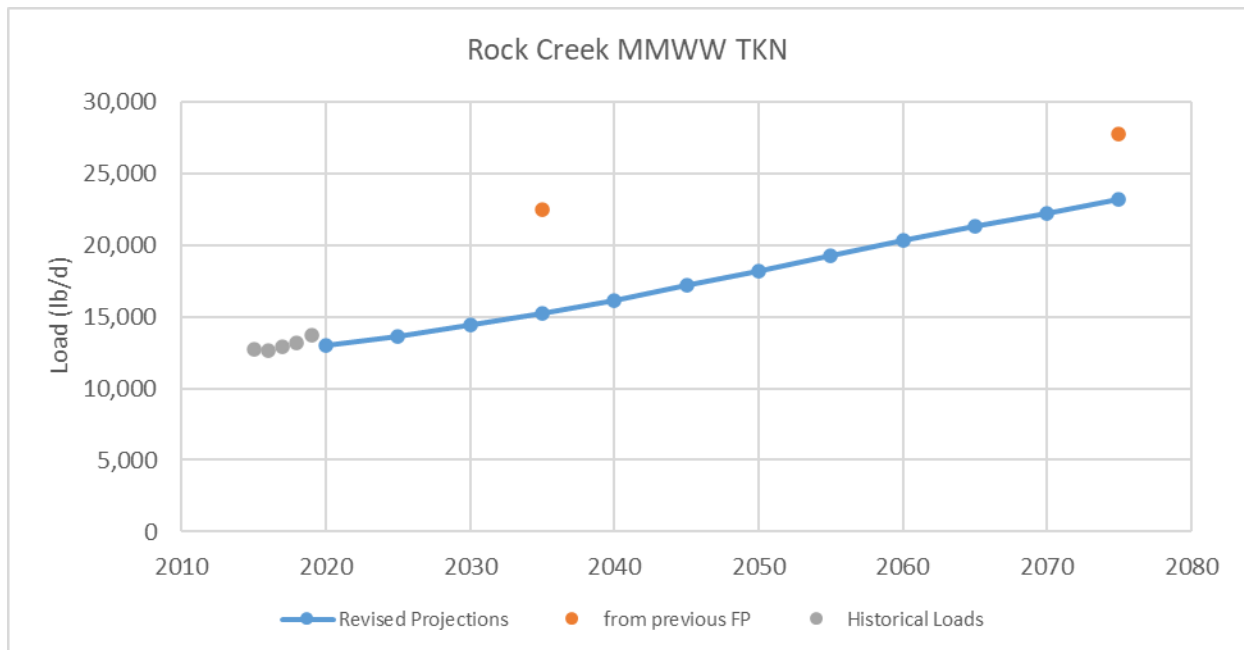


Figure F47. MMWW Load Projection, TKN, Rock Creek WRRF

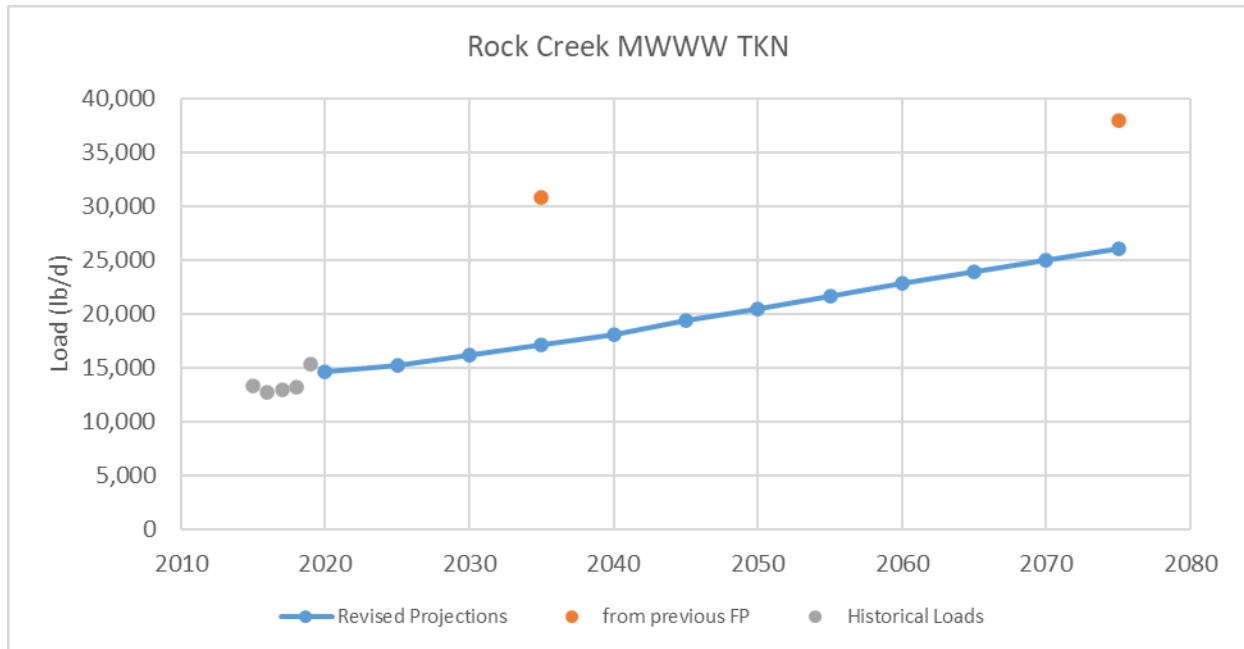


Figure F48. MWWW Load Projection, TKN, Rock Creek WRRF

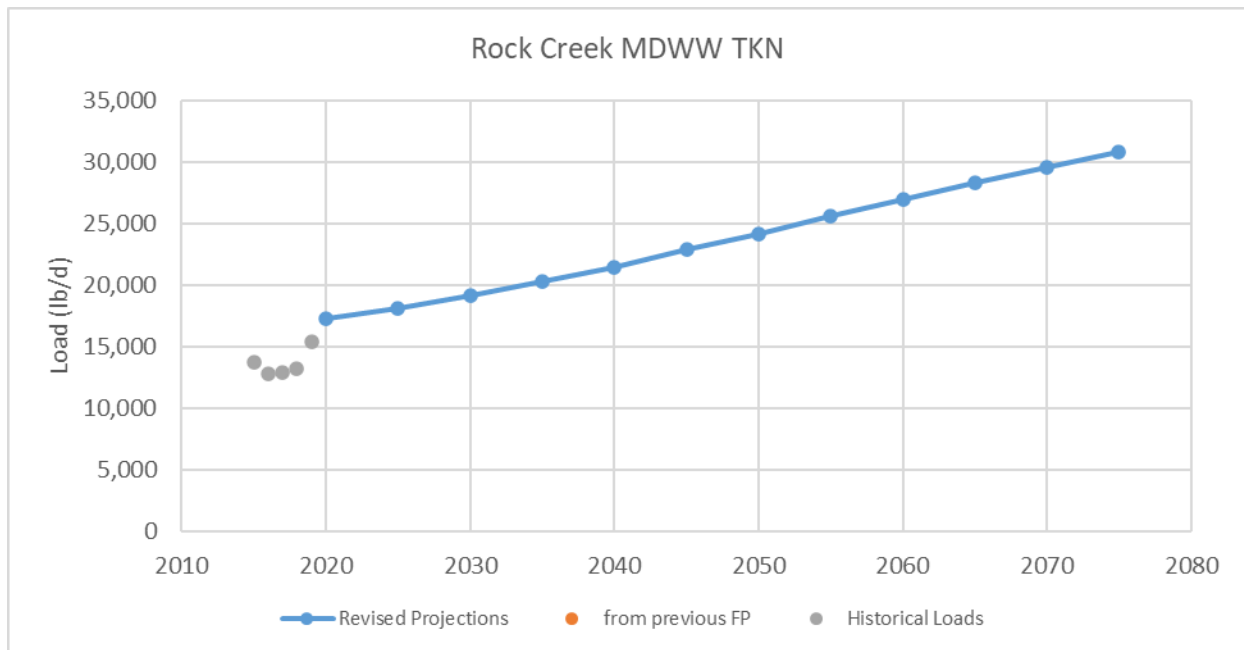


Figure F49. MDWW Load Projection, TKN, Rock Creek WRRF

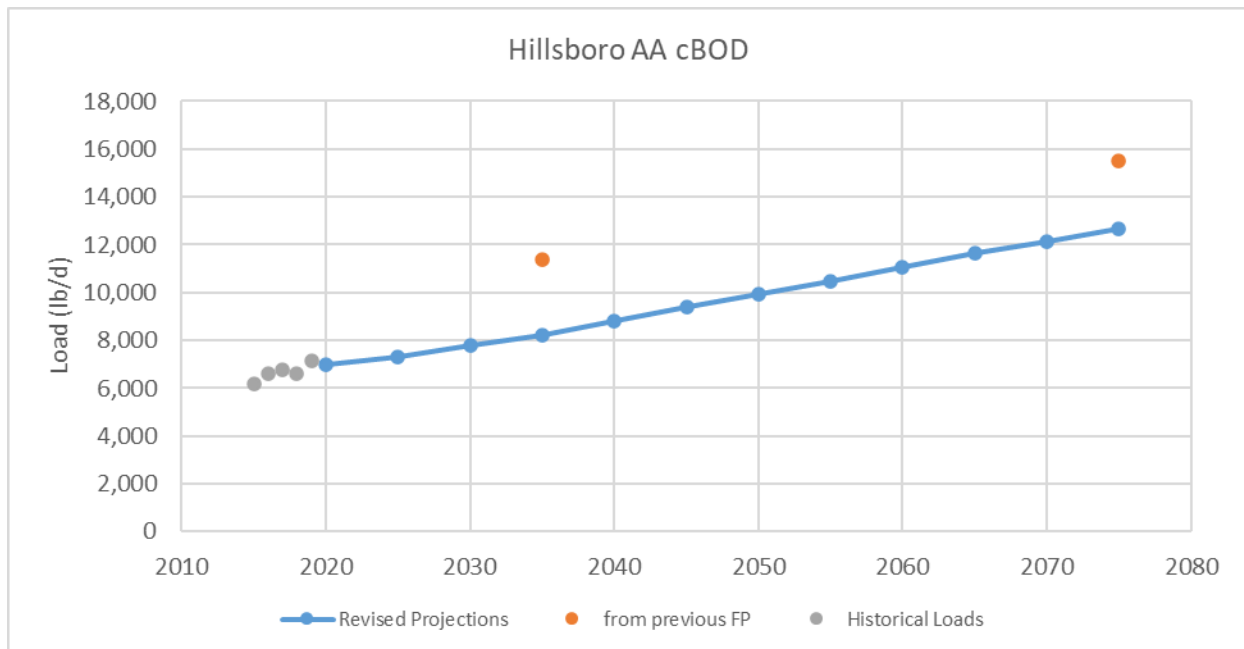
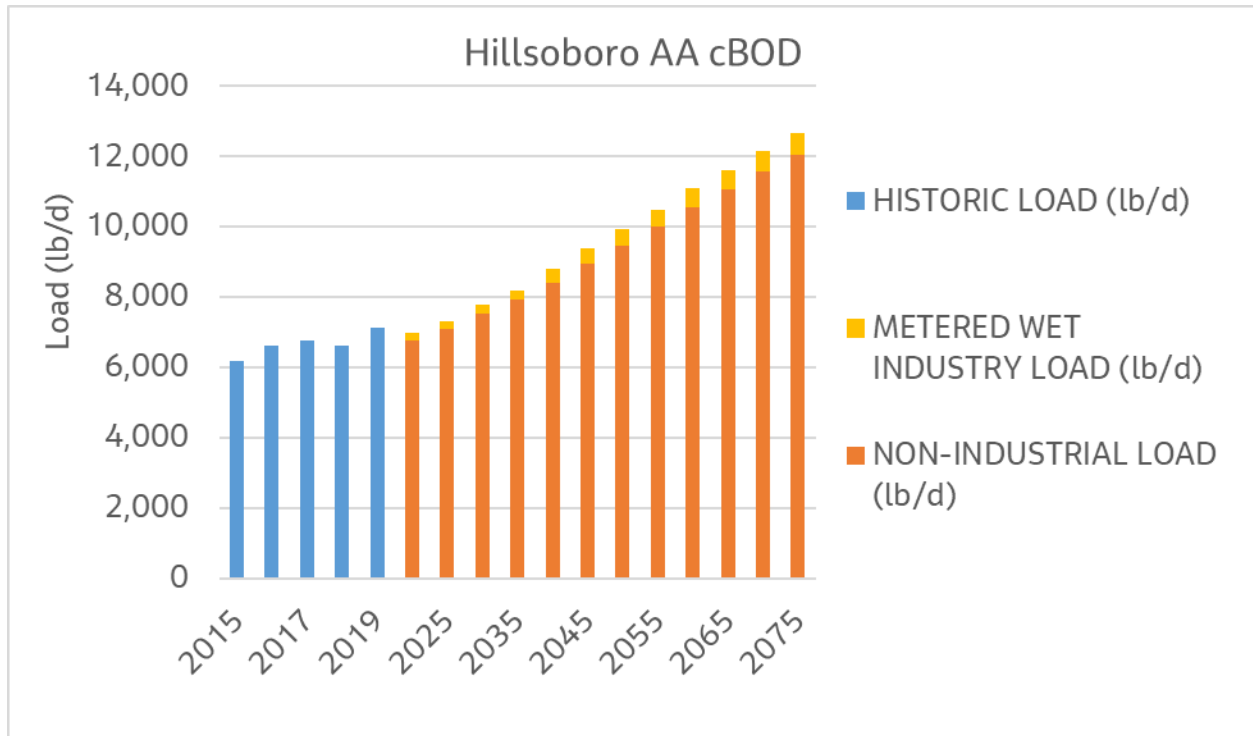


Figure F50. AA Load Projection, cBOD, Hillsboro WRRF

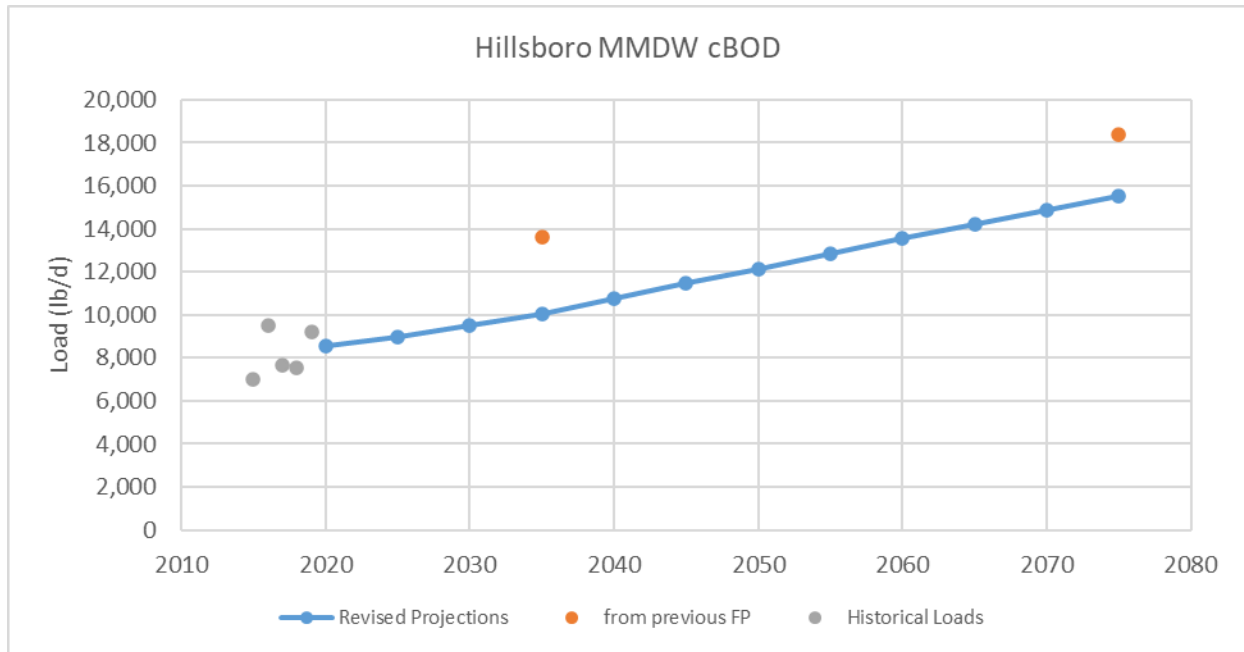


Figure F51. MMDW Load Projection, cBOD, Hillsboro WRRF

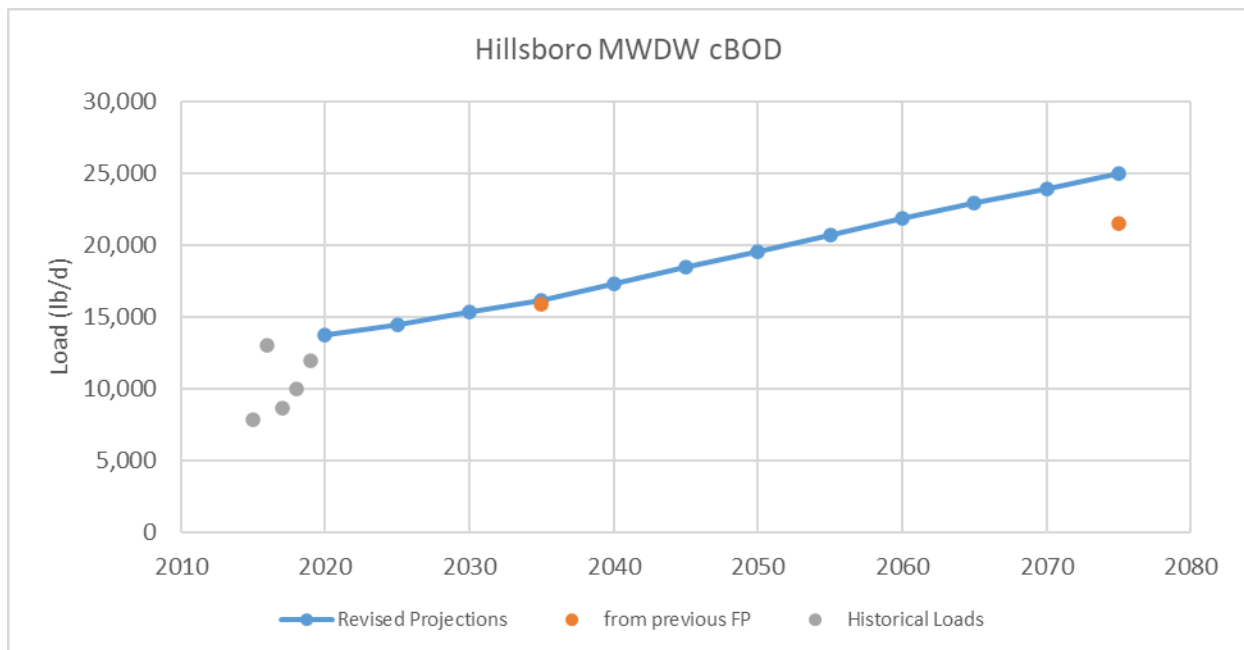


Figure F52. MWDW Load Projection, cBOD, Hillsboro WRRF

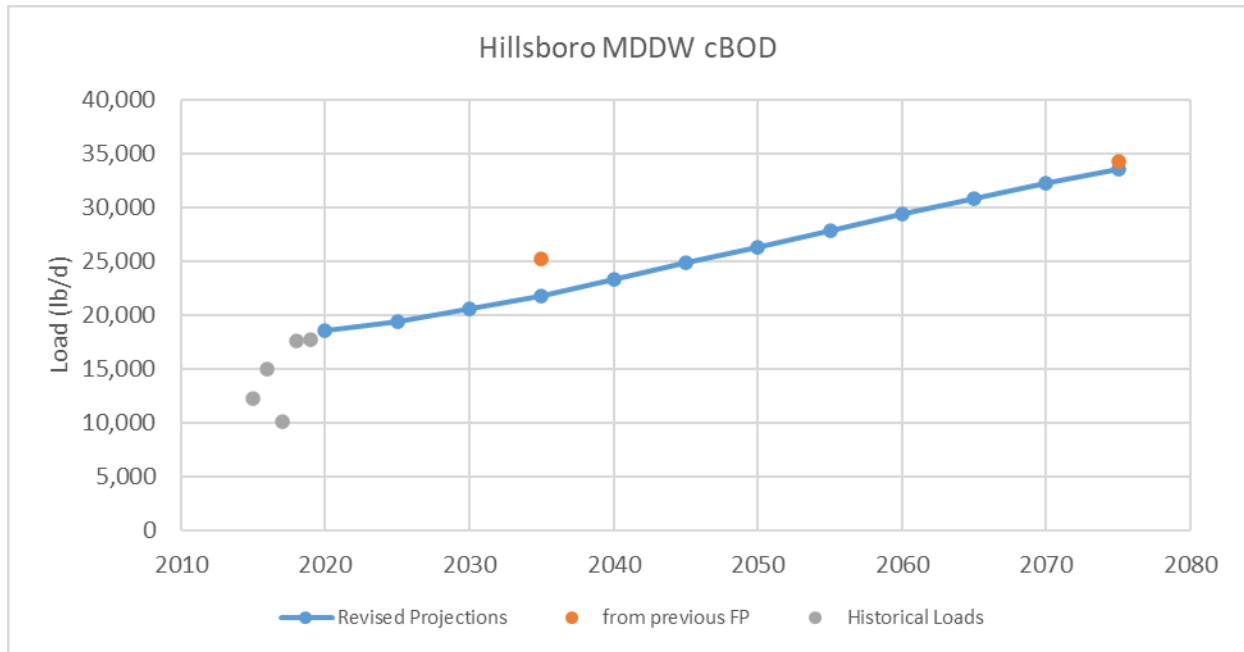


Figure F53. MDDW Load Projection, cBOD, Hillsboro WRRF

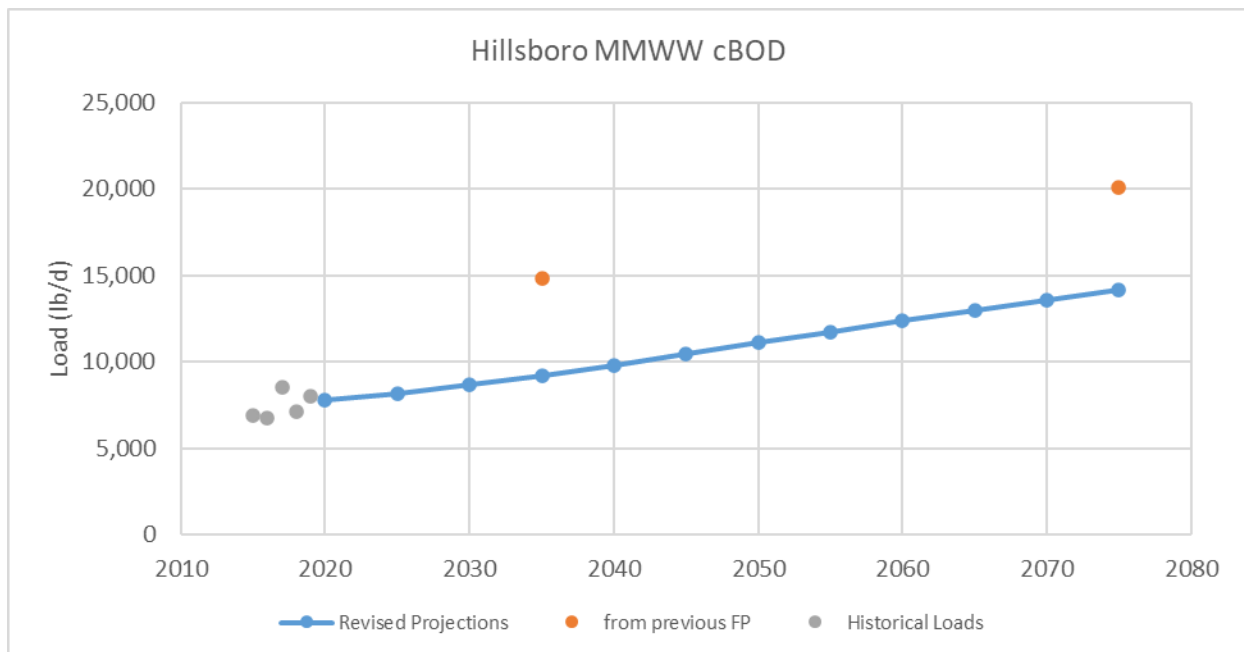


Figure F54. MMWW Load Projection, cBOD, Hillsboro WRRF

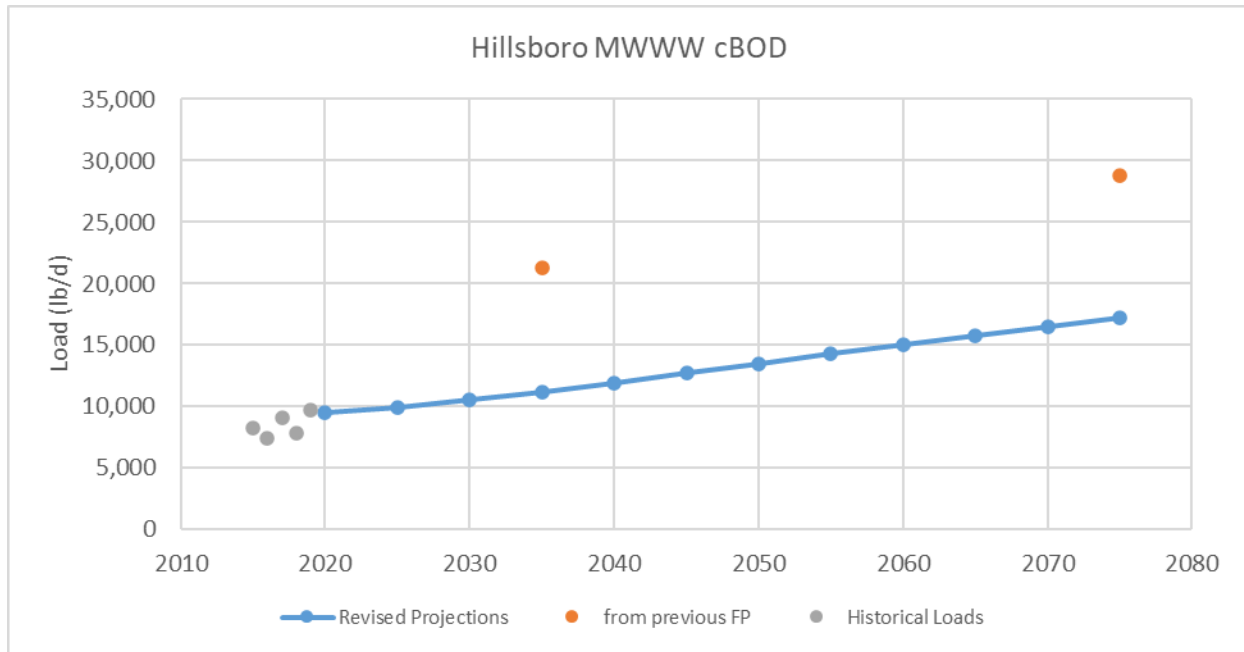


Figure F55. MWWW Load Projection, cBOD, Hillsboro WRRF

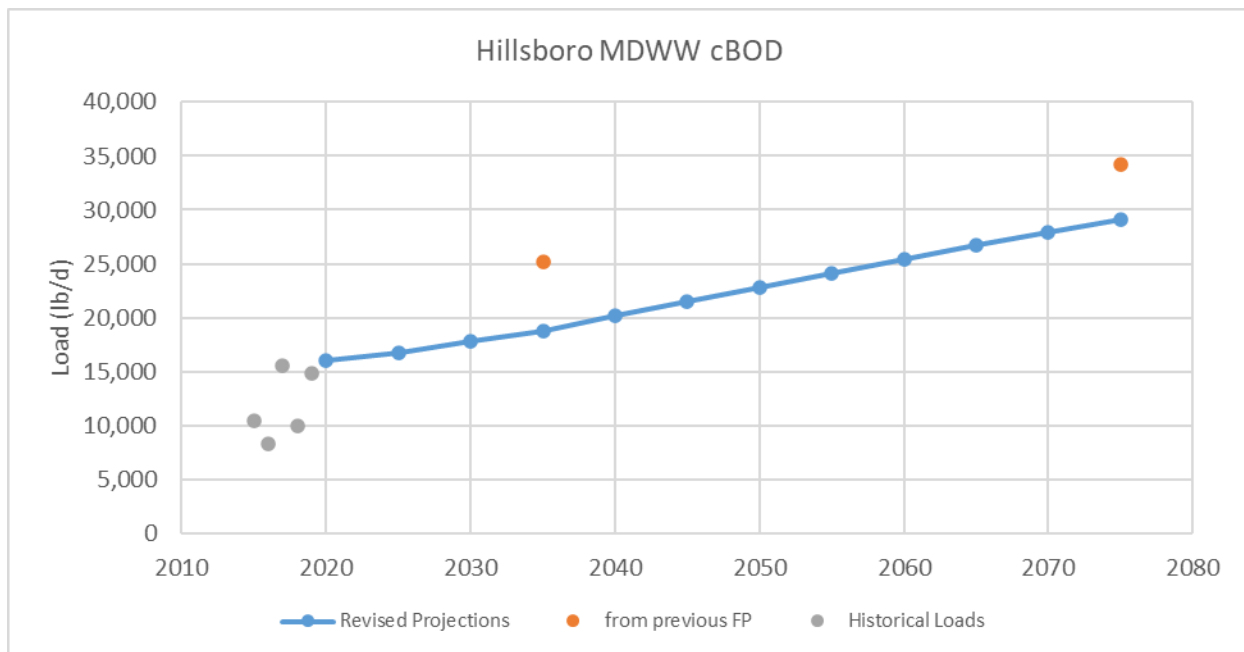


Figure F56. MDWW Load Projection, cBOD, Hillsboro WRRF

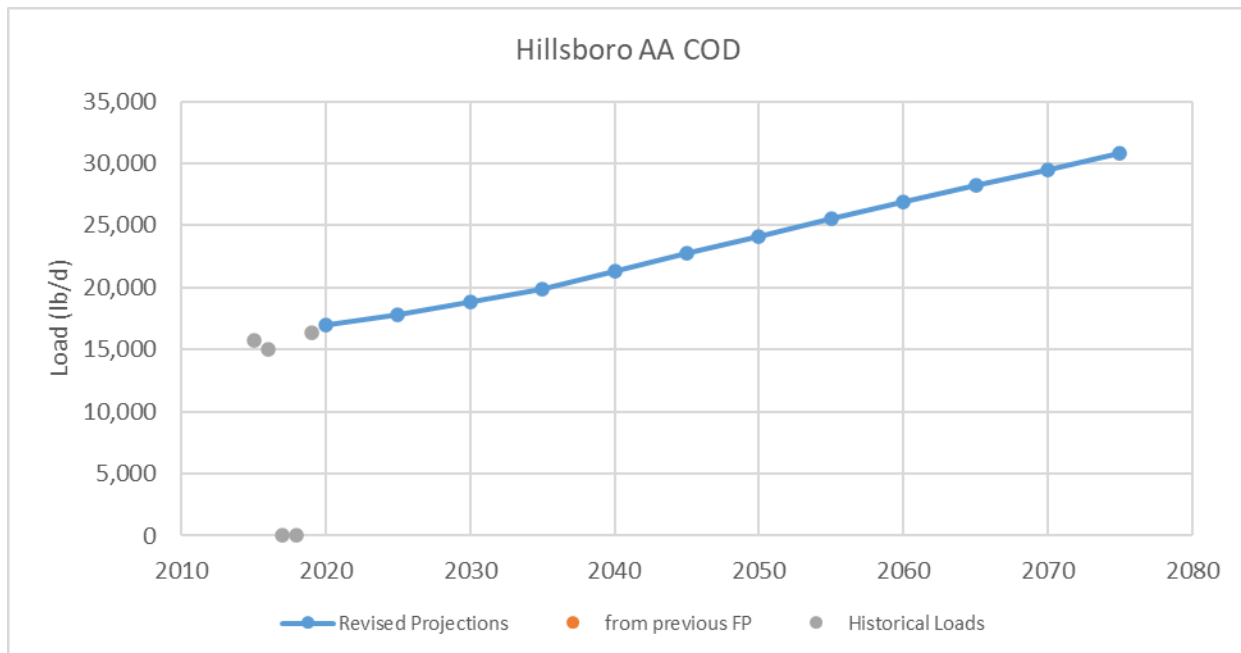
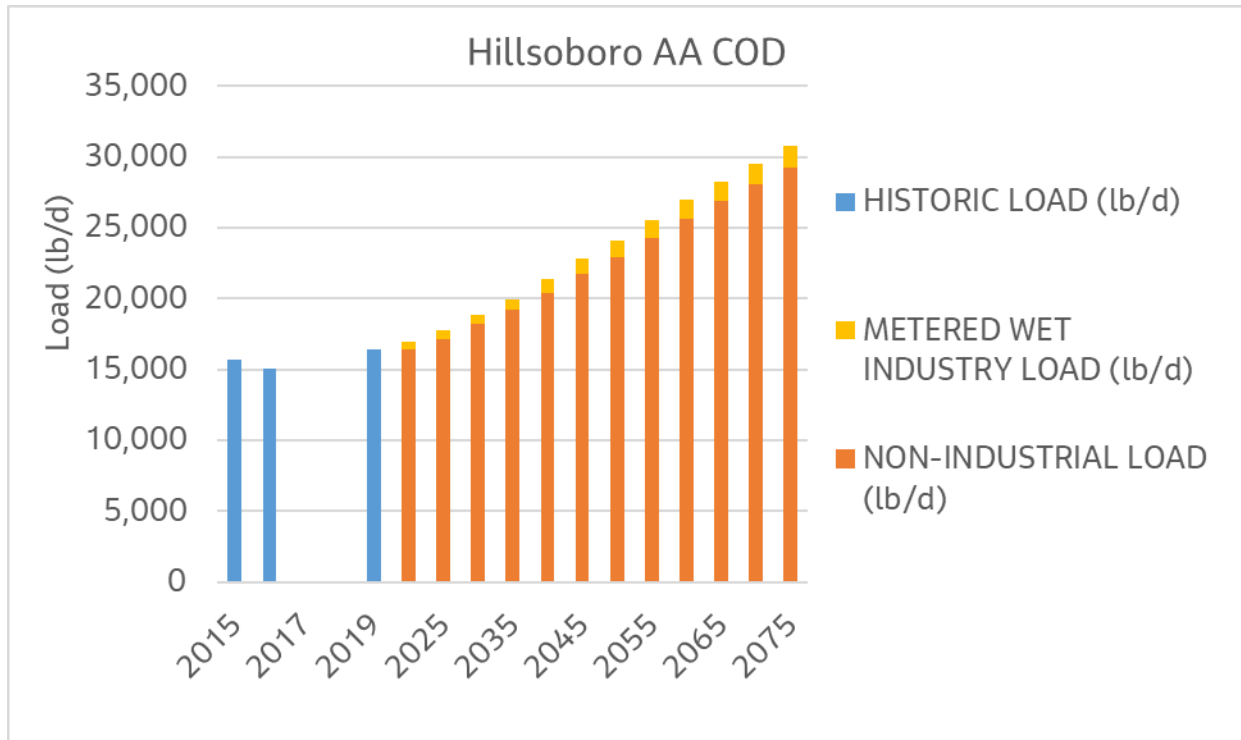


Figure F57. AA Load Projection, COD, Hillsboro WRRF

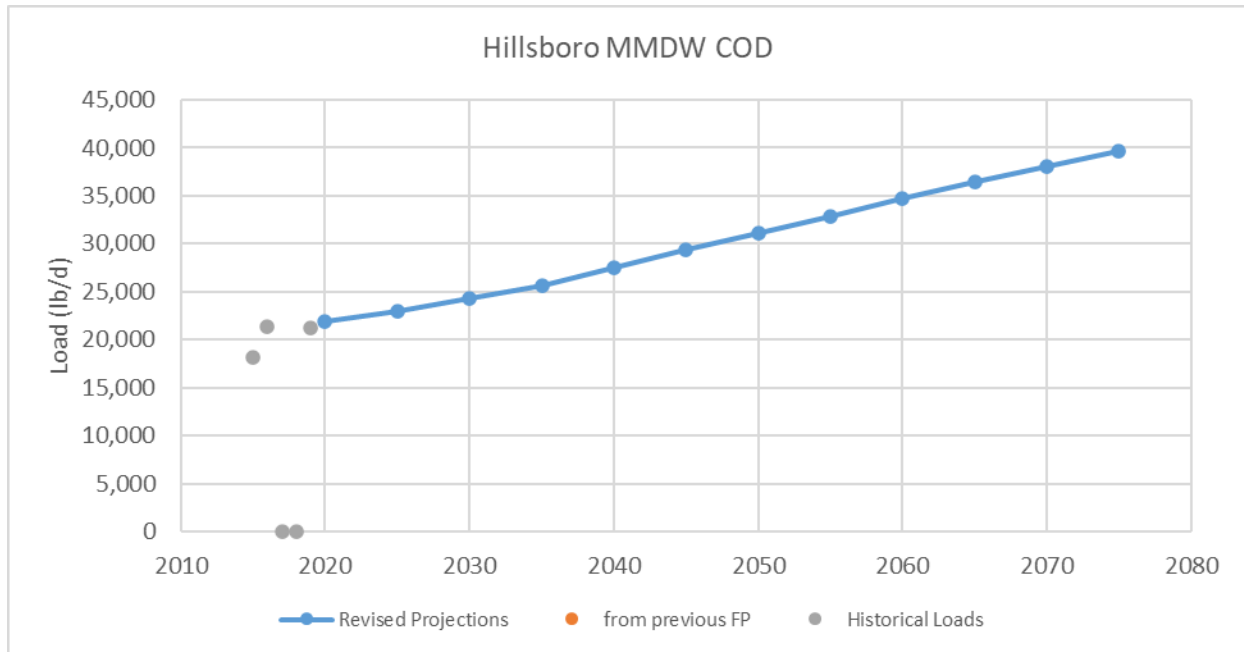


Figure F58. MMDW Load Projection, COD, Hillsboro WRRF

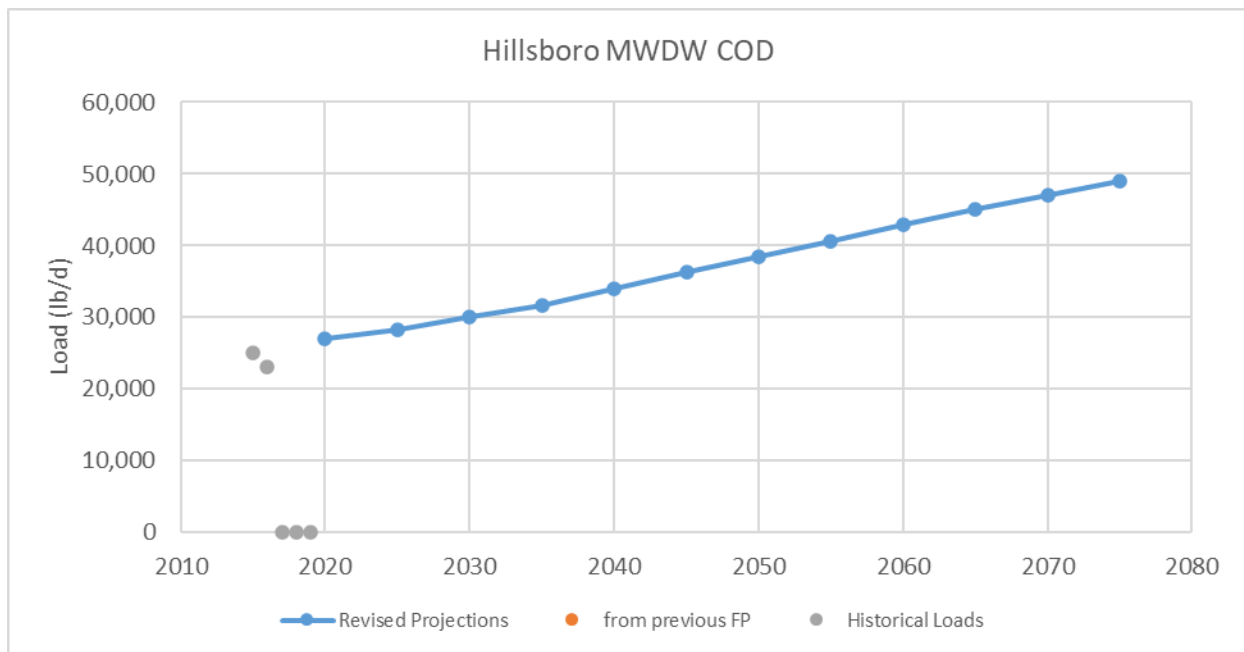


Figure F59. MWDW Load Projection, COD, Hillsboro WRRF

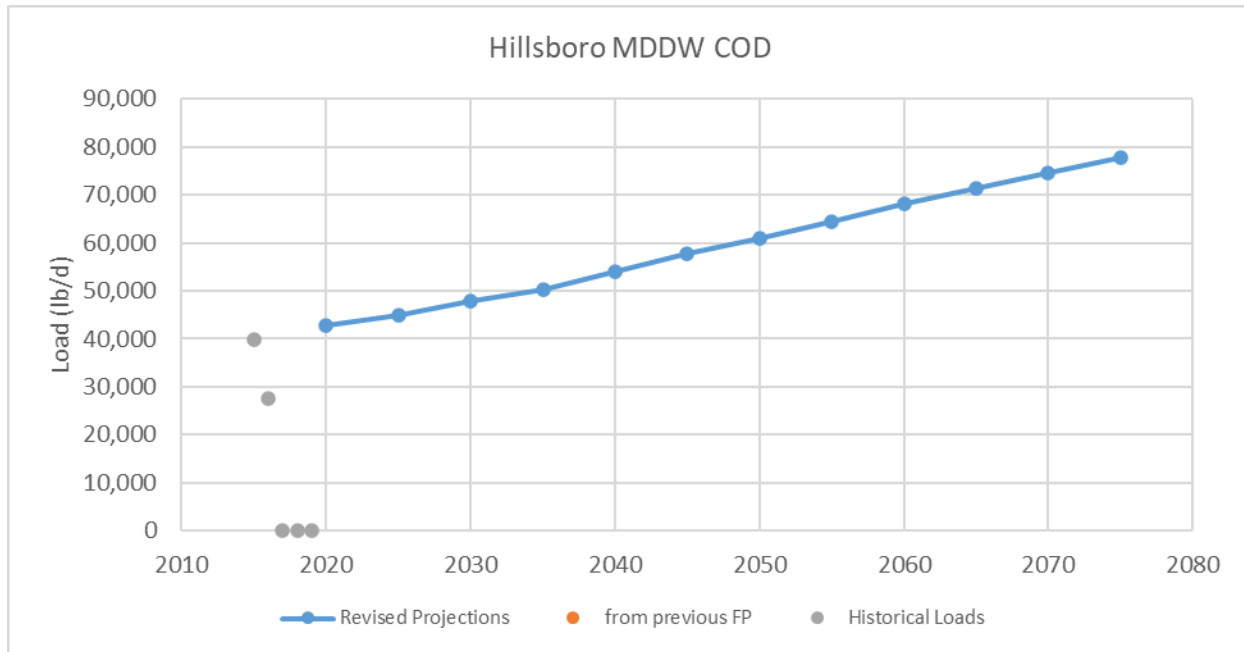


Figure F60. MDDW Load Projection, COD, Hillsboro WRRF

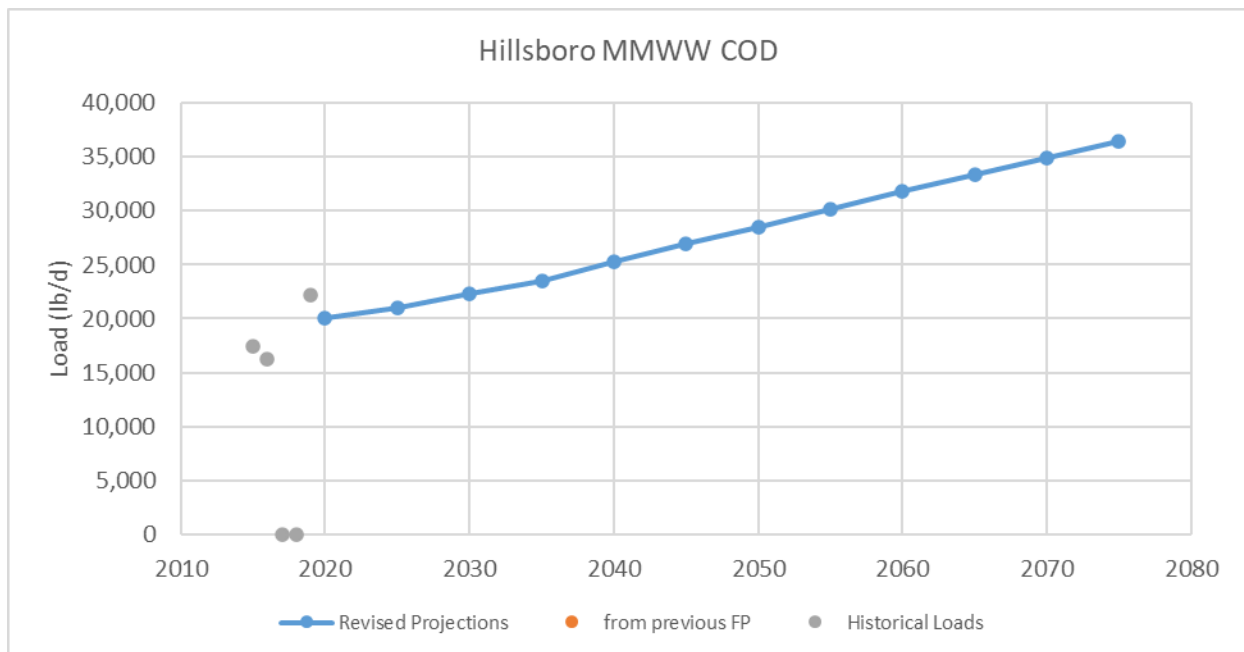


Figure F61. MMWW Load Projection, COD, Hillsboro WRRF

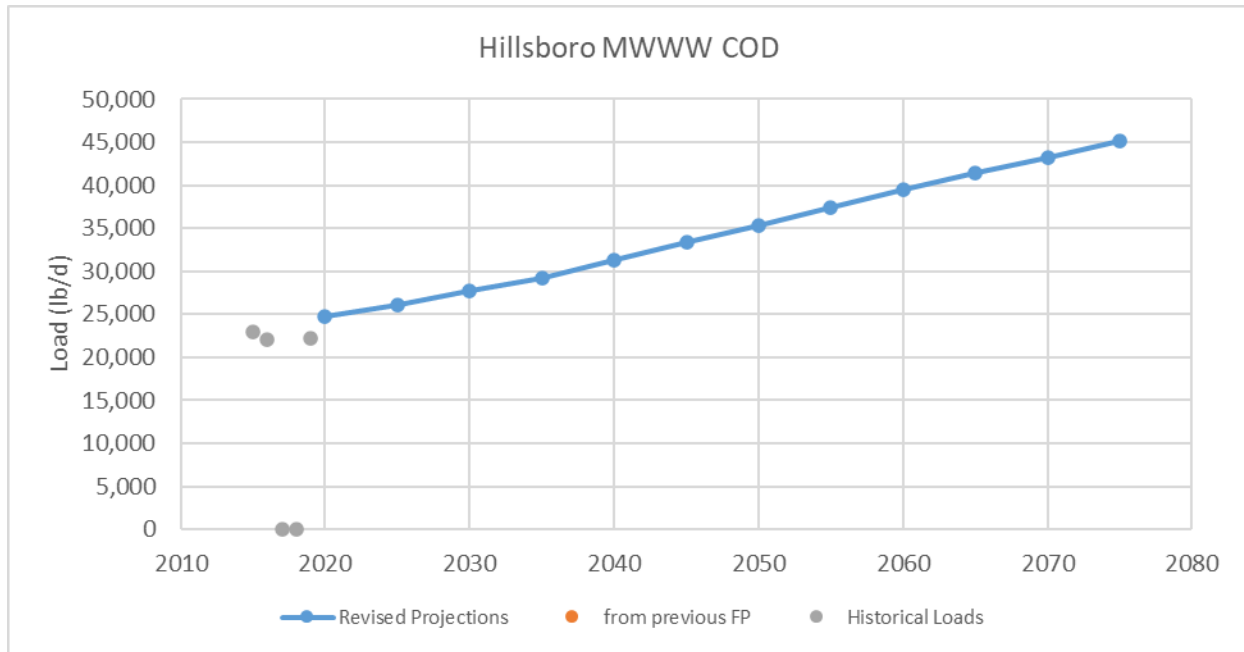


Figure F62. MWWW Load Projection, COD, Hillsboro WRRF

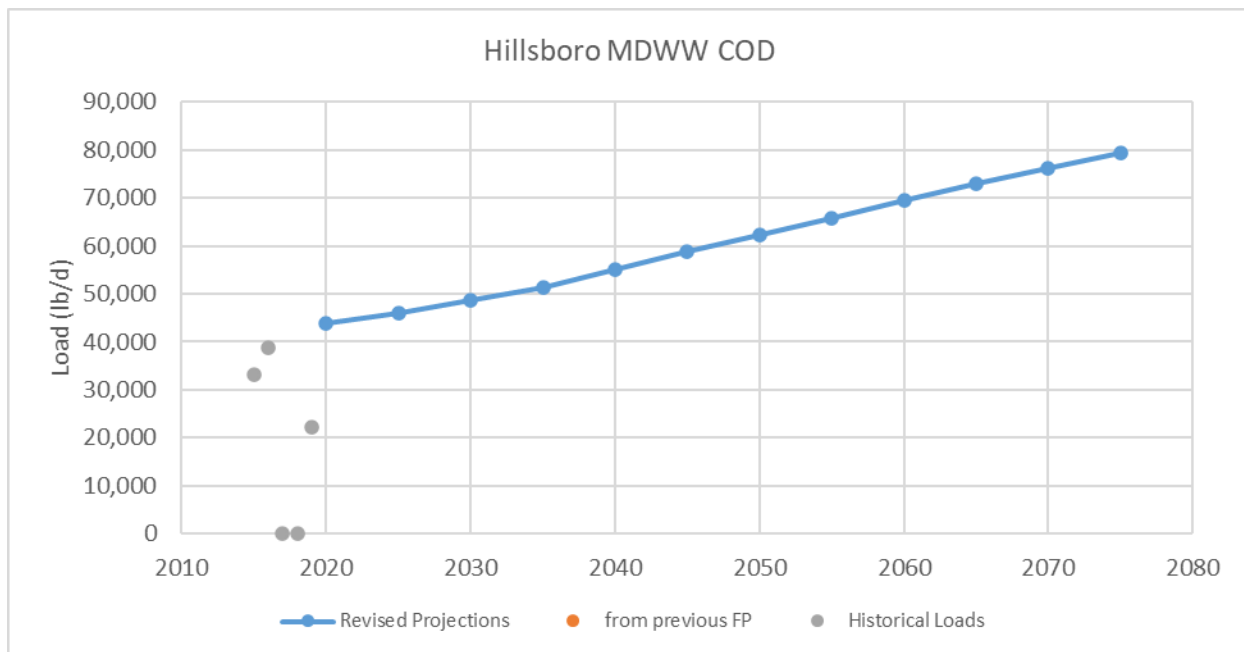


Figure F63. MDWW Load Projection, COD, Hillsboro WRRF

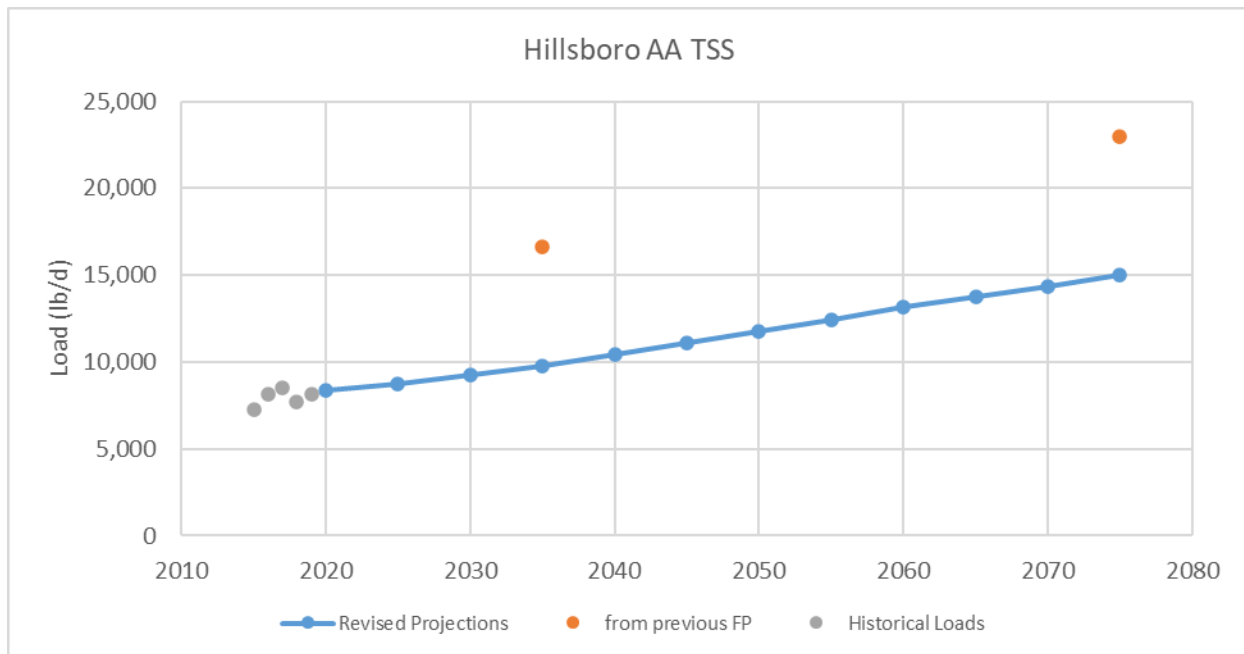
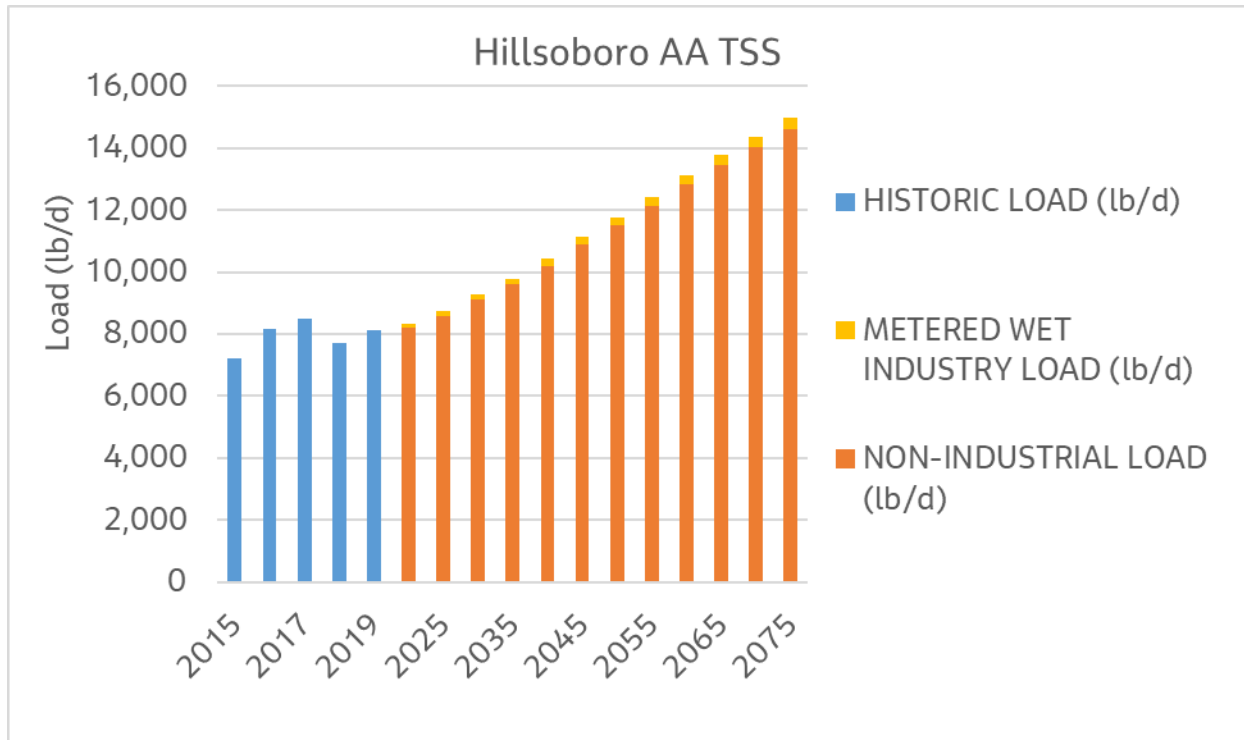


Figure F64. AA Load Projection, TSS, Hillsboro WRRF

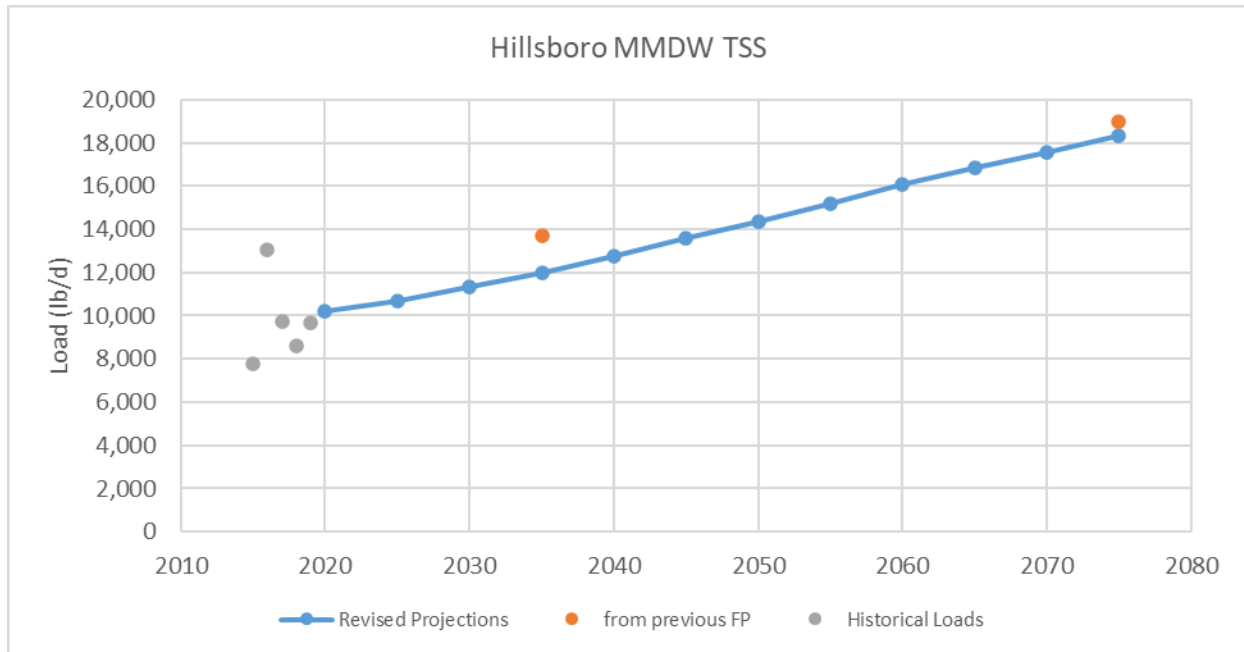


Figure F65. MMDW Load Projection, TSS, Hillsboro WRRF

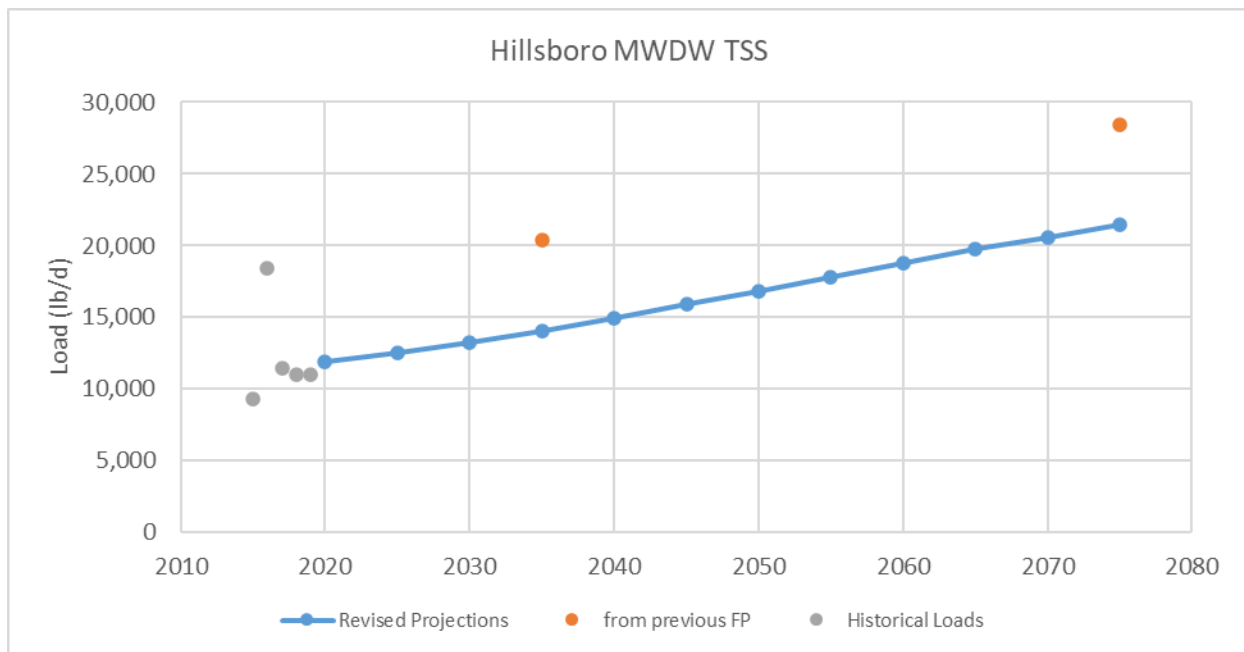


Figure F66. MWDW Load Projection, TSS, Hillsboro WRRF

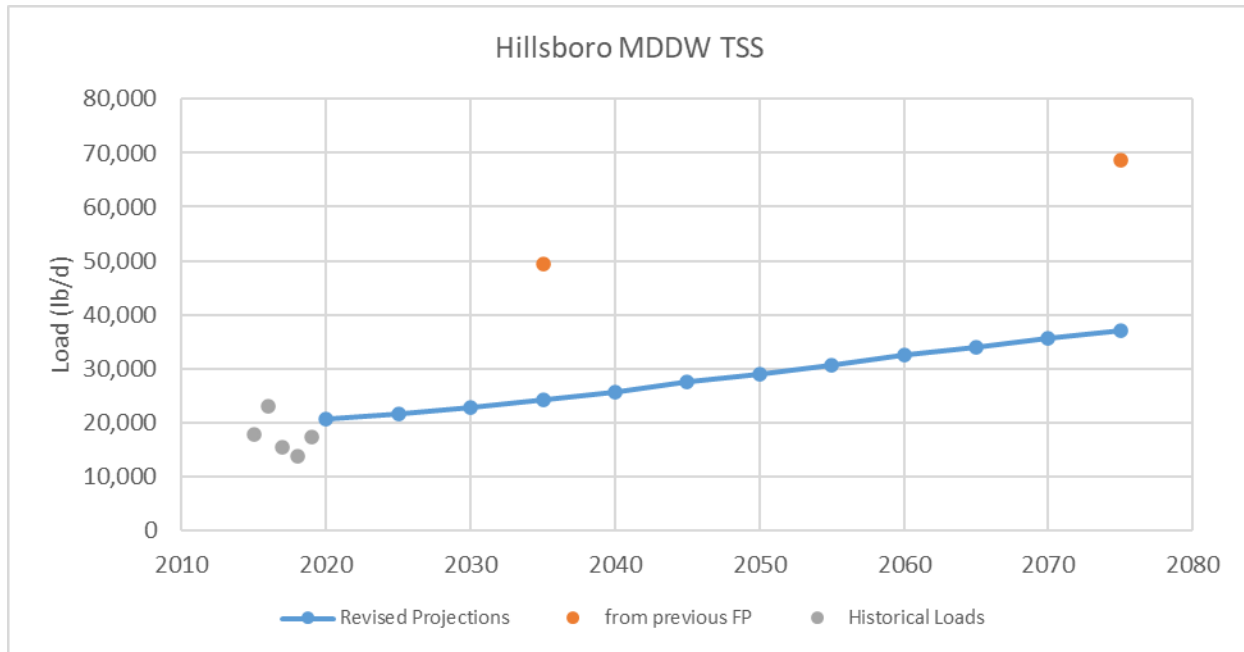


Figure F67. MDDW Load Projection, TSS, Hillsboro WRRF

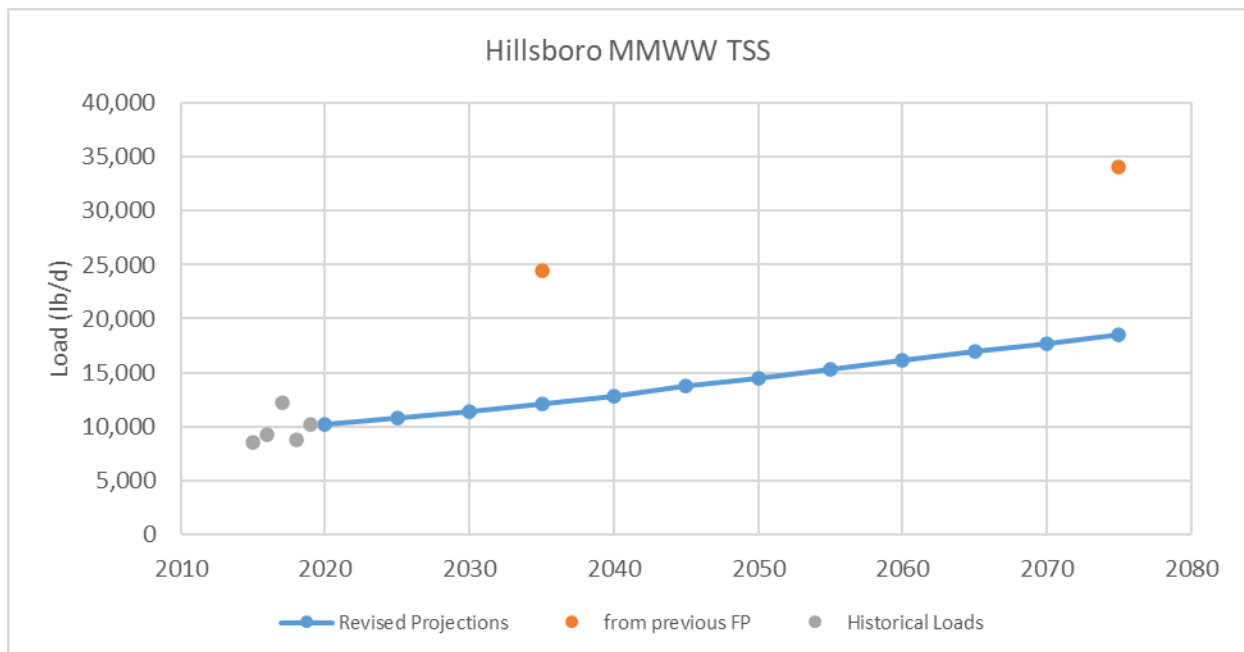


Figure F68. MMWW Load Projection, TSS, Hillsboro WRRF

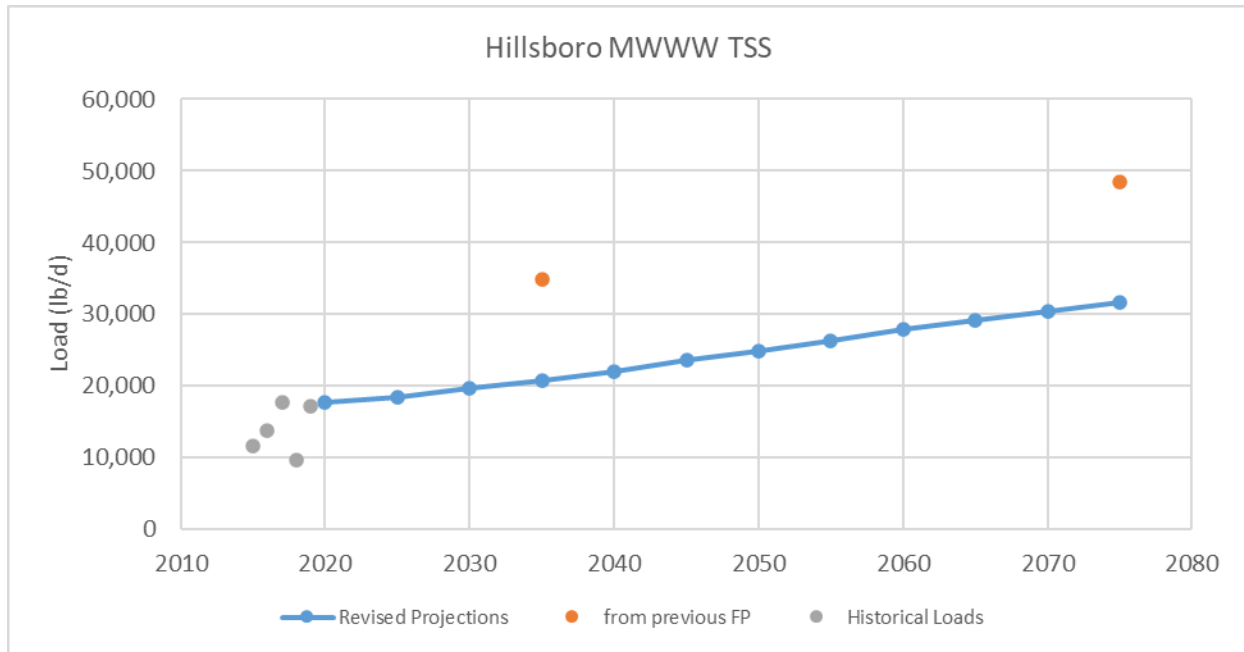


Figure F69. MWWW Load Projection, TSS, Hillsboro WRRF

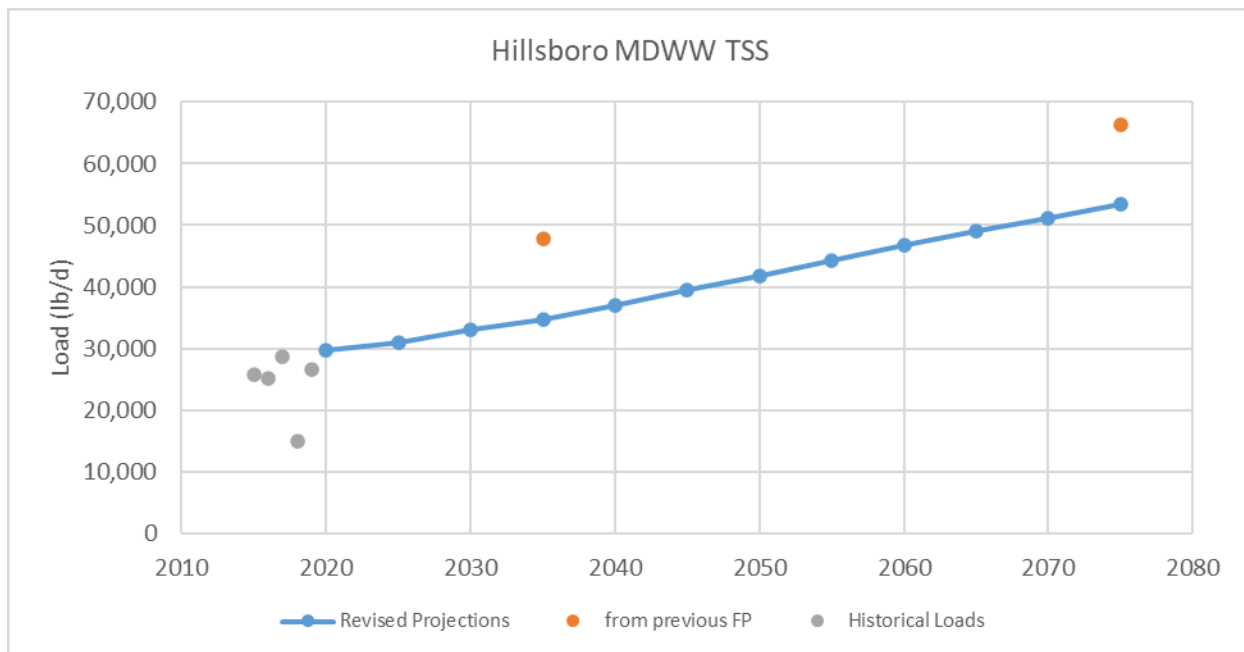


Figure F70. MDWW Load Projection, TSS, Hillsboro WRRF

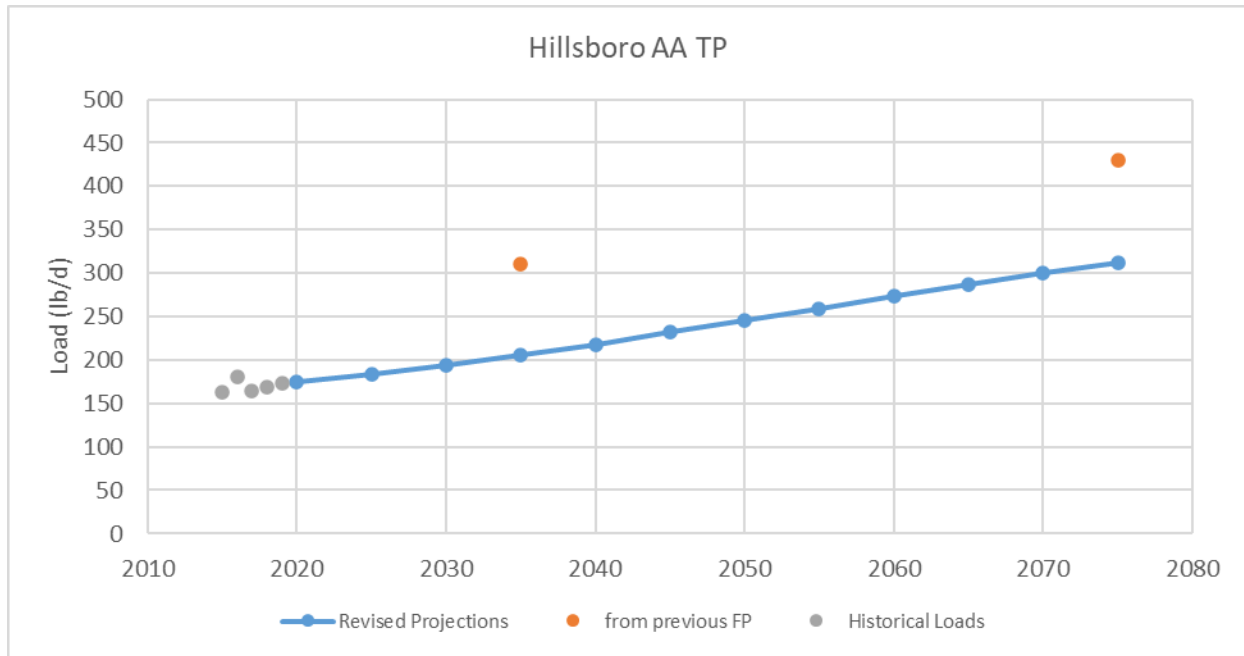


Figure F71. AA Load Projection, TP, Hillsboro WRRF

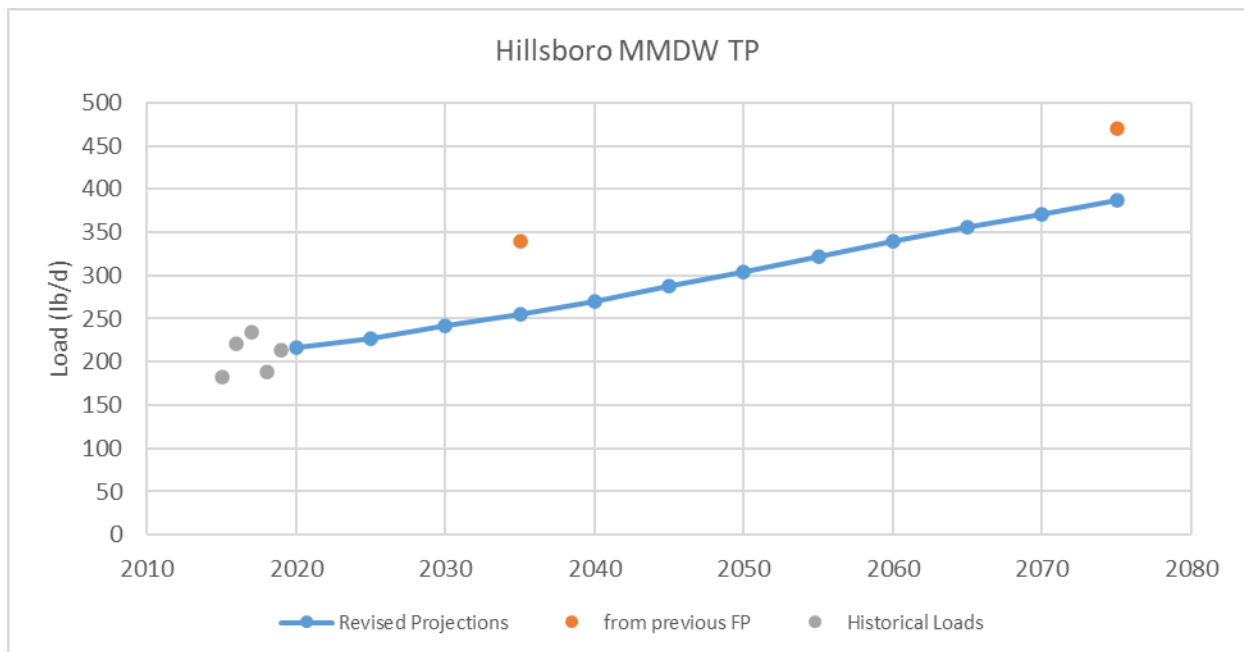


Figure F72. MMDW Load Projection, TP, Hillsboro WRRF

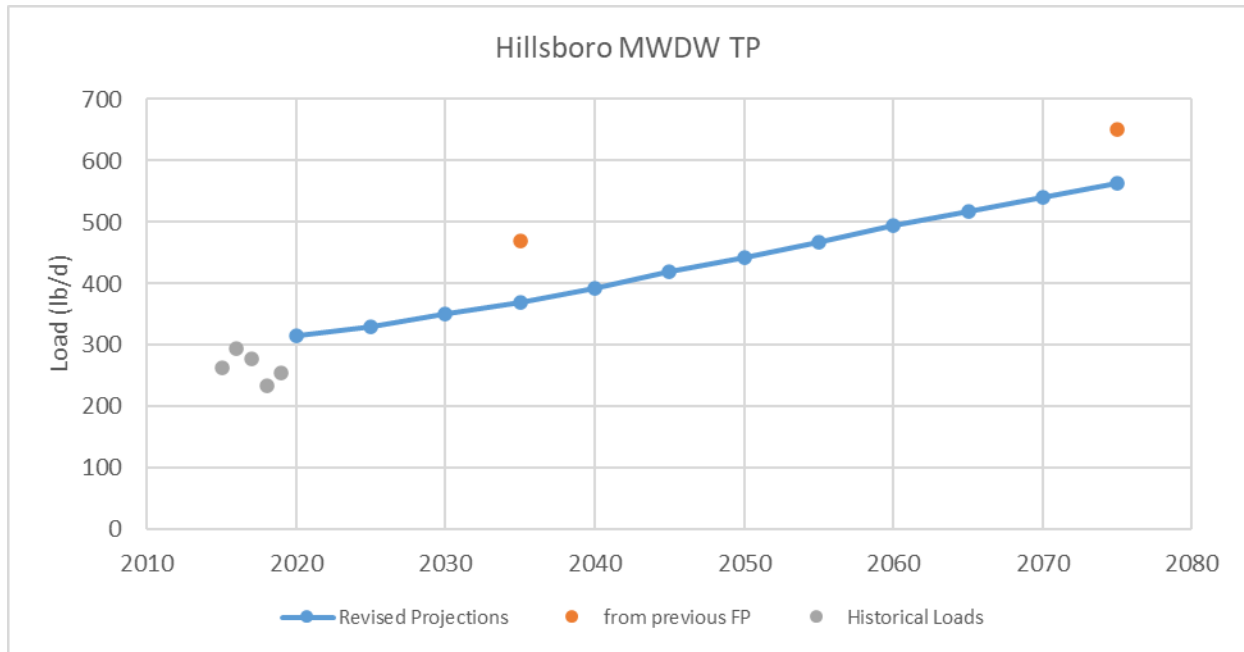


Figure F73. MWDW Load Projection, TP, Hillsboro WRRF

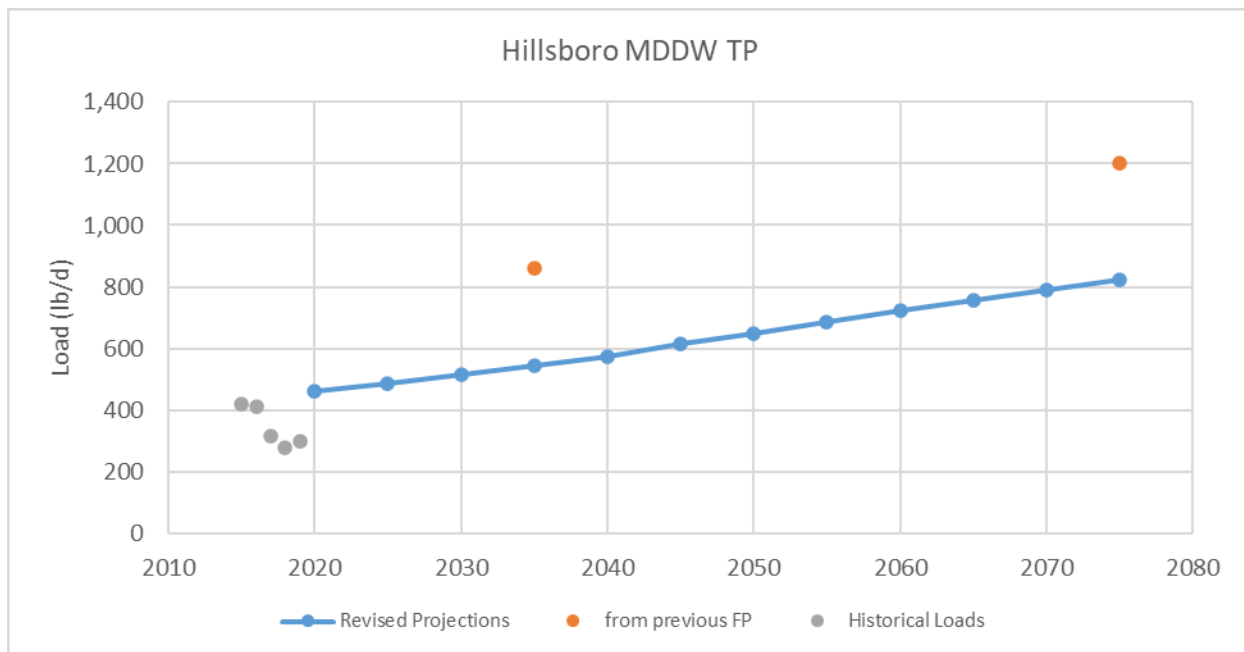


Figure F74. MDDW Load Projection, TP, Hillsboro WRRF

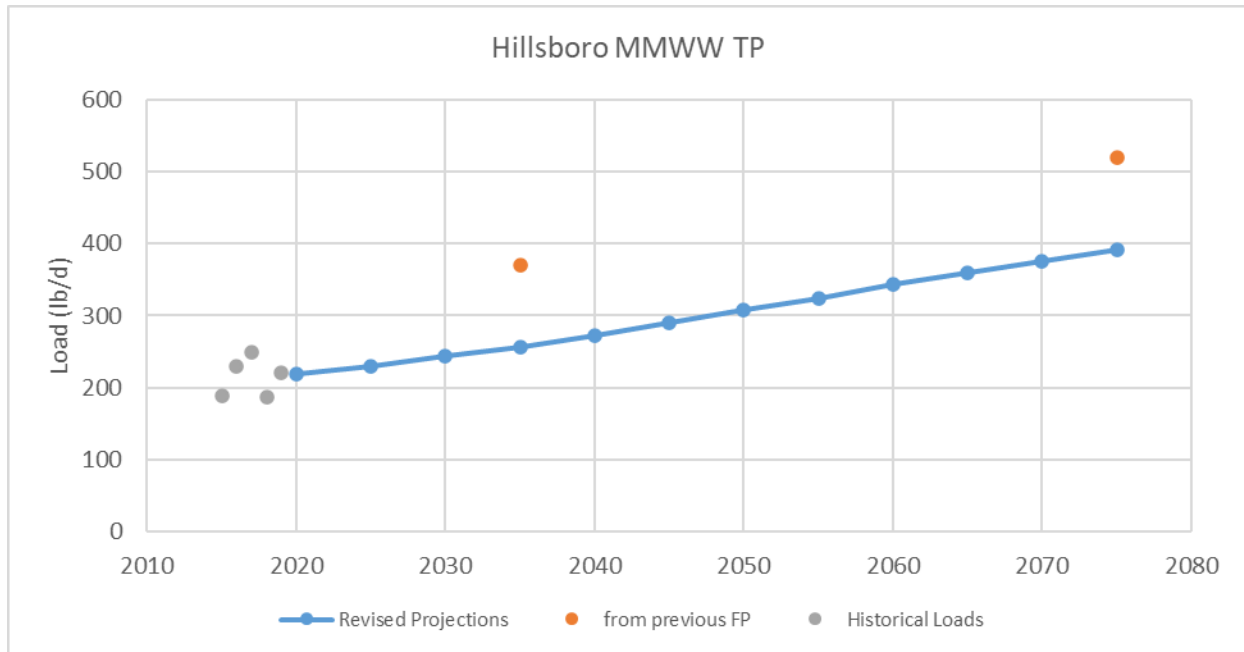


Figure F75. MMWW Load Projection, TP, Hillsboro WRRF

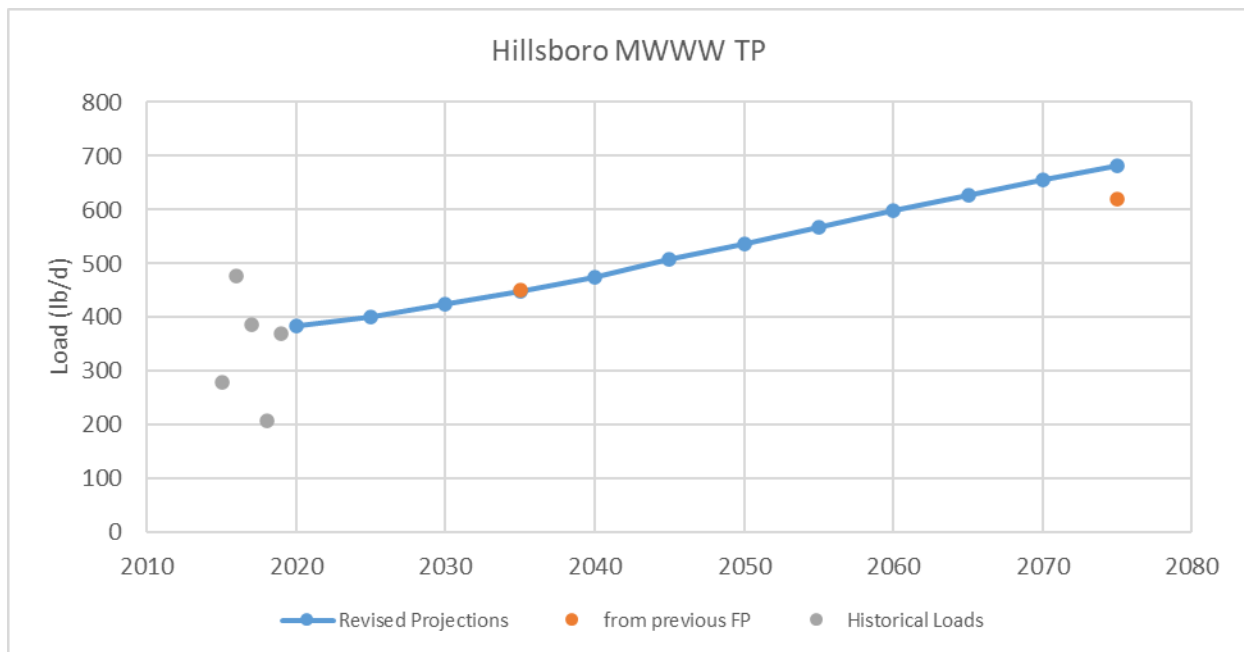


Figure F76. MWWW Load Projection, TP, Hillsboro WRRF

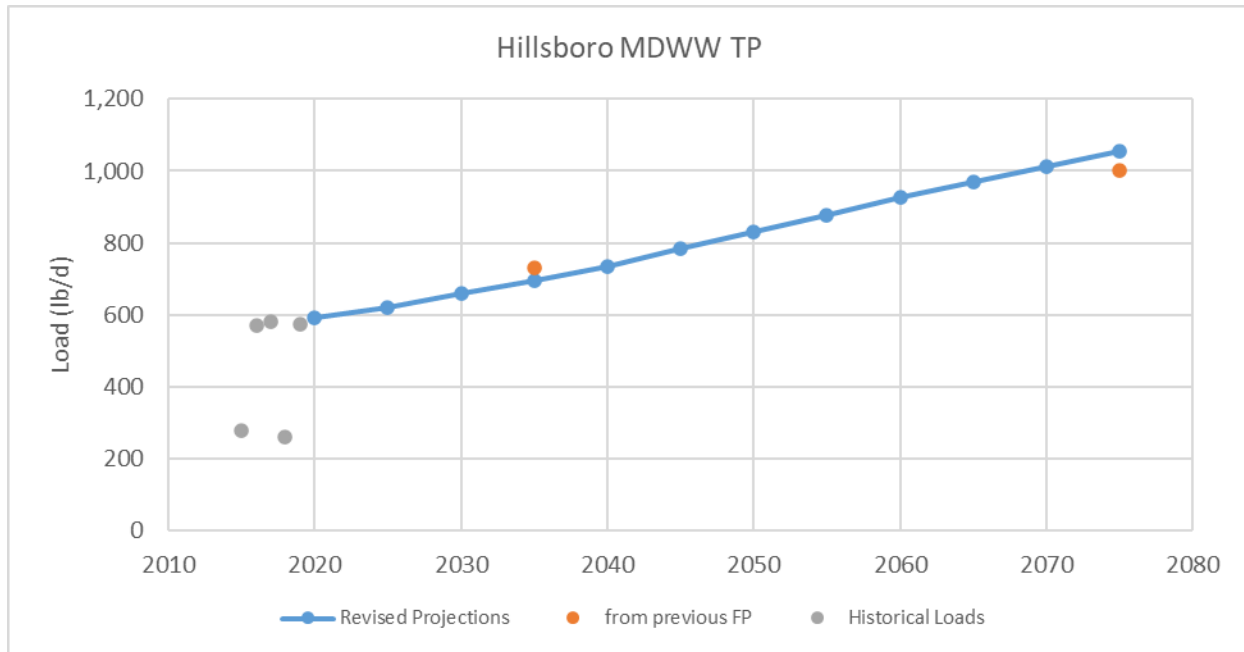


Figure F77. MDWW Load Projection, TP, Hillsboro WRRF

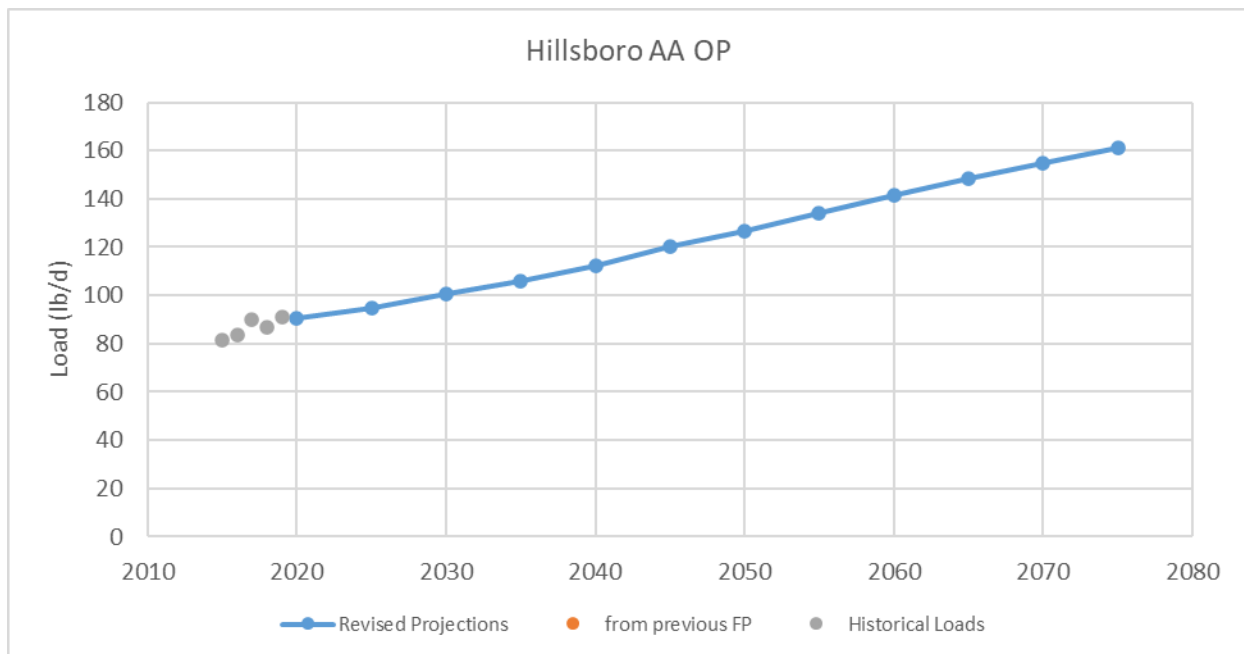


Figure F78. AA Load Projection, oP, Hillsboro WRRF

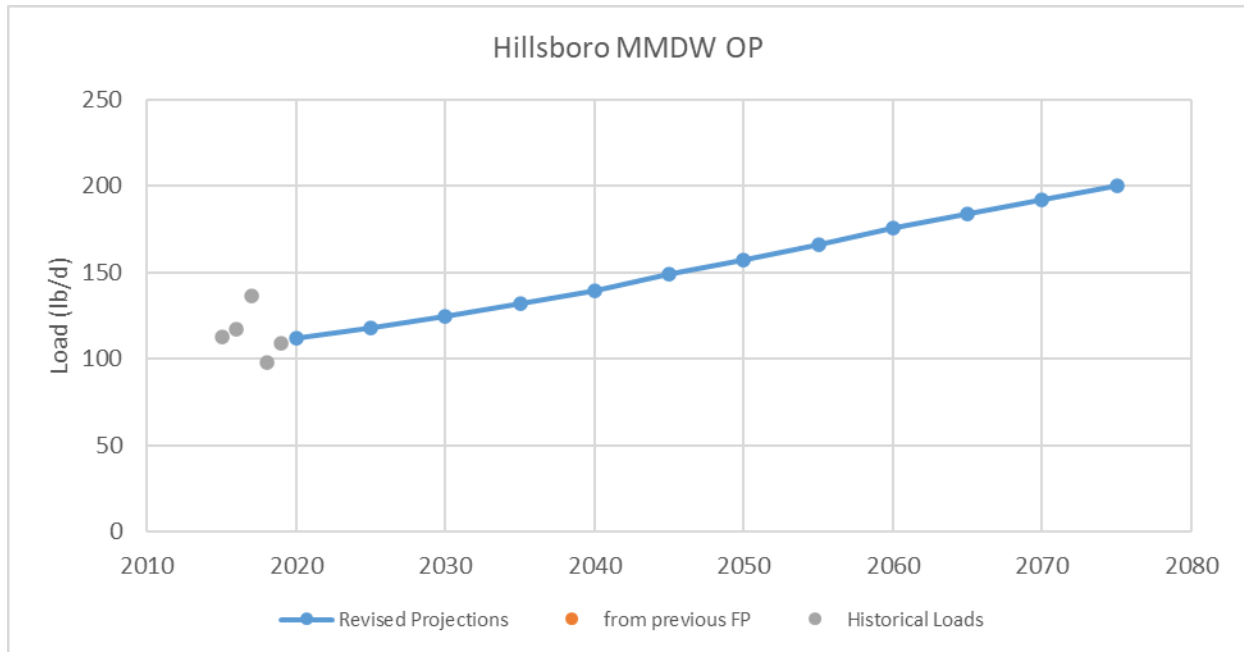


Figure F79. MMDW Load Projection, oP, Hillsboro WRRF

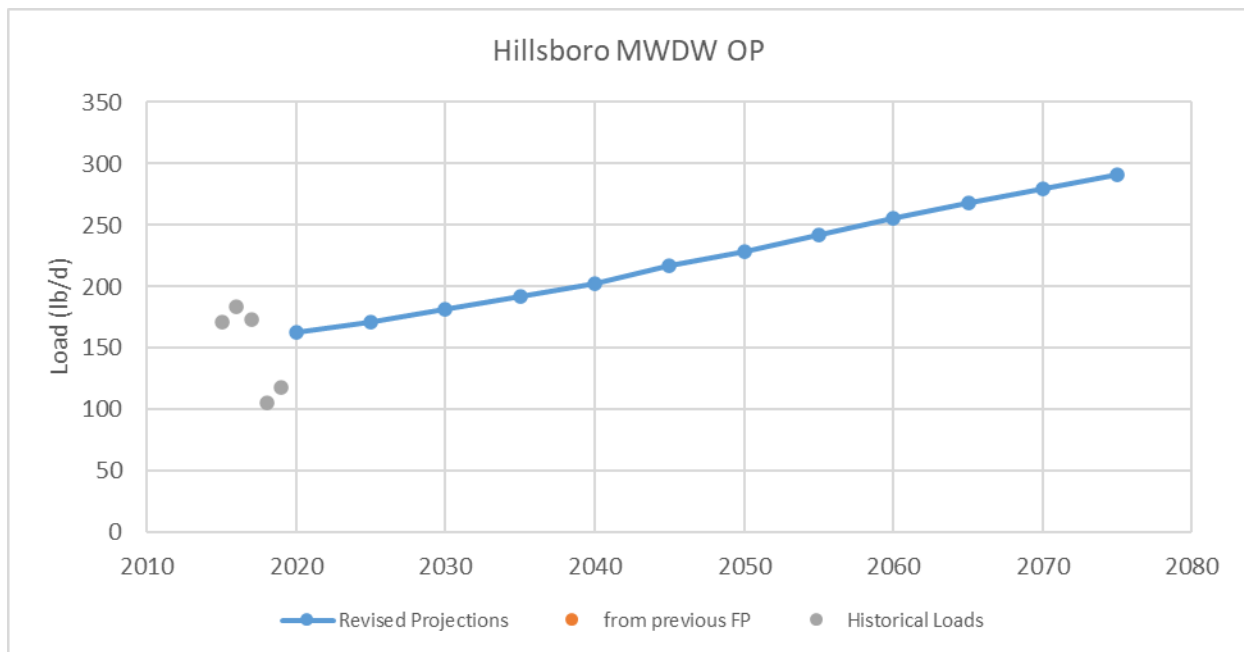


Figure F80. MWDW Load Projection, oP, Hillsboro WRRF

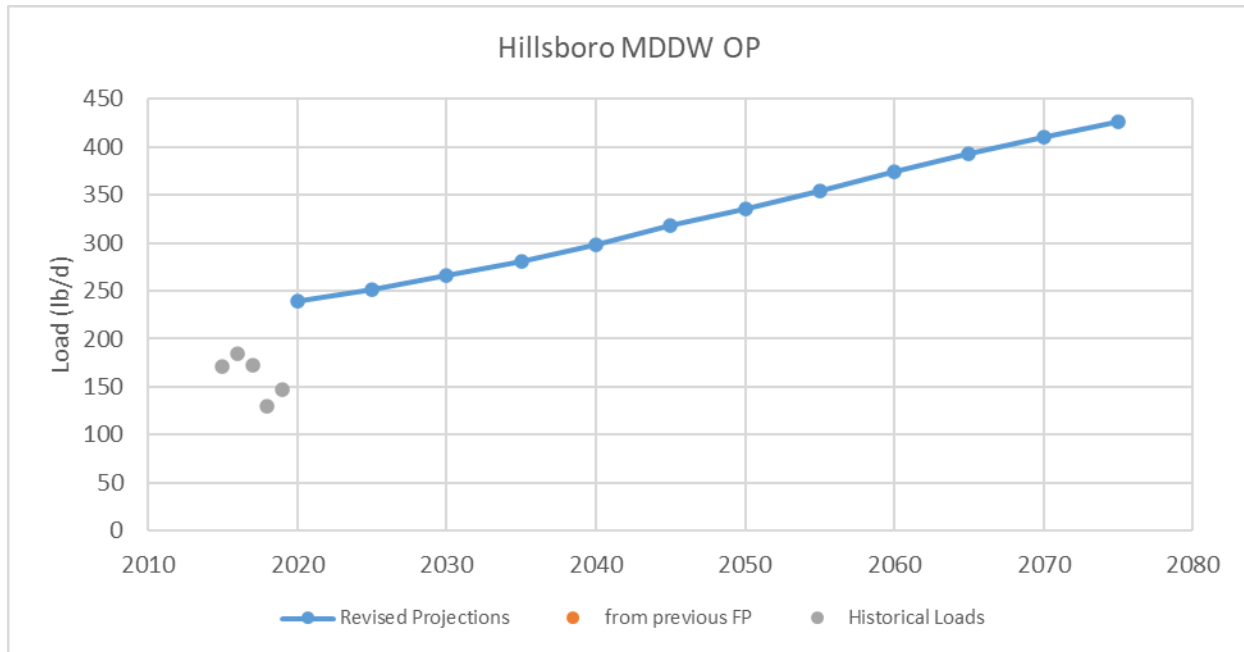


Figure F81. MDDW Load Projection, oP, Hillsboro WRRF

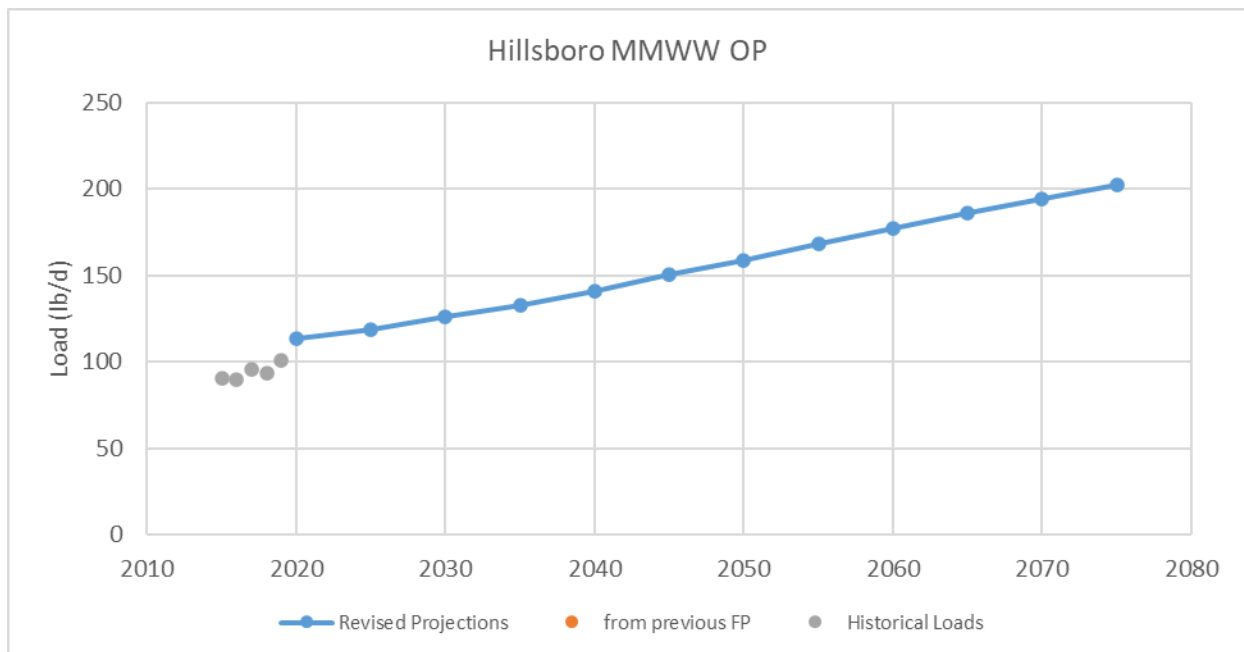


Figure F82. MMWW Load Projection, oP, Hillsboro WRRF

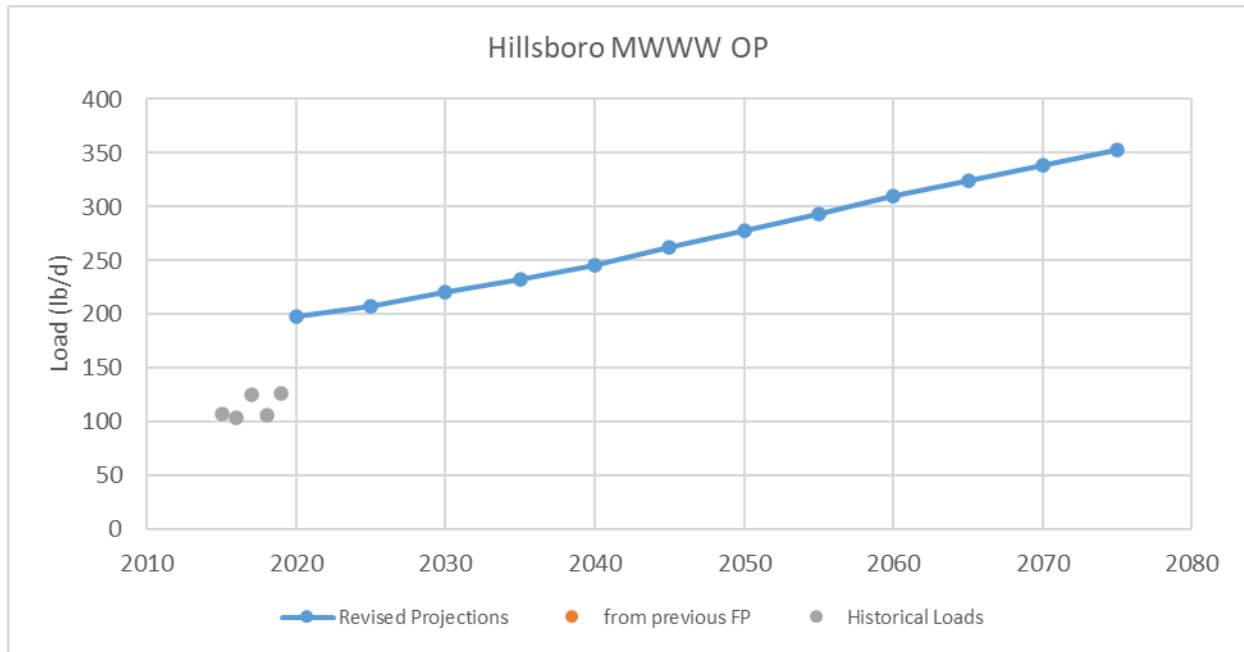


Figure F83. MWWW Load Projection, oP, Hillsboro WRRF

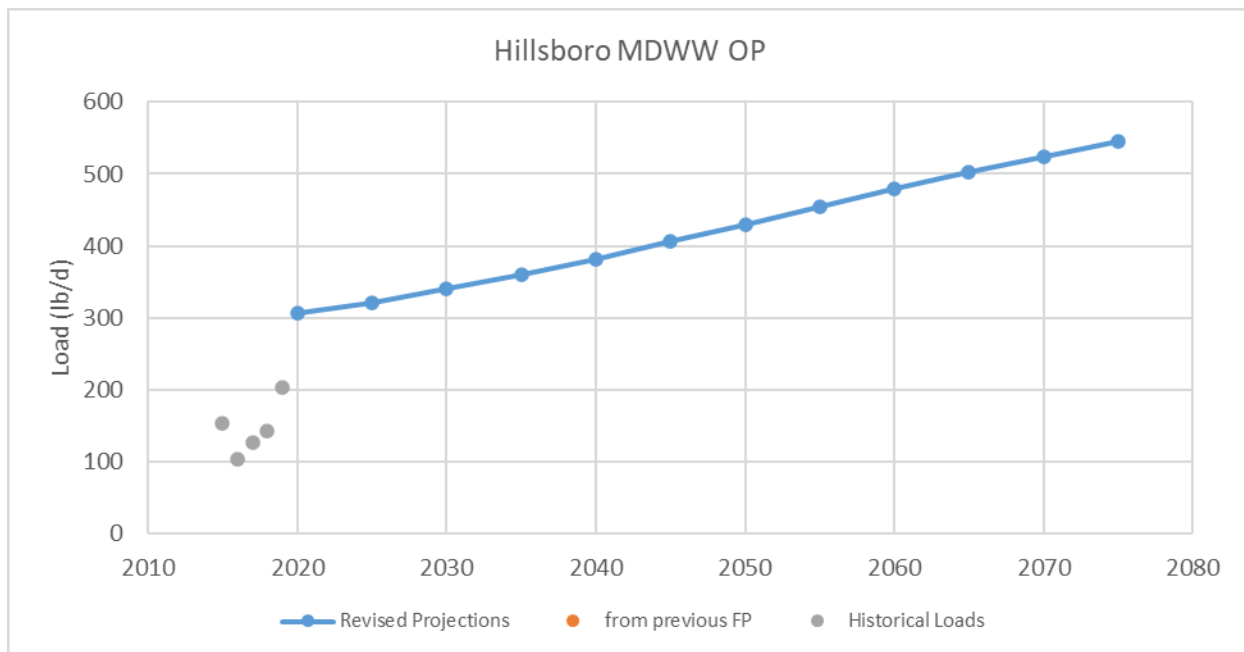


Figure F84. MDWW Load Projection, oP, Hillsboro WRRF

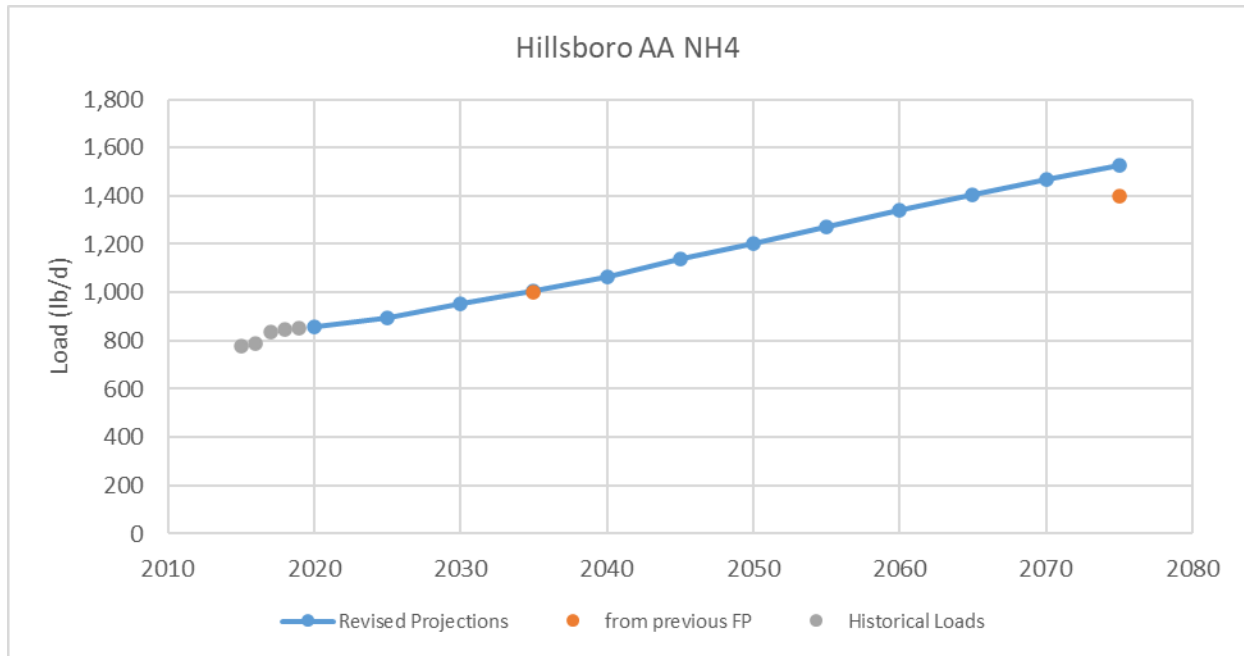


Figure F85. AA Load Projection, NH4, Hillsboro WRRF

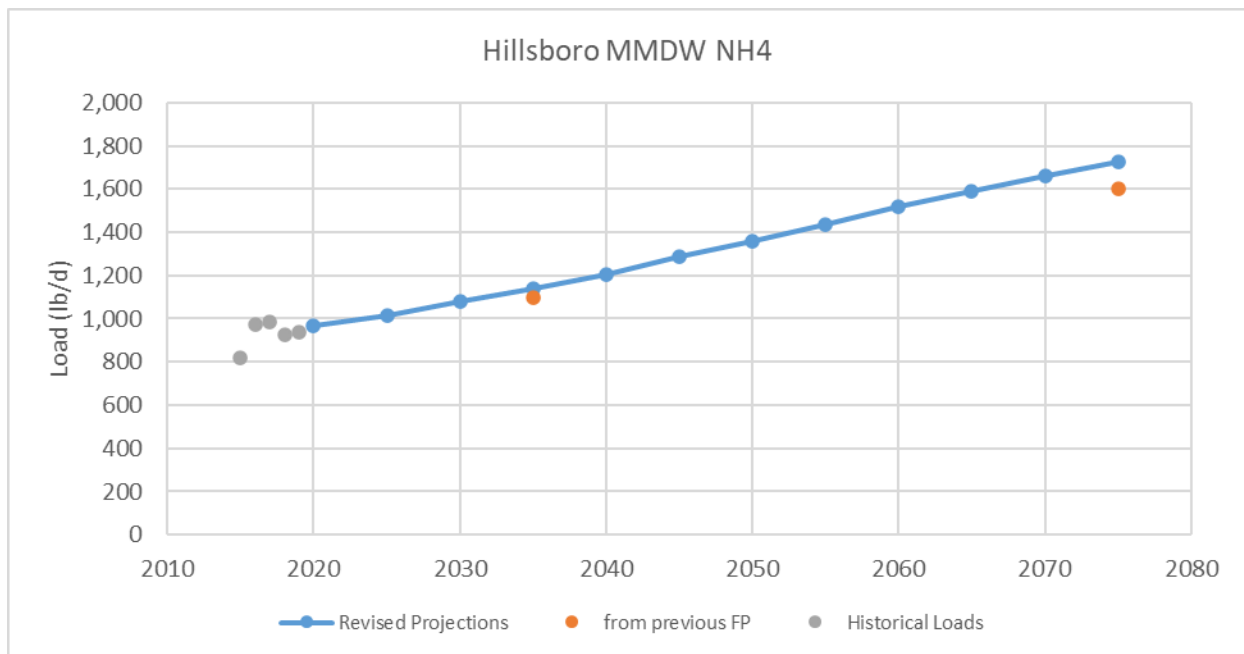


Figure F86. MMDW Load Projection, NH4, Hillsboro WRRF

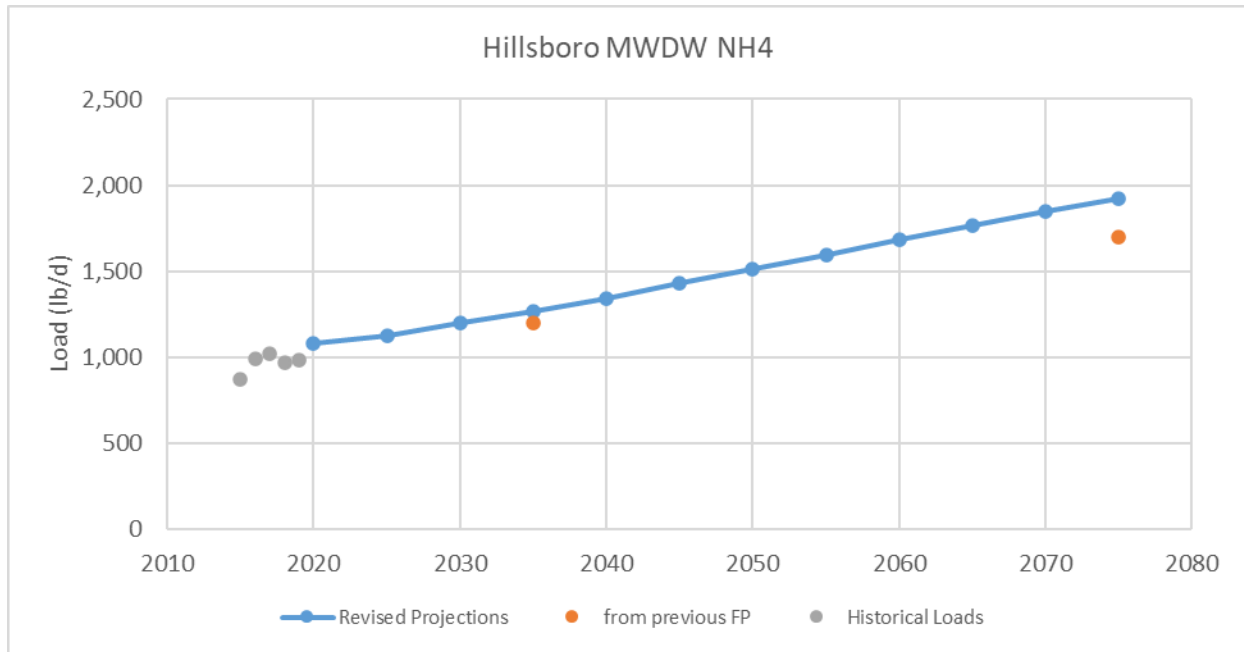


Figure F87. MWDW Load Projection, NH4, Hillsboro WRRF

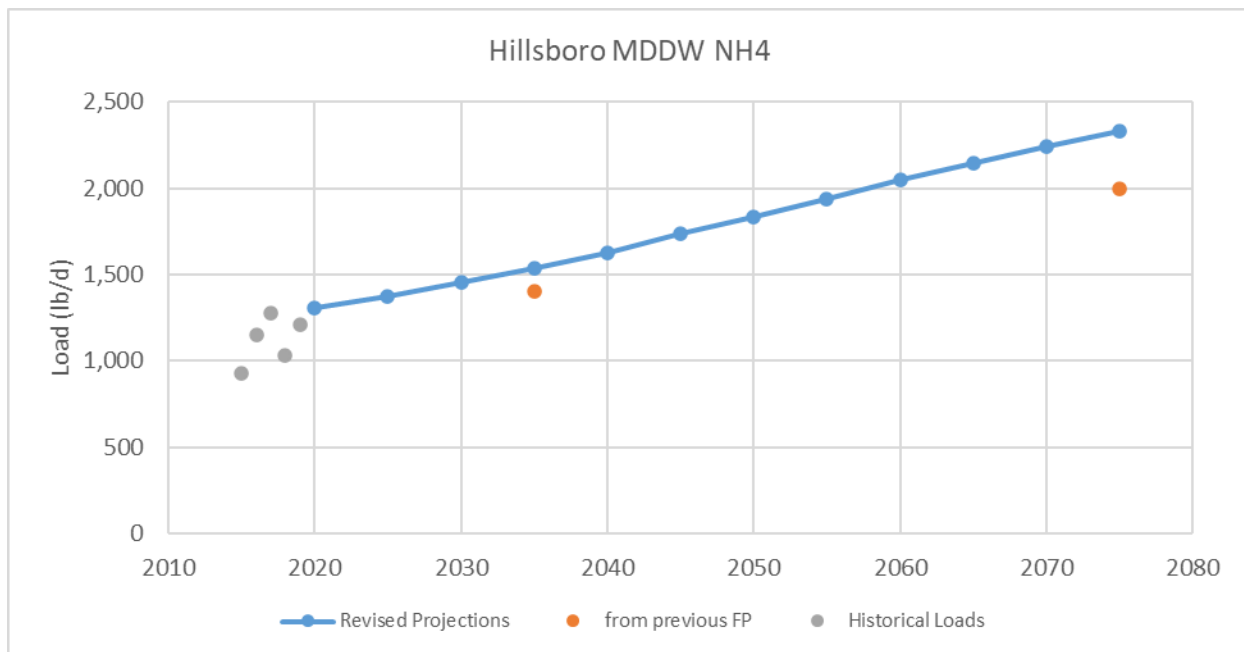


Figure F88. MDDW Load Projection, NH4, Hillsboro WRRF

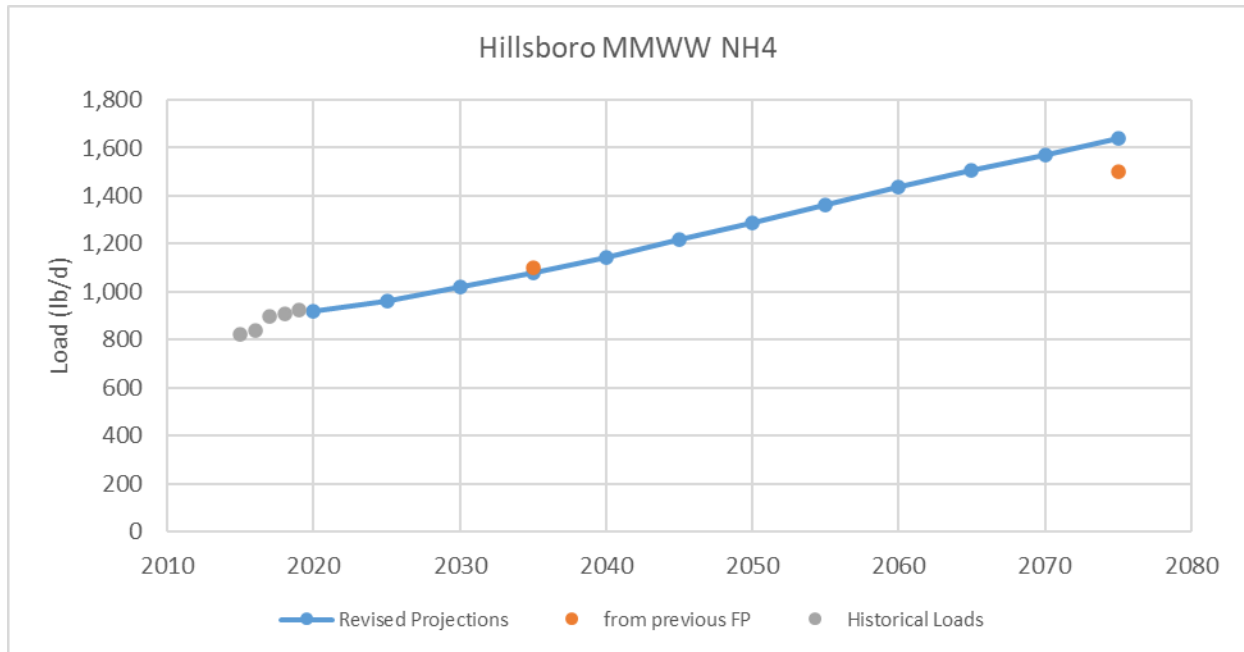


Figure F89. MMWW Load Projection, NH4, Hillsboro WRRF

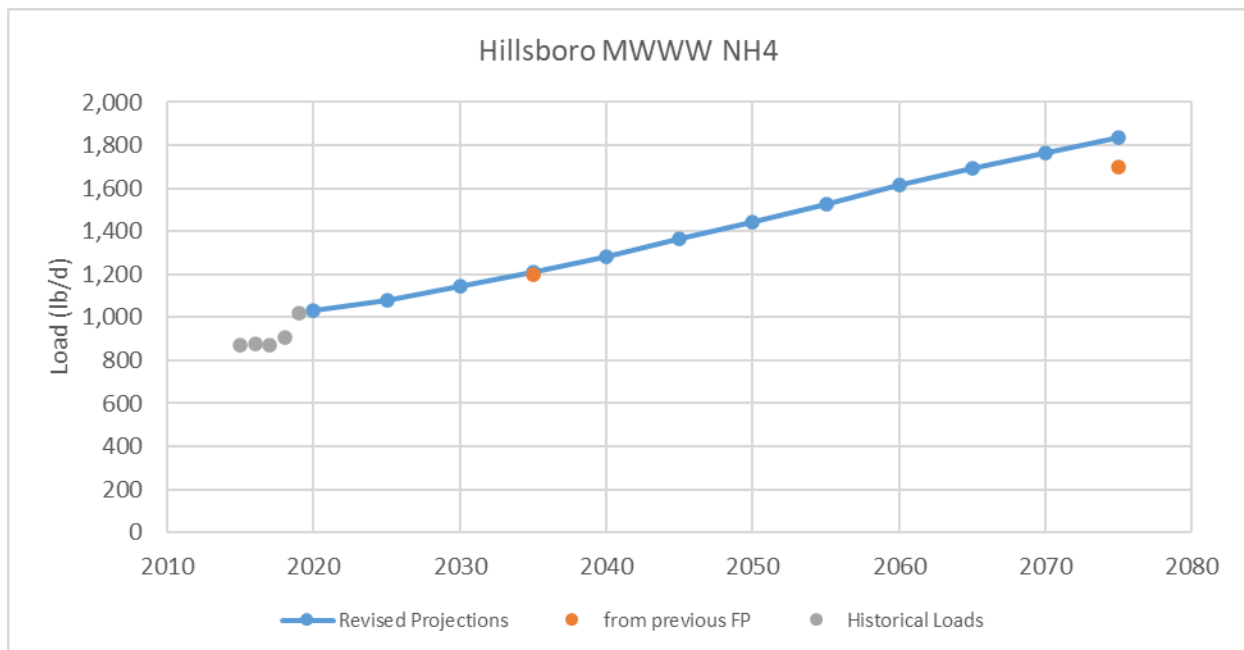


Figure F90. MWWW Load Projection, NH4, Hillsboro WRRF

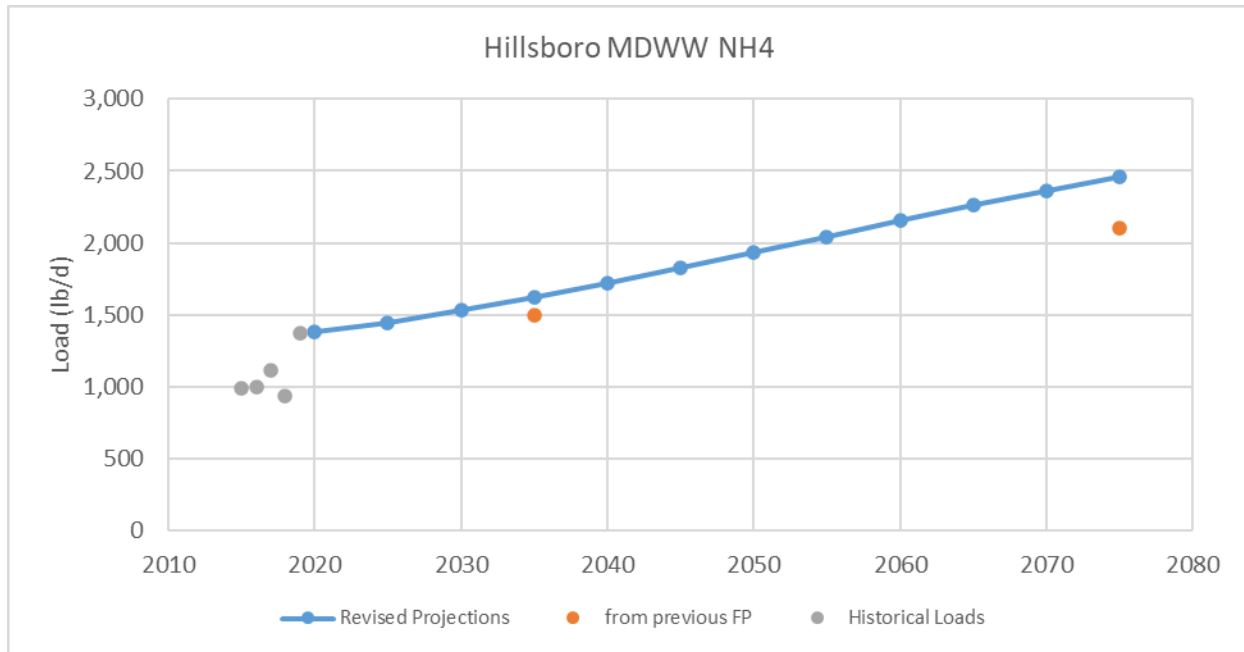


Figure F91. MDWW Load Projection, NH4, Hillsboro WRRF

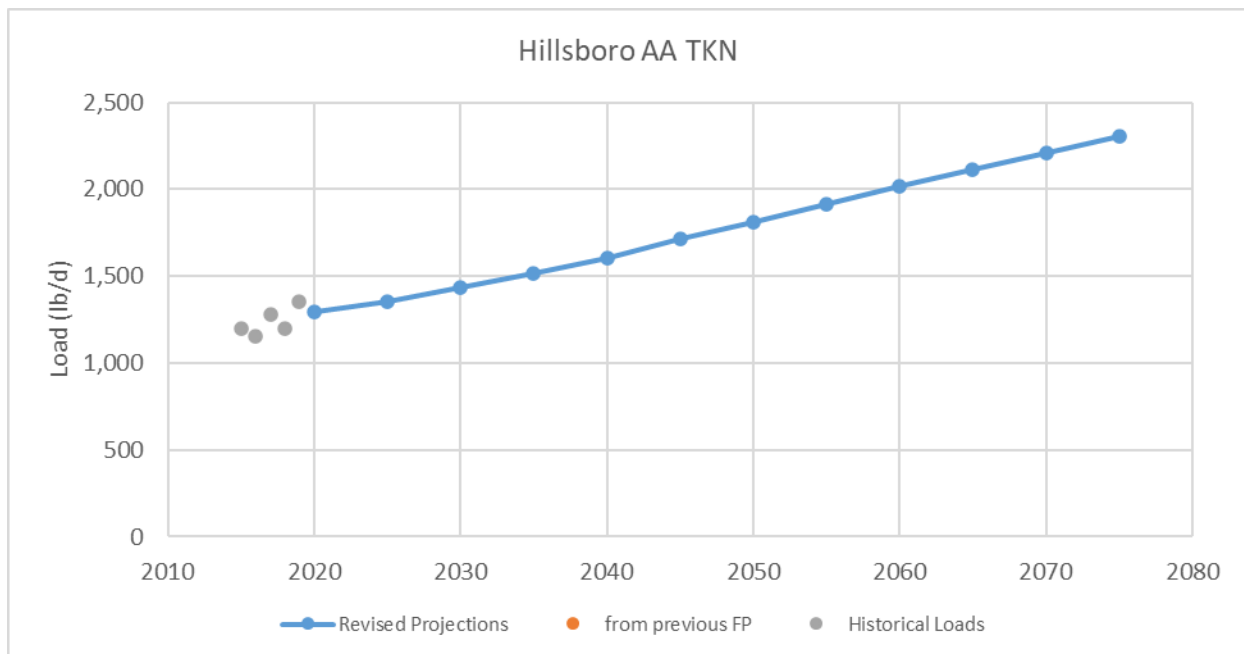


Figure F92. AA Load Projection, TKN, Hillsboro WRRF

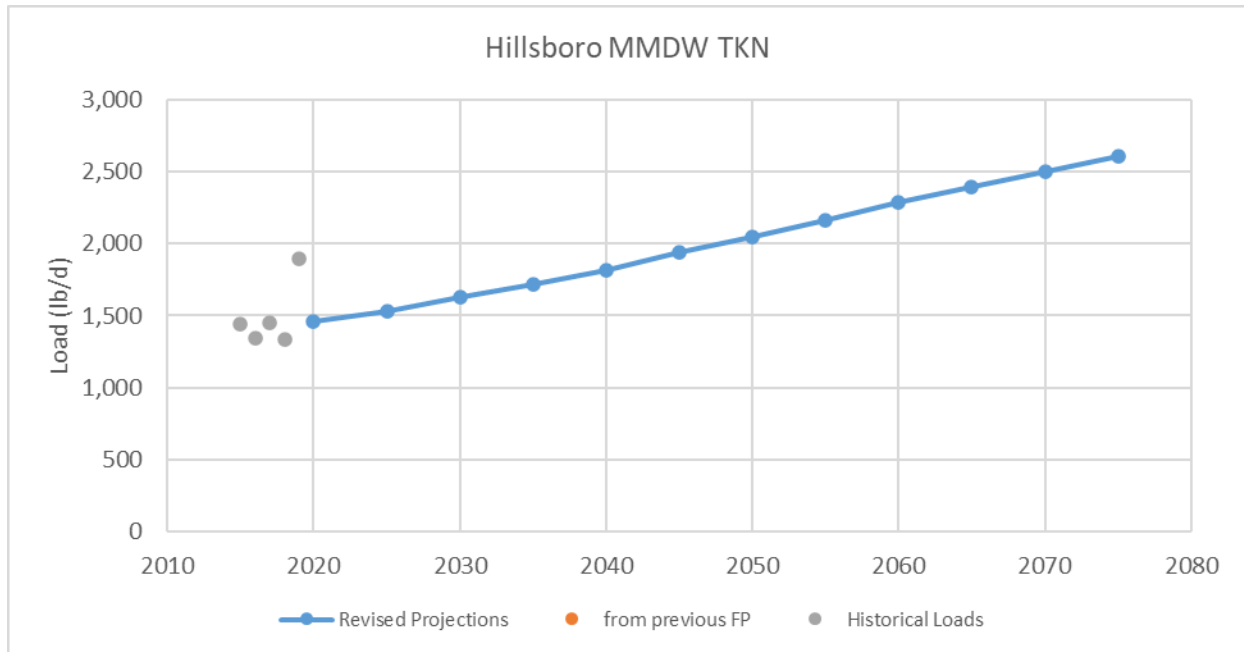


Figure F93. MMDW Load Projection, TKN, Hillsboro WRRF

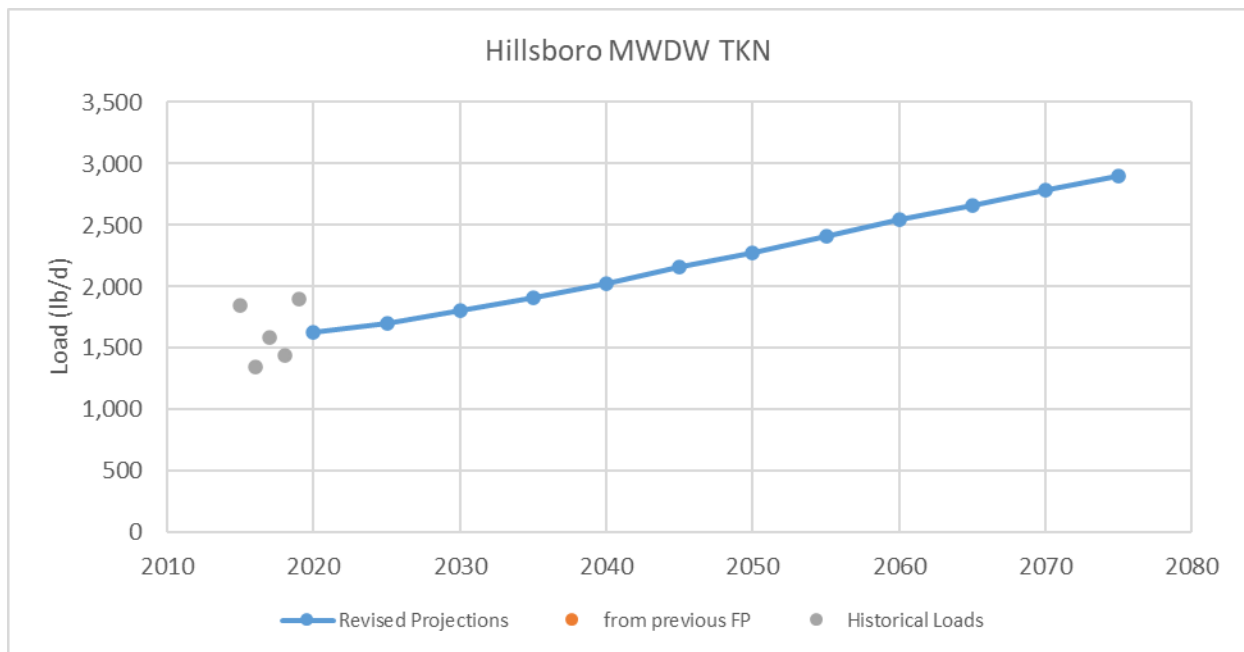


Figure F94. MWDW Load Projection, TKN, Hillsboro WRRF

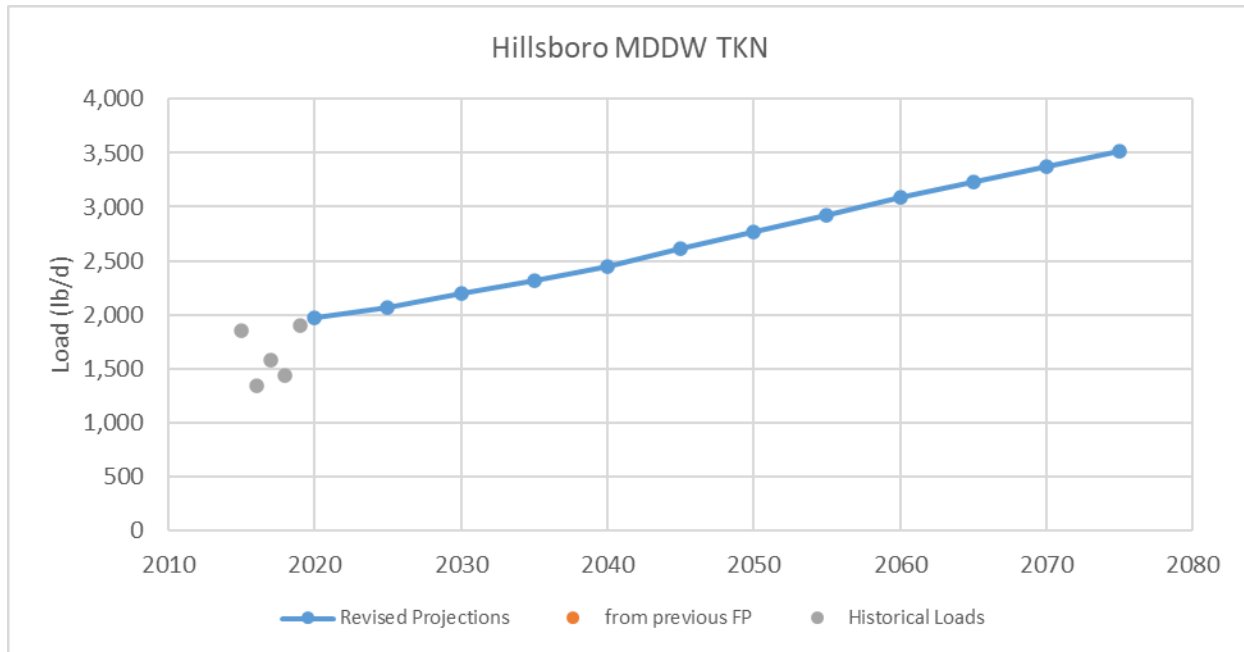


Figure F95. MDDW Load Projection, TKN, Hillsboro WRRF

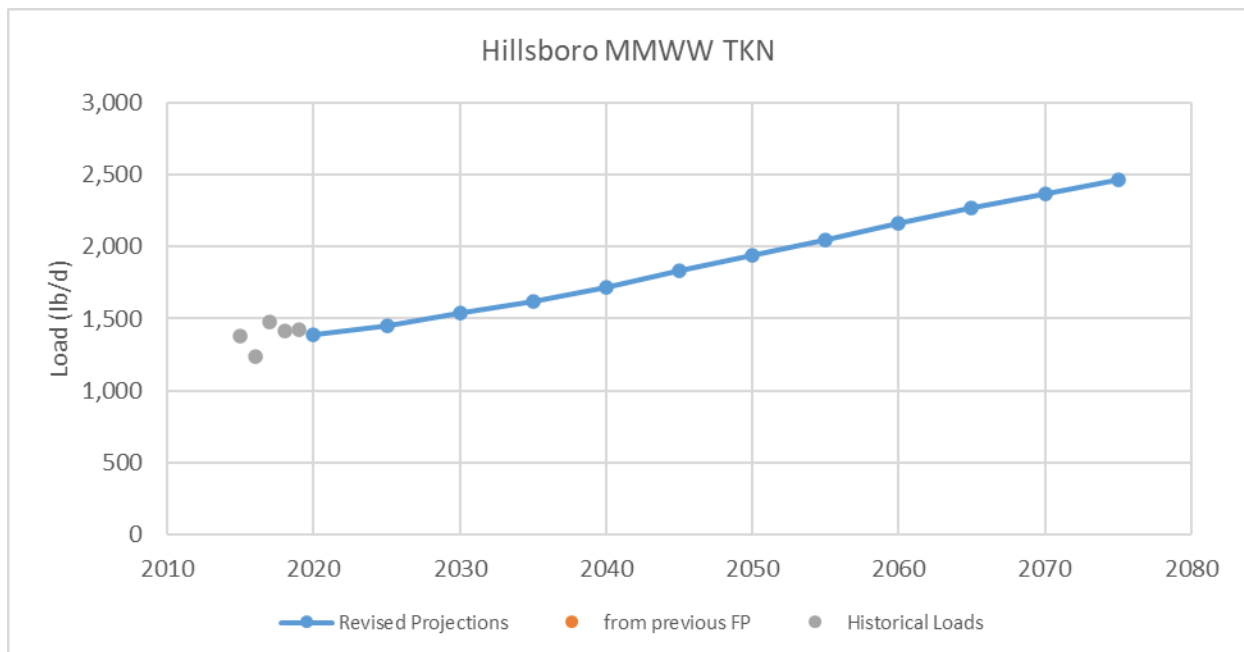


Figure F96. MMWW Load Projection, TKN, Hillsboro WRRF

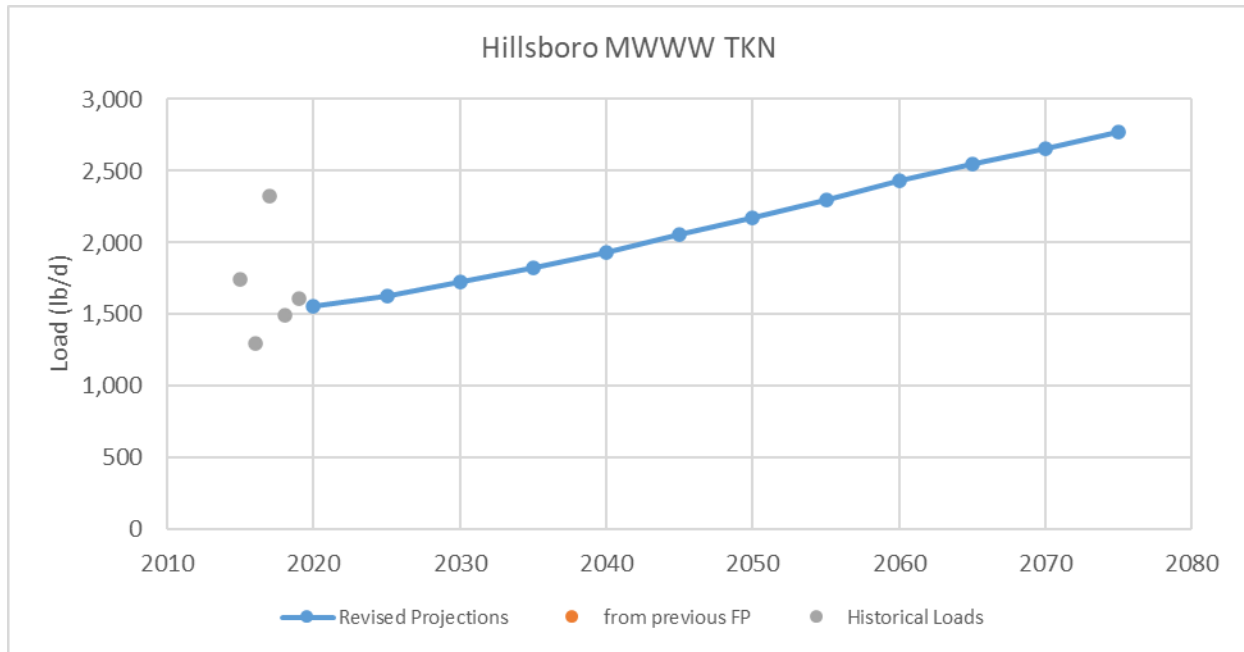


Figure F97. MWWW Load Projection, TKN, Hillsboro WRRF

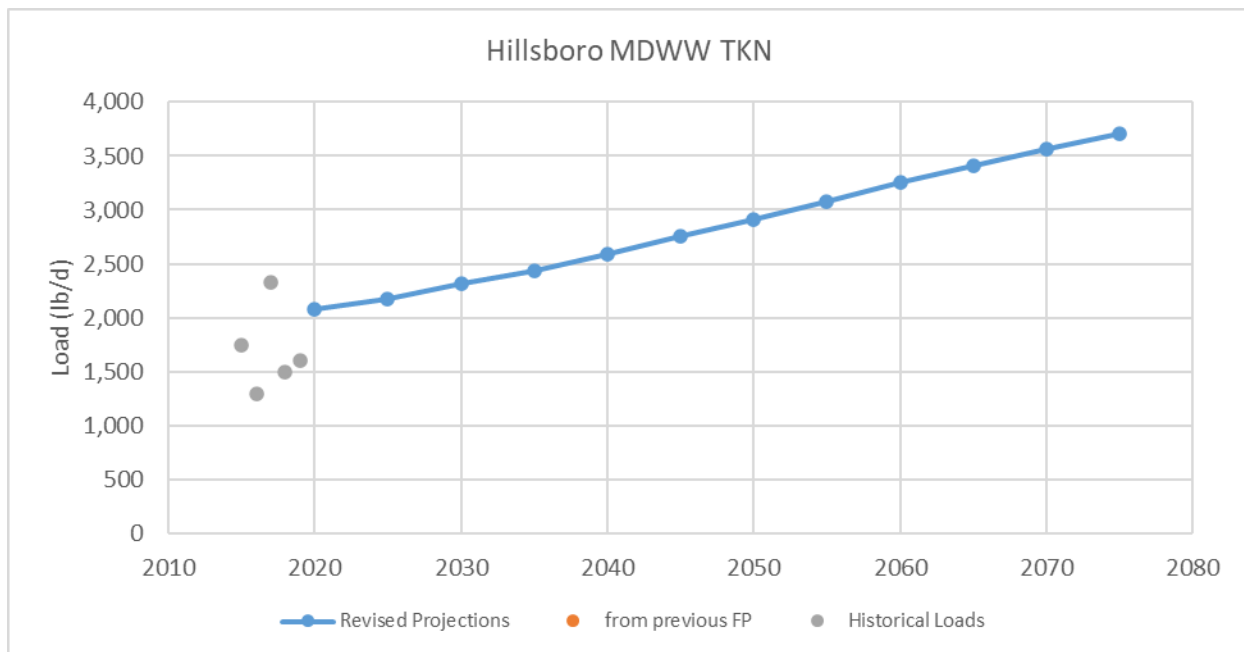


Figure F98. MDWW Load Projection, TKN, Hillsboro WRRF

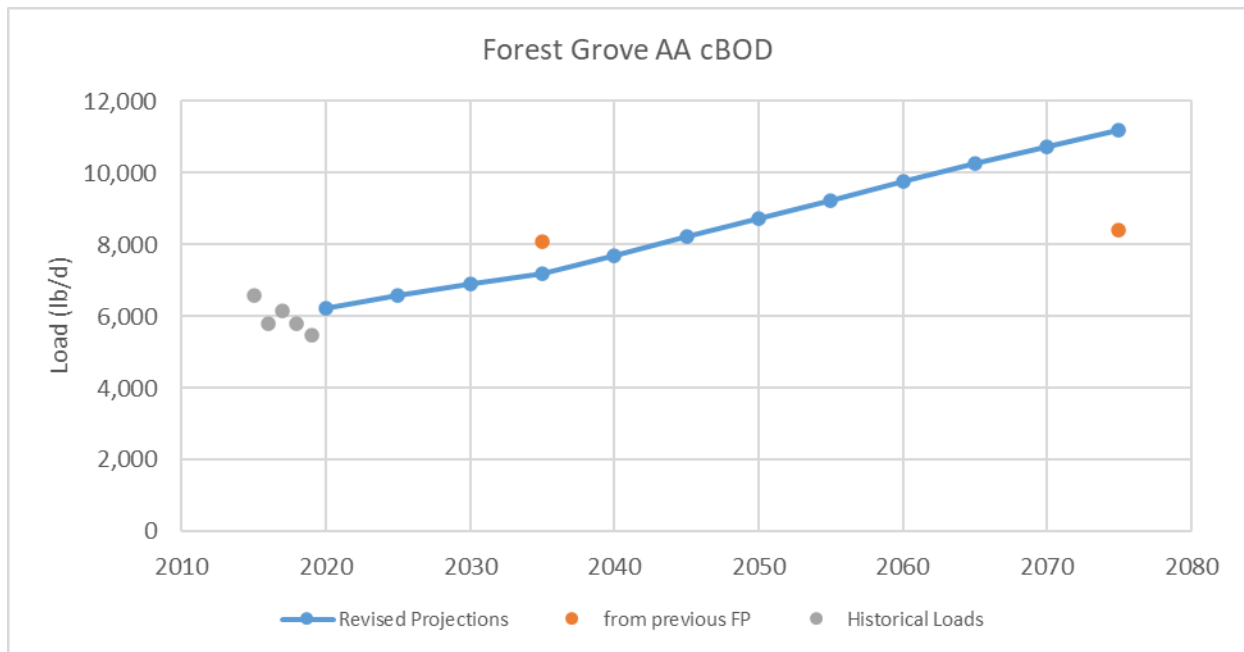
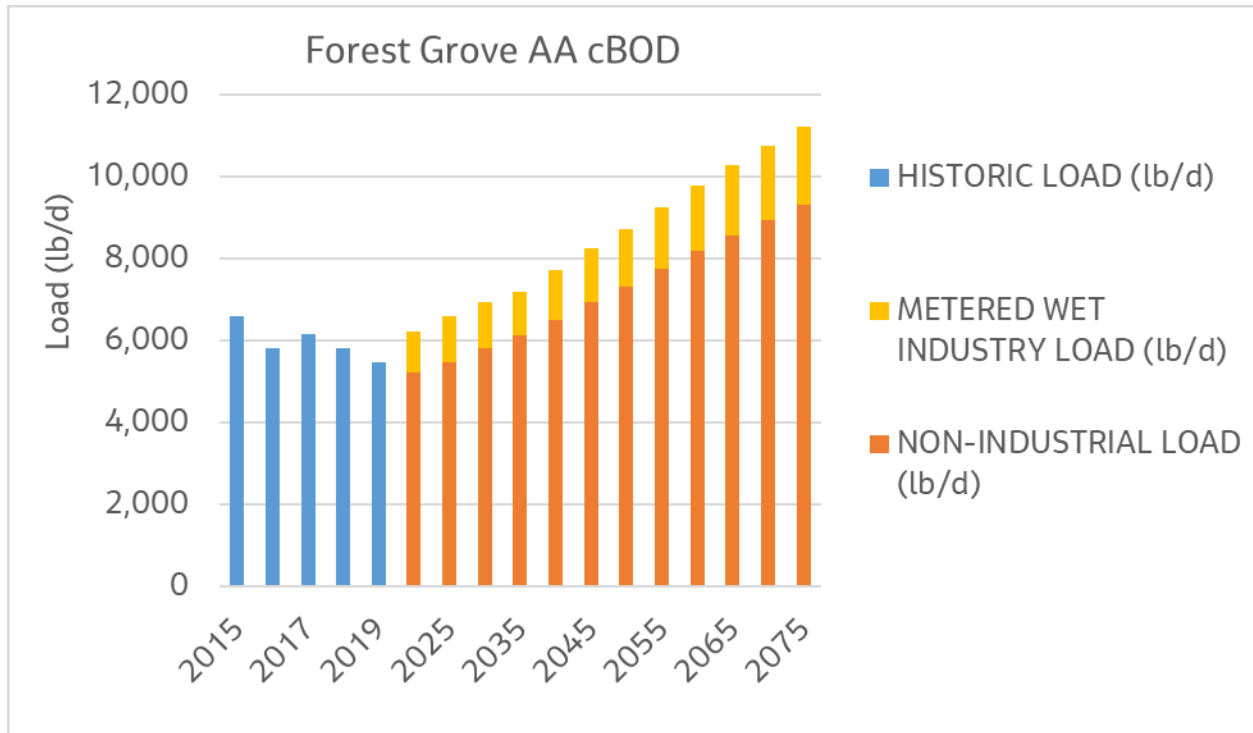


Figure F99. AA Load Projection, cBOD, Forest Grove WRRF

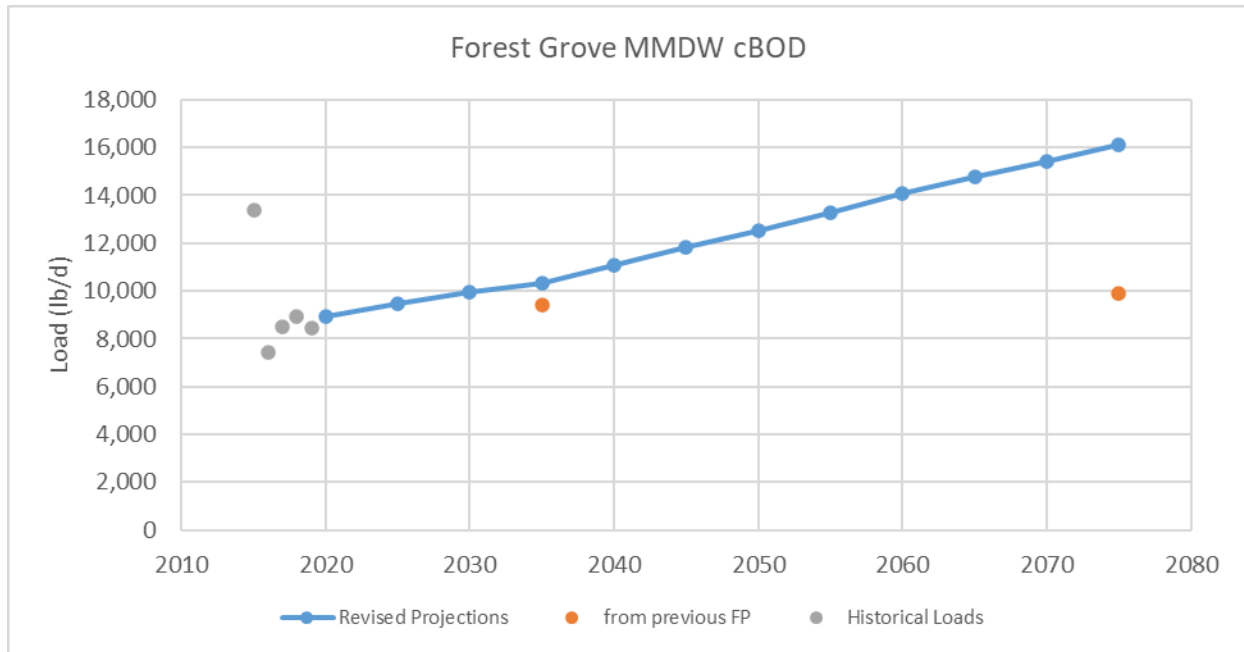


Figure F100. MMDW Load Projection, cBOD, Forest Grove WRRF

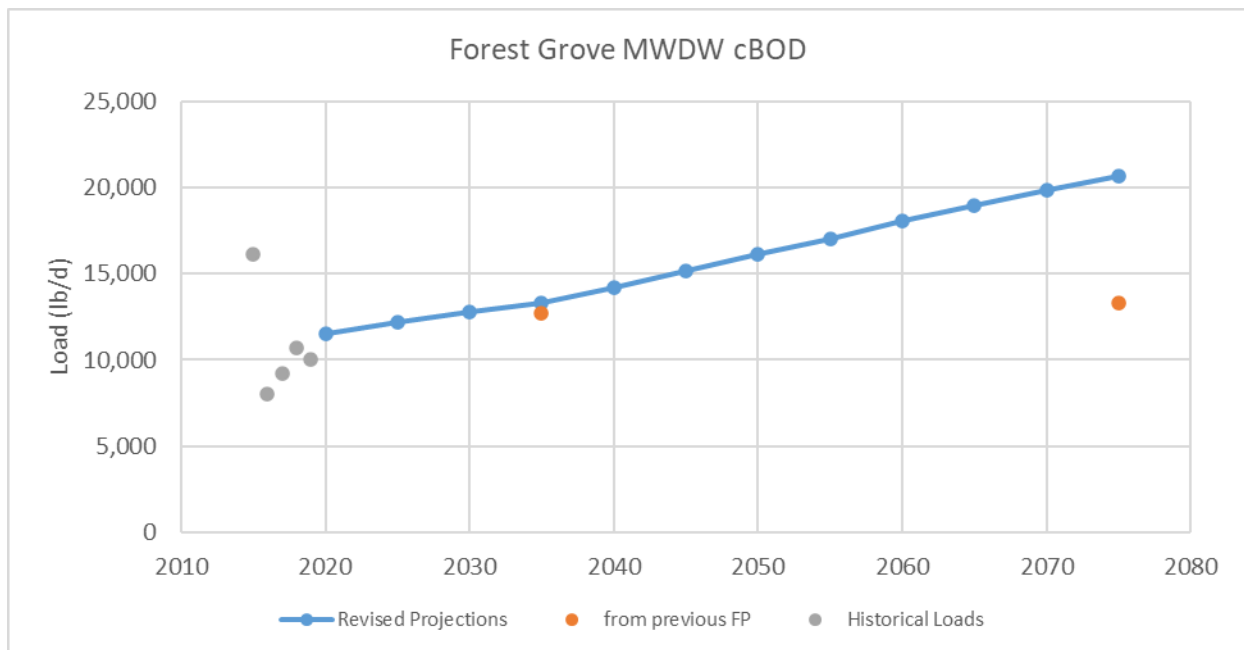


Figure F101. MWDW Load Projection, cBOD, Forest Grove WRRF

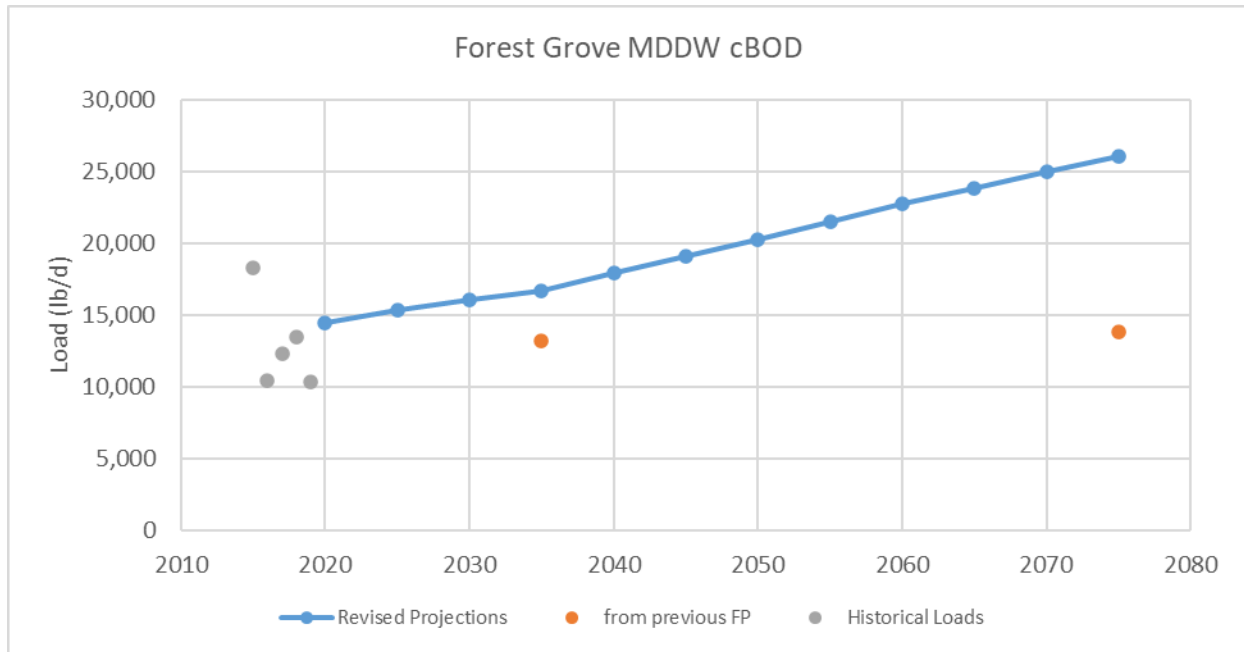


Figure F102. MDDW Load Projection, cBOD, Forest Grove WRRF

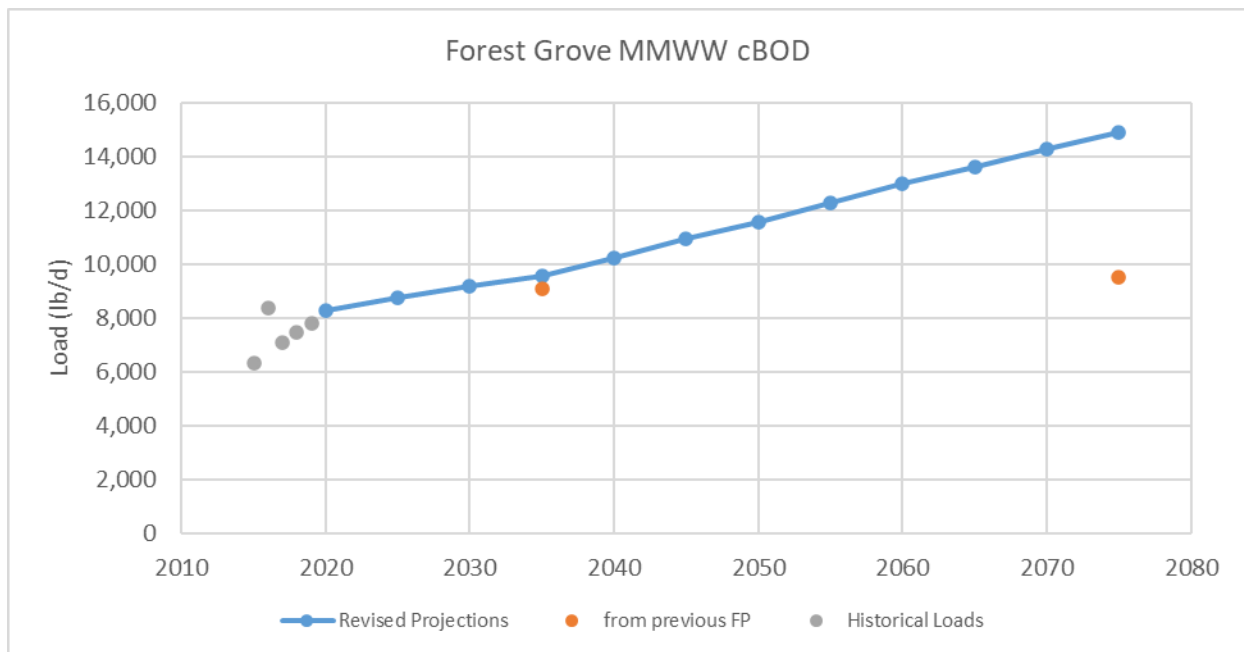


Figure F103. MMWW Load Projection, cBOD, Forest Grove WRRF

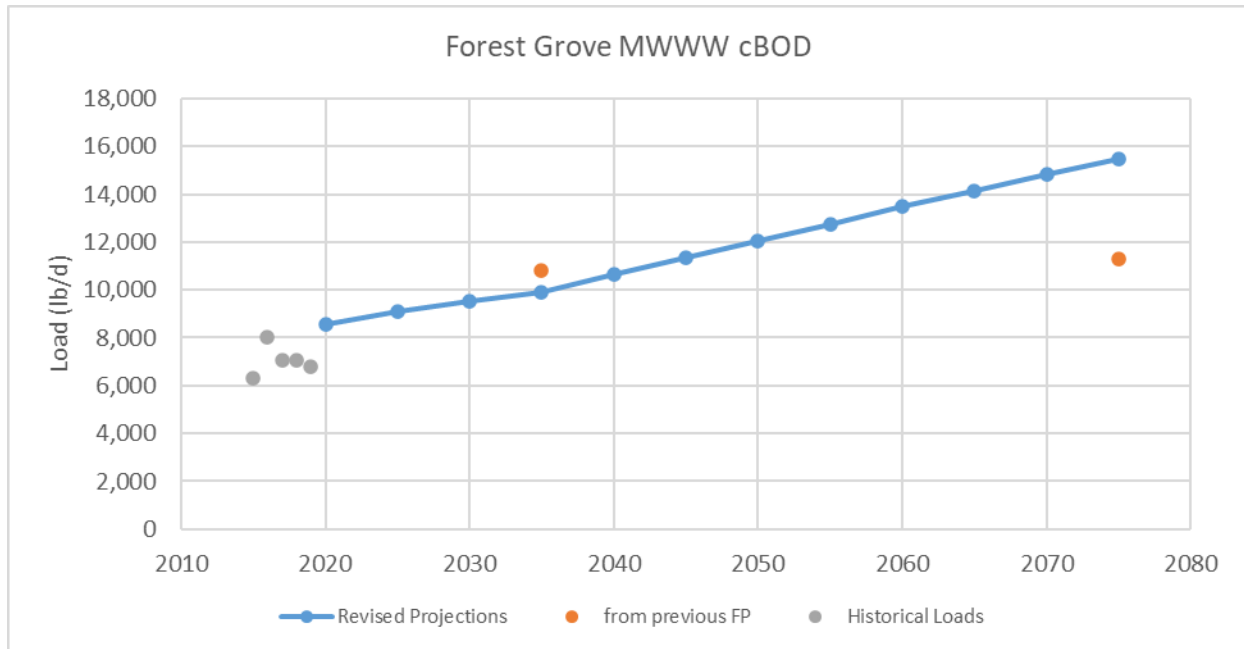


Figure F104. MWWW Load Projection, cBOD, Forest Grove WRRF

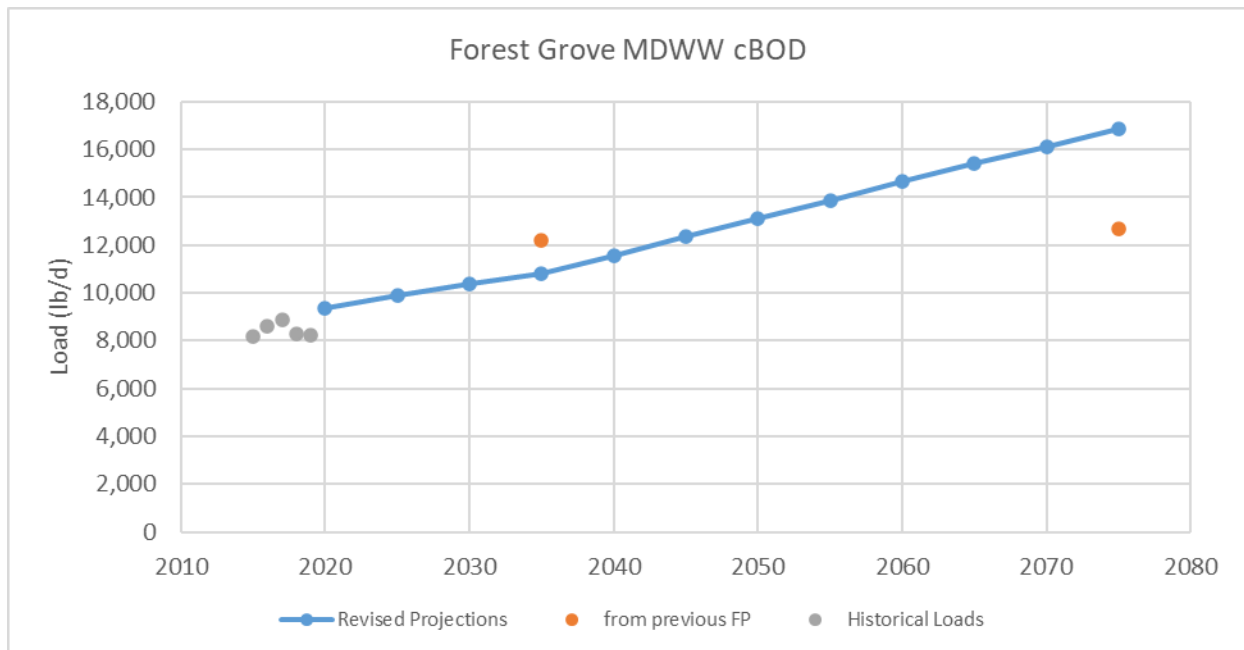


Figure F105. MDWW Load Projection, cBOD, Forest Grove WRRF

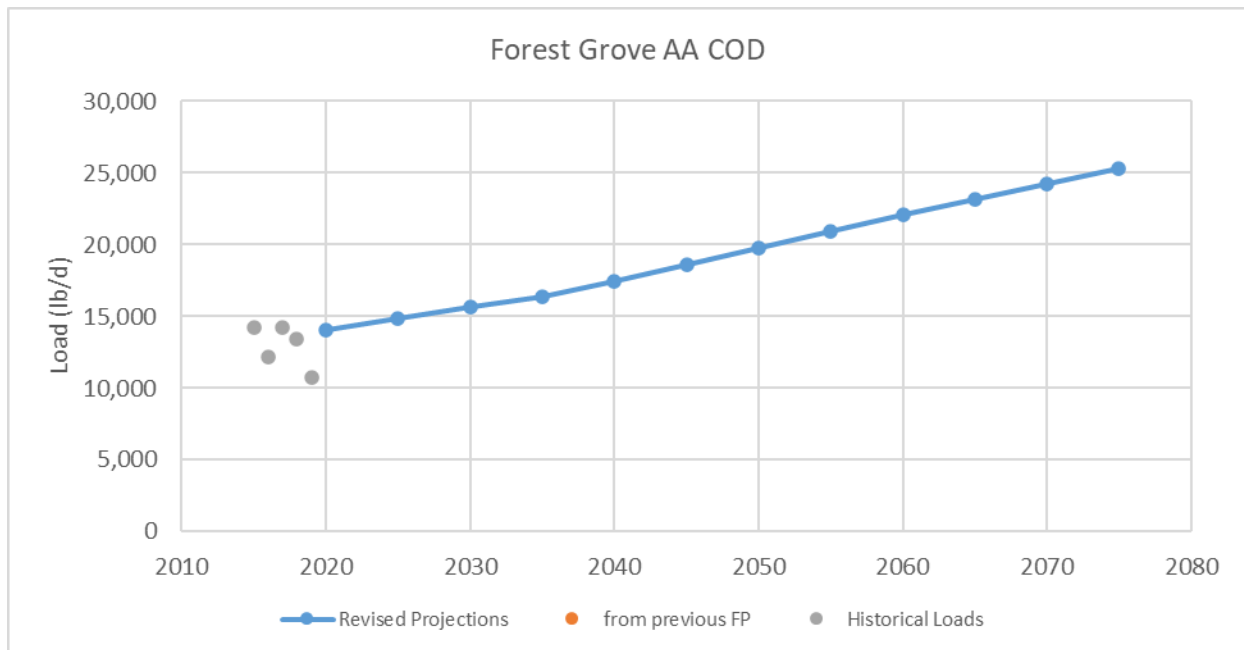
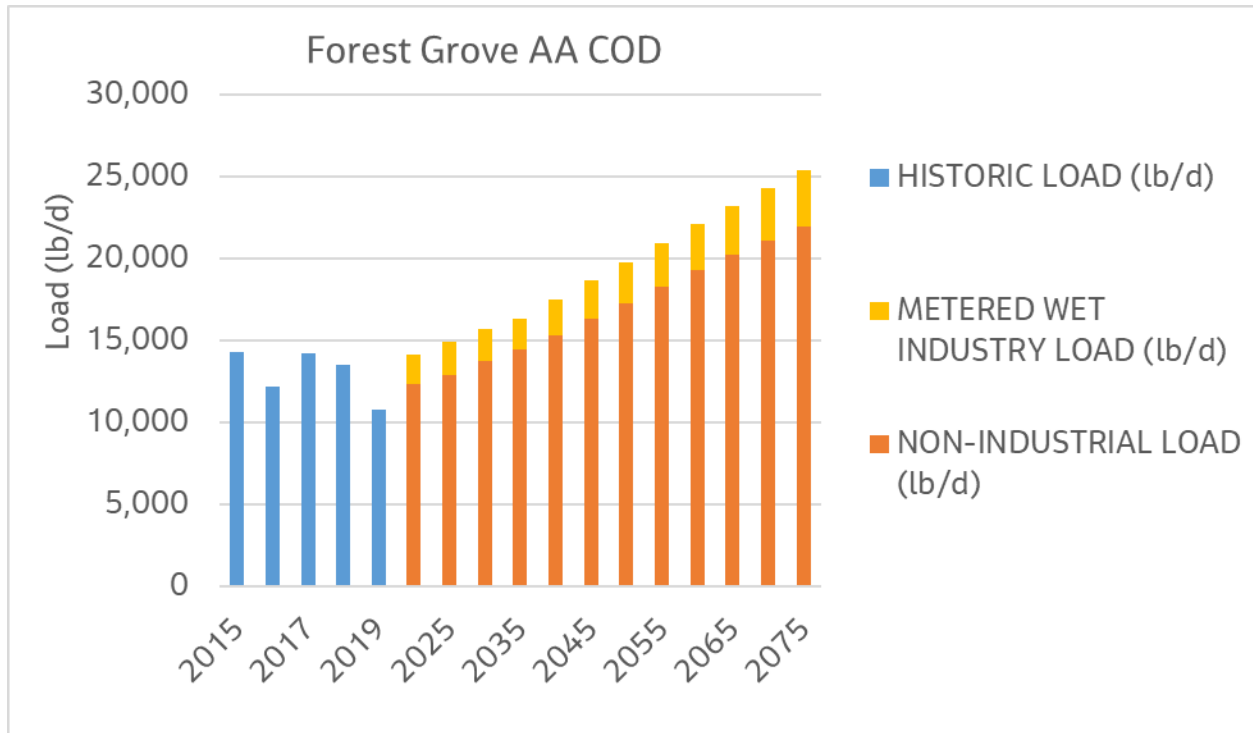


Figure F106. AA Load Projection, COD, Forest Grove WRRF

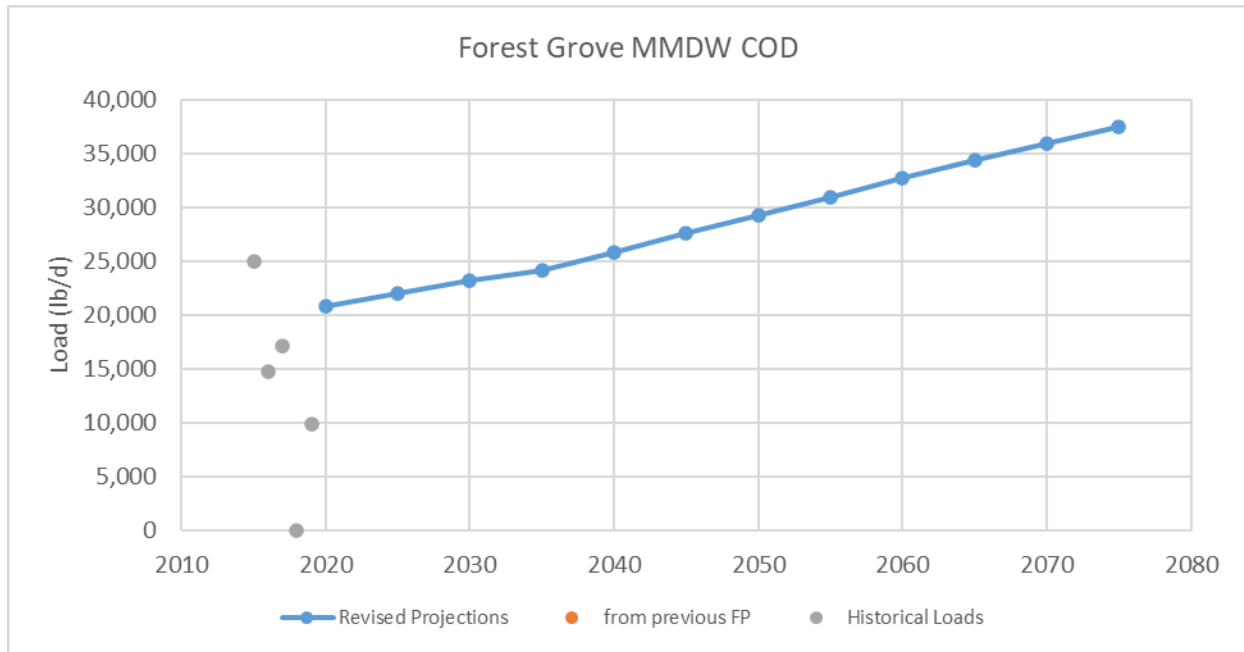


Figure F107. MMDW Load Projection, COD, Forest Grove WRRF

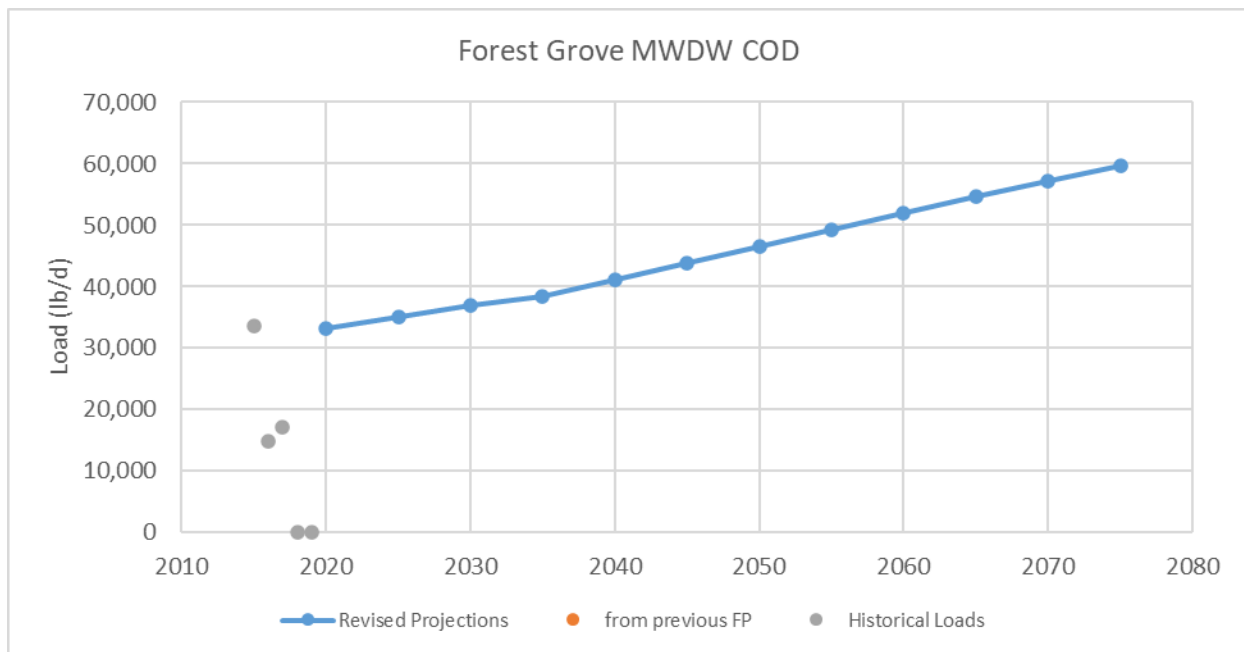


Figure F108. MWDW Load Projection, COD, Forest Grove WRRF

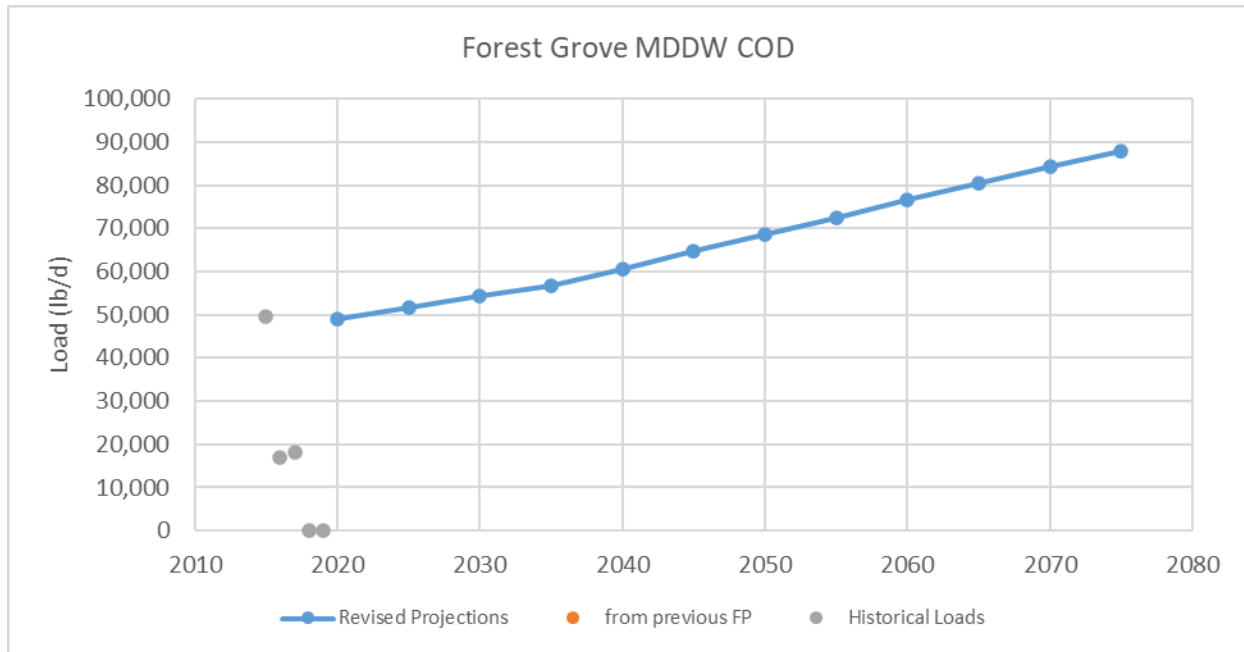


Figure F109. MDDW Load Projection, COD, Forest Grove WRRF

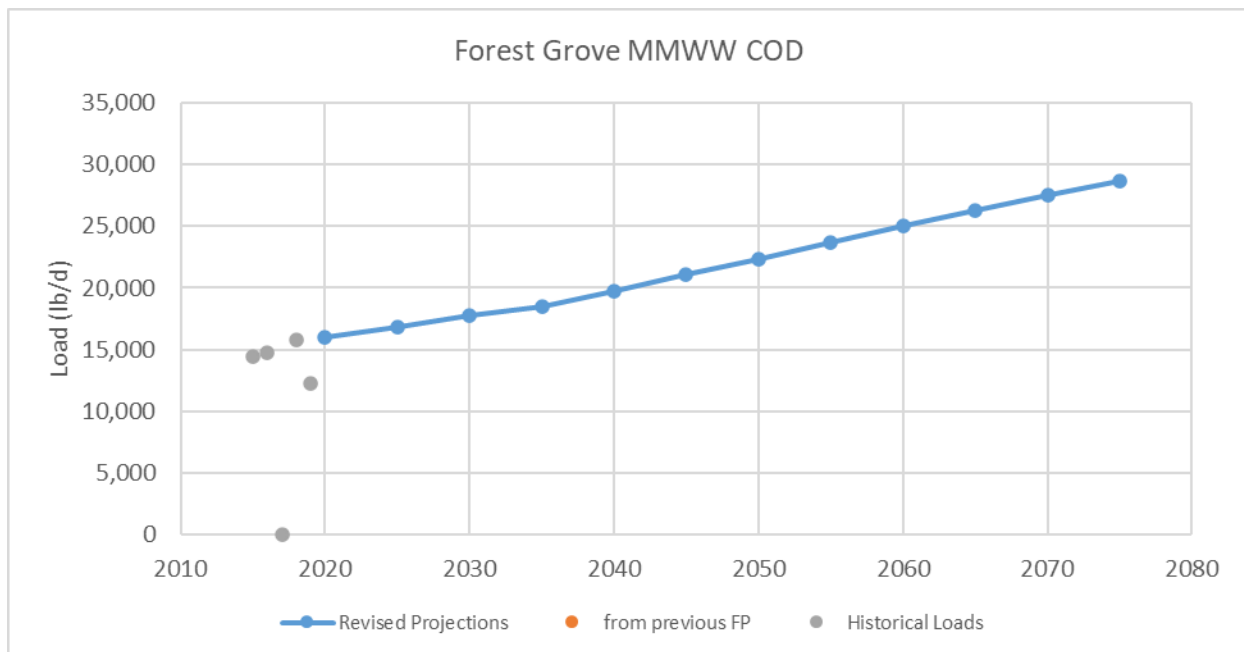


Figure F110. MMWW Load Projection, COD, Forest Grove WRRF

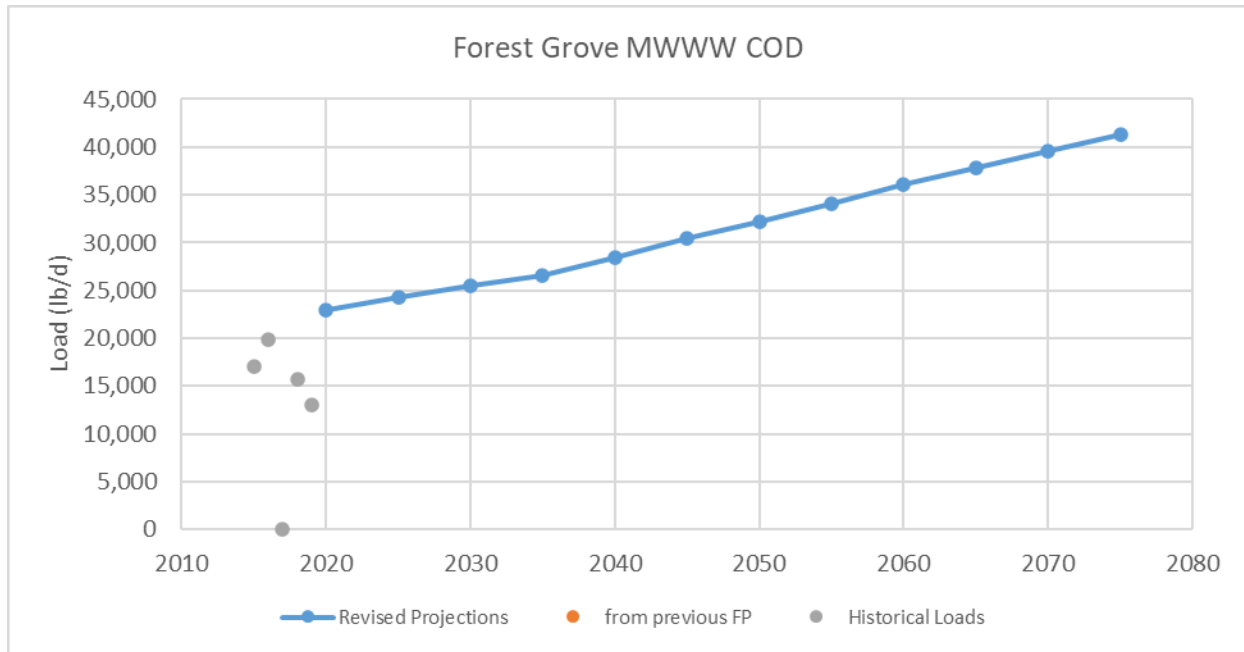


Figure F111. MWWW Load Projection, COD, Forest Grove WRRF

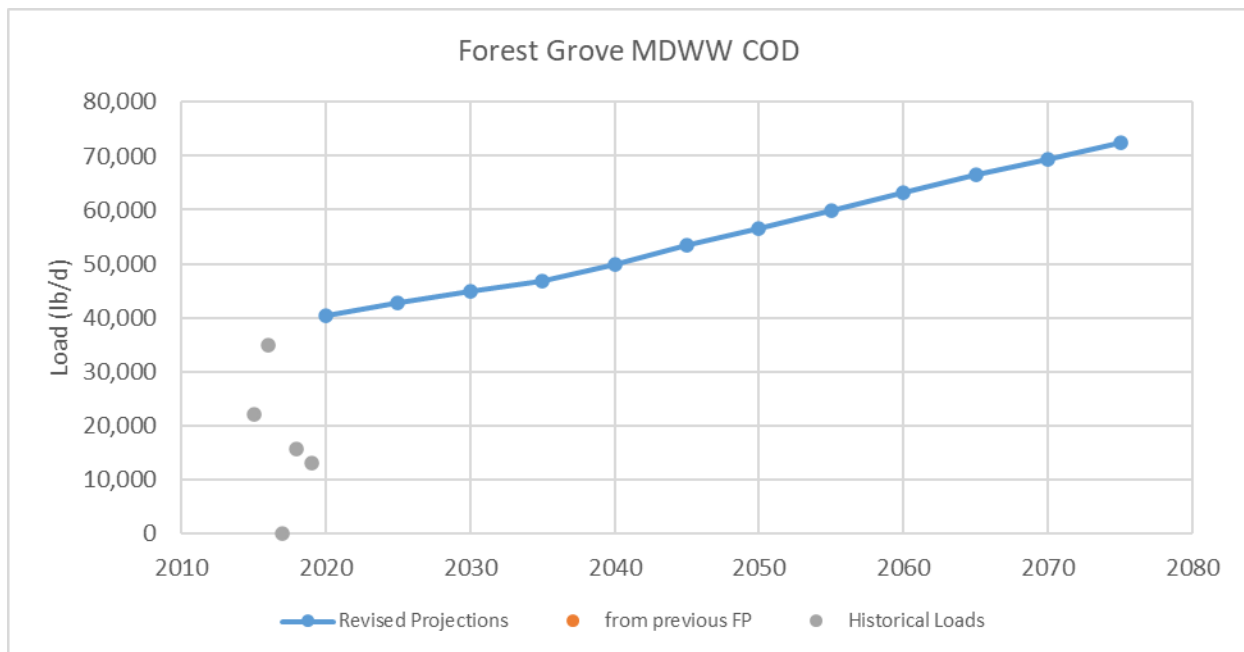


Figure F112. MDWW Load Projection, COD, Forest Grove WRRF

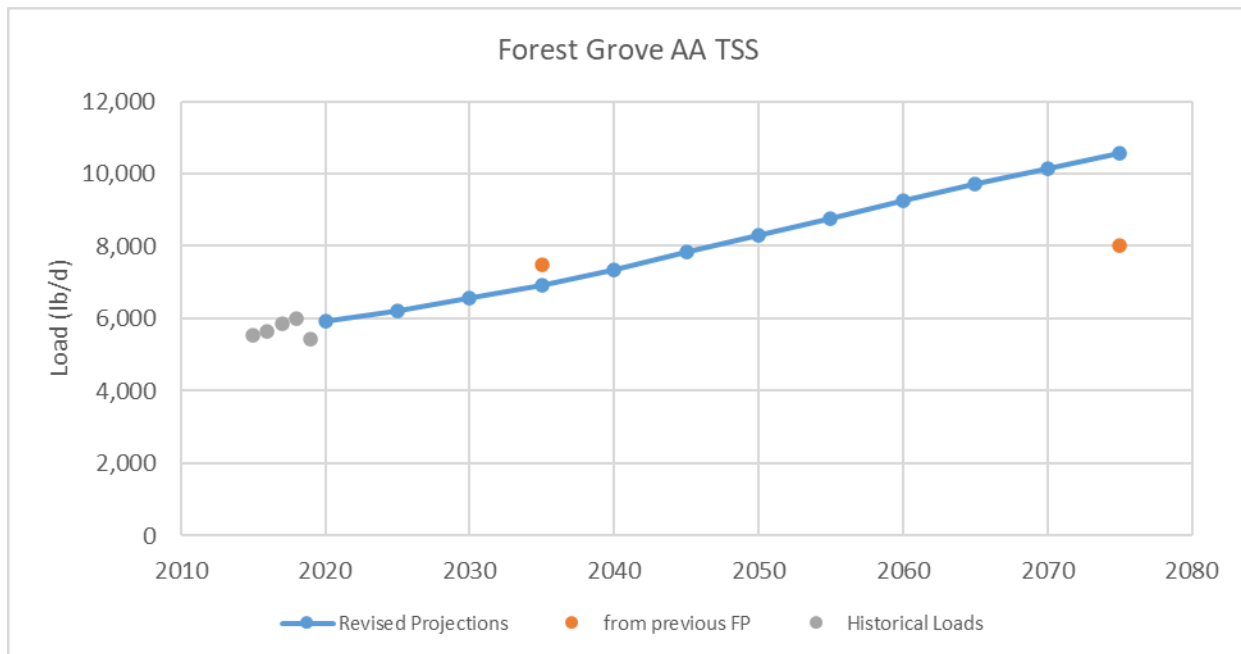
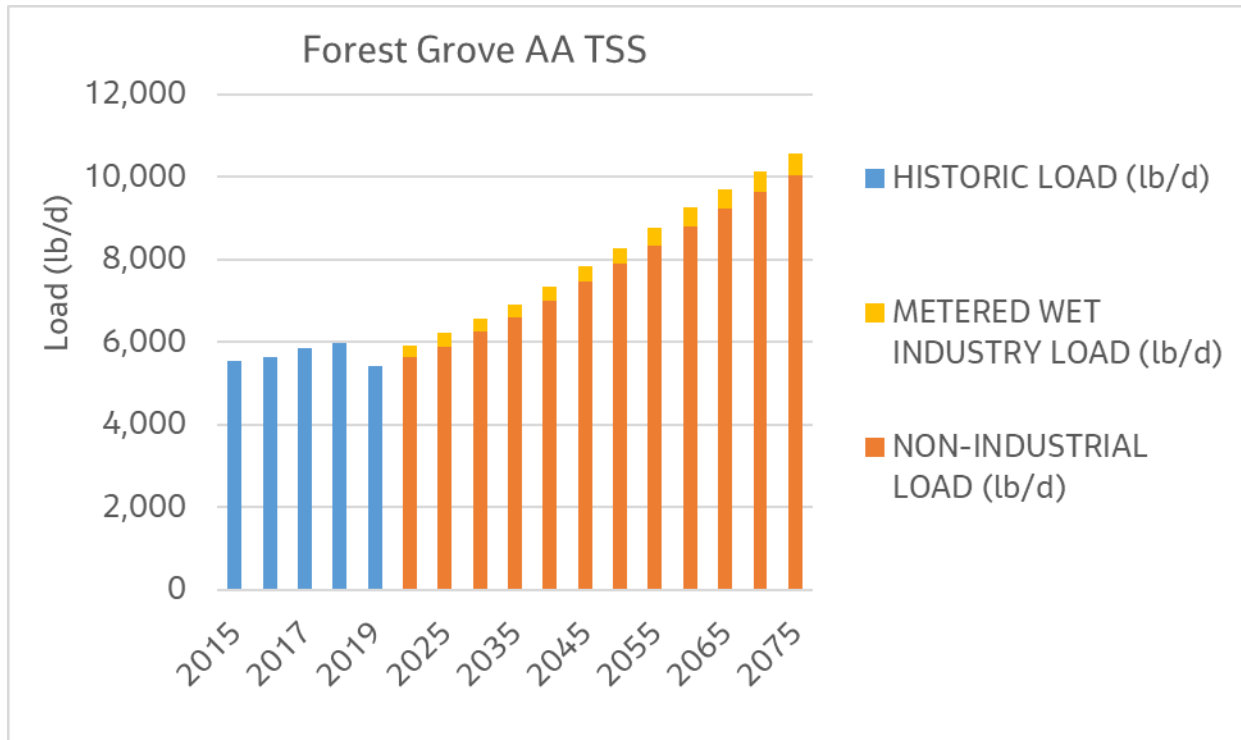


Figure F113. AA Load Projection, TSS, Forest Grove WRRF

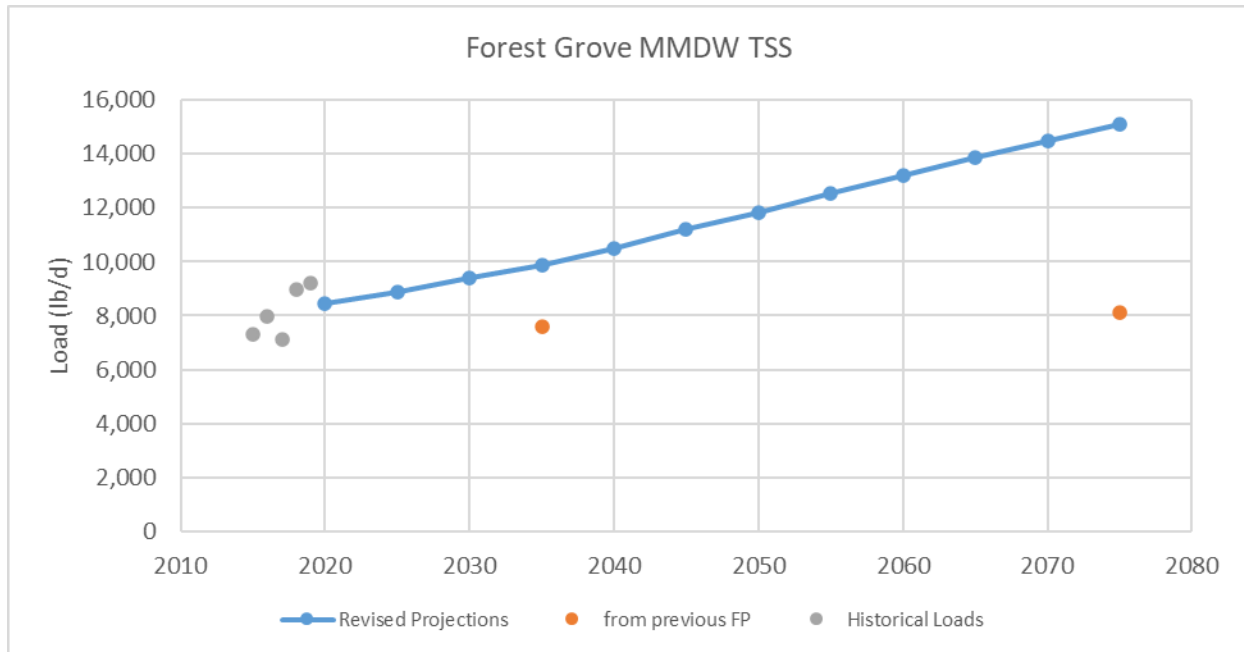


Figure F114. MMDW Load Projection, TSS, Forest Grove WRRF

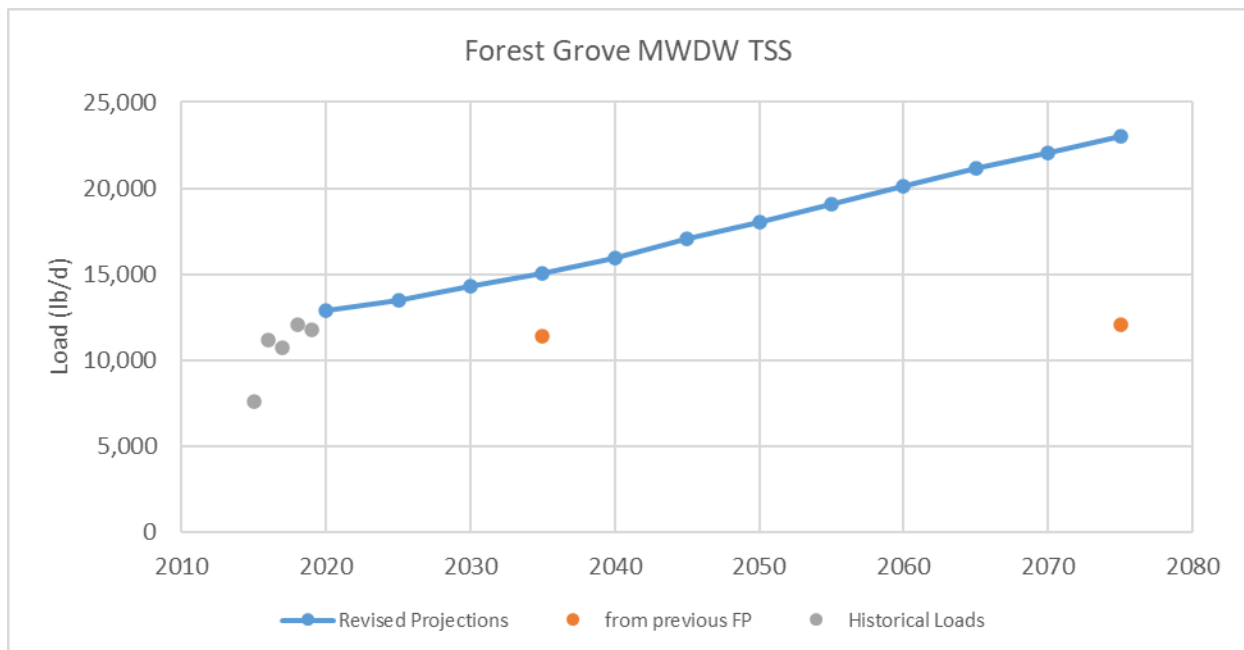


Figure F115. MWDW Load Projection, TSS, Forest Grove WRRF

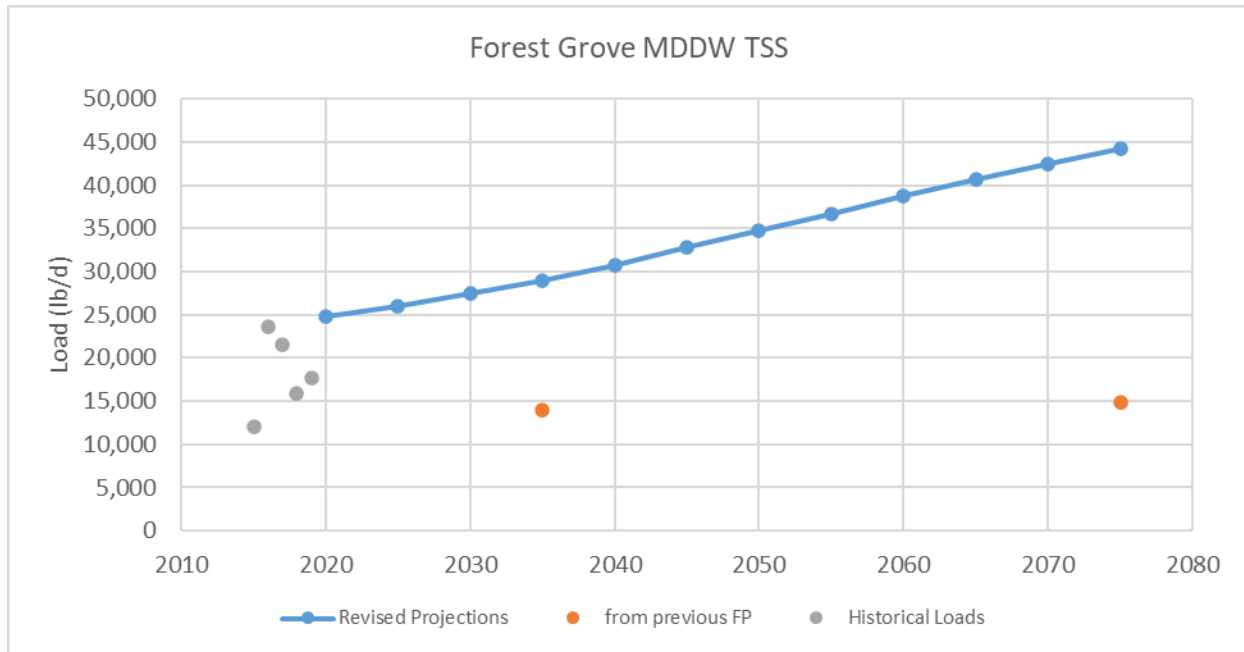


Figure F116. MDDW Load Projection, TSS, Forest Grove WRRF

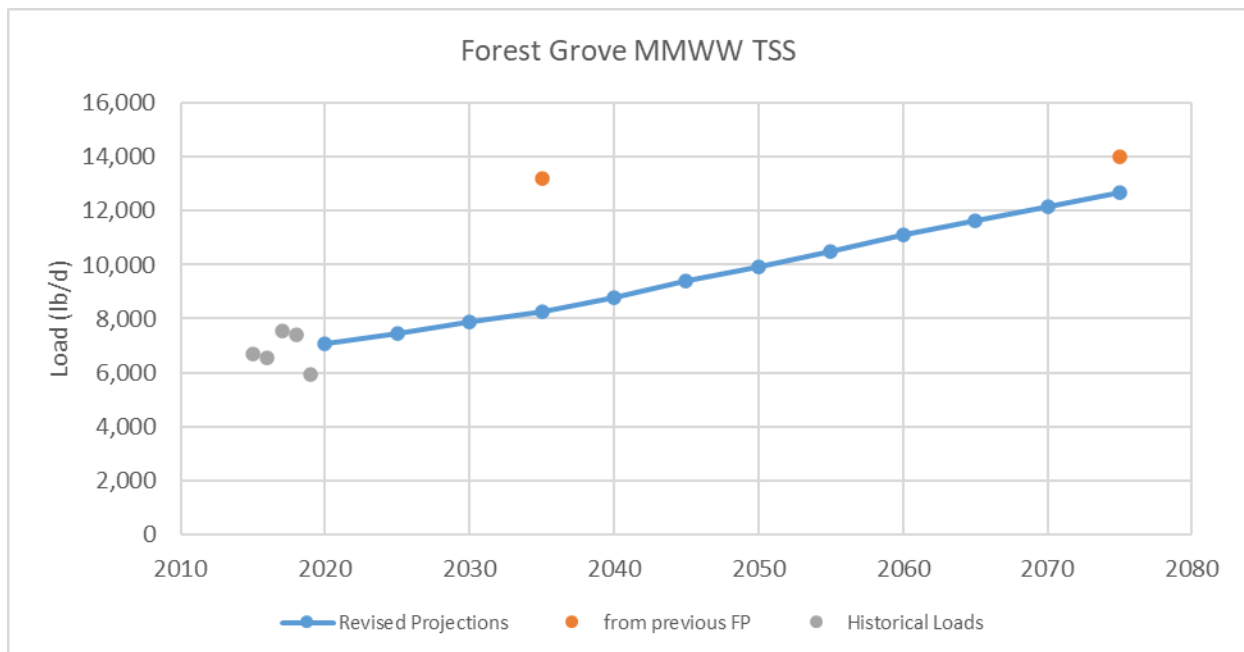


Figure F117. MMWW Load Projection, TSS, Forest Grove WRRF

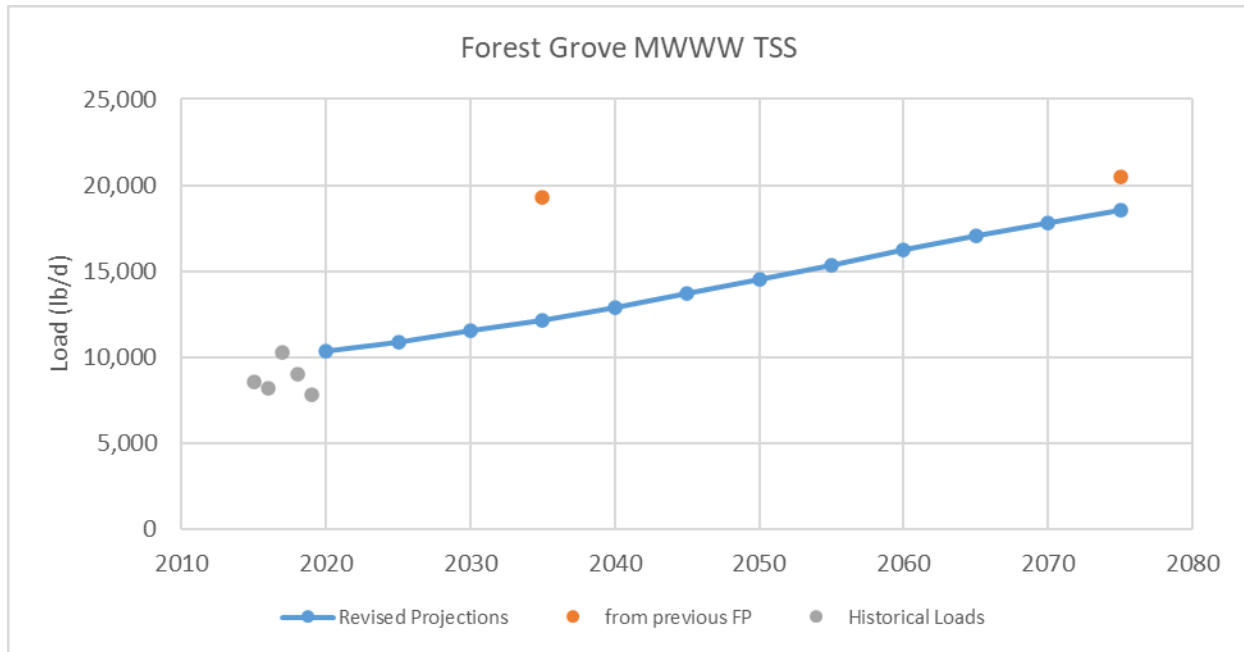


Figure F118. MWWW Load Projection, TSS, Forest Grove WRRF

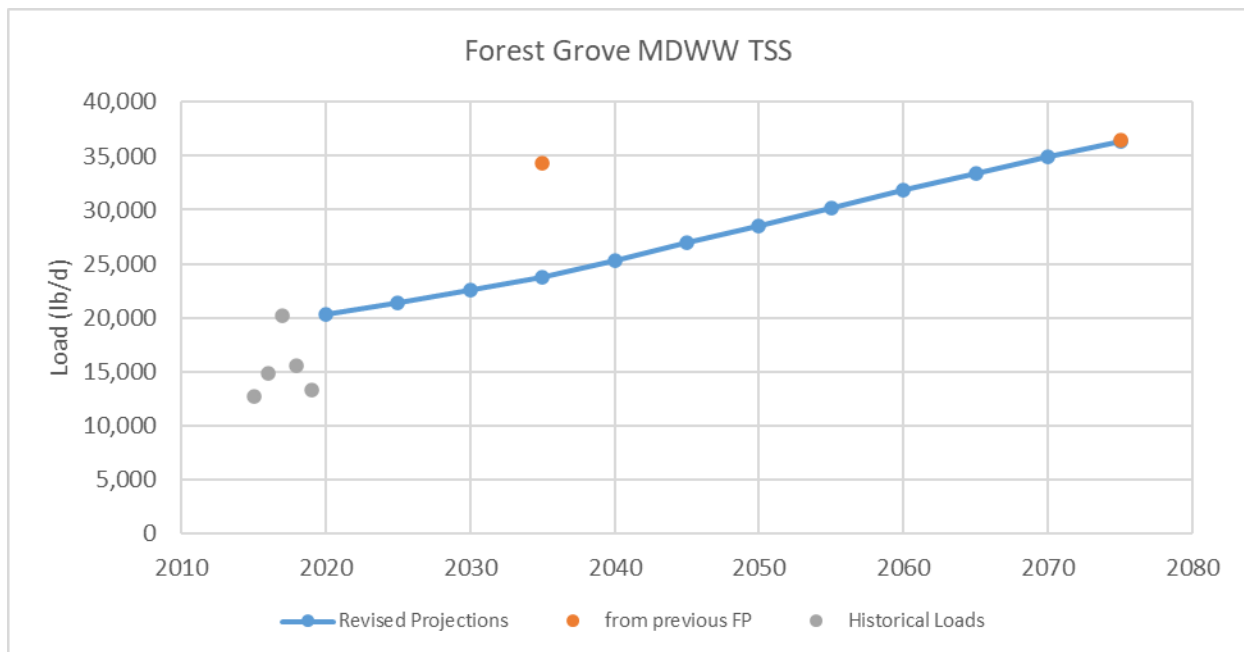


Figure F119. MDWW Load Projection, TSS, Forest Grove WRRF

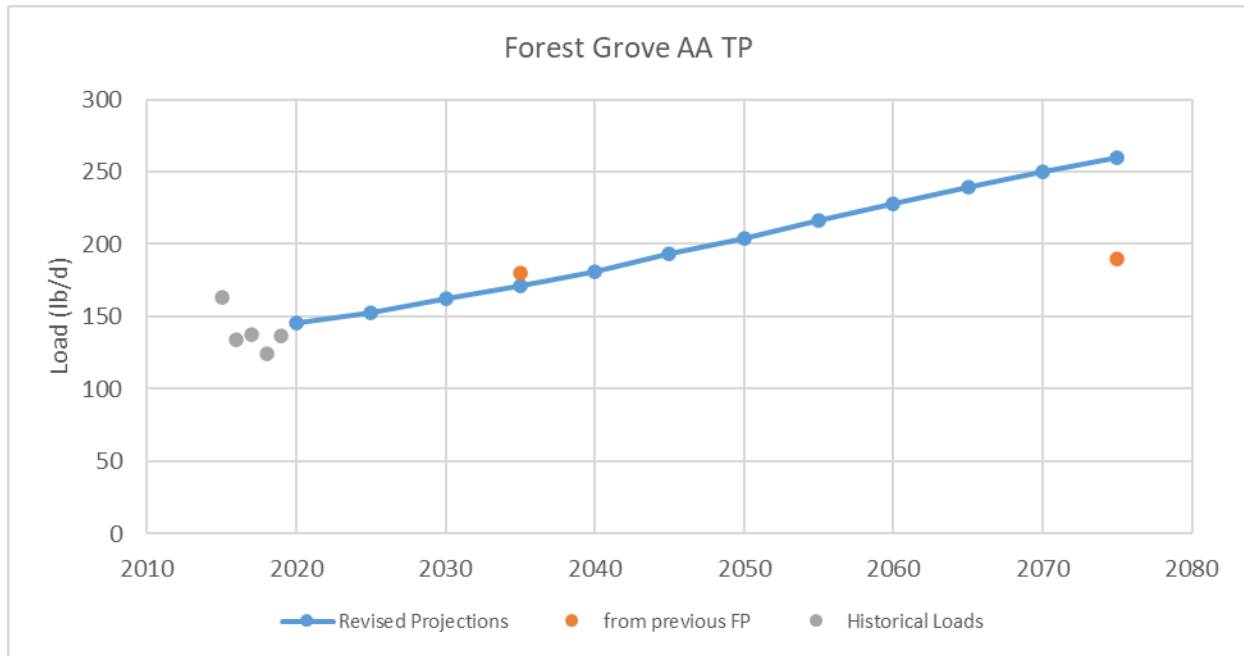


Figure F120. AA Load Projection, TP, Forest Grove WRRF

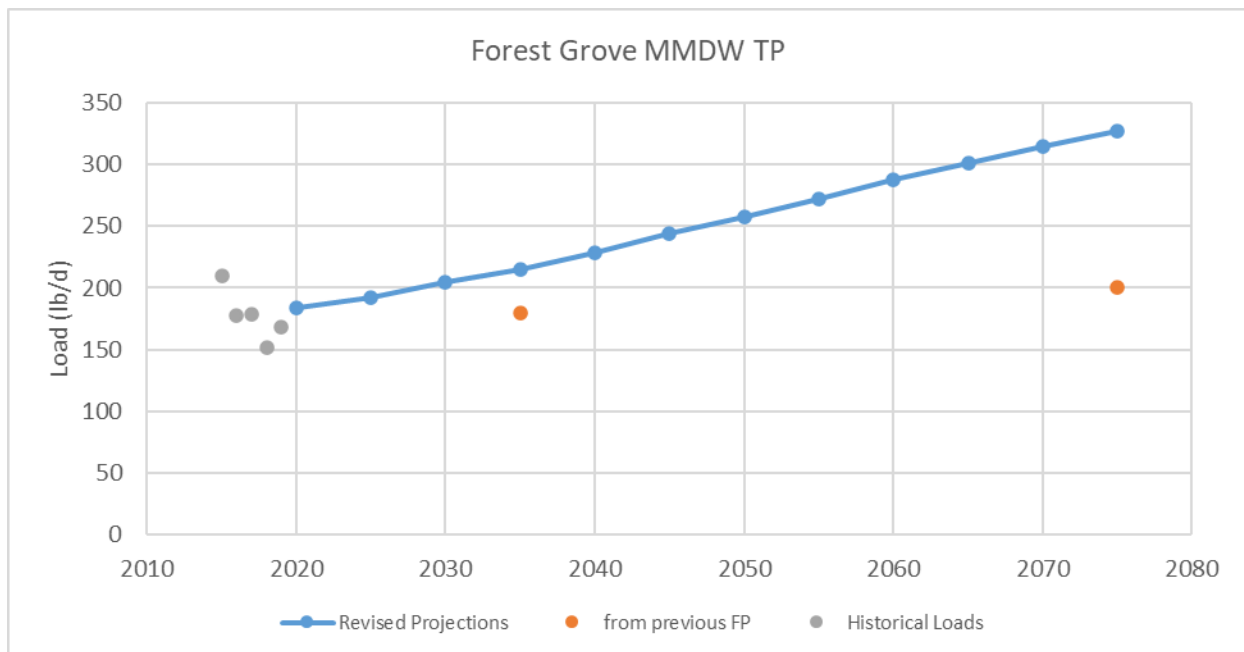


Figure F121. MMDW Load Projection, TP, Forest Grove WRRF

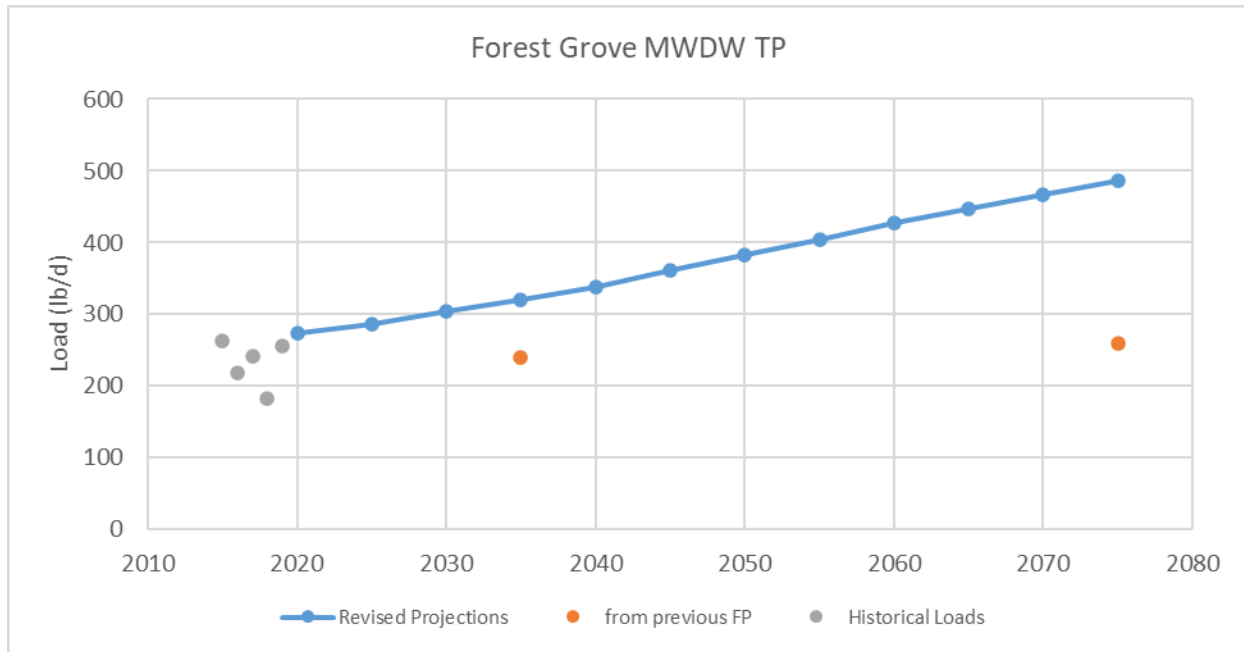


Figure F122. MWDW Load Projection, TP, Forest Grove WRRF

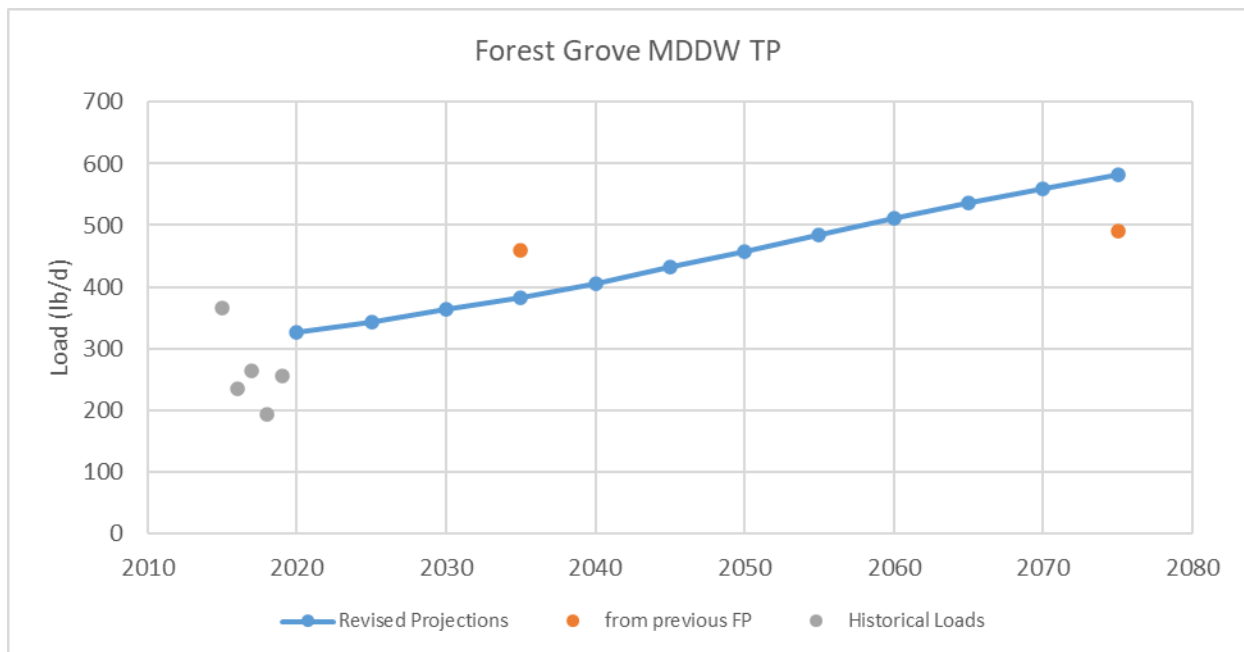


Figure F123. MDDW Load Projection, TP, Forest Grove WRRF

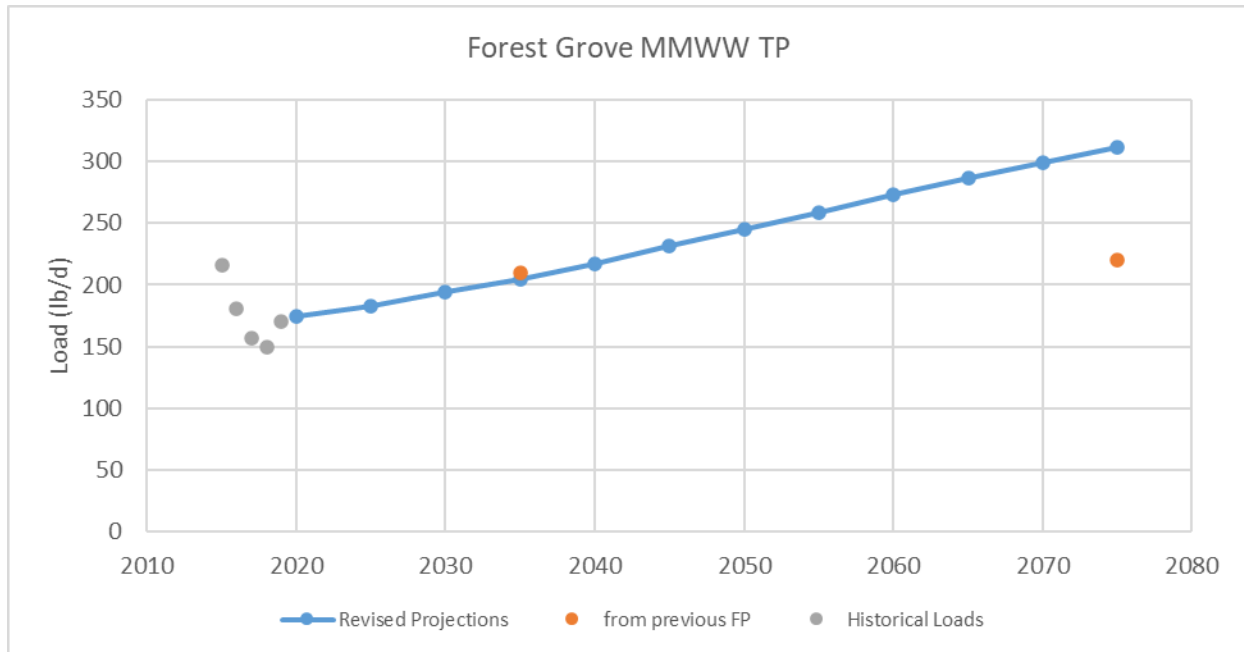


Figure F124. MMWW Load Projection, TP, Forest Grove WRRF

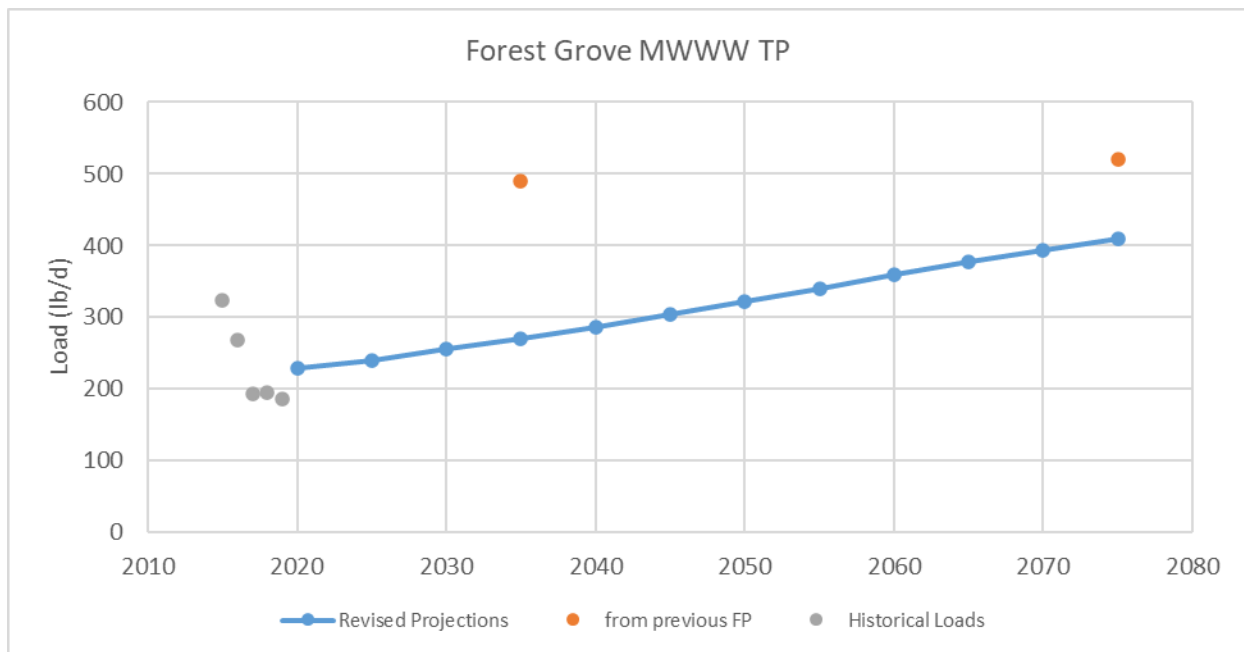


Figure F125. MWWW Load Projection, TP, Forest Grove WRRF

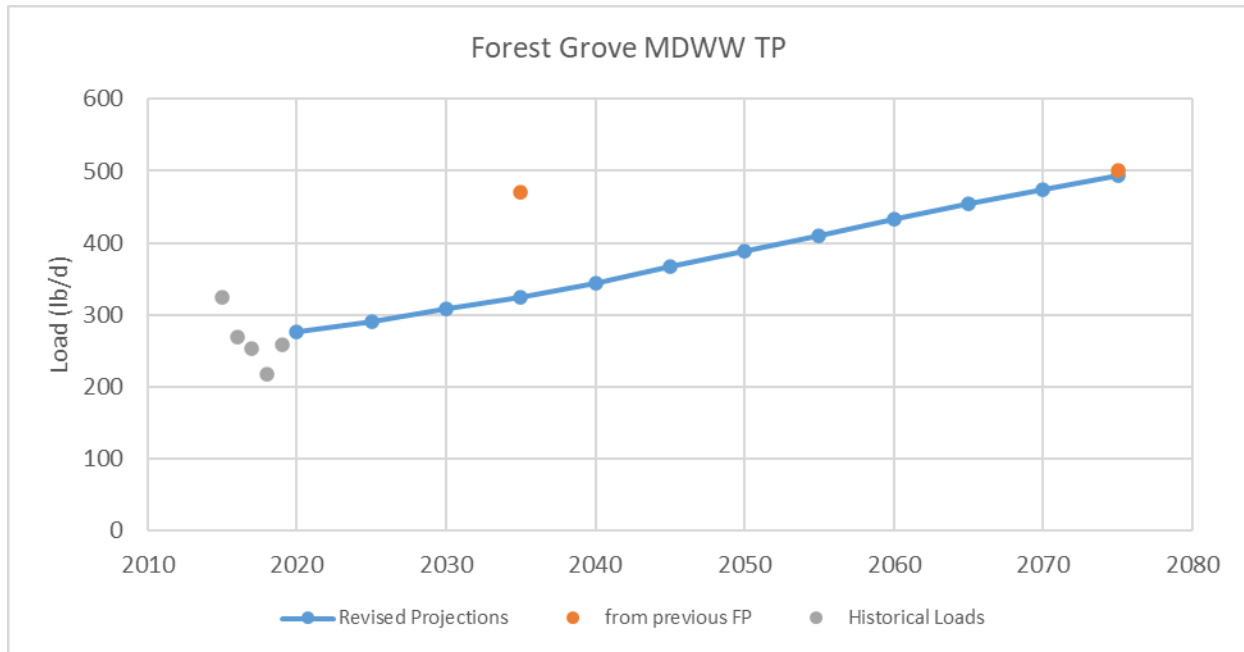


Figure F126. MDWW Load Projection, TP, Forest Grove WRRF

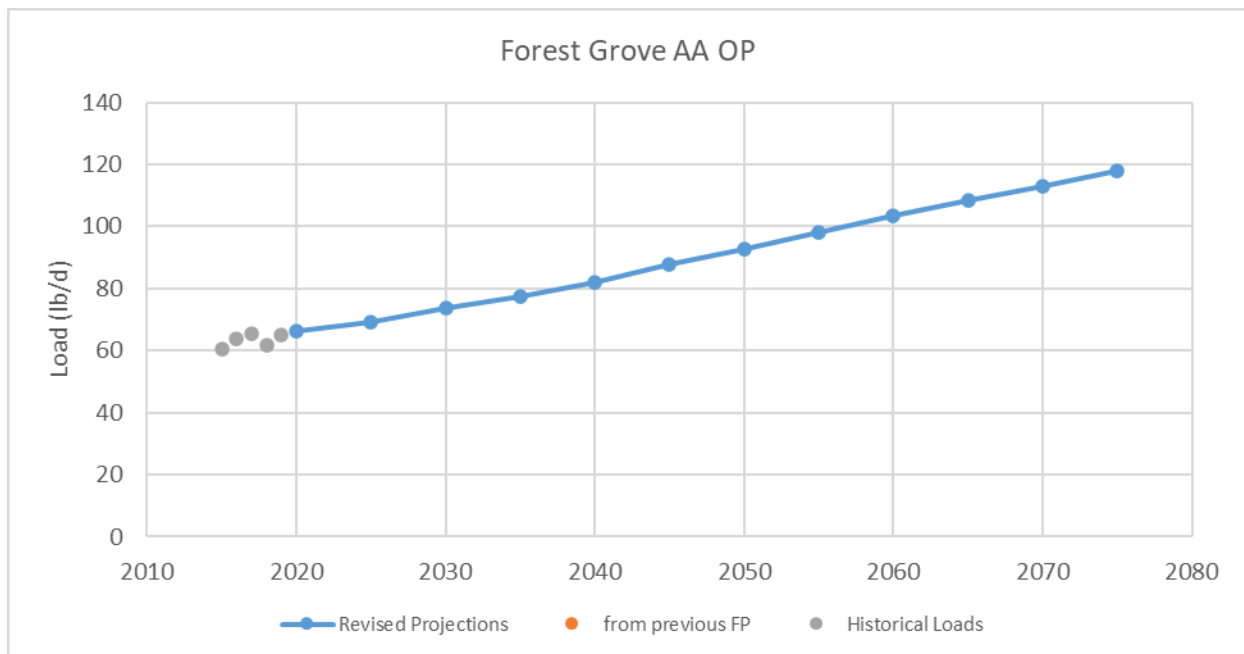


Figure F127. AA Load Projection, oP, Forest Grove WRRF

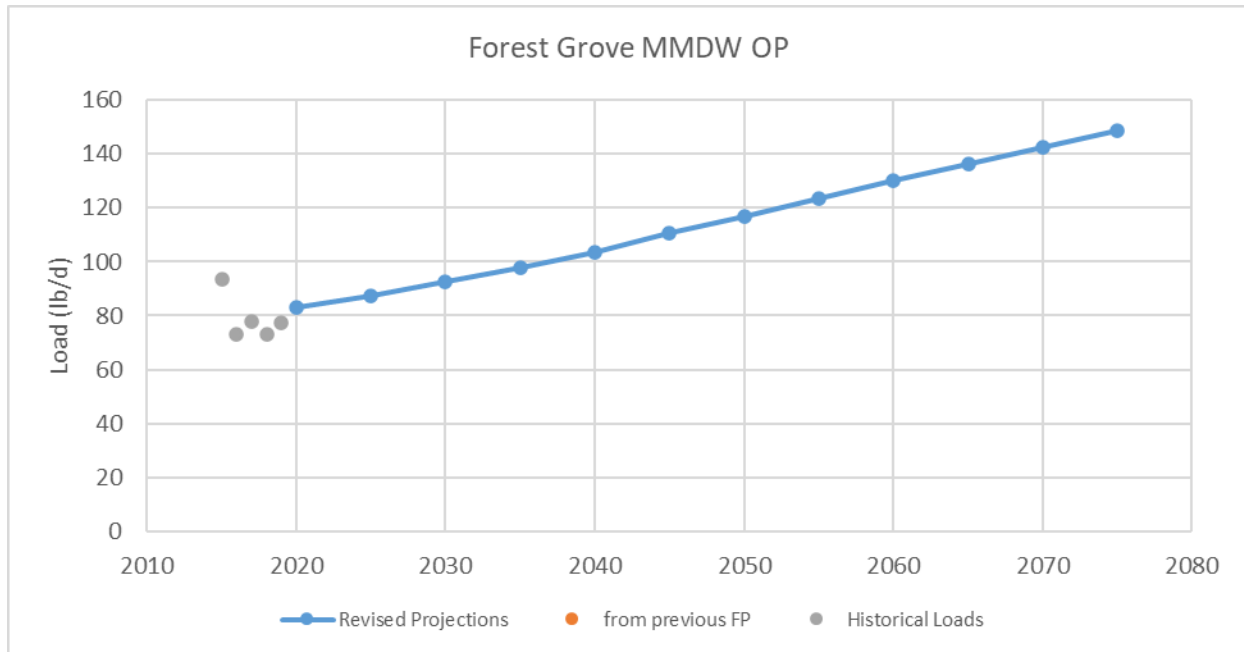


Figure F128. MMDW Load Projection, oP, Forest Grove WRRF

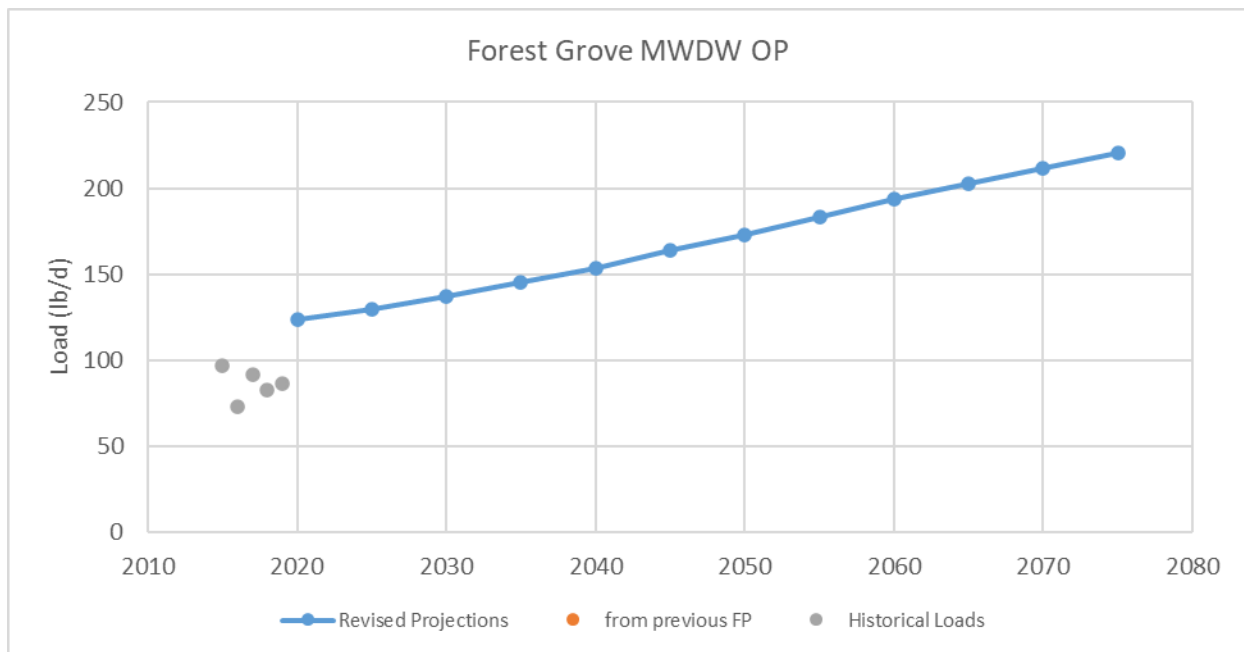


Figure F129. MWDW Load Projection, oP, Forest Grove WRRF

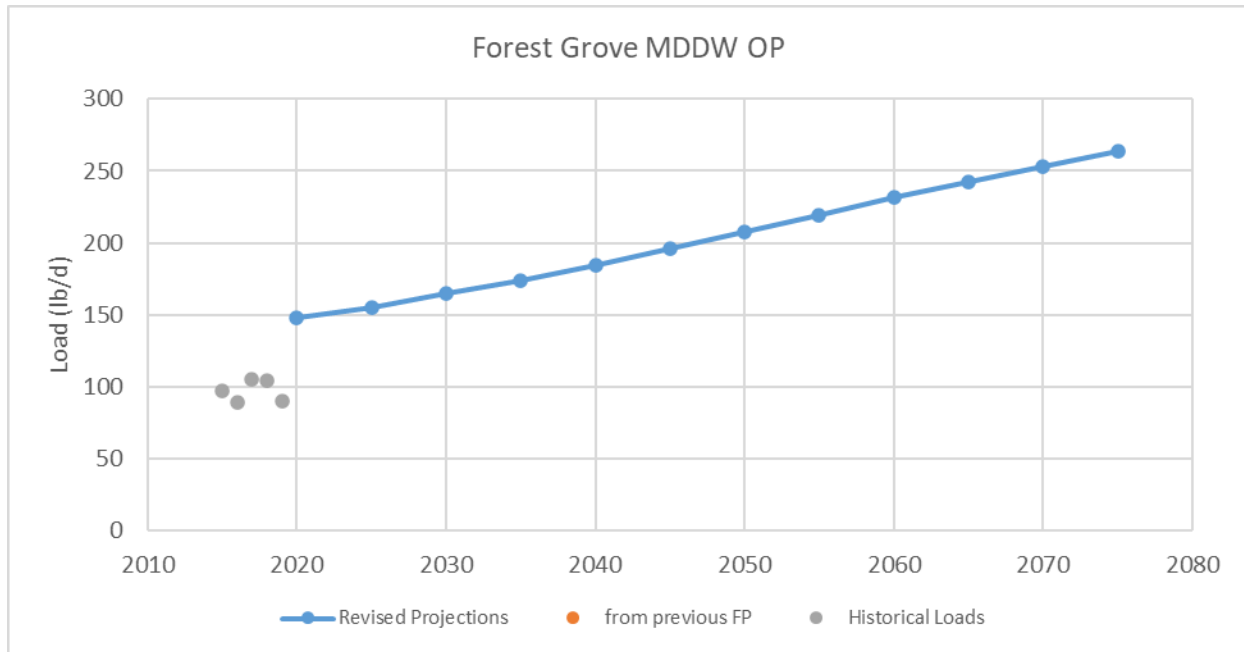


Figure F130. MDDW Load Projection, oP, Forest Grove WRRF

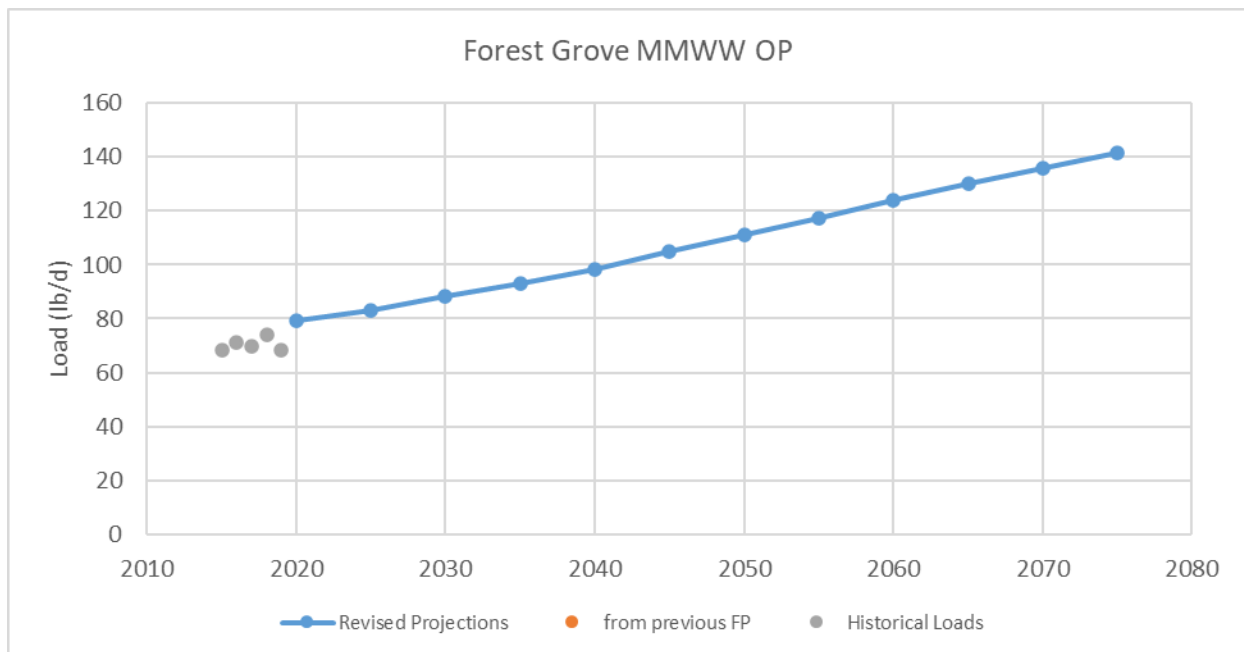


Figure F131. MMWW Load Projection, oP, Forest Grove WRRF

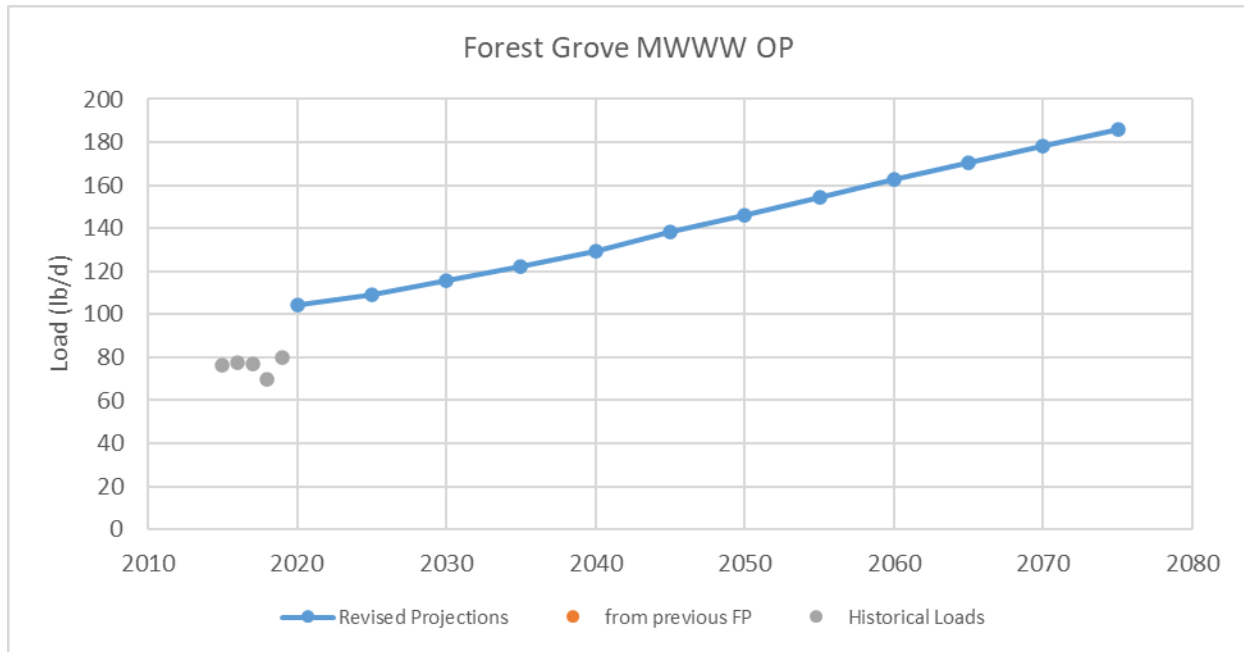


Figure F132. MWWW Load Projection, oP, Forest Grove WRRF

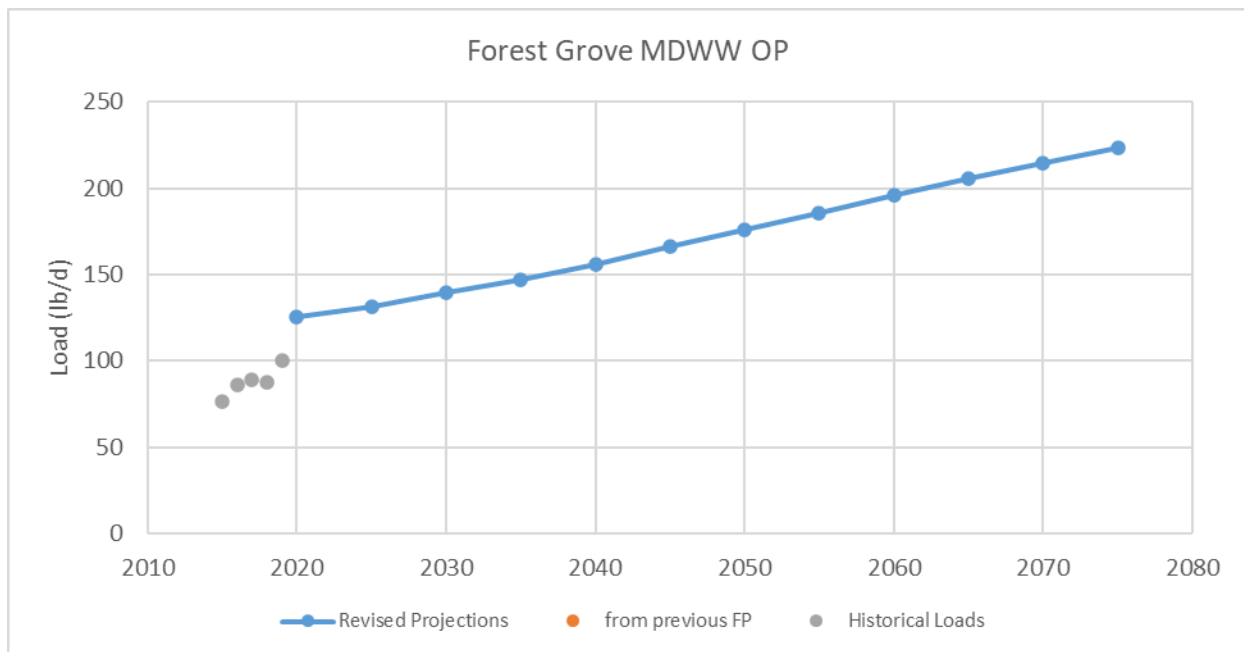


Figure F133. MDWW Load Projection, oP, Forest Grove WRRF

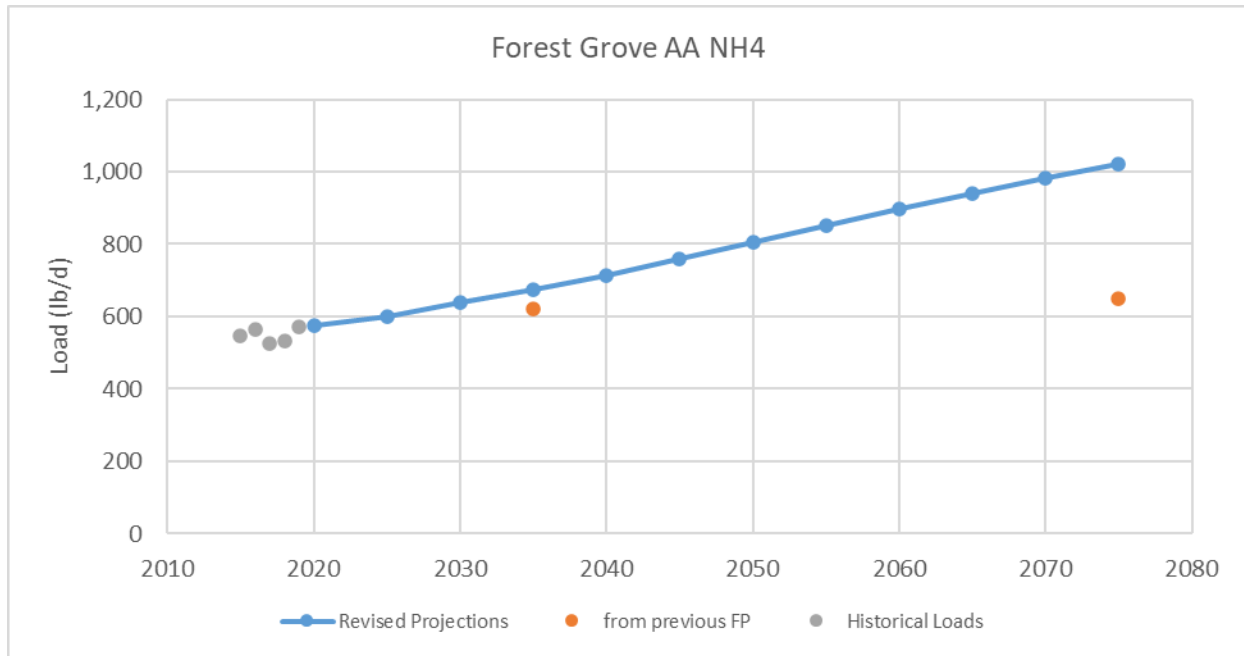


Figure F134. AA Load Projection, NH4, Forest Grove WRRF

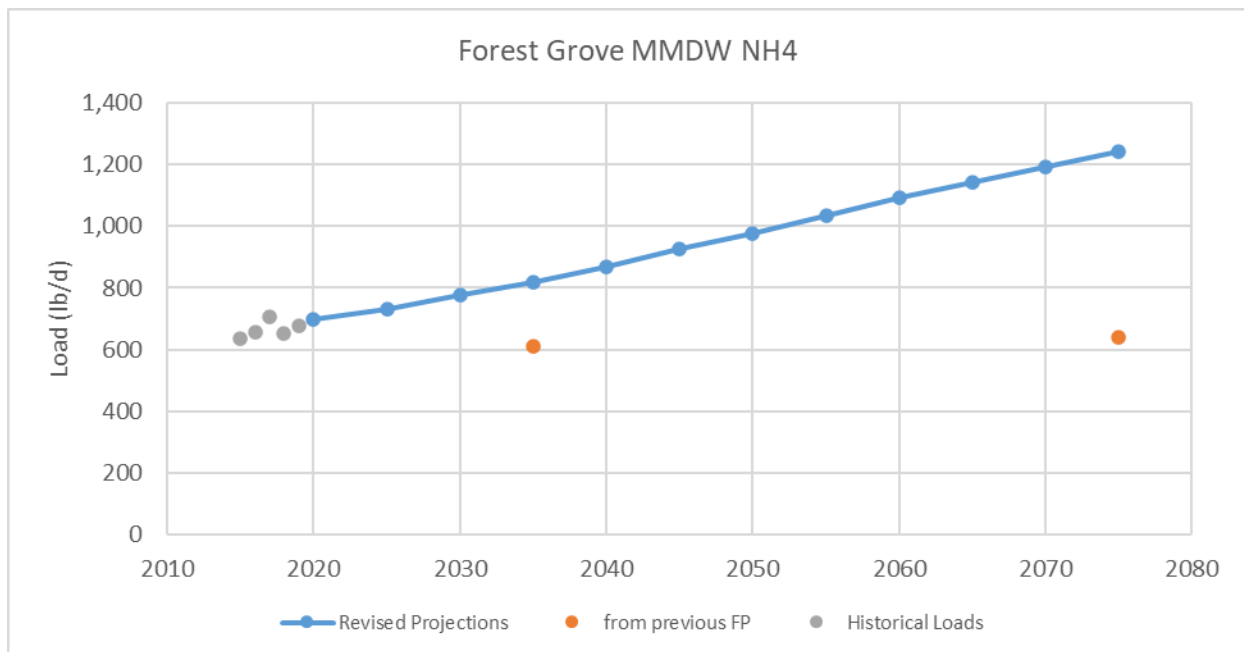


Figure F135. MMDW Load Projection, NH4, Forest Grove WRRF

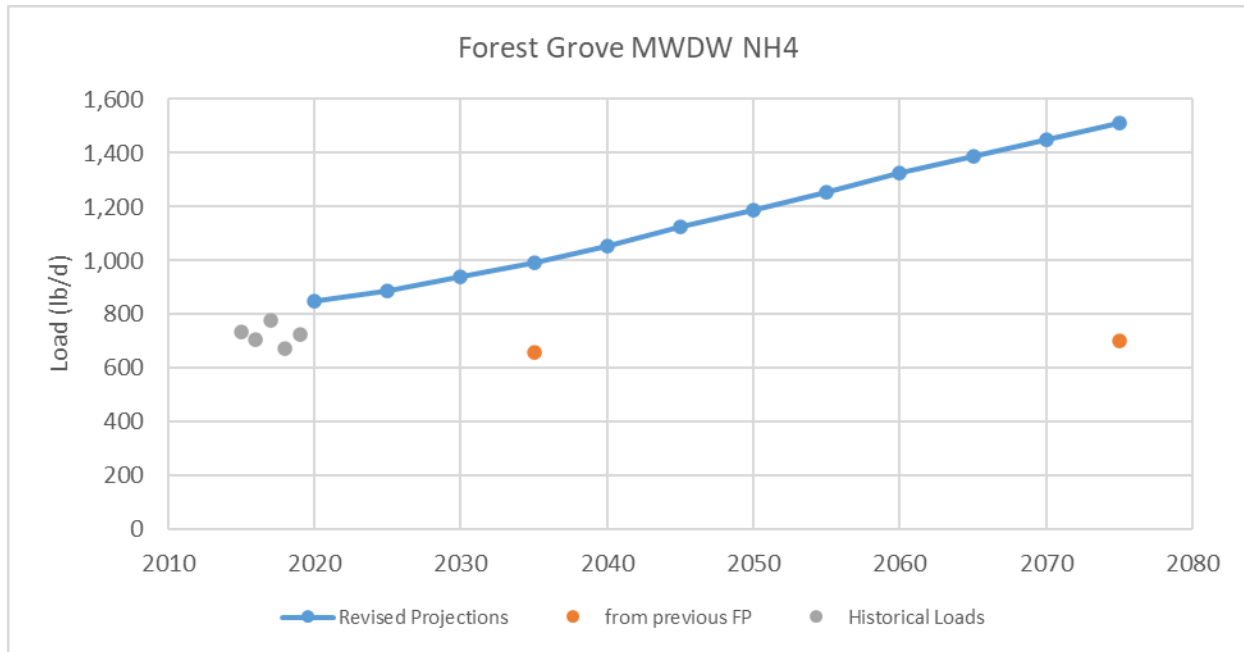


Figure F136. MWDW Load Projection, NH4, Forest Grove WRRF

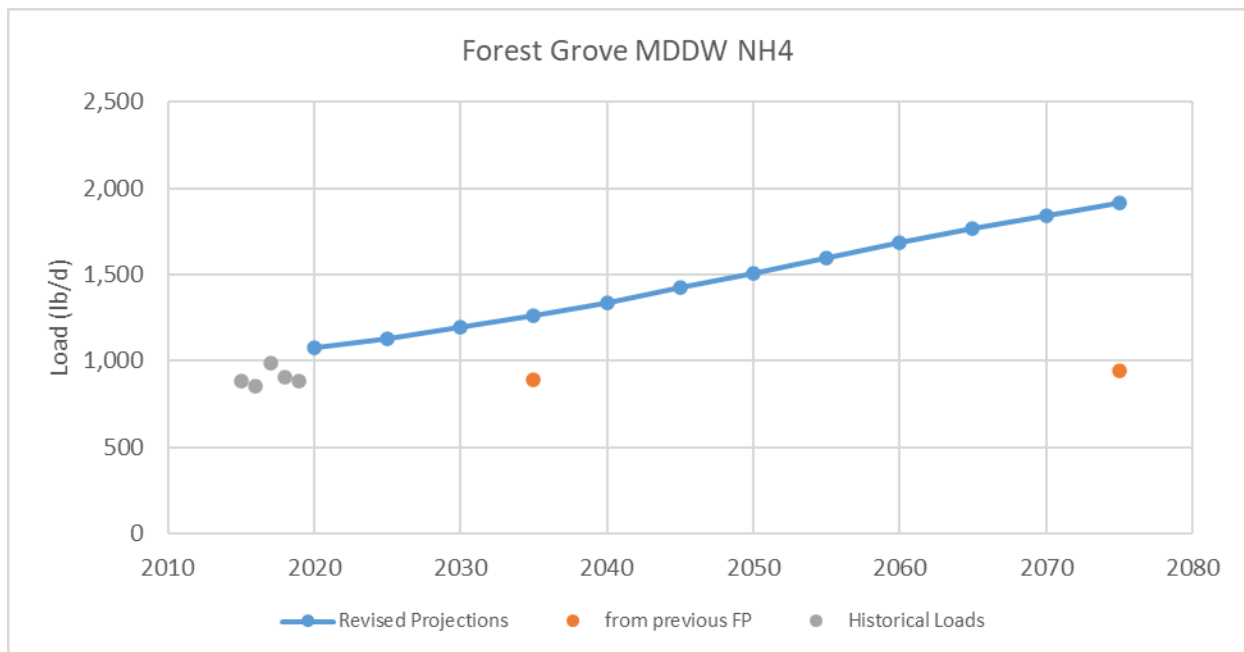


Figure F137. MDDW Load Projection, NH4, Forest Grove WRRF

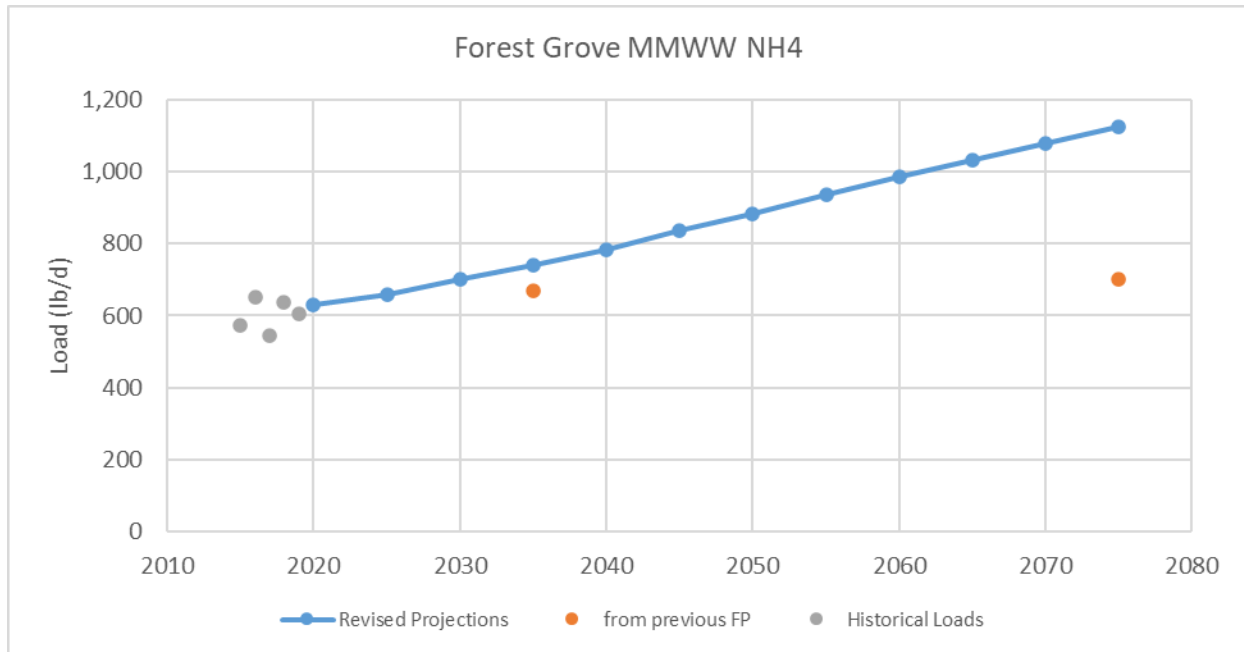


Figure F138. MMWW Load Projection, NH4, Forest Grove WRRF

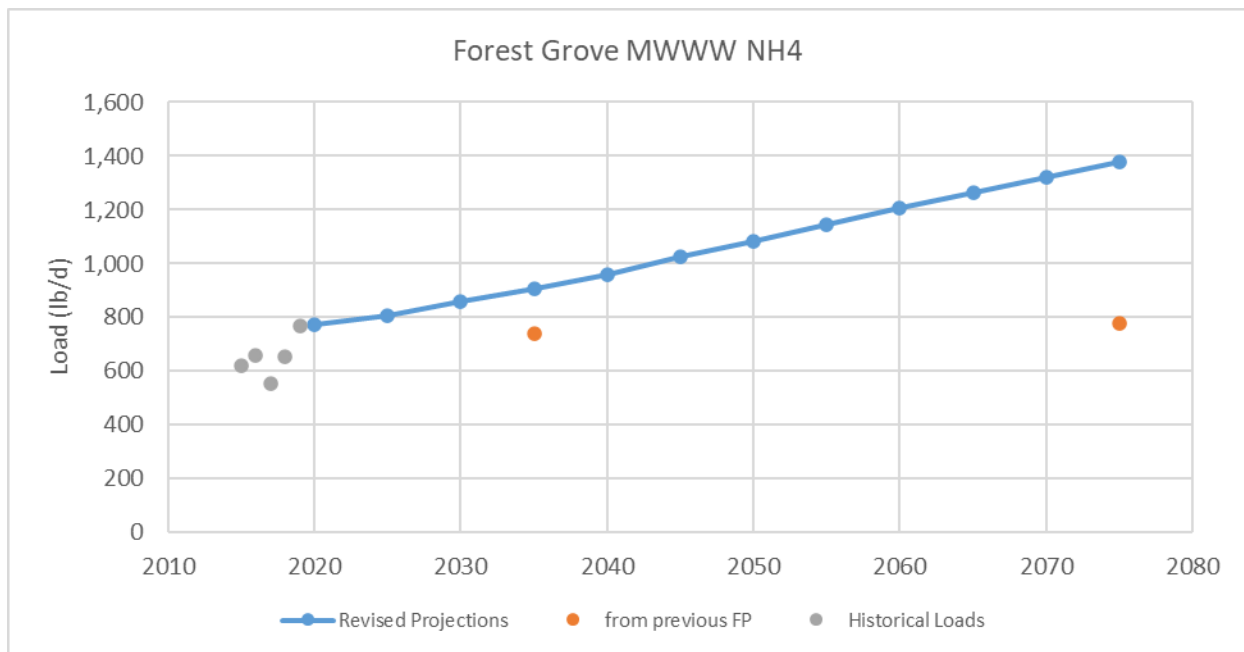


Figure F139. MWWW Load Projection, NH4, Forest Grove WRRF

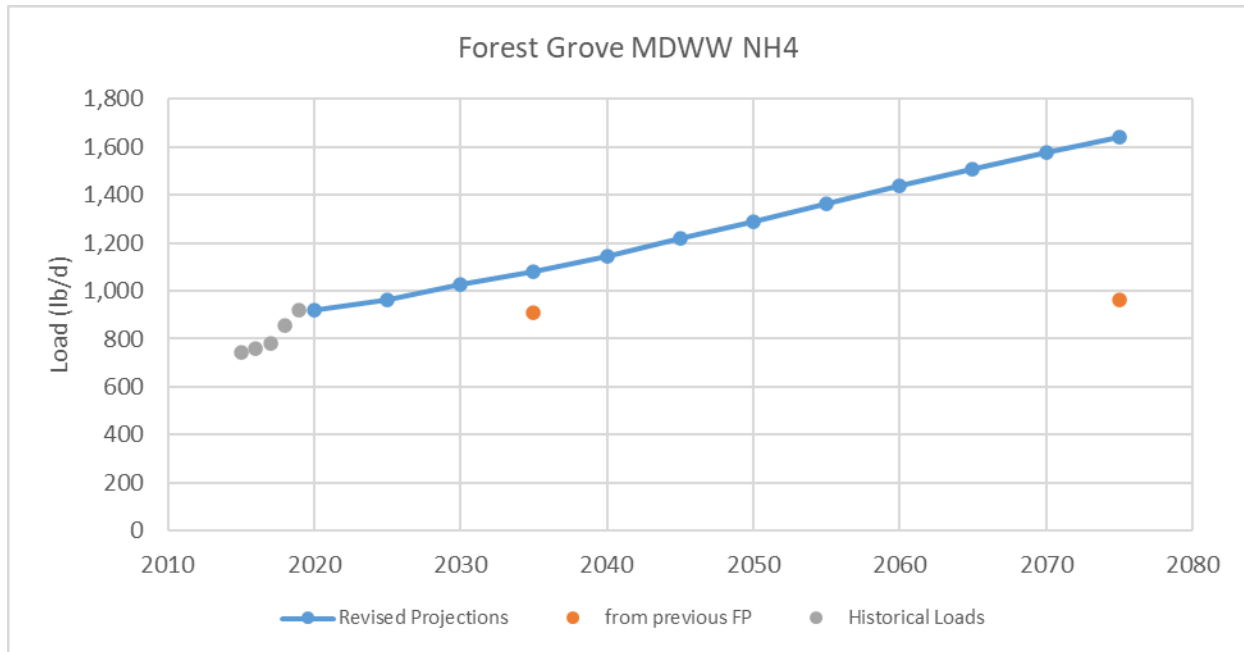


Figure F140. MDWW Load Projection, NH4, Forest Grove WRRF

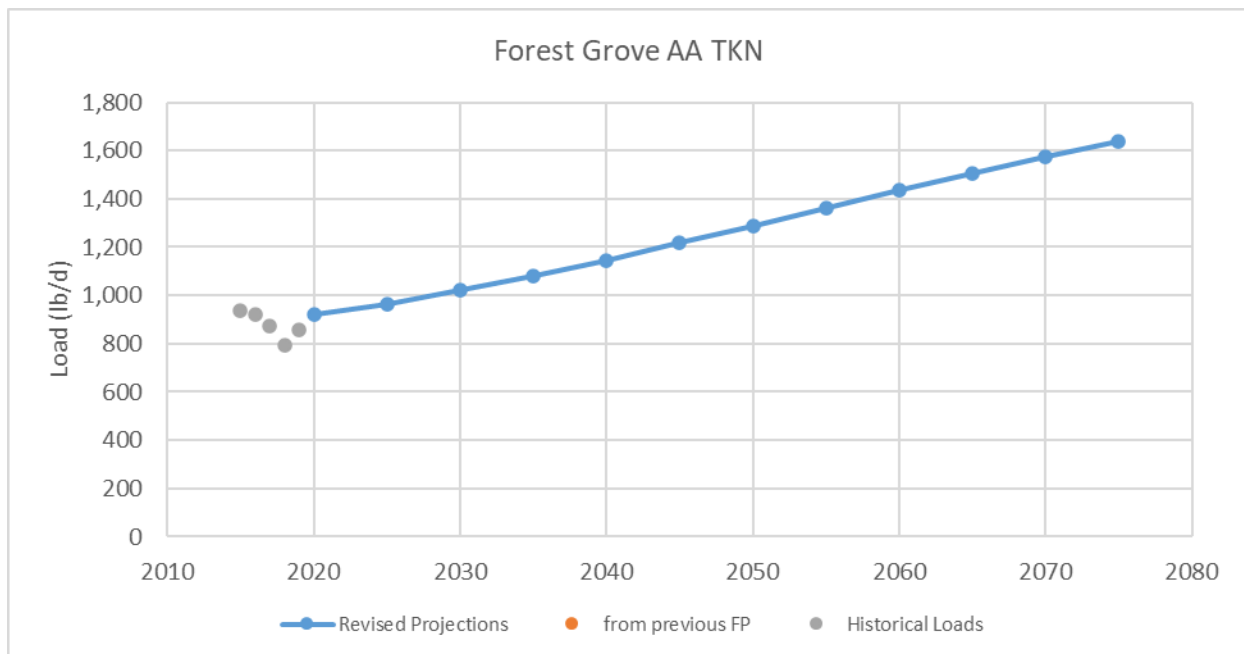


Figure F141. AA Load Projection, TKN, Forest Grove WRRF

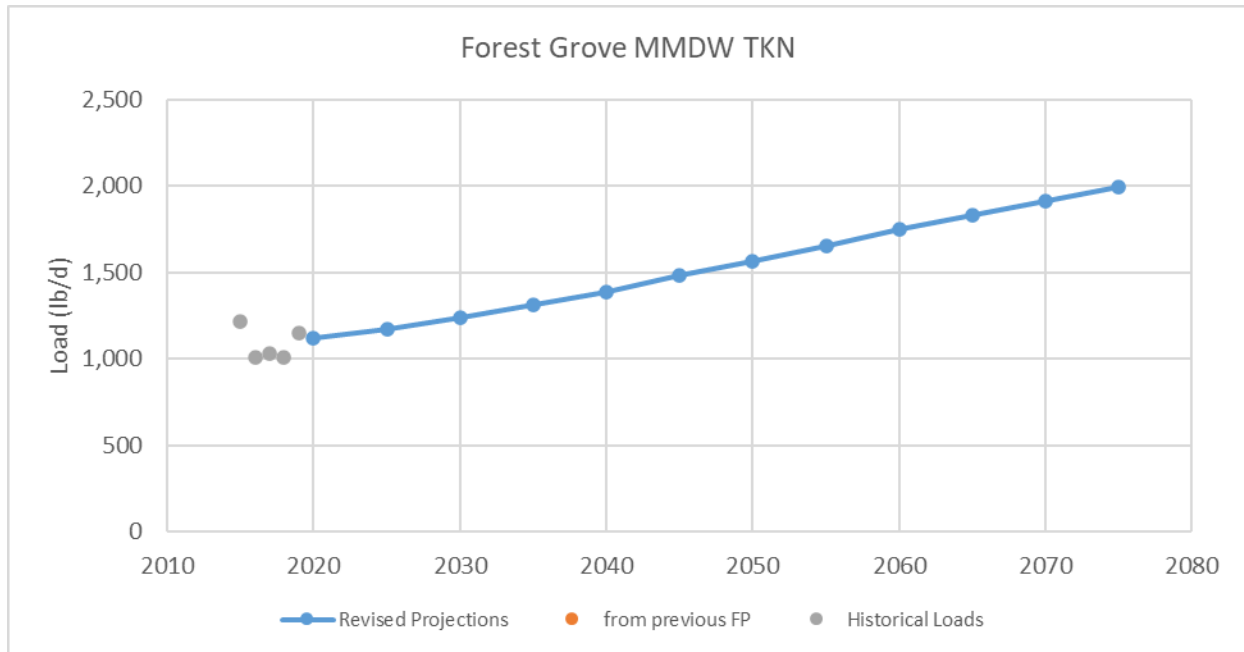


Figure F142. MMDW Load Projection, TKN, Forest Grove WRRF

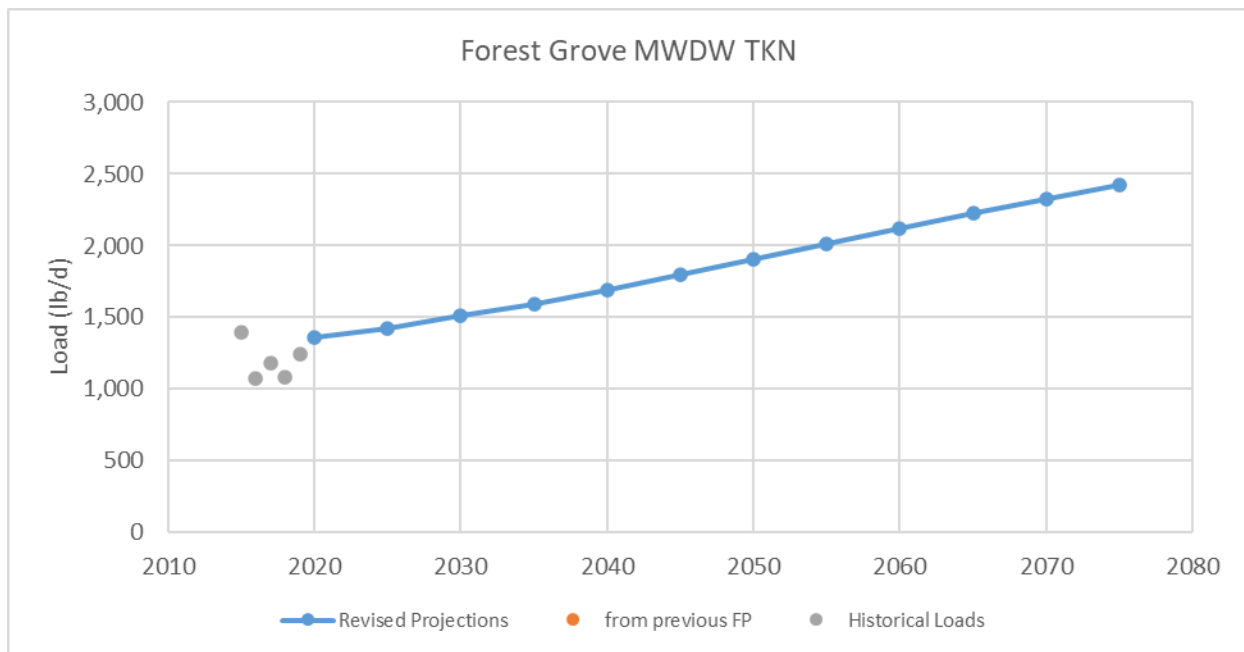


Figure F143. MWDW Load Projection, TKN, Forest Grove WRRF

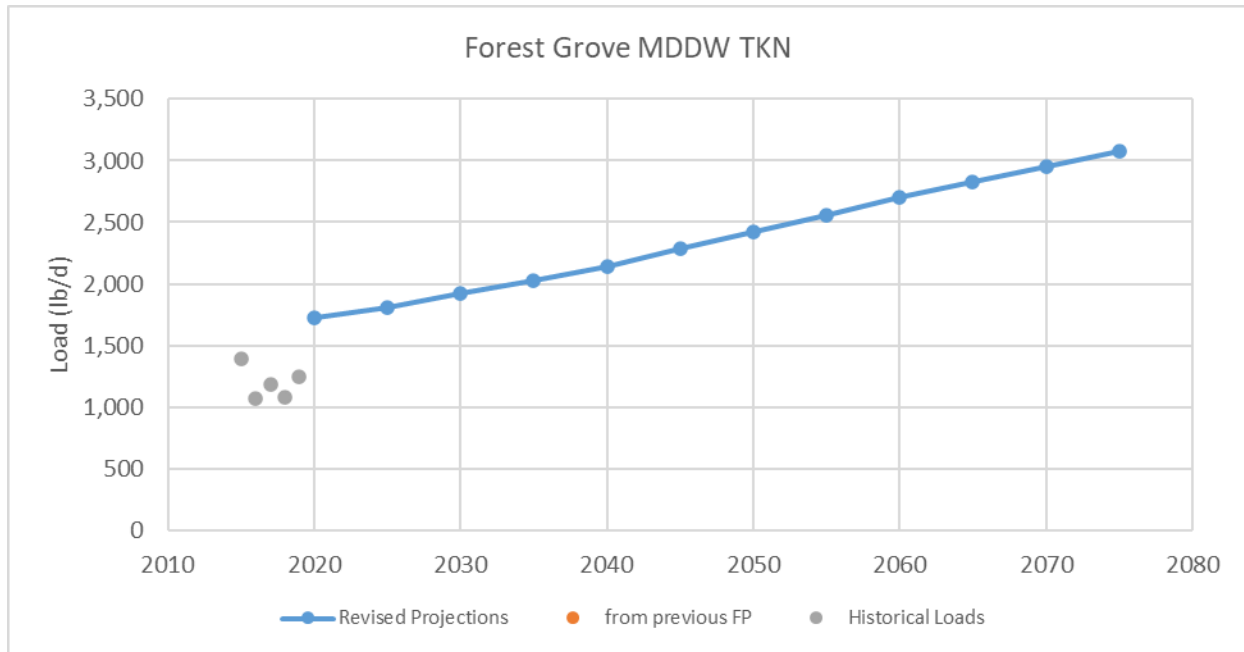


Figure F144. MDDW Load Projection, TKN, Forest Grove WRRF

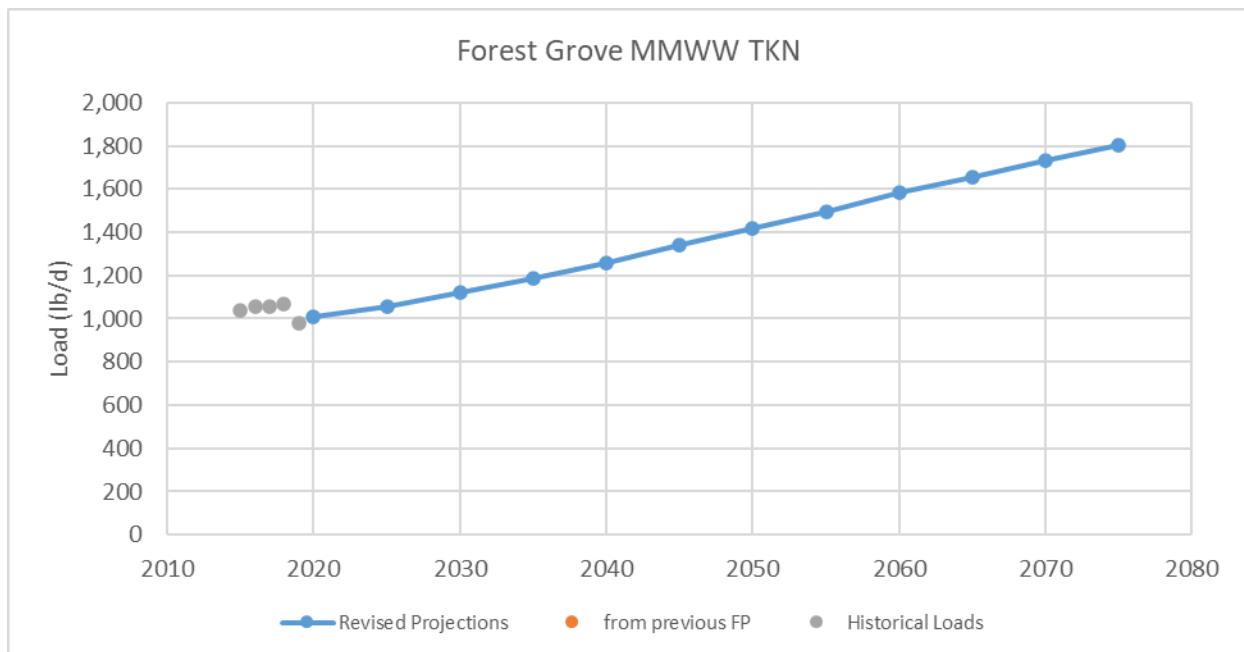


Figure F145. MMWW Load Projection, TKN, Forest Grove WRRF

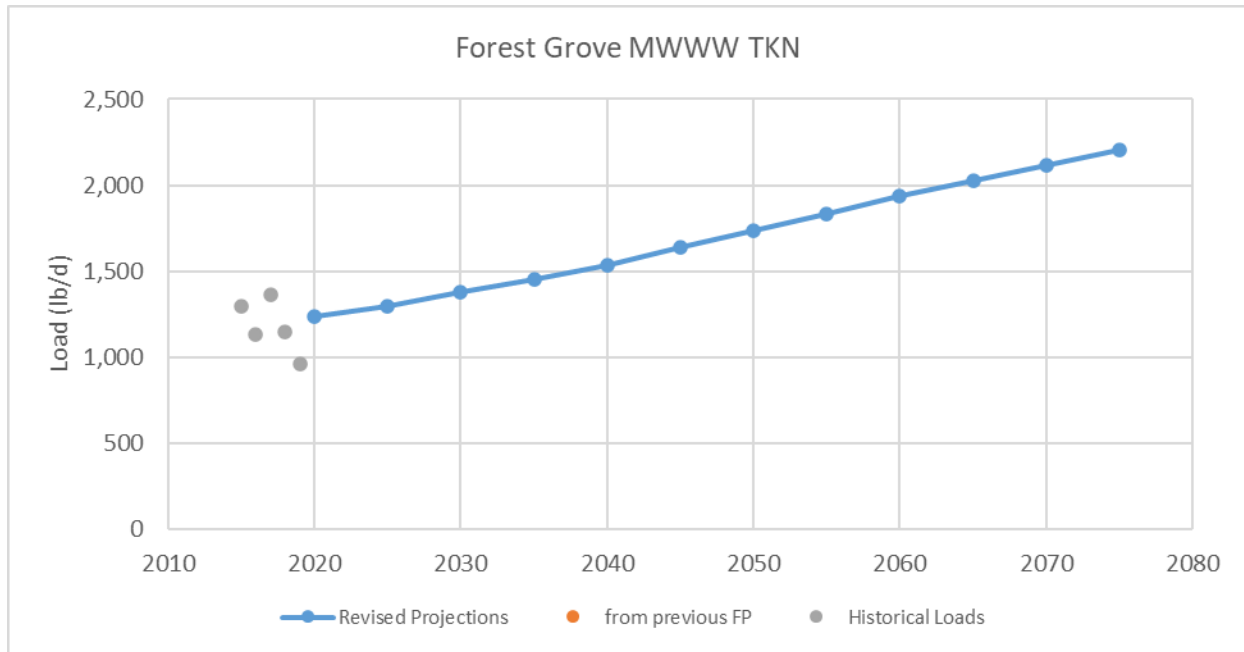


Figure F146. MWWW Load Projection, TKN, Forest Grove WRRF

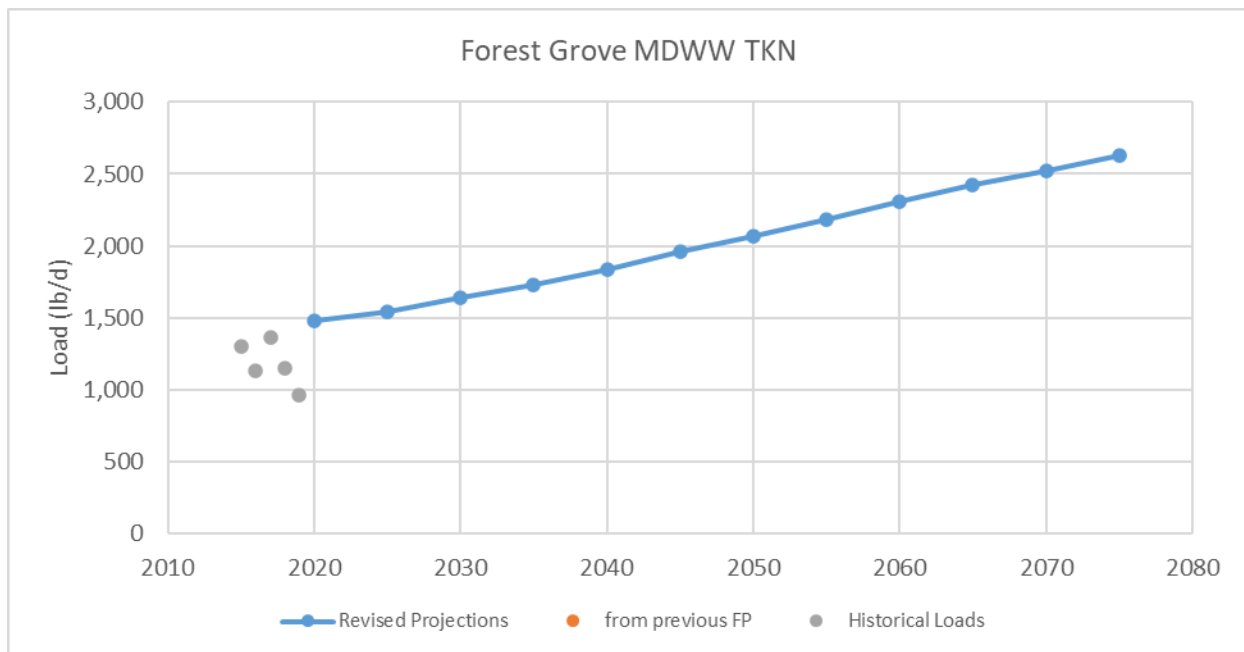


Figure F147. MDWW Load Projection, TKN, Forest Grove WRRF