Elk Valley Water Quality Plan

2022 Implementation Plan Adjustment

Annex A - Modifications to the Regional Water Quality Model

Rev0

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Teck

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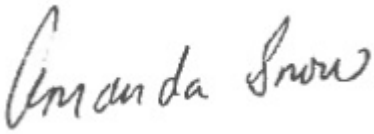

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Table of Contents

Tables

Figures

Appendices

1 Introduction

This document contains a description of changes made to the Regional Water Quality Model (RWQM) since submission of the *2020 Elk Valley Regional Water Quality Model Update* on March 19, 2021 (Teck 2021a). The changes were made in support of the 2022 Implementation Plan Adjustment (IPA) and are outlined in Section 2; their effect on model calibration is outlined in Section 3.

2 Changes Made to the Regional Water Quality Model in Support of the 2022 Implementation Plan Adjustment

A total of forty-one (41) changes were made to the model. These changes are detailed in Table 2-1 and summarized as follows:

- Modifications to the model configuration to reflect the following projects / approvals:
  - *Greenhills Operations (GHO) Tailings Management Project for Existing Permitted Reserves* (Teck 2021b) (10 of the 41 changes).
  - *Fording River Operations North (FRO-N) Saturated Rock Fill (SRF) Phase 2 Project Operations Application* (Teck 2022) (12 of the 41 changes).
  - Fording River Operations (FRO) Swift Phase I Pit Re-Design Application (FRO-081[1]), FRO Swift South Spoil (FRO-047[2]) and FRO Legacy Tailings (Teck 2014) (1 of the 41 changes).
  - *Elkview Operations (EVO) Cedar North In-pit Backfill Extension Project* (Teck 2020a) (1 of the 41 changes).
  - Line Creek Operations (LCO) *East Coal Rejects Dump Extension (ERX) Project* (Golder 2020) (1 of the 41 changes).
- The method used to estimate flows from coarse coal rejects (CCR) piles at FRO was updated and the number of sub-drainages at FRO was increased to support upcoming work related to the FRO Fording River Extension (FRX) Project (3 of 41 changes).
- Updates to explosives information and waste rock volumes used/deposited in 2019 and 2020 to reflect actual values rather than projected values (1 of the 41 changes).
- The method used to estimate nitrate release from waste rock was revised (1 of the 41 changes).
- Errors identified in waste rock volumes in the Cataract Creek drainage at FRO and Natal Pit drainage at EVO were corrected (2 of the 41 changes).
- Future water management activities in the Swift Pit drainage at FRO and the Baldy Ridge Pit and Natal West Pit drainages at EVO were revised (3 of the 41 changes).

[1, 2] FRO-047 and FRO-081 are Notice of Departure (NOD) applications to modify placement of waste rock as outlined in the Swift EA (Teck 2014).

- Model under-projection in March at Koocanusa Reservoir was addressed (1 of the 41 changes).
- The influence of reclamation activities was removed (1 of the 41 changes).
- An error identified in EVO SRF effluent concentrations was corrected (1 of the 41 changes).
- The method used to estimate nitrate release from submerged waste rock at Natal Pit West was revised (1 of the 41 changes).
- Five future SRFs were added (1 of the 41 changes).
- Ability to treat for sulphate was added (1 of the 41 changes).

Twenty-seven of the 41 changes were made to reflect projects that are currently in progress or that have been completed since the 2020 RWQM update and are discussed in more detail in their respective applications. They relate to the first bullet listed above. Twelve of the 41 changes were minor revisions to the method used to estimate flows from CCR piles at FRO, the number of sub-drainages at FRO, waste rock volumes, the method used to estimate nitrate release from waste rock, water management and reclamation activities, bias correction in Koocanusa Reservoir and effluent concentrations. The remaining two changes were larger in scope and are discussed in more detail below in Sections 2.1 and 2.2. They relate to the last two bullets listed above.

Sixteen of the 41 changes affect model performance over the calibration period. The remaining 25 changes only affect future projections.

With two exceptions, the changes made to the RWQM had a small effect on model performance over the calibration period. The exceptions consisted of:

- Modifications to include the *GHO Tailings Management Project for Existing Permitted Reserves* (Teck 2021b); these modifications triggered a re-calibration of the model in the Greenhills Creek drainage (as described in Table 2-1).
- Modifications to include the *FRO-N SRF Phase 2 Project Operations Application* (Teck 2022); these modifications triggered a re-calibration of the model in the Post Ponds, Lake Mountain Pond and Clode Creek drainage; re-calibration activity included changes to the hydraulic lag times assigned to waste rock in these drainages (as described in Table 2-1).

At all other calibration locations, the calibration factors and hydraulic lag times for nitrate, selenium, and sulphate remain unchanged from those outlined in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a). Model performance over the calibration period, before and after changes were made, is illustrated in figures included in Section 3, along with tables of error and bias statistics for nitrate, selenium and sulphate.

Table 2-1: Updates Made to the 2020 Regional Water Quality Model in Support of the 2022 Implementation Plan

Nature of the Change	Description	2020 Regional Water Quality Model	2022 Implementation Plan Adjustment	Rationale
Reflecting *GHO Tailings Management Project for Existing Permitted Reserves* (Teck 2021b)	Increased level of spatial detail (i.e., number of individual sub-drainages) at GHO	• Greenhills Creek divided into two sub-drainages: Greenhills Creek North and Greenhills Creek South.	• Greenhills Creek divided into six sub-drainages: Greenhills Creek North, Gardine Creek, Upper Greenhills Creek South, Tailings Pond, Site D, and Greenhills Creek South.	• Allows for increased level of spatial detail in water quality projections in areas potentially affected by the project.
	Reallocation of historical waste rock volumes at GHO	• No historical waste rock placement in Greenhills Creek South.	• Reallocated 1.1 million BCM of waste rock from Upper Thompson Creek to the Tailings Pond sub-drainage between 1988 and 2001.	• Reflects a better understanding of the area directed to the Tailings Pond at GHO.
	Change to method used to estimate flows from CCR piles at GHO	• Flows from CCR piles estimated using the Snowmelt Runoff Module (SRM).	• Flows from CCR piles estimated using a CCR/MCR module. The CCR/MCR module is based on the waste rock hydrology module from the 2020 RWQM, noting that the simulation results were validated based on results of a seepage analysis.	• Improves the ability of the model to represent magnitude and seasonality of measured flows from CCR piles at GHO.
	Inclusion of flows and loads from MCR at GHO	• MCR not included in the model.	• MCR placement in Site F from 2023 to 2028. Flows from MCR spoils estimated using the CCR/MCR module, noting that the simulation results were validated based on results of a seepage analysis. Constituent concentrations in waters draining from MCR spoils are defined by measured concentrations in drainage from the Greenhills Area A coal refuse pile and the Greenhills Site B coal refuse pile. These measured concentrations were adjusted as part of model calibration.	• Reflects plans for MCR placement in Site F.
	Revision to constituent concentrations in waters released from CCR and tailings storage facilities	• Constituent concentrations in waters flowing through coal refuse piles estimated using measured concentrations in drainage from the Greenhills Area A coal refuse pile. • Constituent concentrations in seepage from the GHO Tailings Storage Facility are based on model calculations, except for nitrate and selenium. Nitrate and selenium concentrations are set to fixed values, reflective of information collected from the South Tailings Pond at FRO.	• Constituent concentrations in waters flowing through coal refuse estimated using measured concentrations in drainage from the Greenhills Area A coal refuse pile and the Greenhills Site B coal refuse pile. These measured concentrations were adjusted as part of model calibration. • Constituent concentrations in seepage from the GHO Tailings Storage Facility are estimated using reasonable, worst-case (95th percentile) geochemical source terms until the planned addition of a dewatering circuit to the Process Plant in 2024. From 2024 onward, constituent concentrations in seepage from the GHO Tailings Storage Facility are based on model projections.	• Reflects a better understanding of constituent concentrations in waters from CCR and tailings storage facilities at GHO.

	Update to tailings water management and process plant water use at GHO	• Tailings water management and process plant water use described in the 2020 RWQM update (Teck 2021a).
		• Seepage from the Tailings Storage Facility at GHO is estimated at 400 m^3/d and is modelled to be sent to the Greenhills Creek Sedimentation Pond Decant (GH_GH1).
			• Tailings water management and process plant water use is updated to reflect current water balance information and incorporates implementation of a dewatering centrifuge in the Process Plant.
			• Seepage rates from the Tailings Storage Facility updated as follows:
			  ◦ 400 m^3/d from 1982 to 2018
			  ◦ 463 m^3/d from 2019 to 2022
			  ◦ 517 m^3/d from 2023 to 2027
			  ◦ 664 m^3/d from 2028 onwards
			• Seepage from the Tailings Storage Facility is modelled to be sent to Gardine Creek, Site D, Fowler Creek and Rush Creek.
				• Reflects an updated understanding of tailings water management and process plant water use at GHO.
				• Reflects an updated understanding of seepage rates from the Tailings Storage Facility at GHO.

	Updated surface water - groundwater partitioning in Greenhills Creek	• 30% of the total flow at the Greenhills Creek Sedimentation Pond Decant (GH_GH1) (up to a maximum of 6,000 m^3/d) bypasses the sediment pond and reports to the GHO Fording River Compliance Point (GH_FR1). The load assigned to this bypass is 10% of the total load at the Greenhills Creek Sedimentation Pond Decant (GH_GH1).	• 29% of the total flow from the Site C CCR pile and all the seepage from the Tailings Storage Facility to Site C are modelled to be sent to the GHO Fording River Compliance Point (GH_FR1) via the Rail Loop Pond from May to September, and to the Greenhills Creek Sedimentation Pond Decant (GH_GH1) for the remainder of the year. • Up to 5.8 L/s of flow from the Site D sub-watershed bypasses the Greenhills Creek Sedimentation Pond Decant (GH_GH1) and reports directly (via groundwater) to the GHO Fording River Compliance Point (GH_FR1). Constituent concentrations assigned to the bypass are the modelled concentrations from the Site D sub-watershed. • Up to 8.2 L/s of flow at the Greenhills Creek Sedimentation Pond Decant (GH_GH1) bypasses the sediment pond and reports (via groundwater) to the GHO Fording River Compliance Point (GH_FR1). Constituent concentrations assigned to the bypass are the modelled concentrations at the Greenhills Creek Sedimentation Pond Decant (GH_GH1).	• Reflects an updated understanding of surface water - groundwater partitioning in Greenhills Creek.
	Adjustment to calibration factors applied to geochemical source terms governing the release of nitrate, selenium, and sulphate from waste rock in Greenhills Creek	• Calibration factors for nitrate, selenium, and sulphate set to 0.6.	• Calibration factors for nitrate, selenium and sulphate set to 1.0, 0.8 and 0.7, respectively.	• Improving model performance at Greenhills Creek Sedimentation Pond Decant (GH_GH1).

Table 2-1: Updates Made to the 2020 Regional Water Quality Model in Support of the 2022 Implementation Plan

Nature of the Change	Description	2020 Regional Water Quality Model	2022 Implementation Plan Adjustment	Rationale
Reflecting FRO-N SRF Phase 2 Project Operations Application (Teck 2022)	Adjustment to discharge locations related to Eagle 6 Pit North	• Flow from Eagle 6 Pit North is modelled to be sent to Clode Creek via Kalmikoff Pond.	• Flow from Eagle 6 Pit North is modelled to be sent to Clode Creek via Eagle 6 Pit West from 2021 onwards.	• Updated to reflect current understanding of water management in this area.
	Adjustment to discharge locations related to Tower Diversion and Tower Diversion Extension	• Flows from Tower Diversion and Tower Diversion Extension are modelled to be sent to Lake Mountain Pond until 2026 and Swift Pit from 2027 onwards.	• Flows from Tower Diversion and Tower Diversion Extension are modelled to be sent to the Fording River from 2023 to 2026.	• Clean water diverted away from treatment until spoiling begins in these watersheds in 2027.
	Adjustment to discharge locations related to Lake Mountain Pond	• Flow from Lake Mountain Pond (FR_LMP1) is modelled to be sent to the Fording River until 2027. Lake Mountain Pond is modelled to be decommissioned in 2027 as mining in Swift Pit progresses.	• Flow from Lake Mountain Pond (FR_LMP1) is modelled to be sent to Liverpool Pond (FR_LP1) from 2023 to 2027. Lake Mountain Pond is modelled to be decommissioned in 2027 as mining in Swift Pit progresses.	• Lake Mountain Pond is modelled to be sent to Liverpool Pond from 2023 to 2027 for collection and treatment.
	Adjustment to discharge locations related to the Swift North West drainage	• Flow from the Swift North West drainage is modelled to be sent to the Elk River until 2026 and Post Ponds from 2027 onward.	• Flow from the Swift North West drainage is modelled to be sent to the Elk River for the entire simulation period.	• Reflects an updated understanding of future water management activities, noting that there is no future permitted waste rock in this drainage.
	Adjustment to dust suppression demand from Eagle 4 Pit	• Water from Eagle 4 Pit is modelled to be used as a source of dust suppression at FRO from 2017 to 2040.	• Water from Eagle 4 Pit is not used as a source of dust suppression at FRO from 2020 onwards.	• Eagle 4 Pit water will be collected for treatment at the Clode Primary Pond Intake.
	Adjustment to water demands at Eagle 4 Pit, Turnbull South Pit, and Kilmarnock Creek	• Water from Eagle 4 Pit, Turnbull South Pit, and Kilmarnock Creek is modelled to be sent to the South Tailings Pond until 2040 (for tailings water management and process plant water use).	• Water from Eagle 4 Pit is modelled to be sent to the South Tailings Pond until 2020. Water modelled to be sent to South Tailings Pond from Turnbull South Pit and Kilmarnock Creek is increased between 2020 and 2040 to make up for the elimination of flow from Eagle 4 Pit to South Tailings Pond.	
	Adjustment to calibration factors and hydraulic lag times for sub-watersheds draining to Lake Mountain Pond and Post Ponds	• Calibration factors applied to geochemical source terms governing the release of nitrate, selenium, and sulphate from waste rock set to 1 in the North and East Tributary Rock Drain sub-watershed. • Calibration factor applied to nitrate release from waste rock placed from 2017 onward in John Creek set to 1. • Hydraulic lag assumed to be variable, starting at 1 year and increasing over a 15-year timeframe to a fixed value of 7.7 years (i.e., average hydraulic lag for existing waste rock spoils) for waste rock placed in the Post Ponds Rock Drain, North and East Tributary Rock Drain and John Creek sub-drainages, with the 15-year increase beginning as soon as waste rock is placed in each drainage. • Hydraulic lag assumed to be a fixed value of 7.7 years (i.e., average hydraulic lag for existing waste rock spoils) for historical and future waste rock placed in the Lake Pit drainage.	• Calibration factors applied to geochemical source terms governing the release of nitrate, selenium, and sulphate from waste rock set to 1.5, 1.2, and 1.5, respectively, in the North and East Tributary Rock Drain sub-drainage. • Calibration factor applied to nitrate release from waste rock placed from 2017 onward in John Creek set to 1.5. • Hydraulic lag assumed to be variable, starting at 1 year and increasing over a 15-year timeframe to a fixed value of 7.7 years (i.e., average hydraulic lag for existing waste rock spoils) for waste rock placed in the Post Ponds Rock Drain, and North and East Tributary Rock Drain sub-drainage, with the 15-year increase beginning 4 years after initial waste rock placement in each drainage. • Hydraulic lag assumed to be a fixed value of 2 years for the first 4 years following initial waste rock placement in John Creek. Hydraulic lag assumed to be variable, starting at 2 years and increasing over a 15-year timeframe to a fixed value of 7.7 years (i.e., average hydraulic lag for existing waste rock spoils), with the 15-year increase beginning 4 years after initial waste rock placement. • Variable hydraulic lag applied to waste rock placed from 2017 onward in the Lake Pit sub-drainage. Hydraulic lag set to 2 years for the first 4 years of waste rock placement (i.e., 2017 to 2021), then increasing over a 15-year timeframe to a fixed value of 7.7 years (i.e., average hydraulic lag for existing waste rock spoils).	• Changes made to address feedback received on 2020 RWQM Update and to improve model performance in these areas.
	Revisions to surface water - groundwater partitioning in Clode Creek	Clode Creek surface water - groundwater partitioning modelled as follows: • 60% of the total flow in Clode Creek up to a maximum of 4,000 m³/day assumed to bypass the monitoring location, with 55% modelled to be sent to the Fording River downstream of Clode Creek (FR_FRDSCC1) and 45% modelled to be sent to Fording River upstream of Kilmarnock Creek (FR_FR2) via Grassy Creek	Clode Creek surface water - groundwater partitioning modelled as follows: • 32% of the total flow prior to the Clode Secondary Pond up to a maximum of 2,900 m³/day assumed to bypass the Clode Secondary Pond until treatment is fully effective (i.e., December 31, 2022). • 15% of the total flow prior to the Clode Secondary Pond up to a maximum of 2,900 m³/day assumed to bypass the Clode Secondary Pond after treatment is fully effective (i.e., from December 31, 2022 onward). • Groundwater flow prior to the Clode Secondary Pond modelled as discharging to the Fording River downstream of Clode Creek (FR_FRDSCC1). • Secondary Pond leakage of 1,100 m³/day modelled to be sent to the Fording River at the North Tailings Pond (FR_FRNTP) via Grassy Creek.	• Reflects an updated understanding of surface water - groundwater partitioning in Clode Creek.
	Addition of Eagle 4 Pit seepage	• Groundwater seepage from Eagle 4 Pit not explicitly modelled.	• Groundwater seepage from Eagle 4 Pit of 1,075 m³/day modelled as discharging to Clode Creek upstream of the Clode Primary Pond.	
	Addition of minimum and maximum pumping rates from Clode Primary Pond, Liverpool Pond, Post Pond and Eagle 6 Pit North	• Minimum and maximum pumping rates from the Clode Primary Pond, Liverpool Pond, Post Pond and Eagle 6 Pit North not considered.	Clode Primary Pond pumping rates: • 3,100 m³/d minimum • 31,000 m³/d maximum Liverpool Pond pumping rates: • 7,600 m³/d minimum • 36,000 m³/d maximum Post Pond pumping rates: • 2,000 m³/d continuous gravity drain • 16,000 m³/d maximum Eagle 6 Pit North pumping rates: • 2,500 m³/d minimum	• Engineering design requirements for minimum and maximum pumping rates based on available flow, pipeline design, pump specs.

Table 2-1: Updates Made to the 2020 Regional Water Quality Model in Support of the 2022 Implementation Plan

Nature of the Change	Description	2020 Regional Water Quality Model	2022 Implementation Plan Adjustment	Rationale
	Addition of an SRF within the model framework in the FRO-N treatment area (i.e., FRO-N 1 SRF)	• An SRF was not explicitly included in the FRO-N treatment area. Treatment of nitrate and selenium assumed to occur at the FRO-N AWTF.	• FRO-N 1 SRF modelled as described in the *Fording River Operations North Saturated Rock Fill Phase 2 Project Operations Application* (Teck 2022).	• Aligns with Teck's strategy to use SRF technology in preference of AWTF technology to manage nitrate and selenium concentrations in the Elk Valley.
Updating CCR information and including more sub-drainages to support upcoming work related to the FRX Project	Increased level of spatial detail (i.e., number of individual sub-drainages) at FRO	• FRO consists of 47 drainages and sub-drainages.	FRO consists of 51 drainages and sub-drainages: • Chauncey Creek sub-divided into three sub-drainages: Chauncey Creek Upper, Chauncey Creek North Tributary, and Chauncey Creek Lower. • A new drainage was added to the Fording River mainstem downstream of Chauncey Creek called Additional to FR_FRDSCH1.	• Allows for increased level of spatial detail in the FRX Project area; although of limited relevance to the 2022 IPA, this change will support future work on the FRX Project Application.
	Change to method used to estimate flows from CCR piles at FRO	• Flows from CCR piles estimated using the Snowmelt Runoff Module (SRM).	• Flows from CCR piles at FRO estimated using a CCR/MCR module. The CCR/MCR module is based on the waste rock hydrology module from the 2020 RWQM.	• Improves the ability of the model to represent magnitude and seasonality of measured flows from CCR piles.
	Change to deposition of CCR in Eagle 4 Pit	• CCR area/volume in Eagle 4 Pit unchanged from 2022 to 2027.	• Continued deposition of CCR in Eagle 4 Pit until 2027YE.	• Reflects planned activity related to permitted mining.
Updating 2019 and 2020 explosives information and waste rock volumes	Revision to explosives information and waste rock volumes used/deposited in 2019 and 2020 at FRO, GHO, LCO, and EVO	• Explosives information and waste rock volumes used/deposited in 2019 and 2020 reflect projected values.	• Explosives information and waste rock volumes used/deposited in 2019 and 2020 updated to reflect actual values.	• Reflects actual explosives usage and waste rock placement.
Update to nitrate release from waste rock	Revision to liner effectiveness values assigned to lined blast holes at FRO, GHO, LCO and EVO	• Liner effectiveness values assigned to lined blast holes at FRO, GHO, LCO and EVO set to 50%.	• Liner effectiveness values assigned to lined blast holes at FRO, GHO, LCO and EVO set to 0% (i.e., liner failure rate = 100%).	• Liner effectiveness set to a default value of 0% until the conceptual and numerical models for nitrate release from waste rock are updated to consider exchangeable ammonium. The default value can still be changed to run sensitivity analyses.

Mine planning - include permitted activities approved since the 2020 RWQM update	Revision to permitted activities at FRO	• Permitted mine plan at FRO reflects information provided by mine planners for the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a).	• Permitted mine plan at FRO updated to reflect:
			  • Swift South Spoil (FRO-047[(a)])
			  • Swift 1 Pit Re-design (FRO-081[(a)])
			  • Legacy Tailings (Teck 2014)
				• Include activities that have been permitted since submission of the 2020 RWQM update.

	Revision to permitted activities at EVO	• Permitted mine plan at EVO reflects information provided by mine planners for the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a).	• Permitted mine plan at EVO updated to reflect the *Cedar North In-pit Backfill Extension Project and Tunnel Water Diversion System Mines Act Amendment Application and Environmental Management Act Notification* (Teck 2020a).	
	Revision to permitted activities at LCO	• Permitted mine plan at LCO reflects information provided by mine planners for the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a).	• Permitted mine plan at LCO updated to reflect the *East Coal Rejects Dump Extension* (ERX) project (Golder 2020).	
Update to water management activities	Temporary water storage in Swift Pit at FRO	• Temporary water storage in Swift Pit at FRO is not included in the model.	• Temporary water storage in Swift Pit at FRO has been added as described in Annex B.	• This feature was added to the model to reflect Teck's hierarchy of controls (e.g., source control and water management ahead of treatment).
	Adjustment to discharge locations for Baldy Ridge Pit at EVO	• Flow from Baldy Ridge Pit is modelled to be sent to Natal Pit West until 2041 and Aqueduct Creek from 2042 onward.	• Flow from Baldy Ridge Pit is modelled to be sent to Natal Pit West for the entire simulation period.	• Flow from Baldy Ridge Pit is modelled to be sent to Natal Pit West for collection and treatment at the EVO SRF.
	Adjustment to maximum pumping rate from Natal Pit West at EVO	• up to 10,000 m^3/day is pumped from Natal Pit West for treatment at the EVO SRF until December 31, 2027.	• up to 5,000 m^3/day is pumped from Natal Pit West for treatment at the EVO SRF until December 31, 2027.	• Added to reflect Teck's hierarchy of controls and more effective management of on-site water to support medium and long-term selenium compliance at the EVO Michel Creek Compliance Point prior to December 31, 2027.
Improving model projections in Koocanusa Reservoir	Adjustment to bias correction values in Koocanusa Reservoir	• A monthly average relative bias value of 2.3 is used in March. It was calculated using limited measured data (i.e., five samples).	• The monthly average relative bias value of 2.3 that was used in March was replaced with the annual average relative bias value of 1.2.	• The relative bias value in March was modified to address model under-prediction in March due to limited measured data (i.e., five samples) and reflects feedback received from KNC.
Correcting EVO SRF effluent concentrations	Adjustment to EVO SRF effluent quality	• Entrained water at the EVO SRF is treated for nitrate and selenium at the SRF.	• Entrained water at the EVO SRF is not treated at the SRF.	• Reflects an updated understanding of SRF performance.
Correcting waste rock volumes	Adjustment to waste rock volumes in Natal Pit West and Natal Pit 2 at EVO	• Waste rock volume inputs for Natal Pit 2 are mistakenly assigned to Natal Pit West in the model and waste rock volume inputs for Natal Pit West are assigned to Natal Pit 2 in the model.	• Waste rock volume inputs for Natal Pit 2 and Natal Pit West are assigned to their respective drainages in the model.	• Eliminates an error in the 2020 RWQM related to waste rock placement in Natal Pit West and Natal Pit 2.
	Adjustment to PAG waste rock volumes in Cataract Creek	• PAG waste rock volumes in Cataract Creek at GHO from 2020 to 2025 were mistakenly entered into the model from 2018 to 2023.	• PAG waste rock volumes in Cataract Creek at GHO from 2020 to 2025 were entered into the model from 2020 to 2025, with updates to actuals as discussed above.	• Eliminates an error in the 2020 RWQM related to projected PAG waste rock volumes in Cataract Creek.

Table 2-1: Updates Made to the 2020 Regional Water Quality Model in Support of the 2022 Implementation Plan

Nature of the Change	Description	2020 Regional Water Quality Model	2022 Implementation Plan Adjustment	Rationale
Changing future flow projections	Effects of reclamation	• Effects of reclamation modelled by decreasing net percolation rates in waste rock spoils starting after the end of active operations. The end of active operations is 2055 year-end (YE) for FRO, 2042YE for GHO, 2043YE for LCO and 2059 YE for EVO.	• Effects of reclamation not considered.	• Ignoring the potential effects of reclamation until more information is available.
Accounting for the effects of submerged waste rock	Adjustment to release of nitrate from submerged waste rock	• The equation used to calculate the release of nitrate from submerged waste rock allowed the mass of nitrate to accumulate over time (i.e., over the time between waste rock placement and waste rock submergence).	• The equation used to calculate the release of nitrate from submerged waste rock has been updated in Natal Pit West at EVO to exclude the time component (i.e., the mass of nitrate does not accumulate over the time between waste rock placement and waste rock submergence).	• Eliminates an error in the 2020 RWQM related to release of nitrate from submerged waste rock in Natal Pit West at EVO.
Addition of sulphate treatment	Addition of sulphate treatment at FRO, LCO, and EVO	• Sulphate treatment was not included in the model.	• Sulphate treatment has been added to the model at FRO, LCO and EVO as described in Section 2.	• Required to support sulphate mitigation planning in the Elk Valley.
Addition of future SRFs	Addition of future SRFs: • Eagle 6 SRF at FRO • FRO-N 2 SRF at FRO • CSP SRF at GHO • NLC SRF at LCO • BRP SRF at EVO	• Future SRFs were not included in the model.	The following future SRFs have been added to the model as described in Section 2.0: • Eagle 6 SRF at FRO • FRO-N 2 SRF at FRO • CSP SRF at GHO • NLC SRF at LCO • BRP SRF at EVO	• Representative of future SRFs and required to support efficient nitrate and selenium treatment planning in the Elk Valley.

BRP = Baldy Ridge Pit; CCR = Coarse Coal Refuse; CSP = Cougar South Pit; EVO = Elkview Operations; FRX = Fording River Extension; FRO = Fording River Operations; FRO-N = Fording River Operations North; GHO = Greenhills Operations; LCO = Line Creek Operations; MCR = Mixed Coal Refuse; NLC = North Line Creek; SRF = Saturated Rock Fill; KNC = Ktunaxa Nation Council; PAG = Potentially Acid Generating; RWQM = Regional Water Quality Model; AWTF = Active Water Treatment Facility; % = percent.
Note: Cells shaded in blue are changes that affect model performance over the calibration period.
(a) FRO-047 and FRO-081 are Notice of Departure (NOD) applications to modify placement of waste rock as outlined in the *FRO Swift Project Environmental Assessment Certificate Application* (Teck 2014).

2.1 Future Saturated Rock Fills

Seven SRFs are incorporated into the water quality component of the RWQM:

- FRO-N 1 SRF, FRO-N 2 SRF, and Eagle 6 Pit SRF at FRO
- Cougar South Pit (CSP) SRF at GHO
- North Line Creek (NLC) SRF at LCO
- EVO SRF and Baldy Ridge Pit (BRP) SRF at EVO

The FRO-N 1 SRF and FRO-N 2 SRF are represented in the model as described in the *Fording River Operations North Saturated Rock Fill Phase 2 Project Operations Application* (Teck 2022). The EVO SRF is represented in the model as described in the *Operations Application for the Elkview Operations Saturated Rock Fill Phase 2 Project* (Teck 2020b). The four remaining SRFs are represented in the model as described below.

SRF sizing is defined by hydraulic capacity in the 2020 RWQM. Hydraulic capacity, expressed in terms of cubic metres per day (m^3/d), refers to the maximum amount of water an SRF can treat. Source waters targeted for treatment are directed to each SRF sequentially from the source with the highest selenium content[3] to the source with the lowest, until the hydraulic capacity is reached, or all available sources are treated. If the hydraulic capacity of the SRF is reached before all available sources are treated, then excess water bypasses the SRF and continues to be discharged to the receiving environment through the source tributary. Thus, the selenium and nitrate load removed by a given SRF is dependent, within the 2020 RWQM, on the hydraulic capacity assigned to the SRF and the availability of water to treat. Assumed removal efficiencies for nitrate and selenium at each SRF are outlined in the main report. Effluent flow rates are equivalent to influent flow rates.

Effluent from an SRF consists of:

- Treated water - injected water that travels through the SRF and undergoes nitrate and selenium removal
- Entrained water - untreated water that is captured and mixed with treated water at the extraction wells

Entrained water is assumed to originate from two sources:

- In-situ water (deep water): water that exists in the SRF prior to the start of treatment and is the deeper waters underlying the SRF active treatment zone
- Recharge water: water that enters the SRF from the local watershed as opposed to through the injection wells

[3] Consideration was given to both the load carried by potential treatment sources and constituent concentrations contained therein, with a view to maximizing the load removal across the SRF while minimizing the volume of treated water as outlined in Annex B.

The methods used in the 2020 RWQM to represent entrainment of in-situ water and recharge water at future SRFs (i.e., at those other than the FRO-N 1 SRF, FRO-N 2 SRF and EVO SRF) are described below. Entrainment at FRO-N 1 SRF, FRO-N 2 SRF and EVO SRF are modelled as described in Teck (2022 and 2020b).

2.1.1 Entrainment of In-situ Water

Entrainment of in-situ water was incorporated into the 2020 RWQM via the submerged waste rock calculations for the following SRFs:

- CSP SRF at GHO
- NLC SRF at LCO
- BRP SRF at EVO

Filling of these mine pits (i.e., Cougar South Pit, North Line Creek Pit and Baldy Ridge Pit) with water and changes to release rates following waste rock submergence are explicitly represented in the 2020 RWQM. These pits are explicitly represented in the 2020 RWQM because of their large size and the longer timeframe over which they fill with water. These pits are modelled using reservoir elements. Each reservoir element has a set volume reflective of the space available to fill with water, and they begin to fill with water once activity in each pit is complete. Water decants from these reservoirs once full, with the option to direct the decant water to an SRF or to the receiving environment. Additional information on the filling of pits with water is provided in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a).

As water levels in these backfilled pits rise, residual nitrate and oxidative products that have not been flushed by infiltrating meteoric water are dissolved into solution, and oxidation below the water surface ceases. This process is represented in the 2020 RWQM by an initial flush of residual nitrate and accumulated oxidative products when submerged. Thereafter, the submerged waste rock ceases to be a source of nitrate, selenium, or sulphate. The constituents released when submerged are available for transport out of the backfilled pit. The mass released as submergence occurs reflects the projected concentrations in the water that exists in the SRF prior to the start of treatment and in the deeper waters that may underlie the active treatment zone (i.e., projected concentrations in the in-situ water).

Eagle 6 Pit was not explicitly represented in the 2020 RWQM (i.e., constituent mass and water volume were not tracked over time). Eagle 6 Pit was not explicitly included in the model, because of its small size, and the shorter timeframe over which it fills with water. As a result, it was necessary to use a different approach to estimate entrainment of in-situ water at the Eagle 6 Pit SRF as described below.

The proportion of in-situ water entrained at the Eagle 6 Pit SRF was calculated using the following equation:

$$E_1 = \frac{\sqrt{\alpha_v L}}{T\sqrt{\pi}} \quad \text{Eq. 1}$$

Where:

E_1 = proportion of entrainment from in-situ water (percent; [%])

α_v = vertical dispersivity; estimated to be 0.1 m [SRK Consulting (Canada) Inc. (SRK) (2022)]

L = average flow distance along the active treatment zone; estimated to be 120 m (SRK 2022)

T = thickness of active treatment zone; estimated to be 25 m (SRK 2022)

Further details on the entrainment of in-situ water are provided in SRK (2022).

The entrainment of in-situ water was calculated to be 8% at the Eagle 6 Pit SRF and was incorporated into the 2020 RWQM by adjusting the proportion of total effluent that is treated water versus untreated (i.e., in-situ) water.

Concentrations in in-situ water at the Eagle 6 Pit SRF were estimated using the submerged waste rock equation from the 2020 RWQM for nitrate and selenium, and an average of the in-situ water concentrations at the EVO SRF and the FRO-N 1 SRF for sulphate. An average of the concentrations in in-situ water at the EVO SRF and FRO-N 1 SRF was used because sulphate concentrations estimated using the submerged waste rock equation were less than those at the EVO SRF and FRO-N 1 SRF.

The mass of nitrate and selenium released per bank cubic metre (BCM) of submerged waste rock was calculated using the following equation:

$$L_i = (1 - p) \cdot V_{Submerged} \cdot R_i \cdot \left(t_{Submerged} - t_{Placement}\right) \quad \text{Eq.2}$$

Where:

L_i = mass loading of constituent ‘i’ released per bank cubic metre of waste rock following waste rock submergence (kg/d)

p = the proportion of waste rock not contacted by meteoric water (unitless); estimated to be 0.5, as outlined in Annex A of the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a)

$V_{Submerged}$ = volume of waste rock inundated by water (BCM); assumed to be 1 BCM for the purposes of calculated mass of nitrate and selenium released per BCM of rock

R_i = geochemical release rate for constituent 'i' (kg/BCM/y); set to 4.1 mg/BCM/yr for selenium, which is the valley-wide average geochemical release rate as developed for pit walls without considered of hydraulic lag (Teck 2021a), and 19 g/BCM/yr for nitrate calculated as outlined below

$t_{Submerged}$ = time when submergence of waste rock occurs (y); estimated to be January 1, 2020

$t_{Placement}$ = time when waste rock was placed (y)

The nitrate release rate required in Equation 2 was calculated using the following equation:

$$M_{Total} = V_{submerged} F_P f_R \times \left(f_{ANFO}\, C_{N,ANFO} + \left[1 - f_{ANFO,}\right] C_{N,emul}\right) \times F_c \qquad \text{Eq. 3}$$

Where:

M_{total} = total mass of nitrate associated with one bank cubic metre of waste rock (kg/d)

F_P = powder factor (mass of explosive used per unit of waste rock generated) (kilograms per BCM [kg/BCM]); set to 0.53, which is the value assigned to FRO in 2020 in the 2020 RWQM

f_R = fraction of explosives remaining after detonation (unitless); estimated to be 0.08, which is the value used for Kilmarnock Creek in the 2020 RWQM

f_{ANFO} = fraction of the total explosives used that were in the form of ANFO (unitless); set to 0.42 which is the value assigned to FRO in 2020 in the 2020 RWQM

$C_{N,ANFO}$ = concentration of nitrogen in ANFO (gram of nitrogen per gram of ammonium nitrate and fuel oil mixture [g N/g ANFO]); set to 0.33

$C_{N,emul}$ = concentration of nitrogen in emulsion (gram of nitrogen per gram of emulsion [g N/g emulsion]); set to 0.28

F_c = calibration factor (unitless); set to 1.5 which is the value assigned to the Eagle 6 South watershed in the 2020 RWQM

The time between waste rock placement and waste rock submergence in Eagle 6 Pit was estimated by calculating the average age of the cumulative waste rock volume in the pit at the time of submergence. Placement of waste rock below the decant point in Eagle 6 Pit was assumed to be complete by December 31, 2019, and any additional waste rock placed from 2020 onward was assumed to be above the decant point of the pit (i.e., not submerged).

Concentrations of nitrate and selenium in the in-situ water were then calculated using the following equation:

$$C_i = \frac{L_i}{n \cdot V_{Submerged}} \times \varphi_1 \quad \text{Eq. 4}$$

Where:

C_i = concentration of constituent 'i' released following waste rock submergence (mg/L)

n = porosity of waste rock; estimated to be 0.3

φ_1 = unit conversion factor of 1000 (mg·m^3/kg/L)

Concentrations in in-situ water at the Eagle 6 Pit SRF are presented in Table 2-2. Concentrations in in-situ water at the EVO SRF and FRO-N 1 SRF are provided for comparison.

Table 2-2: Water Quality of In-situ Water for the EVO SRF, FRO-N 1 SRF and Eagle 6 SRF

Constituent	Units	EVO SRF[(a)]		FRO-N 1 SRF[(b)]		Eagle 6 SRF[(c)]	
		P50	P95	P50	P95	P50	P95
Nitrate_N	mg/L	0.037	0.51	226	331	43	43
Selenium	µg/L	0.14	0.44	140	540	51	67
Sulphate	mg/L	1,517	1,710	1,132	1,390	1,324	1,550

EVO = Elkview Operations; FRO-N = Fording River Operations North; SRF = Saturated Rock Fill; P50 = 50th percentile; P95 = 95th percentile; µg/L = micrograms per litre; mg/L = milligrams per litre.

(a) Values are from the *Operations Application for the Elkview Operations Saturated Rock Fill Phase 2 Project* (Teck 2020b).

(b) Values are from the *Fording River Operations North Saturated Rock Fill Phase 2 Project Operations Application* (Teck 2022).

(c) Values derived following the methods outlined herein.

2.1.2 Entrainment of Recharge Water

The proportion of recharge water entrained at the future SRFs was calculated using the following equation:

$$E_2 = (100\% - F_{CE}) \frac{Q_R}{Q_W} \quad \text{Eq. 5}$$

Where:

E_2 = proportion of entrained water from recharge (%)

F_{CE} = capture efficiency of far-field extraction wells (%); estimated to be 75%, as outlined in SRK (2022)

Q_R = rate of recharge into the SRF (i.e., drainage from local catchment) (cubic metres per day [m^3/day])

Q_W = wellfield flow rate (m^3/day)

Further details on the entrainment of recharge water are provided in SRK (2022).

The entrainment of recharge water was incorporated into the 2020 RWQM by adjusting the water availability of the local catchment to reflect the value of E_2 (i.e., water availability set to a value of 100 - E_2). Water availability is the proportion of total watershed yield that is captured or planned to be captured at each intake location for conveyance to an SRF.

The proportion of recharge water entrained at the future SRFs are presented in Table 2-3.

Table 2-3: Entrainment of Recharge Water for Future Saturated Rock Fills

Future SRF	Efficiency of Far Field Wells (%)	Rate of Recharge into SRF (m^3/day)[(a)]	Well Field Flow Rate (m^3/day)	Entrainment of Recharge Water (%)
North Line	75	6,000	12,500	12
Cougar	75	7,147	5,000	36
Baldy Ridge	75	11,482	5,000	57
Eagle 6 SRF	75	1,263	6,500	5

SRF = Saturated Rock Fill; m^3/day = cubic metres per day; % = percent.

(a) Values presented are the average P50 monthly average flows from the fully effective date to December 31, 2053.

2.2 Addition of Sulphate Treatment

Sulphate treatment has been incorporated into the water quality component of the 2020 RWQM. Sulphate treatment can occur year-round or seasonally. A load removal efficiency of 90% for sulphate is assumed as described in the main report.

Sulphate loading from treatment facilities to downstream environments is calculated by reducing the incoming sulphate load by the load removal efficiency using the following equation:

$$L_{eff} = L_{inf} \times (100\% - L_{RE}) \quad \text{Eq. 6}$$

Where:

L_{eff} = loading of sulphate in the treated effluent from the treatment facility (kilograms per day [kg/d])

L_{inf} = loading of sulphate in the inflow to the treatment facility (kg/d)

L_{RE} = load removal efficiency (%); estimated to be 90%, as described in the main report

The load removed by a given facility is calculated based on the difference between the incoming load and the outgoing load calculated using Equation 6.

Source waters targeted for treatment are directed to each treatment facility sequentially in a predetermined order (as discussed in Annex B), until the hydraulic capacity is reached, or all available sources are treated. If the hydraulic capacity is reached before all available sources are treated, then excess water bypasses the treatment facility and continues to be discharged to the receiving environment through the source tributary.

3 Effect to Model Performance

Changes to model performance over the calibration period, due to changes made to the RWQM and updates to site conditions, are presented in this section. Final values assigned to the calibration factors and hydraulic lag times for nitrate, selenium and sulphate were the same as those reported in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a), with two exceptions:

- Hydraulic lag times in the Post Ponds Rock Drain, North and East Tributary Rock Drain, John Creek and Lake Pit drainages at FRO, calibration factors applied to the geochemical source terms governing the release of nitrate, selenium and sulphate from waste rock in the North and East Tributary Rock Drain drainage and the calibration factor applied to the geochemical source term governing the release of nitrate from waste rock in the John Creek drainage were adjusted as discussed in Appendix 6.2.3-2 of the *Fording River Operations North Saturated Rock Fill Phase 2 Project Operations Application* (Teck 2022) and summarized in Table 2-1.
- Calibration factors applied to the geochemical source terms governing the release of nitrate, selenium and sulphate from waste rock in the Greenhills Creek North drainage at GHO were adjusted as discussed in Appendix 6.1.4-A of the *Greenhills Operations Tailings Management Project for Existing Permitted Reserves Joint Application* (Teck 2021b*)* and summarized in Table 2-1.

Error and bias statistics are also presented for nitrate, selenium and sulphate.

3.1 Nitrate

Model performance over the calibration period is almost identical to that in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a) in most mine-affected tributaries and in the Fording River and Elk River. Simulated results in mine-affected tributaries and the Fording River and Elk River continue to match reasonably well with measured data, in terms of replicating the range of measured concentrations and matching seasonal, yearly and longer-term trends. Comparisons of model outputs to measured data are shown for selected locations in Figure 3-1; comparable plots for all modelled locations are included in Appendix A.

The performance of the model in simulating concentrations of nitrate is weaker compared to that reported in Teck (2021a) at the following locations:

- Lake Mountain Pond (FR_LMP1) at FRO where the relative bias decreased from 0.99 to 0.93, and the percent error increased from 62% to 69% (Table 3-1). These changes are due to the adjustments made to the hydraulic lag times at John Creek and Lake Pit and the nitrate calibration factor at John Creek as part of the FRO-N SRF Phase 2 Project. Adjustments were made to the hydraulic lag times and nitrate calibration factor so that simulated nitrate concentrations would more closely follow the increasing trend in measured data from 2019 to 2021. The calibration statistics continue to be calculated from 2006 to 2018, consistent with the 2020 RWQM update and do not consider model performance from 2019 onward. Thus, the changes made have a more positive influence on model performance than the changes to the overall relative bias and percent error statistics would suggest.
- Greenhills Creek Sediment Pond Decant (GH_GH1) at GHO where the relative bias increased from 0.85 to 1.3 and the percent error increased from 39% to 55% (Table 3-1). These changes are due to updates made to the model as part of the GHO Tailings Management Project for Existing Permitted Reserves and include the increased level of spatial detail in Greenhills Creek, reallocation of historical waste rock volumes, revision to constituent concentrations in waters released from CCR and tailings storage facilities at GHO, change to the method used to estimate flows from CCR piles at GHO, updates to tailings water management and process plant use and updates to surface water - groundwater partitioning in Greenhills Creek.
- Fording River upstream of Kilmarnock Creek (FR_FR2) where the percent error increased from 28% to 30%, while relative bias is unchanged (Table 3-1). These changes are due to the adjustments made to the hydraulic lag times in the Post Ponds Rock Drain, North and East Tributary Rock Drain, John Creek and Lake Pit drainages, and calibration factors in the North and East Tributary Rock Drain and John Creek drainages as part of the FRO-N SRF Phase 2 Project. Adjustments were made to the hydraulic lag times and calibration factors so that simulated nitrate concentrations would more closely follow measured data at the Post Ponds Sediment Pond Decant (FR_PP1) and Lake Mountain Pond (FR_LMP1) from 2019 to 2021. As noted above, the calibration statistics continue to be calculated from 2006 to 2018, consistent with the 2020 RWQM update and do not consider model performance from 2019 onward. Thus, the changes made have a more positive influence on model performance than the change to the overall percent error statistic would suggest.

The performance of the model in simulating concentrations of nitrate is unchanged compared to that reported in Teck (2021a) at the GHO Fording River Compliance Point (GH_FR1; 0200378).

Figure 3-1: Projected Nitrate Concentrations in Lake Mountain Pond, Greenhills Creek, and the Fording River between 2006 and 2020

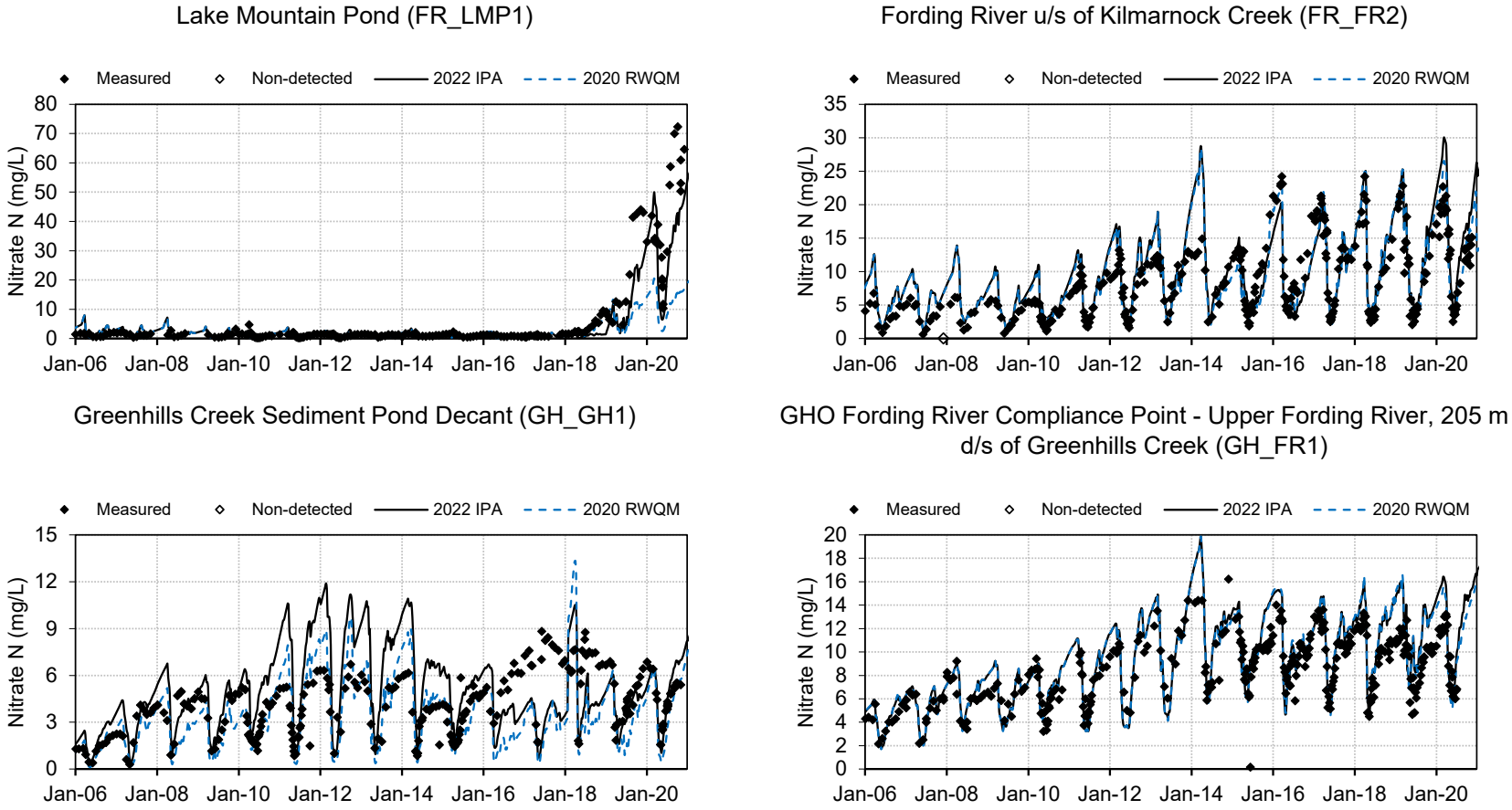


Table 3-1: Error and Bias Results for Nitrate Calibration for the 2020 RWQM and 2022 IPA, 2006-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River Operations (FRO)	FR_HC1	Henretta Creek u/s of the Fording River	0.55	1.1	1.5	34%	0.55	1.1	1.5	34%	0%	0%
	FR_CC1	Clode Creek Sediment Pond Decant	7.8	1.3	17	54%	2.9	1.1	17	55%	-15%	2%
	FR_LMP1	Lake Mountain Pond	-0.0072	0.99	0.77	62%	-0.083	0.93	0.86	69%	-6%	11%
	FR_KC1	Kilmarnock Creek d/s of Rock Drain	-4.3	0.92	11	20%	-2.2	0.96	11	20%	4%	0%
	GH_SC1	Swift Creek Settling Pond Discharge	6.7	1.2	11	35%	6.7	1.2	11	35%	0%	0%
	GH_CC1	Cataract Creek Sediment Pond Decant	2.9	1.1	4.7	15%	2.9	1.1	4.7	15%	0%	0%
Greenhills Operations (GHO)	GH_PC1	Porter Creek Sediment Pond Decant	0.86	1.4	1.6	65%	0.86	1.4	1.6	65%	0%	0%
	GH_GH1	Greenhills Creek Sediment Pond Decant	-0.55	0.85	1.5	39%	1.0	1.3	2.1	55%	53%	41%
	GH_LC1	Leask Creek Sediment Pond Decant	-4.2	0.84	10	39%	-4.2	0.84	10	39%	0%	0%
	GH_WC1	Wolfram Creek Sediment Pond Decant	-2.9	0.89	12	46%	-3.0	0.88	12	46%	-1%	0%
	GH_TC1	Thompson Creek at LRP Road	1.3	1.2	3.5	43%	1.4	1.2	3.4	43%	0%	0%
Line Creek Operations (LCO)	LC_DC3	Dry Creek u/s of East Tributary	-0.74	0.8	2.1	55%	-0.73	0.83	2.1	55%	4%	0%
	LC_DCDS	Dry Creek d/s of Sedimentation Ponds	-0.59	0.84	2.1	55%	-0.58	0.85	2.1	55%	1%	0%
	LC_DC1	Dry Creek near mouth (at bridge)	0.039	1.0	0.62	69%	0.042	1.0	0.62	69%	0%	0%
	LC_LCUSWLC	Line Creek u/s of West Line Creek	1.3	1.1	3.3	27%	1.3	1.1	3.3	27%	0%	0%
	LC_WLC	West Line Creek	-1.9	0.93	5.2	20%	-1.9	0.93	5.2	20%	0%	0%
	LC_LC3	Line Creek d/s of West Line Creek	0.24	1.0	2.9	22%	0.24	1.0	2.9	22%	0%	0%
	LC_LCDSSLCC (EMS E297110)	LCO Compliance Point (Line Creek d/s of South Line Creek confluence)	-0.46	0.95	1.7	18%	-0.45	0.95	1.7	18%	0%	0%
	LC_LC4	Line Creek u/s of Process Plant	0.52	1.1	1.6	23%	0.52	1.1	1.6	23%	0%	0%
Elkview Operations (EVO)	EV_EC1	Erickson Creek at the Mouth	0.83	1.1	1.4	14%	0.58	1.1	1.3	13%	0%	-7%
	EV_GT1	Gate Creek Sedimentation Pond Decant	-5.4	0.81	10	38%	-4.6	0.84	9.7	35%	4%	-8%
	EV_BC1	Bodie Creek Sedimentation Pond Decant	-1.6	0.96	13	34%	0.086	1.0	12	33%	4%	-3%
	EV_DC1	EVO Dry Creek Sediment Pond Decant	0.52	1.1	0.92	23%	0.52	1.1	0.92	23%	0%	0%
	EV_HC1 (EMS E102682)	EVO Harmer Compliance Point (Harmer Creek Dam Spillway)	0.11	1.1	0.25	26%	0.11	1.1	0.25	26%	0%	0%
Fording River	FR_FR1	Fording River d/s of Henretta Creek	0.15	1.1	1.0	38%	0.15	1.1	1.0	38%	0%	0%
	FR_FR2	Fording River u/s Kilmarnock Creek	0.83	1.1	2.2	28%	1.0	1.1	2.3	30%	0%	7%
	FR_FR4	Fording River between Swift and Cataract Creeks	0.79	1.1	2.7	35%	1.1	1.1	2.8	36%	0%	3%
	FR_FRCP1[f]	Fording River, 525 m d/s of Cataract Creek	-1.4	0.9	2.9	20%	-1.5	0.9	2.8	19%	0%	-5%

Table 3-1: Error and Bias Results for Nitrate Calibration for the 2020 RWQM and 2022 IPA, 2006-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River	GH_PC2	Fording River d/s of Porter Creek	-0.38	0.98	3.2	18%	-0.17	0.99	3.2	18%	1%	0%
	FR_FRABCH (EMS E223753)	FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek)	-0.19	0.99	2.5	14%	-0.23	0.99	2.5	14%	0%	0%
	LC_FRDSDC	Fording River d/s of Dry Creek	0.49	1.0	1.6	15%	0.42	1.0	1.5	15%	0%	0%
	GH_FR1 (EMS 0200378)	GHO Fording River Compliance Point - Upper Fording River, 205 m d/s of Greenhills Creek	0.75	1.1	1.3	15%	0.74	1.1	1.2	15%	0%	0%
	LC_LC5 (EMS 0200028)	Fording River d/s of Line Creek	-0.027	1.0	1.1	15%	-0.013	1.0	1.1	15%	0%	0%
Michel Creek	**CM_MC2 (EMS E258937)**	CMO Compliance Point (Michel Creek d/s of CMO near Andy Goode Creek junction)	0.65	1.3	0.85	40%	0.65	1.3	0.85	40%	0%	0%
	EV_MC3	Michel Creek u/s of Erickson Creek	0.14	1.7	0.2	92%	0.14	1.7	0.2	92%	0%	0%
	EV_MC2 (EMS E300091)	EVO Michel Creek Compliance Point	-0.5	0.81	0.99	37%	-0.52	0.8	0.94	35%	-1%	-5%
	EV_MC1	Michel Creek u/s of Highway 43 Bridge	0.45	1.4	0.6	49%	0.48	1.4	0.61	50%	0%	2%
Elk River	**GH_ERC**	GHO Elk River Compliance Point - Elk River, 220 m d/s of Thompson Creek	0.086	1.2	0.16	45%	0.08	1.2	0.16	45%	0%	0%
	GH_ER1 (EMS E206661)	Elk River u/s of Boivin Creek (u/s of Fording River)	0.0043	1.0	0.081	34%	0.004	1.0	0.08	34%	0%	0%
	EV_ER4 (EMS 0200389)	Elk River u/s of Grave Creek (from Fording River to Michel Creek)	0.1	1.0	0.64	24%	0.12	1.0	0.64	25%	0%	4%
	EV_ER2	Elk River u/s of Michel Creek	0.14	1.1	0.5	26%	0.15	1.1	0.5	26%	0%	0%
	EV_ER1 (EMS 0200393)	Elk River d/s of Michel Creek	0.19	1.1	0.42	24%	0.21	1.1	0.43	25%	0%	4%
	RG_ELKORES	Elk River at Elko Reservoir	0.0075	1.0	0.19	14%	0.019	1.0	0.19	14%	0%	0%
	RG_ELKMOUTH	Elk River at Highway 93 near Elko	0.033	1.0	0.17	16%	0.043	1.0	0.17	16%	0%	0%
Koocanusa Reservoir	**RG_DSELK (EMS E300230)[g]**	Koocanusa Reservoir - South of the Elk River	0.066	1.2	0.1	37%	0.068	1.3	0.1	38%	8%	3%

[a] The difference in relative bias was calculated using the following equation: (Relative $Bias_{2022\ IPA}$ – Relative $Bias_{2020\ RWQM}$)/Relative $Bias_{2020\ RWQM}$ x 100. The difference in percent error was calculated using the following equation: (Percent $Error_{2022\ IPA}$ – Percent $Error_{2020\ RWQM}$)/Percent $Error_{2020\ RWQM}$ x 100.

[b] Bias represents the average difference between simulated and measured concentrations. A positive bias indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.

[c] A relative bias greater than one indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.

[d] The error represents the average absolute difference between simulated and measured concentrations.

[e] The percent error represents the ratio of the error to the average measured concentration.

[f] Simulated concentrations at FR_FRCP1 reflect fully mixed conditions, whereas measured data collected during low flow periods reflect primarily the quality of Cataract Creek water; hence, the difference between simulated concentrations and measured data during low flow periods.

[g] The comparison of simulated to measured data considers measured data at the four stations located downstream of the Elk River: RG_DSELK, RG_GRASMERE, RG_USGOLD and RG_BORDER.

CMO = Coal Mountain Operations; d/s = downstream; u/s = upstream; m = metre; mg/L = milligrams per litre.

Note: Sites in **bold** font correspond to Order Stations and Compliance Points listed in EMA Permit 107517; Order Stations are indicated by underlined font.

3.2 Selenium

Model performance with respect to projected selenium concentrations over the calibration period is almost identical to that in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a) in most mine-affected tributaries and in the Fording River and Elk River. Simulated results in mine-affected tributaries and the Fording River and Elk River continue to match reasonably well with measured data, in terms of replicating the range of measured concentrations and matching seasonal, yearly and longer-term trends. Comparisons of model outputs to measured data are shown for selected locations in Figure 3-2; comparable plots for all modelled locations are included in Appendix B.

The performance of the model in simulating concentrations of selenium has improved compared to that reported in Teck (2021a) at the following locations:

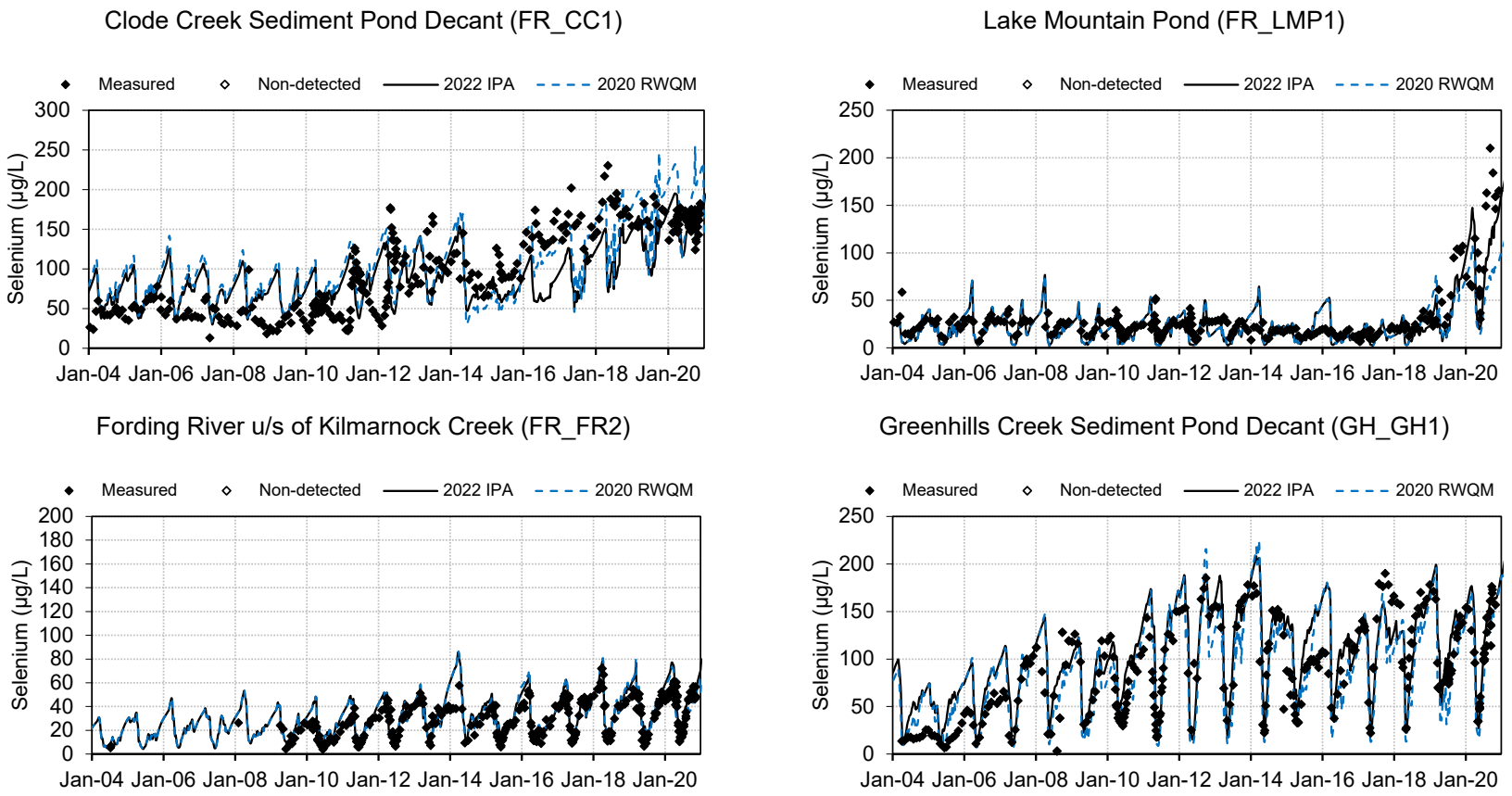
- Clode Creek Sediment Pond Decant (FR_CC1) at FRO where the relative bias decreased from 1.1 to 0.97, while the percent error is unchanged (Table 3-2). These changes are due to updates made to the model as part of the FRO-N SRF Phase 2 Project and include updates to surface water - groundwater partitioning in Clode Creek and addition of seepage from Eagle 4 Pit.
- GHO Fording River Compliance Point (GH_FR1; 0200378) where the relative bias increased from 0.99 to 1.0, while the percent error is unchanged (Table 3-2). This change is due to updates made to the model as part of the FRO-N SRF Phase 2 Project and the GHO Tailings Management Project for Existing Permitted Reserves.

The performance of the model in simulating concentrations of selenium has weakened compared to that reported in Teck (2021a) at the following locations:

- Lake Mountain Pond (FR_LMP1) at FRO where the relative bias decreased from 0.86 to 0.85, and the percent error increased from 47% to 48% (Table 3-2). These changes are due to the adjustments made to the hydraulic lag times at John Creek and Lake Pit as part of the FRO-N SRF Phase 2 Project. Adjustments were made to the hydraulic lag times so that simulated selenium concentrations would more closely follow the increasing trend in measured data from 2019 to 2021. The calibration statistics continue to be calculated from 2004 to 2018, consistent with the 2020 RWQM update and do not consider model performance from 2019 onward. Thus, the changes made have a more positive influence on model performance than the changes to the overall relative bias and percent error statistics would suggest.
- Greenhills Creek Sediment Pond Decant (GH_GH1) at GHO where the relative bias increased from 1.0 to 1.2 and the percent error increased from 31% to 34% (Table 3-2). Similar to nitrate, these changes are due to updates made to the model as part of the GHO Tailings Management Project for Existing Permitted Reserves.

The performance of the model in simulating concentrations is unchanged compared to that reported in Teck (2021a) at Fording River upstream of Kilmarnock Creek (FR_FR2).

Figure 3-2: Projected Selenium Concentrations in Clode Creek, Lake Mountain Pond, Greenhills Creek, and the Fording River between 2004 and 2020



GHO Fording River Compliance Point - Upper Fording River, 205 m d/s of Greenhills Creek (GH_FR1)

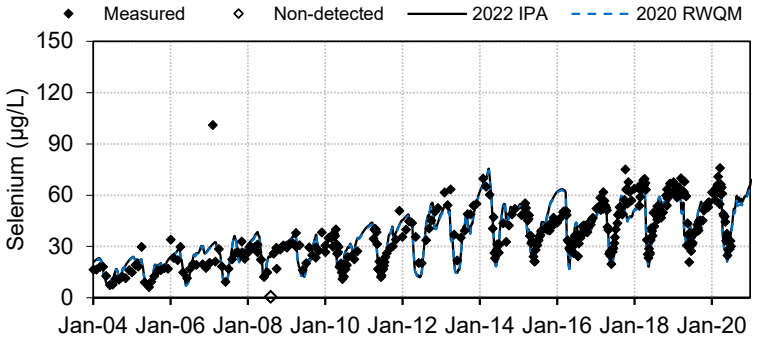


Table 3-2: Error and Bias Results for Selenium Calibration for the 2020 RWQM and 2022 IPA, 2004-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (µg/L)	Relative Bias[c]	Error[d] (µg/L)	Percent Error[e]	Bias[b] (µg/L)	Relative Bias[c]	Error[d] (µg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River Operations (FRO)	FR_HC1	Henretta Creek u/s of the Fording River	0.81	1.0	5.5	34%	0.81	1.0	5.5	34%	0%	0%
	FR_CC1	Clode Creek Sediment Pond Decant	9.9	1.1	41	49%	-2.4	0.97	41	49%	-12%	0%
	FR_LMP1	Lake Mountain Pond	-2.8	0.86	9.5	47%	-3.0	0.85	9.7	48%	-1%	2%
	FR_KC1	Kilmarnock Creek d/s of Rock Drain	-5.7	0.94	26	26%	-1.9	0.98	26	26%	4%	0%
	GH_SC1	Swift Creek Settling Pond Discharge	110	1.3	133	33%	109	1.3	132	33%	0%	0%
	GH_CC1	Cataract Creek Sediment Pond Decant	34	1.1	76	16%	34	1.1	76	16%	0%	0%
Greenhills Operations (GHO)	GH_PC1	Porter Creek Sediment Pond Decant	5.2	1.1	16	22%	5.2	1.1	16	22%	0%	0%
	GH_GH1	Greenhills Creek Sediment Pond Decant	1.6	1.0	25	31%	15	1.2	27	34%	20%	10%
	GH_LC1	Leask Creek Sediment Pond Decant	-14	0.78	28	44%	-14	0.78	28	44%	0%	0%
	GH_WC1	Wolfram Creek Sediment Pond Decant	5.3	1.1	31	56%	5.1	1.1	31	57%	0%	2%
	GH_TC1	Thompson Creek at LRP Road	-7.7	0.89	20	28%	-8.8	0.88	20	28%	-1%	0%
Line Creek Operations (LCO)	LC_DC3	Dry Creek u/s of East Tributary	0.091	1.0	3.7	56%	0.091	1.0	3.7	56%	0%	0%
	LC_DCDS	Dry Creek d/s of Sedimentation Ponds	0.39	1.1	3.4	51%	0.39	1.1	3.4	51%	0%	0%
	LC_DC1	Dry Creek near mouth (at bridge)	-0.056	0.98	1.7	56%	-0.056	0.98	1.7	56%	0%	0%
	LC_LCUSWLC	Line Creek u/s of West Line Creek	1.1	1.0	6.5	20%	1.1	1.0	6.5	20%	0%	0%
	LC_WLC	West Line Creek	-24	0.94	75	18%	-24	0.94	75	18%	0%	0%
	LC_LC3	Line Creek d/s of West Line Creek	-4.7	0.92	16	28%	-4.7	0.92	16	28%	0%	0%
	LC_LCDSSLCC (EMS E297110)	LCO Compliance Point (Line Creek d/s of South Line Creek confluence)	3.8	1.1	8.7	21%	3.8	1.1	8.7	21%	0%	0%
	LC_LC4	Line Creek u/s of Process Plant	2.0	1.1	7.6	24%	2.0	1.1	7.6	21%	0%	-13%
Elkview Operations (EVO)	EV_EC1	Erickson Creek at the Mouth	18	1.2	20	19%	19	1.2	20	19%	0%	0%
	EV_GT1	Gate Creek Sedimentation Pond Decant	2.4	1.0	37	32%	-3.2	0.97	38	33%	-3%	3%
	EV_BC1	Bodie Creek Sedimentation Pond Decant	0.9	1.0	45	31%	-14	0.91	45	31%	-9%	0%
	EV_DC1	EVO Dry Creek Sediment Pond Decant	-15	0.89	29	21%	-15	0.89	29	21%	0%	0%
	EV_HC1 (EMS E102682)	EVO Harmer Compliance Point (Harmer Creek Dam Spillway)	-2.3	0.92	8.2	28%	-2.3	0.92	8.2	28%	0%	0%
Fording River	FR_FR1	Fording River d/s of Henretta Creek	-0.34	0.97	4.1	37%	-0.34	0.97	4.1	37%	0%	0%
	FR_FR2	Fording River u/s Kilmarnock Creek	4.5	1.2	7.3	27%	4.5	1.2	7.0	27%	0%	0%
	FR_FR4	Fording River between Swift and Cataract Creeks	8.4	1.2	14	40%	8.2	1.2	14	40%	0%	0%
	FR_FRCP1[f]	Fording River, 525 m d/s of Cataract Creek	-49	0.61	63	51%	-50	0.6	64	51%	-2%	0%

Table 3-2: Error and Bias Results for Selenium Calibration for the 2020 RWQM and 2022 IPA, 2004-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (µg/L)	Relative Bias[c]	Error[d] (µg/L)	Percent Error[e]	Bias[b] (µg/L)	Relative Bias[c]	Error[d] (µg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River	GH_PC2	Fording River d/s of Porter Creek	0.33	1.0	11	19%	0.33	1.0	10	19%	0%	0%
	FR_FRABCH (EMS E223753)	FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek)	-1.5	0.98	11	15%	-1.8	0.98	11	16%	0%	7%
	LC_FRDSDC	Fording River d/s of Dry Creek	2.1	1.1	6.4	17%	1.7	1.0	6.3	16%	-9%	-6%
	GH_FR1 (EMS 0200378)	GHO Fording River Compliance Point - Upper Fording River, 205 m d/s of Greenhills Creek	-0.23	0.99	5.9	17%	0.2	1.0	5.9	17%	1%	0%
	LC_LC5 (EMS 0200028)	Fording River d/s of Line Creek	-0.31	0.99	4.8	16%	-0.035	1.0	4.8	16%	1%	0%
Michel Creek	**CM_MC2 (EMS E258937)**	CMO Compliance Point (Michel Creek d/s of CMO near Andy Goode Creek junction)	5.3	2.0	5.3	100%	5.3	2.0	5.3	100%	0%	0%
	EV_MC3	Michel Creek u/s of Erickson Creek	0.87	1.7	0.99	79%	0.87	1.7	0.99	79%	0%	0%
	EV_MC2 (EMS E300091)	EVO Michel Creek Compliance Point	-4.9	0.66	5.3	37%	-5.2	0.64	5.5	39%	-3%	-5%
	EV_MC1	Michel Creek u/s of Highway 43 Bridge	4.3	1.6	4.6	60%	4.0	1.5	4.3	57%	-6%	-5%
Elk River	**GH_ERC**	GHO Elk River Compliance Point - Elk River, 220 m d/s of Thompson Creek	0.56	1.3	0.85	52%	0.53	1.3	0.82	51%	0%	-2%
	GH_ER1 (EMS E206661)	Elk River u/s of Boivin Creek (u/s of Fording River)	-0.031	0.98	0.42	30%	-0.05	0.96	0.41	30%	-2%	0%
	EV_ER4 (EMS 0200389)	Elk River u/s of Grave Creek (from Fording River to Michel Creek)	-0.017	1.0	2.5	24%	0.11	1.0	2.6	25%	0%	4%
	EV_ER2	Elk River u/s of Michel Creek	0.11	1.0	1.9	23%	0.21	1.0	1.9	23%	0%	0%
	EV_ER1 (EMS 0200393)	Elk River d/s of Michel Creek	0.63	1.1	1.7	21%	0.62	1.1	1.7	21%	0%	0%
	RG_ELKORES	Elk River at Elko Reservoir	0.29	1.0	0.9	14%	0.28	1.0	0.92	14%	0%	0%
	RG_ELKMOUTH	Elk River at Highway 93 near Elko	0.23	1.0	0.76	16%	0.22	1.0	0.75	16%	0%	0%
Koocanusa Reservoir	**RG_DSELK (EMS E300230)[g]**	Koocanusa Reservoir - South of the Elk River	0.012	1.0	0.16	14%	0.01	1.0	0.15	14%	0%	0%

(a) The difference in relative bias was calculated using the following equation: (Relative $Bias_{2022\ IPA}$ – Relative $Bias_{2020\ RWQM}$)/Relative $Bias_{2020\ RWQM}$ x 100. The difference in percent error was calculated using the following equation: (Percent $Error_{2022\ IPA}$ – Percent $Error_{2020\ RWQM}$)/Percent $Error_{2020\ RWQM}$ x 100.

(b) Bias represents the average difference between simulated and measured concentrations. A positive bias indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.

(c) A relative bias greater than one indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.

(d) The error represents the average absolute difference between simulated and measured concentrations.

(e) The percent error represents the ratio of the error to the average measured concentration.

(f) Simulated concentrations at FR_FRCP1 reflect fully mixed conditions, whereas measured data collected during low flow periods reflect primarily the quality of Cataract Creek water; hence, the difference between simulated concentrations and measured data during low flow periods.

(g) The comparison of simulated to measured data considers measured data at the four stations located downstream of the Elk River: RG_DSELK, RG_GRASMERE, RG_USGOLD and RG_BORDER.

CMO = Coal Mountain Operations; d/s = downstream; u/s = upstream; m = metre; µg/L = micrograms per litre.

Note: Sites in **bold** font correspond to Order Stations and Compliance Points listed in EMA Permit 107517; Order Stations are indicated by underlined font.

3.3 Sulphate

Model performance for sulphate over the calibration period is almost identical to that in the *2020 Elk Valley Regional Water Quality Model Update* (Teck 2021a) in most mine-affected tributaries and in the Fording River and Elk River. Simulated results in mine-affected tributaries and the Fording River and Elk River continue to match reasonably well with measured data, in terms of replicating the range of measured concentrations and matching seasonal, yearly and longer-term trends. Comparisons of model outputs to monitored data are shown for selected locations in Figure 3-3; comparable plots for all modelled locations are included in Appendix C.

The performance of the model in simulating concentrations of sulphate has improved compared to that reported in Teck (2021a) at the GHO Fording River Compliance Point (GH_FR1; 0200378) where the relative bias increased from 0.95 to 0.97, while the percent error is unchanged (Table 3-2). Similar to selenium, this change is due to updates made to the model as part of the FRO-N SRF Phase 2 Project and the GHO Tailings Management Project for Existing Permitted Reserves.

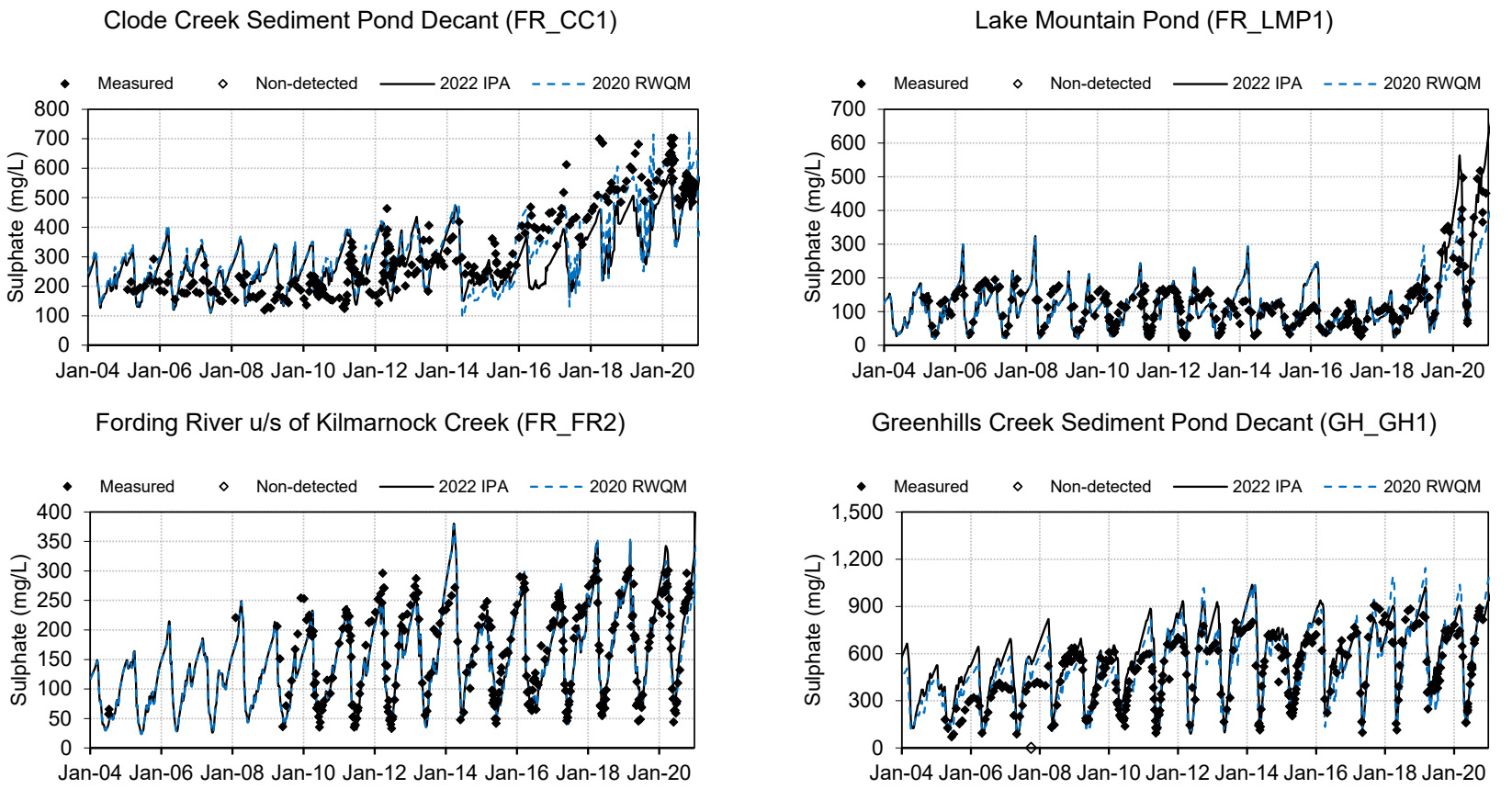
The performance of the model in simulating concentrations of sulphate has weakened compared to that reported in Teck (2021a) at the following locations:

- Lake Mountain Pond (FR_LMP1) at FRO where the percent error increased from 32% to 33%, while the relative bias is unchanged (Table 3-3). Similar to selenium, these changes are due to adjustments made to the model as part of the FRO-N SRF Phase 2 Project.
- Greenhills Creek Sediment Pond Decant (GH_GH1) at GHO where the relative bias increased from 1.0 to 1.2 and the percent error increased from 21% to 27% (Table 3-3). Similar to selenium, these changes are due to updates made to the model as part of the GHO Tailings Management Project for Existing Permitted Reserves.

The performance of the model in simulating concentrations has changed compared to that reported in Teck (2021a) at Clode Creek Sediment Pond Decant (FR_CC1) at FRO where the relative bias decreased from 1.1 to 0.99, while the percent error increased from 34% to 36% (Table 3-3). Similar to selenium, these changes are due to updates made to the model as part of the FRO-N SRF Phase 2 Project.

The performance of the model in simulating concentrations of selenium is unchanged compared to that reported in Teck (2021a) at Fording River upstream of Kilmarnock Creek (FR_FR2).

Figure 3-3: Projected Sulphate Concentrations in Clode Creek, Lake Mountain Pond, Greenhills Creek, and the Fording River between 2004 and 2020



GHO Fording River Compliance Point - Upper Fording River, 205 m d/s of Greenhills Creek (GH_FR1)

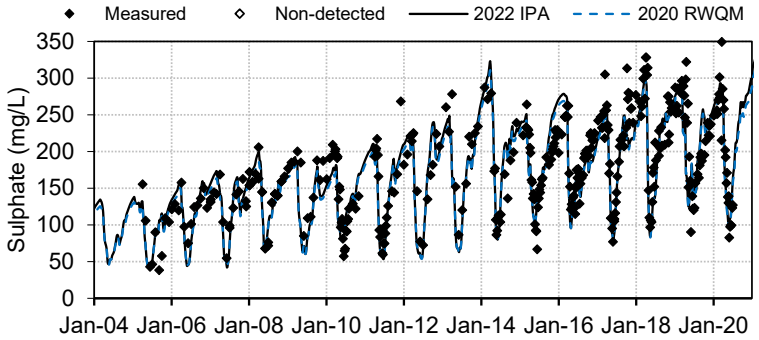


Table 3-3: Error and Bias Results for Sulphate Calibration for the 2020 RWQM and 2022 IPA, 2004-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River Operations (FRO)	FR_HC1	Henretta Creek u/s of the Fording River	1.6	1.0	30	28%	1.6	1.0	30	28%	0%	0%
	FR_CC1	Clode Creek Sediment Pond Decant	20	1.1	91	34%	-3.9	0.99	97	36%	-10%	6%
	FR_LMP1	Lake Mountain Pond	-5.5	0.94	32	32%	-6.3	0.94	32	33%	0%	3%
	FR_KC1	Kilmarnock Creek d/s of Rock Drain	-14	0.96	61	19%	-2.8	0.99	65	20%	3%	5%
	GH_SC1	Swift Creek Settling Pond Discharge	254	1.2	287	27%	254	1.2	287	27%	0%	0%
	GH_CC1	Cataract Creek Sediment Pond Decant	170	1.1	210	15%	170	1.1	210	15%	0%	0%
Greenhills Operations (GHO)	GH_PC1	Porter Creek Sediment Pond Decant	43	1.1	84	22%	43	1.1	84	22%	0%	0%
	GH_GH1	Greenhills Creek Sediment Pond Decant	21	1.0	96	21%	80	1.2	120	27%	20%	29%
	GH_LC1	Leask Creek Sediment Pond Decant	-36	0.91	117	28%	-36	0.91	117	28%	0%	0%
	GH_WC1	Wolfram Creek Sediment Pond Decant	53	1.1	157	36%	53	1.1	156	36%	0%	0%
	GH_TC1	Thompson Creek at LRP Road	11	1.0	93	21%	4.9	1.0	92	21%	0%	0%
Line Creek Operations (LCO)	LC_DC3	Dry Creek u/s of East Tributary	-5.9	0.78	11	40%	-5.9	0.78	11	40%	0%	0%
	LC_DCDS	Dry Creek d/s of Sedimentation Ponds	-5.5	0.8	10	37%	-5.5	0.8	10	37%	0%	0%
	LC_DC1	Dry Creek near mouth (at bridge)	-0.71	0.94	3.3	28%	-0.71	0.94	3.3	28%	0%	0%
	LC_LCUSWLC	Line Creek u/s of West Line Creek	-3.7	0.98	31	16%	-3.7	0.98	31	16%	0%	0%
	LC_WLC	West Line Creek	-81	0.91	158	17%	-81	0.91	158	17%	0%	0%
	LC_LC3	Line Creek d/s of West Line Creek	-34	0.87	47	18%	-31	0.88	47	19%	1%	6%
	LC_LCDSSLCC (EMS E297110)	LCO Compliance Point (Line Creek d/s of South Line Creek confluence)	-17	0.92	35	17%	-12	0.94	34	16%	2%	-6%
	LC_LC4	Line Creek u/s of Process Plant	-11	0.93	24	16%	-9.0	0.94	25	16%	1%	0%
Elkview Operations (EVO)	EV_EC1	Erickson Creek at the Mouth	33	1.1	62	10%	33	1.1	62	10%	0%	0%
	EV_GT1	Gate Creek Sedimentation Pond Decant	28	1.0	175	25%	15	1.0	184	26%	0%	4%
	EV_BC1	Bodie Creek Sedimentation Pond Decant	38	1.1	198	30%	-2.9	1.0	206	31%	-9%	3%
	EV_DC1	EVO Dry Creek Sediment Pond Decant	77	1.1	118	18%	77	1.1	118	18%	0%	0%
	EV_HC1 (EMS E102682)	EVO Harmer Compliance Point (Harmer Creek Dam Spillway)	2.0	1.0	41	25%	2.0	1.0	41	25%	0%	0%
Fording River	FR_FR1	Fording River d/s of Henretta Creek	-0.76	0.99	19	25%	-0.77	0.99	19	25%	0%	0%
	FR_FR2	Fording River u/s Kilmarnock Creek	-8.2	0.95	27	17%	-7.4	0.95	26	17%	0%	0%
	FR_FR4	Fording River between Swift and Cataract Creeks	7.8	1.0	37	22%	8.2	1.0	37	22%	0%	0%
	FR_FRCP1[f]	Fording River, 525 m d/s of Cataract Creek	-158	0.65	202	45%	-1.6	0.64	203	45%	-2%	0%

Table 3-3: Error and Bias Results for Sulphate Calibration for the 2020 RWQM and 2022 IPA, 2004-2018

Operation	Node	Node Description	2020 Regional Water Quality Model Update				2022 Implementation Plan Adjustment				Difference[a]	
			Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Bias[b] (mg/L)	Relative Bias[c]	Error[d] (mg/L)	Percent Error[e]	Relative Bias	Percent Error
Fording River	GH_PC2	Fording River d/s of Porter Creek	7.6	1.0	39	15%	8.5	1.0	39	15%	0%	0%
	FR_FRABCH (EMS E223753)	FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek)	15	1.1	37	14%	15	1.1	36	14%	0%	0%
	LC_FRDSDC	Fording River d/s of Dry Creek	18	1.1	26	17%	17	1.1	26	17%	0%	0%
	GH_FR1 (EMS 0200378)	GHO Fording River Compliance Point - Upper Fording River, 205 m d/s of Greenhills Creek	-8.8	0.95	22	13%	-5.2	0.97	22	13%	2%	0%
	LC_LC5 (EMS 0200028)	Fording River d/s of Line Creek	-5.8	0.96	18	13%	-2.1	0.99	19	13%	3%	0%
Michel Creek	**CM_MC2 (EMS E258937)**	CMO Compliance Point (Michel Creek d/s of CMO near Andy Goode Creek junction)	49	1.2	72	31%	49	1.2	72	31%	0%	0%
	EV_MC3	Michel Creek u/s of Erickson Creek	15	1.4	18	51%	15	1.4	18	51%	0%	0%
	EV_MC2 (EMS E300091)	EVO Michel Creek Compliance Point	-7.7	0.94	30	24%	-9.1	0.93	29	24%	-1%	0%
	EV_MC1	Michel Creek u/s of Highway 43 Bridge	26	1.4	28	44%	25	1.4	28	43%	0%	-2%
Elk River	**GH_ERC**	GHO Elk River Compliance Point - Elk River, 220 m d/s of Thompson Creek	11	1.4	11	38%	11	1.4	11	38%	0%	0%
	GH_ER1 (EMS E206661)	Elk River u/s of Boivin Creek (u/s of Fording River)	4.6	1.2	5.8	24%	4.4	1.2	5.7	23%	0%	-4%
	EV_ER4 (EMS 0200389)	Elk River u/s of Grave Creek (from Fording River to Michel Creek)	-0.9	0.99	13	19%	0.54	1.0	13	20%	1%	5%
	EV_ER2	Elk River u/s of Michel Creek	2.8	1.0	13	22%	4.1	1.1	14	23%	10%	5%
	EV_ER1 (EMS 0200393)	Elk River d/s of Michel Creek	11	1.2	16	26%	12	1.2	17	27%	0%	4%
	RG_ELKORES	Elk River at Elko Reservoir	6.8	1.1	8.7	16%	7.2	1.1	8.9	17%	0%	6%
	RG_ELKMOUTH	Elk River at Highway 93 near Elko	5.5	1.1	7.7	19%	5.9	1.1	7.8	19%	0%	0%
Koocanusa Reservoir	**RG_DSELK (EMS E300230)[g]**	Koocanusa Reservoir - South of the Elk River	7.6	1.3	8.0	33%	7.6	1.3	8.1	33%	0%	0%

[a] The difference in relative bias was calculated using the following equation: (Relative $Bias_{2022\ IPA}$ – Relative $Bias_{2020\ RWQM}$)/Relative $Bias_{2020\ RWQM}$ x 100. The difference in percent error was calculated using the following equation: (Percent $Error_{2022\ IPA}$ – Percent $Error_{2020\ RWQM}$)/Percent $Error_{2020\ RWQM}$ x 100.
[b] Bias represents the average difference between simulated and measured concentrations. A positive bias indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.
[c] A relative bias greater than one indicates that modelled concentrations are greater, on average, than measured concentrations, whereas a negative bias indicates the reverse.
[d] The error represents the average absolute difference between simulated and measured concentrations.
[e] The percent error represents the ratio of the error to the average measured concentration.
[f] Simulated concentrations at FR_FRCP1 reflect fully mixed conditions, whereas measured data collected during low flow periods reflect primarily the quality of Cataract Creek water; hence, the difference between simulated concentrations and measured data during low flow periods.
[g] The comparison of simulated to measured data considers measured data at the four stations located downstream of the Elk River: RG_DSELK, RG_GRASMERE, RG_USGOLD and RG_BORDER.
CMO = Coal Mountain Operations; d/s = downstream; u/s = upstream; m = metre; mg/L = milligrams per litre.
Note: Sites in **bold** font correspond to Order Stations and Compliance Points listed in EMA Permit 107517; Order Stations are indicated by underlined font.

4 References

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APPENDIX A

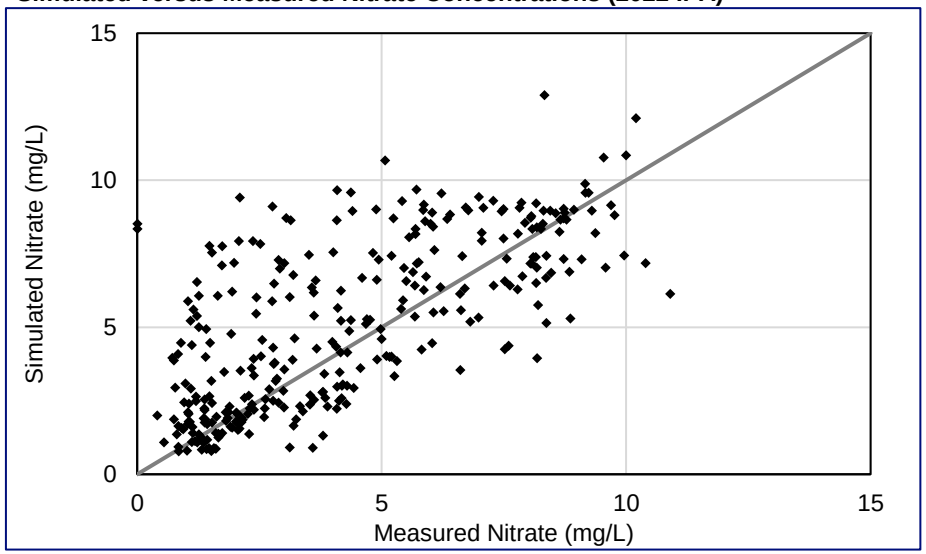
Model Calibration Results for Nitrate

A1-1: Nitrate Calibration Information for Node FR_HC1 - Henretta Creek u/s of Fording River (EMS E216778)

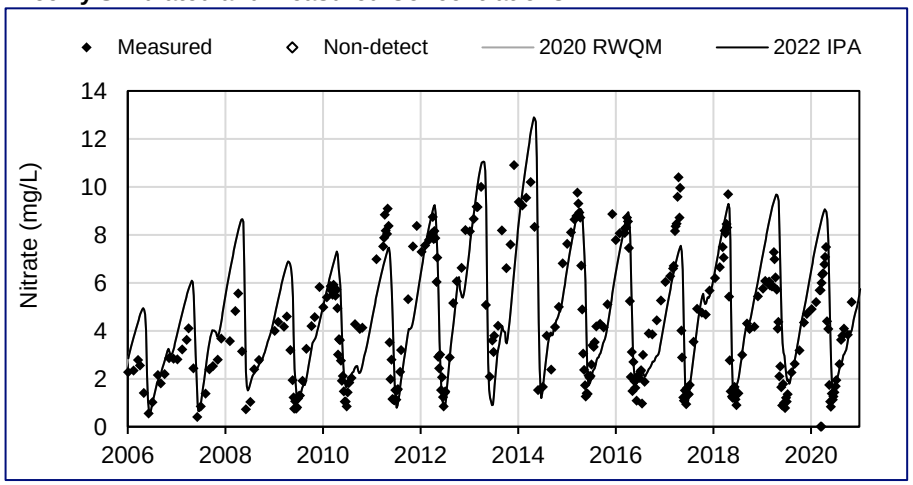
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	260	260
Non-Detect Count	0	0
Measured Mean (mg/L)	4.4	4.4
Simulated Mean (mg/L)	4.9	4.9
Bias (mg/L)	0.55	0.55
Relative Bias	1.1	1.1
Error (mg/L)	1.5	1.5
Percent Error	34%	34%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

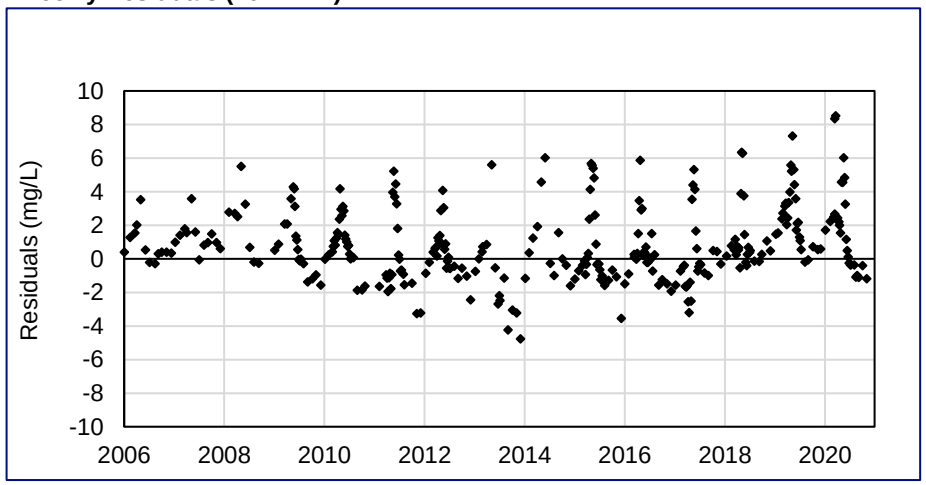


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



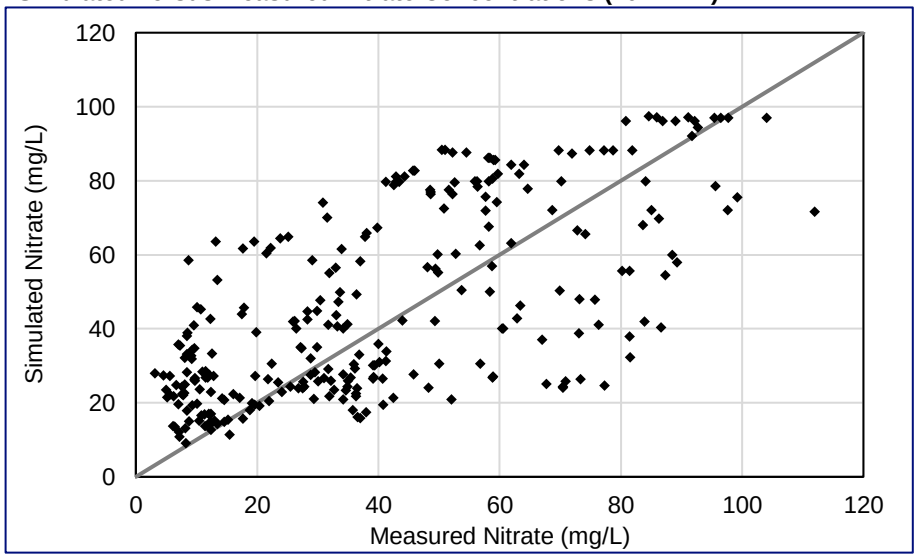
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-2: Nitrate Calibration Information for Node FR_CC1 - Clode Creek Sediment Pond Decant (EMS E102481)

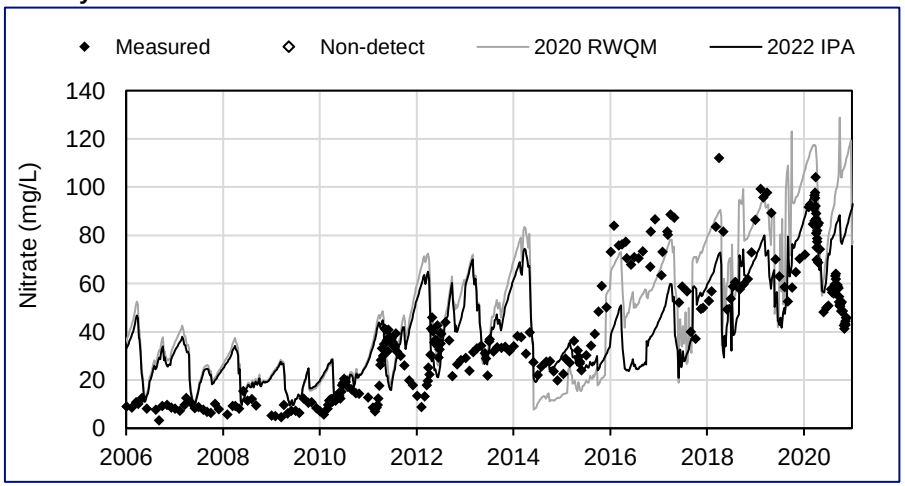
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	207	207
Non-Detect Count	0	0
Measured Mean (mg/L)	31	31
Simulated Mean (mg/L)	39	34
Bias (mg/L)	7.8	2.9
Relative Bias	1.3	1.1
Error (mg/L)	17	17
Percent Error	54%	55%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

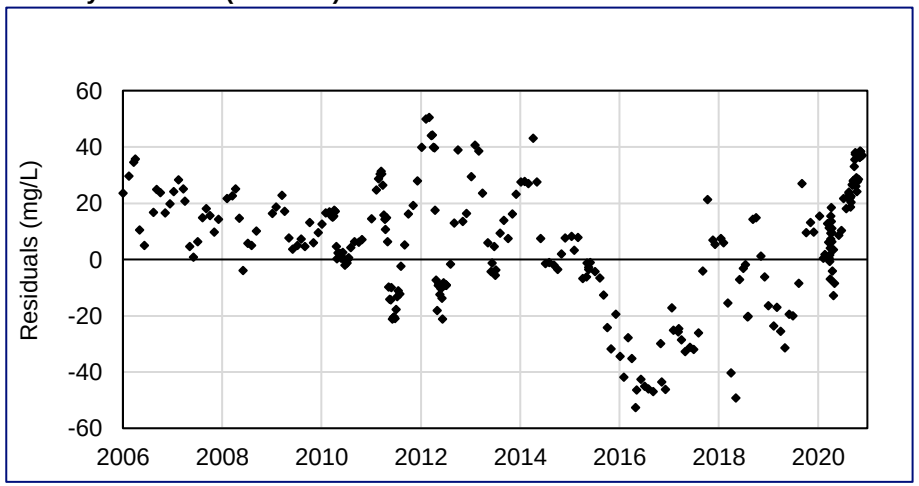


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



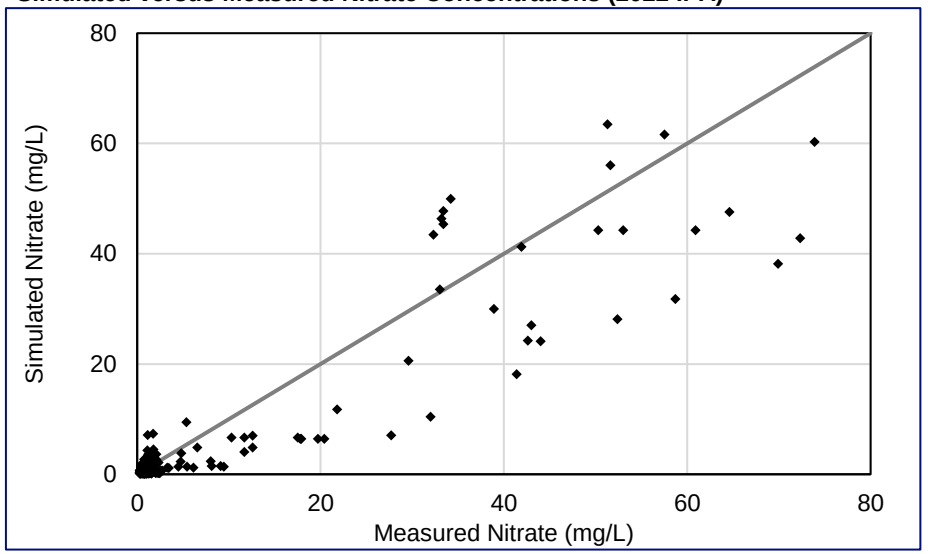
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-3: Nitrate Calibration Information for Node FR_LMP1 - Lake Mountain Pond

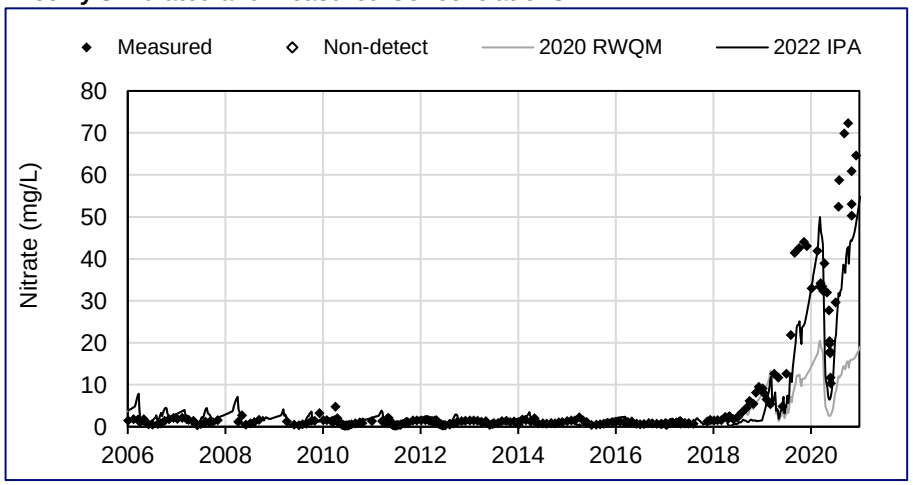
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/10/2018	12/10/2018
Data Points Available for Comparison, n	214	214
Non-Detect Count	0	0
Measured Mean (mg/L)	1.2	1.2
Simulated Mean (mg/L)	1.2	1.2
Bias (mg/L)	-0.0072	-0.083
Relative Bias	0.99	0.93
Error (mg/L)	0.77	0.86
Percent Error	62%	69%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

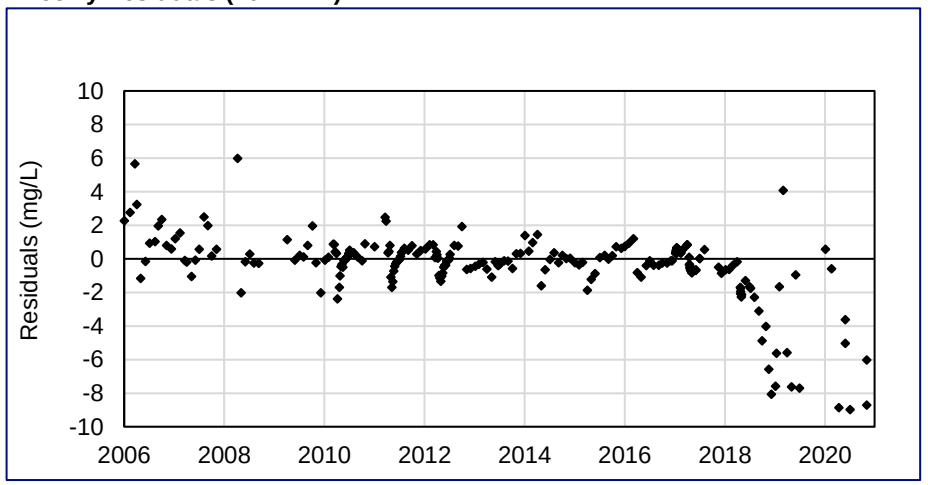


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



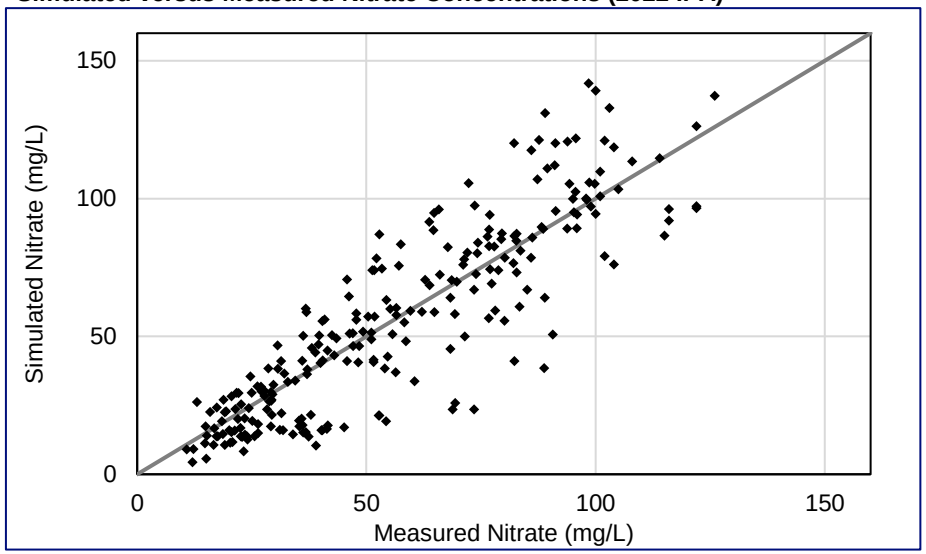
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-4: Nitrate Calibration Information for Node FR_KC1 - Kilmarnock Creek d/s of Rock Drain (EMS 0200252)

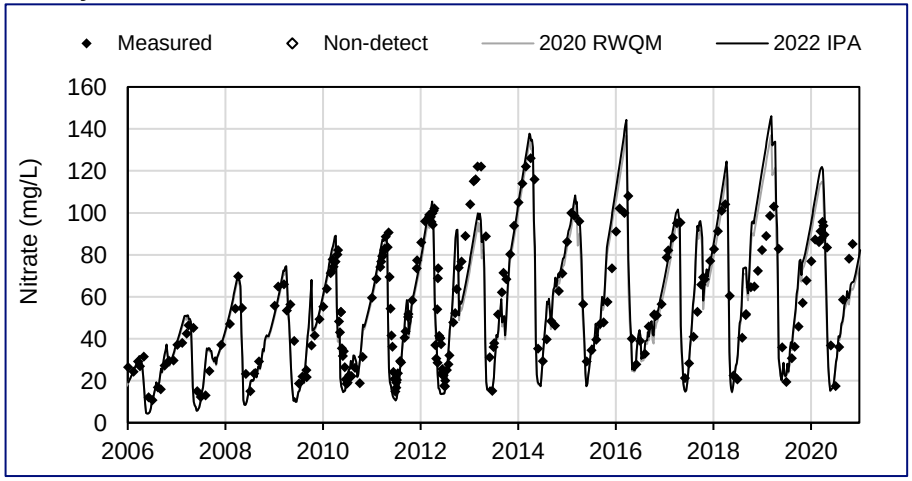
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	217	217
Non-Detect Count	0	0
Measured Mean (mg/L)	55	55
Simulated Mean (mg/L)	50	52
Bias (mg/L)	-4.3	-2.2
Relative Bias	0.92	0.96
Error (mg/L)	11	11
Percent Error	20%	20%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

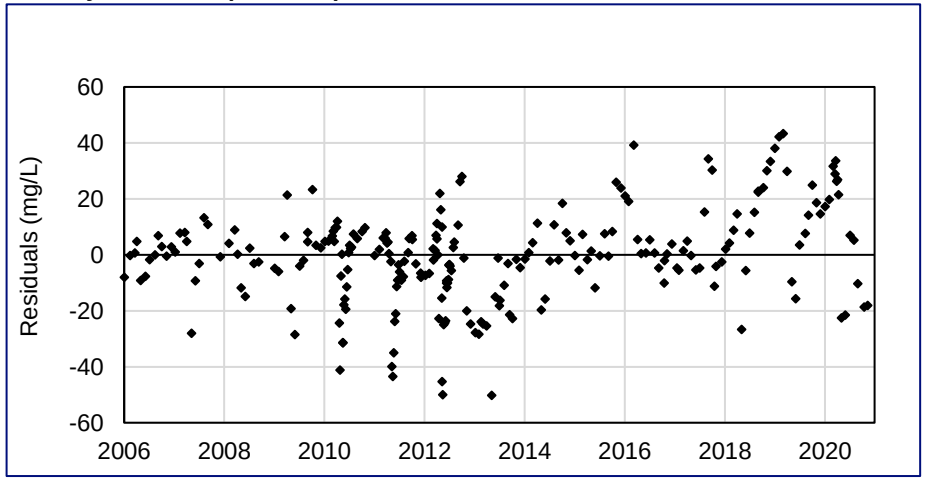


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



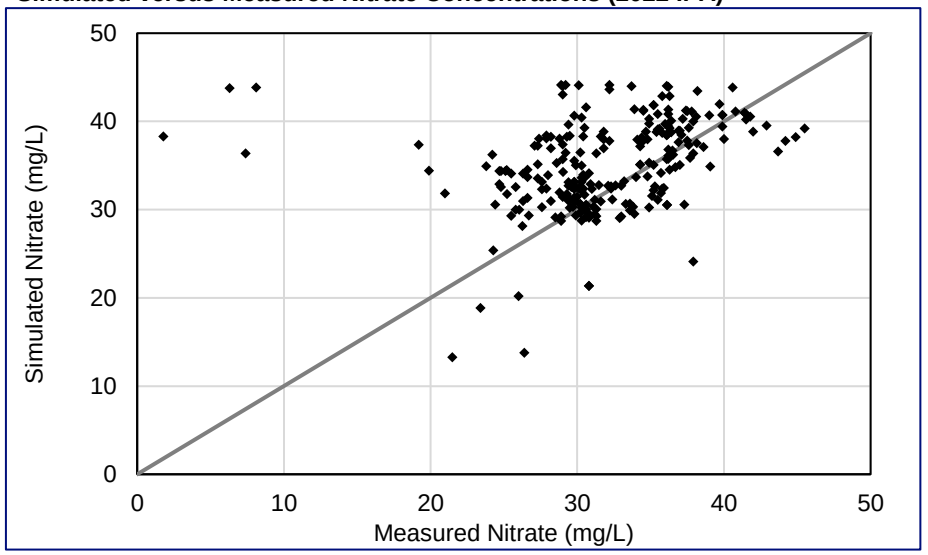
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-6: Nitrate Calibration Information for Node GH_CC1 - Cataract Creek Sediment Pond Decant (EMS 0200384)

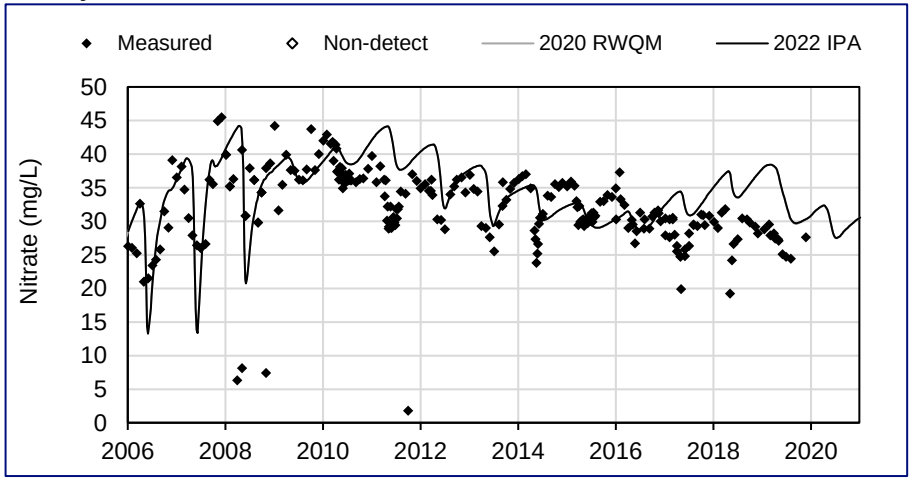
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	237	237
Non-Detect Count	0	0
Measured Mean (mg/L)	32	32
Simulated Mean (mg/L)	35	35
Bias (mg/L)	2.9	2.9
Relative Bias	1.1	1.1
Error (mg/L)	4.7	4.7
Percent Error	15%	15%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

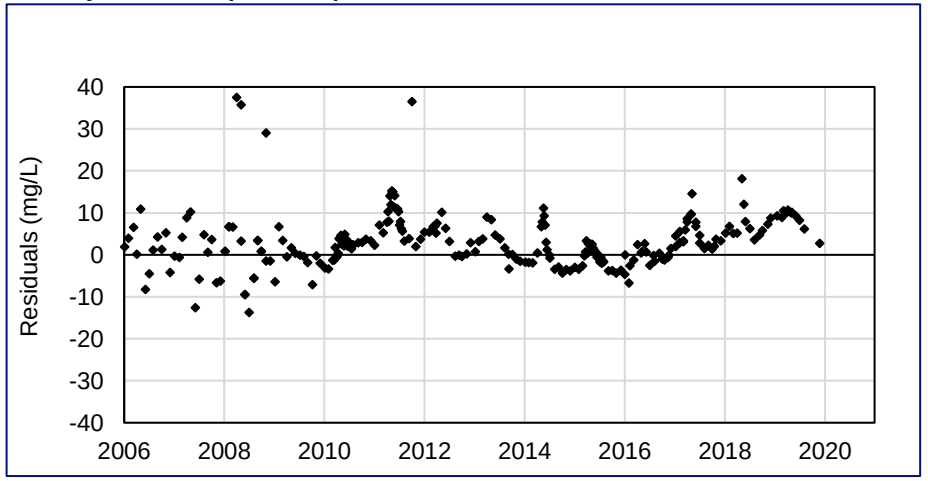


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



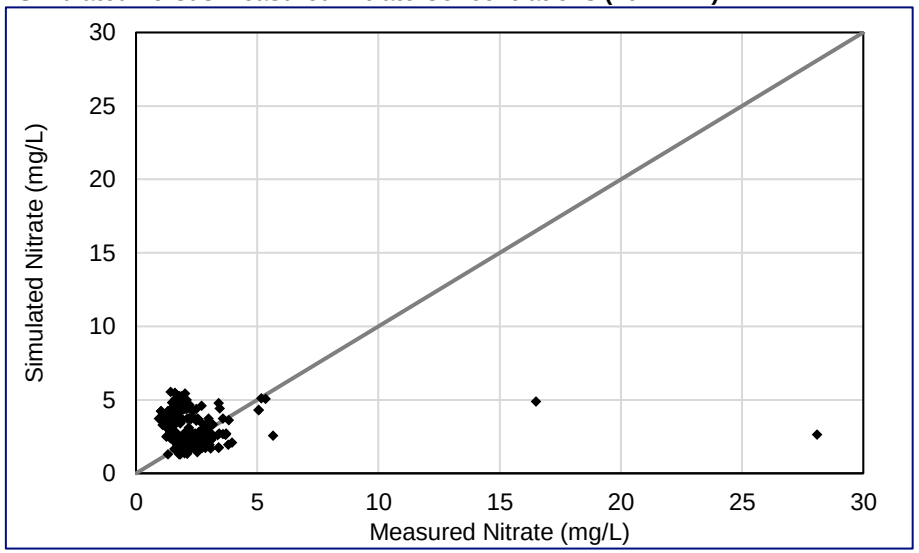
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-7: Nitrate Calibration Information for Node GH_PC1 - Porter Creek Sediment Pond Decant (EMS 0200385)

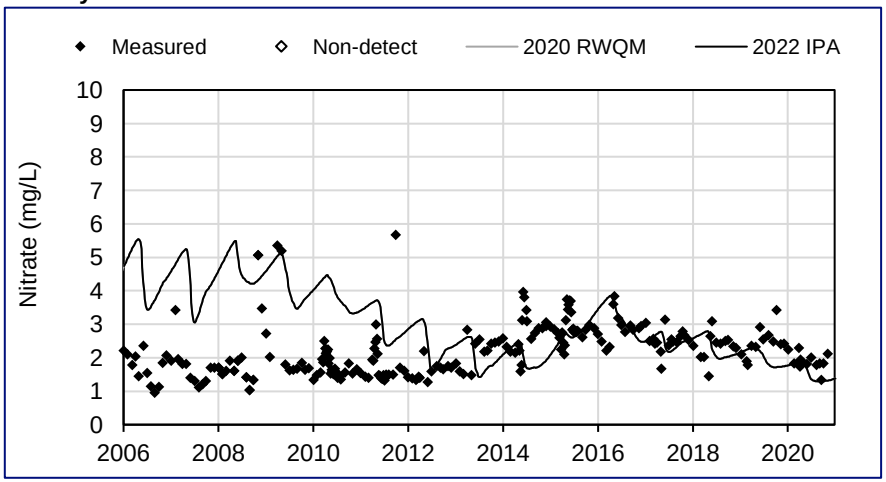
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	2006-01-04	2006-01-04
Last Measured Sample	2018-12-04	2018-12-04
Data Points Available for Comparison, n	223	223
Non-Detect Count	0	0
Measured Mean (mg/L)	2.4	2.4
Simulated Mean (mg/L)	3.2	3.2
Bias (mg/L)	0.86	0.86
Relative Bias	1.4	1.4
Error (mg/L)	1.6	1.6
Percent Error	65%	65%

Simulated versus Measured Nitrate Concentrations (2022 IPA)



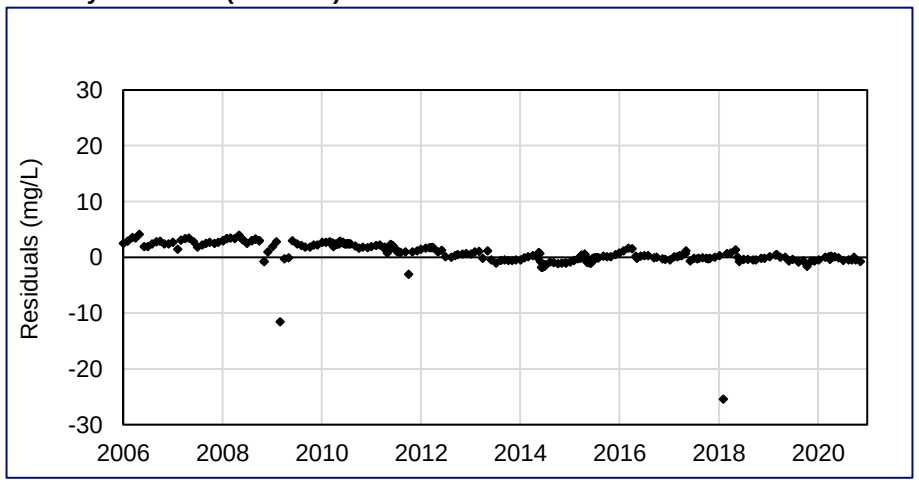
Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.

In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



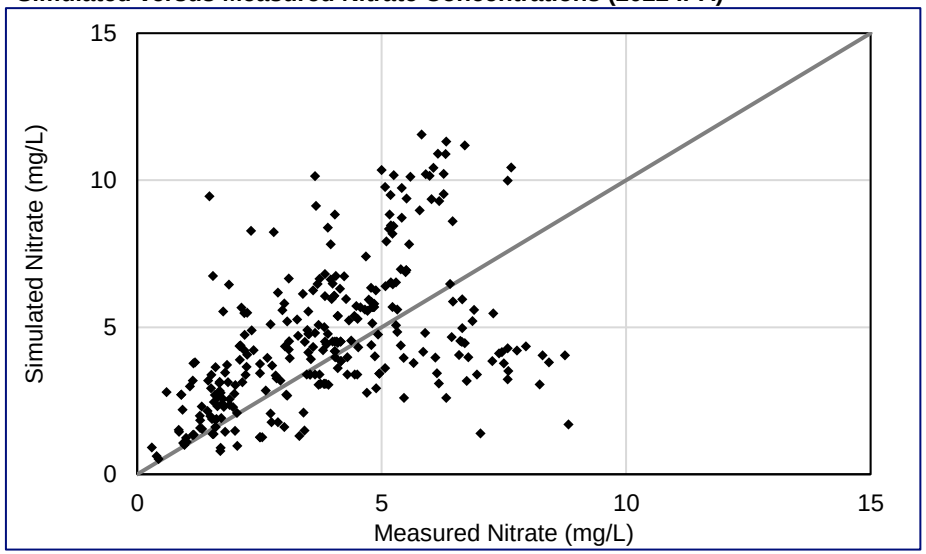
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-8: Nitrate Calibration Information for Node GH_GH1 - Greenhills Creek Sediment Pond Decant (EMS E102709)

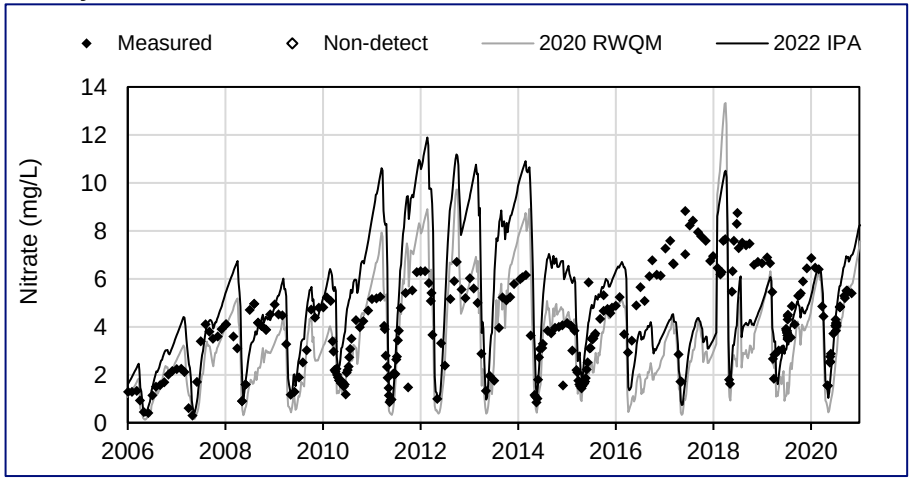
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	230	230
Non-Detect Count	0	0
Measured Mean (mg/L)	3.8	3.8
Simulated Mean (mg/L)	3.2	4.8
Bias (mg/L)	-0.55	1.0
Relative Bias	0.85	1.3
Error (mg/L)	1.5	2.1
Percent Error	39%	55%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

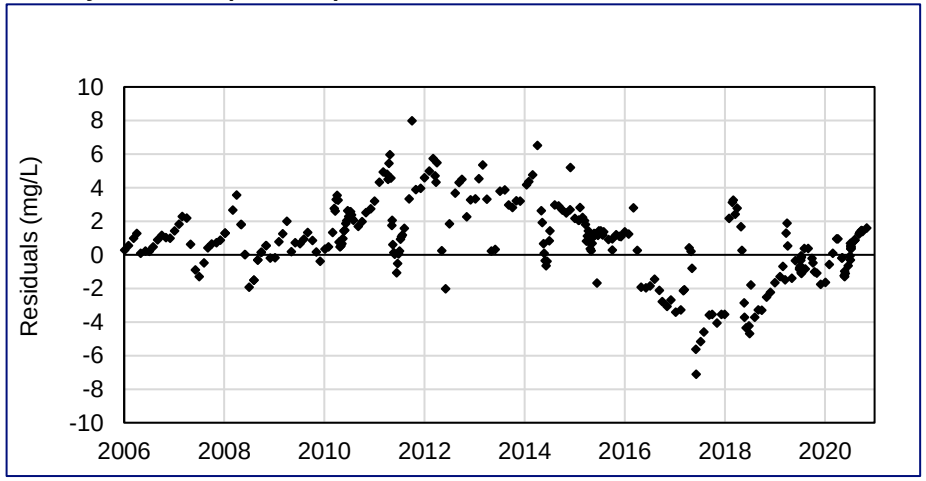


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



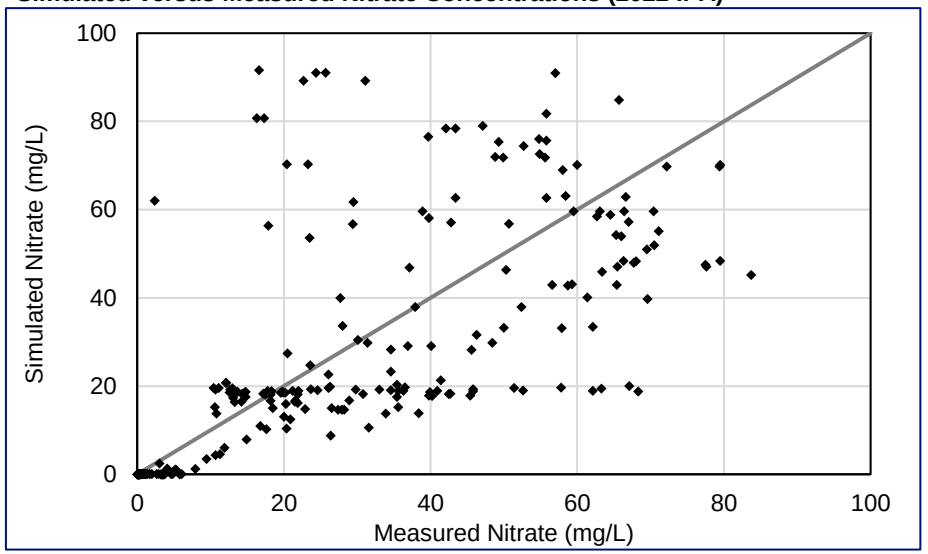
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-9: Nitrate Calibration Information for Node GH_LC1 - Leask Creek Sediment Pond Decant (EMS E257796)

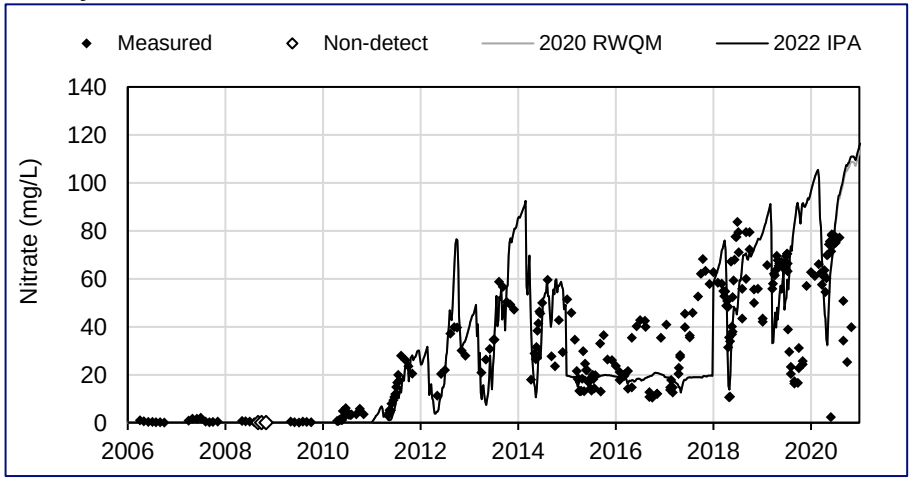
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	4/3/2006	4/3/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	199	199
Non-Detect Count	3	3
Measured Mean (mg/L)	26	26
Simulated Mean (mg/L)	22	22
Bias (mg/L)	-4.2	-4.2
Relative Bias	0.84	0.84
Error (mg/L)	10	10
Percent Error	39%	39%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

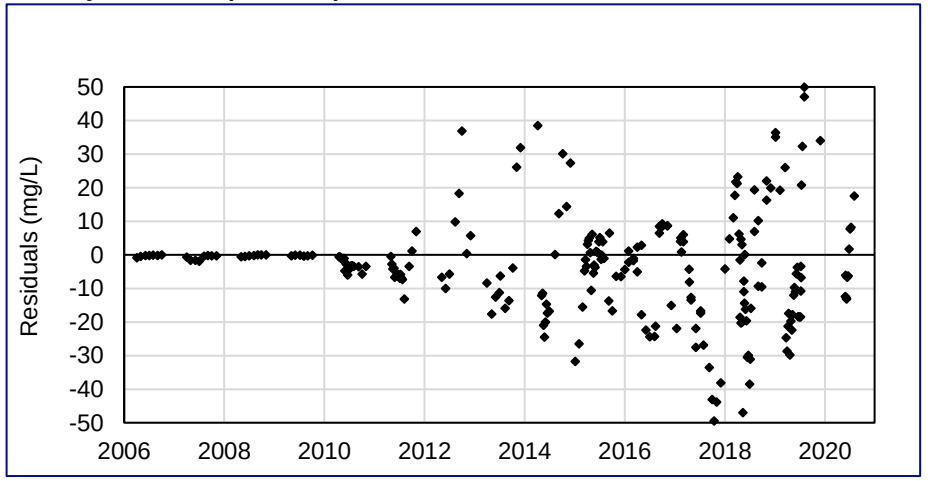


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



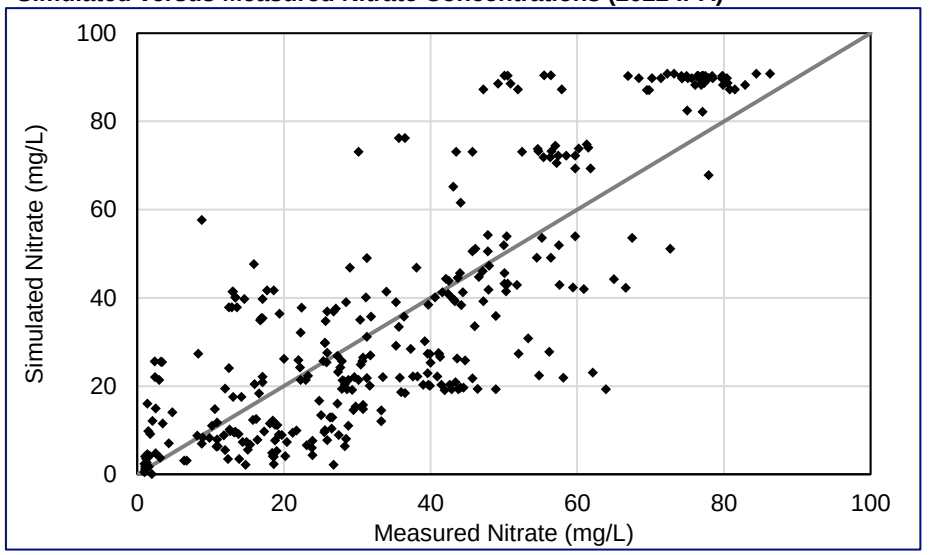
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-10: Nitrate Calibration Information for Node GH_WC1 - Wolfram Creek Sediment Pond Decant (EMS E257795)

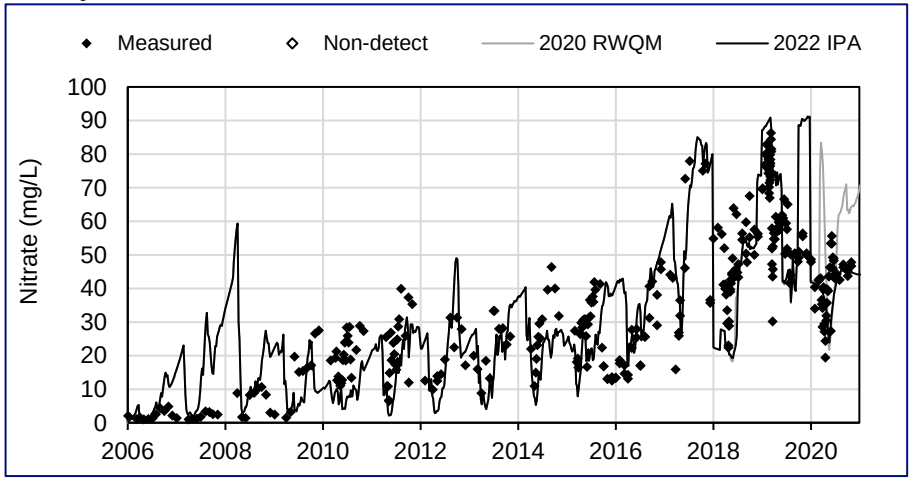
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	226	226
Non-Detect Count	0	0
Measured Mean (mg/L)	26	26
Simulated Mean (mg/L)	23	23
Bias (mg/L)	-2.9	-3.0
Relative Bias	0.89	0.88
Error (mg/L)	12	12
Percent Error	46%	46%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

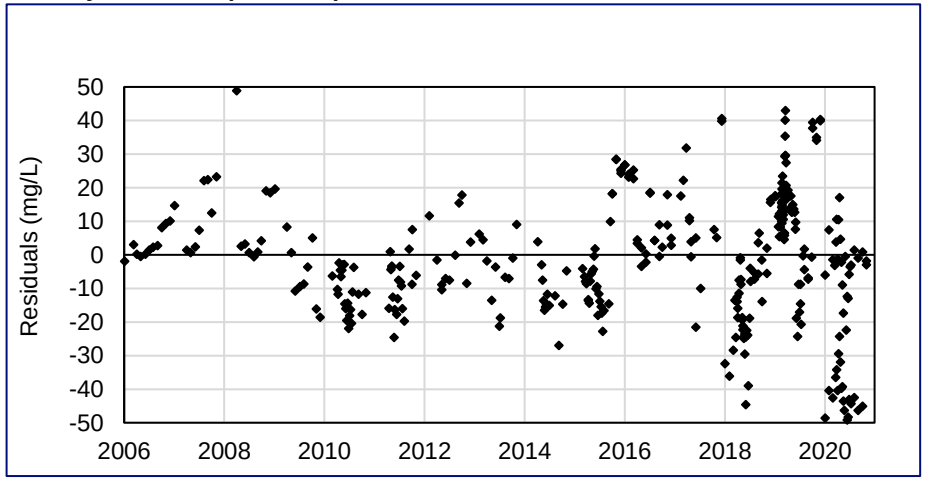


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



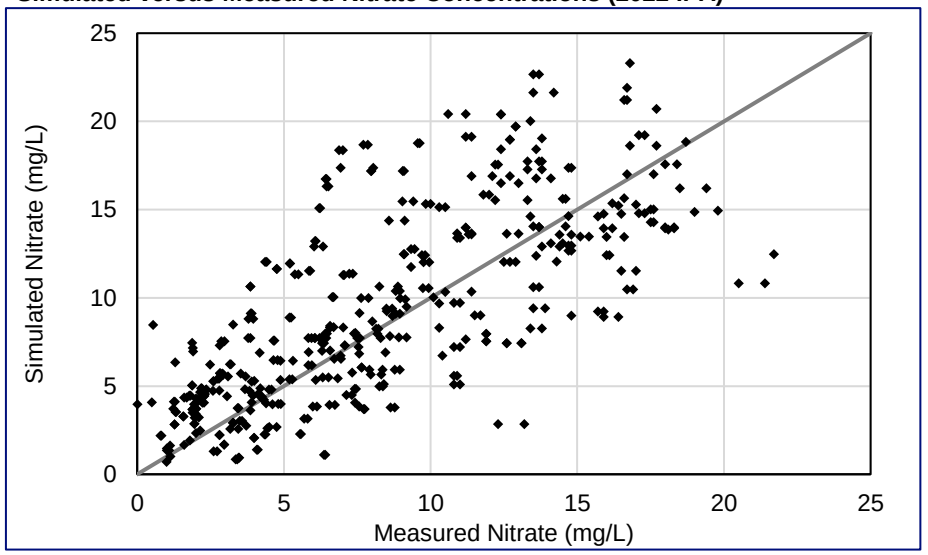
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-11: Nitrate Calibration Information for Node GH_TC1 - Thompson Creek at LRP Road (EMS E102714)

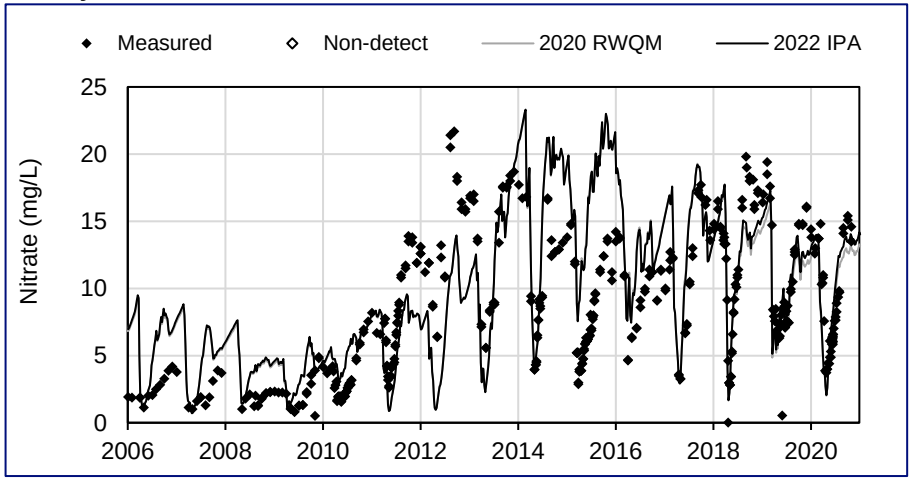
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	375	375
Non-Detect Count	0	0
Measured Mean (mg/L)	8.0	8.0
Simulated Mean (mg/L)	9.3	9.3
Bias (mg/L)	1.3	1.4
Relative Bias	1.2	1.2
Error (mg/L)	3.5	3.4
Percent Error	43%	43%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

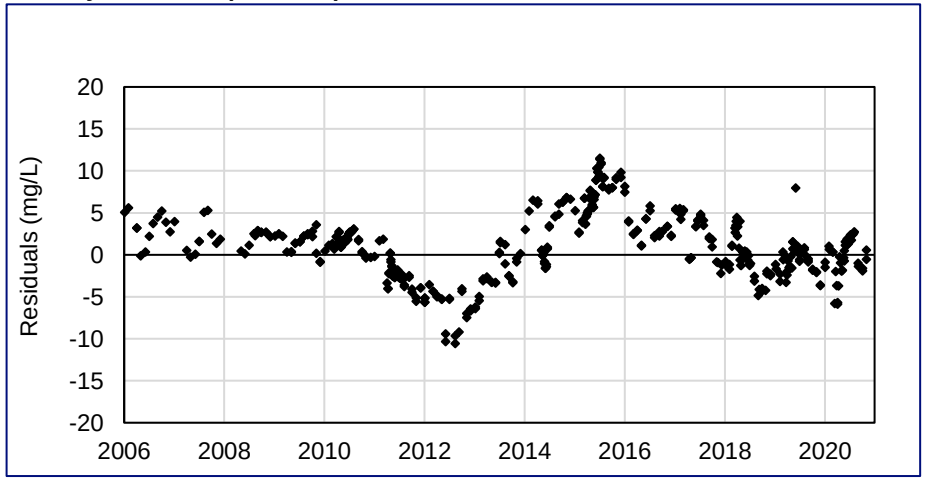


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



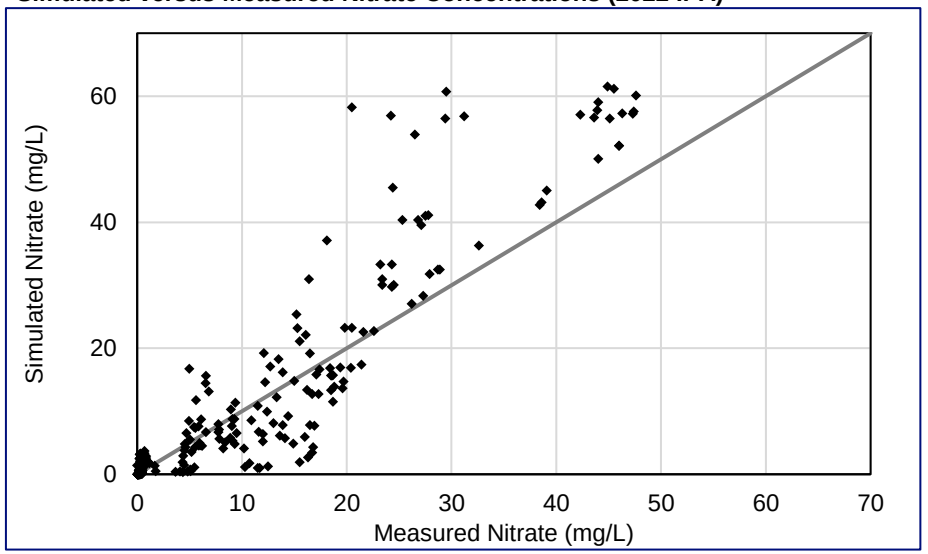
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-12: Nitrate Calibration Information for Node LC_DC3 - Dry Creek u/s of East Tributary (EMS E288273)

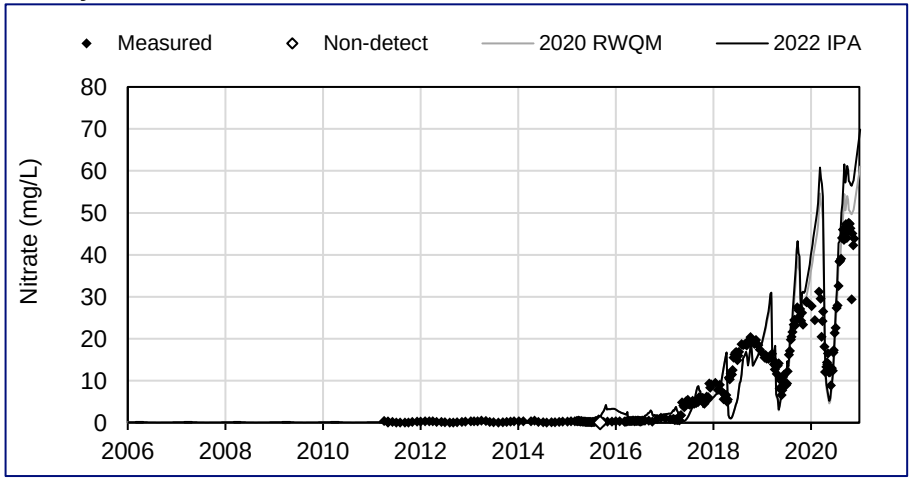
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	4/6/2011	4/6/2011
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	177	177
Non-Detect Count	1	1
Measured Mean (mg/L)	3.7	3.7
Simulated Mean (mg/L)	3.0	3.0
Bias (mg/L)	-0.74	-0.73
Relative Bias	0.8	0.8
Error (mg/L)	2.1	2.1
Percent Error	55%	55%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

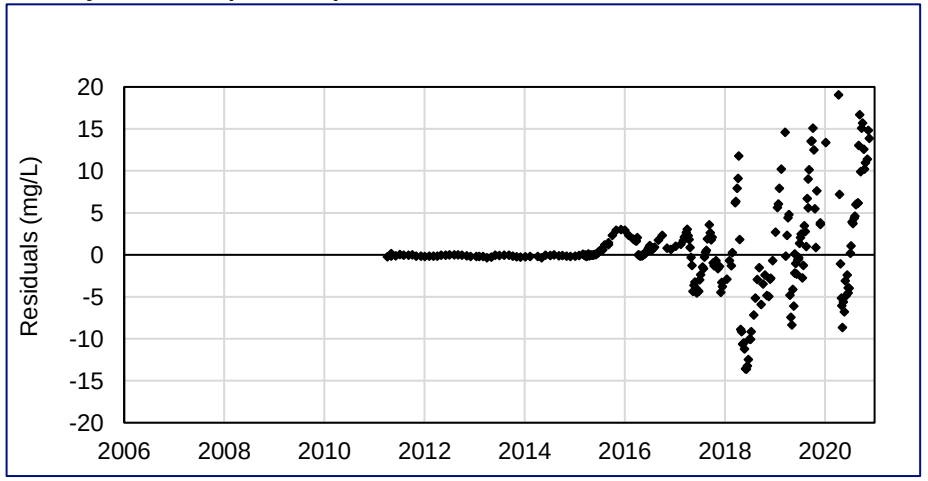


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



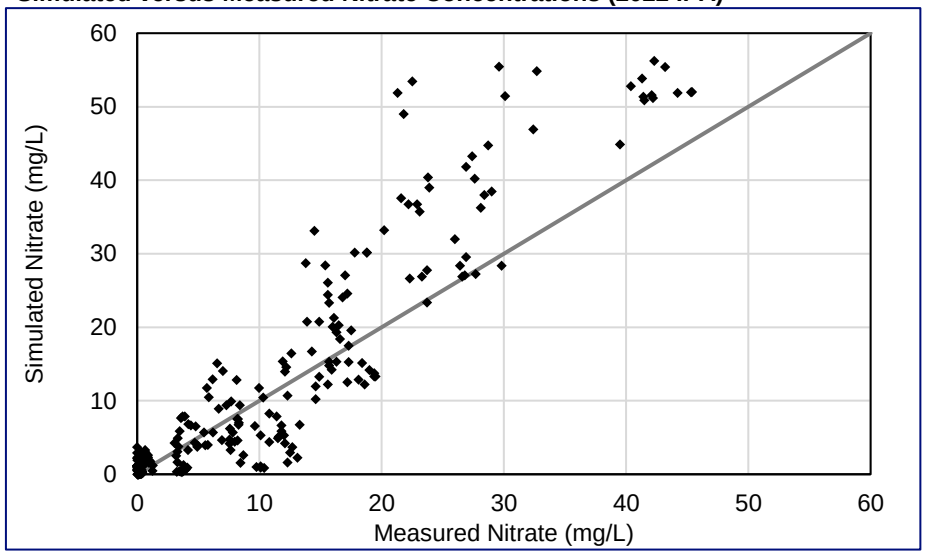
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-13: Nitrate Calibration Information for Node LC_DCDS - Dry Creek d/s of Sedimentation Ponds (EMS E295210)

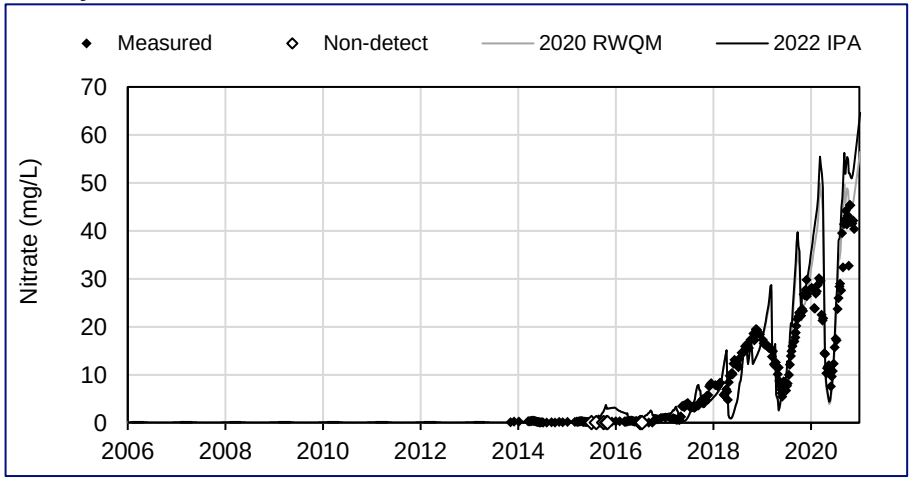
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	11/6/2013	11/6/2013
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	162	162
Non-Detect Count	8	8
Measured Mean (mg/L)	3.8	3.8
Simulated Mean (mg/L)	3.2	3.2
Bias (mg/L)	-0.59	-0.58
Relative Bias	0.84	0.85
Error (mg/L)	2.1	2.1
Percent Error	55%	55%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

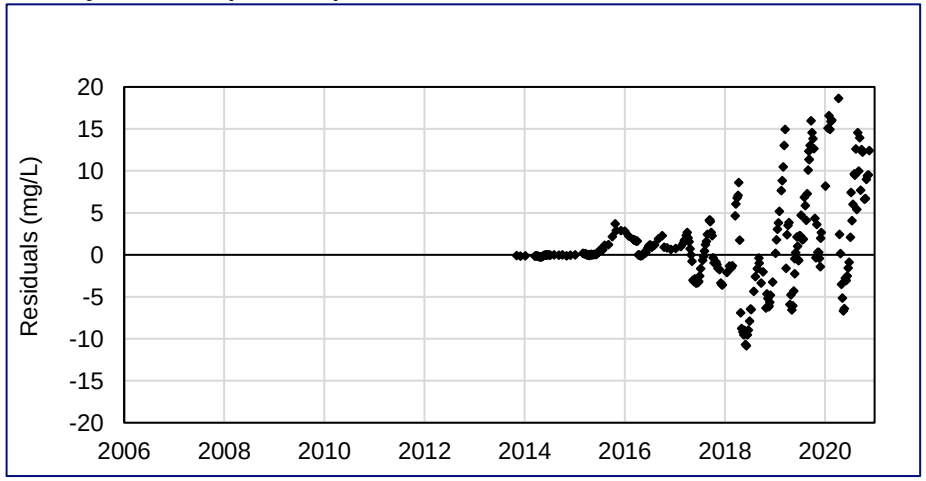


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



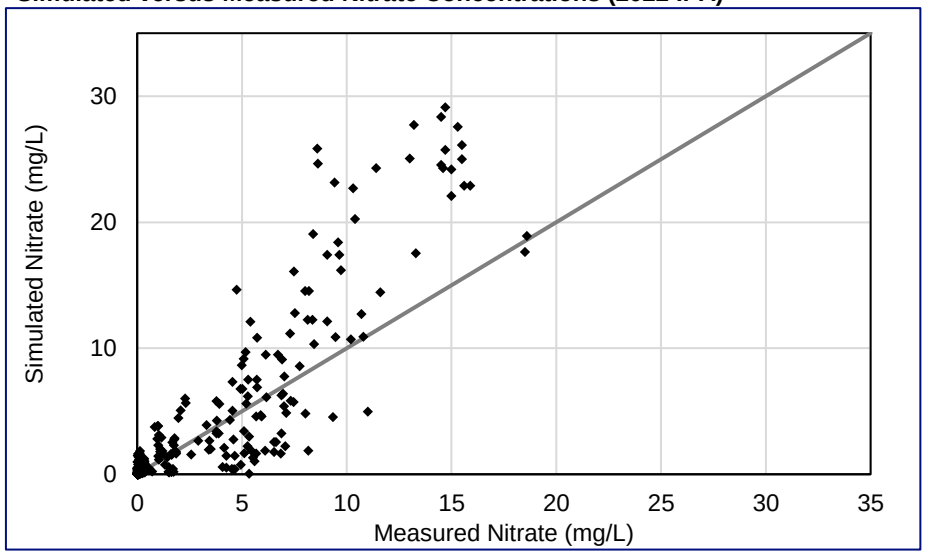
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-14: Nitrate Calibration Information for Node LC_DC1 - Dry Creek near mouth (at bridge) (EMS E288270)

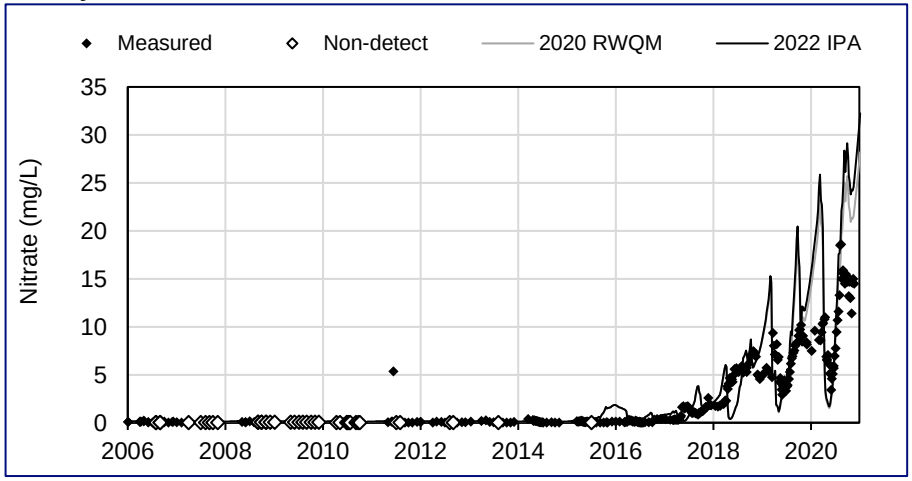
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	251	251
Non-Detect Count	42	42
Measured Mean (mg/L)	0.89	0.89
Simulated Mean (mg/L)	0.93	0.93
Bias (mg/L)	0.039	0.042
Relative Bias	1.0	1.0
Error (mg/L)	0.62	0.62
Percent Error	69%	69%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

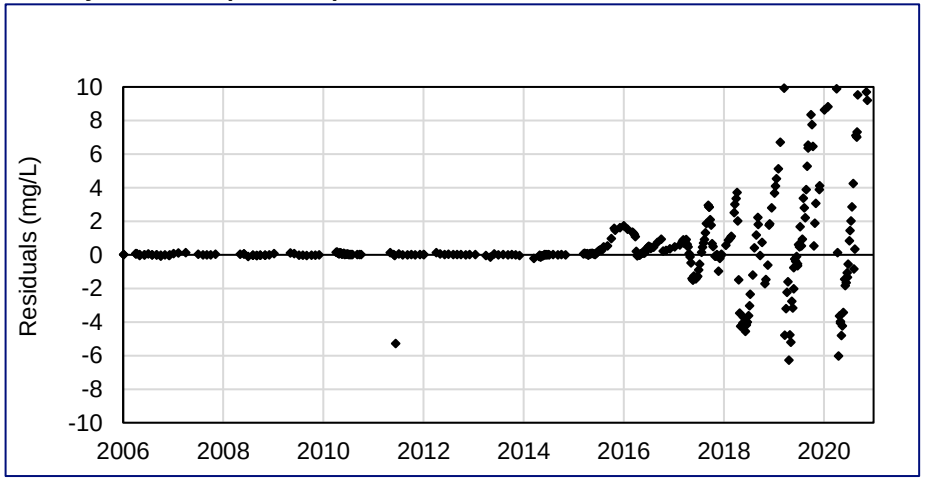


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



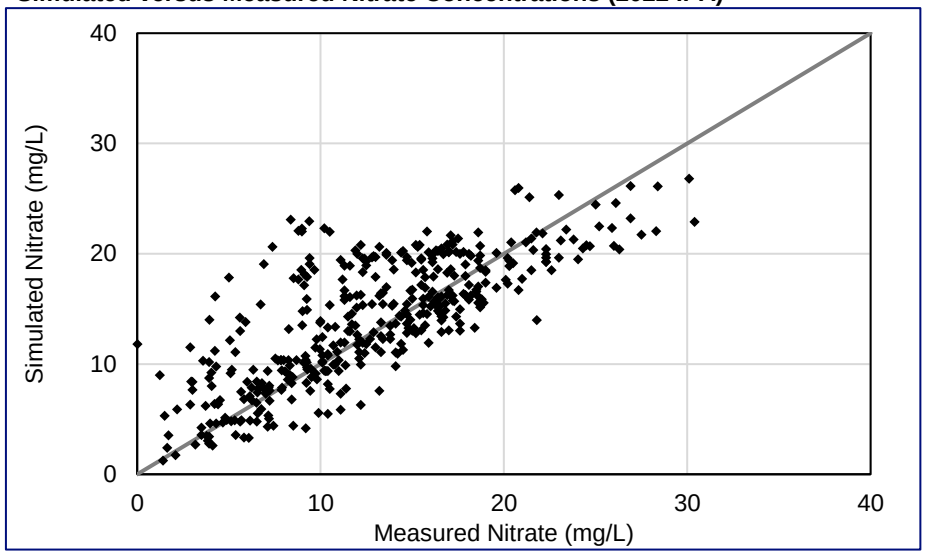
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-15: Nitrate Calibration Information for Node LC_LCUSWLC - Line Creek u/s of West Line Creek (EMS E293369)

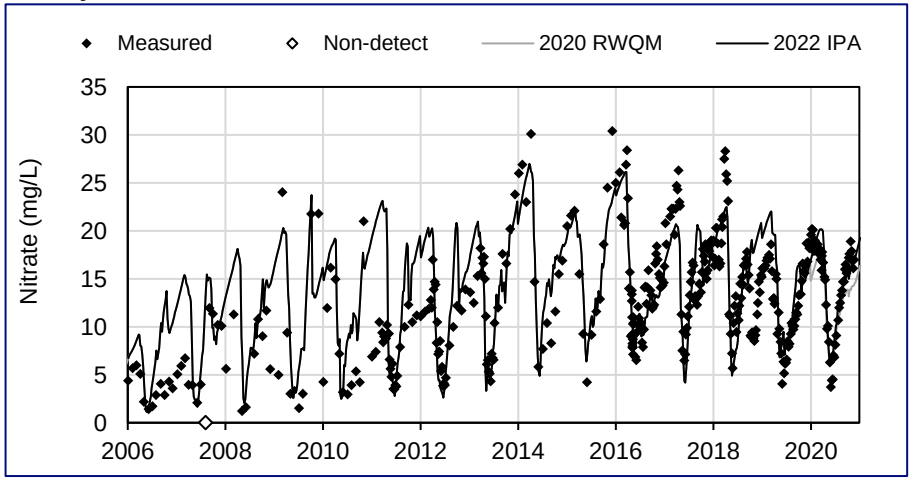
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	310	310
Non-Detect Count	1	1
Measured Mean (mg/L)	13	13
Simulated Mean (mg/L)	14	14
Bias (mg/L)	1.3	1.3
Relative Bias	1.1	1.1
Error (mg/L)	3.3	3.3
Percent Error	27%	27%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

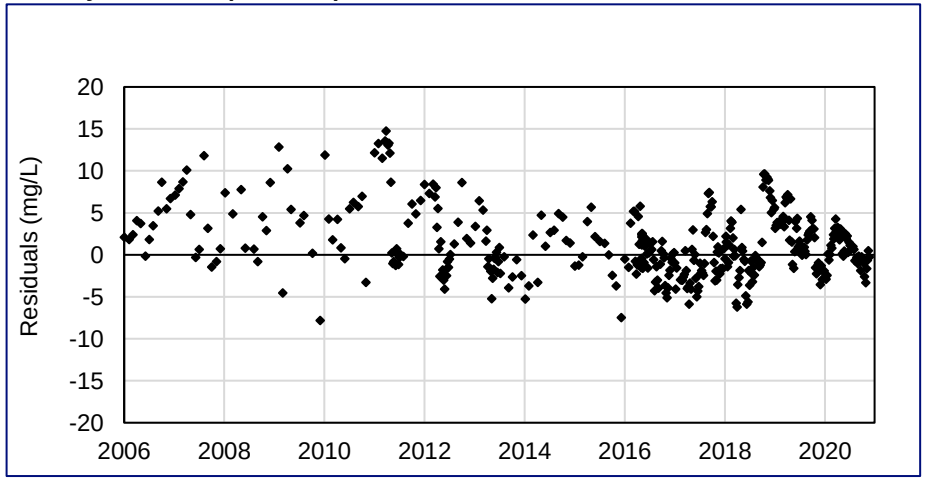


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



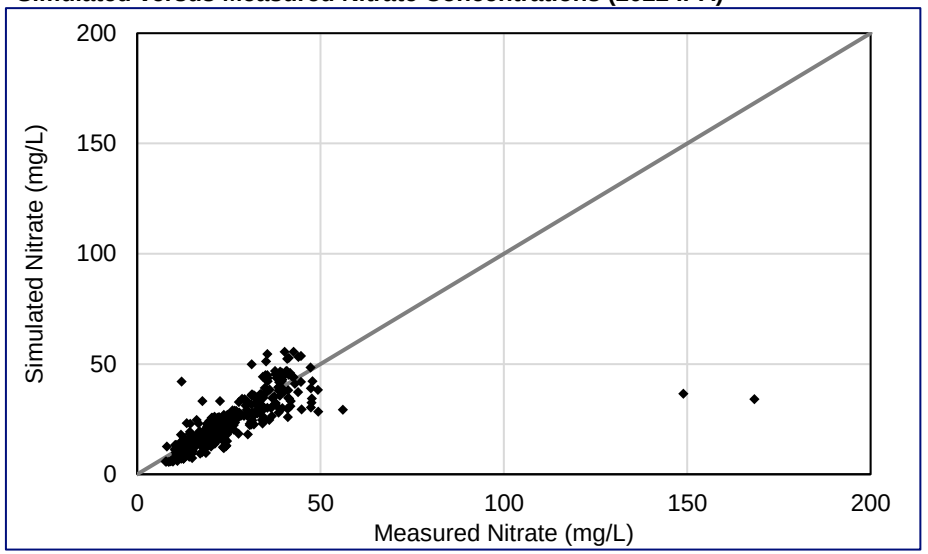
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-16: Nitrate Calibration Information for Node LC_WLC - West Line Creek (EMS E261958)

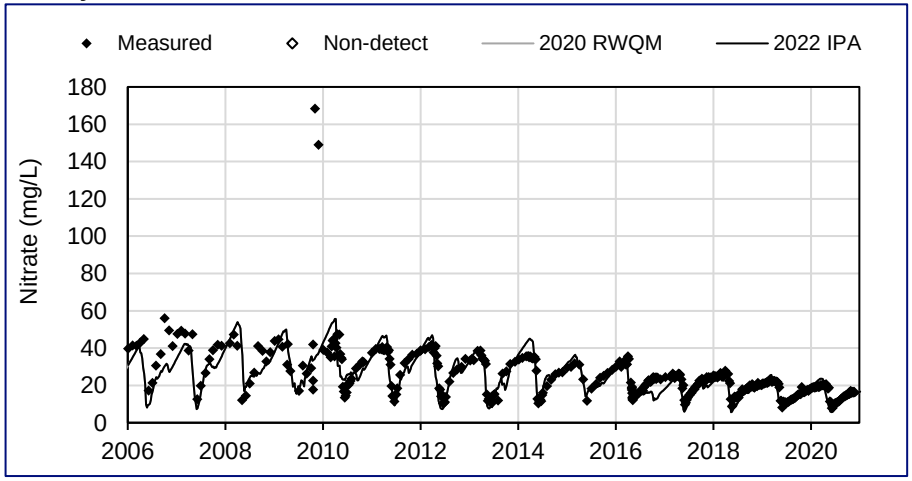
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	343	343
Non-Detect Count	0	0
Measured Mean (mg/L)	27	27
Simulated Mean (mg/L)	25	25
Bias (mg/L)	-1.9	-1.9
Relative Bias	0.93	0.93
Error (mg/L)	5.2	5.2
Percent Error	20%	20%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

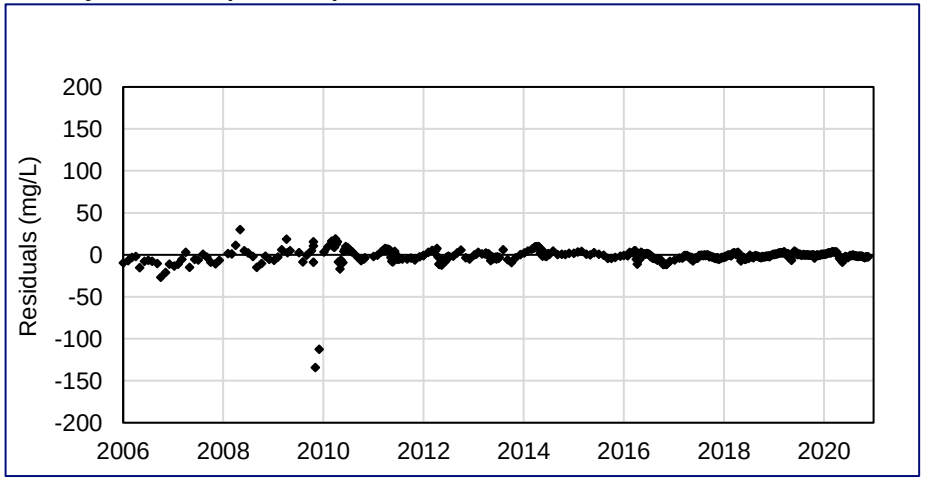


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



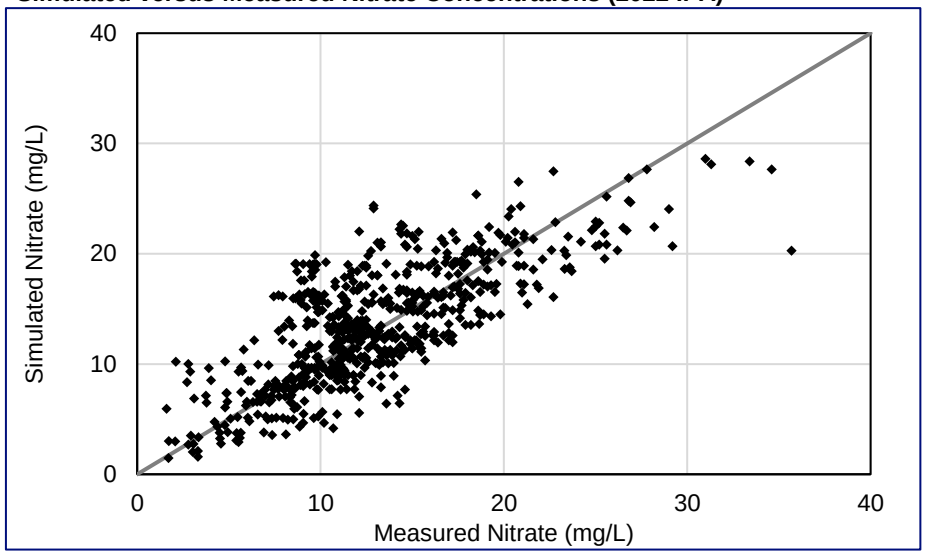
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-17: Nitrate Calibration Information for Node LC_LC3 - Line Creek d/s of West Line Creek (EMS 0200337)

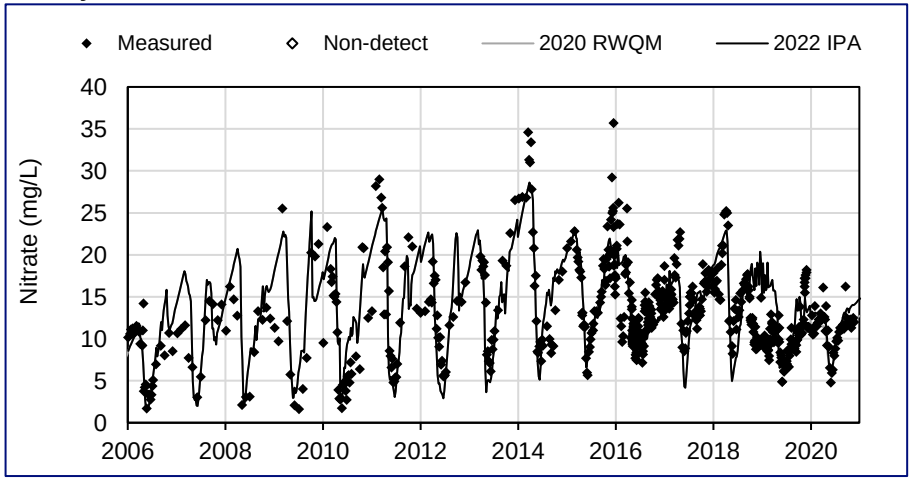
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	505	505
Non-Detect Count	0	0
Measured Mean (mg/L)	14	14
Simulated Mean (mg/L)	14	14
Bias (mg/L)	0.24	0.24
Relative Bias	1.0	1.0
Error (mg/L)	2.9	2.9
Percent Error	22%	22%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

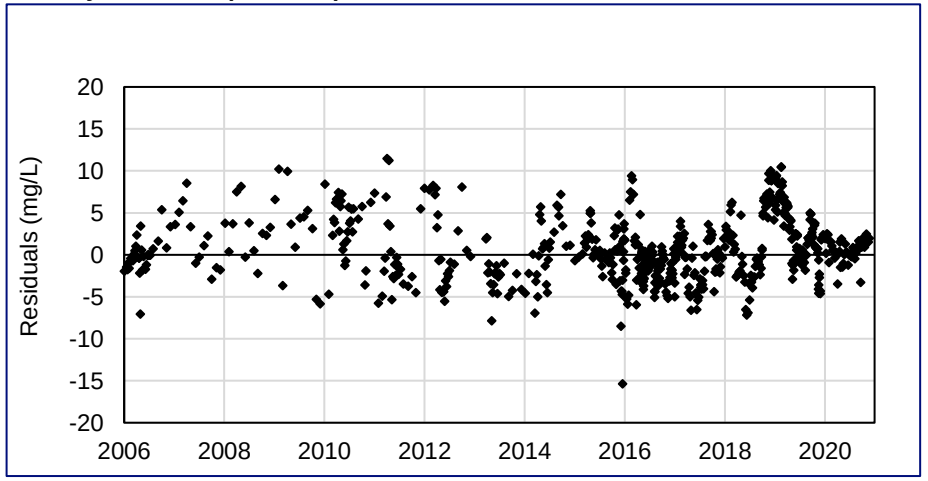


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



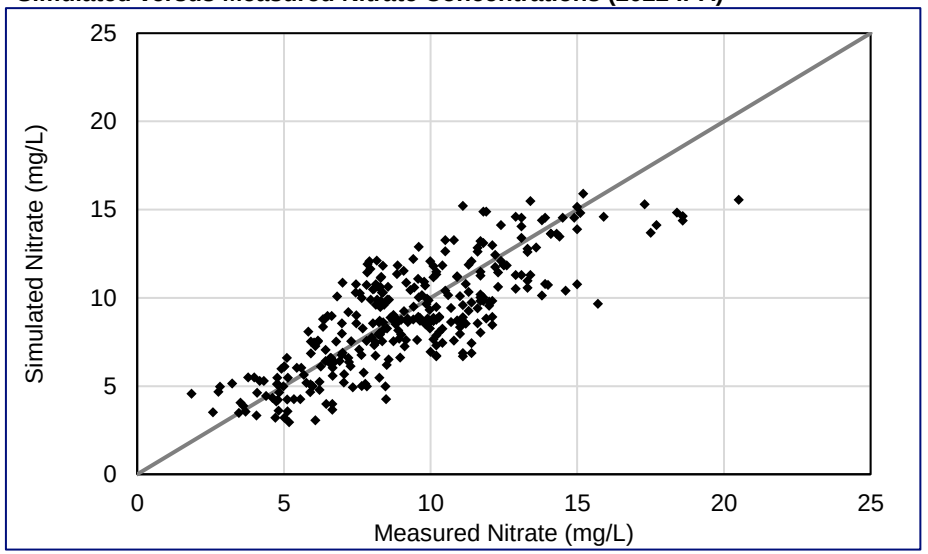
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-18: Nitrate Calibration Information for Node LC_LCDSSLCC - LCO Compliance Point - Line Creek d/s of South Line Creek Confluence (EMS E297110)

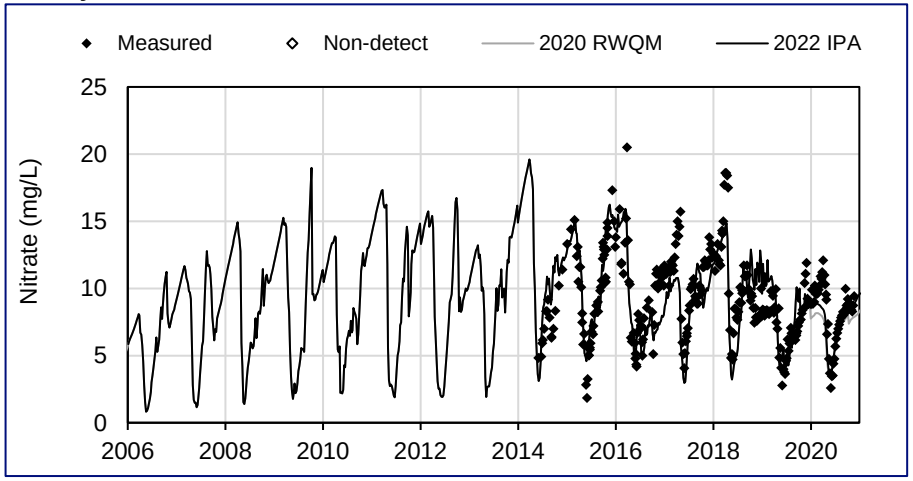
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	6/4/2014	6/4/2014
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	218	218
Non-Detect Count	0	0
Measured Mean (mg/L)	9.9	9.9
Simulated Mean (mg/L)	9.4	9.5
Bias (mg/L)	-0.46	-0.45
Relative Bias	0.95	0.95
Error (mg/L)	1.7	1.7
Percent Error	18%	18%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

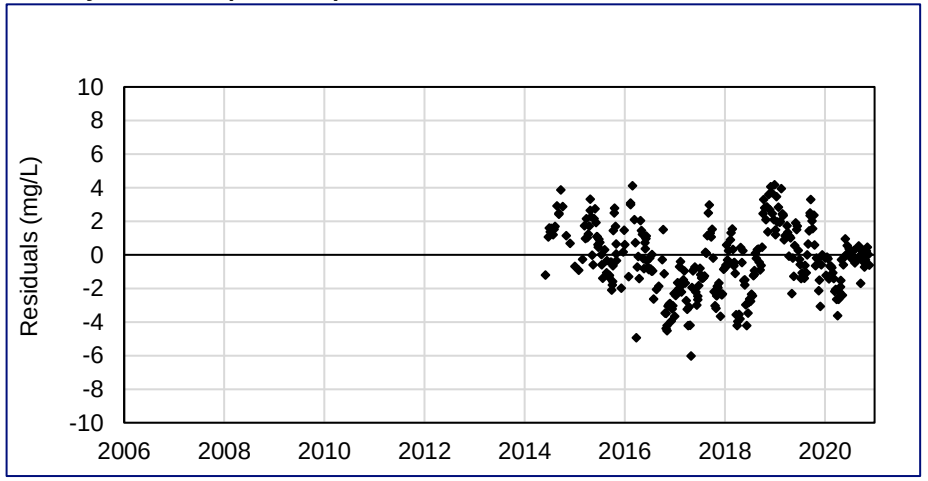


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



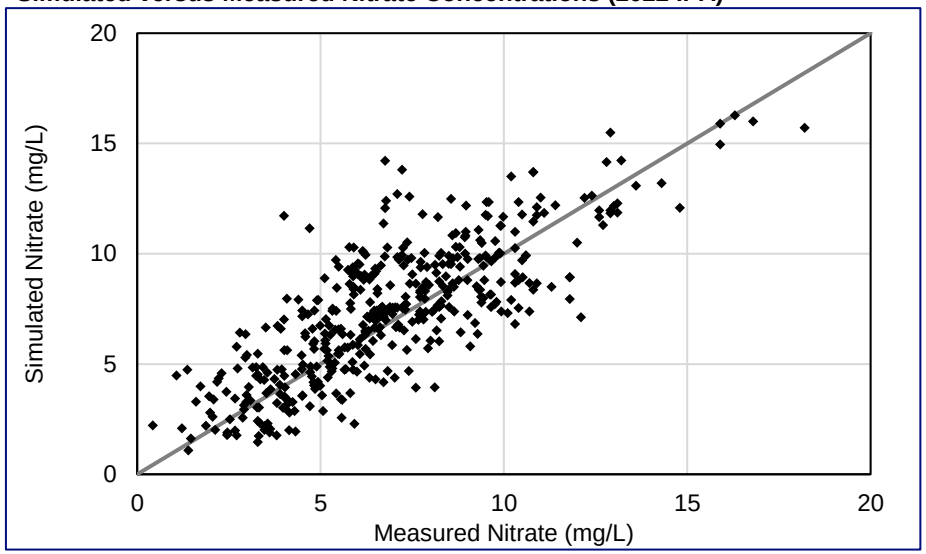
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-19: Nitrate Calibration Information for Node LC_LC4 - Line Creek u/s of Process Plant (EMS 0200044)

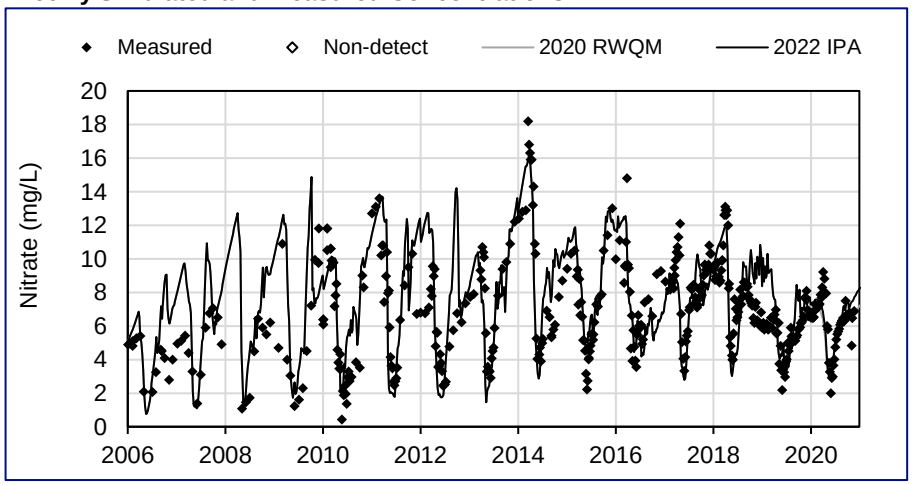
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	346	346
Non-Detect Count	0	0
Measured Mean (mg/L)	7.1	7.1
Simulated Mean (mg/L)	7.6	7.6
Bias (mg/L)	0.52	0.52
Relative Bias	1.1	1.1
Error (mg/L)	1.6	1.6
Percent Error	23%	23%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

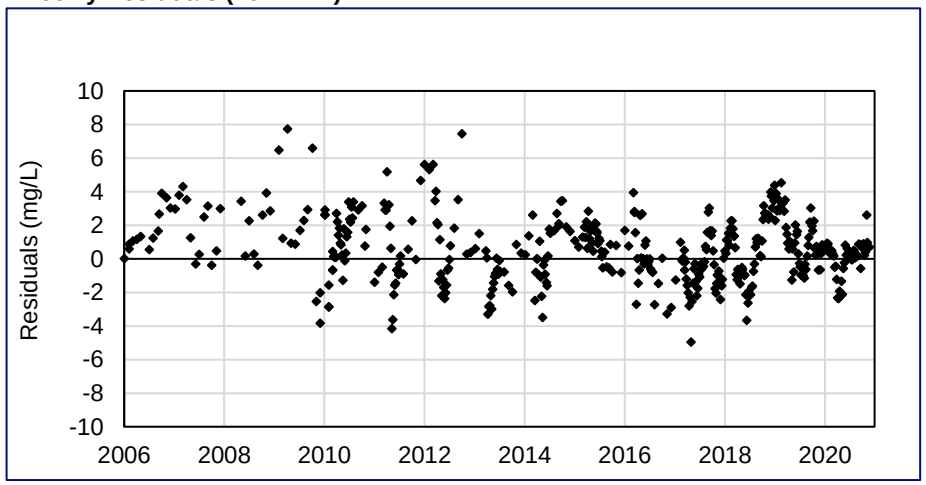


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



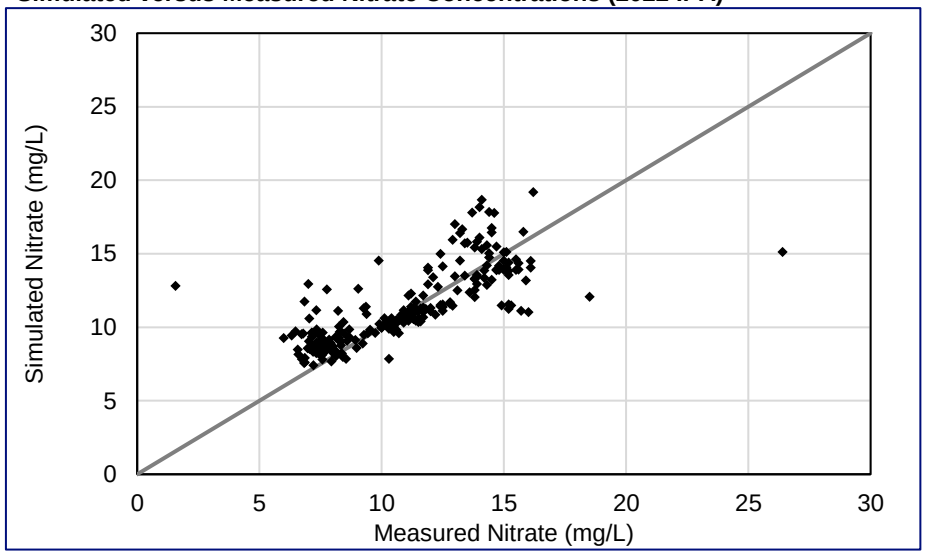
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-20: Nitrate Calibration Information for Node EV_EC1 - Erickson Creek at Mouth (EMS 0200097)

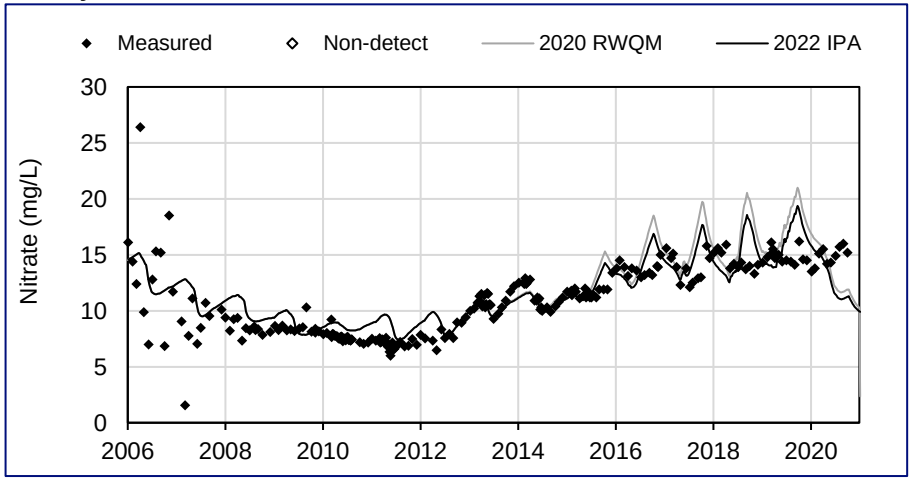
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	215	215
Non-Detect Count	0	0
Measured Mean (mg/L)	10	10
Simulated Mean (mg/L)	11	11
Bias (mg/L)	0.83	0.58
Relative Bias	1.1	1.1
Error (mg/L)	1.4	1.3
Percent Error	14%	13%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

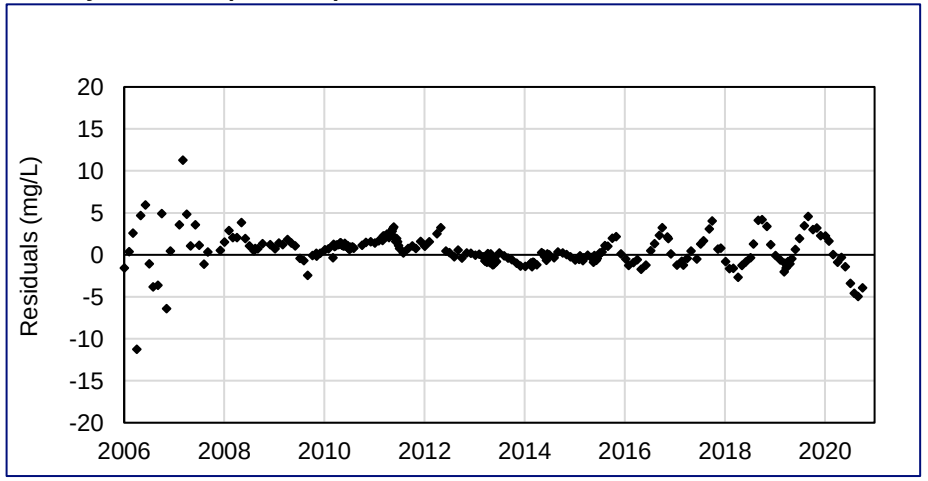


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



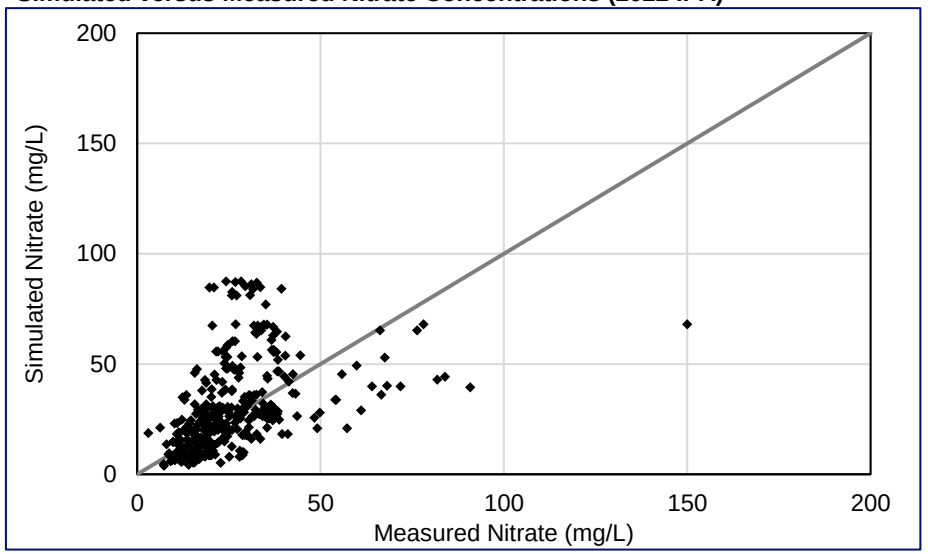
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-21: Nitrate Calibration Information for Node EV_GT1 - Gate Creek Sediment Pond Decant (EMS E206231)

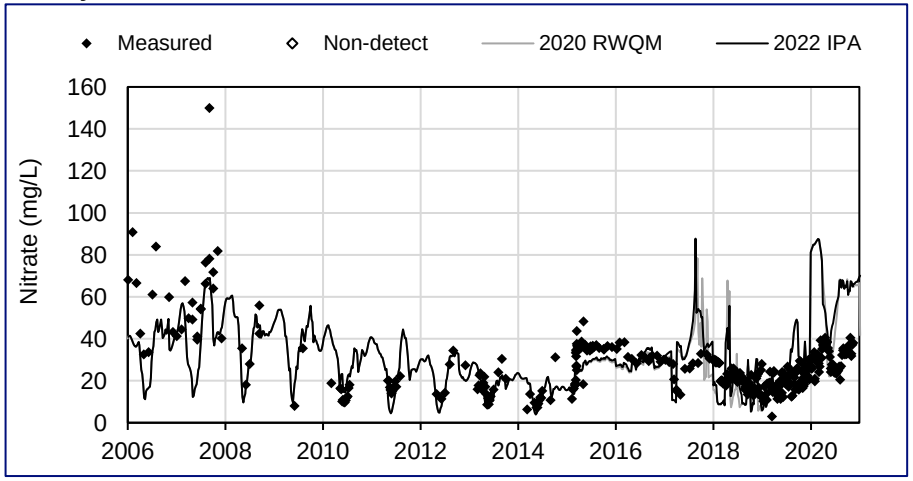
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	232	232
Non-Detect Count	0	0
Measured Mean (mg/L)	28	28
Simulated Mean (mg/L)	22	23
Bias (mg/L)	-5.4	-4.6
Relative Bias	0.81	0.84
Error (mg/L)	10	9.7
Percent Error	38%	35%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

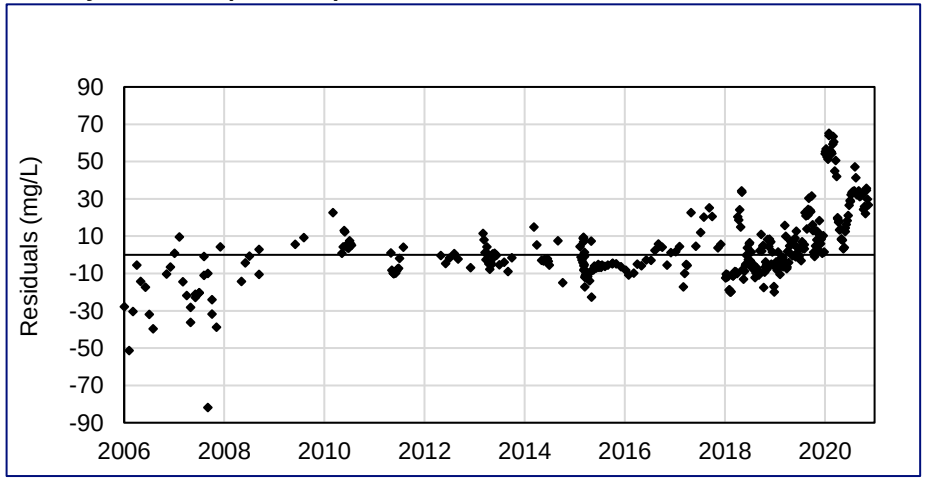


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



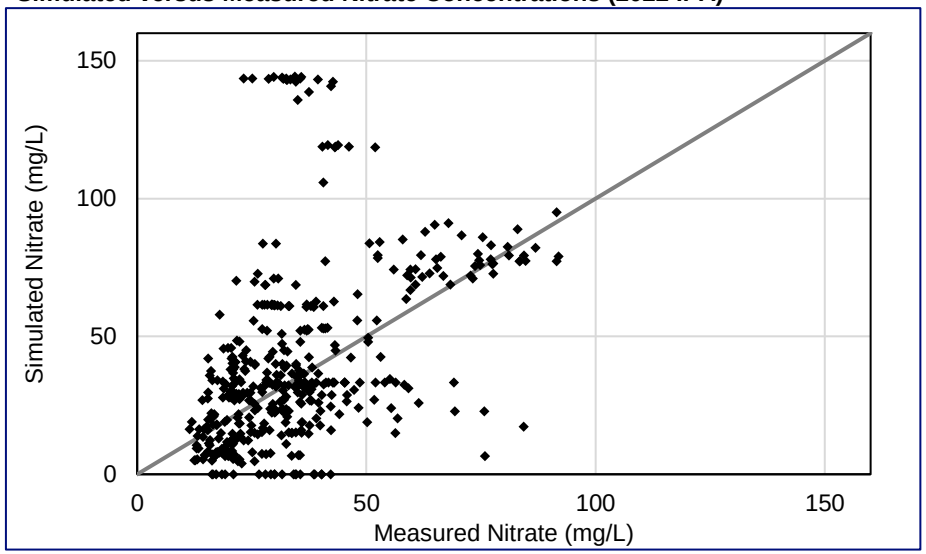
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-22: Nitrate Calibration Information for Node EV_BC1 - Bodie Creek Sediment Pond Decant (EMS E102685)

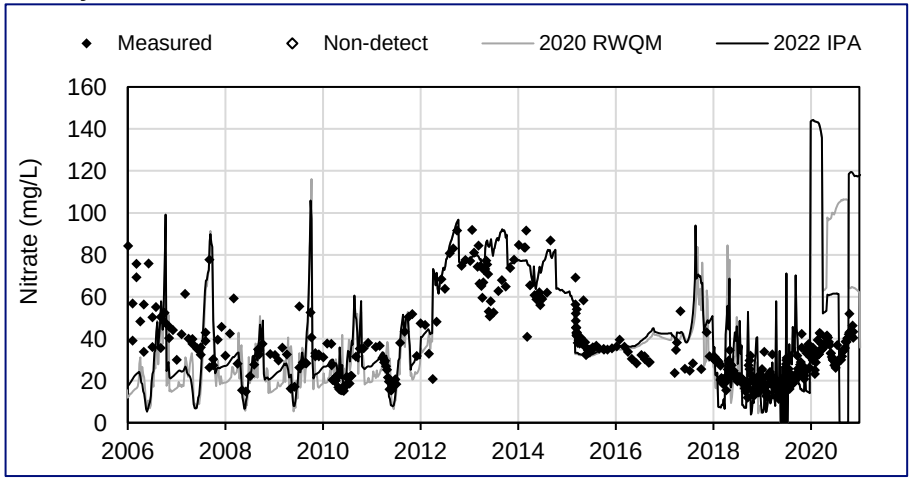
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	305	305
Non-Detect Count	0	0
Measured Mean (mg/L)	37	37
Simulated Mean (mg/L)	36	37
Bias (mg/L)	-1.6	0.086
Relative Bias	0.96	1.0
Error (mg/L)	13	12
Percent Error	34%	33%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

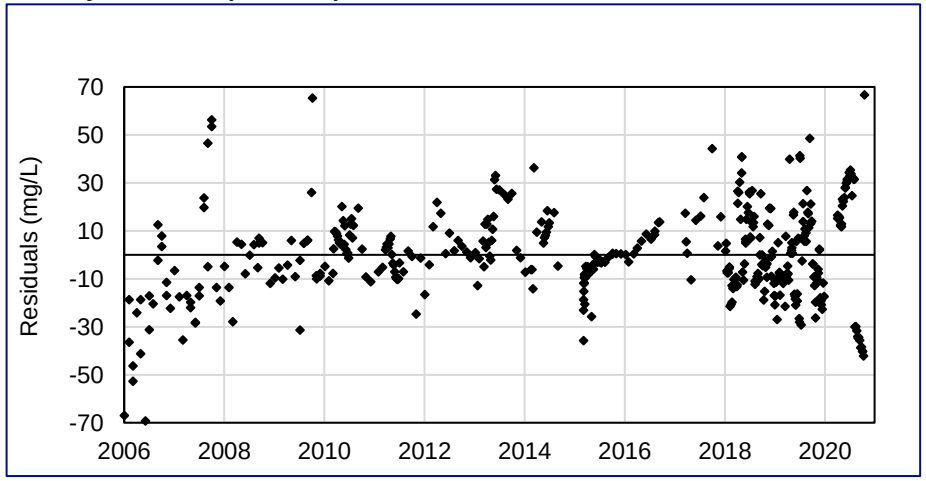


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



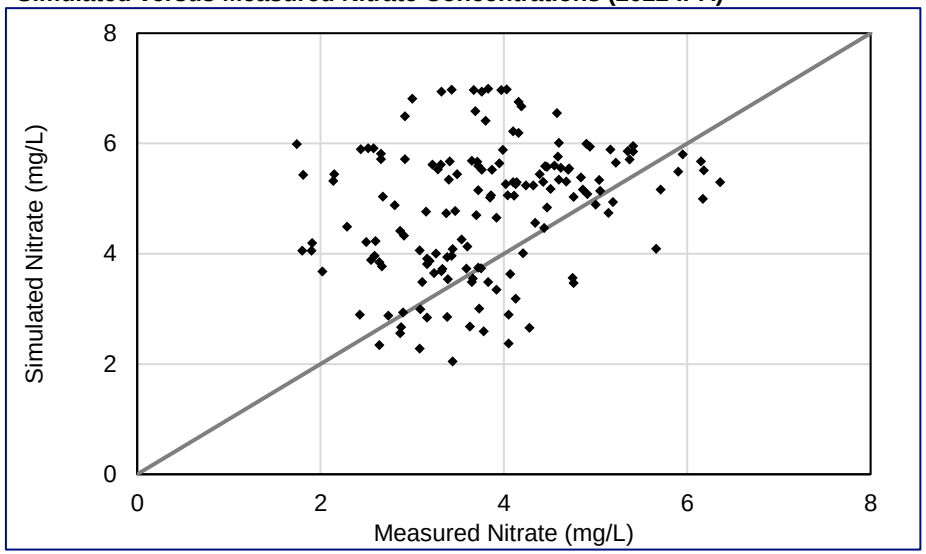
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-23: Nitrate Calibration Information for Node EV_DC1 - EVO Dry Creek Sediment Pond Decant (EMS E298590)

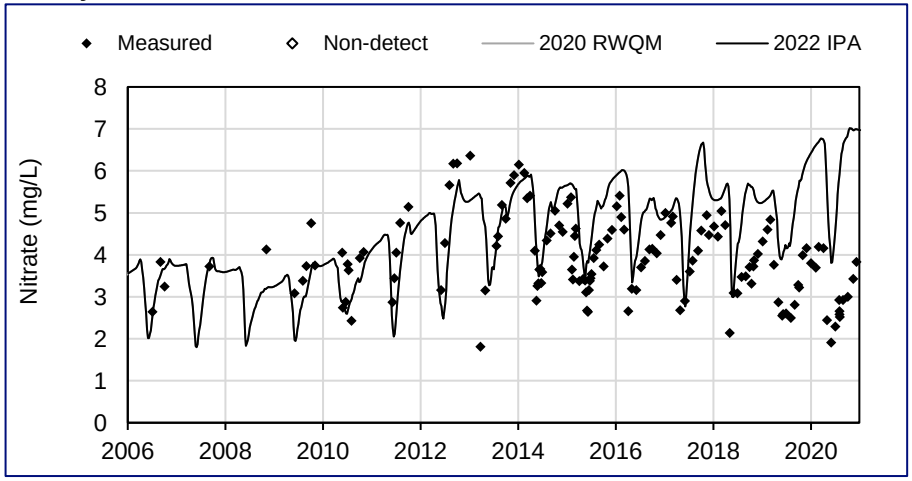
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	7/4/2006	7/4/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	116	116
Non-Detect Count	0	0
Measured Mean (mg/L)	4.0	4.0
Simulated Mean (mg/L)	4.6	4.6
Bias (mg/L)	0.52	0.52
Relative Bias	1.1	1.1
Error (mg/L)	0.92	0.92
Percent Error	23%	23%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

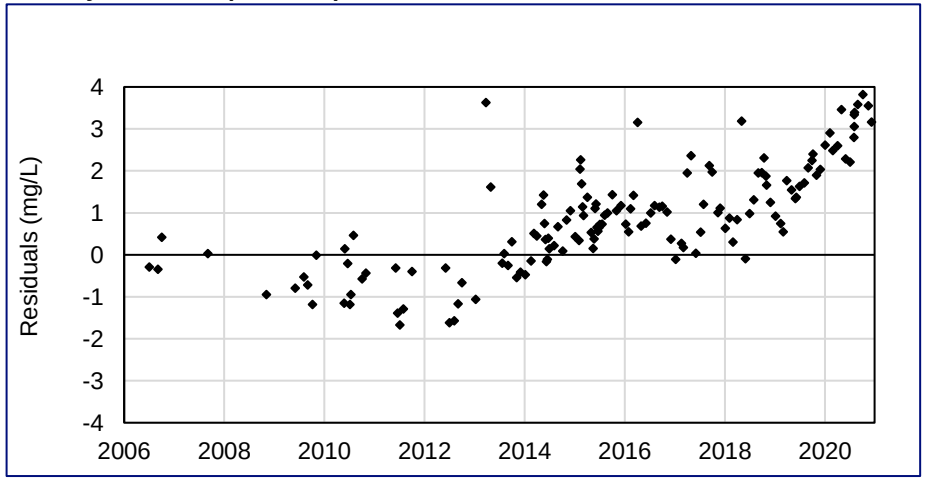


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



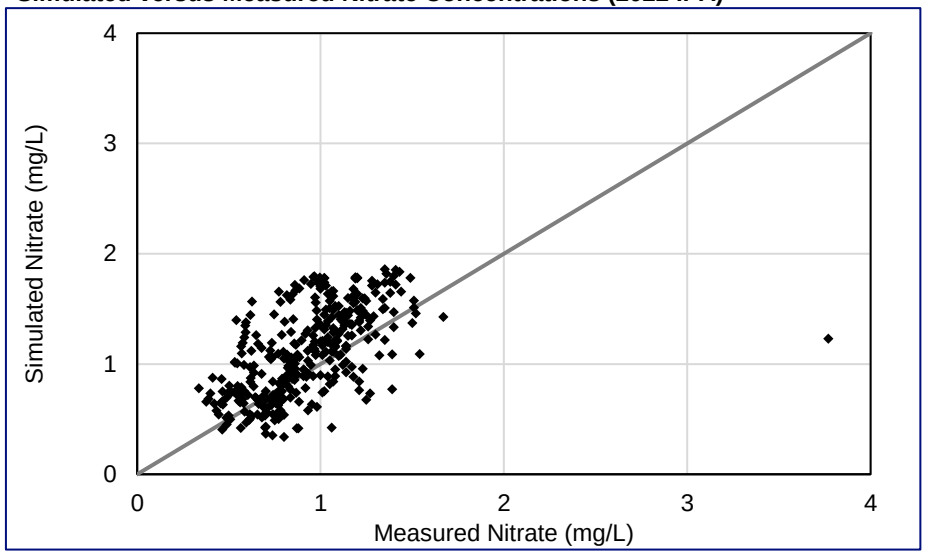
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-24: Nitrate Calibration Information for Node EV_HC1 - EVO Harmer Compliance Point (Harmer Creek Dam Spillway) (EMS E102682)

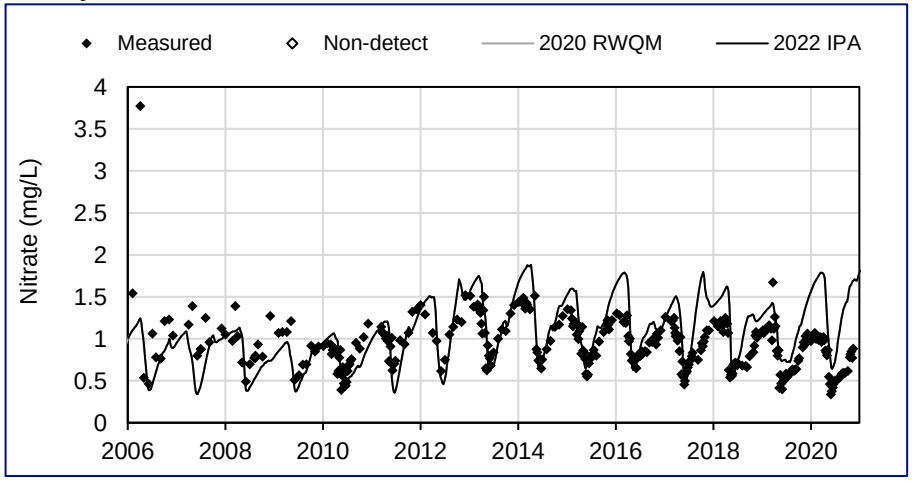
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	2/7/2006	2/7/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	277	277
Non-Detect Count	0	0
Measured Mean (mg/L)	0.96	0.96
Simulated Mean (mg/L)	1.1	1.1
Bias (mg/L)	0.11	0.11
Relative Bias	1.1	1.1
Error (mg/L)	0.25	0.25
Percent Error	26%	26%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

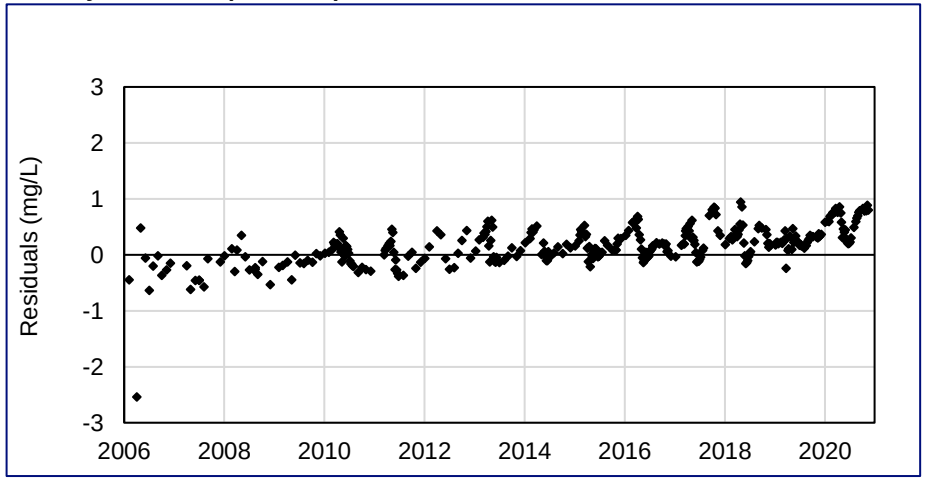


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



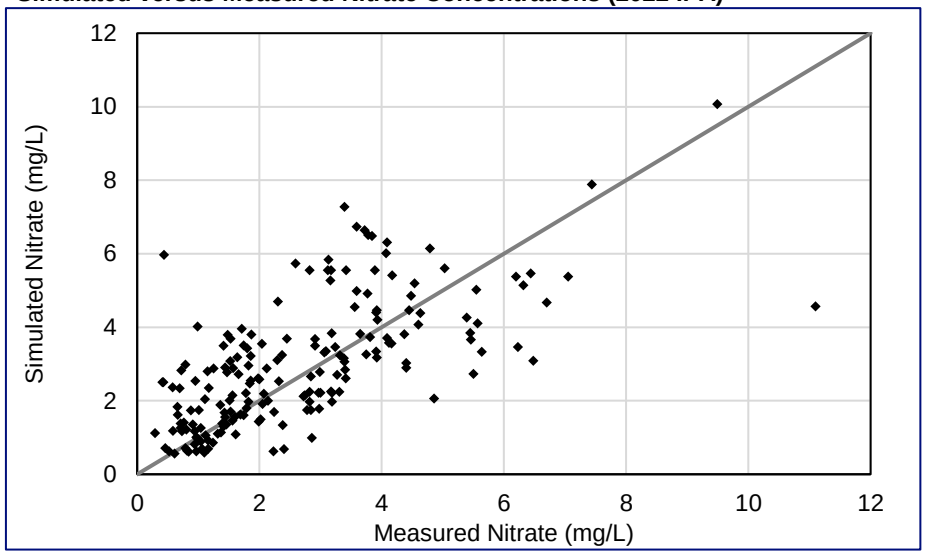
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-25: Nitrate Calibration Information for Node FR_FR1 - Fording River d/s of Henretta Creek (EMS 0200251)

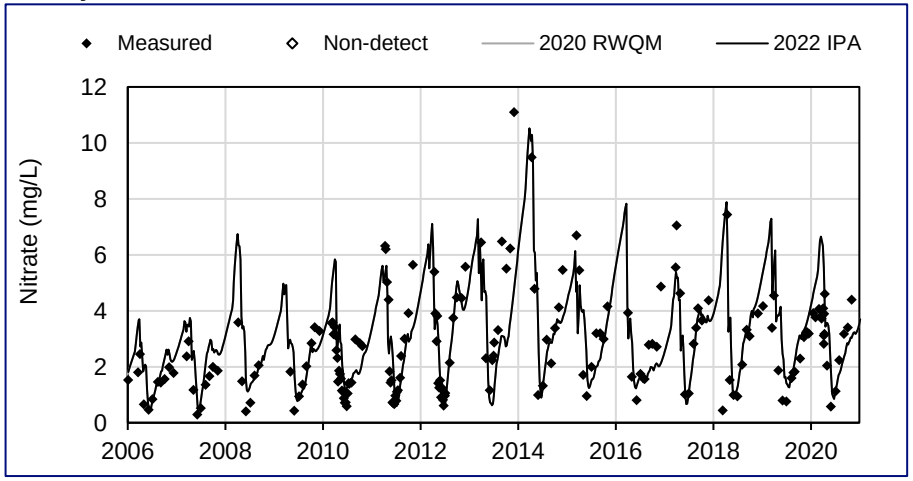
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	152	152
Non-Detect Count	0	0
Measured Mean (mg/L)	2.6	2.6
Simulated Mean (mg/L)	2.8	2.8
Bias (mg/L)	0.15	0.15
Relative Bias	1.1	1.1
Error (mg/L)	1.0	1.0
Percent Error	38%	38%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

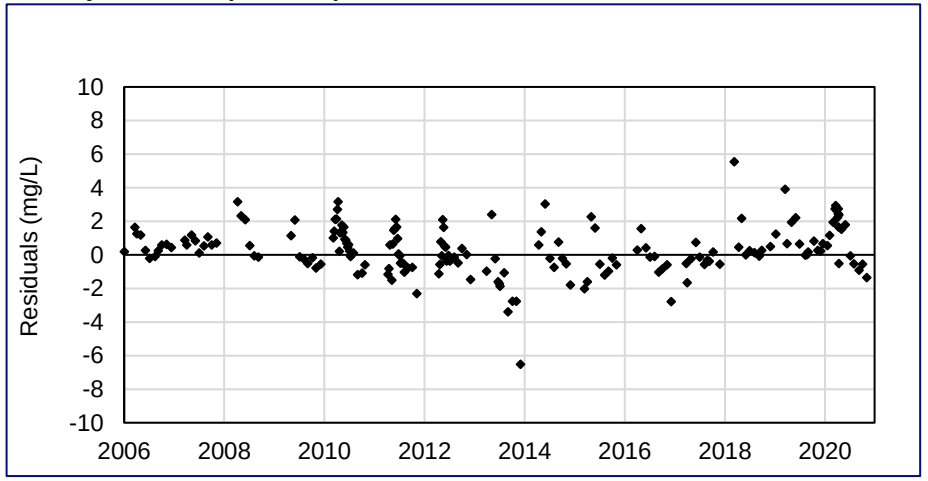


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



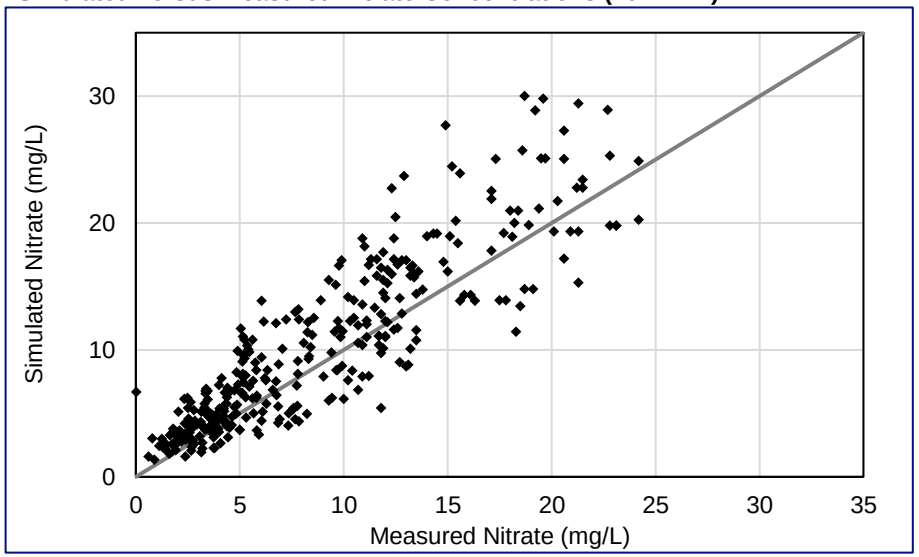
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-26: Nitrate Calibration Information for Node FR_FR2 - Fording River u/s of Kilmarnock Creek (EMS 0200201)

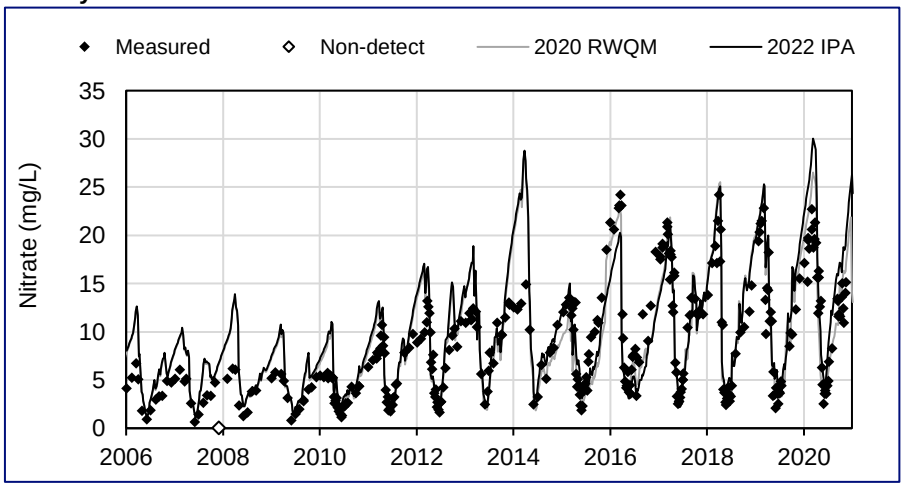
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	275	275
Non-Detect Count	1	1
Measured Mean (mg/L)	7.7	7.7
Simulated Mean (mg/L)	8.6	8.8
Bias (mg/L)	0.83	1.0
Relative Bias	1.1	1.1
Error (mg/L)	2.2	2.3
Percent Error	28%	30%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

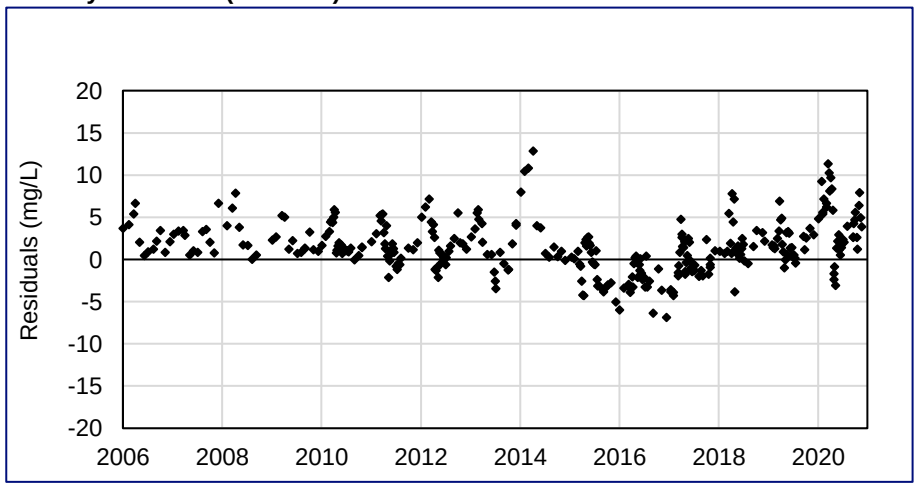


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



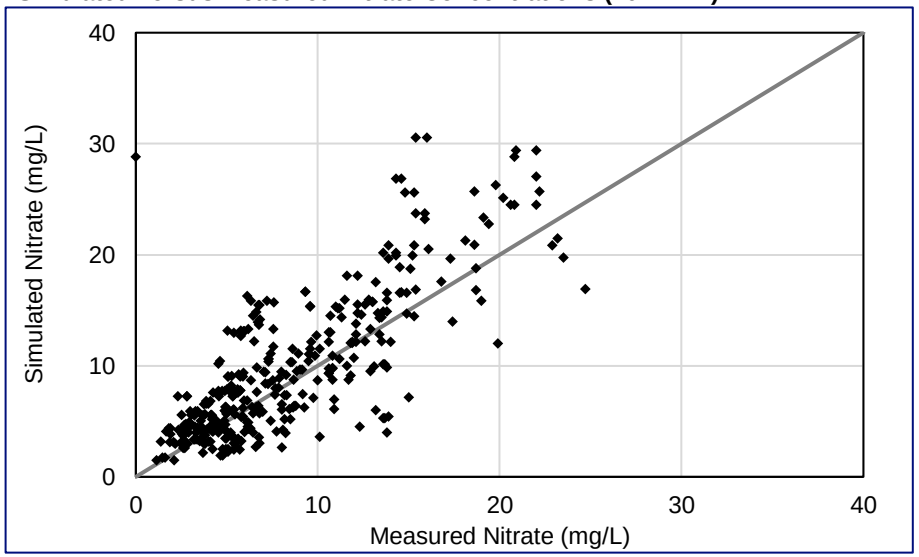
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-27: Nitrate Calibration Information for Node FR_FR4 - Fording River between Swift and Cataract Creeks (EMS 0200311)

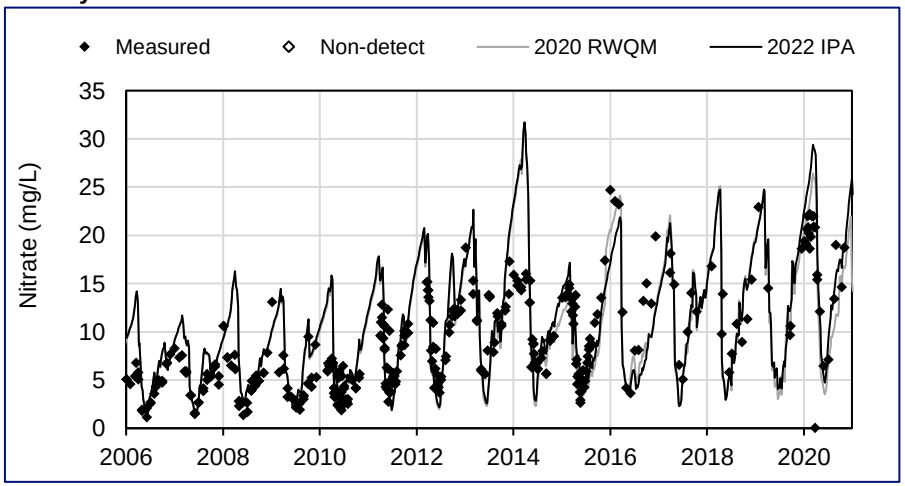
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	335	335
Non-Detect Count	0	0
Measured Mean (mg/L)	7.6	7.6
Simulated Mean (mg/L)	8.4	8.8
Bias (mg/L)	0.79	1.1
Relative Bias	1.1	1.1
Error (mg/L)	2.7	2.8
Percent Error	35%	36%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

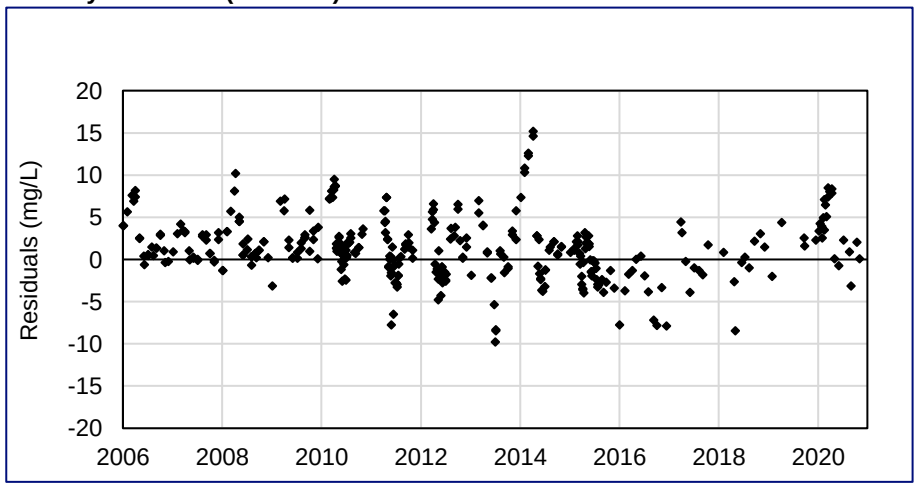


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



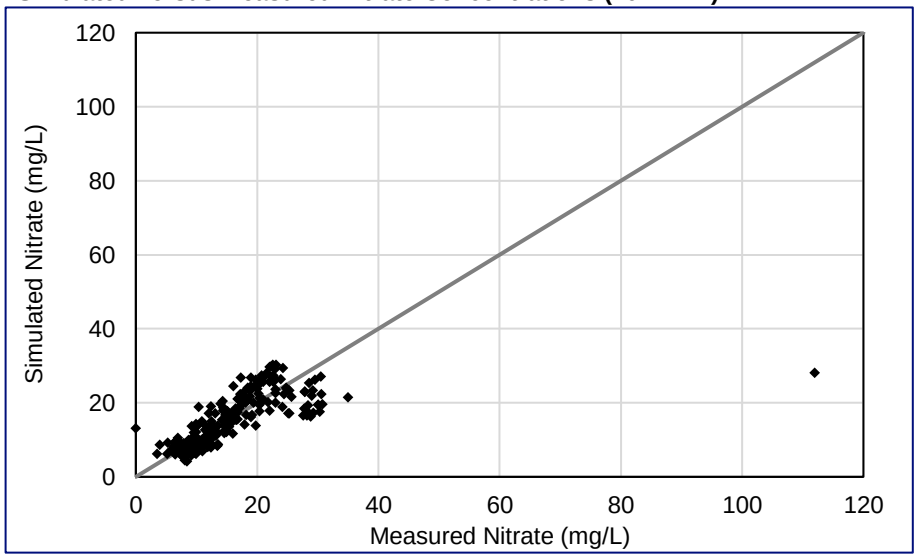
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-28: Nitrate Calibration Information for Node FR_FRCP1 - Fording River, 525 m d/s of Cataract Creek (EMS E300071)

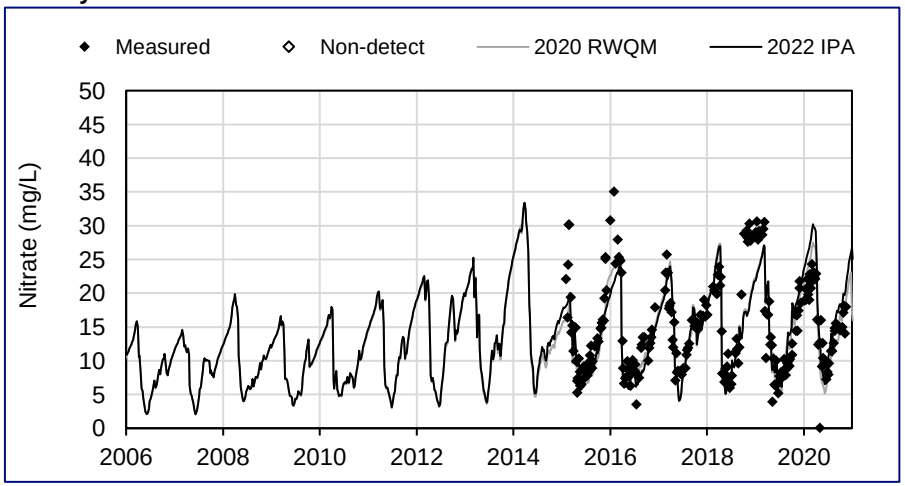
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	2/3/2015	2/3/2015
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	155	155
Non-Detect Count	0	0
Measured Mean (mg/L)	15	15
Simulated Mean (mg/L)	13	13
Bias (mg/L)	-1.4	-1.5
Relative Bias	0.9	0.9
Error (mg/L)	2.9	2.8
Percent Error	20%	19%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

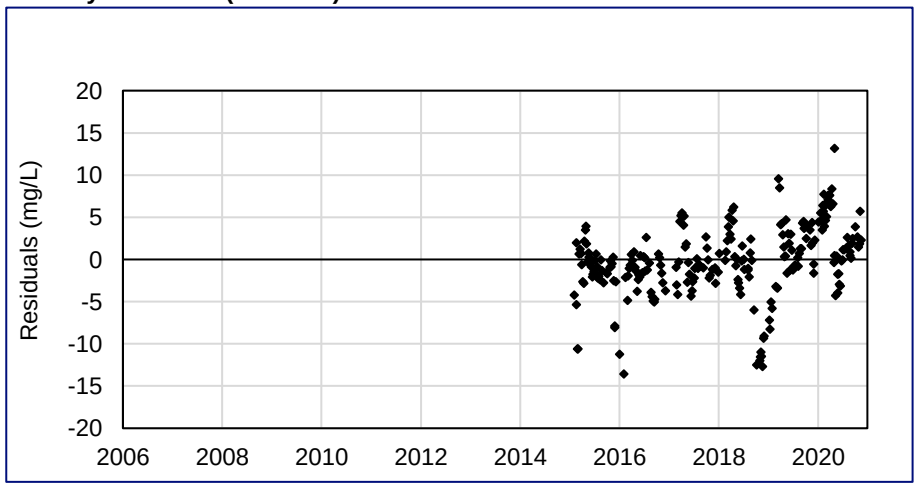


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



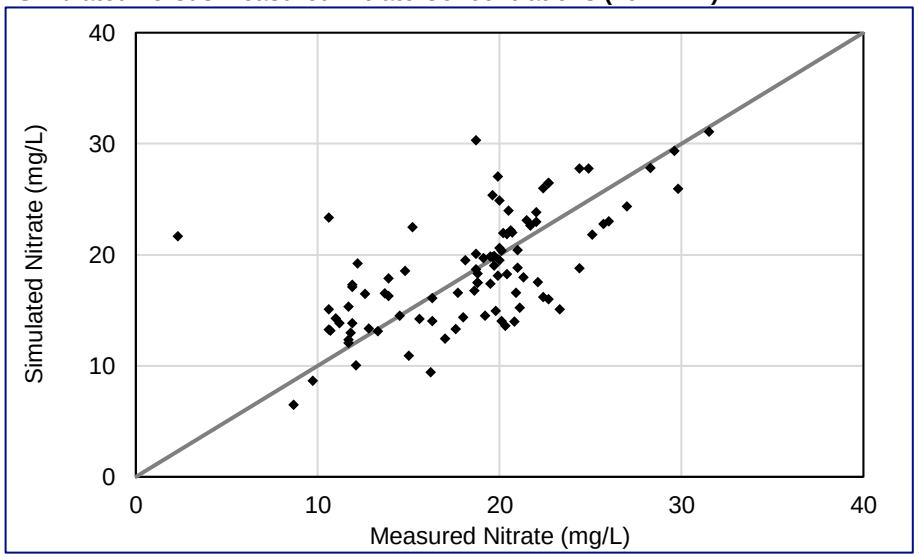
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-29: Nitrate Calibration Information for Node GH_PC2 - Fording River d/s of Porter Creek (EMS E287431)

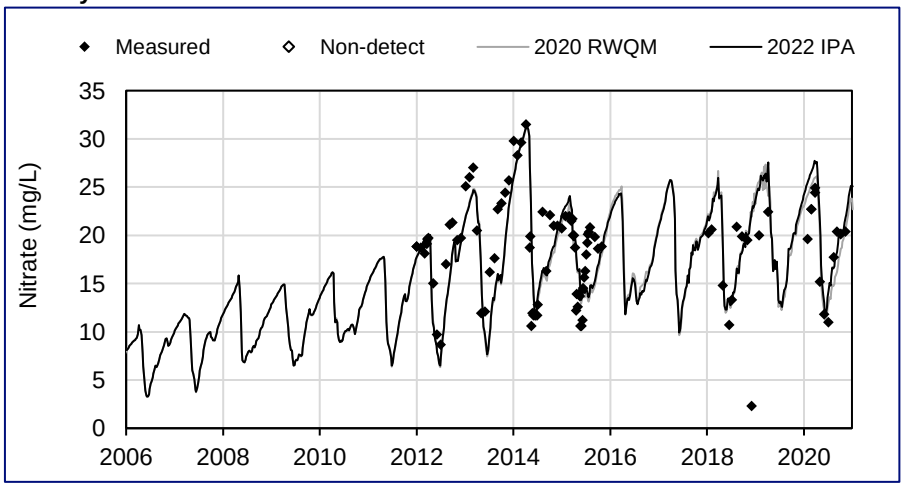
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2012	1/3/2012
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	81	81
Non-Detect Count	0	0
Measured Mean (mg/L)	18	18
Simulated Mean (mg/L)	18	18
Bias (mg/L)	-0.38	-0.17
Relative Bias	0.98	0.99
Error (mg/L)	3.2	3.2
Percent Error	18%	18%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

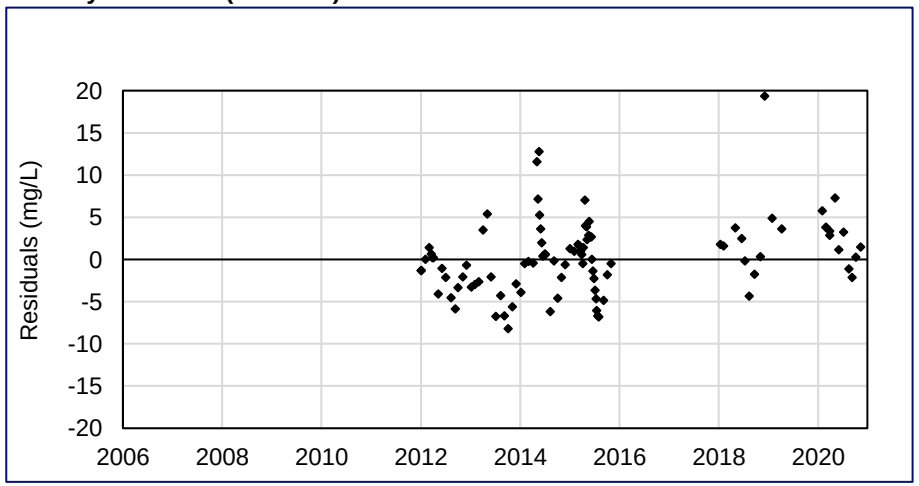


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



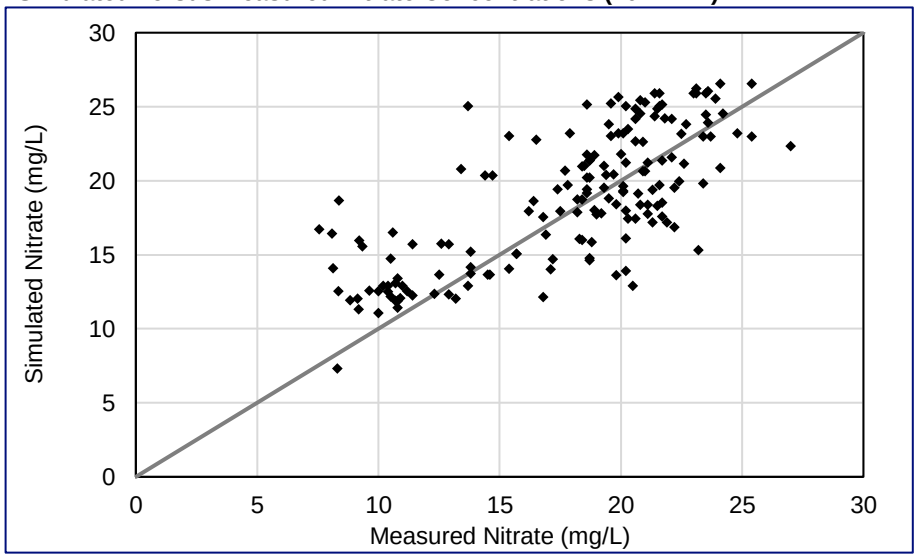
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-30: Nitrate Calibration Information for Node FR_FRABCH - FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek) (EMS E223753)

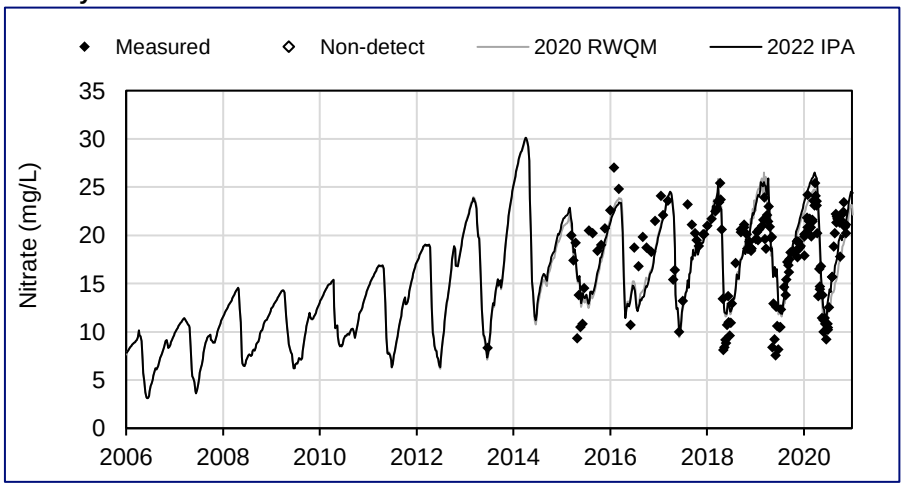
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	6/24/2013	6/24/2013
Last Measured Sample	12/6/2018	12/6/2018
Data Points Available for Comparison, n	71	71
Non-Detect Count	0	0
Measured Mean (mg/L)	18	18
Simulated Mean (mg/L)	18	18
Bias (mg/L)	-0.19	-0.23
Relative Bias	0.99	0.99
Error (mg/L)	2.5	2.5
Percent Error	14%	14%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

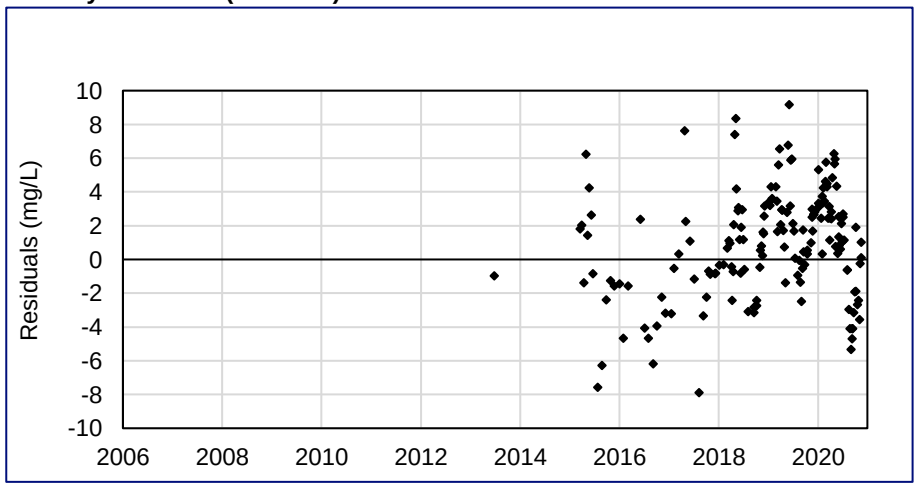


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



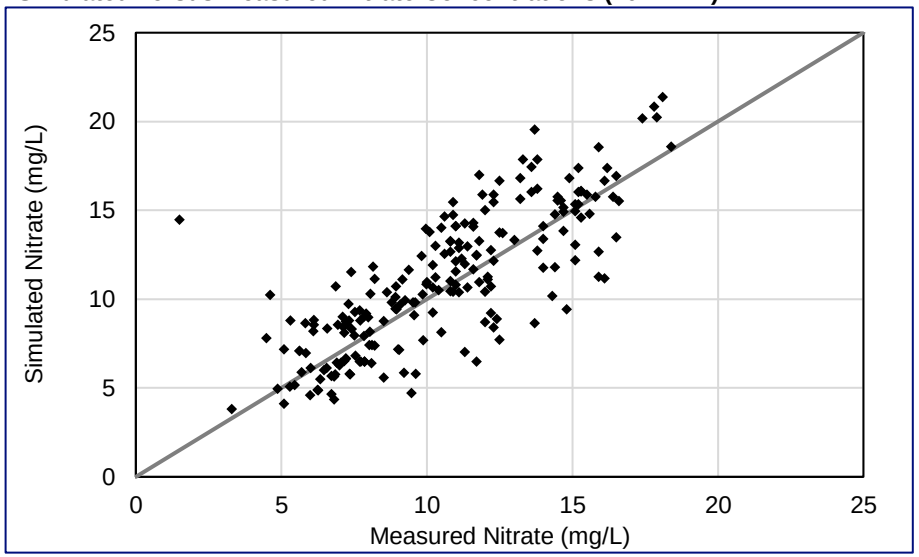
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-31: Nitrate Calibration Information for Node LC_FRDSDC - Fording River d/s of Dry Creek (EMS E288272)

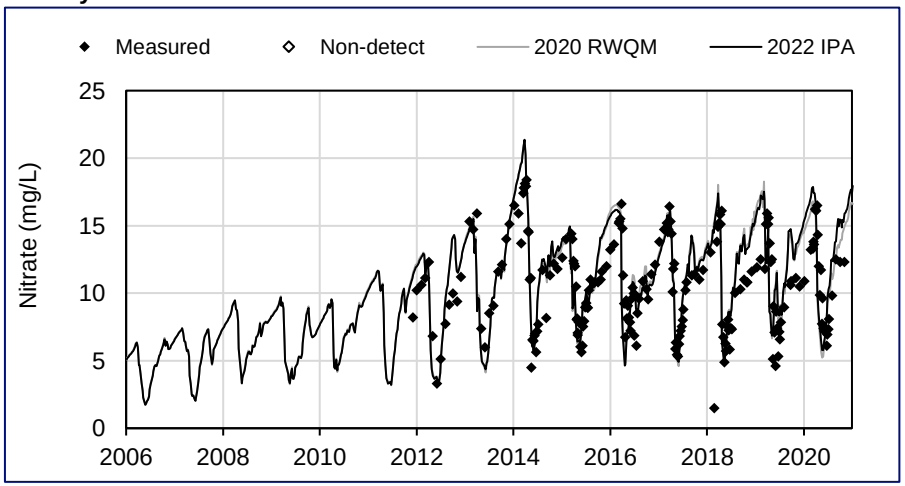
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	12/7/2011	12/7/2011
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	160	160
Non-Detect Count	0	0
Measured Mean (mg/L)	10	10
Simulated Mean (mg/L)	11	11
Bias (mg/L)	0.49	0.42
Relative Bias	1.0	1.0
Error (mg/L)	1.6	1.5
Percent Error	15%	15%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

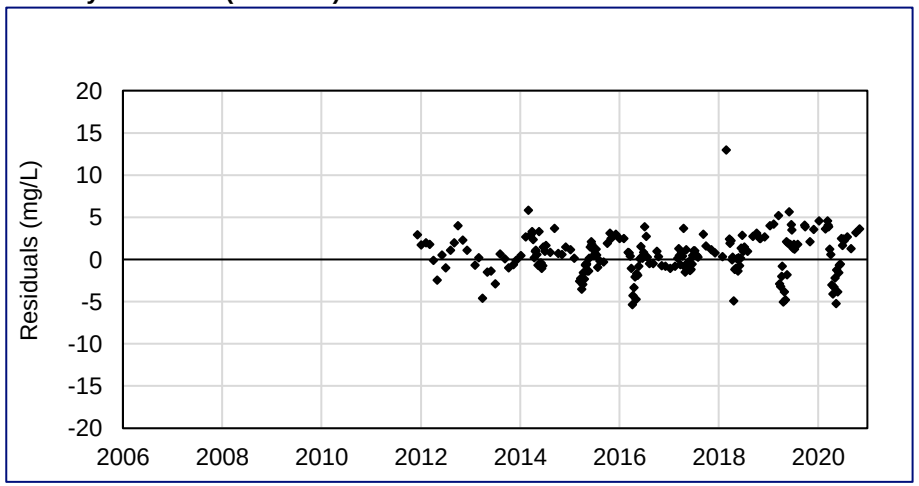


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



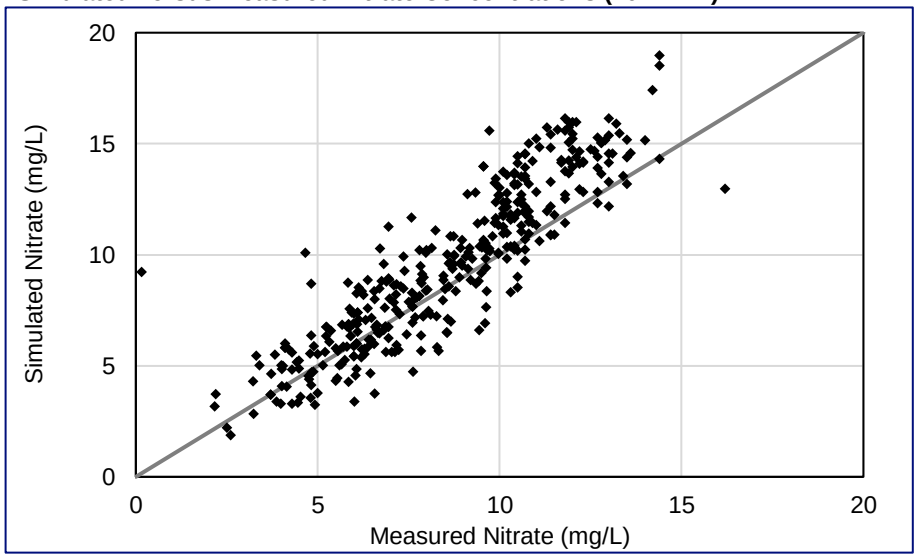
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-32: Nitrate Calibration Information for Node GH_FR1 - GHO Fording River Compliance Point (EMS 0200378)

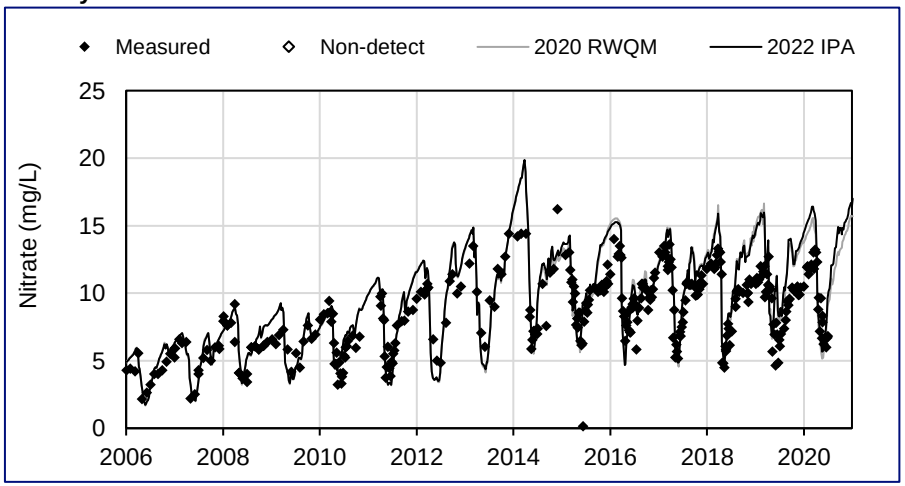
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	308	308
Non-Detect Count	0	0
Measured Mean (mg/L)	8.3	8.3
Simulated Mean (mg/L)	9.1	9.1
Bias (mg/L)	0.75	0.74
Relative Bias	1.1	1.1
Error (mg/L)	1.3	1.2
Percent Error	15%	15%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

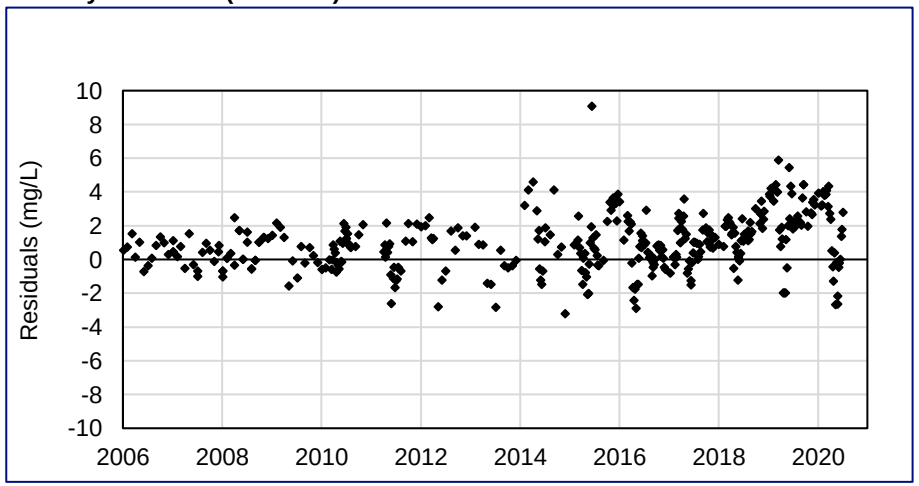


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



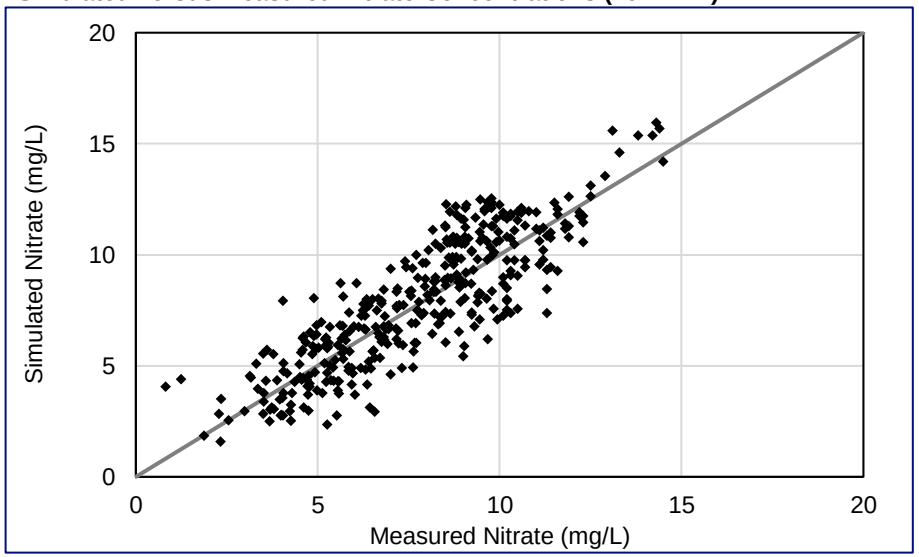
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-33: Nitrate Calibration Information for Node LC_LC5 - Fording River d/s of Line Creek (EMS 0200028)

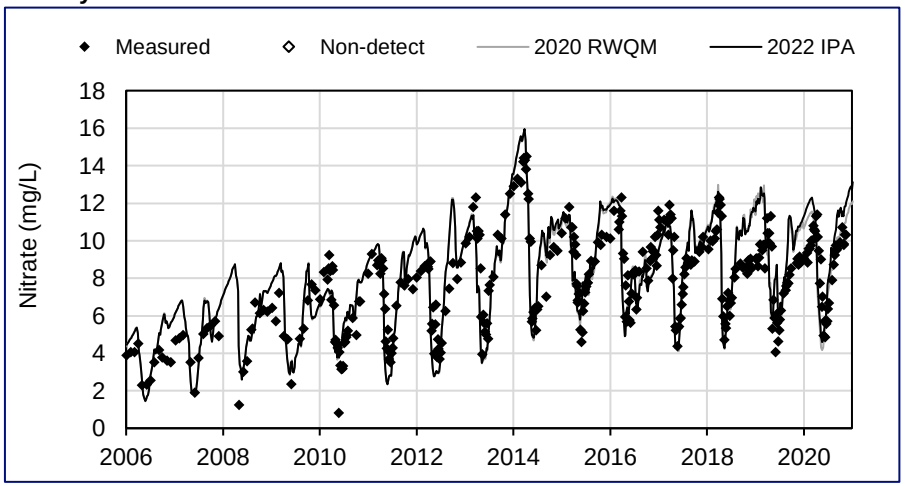
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	303	303
Non-Detect Count	0	0
Measured Mean (mg/L)	7.6	7.6
Simulated Mean (mg/L)	7.5	7.6
Bias (mg/L)	-0.027	-0.013
Relative Bias	1.0	1.0
Error (mg/L)	1.1	1.1
Percent Error	15%	15%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

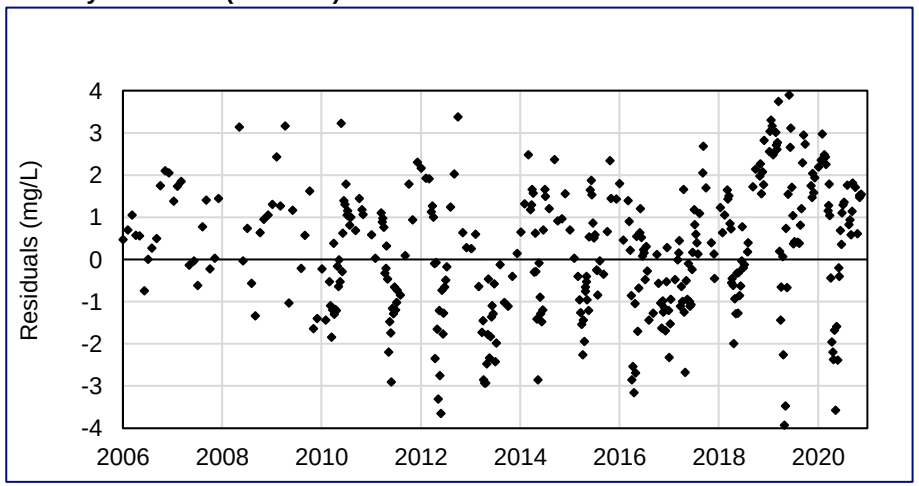


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

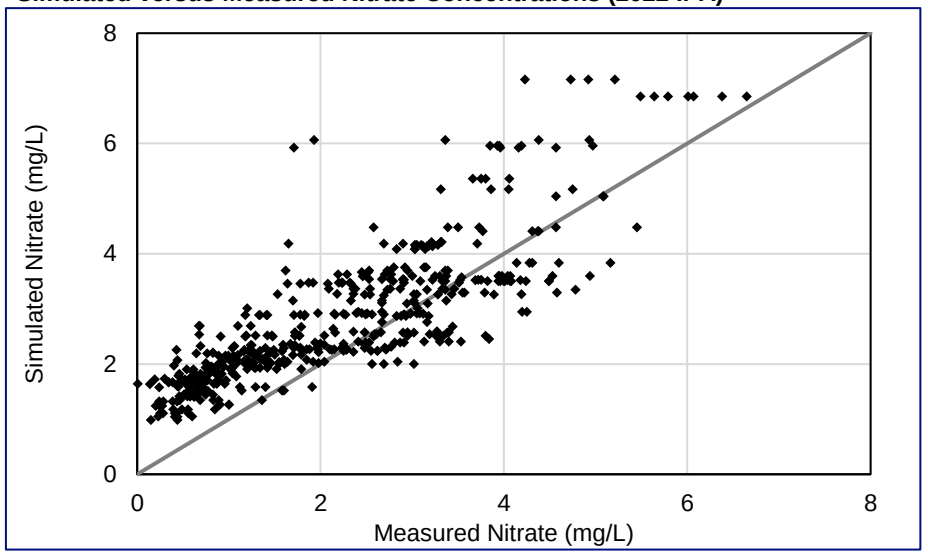
A1-34: Nitrate Calibration Information for Node CM_MC2 - CMO Compliance Point (EMS E258937)

Measured and Simulated Nitrate Data and Calibration Statistics

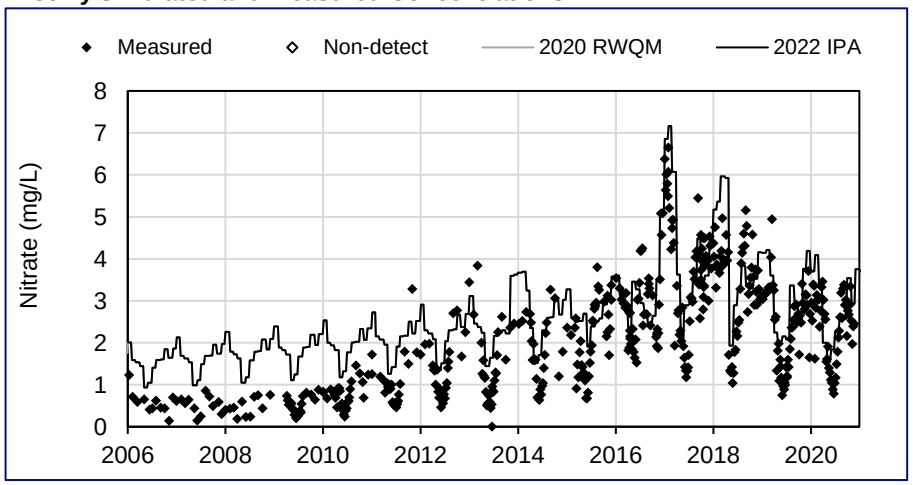
Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/11/2006	1/11/2006
Last Measured Sample	12/28/2018	12/28/2018
Data Points Available for Comparison, n	398	398
Non-Detect Count	0	0
Measured Mean (mg/L)	2.1	2.1
Simulated Mean (mg/L)	2.8	2.8
Bias (mg/L)	0.65	0.65
Relative Bias	1.3	1.3
Error (mg/L)	0.85	0.85
Percent Error	40%	40%

Note: Simulated data are from the CMO Water and Load Balance Model.

Simulated versus Measured Nitrate Concentrations (2022 IPA)

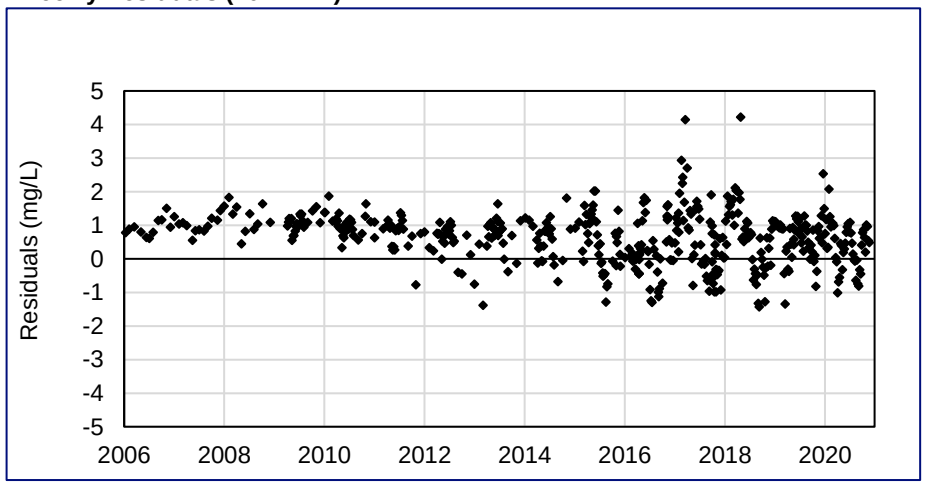


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



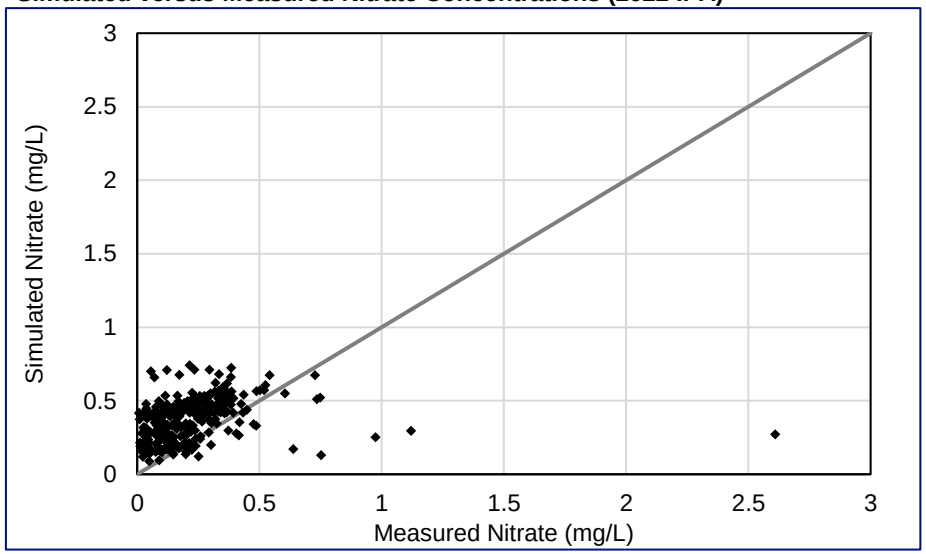
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-35: Nitrate Calibration Information for Node EV_MC3 - Michel Creek u/s of Erickson Creek (EMS 0200203)

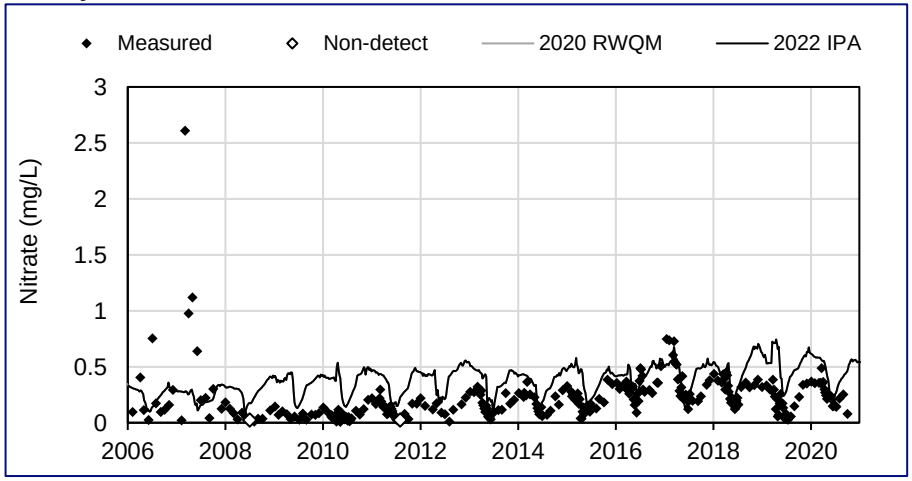
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	2/7/2006	2/7/2006
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	261	261
Non-Detect Count	2	2
Measured Mean (mg/L)	0.21	0.21
Simulated Mean (mg/L)	0.36	0.36
Bias (mg/L)	0.14	0.14
Relative Bias	1.7	1.7
Error (mg/L)	0.2	0.2
Percent Error	92%	92%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

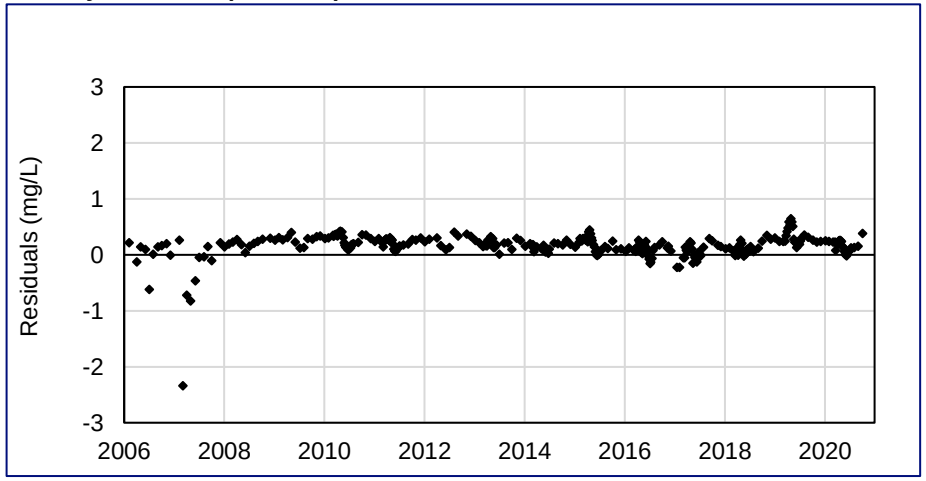


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



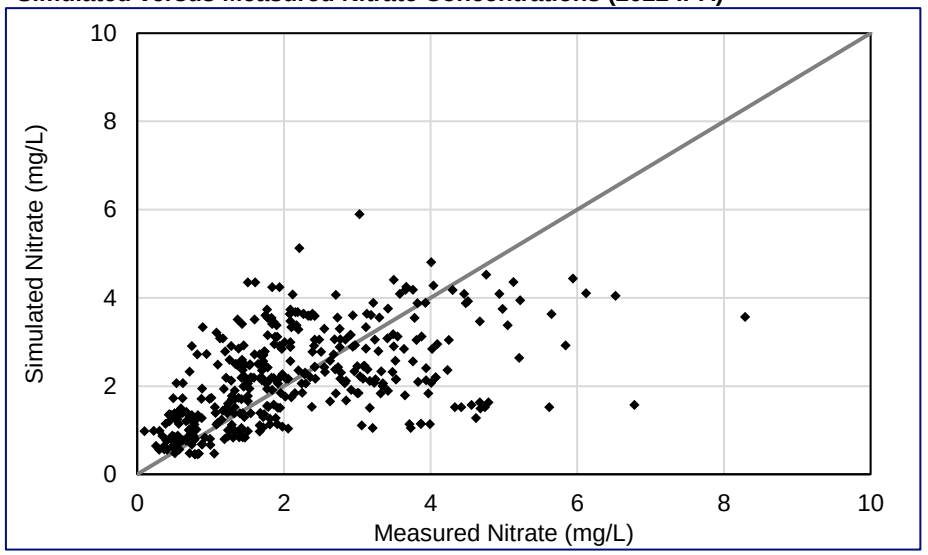
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-36: Nitrate Calibration Information for Node EV_MC2 - EVO Michel Creek Compliance Point (EMS E300091)

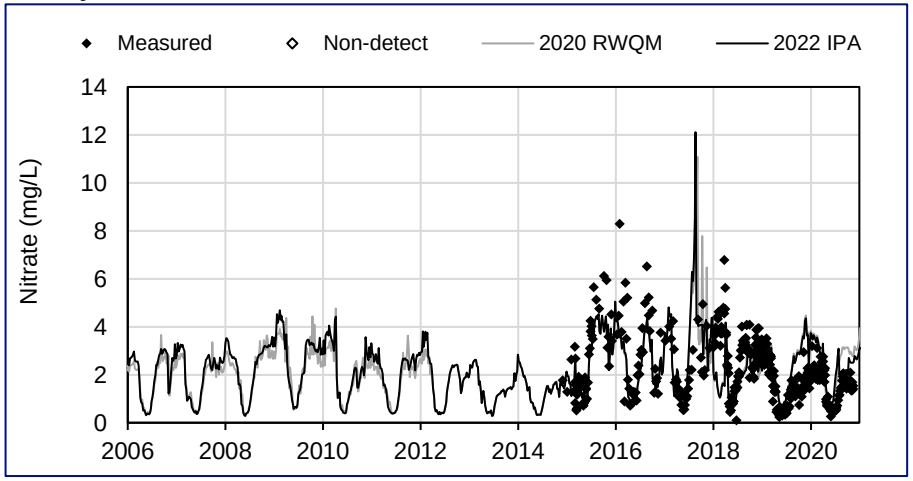
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	12/3/2014	12/3/2014
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	212	212
Non-Detect Count	0	0
Measured Mean (mg/L)	2.6	2.6
Simulated Mean (mg/L)	2.1	2.1
Bias (mg/L)	-0.5	-0.52
Relative Bias	0.81	0.8
Error (mg/L)	0.99	0.94
Percent Error	37%	35%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

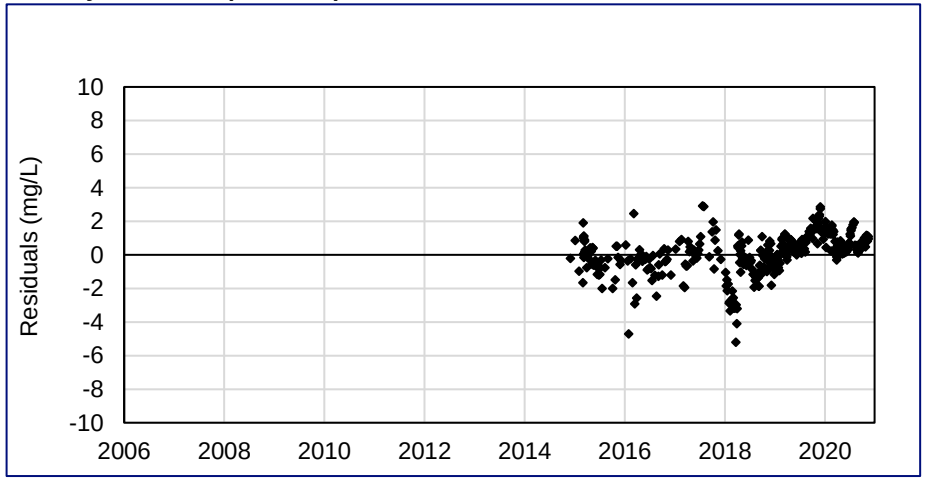


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



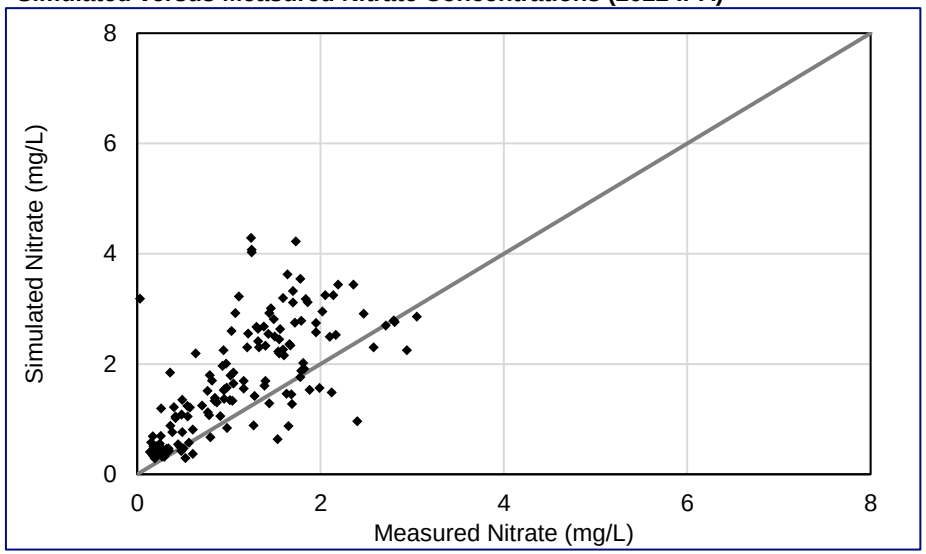
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-37: Nitrate Calibration Information for Node EV_MC1 - Michel Creek u/s of Highway 43 Bridge (EMS 0200425)

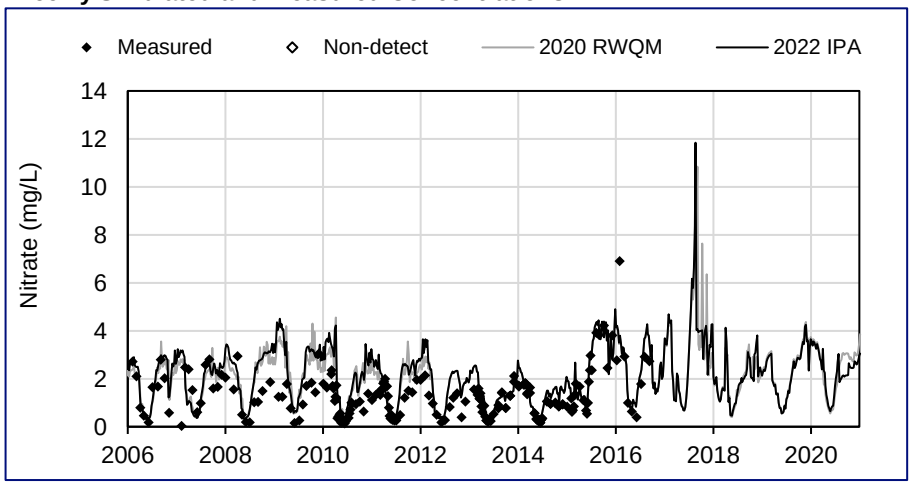
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	2/7/2006	2/7/2006
Last Measured Sample	9/13/2016	9/13/2016
Data Points Available for Comparison, n	184	184
Non-Detect Count	0	0
Measured Mean (mg/L)	1.2	1.3
Simulated Mean (mg/L)	1.7	1.8
Bias (mg/L)	0.45	0.52
Relative Bias	1.4	1.4
Error (mg/L)	0.6	0.66
Percent Error	49%	53%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

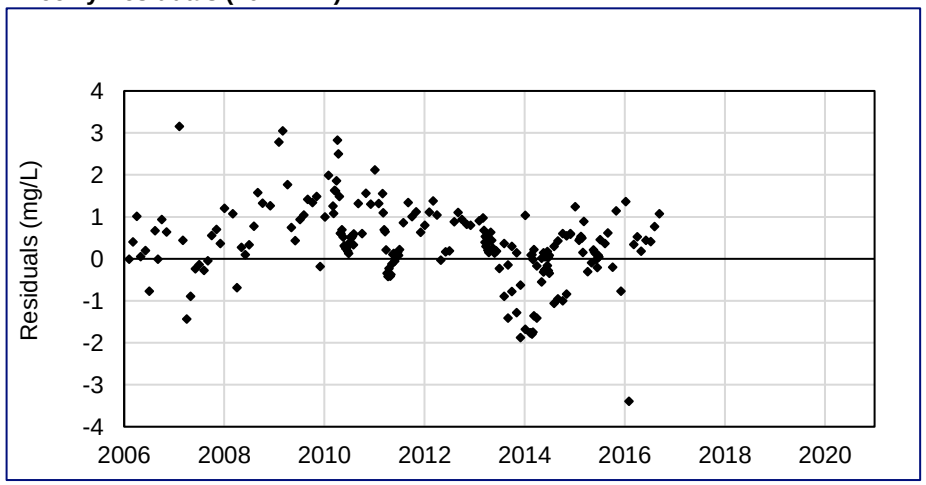


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



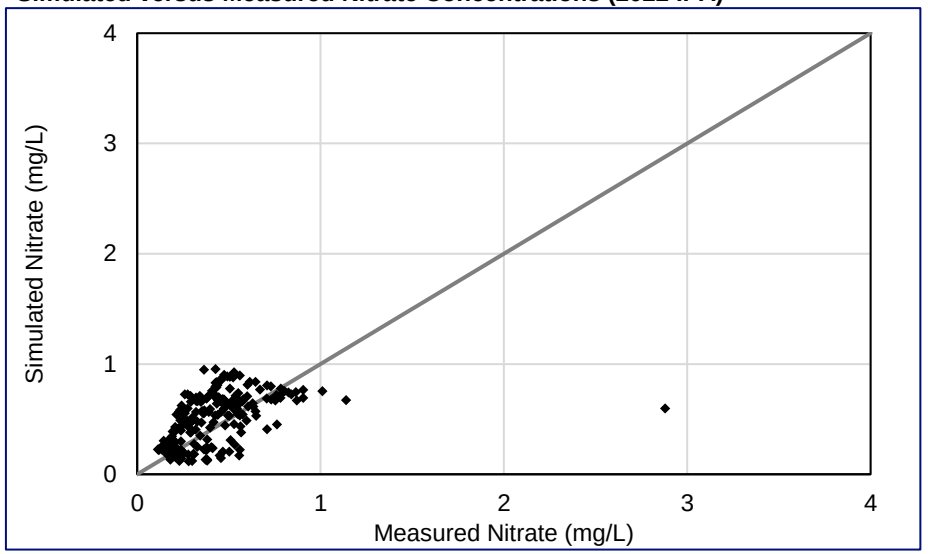
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-38: Nitrate Calibration Information for Node GH_ERC - GHO Elk River Compliance Point (EMS E300090)

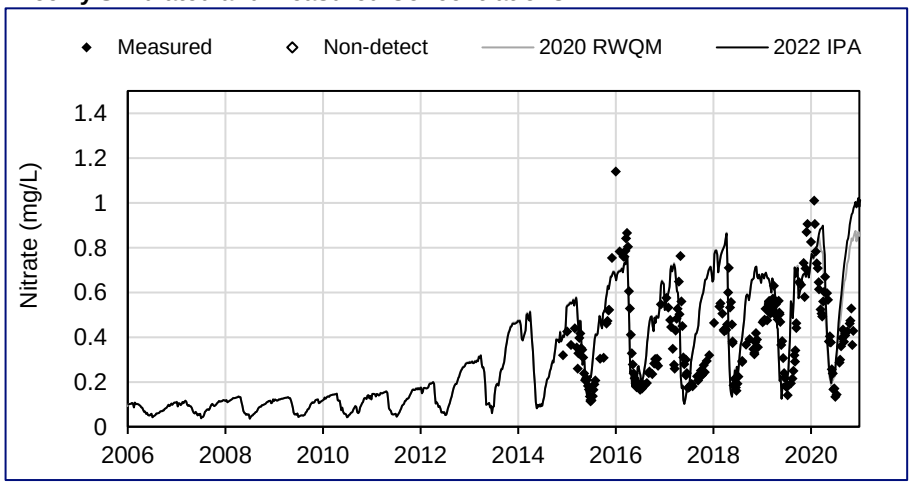
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	12/4/2014	12/4/2014
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	135	135
Non-Detect Count	0	0
Measured Mean (mg/L)	0.36	0.36
Simulated Mean (mg/L)	0.45	0.45
Bias (mg/L)	0.086	0.085
Relative Bias	1.2	1.2
Error (mg/L)	0.16	0.16
Percent Error	45%	45%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

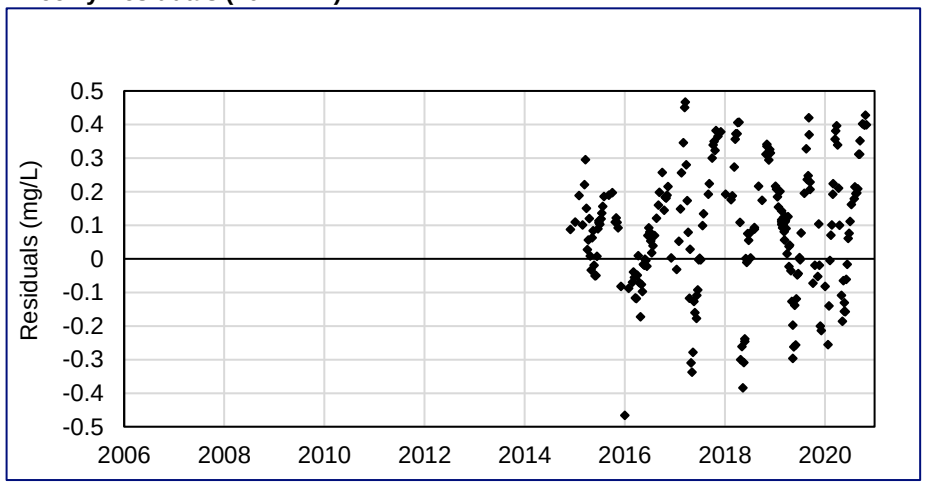


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



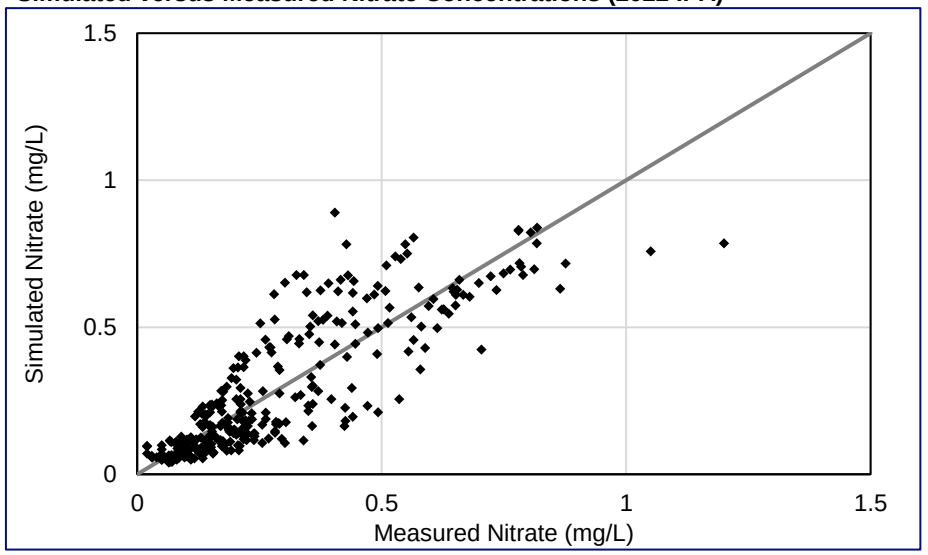
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-39: Nitrate Calibration Information for Node GH_ER1 - Elk River u/s of Boivin Creek (u/s of Fording River) (EMS E206661)

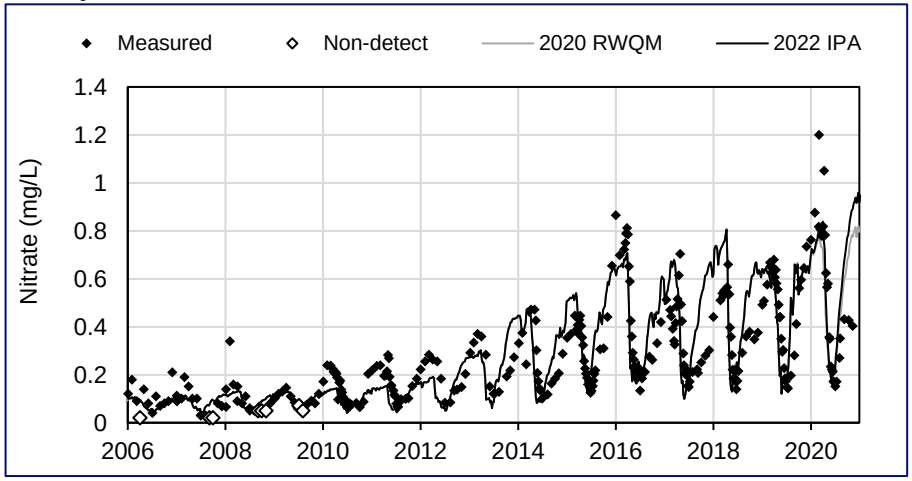
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/4/2006	1/4/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	256	256
Non-Detect Count	8	8
Measured Mean (mg/L)	0.24	0.24
Simulated Mean (mg/L)	0.24	0.24
Bias (mg/L)	0.0043	0.004
Relative Bias	1.0	1.0
Error (mg/L)	0.081	0.08
Percent Error	34%	34%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

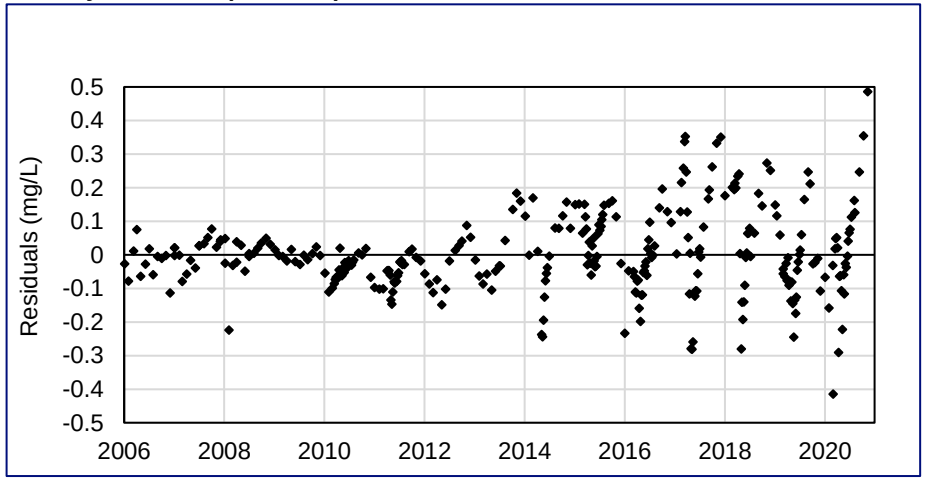


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



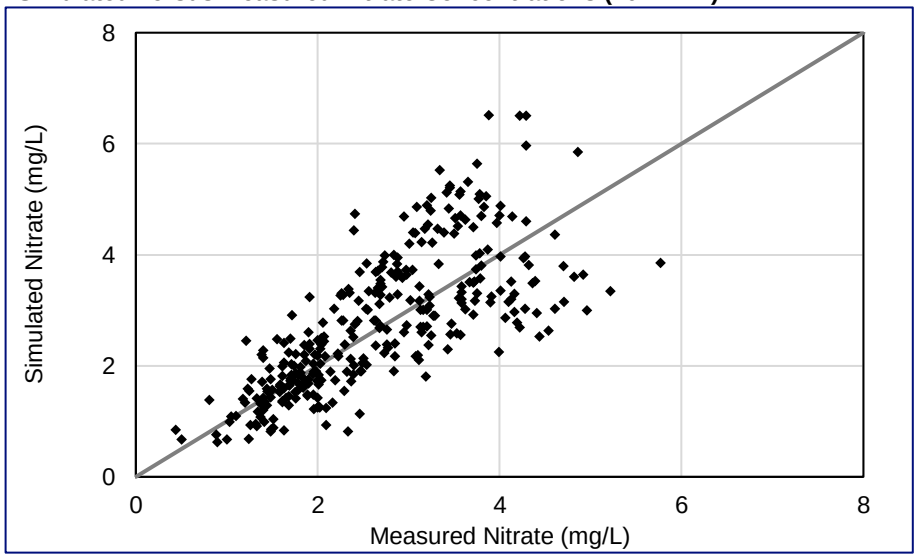
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-40: Nitrate Calibration Information for Node EV_ER4 - Elk River u/s of Grave Creek (EMS 0200027)

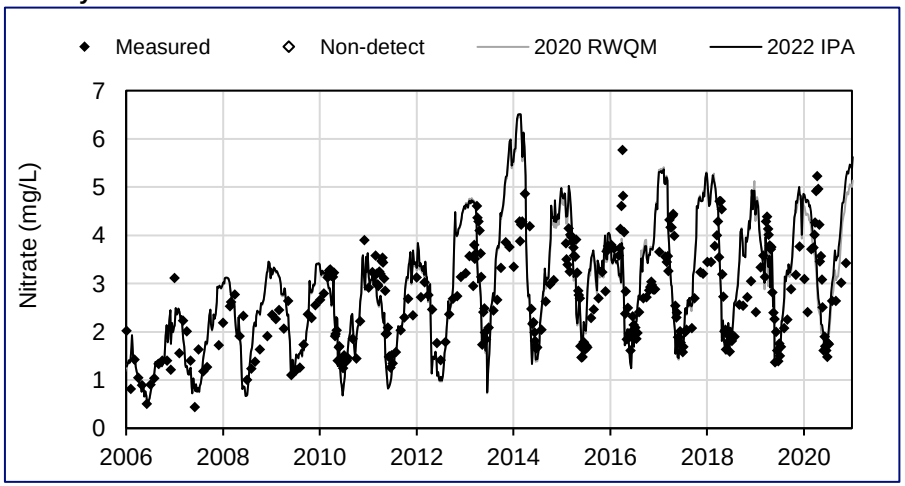
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	269	269
Non-Detect Count	0	0
Measured Mean (mg/L)	2.6	2.6
Simulated Mean (mg/L)	2.7	2.7
Bias (mg/L)	0.1	0.12
Relative Bias	1.0	1.0
Error (mg/L)	0.64	0.64
Percent Error	24%	25%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

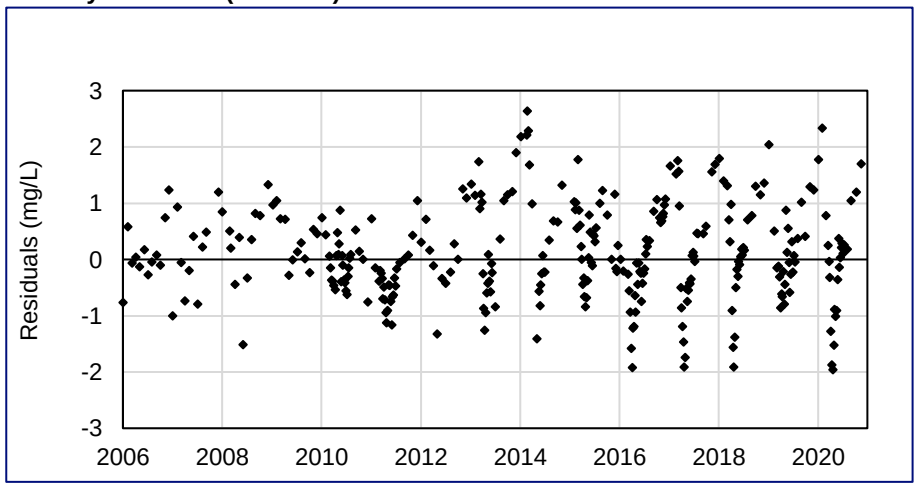


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



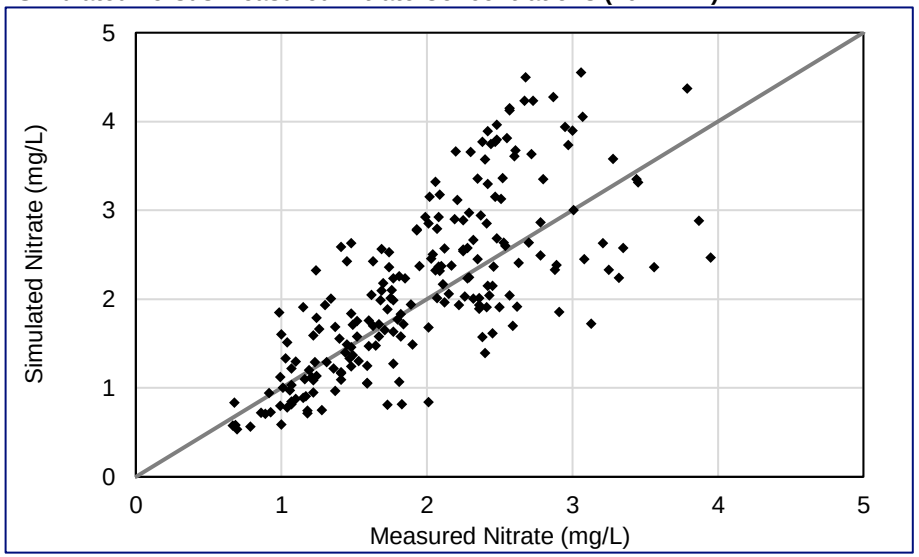
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-41: Nitrate Calibration Information for Node EV_ER2 - Elk River u/s of Michel Creek (EMS 0200111)

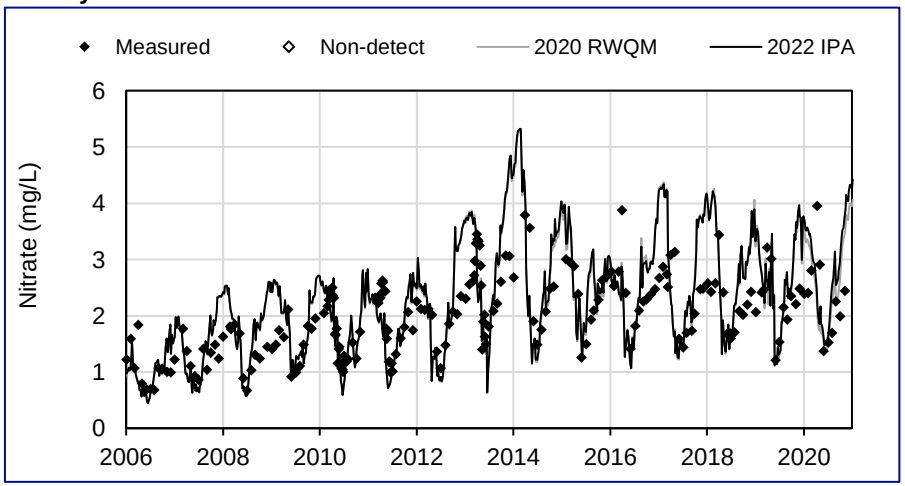
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	188	188
Non-Detect Count	0	0
Measured Mean (mg/L)	1.9	1.9
Simulated Mean (mg/L)	2.1	2.1
Bias (mg/L)	0.14	0.15
Relative Bias	1.1	1.1
Error (mg/L)	0.5	0.5
Percent Error	26%	26%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

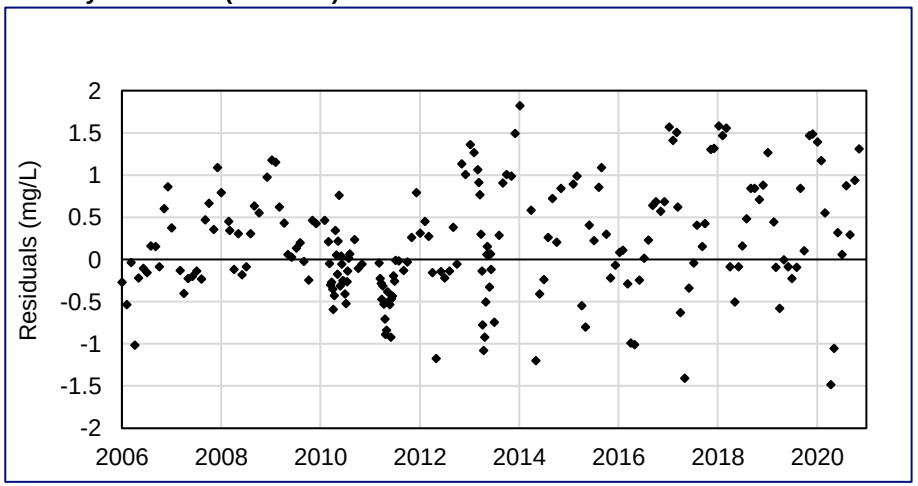


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



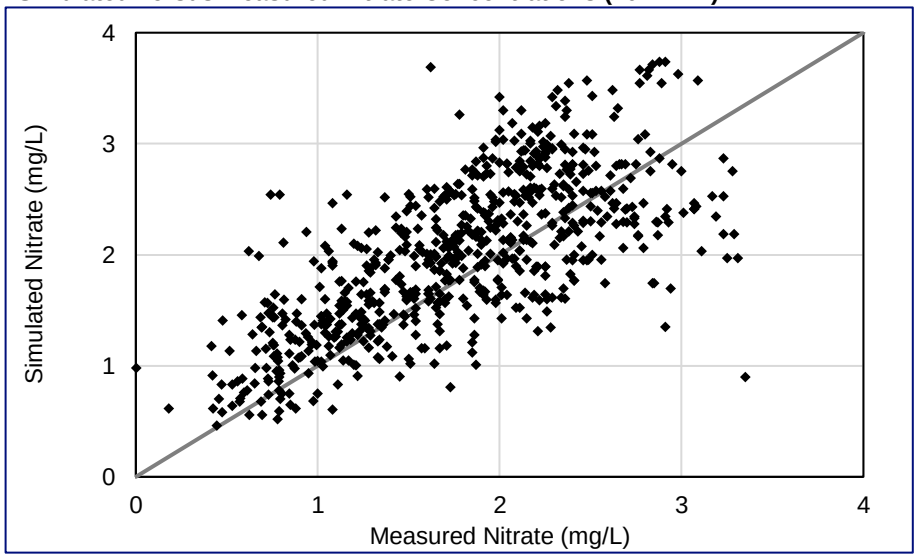
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-42: Nitrate Calibration Information for Node EV_ER1 - Elk River d/s of Michel Creek (EMS 0200393)

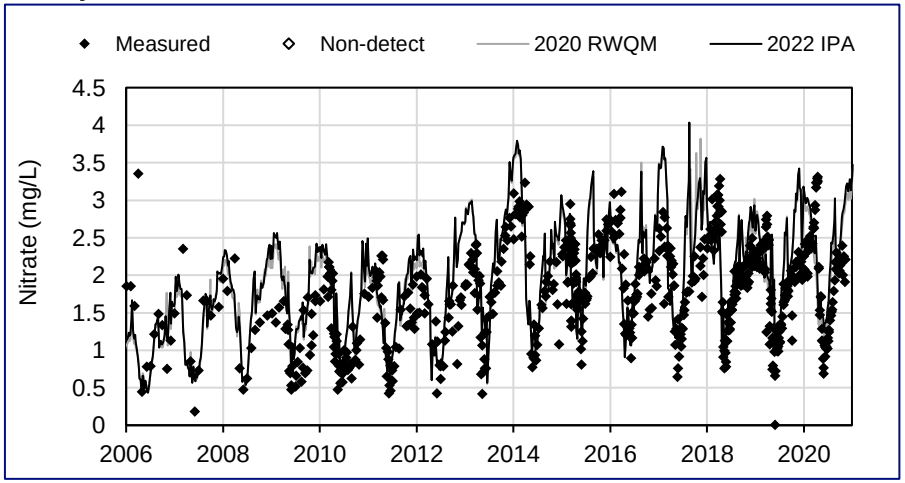
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	1/3/2006	1/3/2006
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	535	535
Non-Detect Count	0	0
Measured Mean (mg/L)	1.7	1.7
Simulated Mean (mg/L)	1.9	1.9
Bias (mg/L)	0.19	0.21
Relative Bias	1.1	1.1
Error (mg/L)	0.42	0.43
Percent Error	24%	25%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

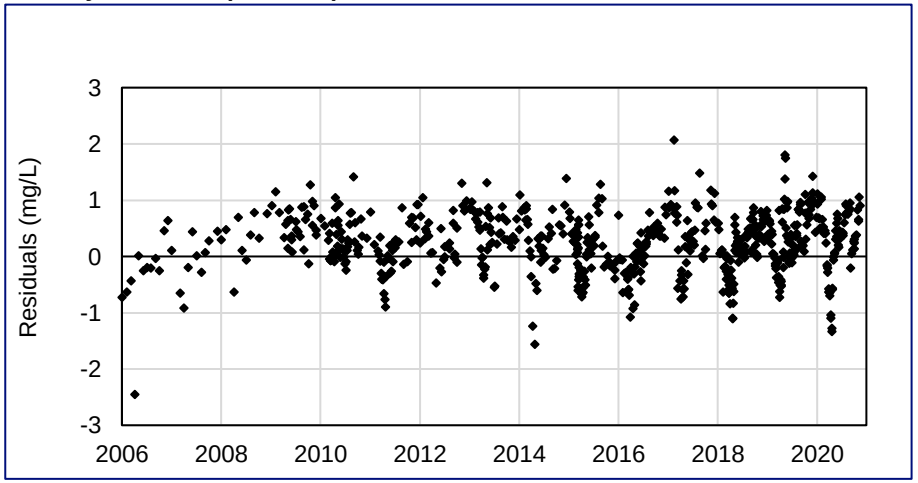


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



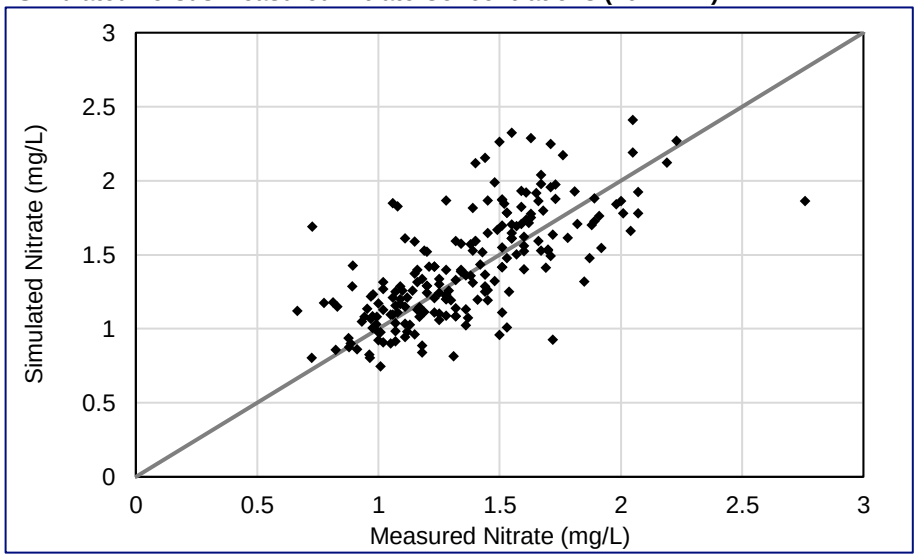
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-43: Nitrate Calibration Information for Node RG_ELKORES - Elk River at Elko Reservoir (EMS E294312)

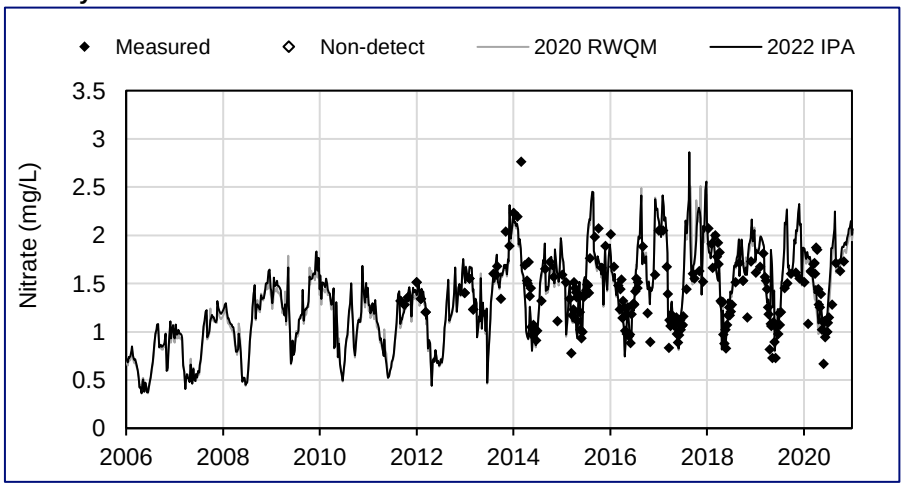
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	9/6/2011	9/6/2011
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	154	154
Non-Detect Count	0	0
Measured Mean (mg/L)	1.4	1.4
Simulated Mean (mg/L)	1.4	1.4
Bias (mg/L)	0.0075	0.019
Relative Bias	1.0	1.0
Error (mg/L)	0.19	0.19
Percent Error	14%	14%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

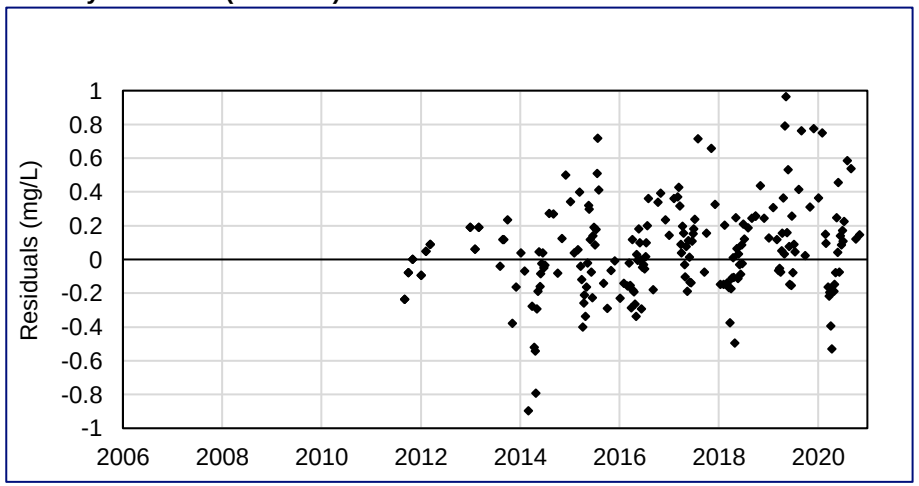


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



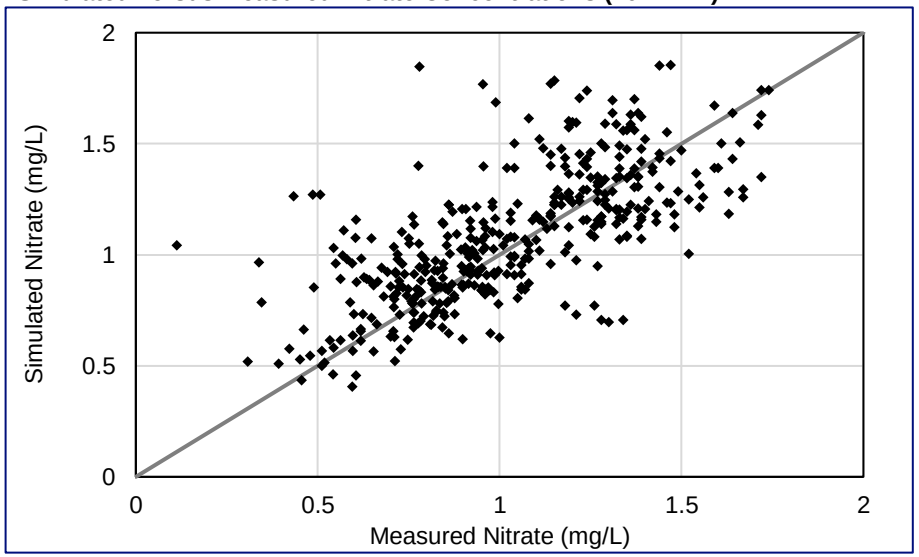
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-44: Nitrate Calibration Information for Node RG_ELKMOUTH - Elk River at Highway 93 near Elko

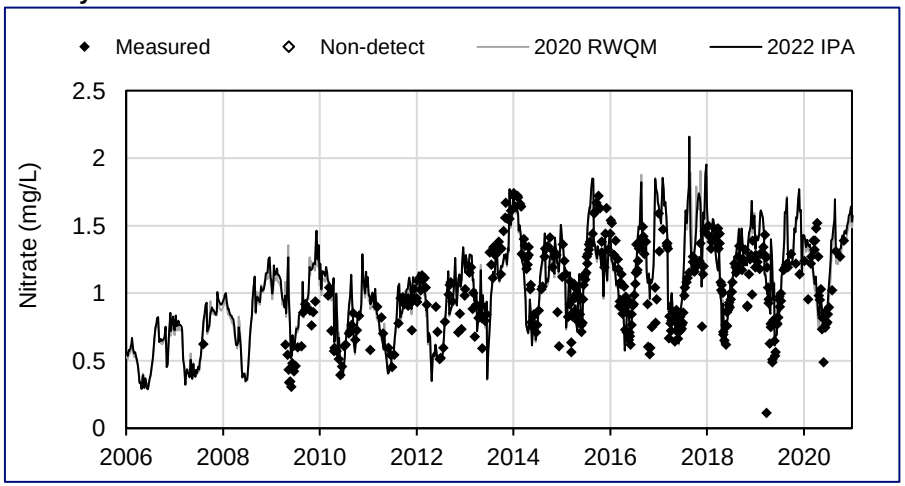
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	8/6/2007	8/6/2007
Last Measured Sample	12/16/2018	12/16/2018
Data Points Available for Comparison, n	346	346
Non-Detect Count	0	0
Measured Mean (mg/L)	1.0	1.0
Simulated Mean (mg/L)	1.1	1.1
Bias (mg/L)	0.033	0.043
Relative Bias	1.0	1.0
Error (mg/L)	0.17	0.17
Percent Error	16%	16%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

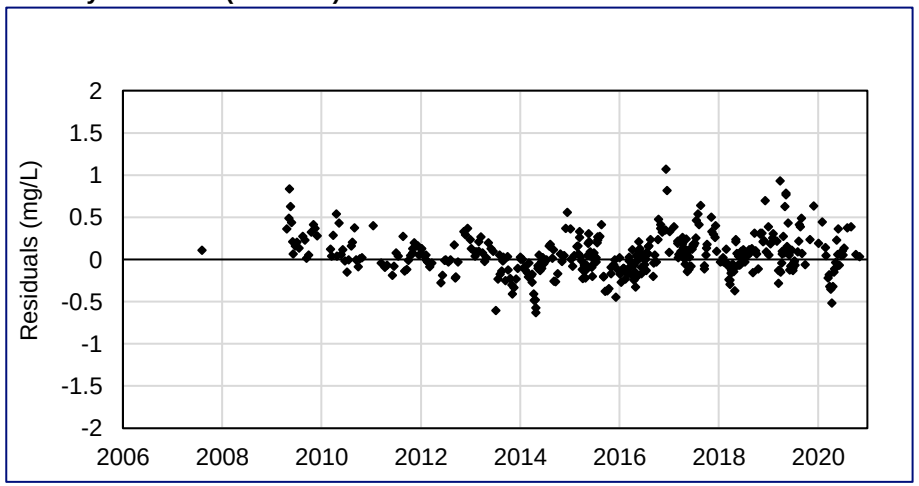


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



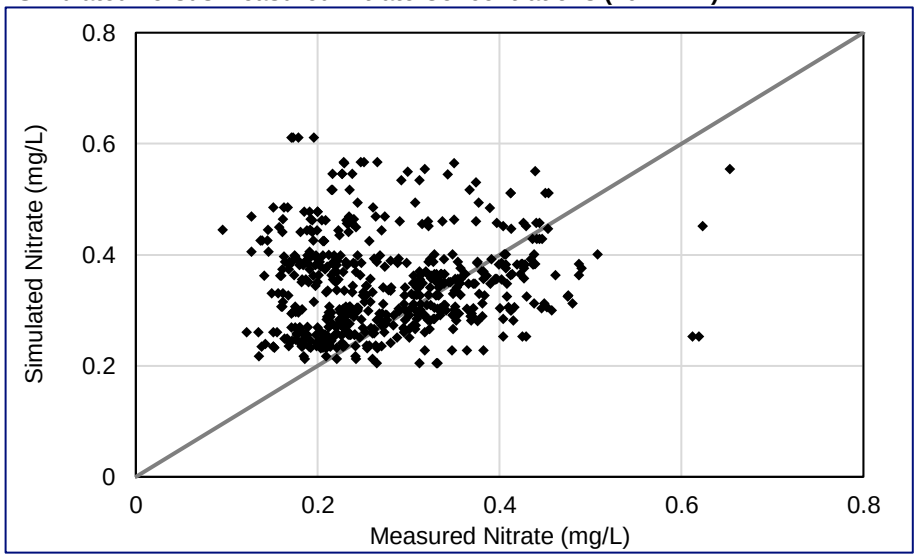
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

A1-45: Nitrate Calibration Information for Node RG_DSELK - Koocanusa Reservoir - South of the Elk River (EMS E300230)

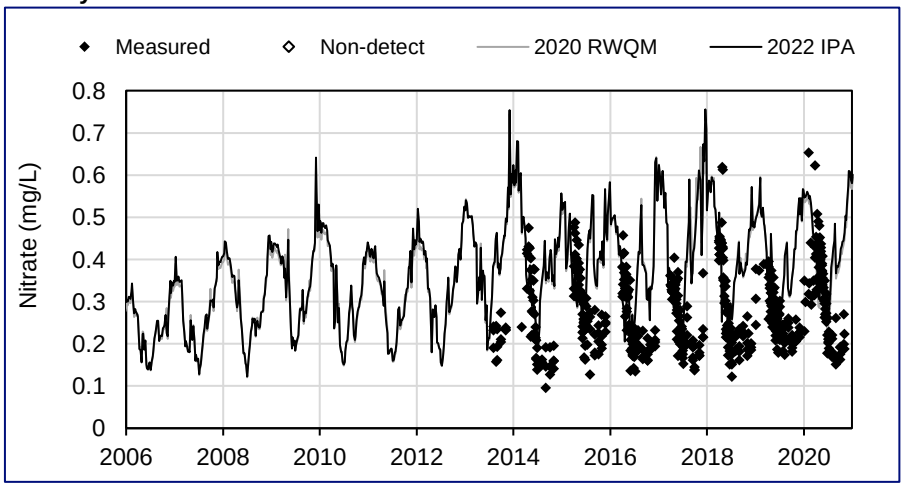
Measured and Simulated Nitrate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2006 to 2018	2006 to 2018
First Measured Sample	8/7/2013	8/7/2013
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	377	377
Non-Detect Count	0	0
Measured Mean (mg/L)	0.27	0.27
Simulated Mean (mg/L)	0.34	0.34
Bias (mg/L)	0.066	0.068
Relative Bias	1.2	1.3
Error (mg/L)	0.1	0.1
Percent Error	37%	38%

Simulated versus Measured Nitrate Concentrations (2022 IPA)

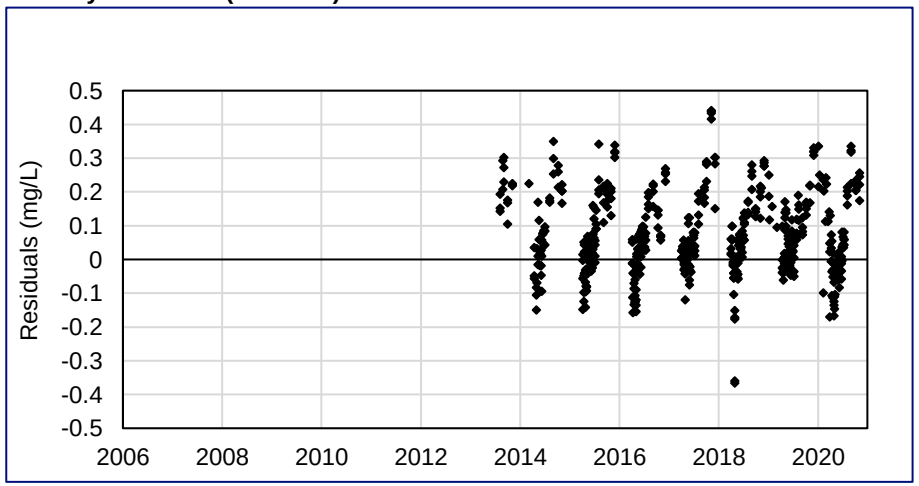


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

APPENDIX B

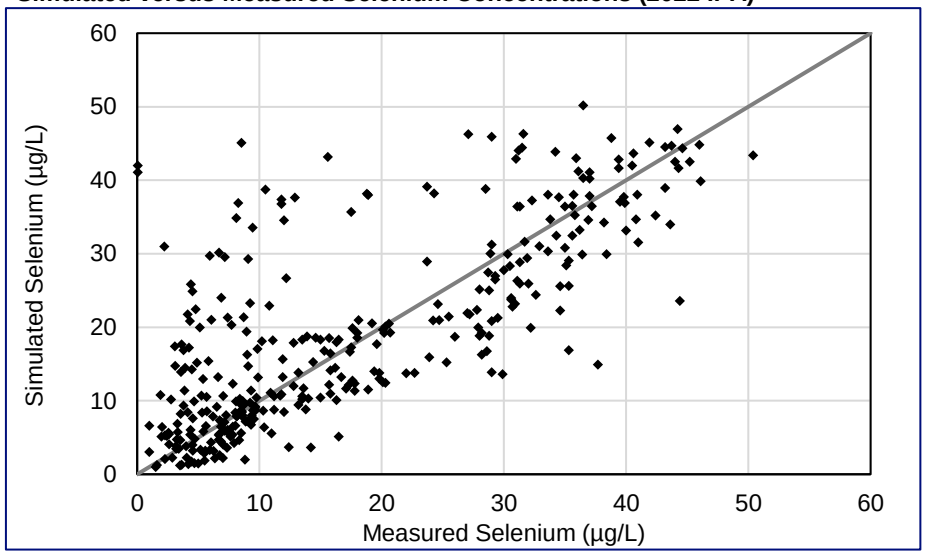
Model Calibration Results for Selenium

B1-1: Selenium Calibration Information for Node FR_HC1 - Henretta Creek u/s of Fording River (EMS E216778)

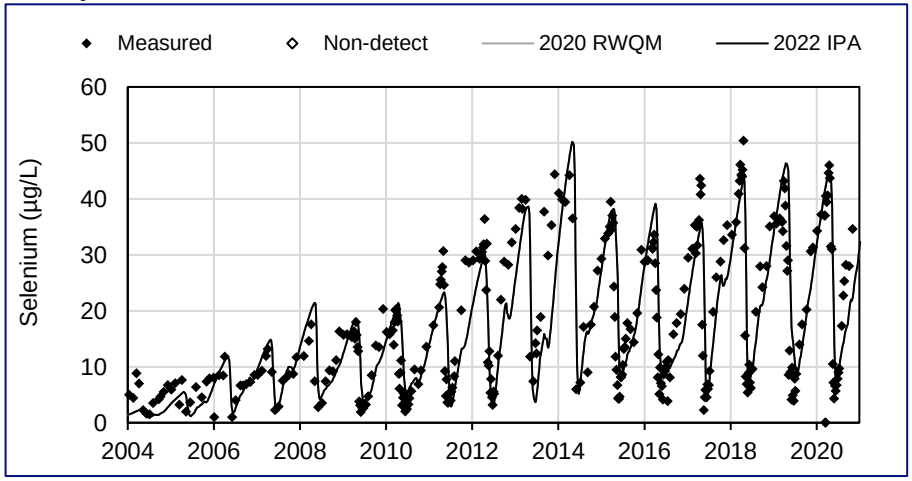
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/12/2004	1/12/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	290	290
Non-Detect Count	0	0
Measured Mean (µg/L)	16	16
Simulated Mean (µg/L)	17	17
Bias (µg/L)	0.81	0.81
Relative Bias	1.0	1.0
Error (µg/L)	5.5	5.5
Percent Error	34%	34%

Simulated versus Measured Selenium Concentrations (2022 IPA)

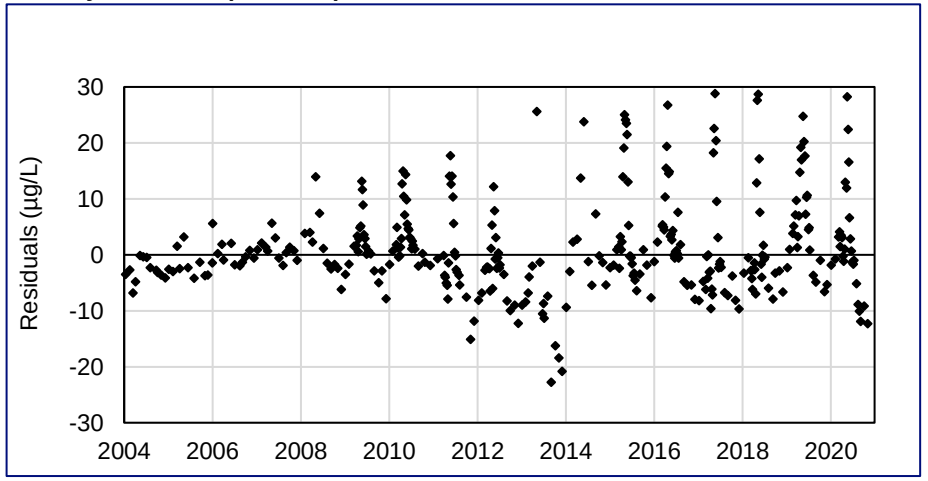


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



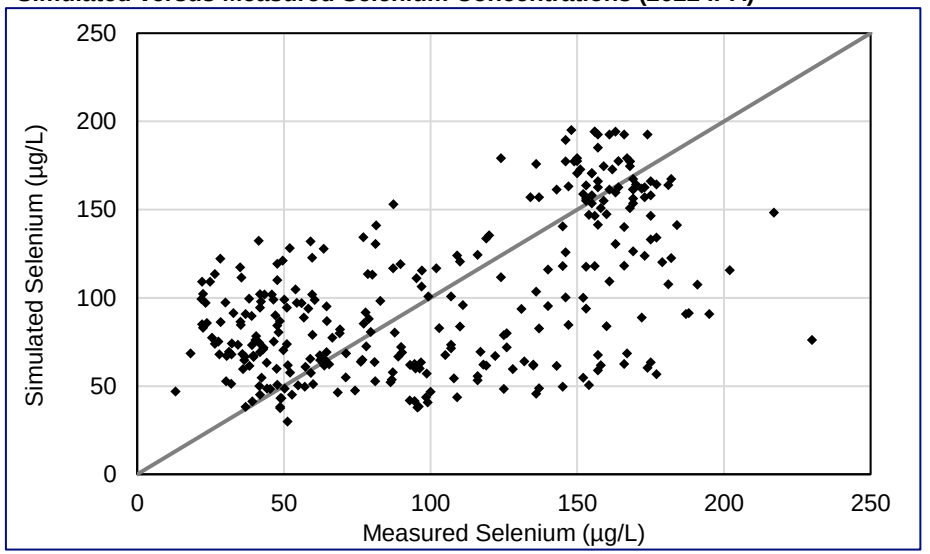
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-2: Selenium Calibration Information for Node FR_CC1 - Clode Creek Sediment Pond Decant (EMS E102481)

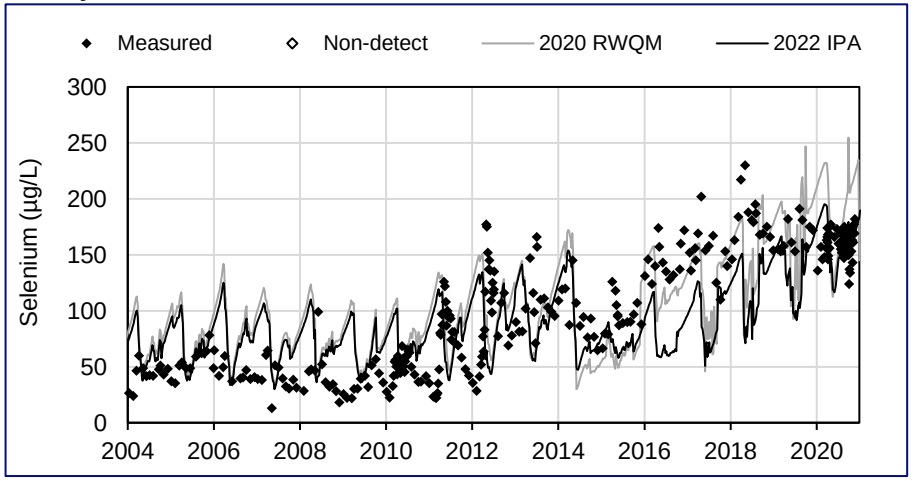
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/12/2004	1/12/2004
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	234	234
Non-Detect Count	0	0
Measured Mean (µg/L)	84	84
Simulated Mean (µg/L)	94	82
Bias (µg/L)	9.9	-2.4
Relative Bias	1.1	0.97
Error (µg/L)	41	41
Percent Error	49%	49%

Simulated versus Measured Selenium Concentrations (2022 IPA)

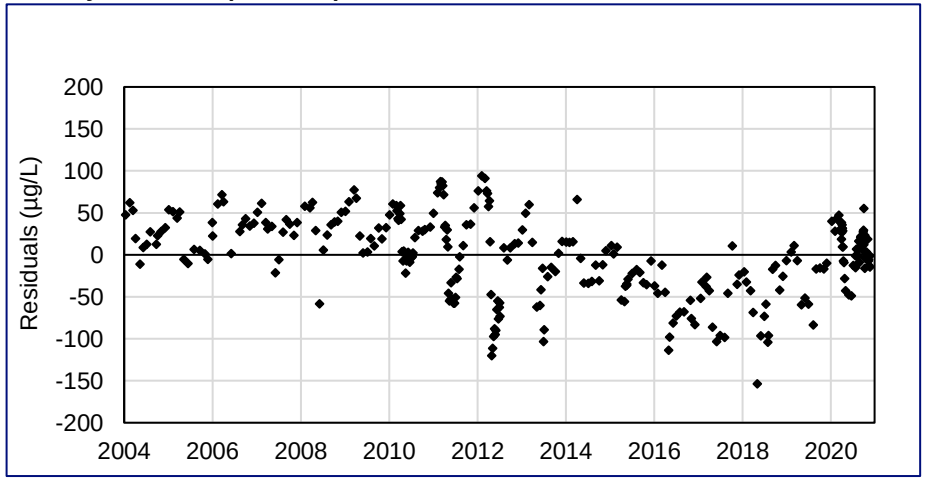


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



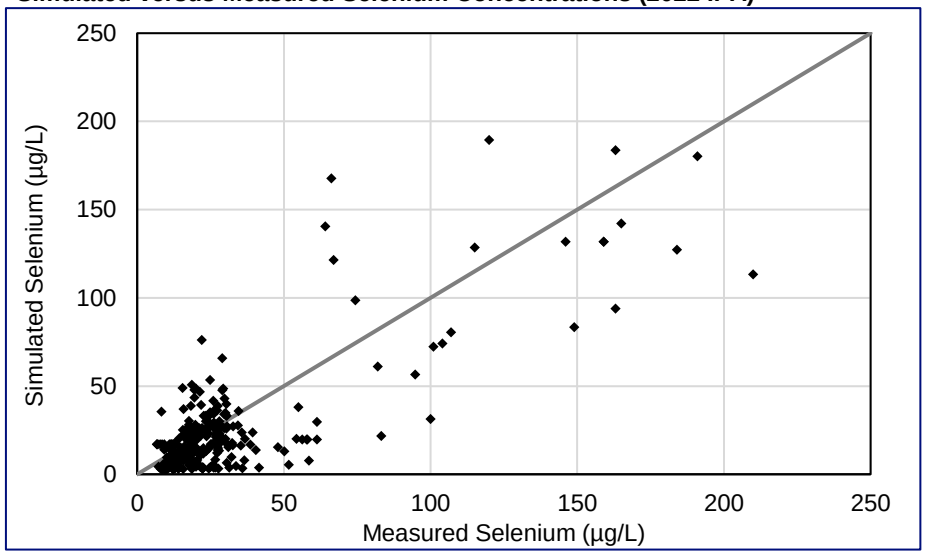
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-3: Selenium Calibration Information for Node FR_LMP1 - Lake Mountain Pond

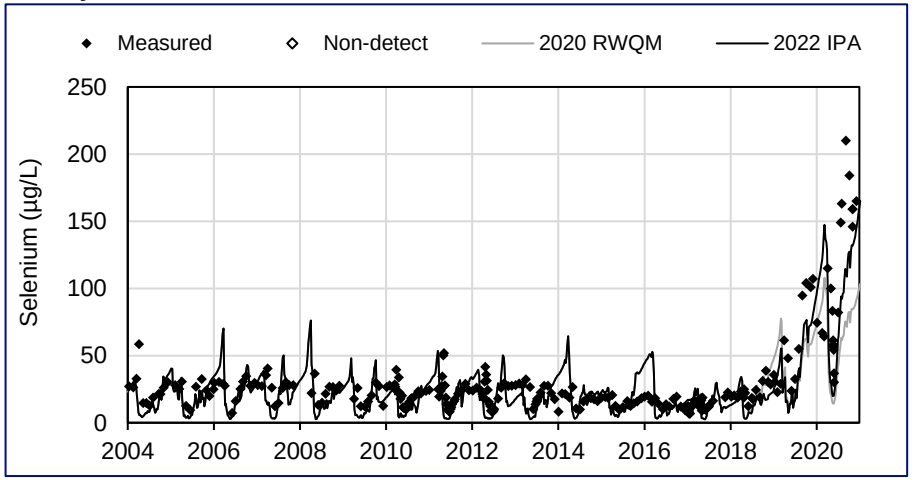
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/12/2004	1/12/2004
Last Measured Sample	12/10/2018	12/10/2018
Data Points Available for Comparison, n	240	240
Non-Detect Count	0	0
Measured Mean (µg/L)	20	20
Simulated Mean (µg/L)	17	17
Bias (µg/L)	-2.8	-3.0
Relative Bias	0.86	0.85
Error (µg/L)	9.5	9.7
Percent Error	47%	48%

Simulated versus Measured Selenium Concentrations (2022 IPA)

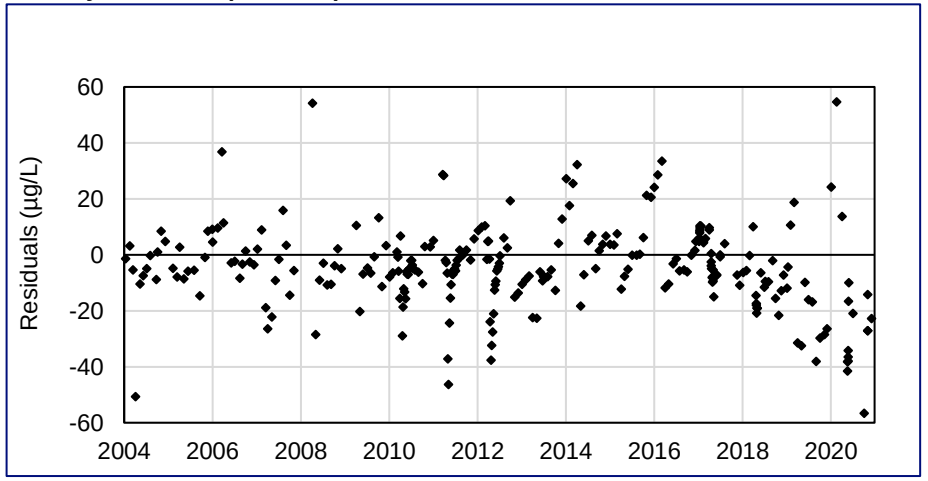


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



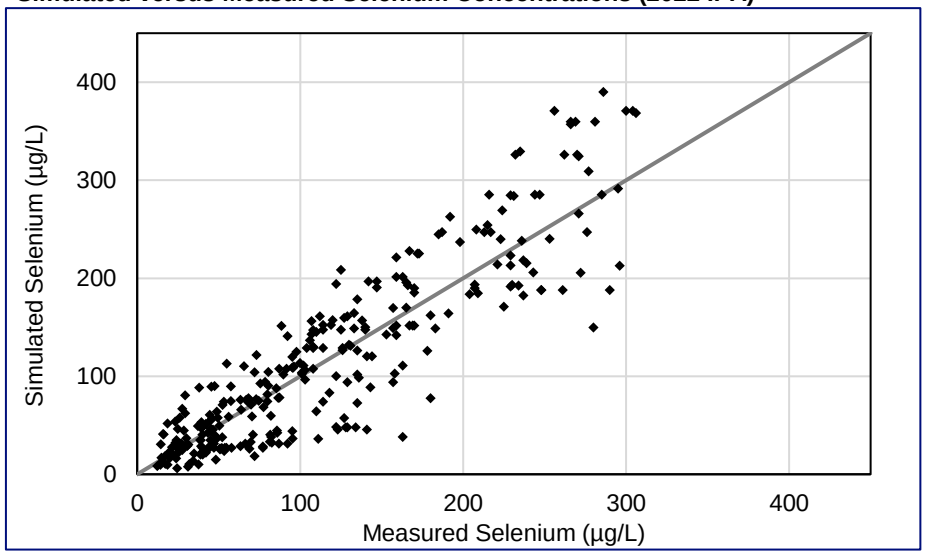
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-4: Selenium Calibration Information for Node FR_KC1 - Kilmarnock Creek d/s of Rock Drain (EMS 0200252)

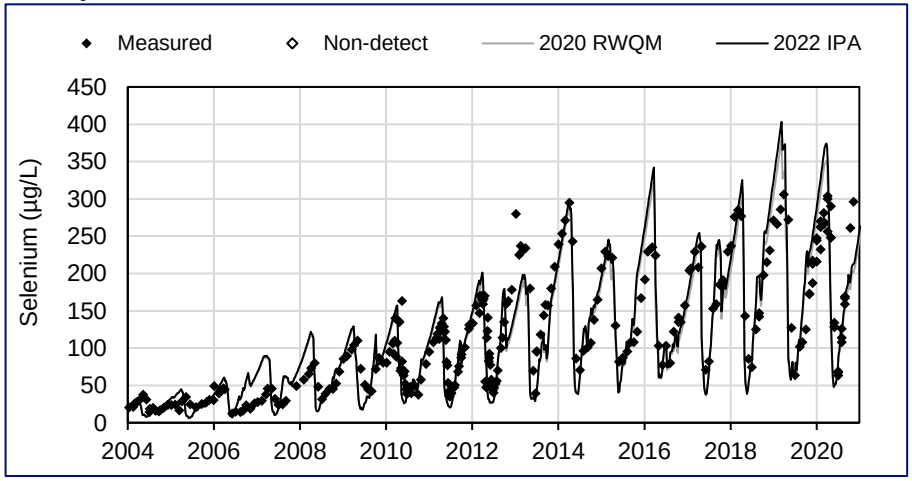
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/12/2004	1/12/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	244	244
Non-Detect Count	0	0
Measured Mean (µg/L)	102	102
Simulated Mean (µg/L)	96	100
Bias (µg/L)	-5.7	-1.9
Relative Bias	0.94	0.98
Error (µg/L)	26	26
Percent Error	26%	26%

Simulated versus Measured Selenium Concentrations (2022 IPA)

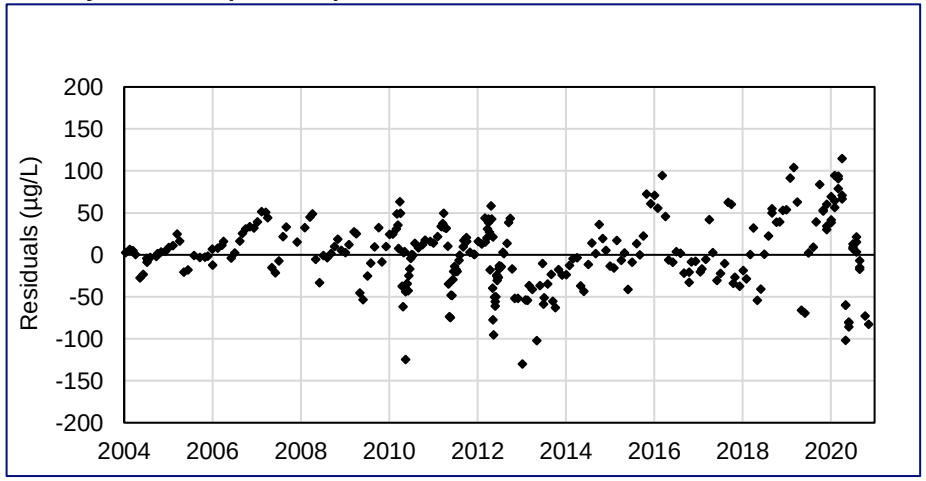


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



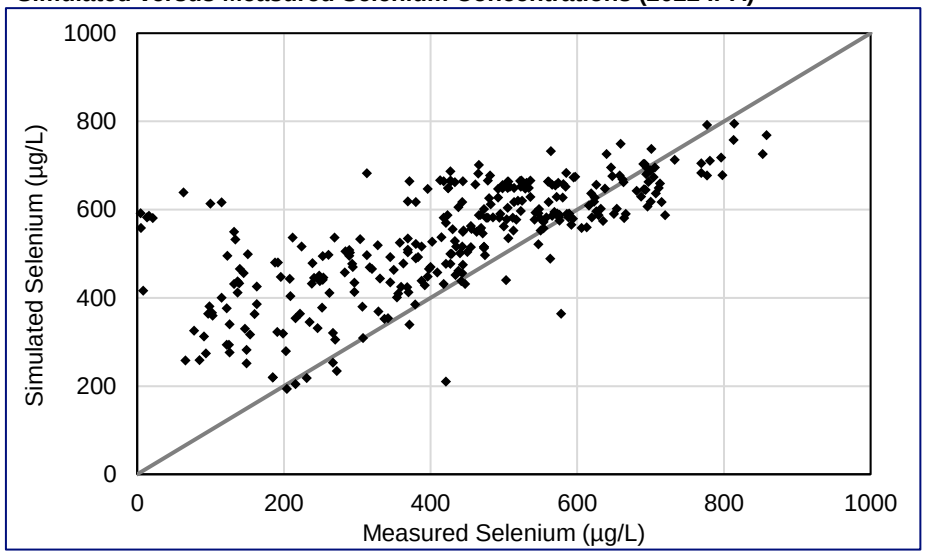
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-5: Selenium Calibration Information for Node GH_SC1 - Swift Creek Sediment Pond Decant (EMS E221329)

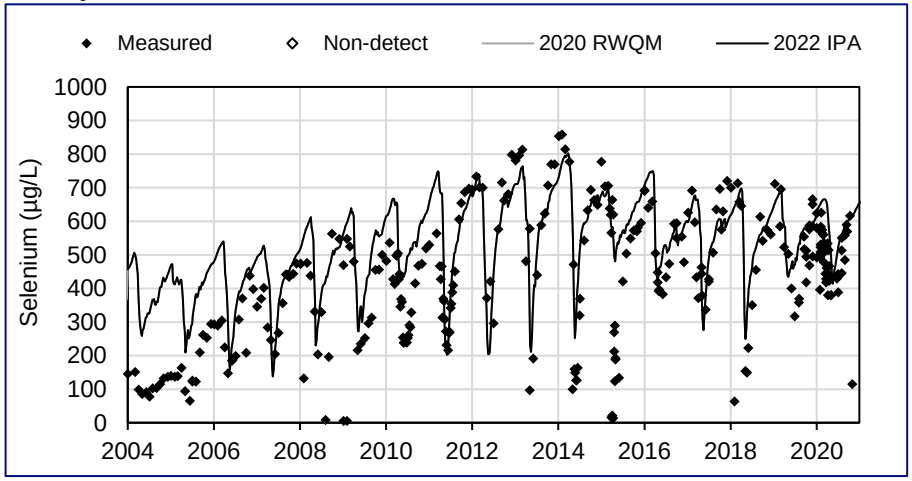
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/10/2018	12/10/2018
Data Points Available for Comparison, n	242	242
Non-Detect Count	0	0
Measured Mean (µg/L)	407	407
Simulated Mean (µg/L)	516	516
Bias (µg/L)	110	110
Relative Bias	1.3	1.3
Error (µg/L)	133	133
Percent Error	33%	33%

Simulated versus Measured Selenium Concentrations (2022 IPA)

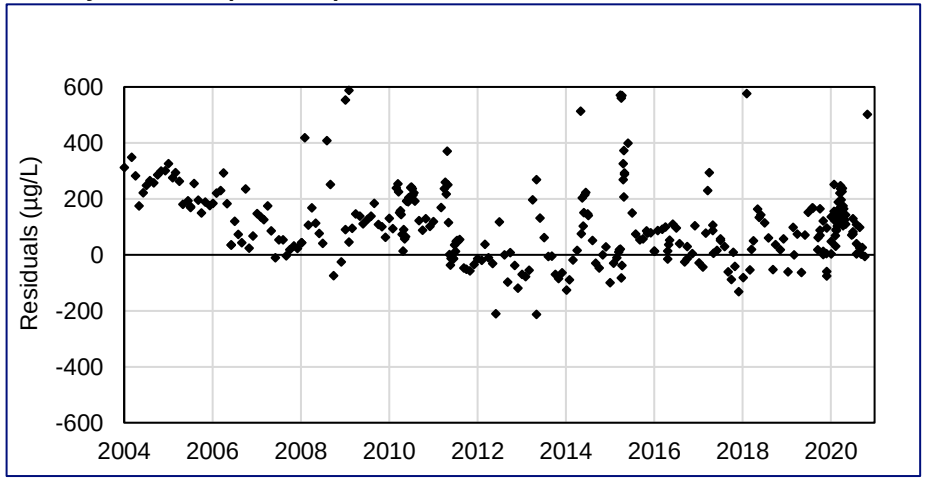


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



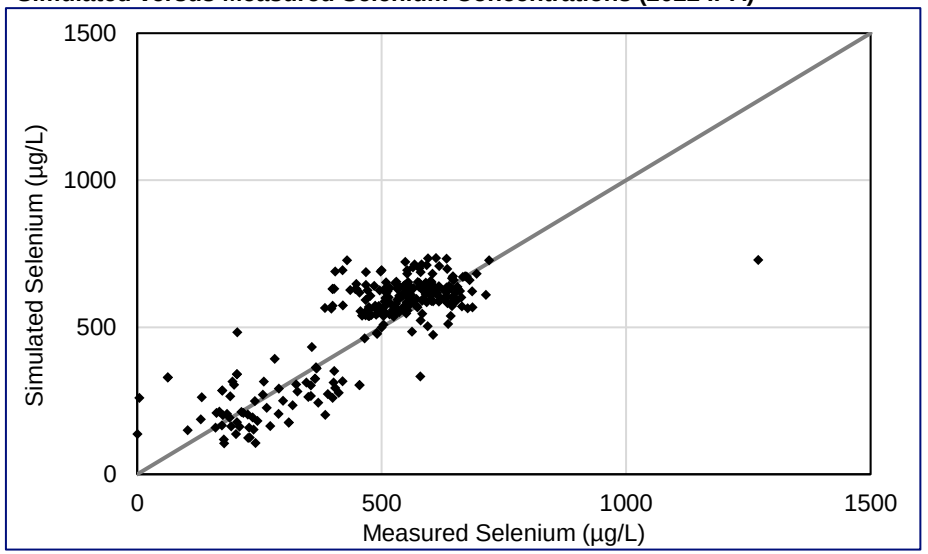
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-6: Selenium Calibration Information for Node GH_CC1 - Cataract Creek Sediment Pond Decant (EMS 0200384)

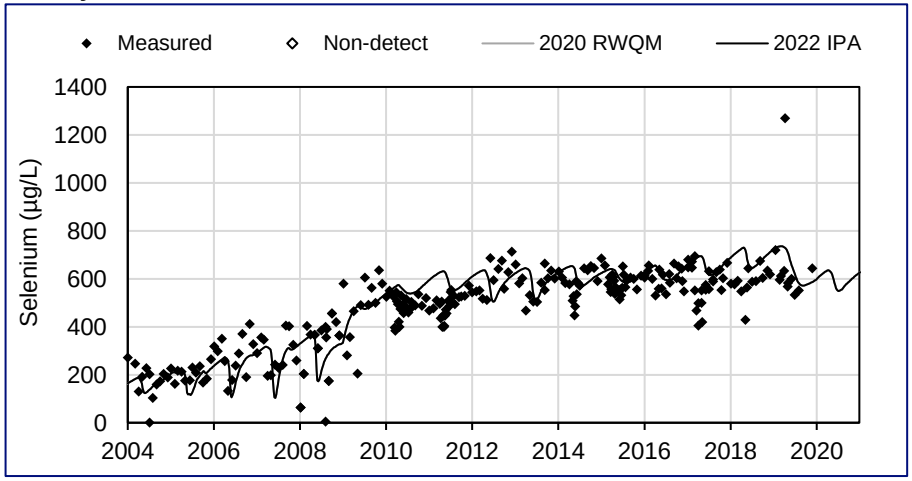
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	257	257
Non-Detect Count	0	0
Measured Mean (µg/L)	471	471
Simulated Mean (µg/L)	504	504
Bias (µg/L)	34	34
Relative Bias	1.1	1.1
Error (µg/L)	76	76
Percent Error	16%	16%

Simulated versus Measured Selenium Concentrations (2022 IPA)

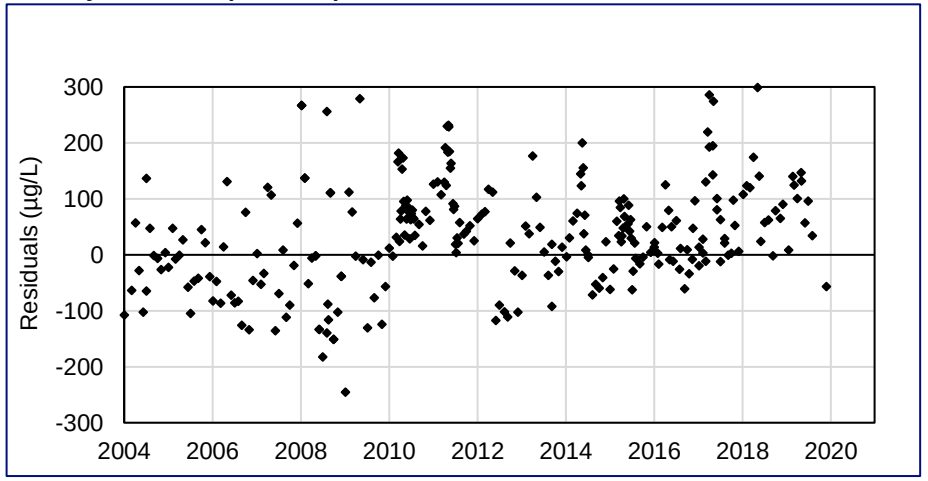


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



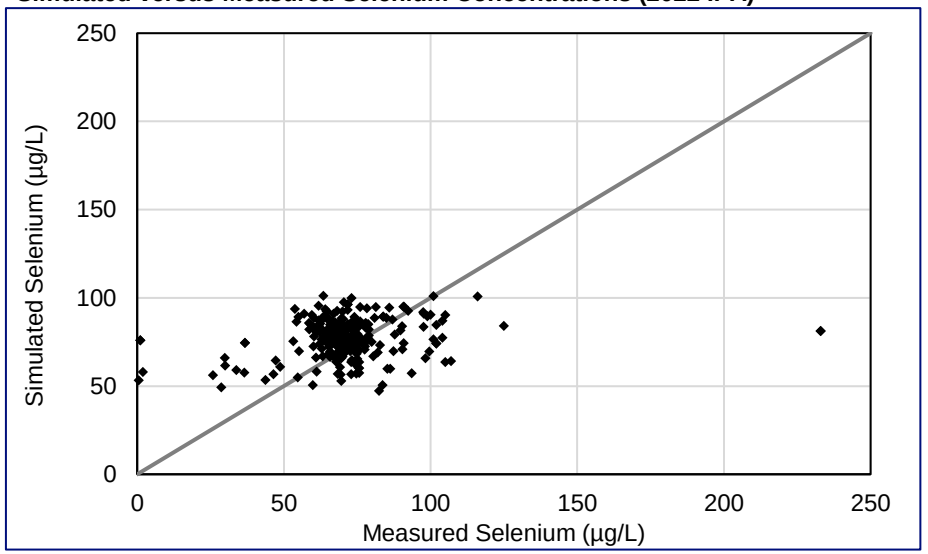
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-7: Selenium Calibration Information for Node GH_PC1 - Porter Creek Sediment Pond Decant (EMS 0200385)

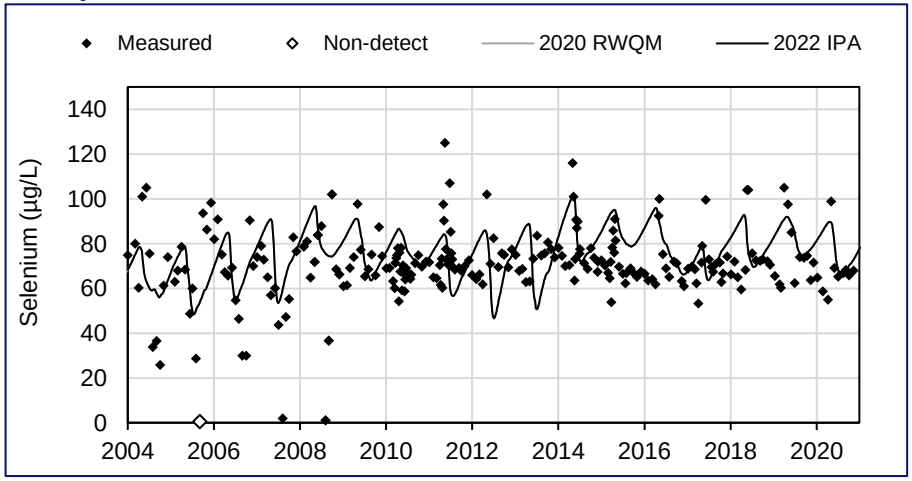
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	234	234
Non-Detect Count	1	1
Measured Mean (µg/L)	72	72
Simulated Mean (µg/L)	77	77
Bias (µg/L)	5.2	5.2
Relative Bias	1.1	1.1
Error (µg/L)	16	16
Percent Error	22%	22%

Simulated versus Measured Selenium Concentrations (2022 IPA)

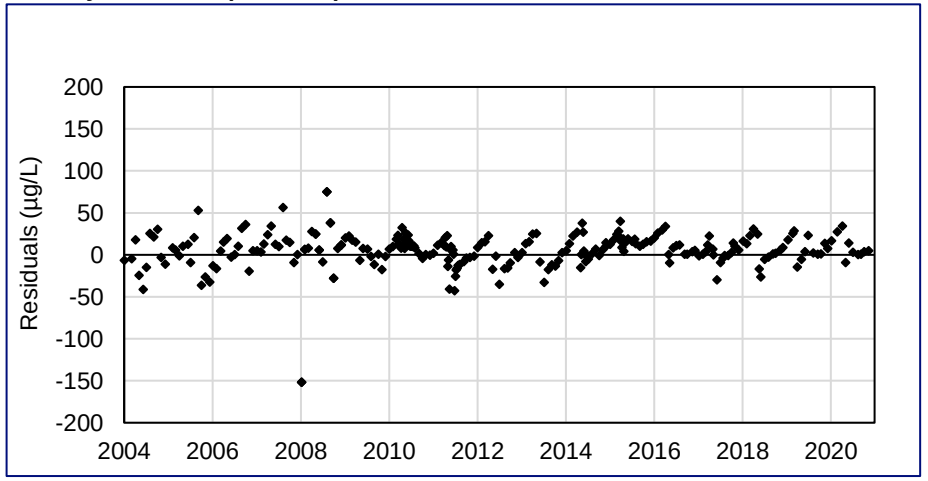


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



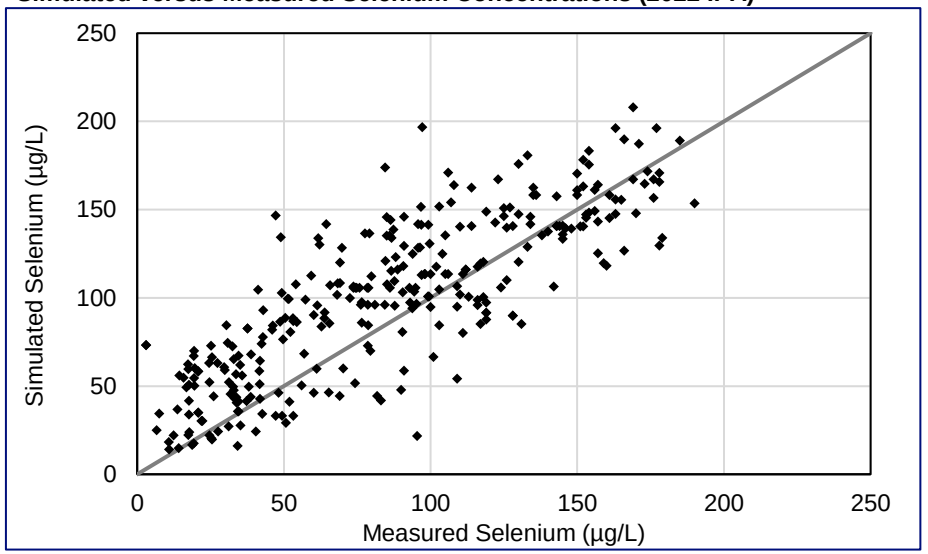
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-8: Selenium Calibration Information for Node GH_GH1 - Greenhills Creek Sediment Pond Decant (EMS E102709)

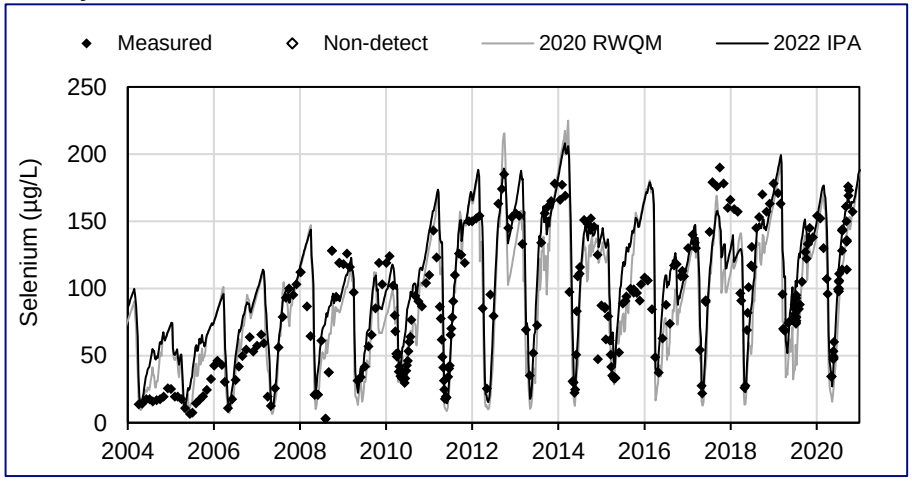
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/4/2004	4/4/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	240	240
Non-Detect Count	0	0
Measured Mean (µg/L)	80	80
Simulated Mean (µg/L)	81	95
Bias (µg/L)	1.6	15
Relative Bias	1.0	1.2
Error (µg/L)	25	27
Percent Error	31%	34%

Simulated versus Measured Selenium Concentrations (2022 IPA)

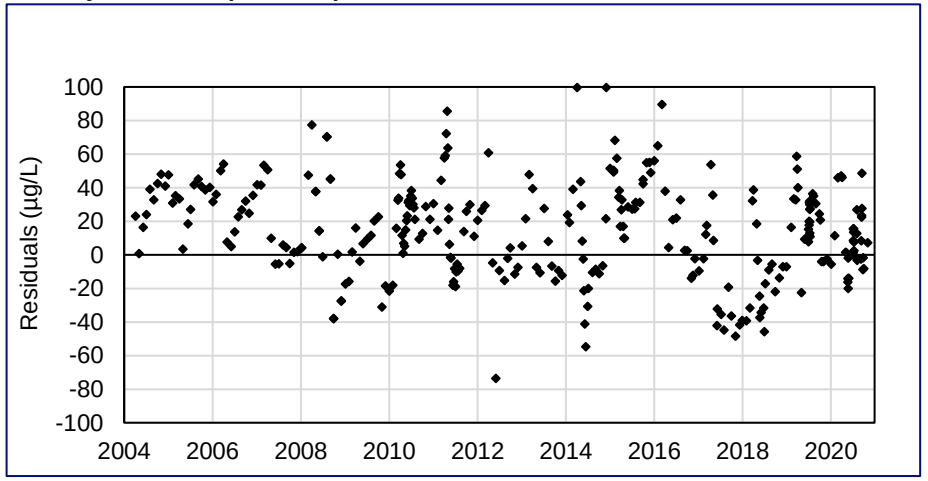


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



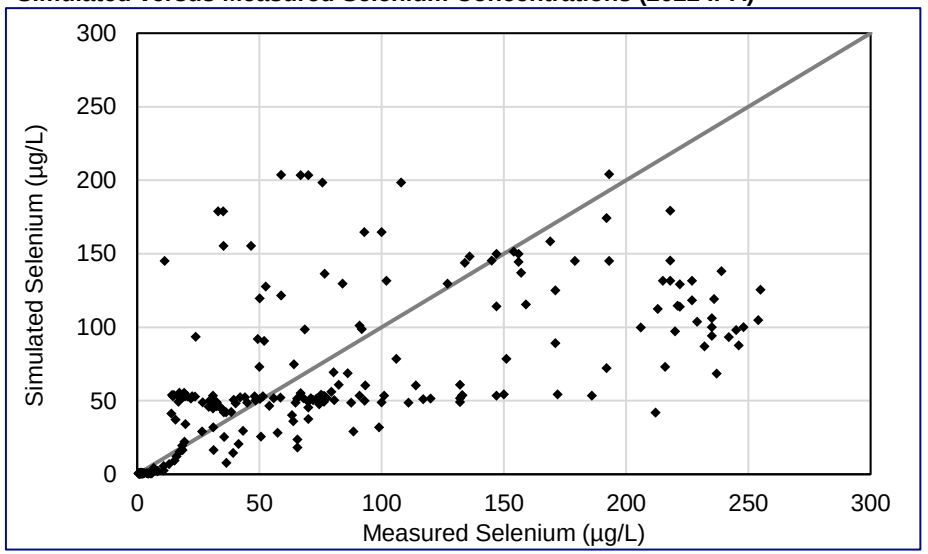
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-9: Selenium Calibration Information for Node GH_LC1 - Leask Creek Sediment Pond Decant (EMS E257796)

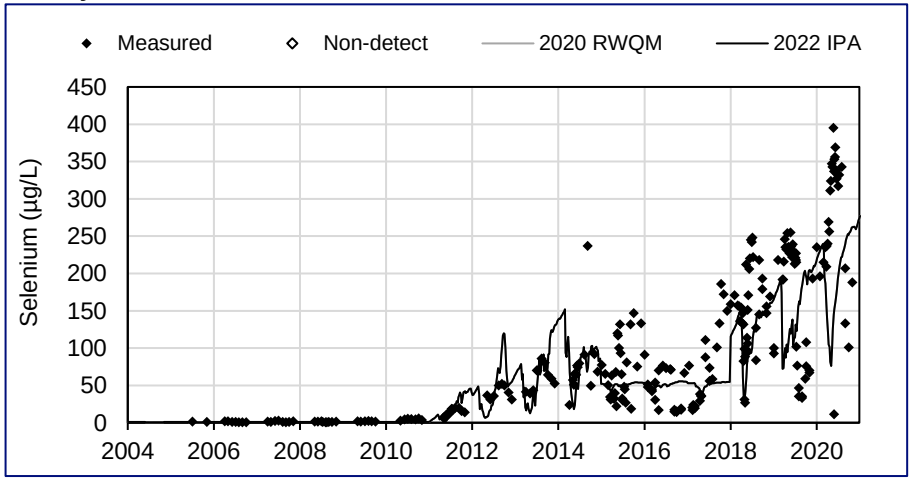
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/3/2005	7/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	191	191
Non-Detect Count	0	0
Measured Mean (µg/L)	63	63
Simulated Mean (µg/L)	49	49
Bias (µg/L)	-14	-14
Relative Bias	0.78	0.78
Error (µg/L)	28	28
Percent Error	44%	44%

Simulated versus Measured Selenium Concentrations (2022 IPA)

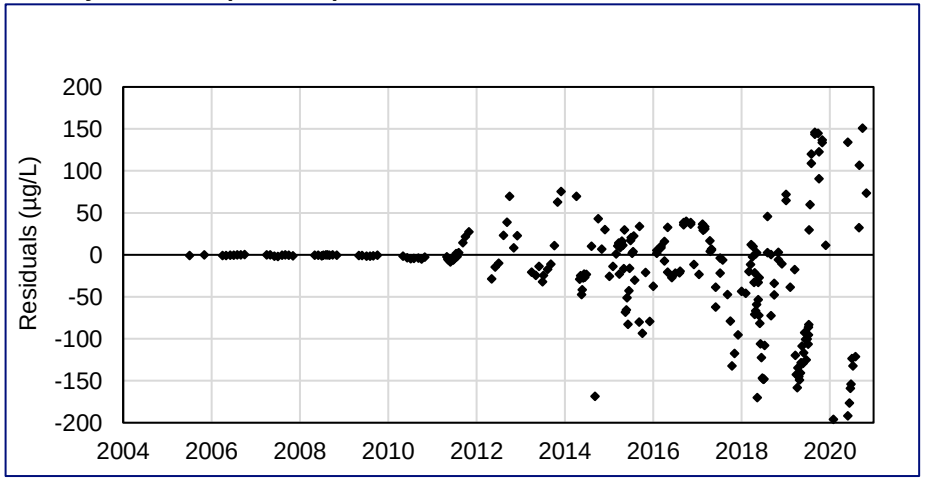


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



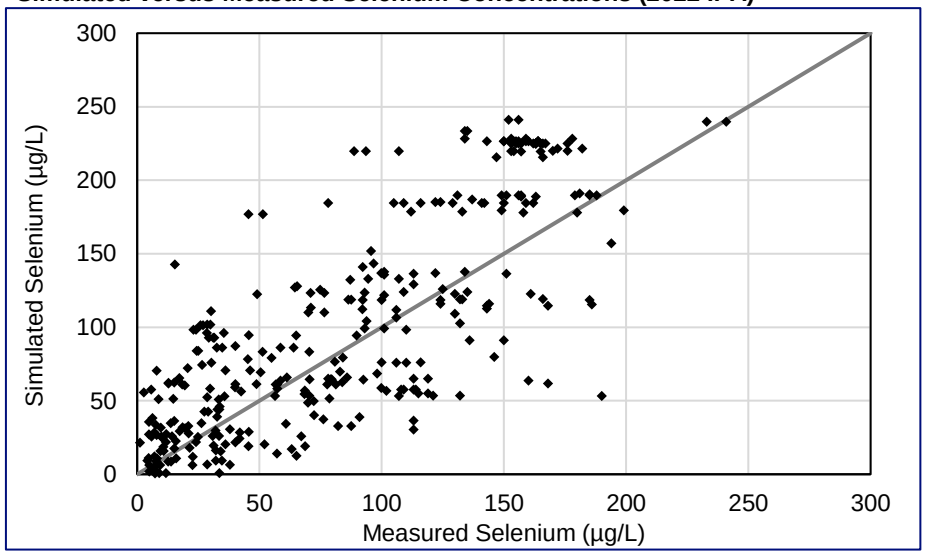
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-10: Selenium Calibration Information for Node GH_WC1 - Wolfram Creek Sediment Pond Decant (EMS E257795)

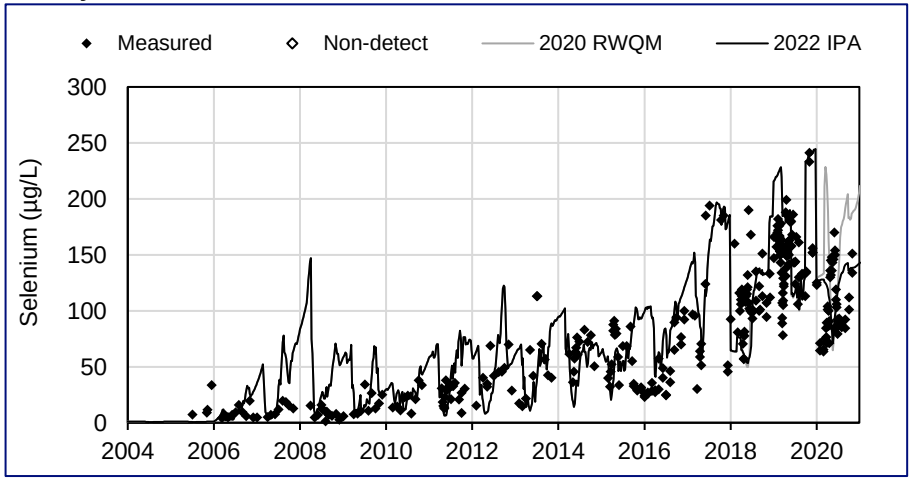
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/3/2005	7/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	211	211
Non-Detect Count	0	0
Measured Mean (µg/L)	55	55
Simulated Mean (µg/L)	60	60
Bias (µg/L)	5.3	5.1
Relative Bias	1.1	1.1
Error (µg/L)	31	31
Percent Error	56%	57%

Simulated versus Measured Selenium Concentrations (2022 IPA)

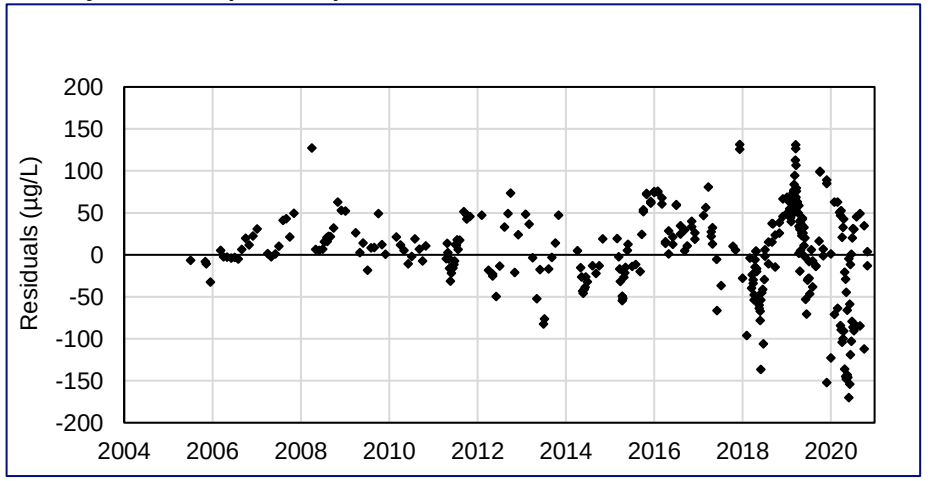


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



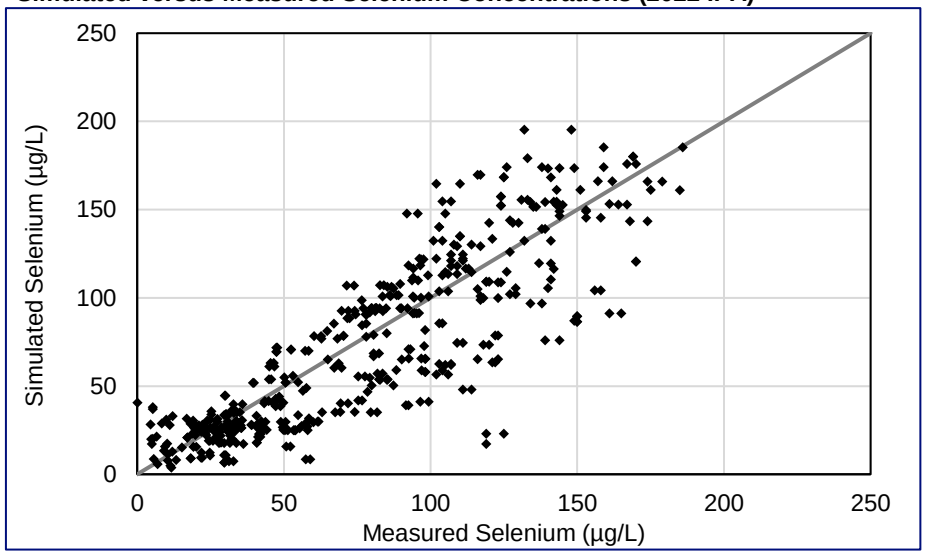
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-11: Selenium Calibration Information for Node GH_TC1 - Thompson Creek at LRP Road (EMS E102714)

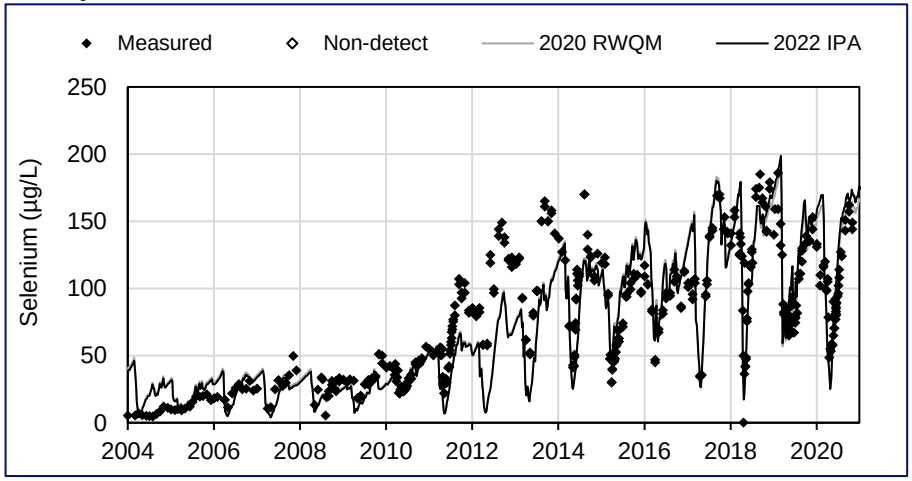
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	371	371
Non-Detect Count	0	0
Measured Mean (µg/L)	73	73
Simulated Mean (µg/L)	65	64
Bias (µg/L)	-7.7	-8.8
Relative Bias	0.89	0.88
Error (µg/L)	20	20
Percent Error	28%	28%

Simulated versus Measured Selenium Concentrations (2022 IPA)

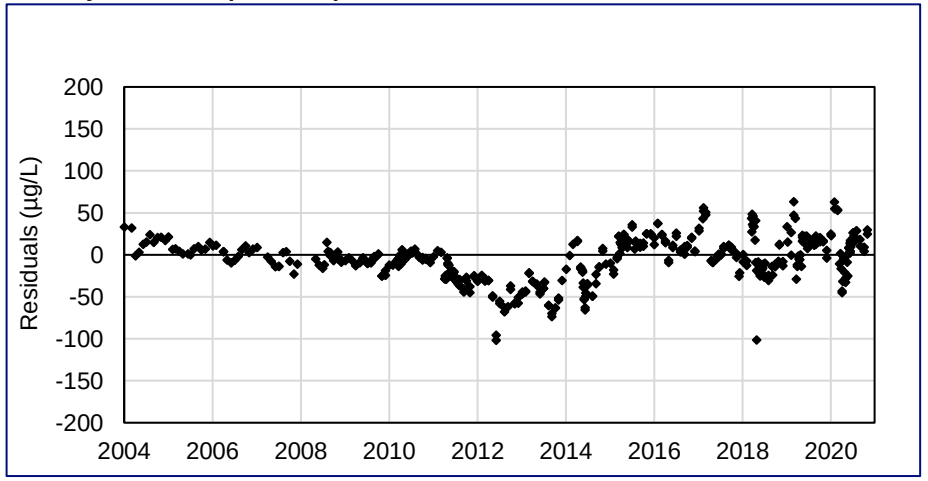


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



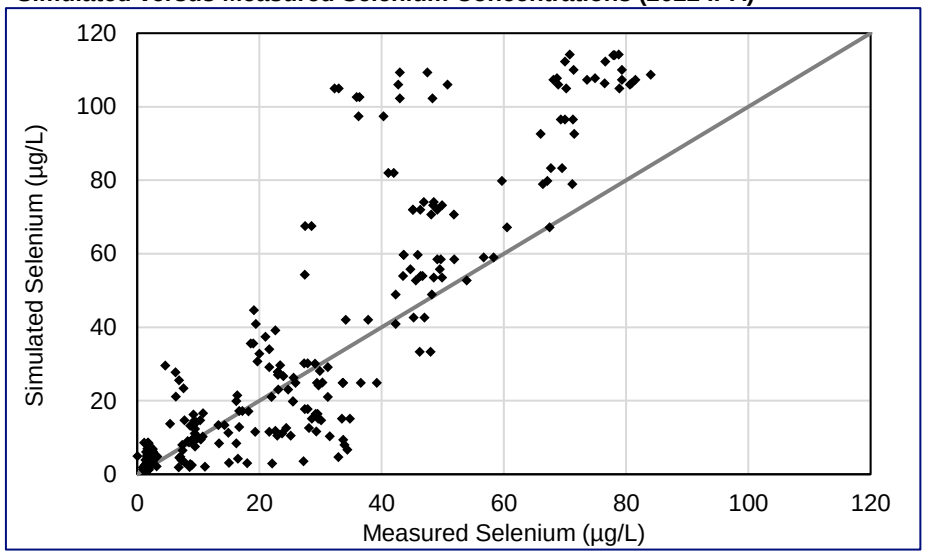
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-12: Selenium Calibration Information for Node LC_DC3 - Dry Creek u/s of East Tributary (EMS E288273)

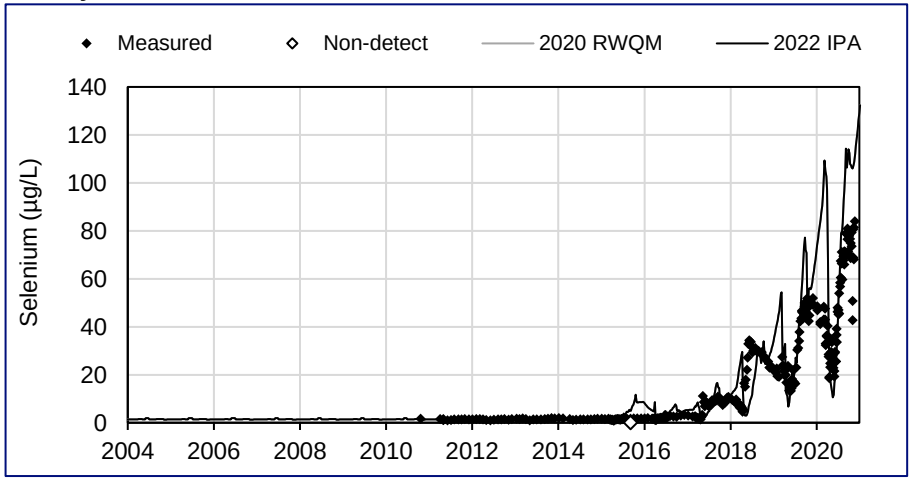
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	10/21/2010	10/21/2010
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	178	178
Non-Detect Count	1	1
Measured Mean (µg/L)	6.6	6.6
Simulated Mean (µg/L)	6.6	6.6
Bias (µg/L)	0.091	0.091
Relative Bias	1.0	1.0
Error (µg/L)	3.7	3.7
Percent Error	56%	56%

Simulated versus Measured Selenium Concentrations (2022 IPA)

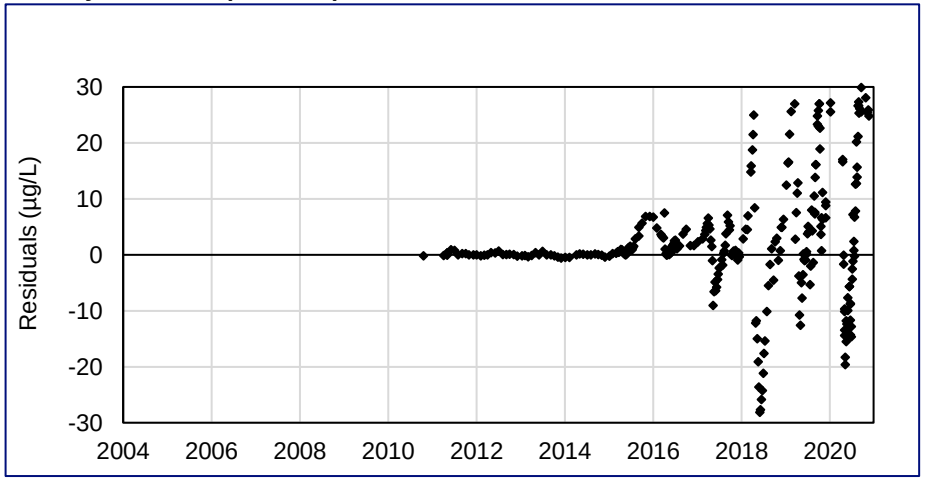


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



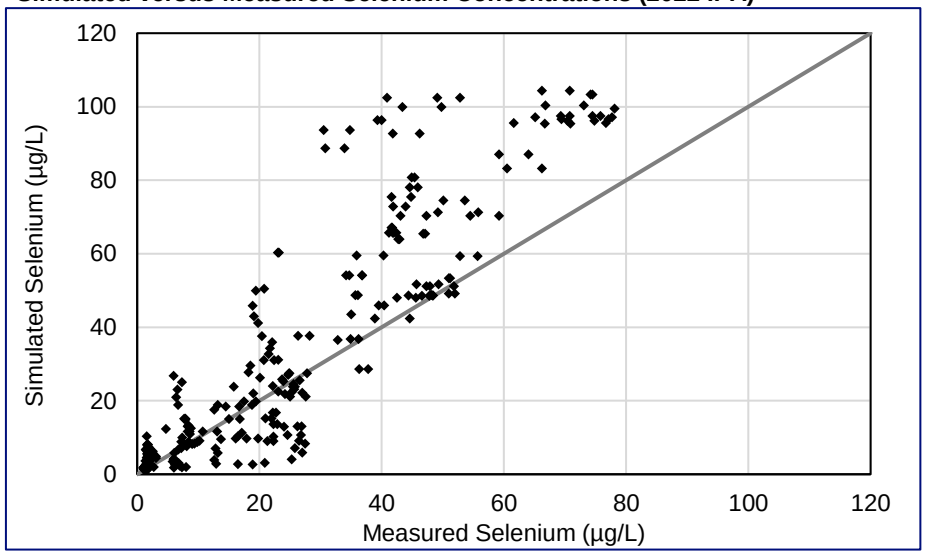
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-13: Selenium Calibration Information for Node LC_DCDS - Dry Creek d/s of Sedimentation Ponds (EMS E295210)

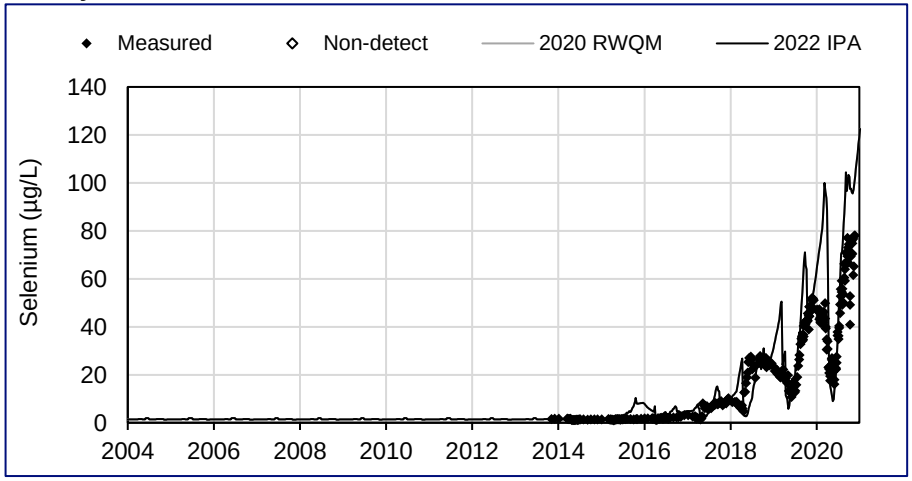
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	11/6/2013	11/6/2013
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	162	162
Non-Detect Count	0	0
Measured Mean (µg/L)	6.7	6.7
Simulated Mean (µg/L)	7.1	7.1
Bias (µg/L)	0.39	0.39
Relative Bias	1.1	1.1
Error (µg/L)	3.4	3.4
Percent Error	51%	51%

Simulated versus Measured Selenium Concentrations (2022 IPA)

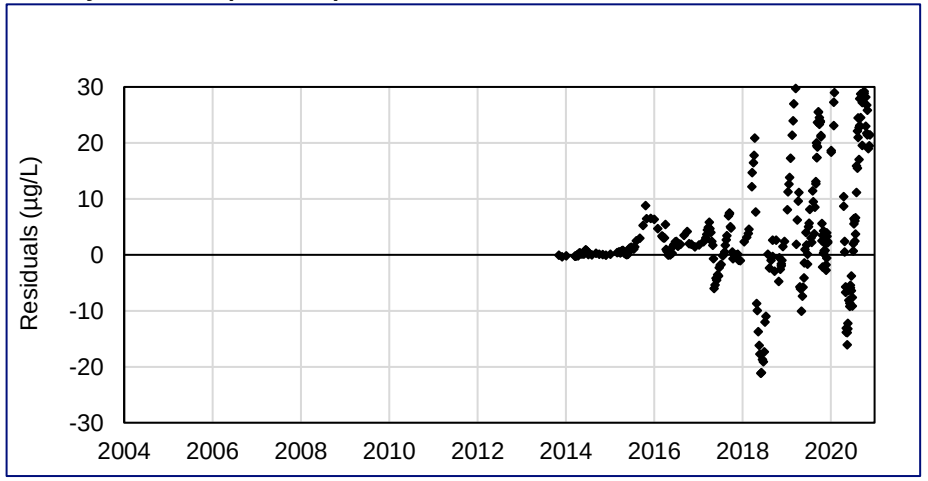


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



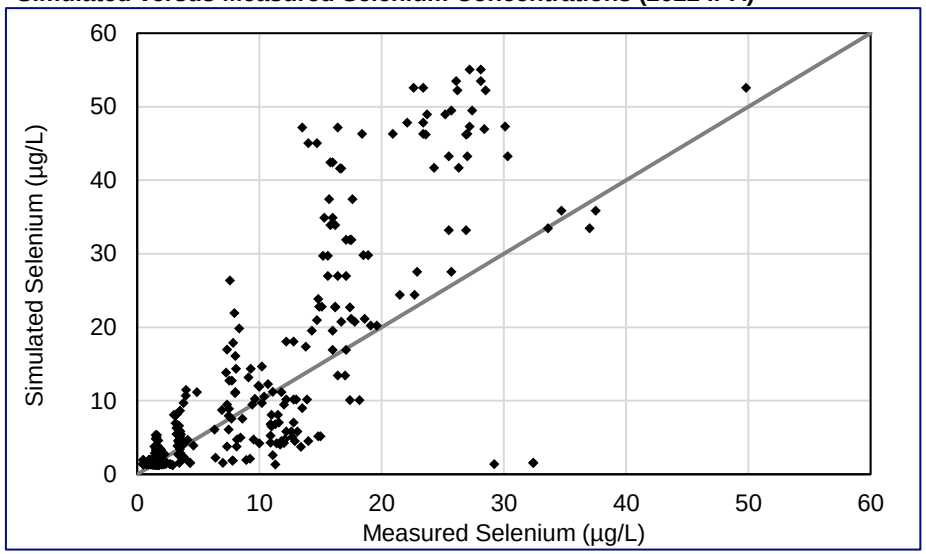
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-14: Selenium Calibration Information for Node LC_DC1 - Dry Creek near mouth (at bridge) (EMS E288270)

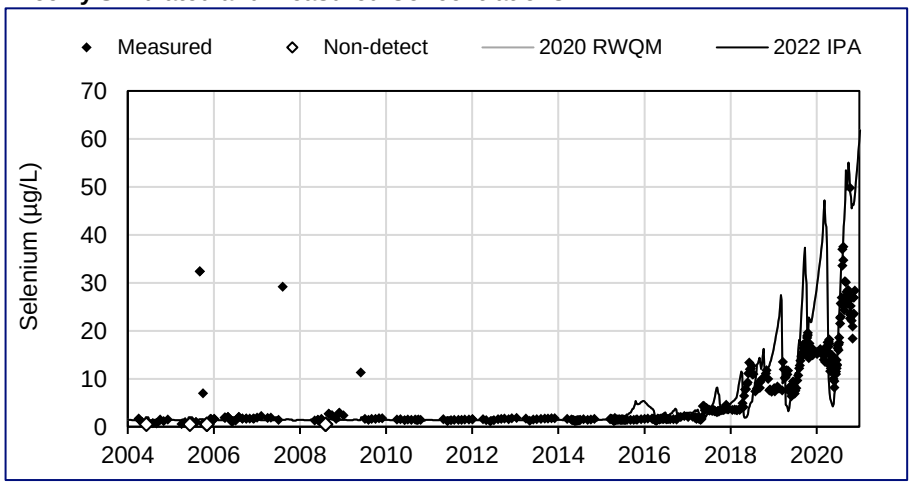
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/4/2004	4/4/2004
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	258	258
Non-Detect Count	6	6
Measured Mean (µg/L)	3.0	3.0
Simulated Mean (µg/L)	3.0	3.0
Bias (µg/L)	-0.056	-0.056
Relative Bias	0.98	0.98
Error (µg/L)	1.7	1.7
Percent Error	56%	56%

Simulated versus Measured Selenium Concentrations (2022 IPA)

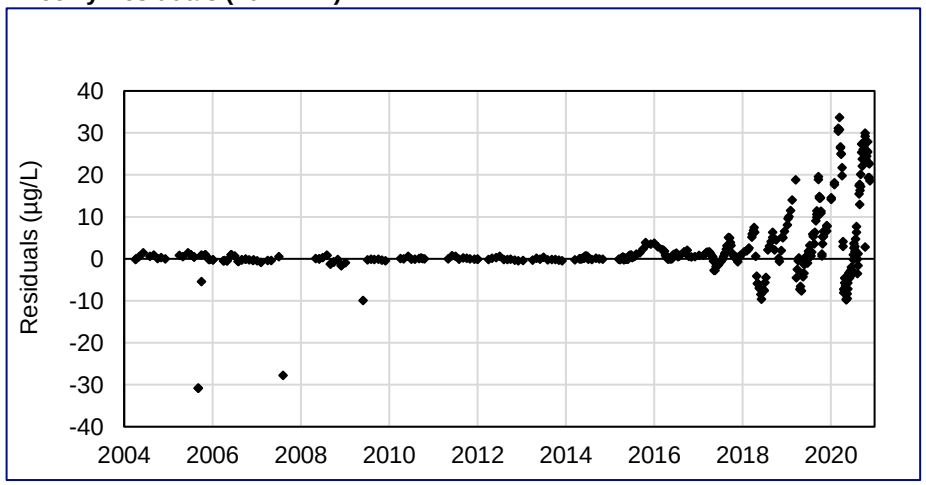


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



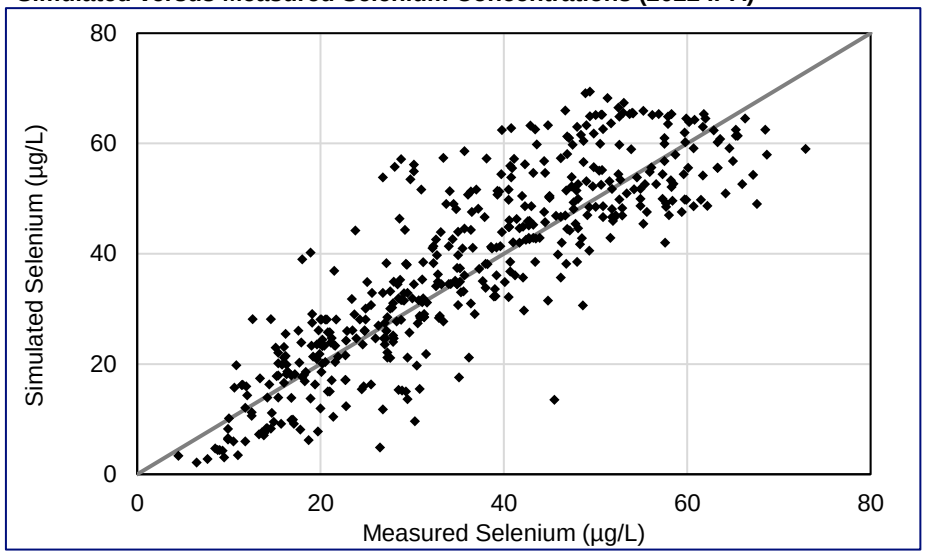
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-15: Selenium Calibration Information for Node LC_LCUSWLC - Line Creek u/s of West Line Creek (EMS E293369)

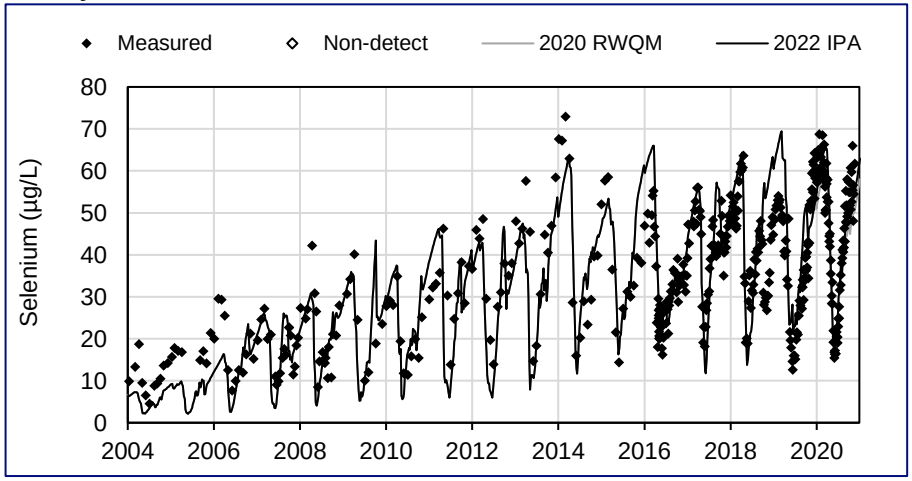
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/13/2004	1/13/2004
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	306	306
Non-Detect Count	0	0
Measured Mean (µg/L)	32	32
Simulated Mean (µg/L)	33	33
Bias (µg/L)	1.1	1.1
Relative Bias	1.0	1.0
Error (µg/L)	6.5	6.5
Percent Error	20%	20%

Simulated versus Measured Selenium Concentrations (2022 IPA)

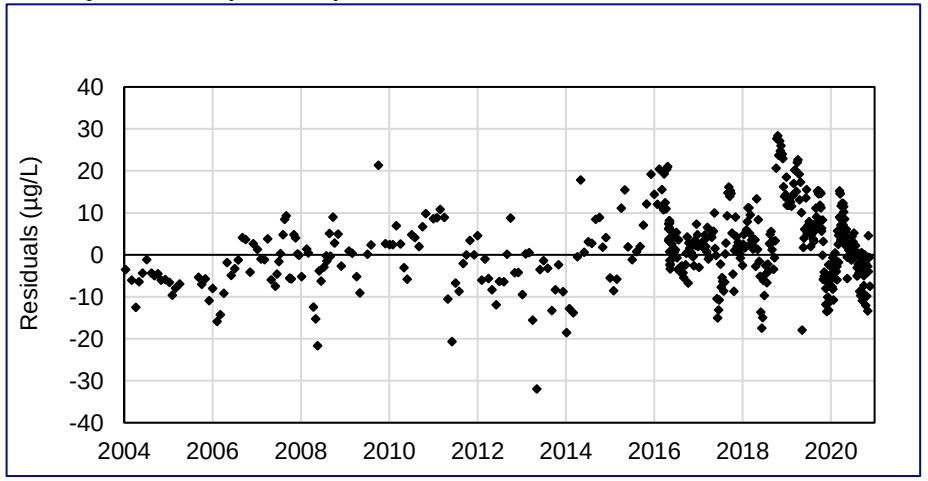


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



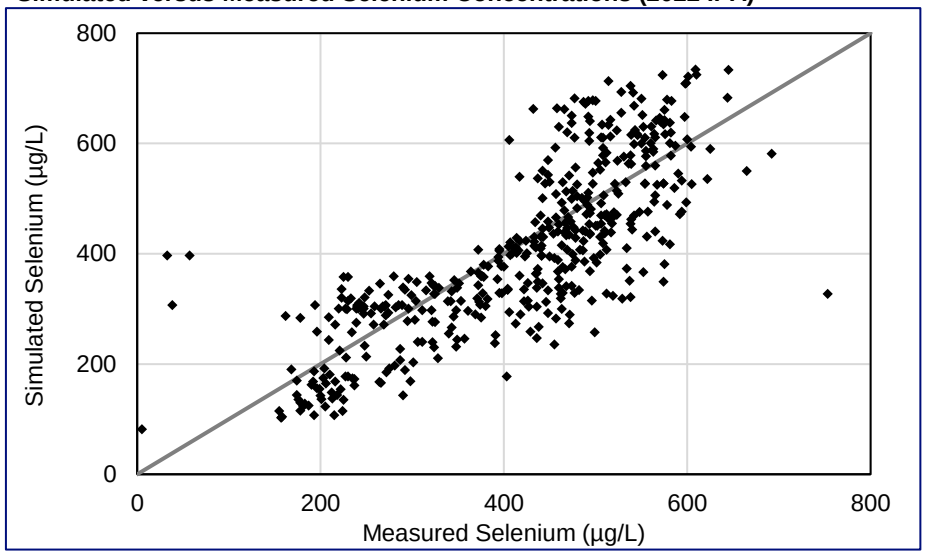
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-16: Selenium Calibration Information for Node LC_WLC - West Line Creek (EMS E261958)

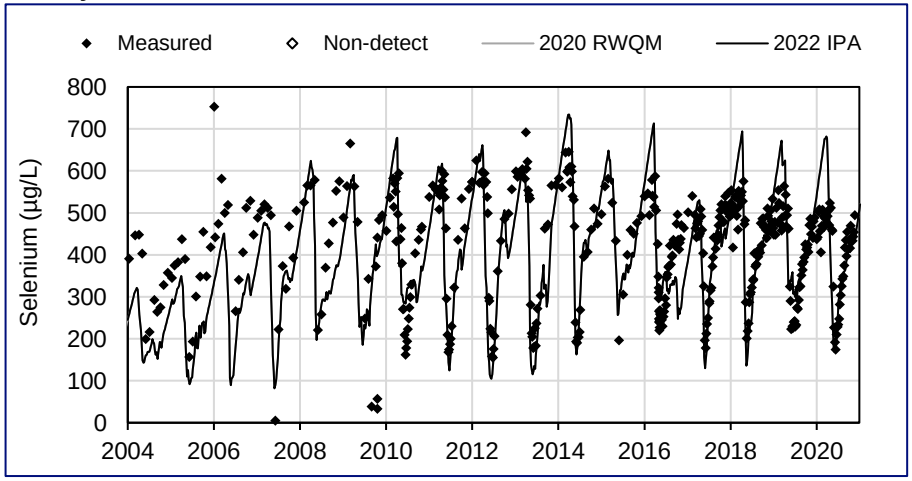
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/13/2004	1/13/2004
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	364	364
Non-Detect Count	0	0
Measured Mean (µg/L)	419	419
Simulated Mean (µg/L)	395	395
Bias (µg/L)	-24	-24
Relative Bias	0.94	0.94
Error (µg/L)	75	75
Percent Error	18%	18%

Simulated versus Measured Selenium Concentrations (2022 IPA)

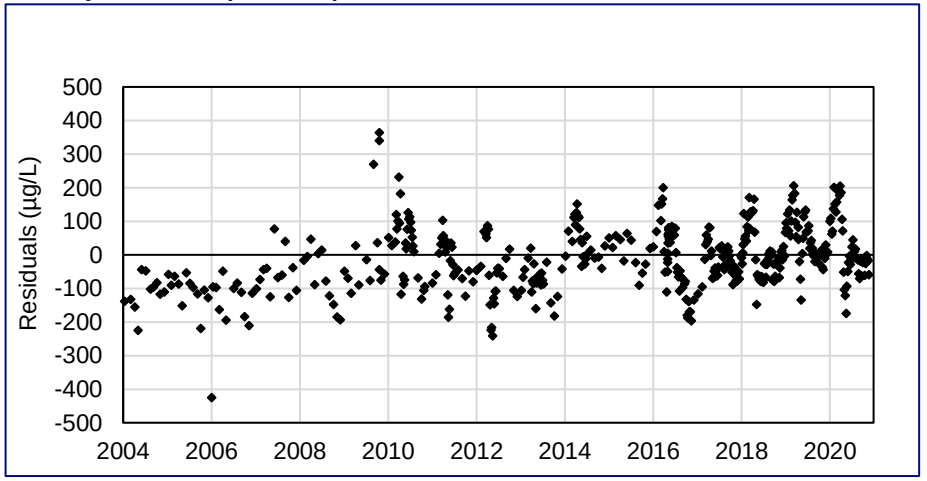


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



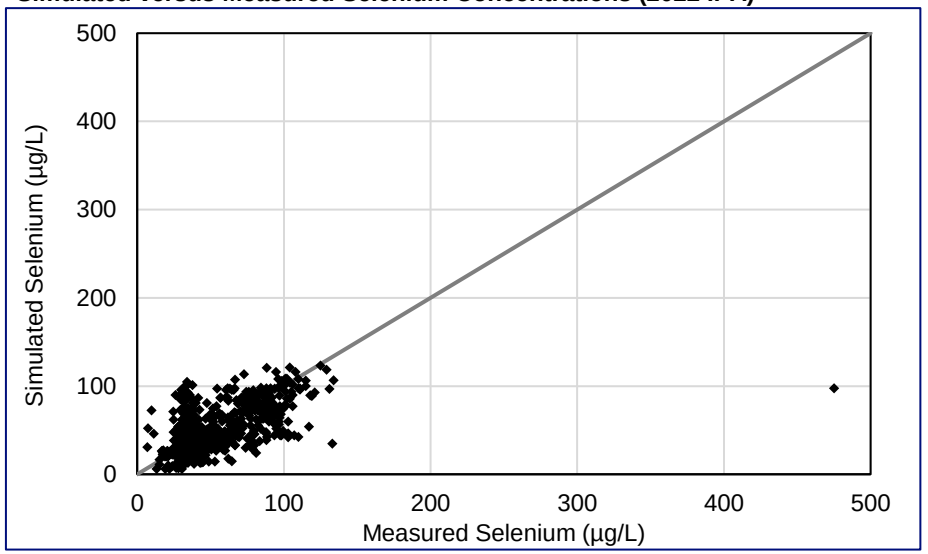
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-17: Selenium Calibration Information for Node LC_LC3 - Line Creek d/s of West Line Creek (EMS 0200337)

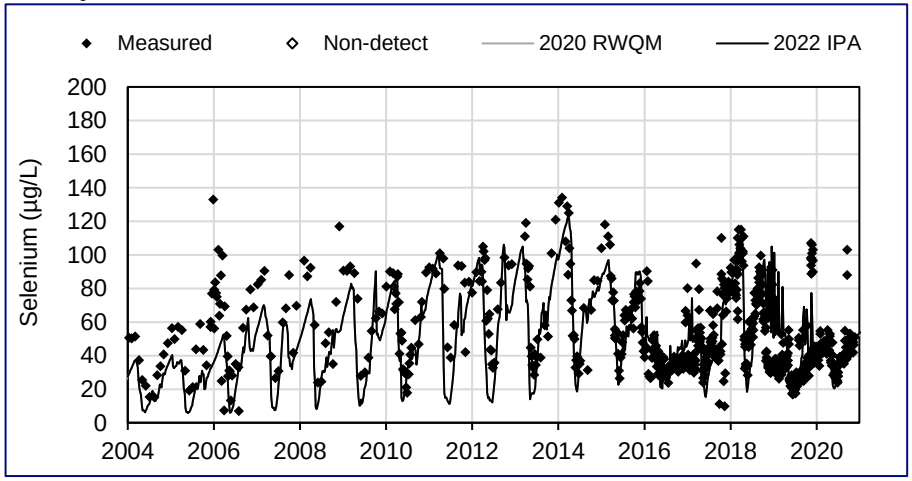
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/13/2004	1/13/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	567	567
Non-Detect Count	0	0
Measured Mean (µg/L)	59	59
Simulated Mean (µg/L)	54	54
Bias (µg/L)	-4.7	-4.7
Relative Bias	0.92	0.92
Error (µg/L)	16	16
Percent Error	28%	28%

Simulated versus Measured Selenium Concentrations (2022 IPA)

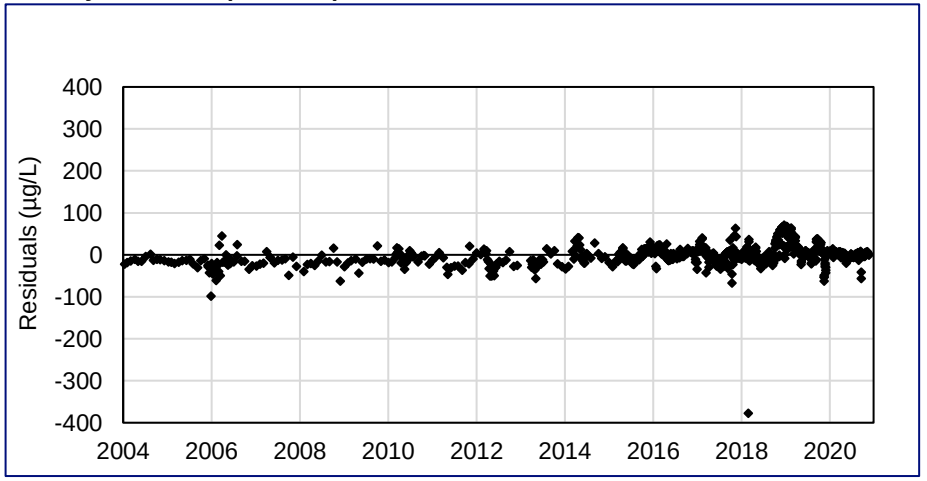


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



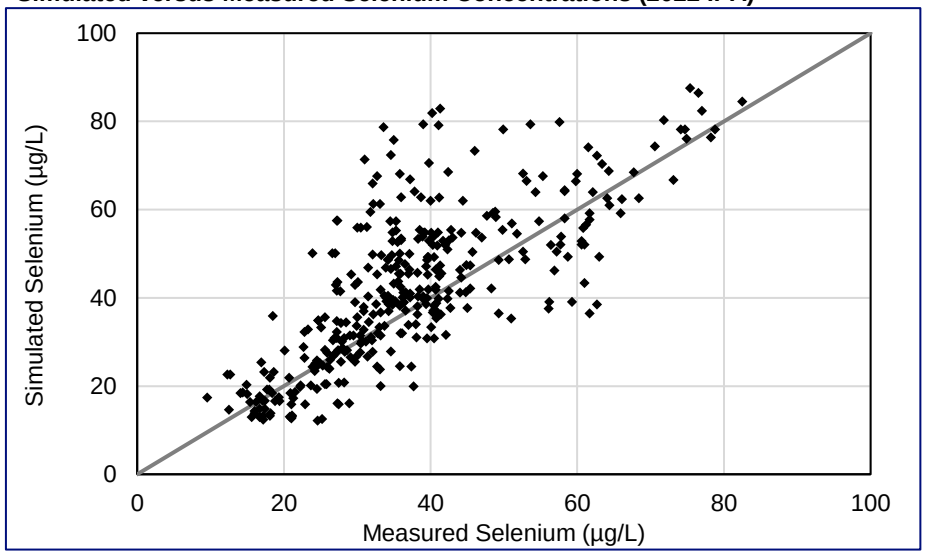
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-18: Selenium Calibration Information for Node LC_LCDSSLCC - LCO Compliance Point - Line Creek d/s of South Line Creek Confluence (EMS E297110)

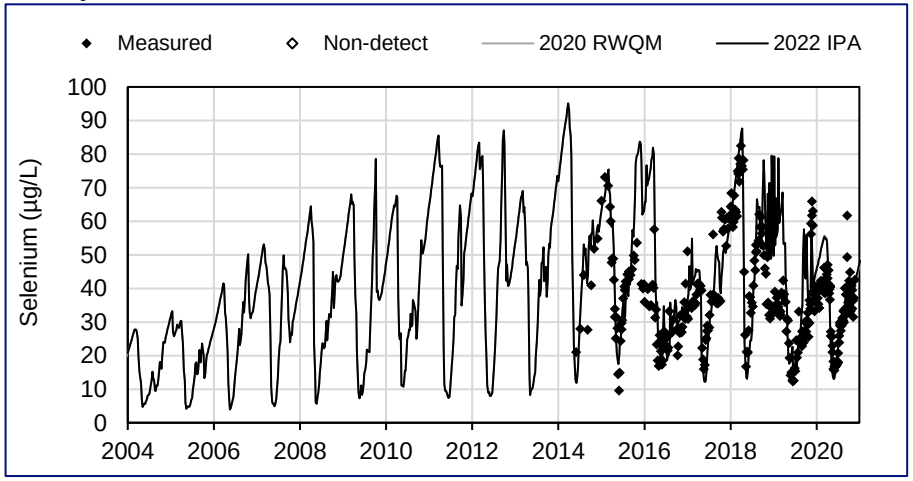
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	6/4/2014	6/4/2014
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	198	198
Non-Detect Count	0	0
Measured Mean (µg/L)	41	41
Simulated Mean (µg/L)	45	45
Bias (µg/L)	3.8	3.8
Relative Bias	1.1	1.1
Error (µg/L)	8.7	8.7
Percent Error	21%	21%

Simulated versus Measured Selenium Concentrations (2022 IPA)

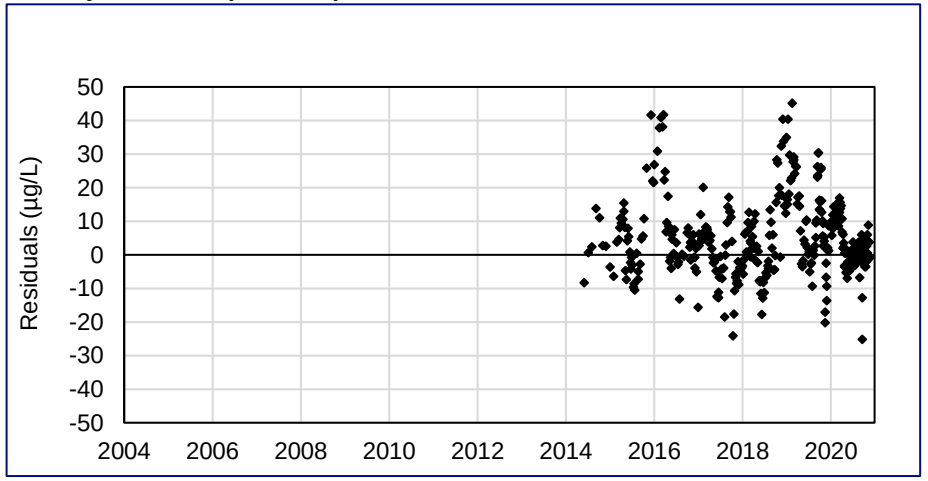


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



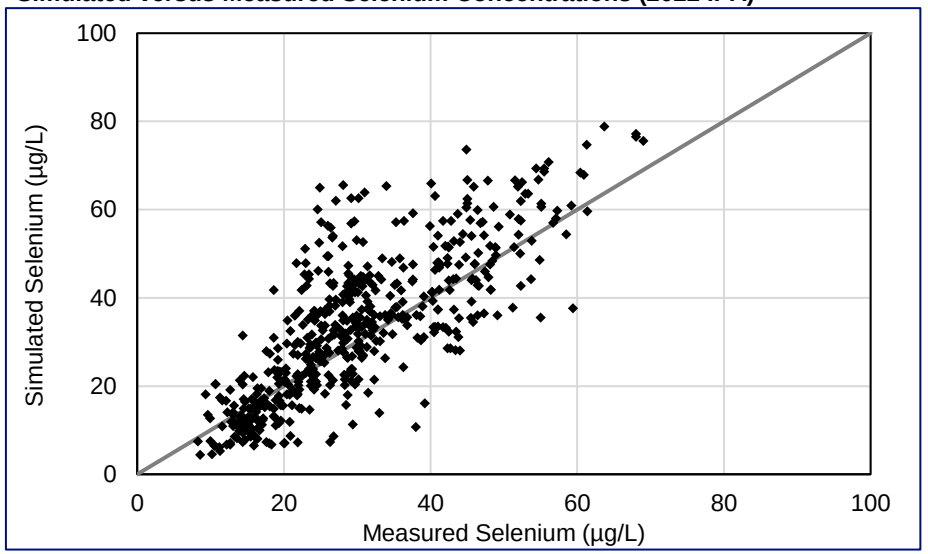
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-19: Selenium Calibration Information for Node LC_LC4 - Line Creek u/s of Process Plant (EMS 0200044)

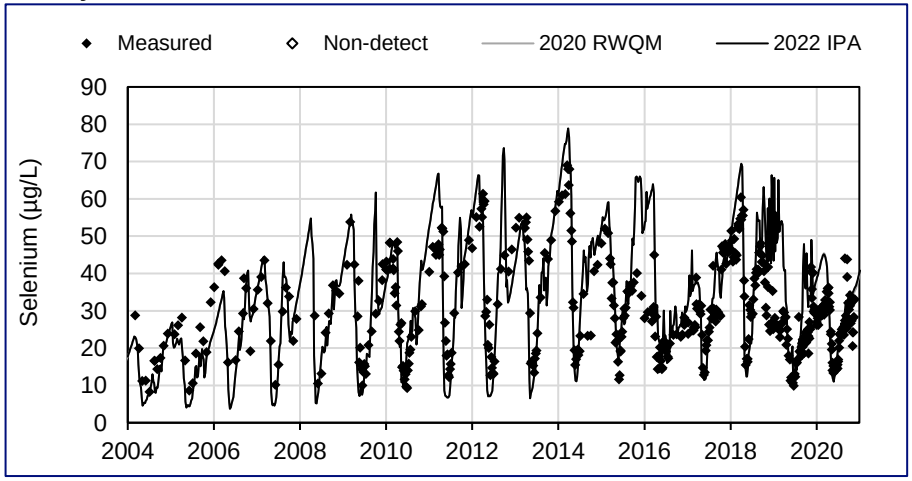
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	3/4/2004	3/4/2004
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	376	376
Non-Detect Count	0	0
Measured Mean (µg/L)	32	32
Simulated Mean (µg/L)	34	34
Bias (µg/L)	2.0	2.0
Relative Bias	1.1	1.1
Error (µg/L)	7.6	7.6
Percent Error	24%	24%

Simulated versus Measured Selenium Concentrations (2022 IPA)

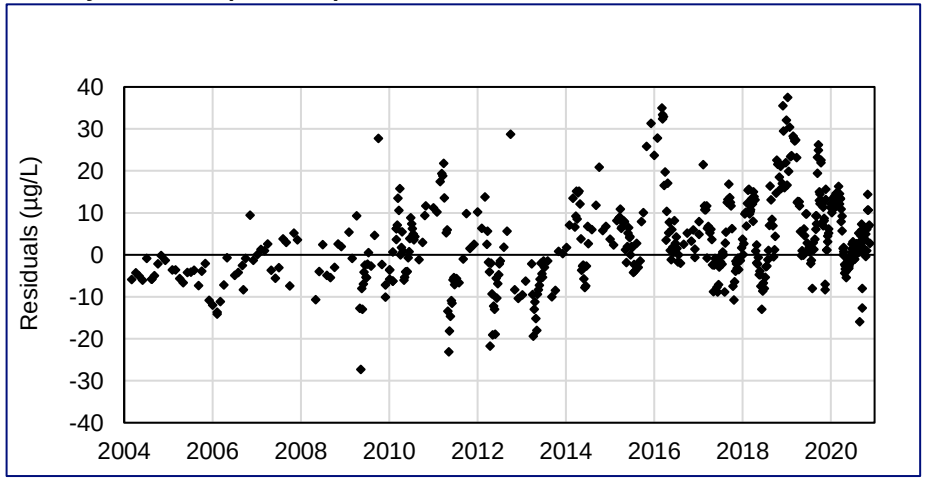


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



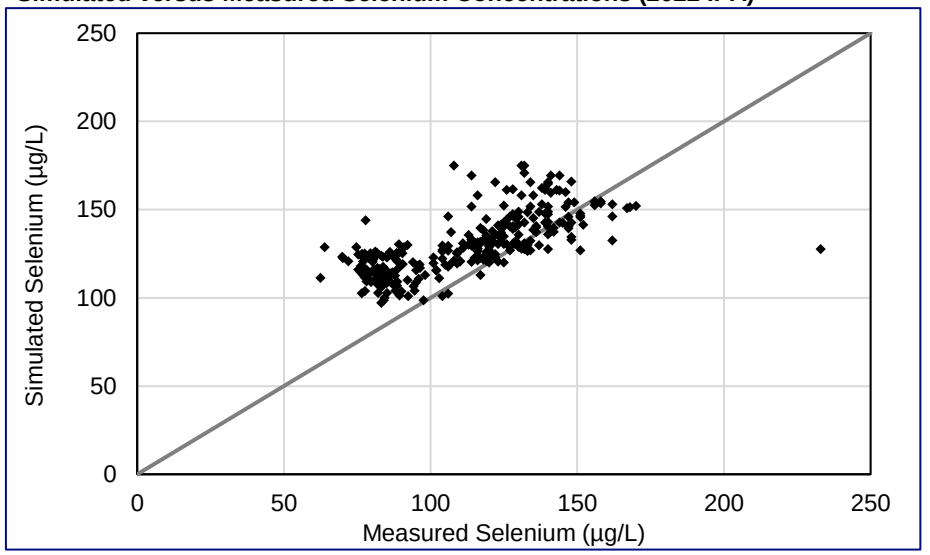
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-20: Selenium Calibration Information for Node EV_EC1 - Erickson Creek at Mouth (EMS 0200097)

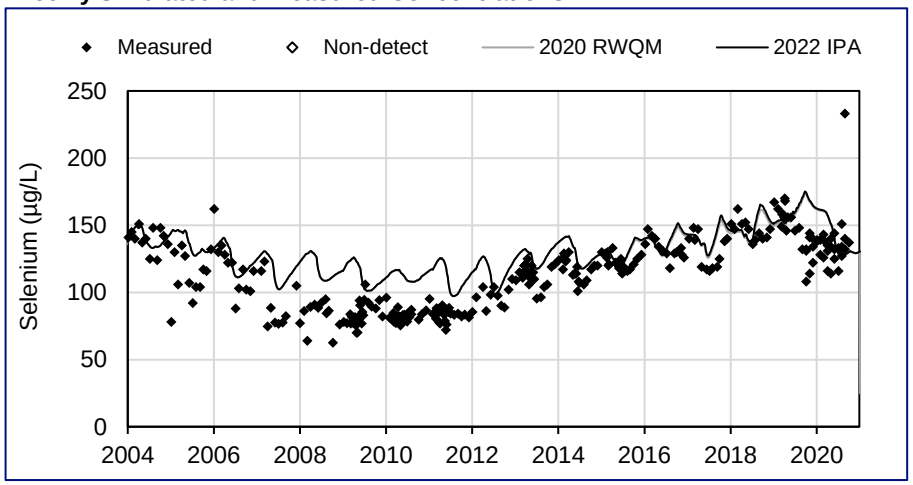
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	251	251
Non-Detect Count	0	0
Measured Mean (µg/L)	107	107
Simulated Mean (µg/L)	125	126
Bias (µg/L)	18	19
Relative Bias	1.2	1.2
Error (µg/L)	20	20
Percent Error	19%	19%

Simulated versus Measured Selenium Concentrations (2022 IPA)

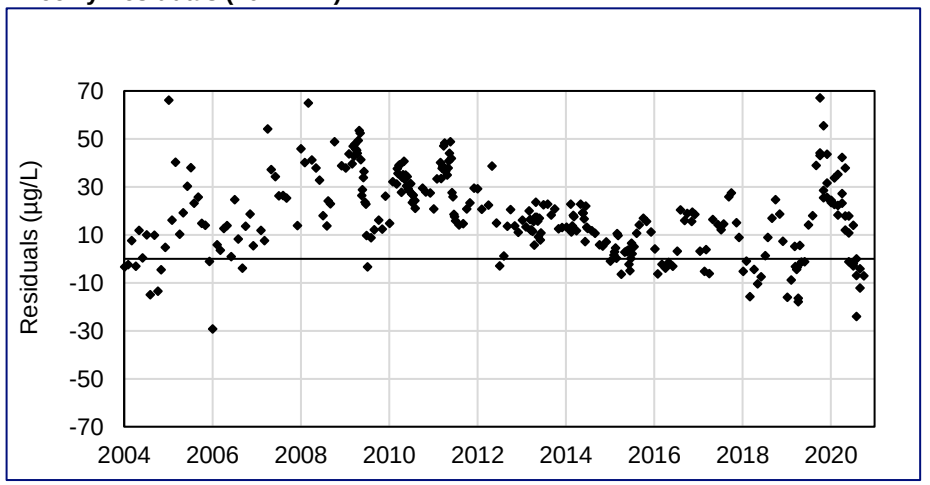


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



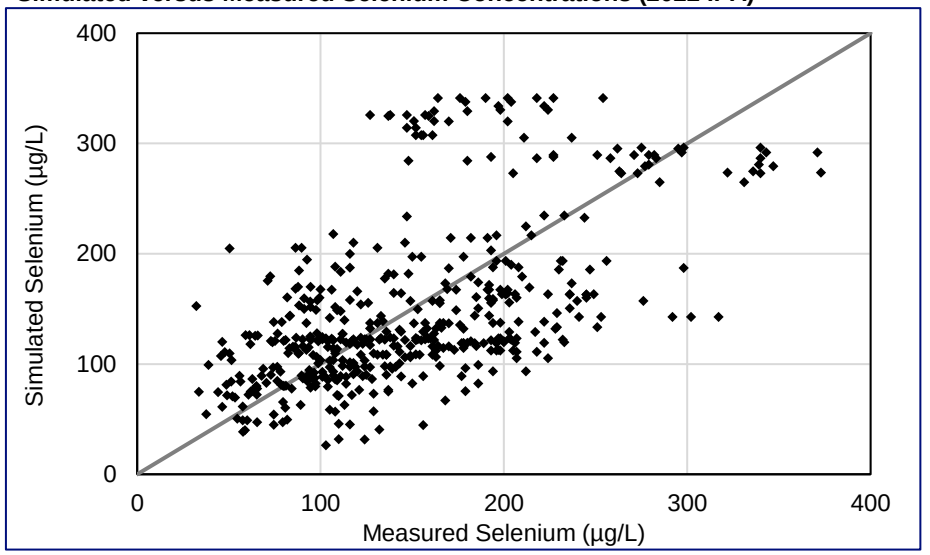
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-21: Selenium Calibration Information for Node EV_GT1 - Gate Creek Sediment Pond Decant (EMS E206231)

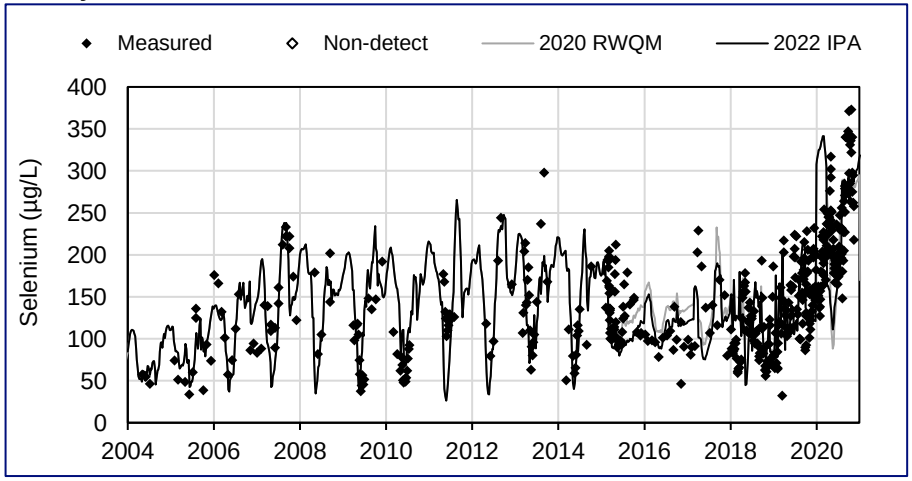
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	5/4/2004	5/4/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	266	266
Non-Detect Count	0	0
Measured Mean (µg/L)	117	117
Simulated Mean (µg/L)	119	113
Bias (µg/L)	2.4	-3.2
Relative Bias	1.0	0.97
Error (µg/L)	37	38
Percent Error	32%	33%

Simulated versus Measured Selenium Concentrations (2022 IPA)

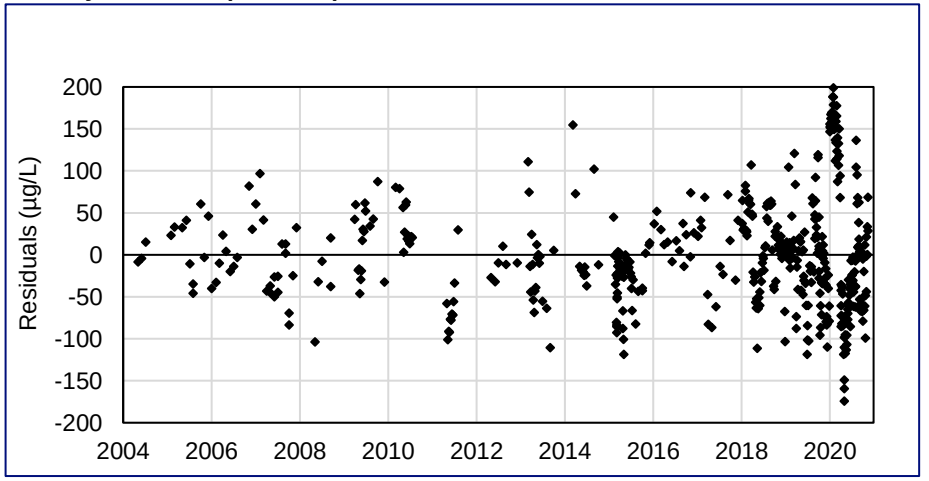


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



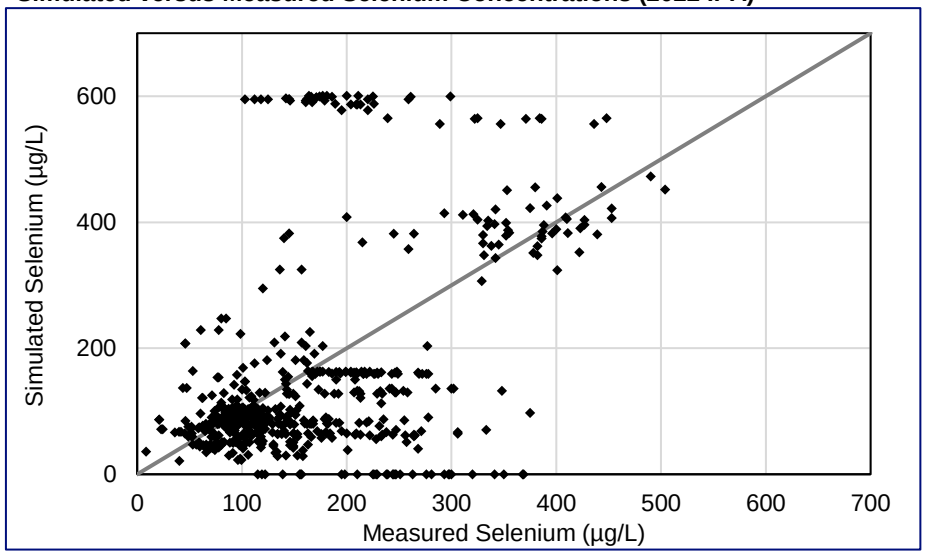
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-22: Selenium Calibration Information for Node EV_BC1 - Bodie Creek Sediment Pond Decant (EMS E102685)

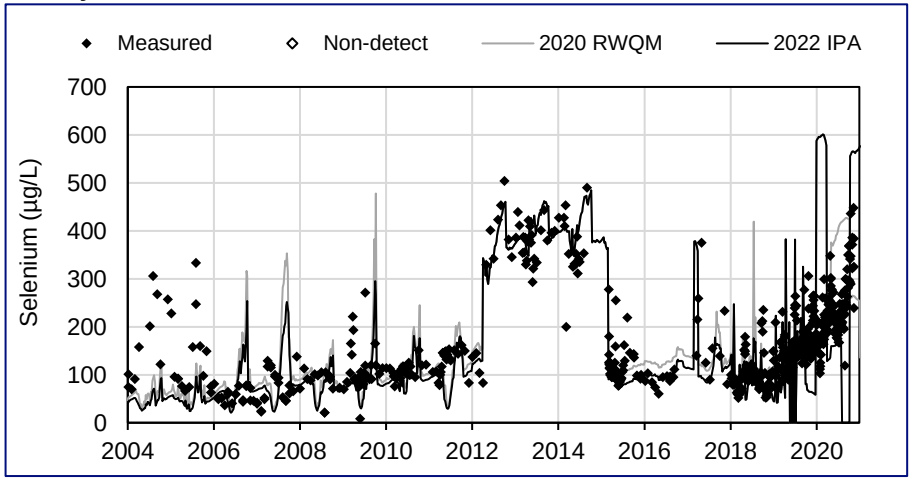
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	353	353
Non-Detect Count	0	0
Measured Mean (µg/L)	144	144
Simulated Mean (µg/L)	145	131
Bias (µg/L)	0.9	-14
Relative Bias	1.0	0.91
Error (µg/L)	45	45
Percent Error	31%	31%

Simulated versus Measured Selenium Concentrations (2022 IPA)

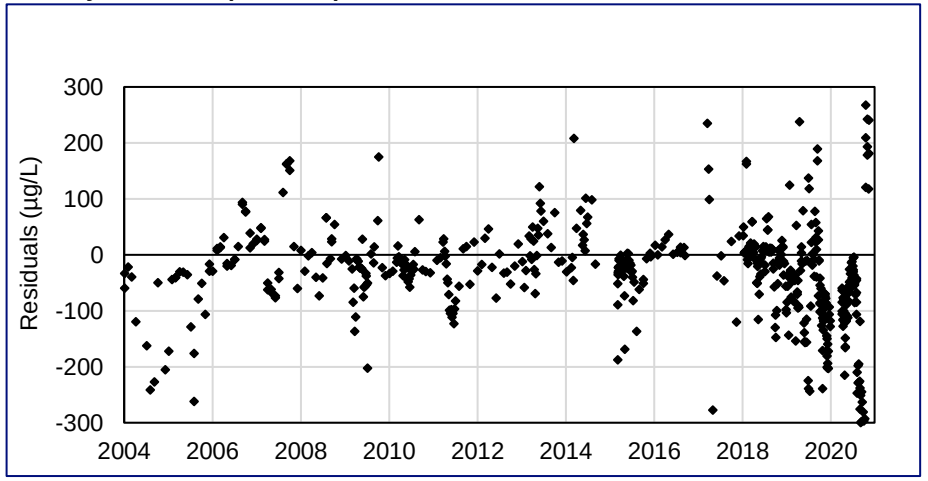


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



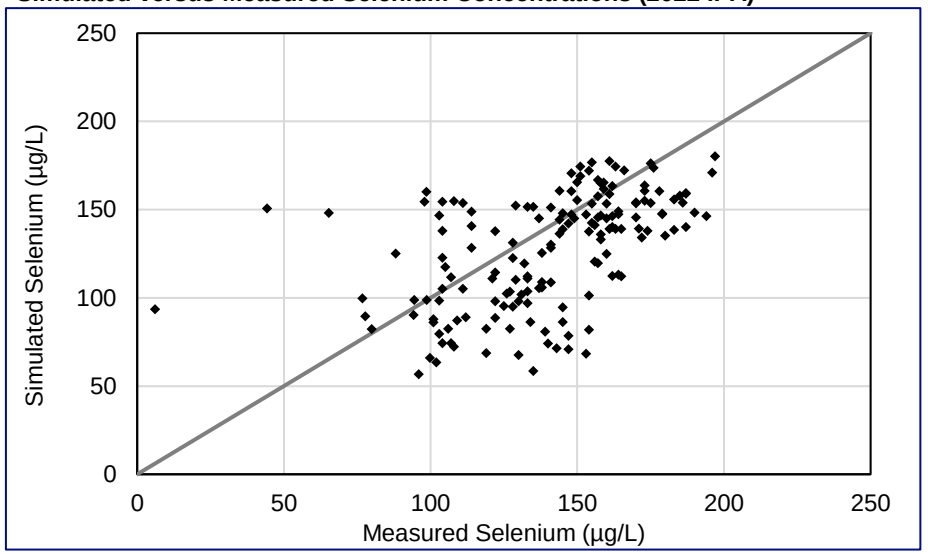
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-23: Selenium Calibration Information for Node EV_DC1 - EVO Dry Creek Sediment Pond Decant (EMS E298590)

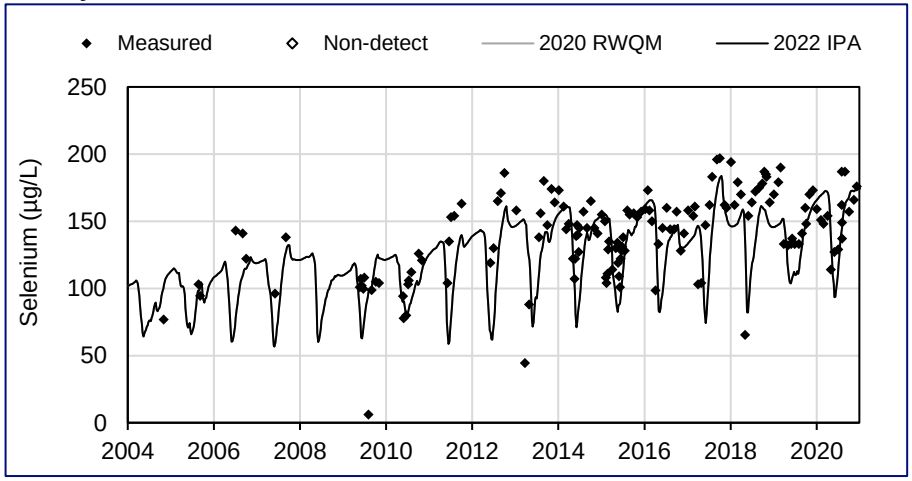
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	11/2/2004	11/2/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	123	123
Non-Detect Count	0	0
Measured Mean (µg/L)	137	137
Simulated Mean (µg/L)	122	122
Bias (µg/L)	-15	-15
Relative Bias	0.89	0.89
Error (µg/L)	29	29
Percent Error	21%	21%

Simulated versus Measured Selenium Concentrations (2022 IPA)

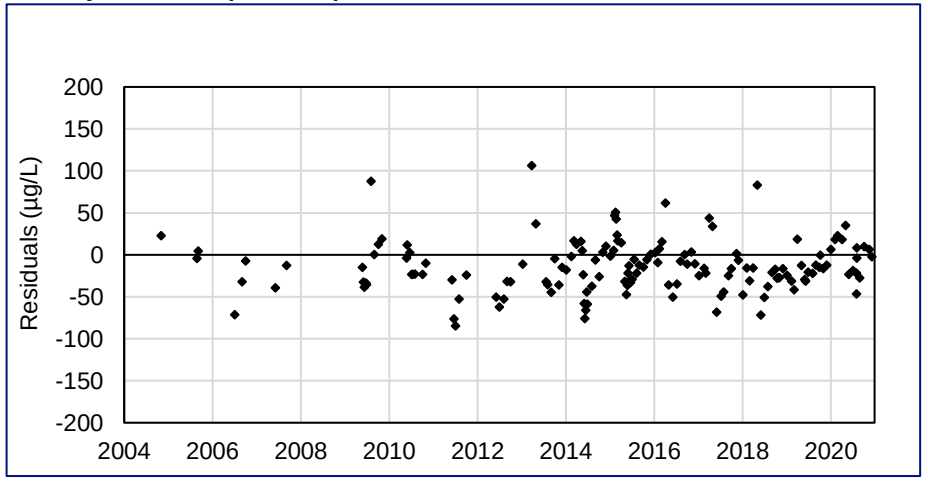


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



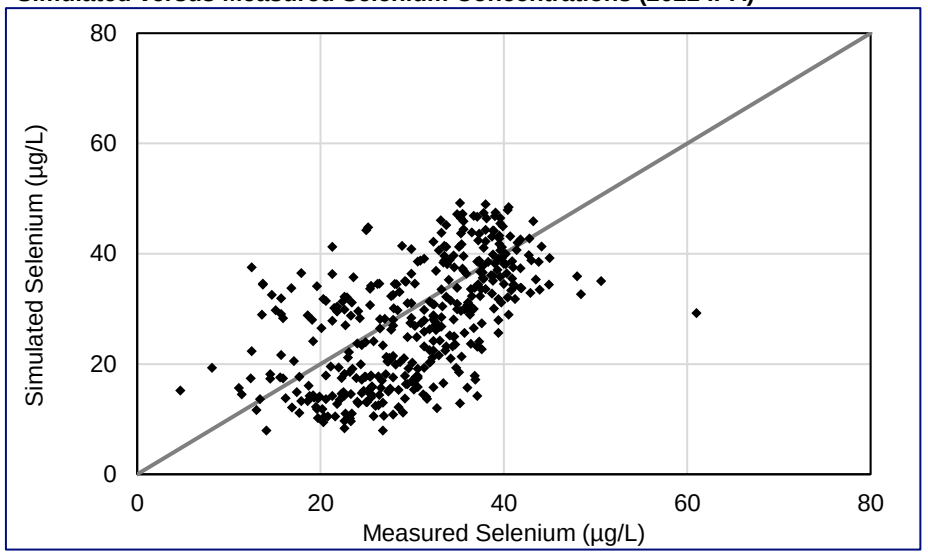
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-24: Selenium Calibration Information for Node EV_HC1 - EVO Harmer Compliance Point (Harmer Creek Dam Spillway) (EMS E102682)

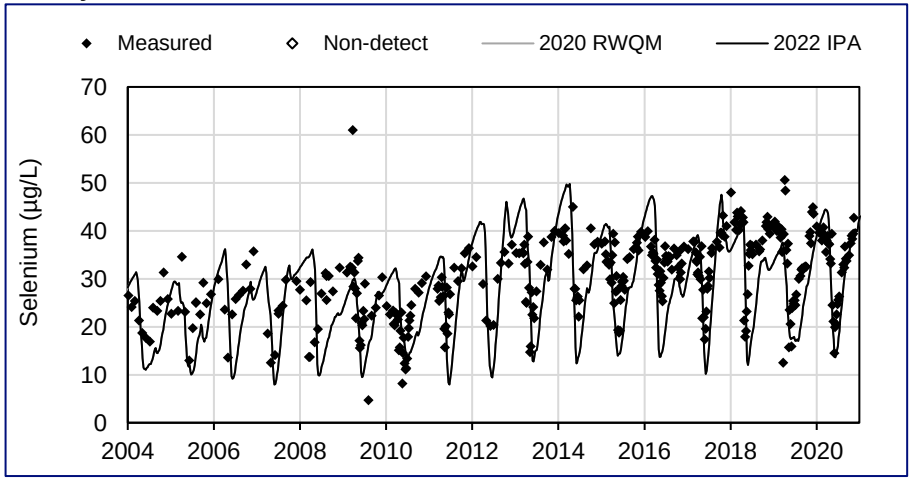
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	316	316
Non-Detect Count	0	0
Measured Mean (µg/L)	29	29
Simulated Mean (µg/L)	27	27
Bias (µg/L)	-2.3	-2.3
Relative Bias	0.92	0.92
Error (µg/L)	8.2	8.2
Percent Error	28%	28%

Simulated versus Measured Selenium Concentrations (2022 IPA)

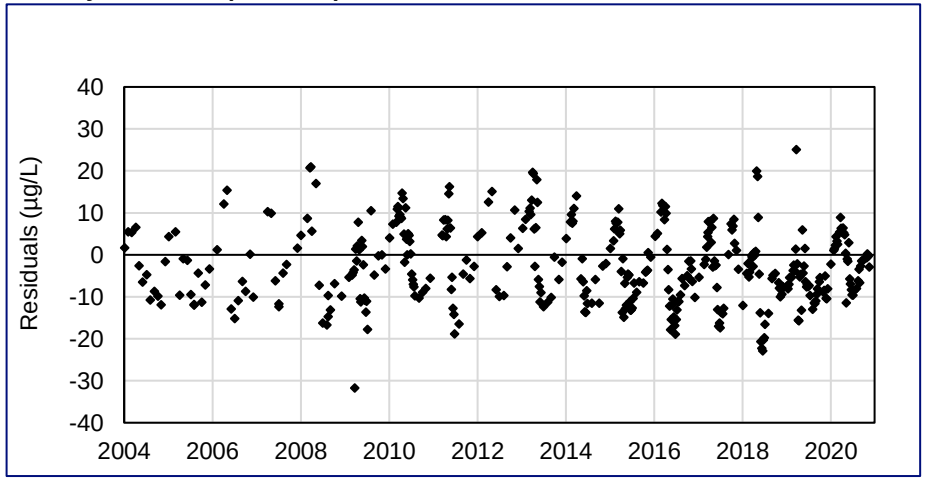


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



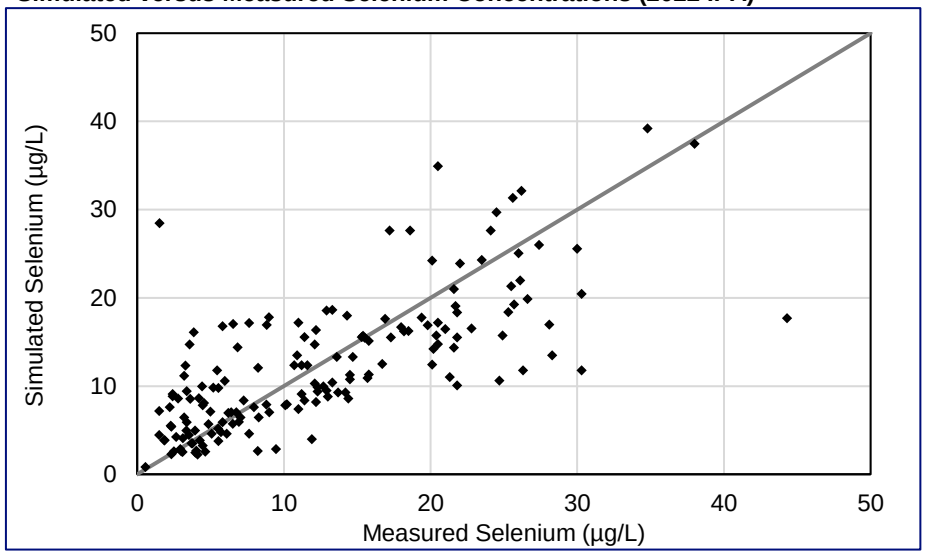
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-25: Selenium Calibration Information for Node FR_FR1 - Fording River d/s of Henretta Creek (EMS 0200251)

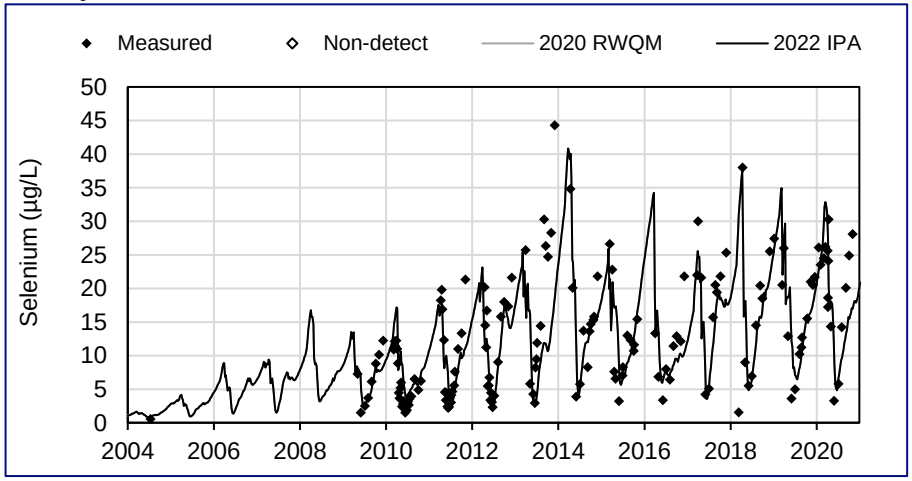
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/13/2004	7/13/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	134	134
Non-Detect Count	0	0
Measured Mean (µg/L)	11	11
Simulated Mean (µg/L)	11	11
Bias (µg/L)	-0.34	-0.34
Relative Bias	0.97	0.97
Error (µg/L)	4.1	4.1
Percent Error	37%	37%

Simulated versus Measured Selenium Concentrations (2022 IPA)

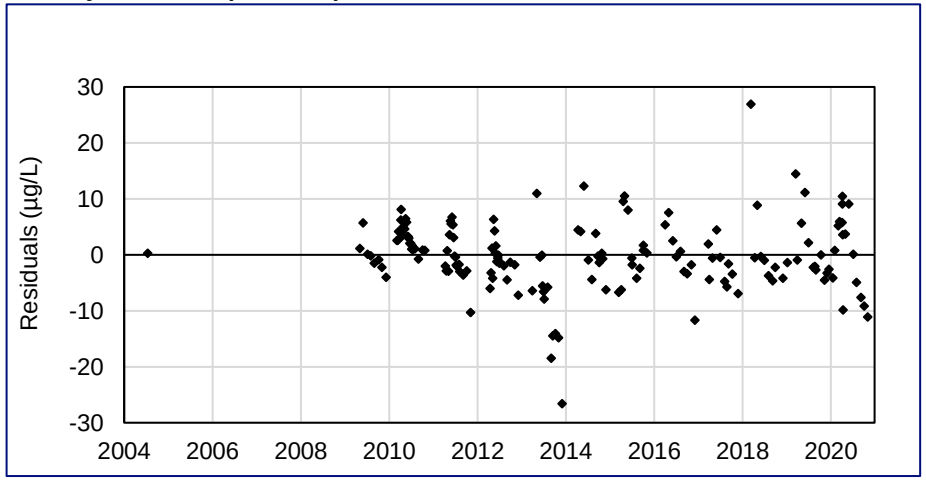


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



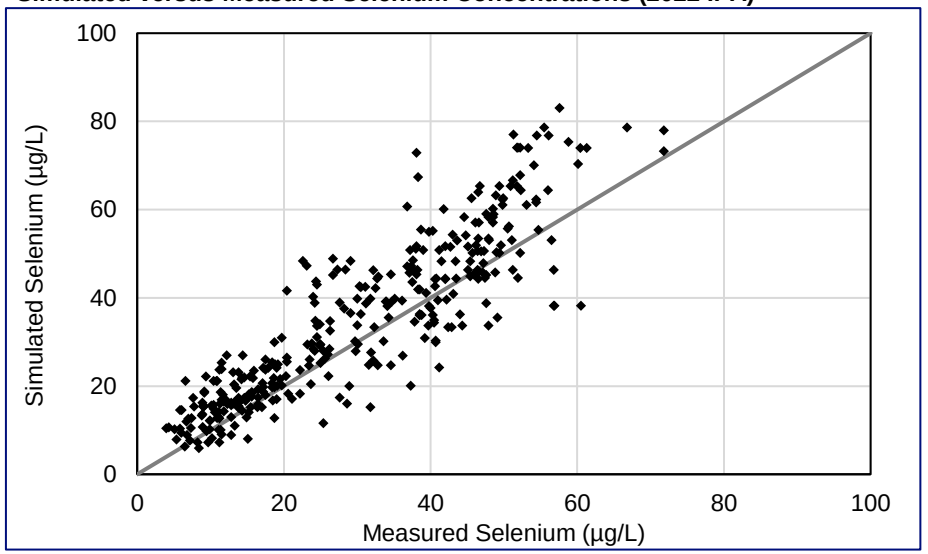
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-26: Selenium Calibration Information for Node FR_FR2 - Fording River u/s of Kilmarnock Creek (EMS 0200201)

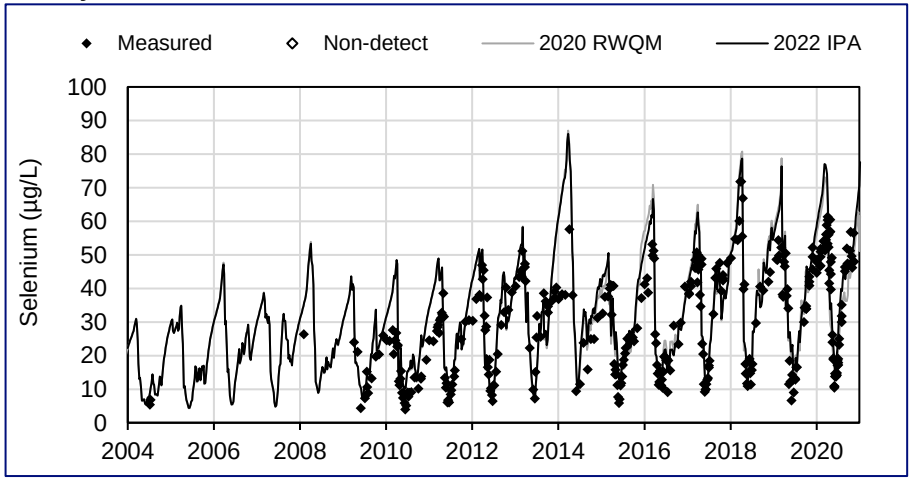
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/7/2004	7/7/2004
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	250	250
Non-Detect Count	0	0
Measured Mean (µg/L)	27	27
Simulated Mean (µg/L)	31	31
Bias (µg/L)	4.5	4.5
Relative Bias	1.2	1.2
Error (µg/L)	7.3	7.0
Percent Error	27%	27%

Simulated versus Measured Selenium Concentrations (2022 IPA)

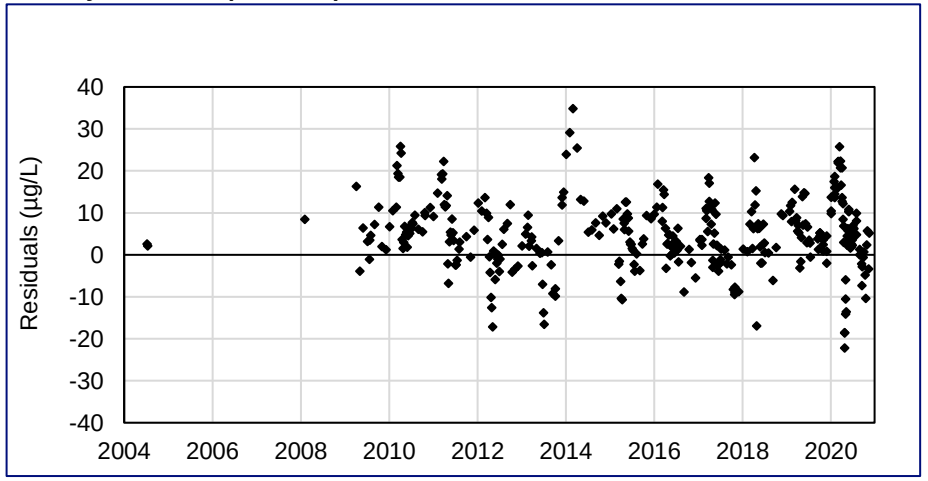


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



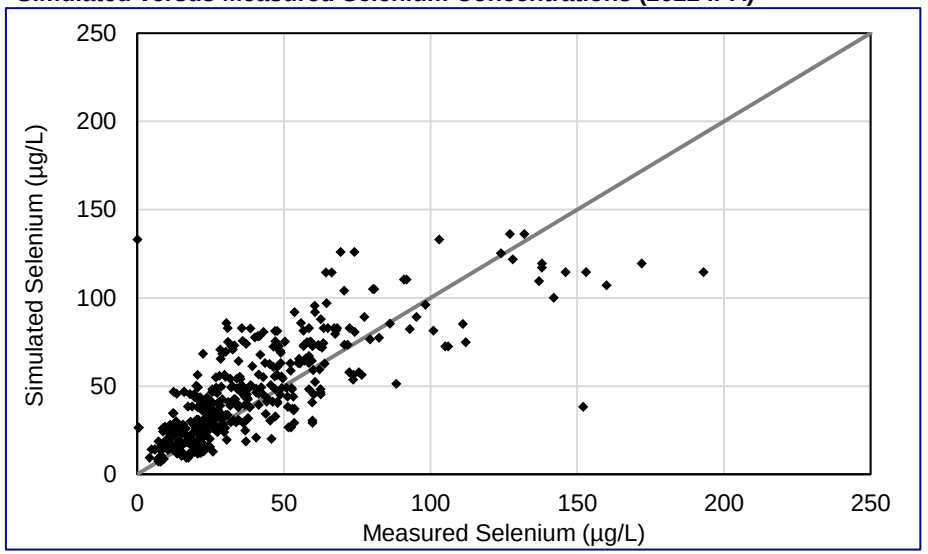
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-27: Selenium Calibration Information for Node FR_FR4 - Fording River between Swift and Cataract Creeks (EMS 0200311)

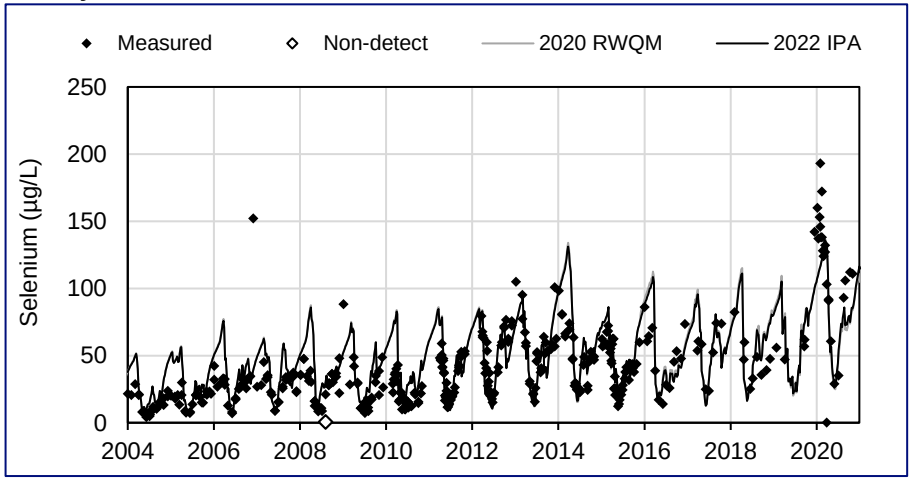
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	372	372
Non-Detect Count	2	2
Measured Mean (µg/L)	35	35
Simulated Mean (µg/L)	43	43
Bias (µg/L)	8.4	8.2
Relative Bias	1.2	1.2
Error (µg/L)	14	14
Percent Error	40%	40%

Simulated versus Measured Selenium Concentrations (2022 IPA)

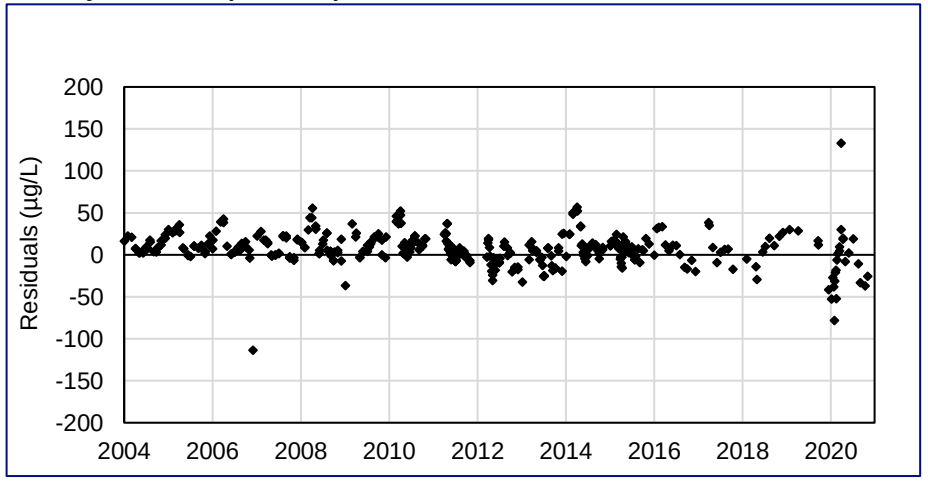


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



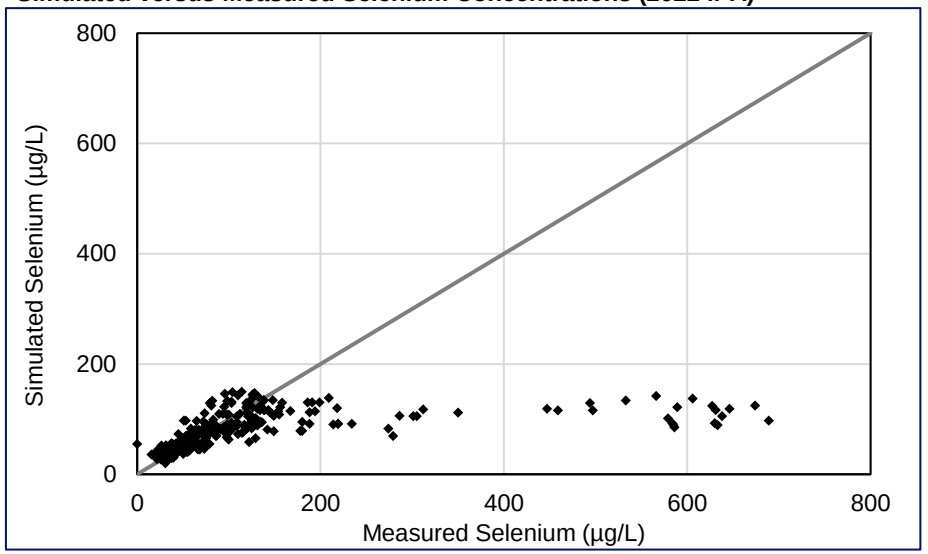
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-28: Selenium Calibration Information for Node FR_FRCP1 - Fording River, 525 m d/s of Cataract Creek (EMS E300071)

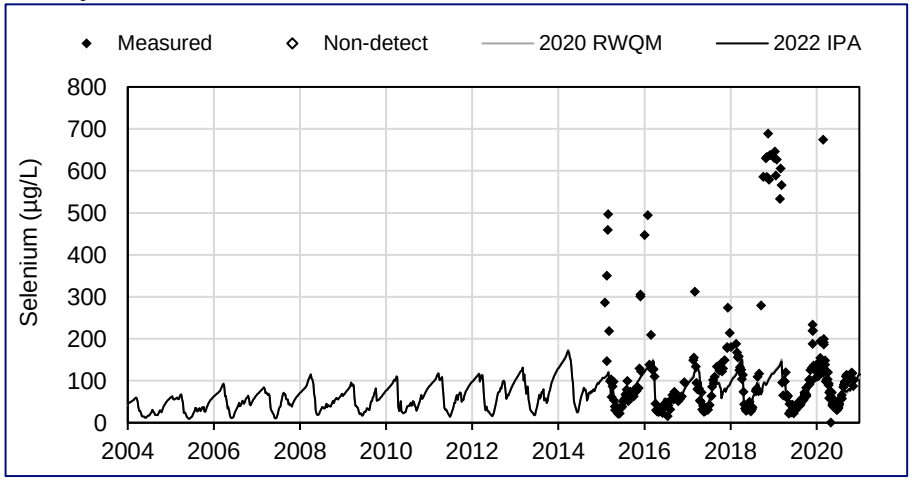
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/3/2015	2/3/2015
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	155	155
Non-Detect Count	0	0
Measured Mean (µg/L)	125	125
Simulated Mean (µg/L)	76	75
Bias (µg/L)	-49	-50
Relative Bias	0.61	0.6
Error (µg/L)	63	64
Percent Error	51%	51%

Simulated versus Measured Selenium Concentrations (2022 IPA)

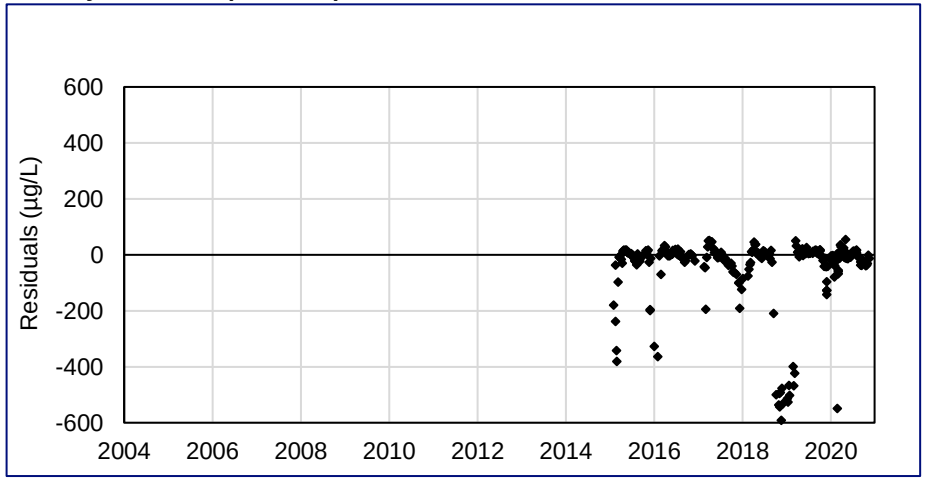


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



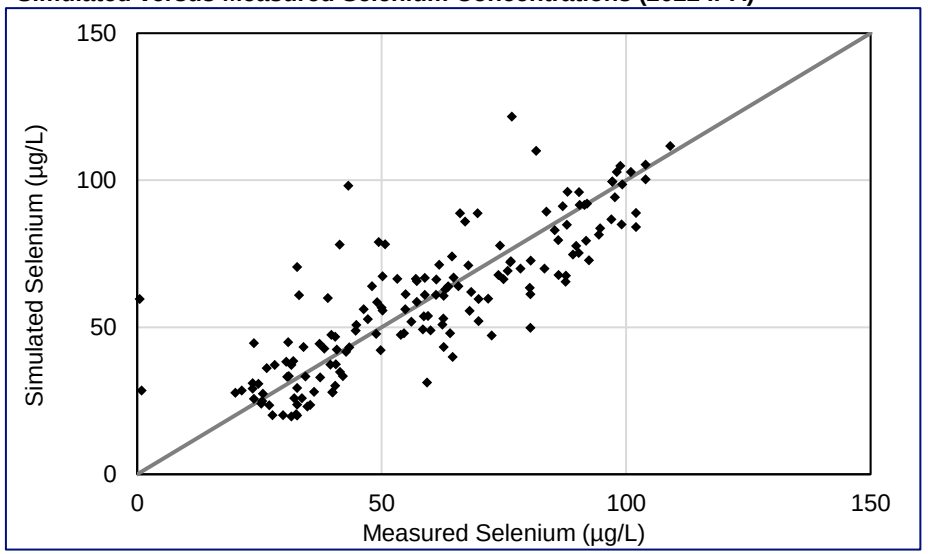
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-29: Selenium Calibration Information for Node GH_PC2 - Fording River d/s of Porter Creek (EMS E287431)

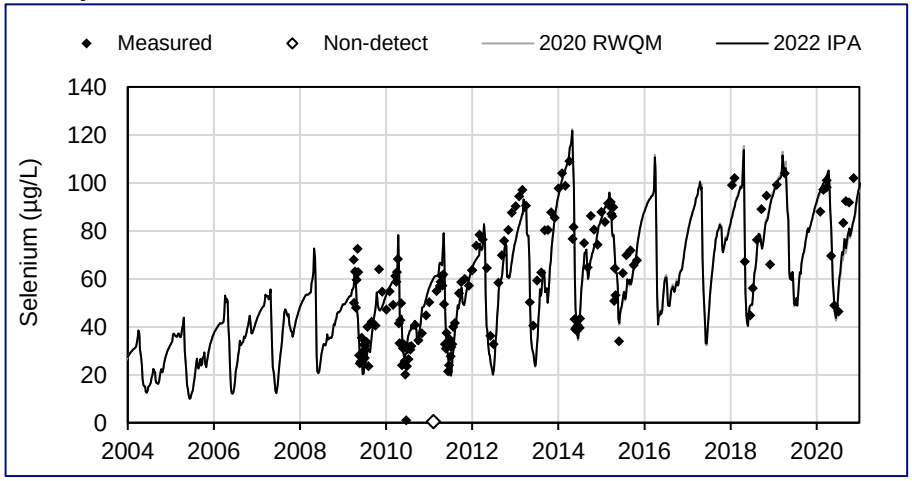
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/1/2009	4/1/2009
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	143	143
Non-Detect Count	1	1
Measured Mean (µg/L)	56	56
Simulated Mean (µg/L)	56	56
Bias (µg/L)	0.33	0.33
Relative Bias	1.0	1.0
Error (µg/L)	11	10
Percent Error	19%	19%

Simulated versus Measured Selenium Concentrations (2022 IPA)

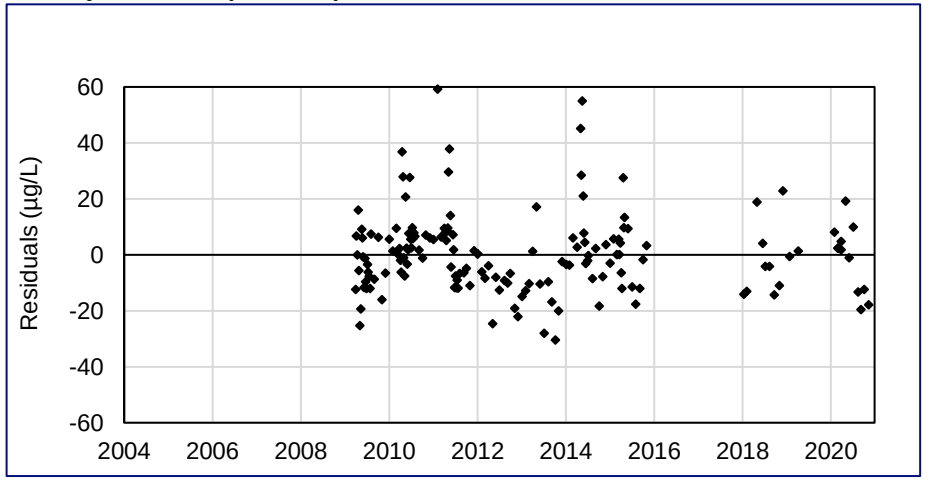


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



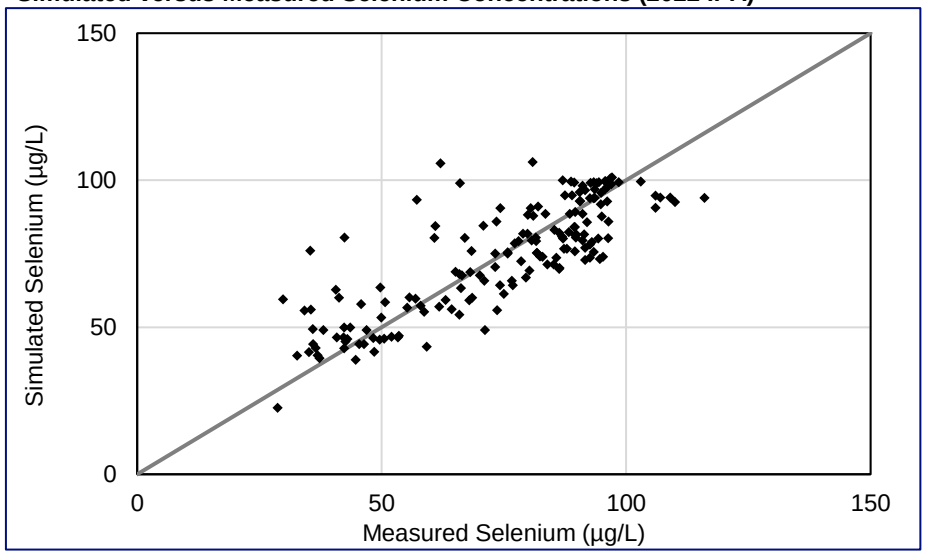
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-30: Selenium Calibration Information for Node FR_FRABCH - FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek) (EMS E223753)

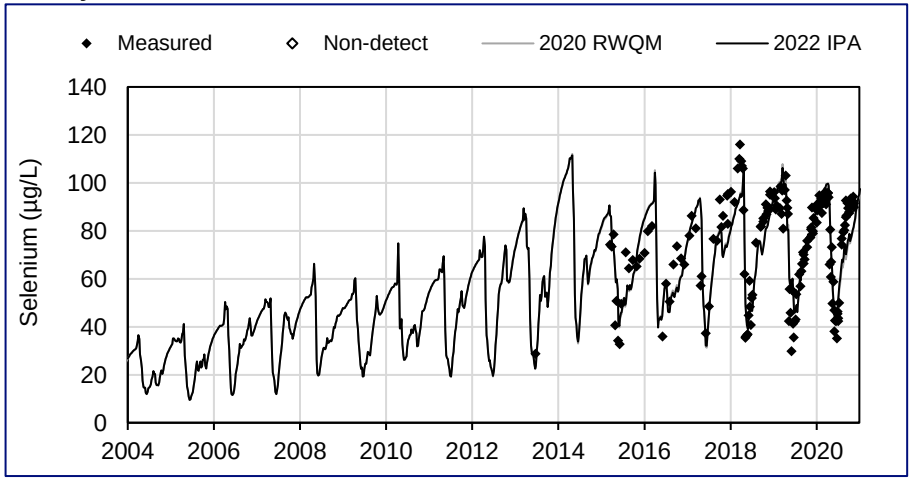
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	6/24/2013	6/24/2013
Last Measured Sample	12/6/2018	12/6/2018
Data Points Available for Comparison, n	72	72
Non-Detect Count	0	0
Measured Mean (µg/L)	72	72
Simulated Mean (µg/L)	70	70
Bias (µg/L)	-1.5	-1.8
Relative Bias	0.98	0.97
Error (µg/L)	11	11
Percent Error	15%	16%

Simulated versus Measured Selenium Concentrations (2022 IPA)

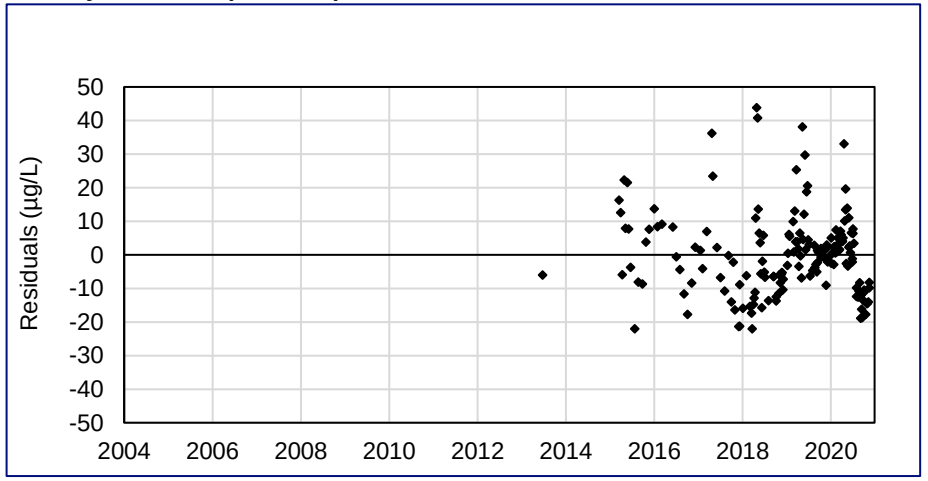


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



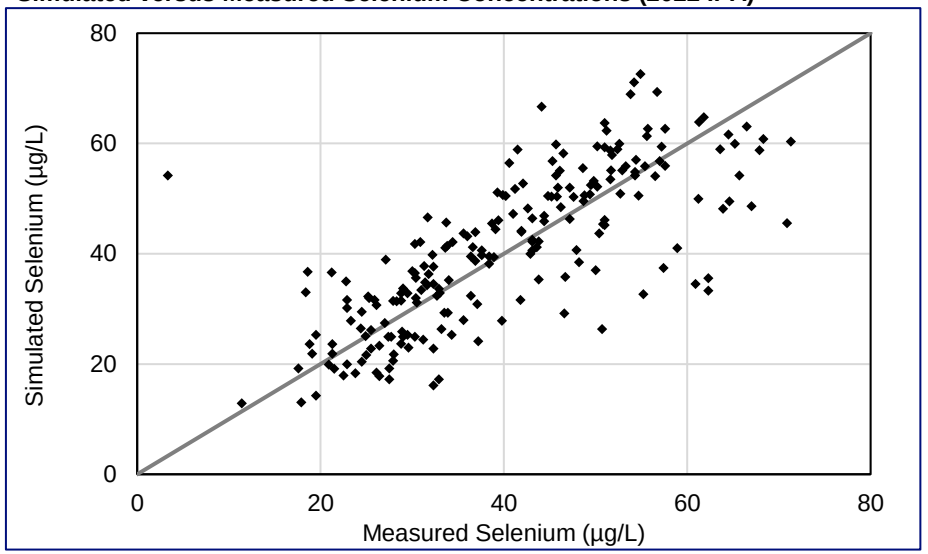
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-31: Selenium Calibration Information for Node LC_FRDSDC - Fording River d/s of Dry Creek (EMS E288272)

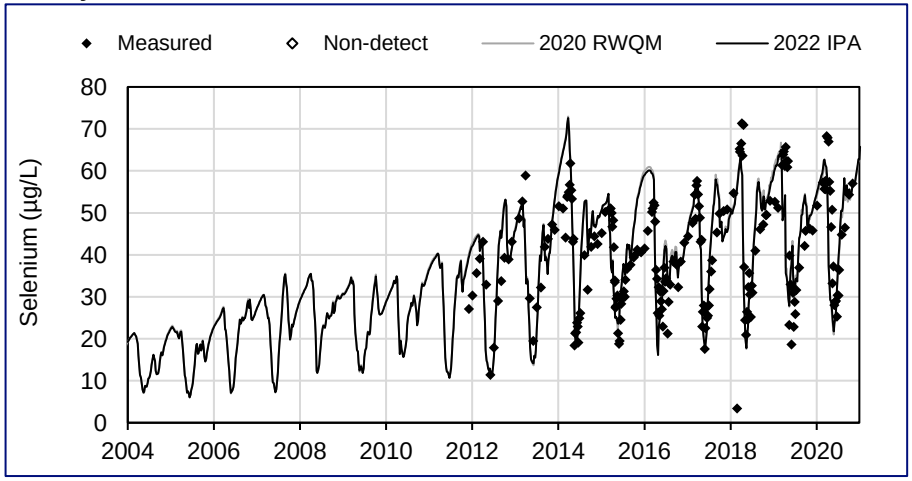
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/7/2011	12/7/2011
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	160	160
Non-Detect Count	0	0
Measured Mean (µg/L)	38	38
Simulated Mean (µg/L)	40	40
Bias (µg/L)	2.1	1.7
Relative Bias	1.1	1.0
Error (µg/L)	6.4	6.3
Percent Error	17%	16%

Simulated versus Measured Selenium Concentrations (2022 IPA)

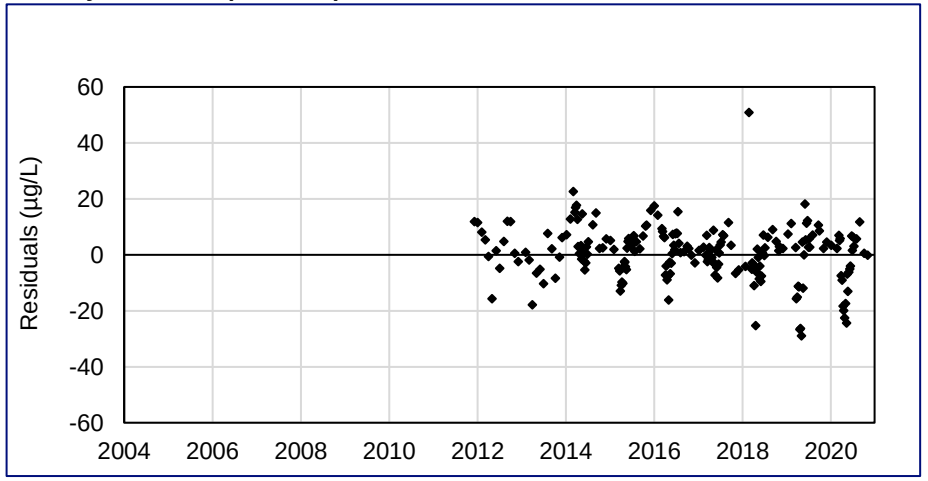


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



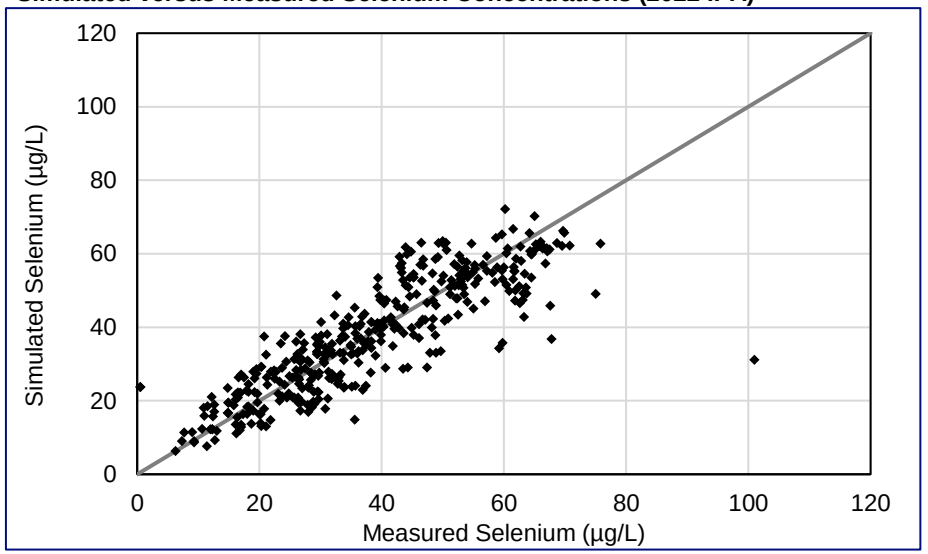
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-32: Selenium Calibration Information for Node GH_FR1 - GHO Fording River Compliance Point (EMS 0200378)

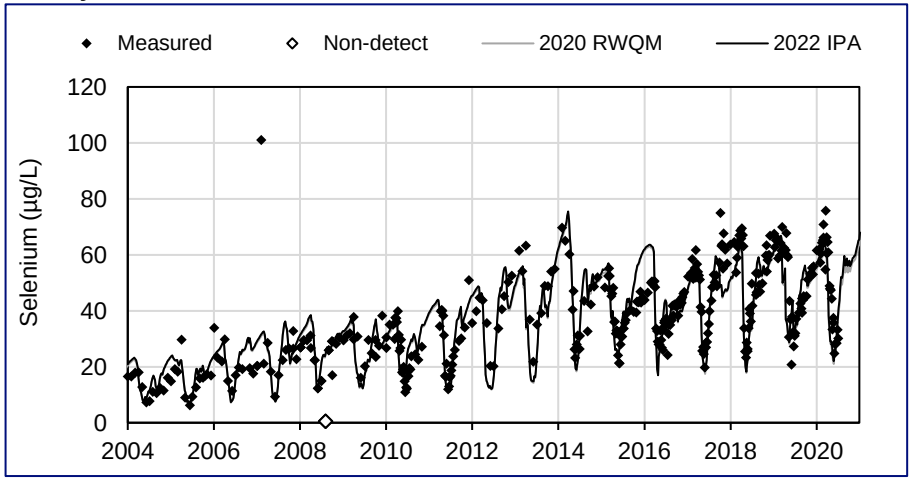
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	333	333
Non-Detect Count	2	2
Measured Mean (µg/L)	35	35
Simulated Mean (µg/L)	35	36
Bias (µg/L)	-0.23	0.2
Relative Bias	0.99	1.0
Error (µg/L)	5.9	5.9
Percent Error	17%	17%

Simulated versus Measured Selenium Concentrations (2022 IPA)

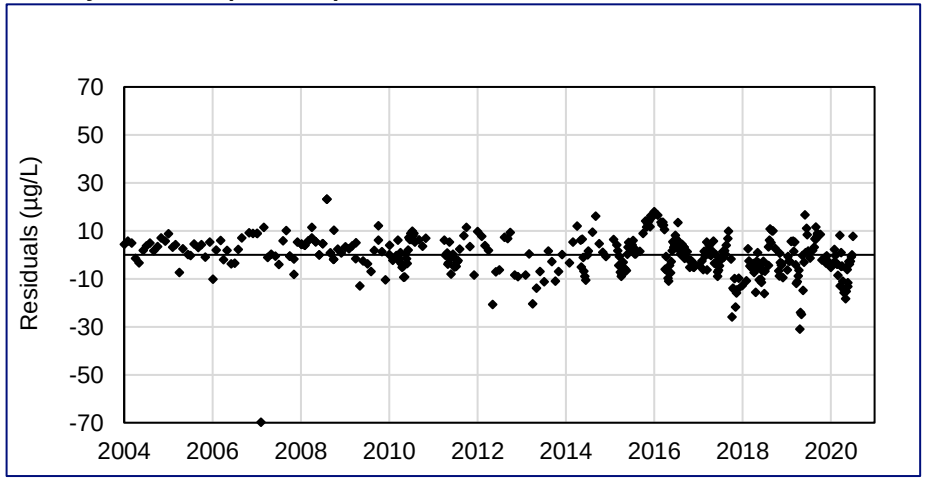


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



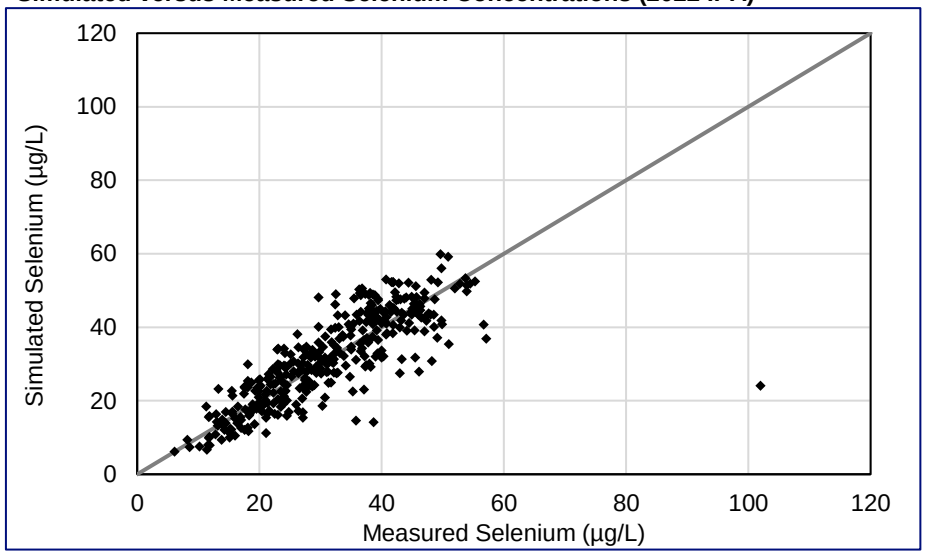
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-33: Selenium Calibration Information for Node LC_LC5 - Fording River d/s of Line Creek (EMS 0200028)

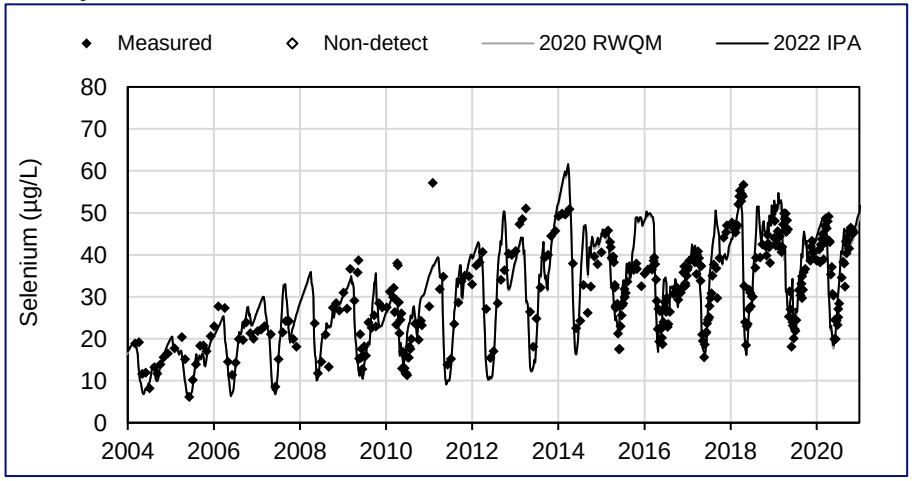
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	3/4/2004	3/4/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	281	281
Non-Detect Count	0	0
Measured Mean (µg/L)	30	30
Simulated Mean (µg/L)	29	30
Bias (µg/L)	-0.31	-0.035
Relative Bias	0.99	1.0
Error (µg/L)	4.8	4.8
Percent Error	16%	16%

Simulated versus Measured Selenium Concentrations (2022 IPA)

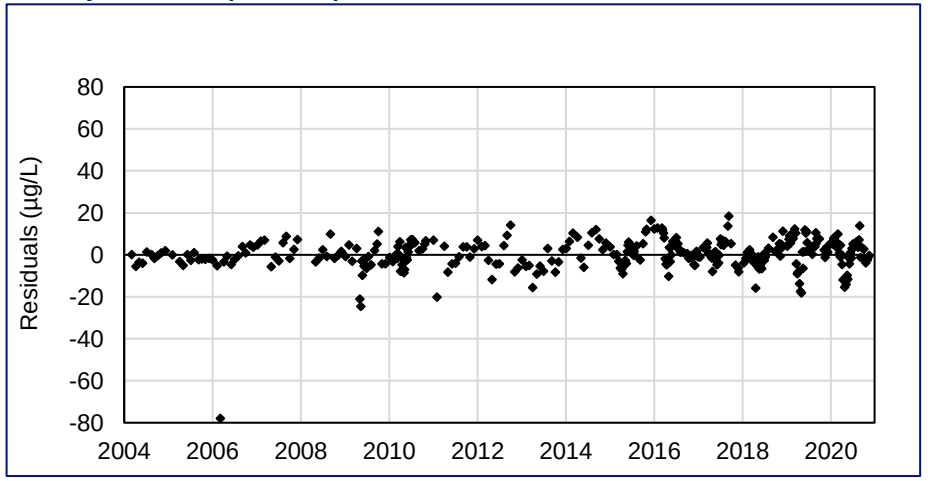


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

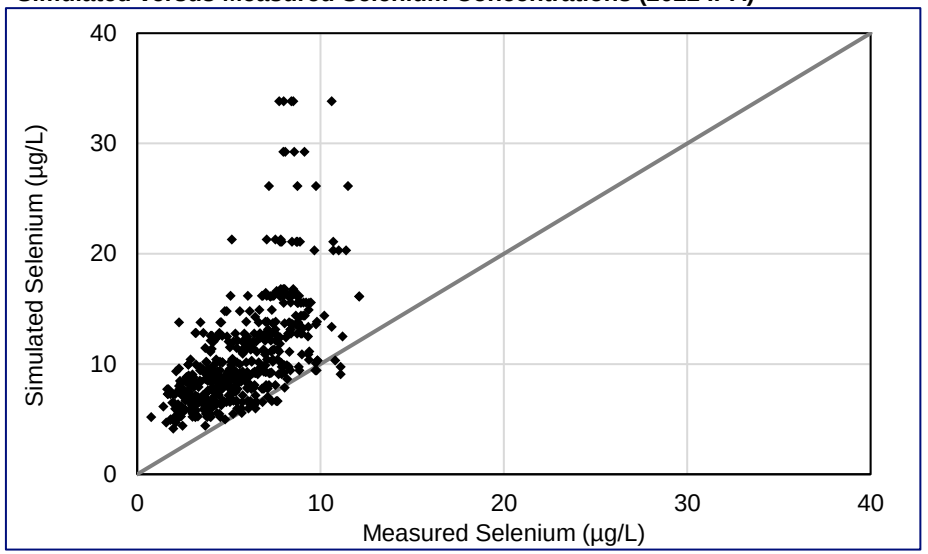
B1-34: Selenium Calibration Information for Node CM_MC2 - CMO Compliance Point (EMS E258937)

Measured and Simulated Selenium Data and Calibration Statistics

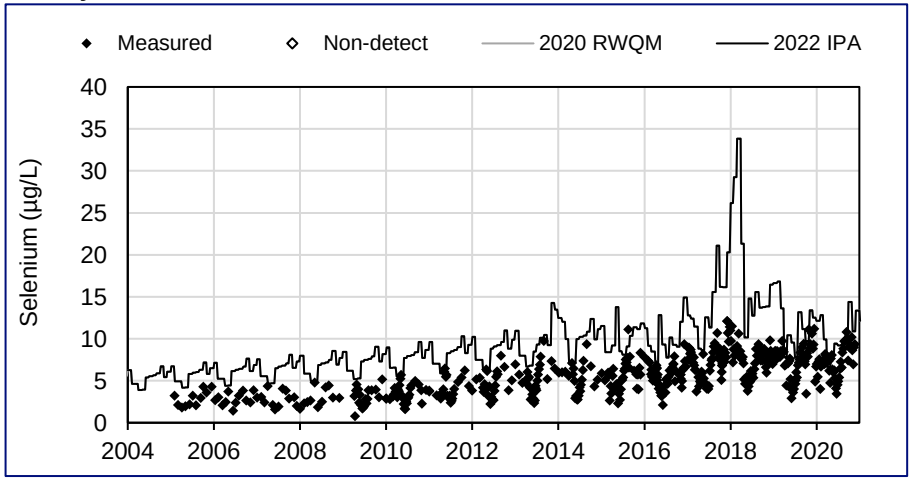
Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/28/2018	12/28/2018
Data Points Available for Comparison, n	408	408
Non-Detect Count	0	0
Measured Mean (µg/L)	5.3	5.3
Simulated Mean (µg/L)	11	11
Bias (µg/L)	5.3	5.3
Relative Bias	2.0	2.0
Error (µg/L)	5.3	5.3
Percent Error	100%	100%

Note: Simulated data are from the CMO Water and Load Balance Model.

Simulated versus Measured Selenium Concentrations (2022 IPA)

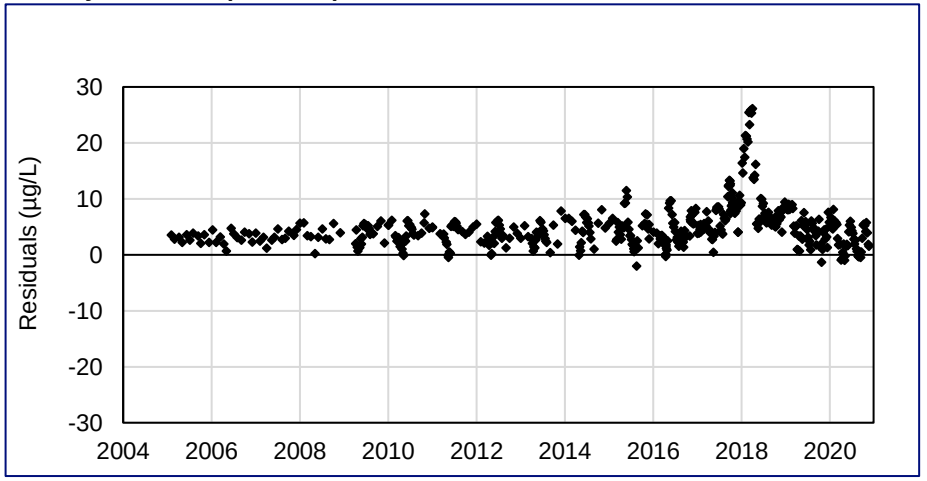


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



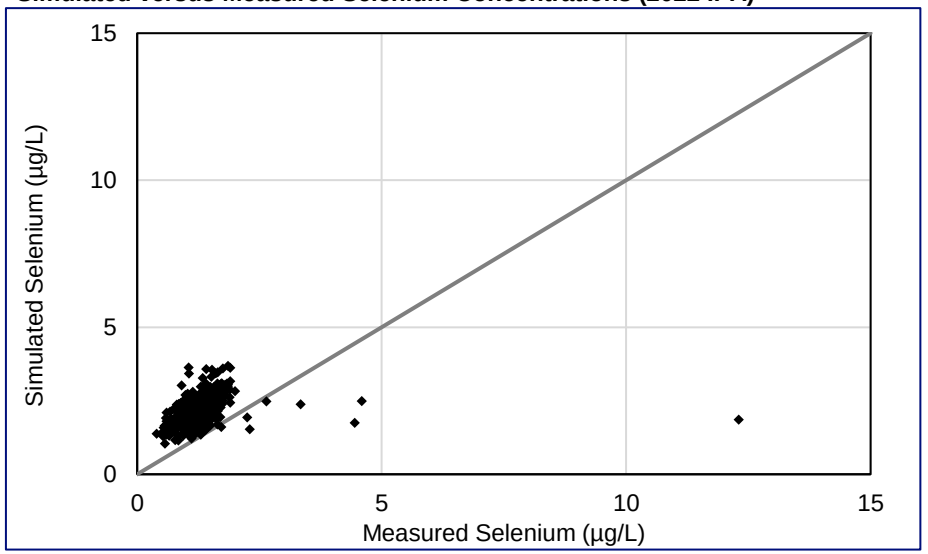
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-35: Selenium Calibration Information for Node EV_MC3 - Michel Creek u/s of Erickson Creek (EMS 0200203)

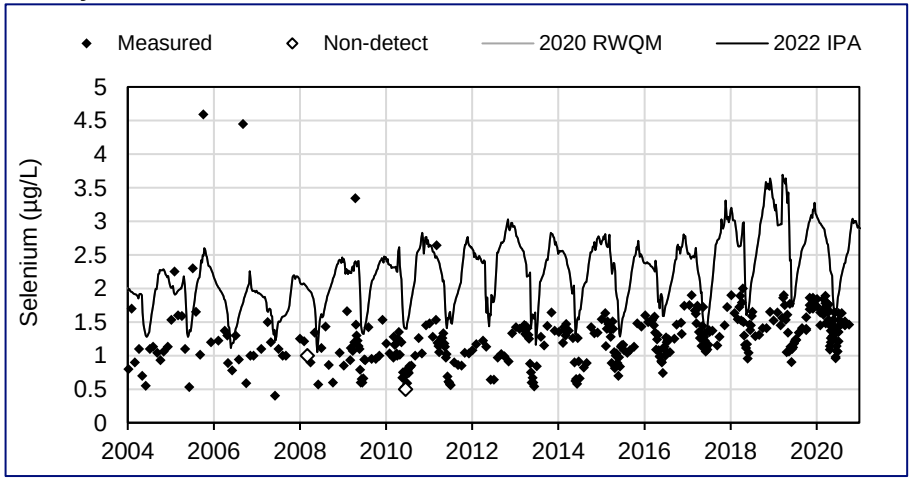
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	295	295
Non-Detect Count	2	2
Measured Mean (µg/L)	1.2	1.2
Simulated Mean (µg/L)	2.1	2.1
Bias (µg/L)	0.87	0.87
Relative Bias	1.7	1.7
Error (µg/L)	0.99	0.99
Percent Error	79%	79%

Simulated versus Measured Selenium Concentrations (2022 IPA)

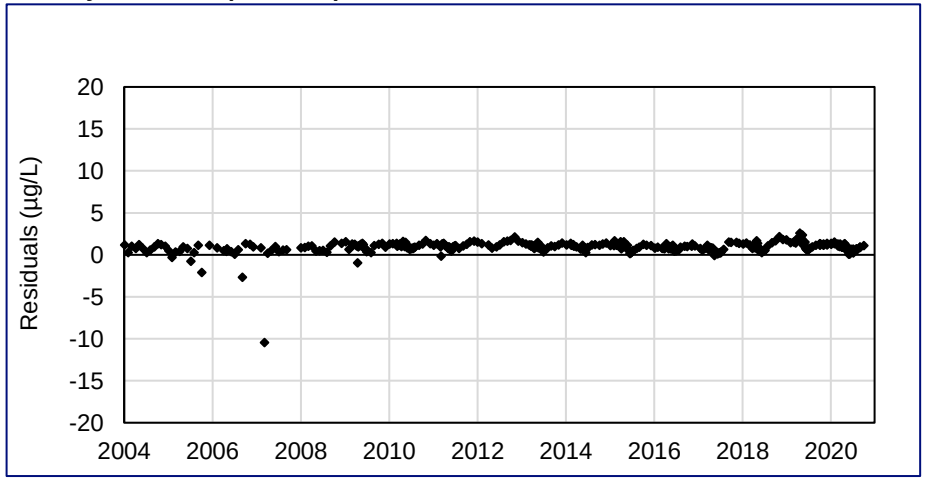


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



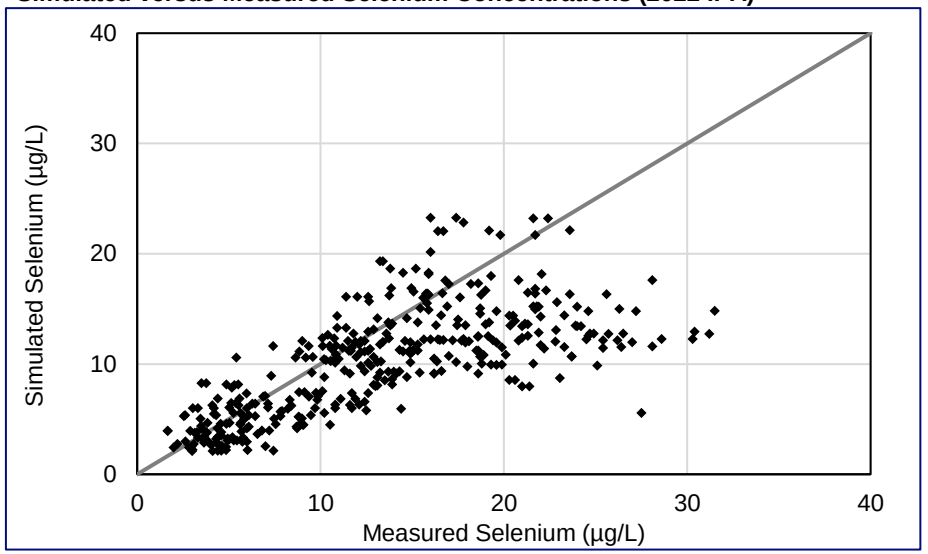
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-36: Selenium Calibration Information for Node EV_MC2_BiasC - EVO Michel Creek Compliance Point (EMS E300091)

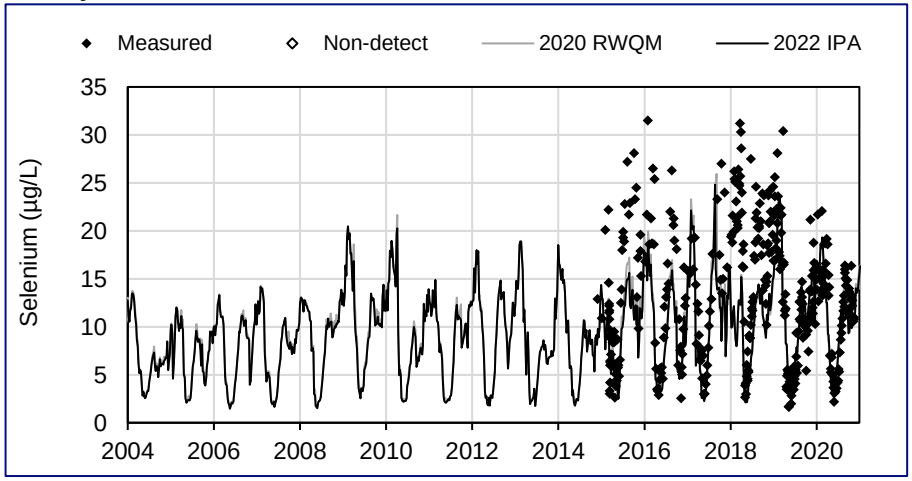
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/3/2014	12/3/2014
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	217	217
Non-Detect Count	0	0
Measured Mean (µg/L)	14	14
Simulated Mean (µg/L)	9.4	9.1
Bias (µg/L)	-4.9	-5.2
Relative Bias	0.66	0.64
Error (µg/L)	5.3	5.5
Percent Error	37%	39%

Simulated versus Measured Selenium Concentrations (2022 IPA)

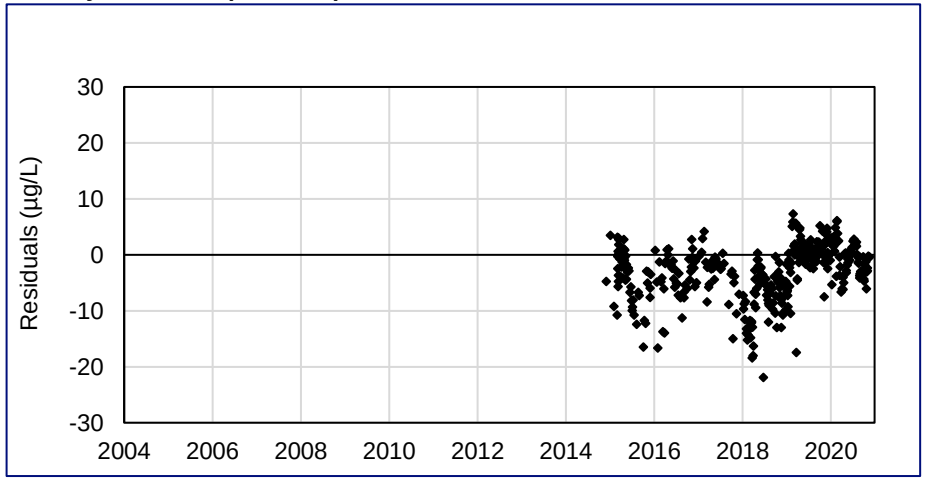


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



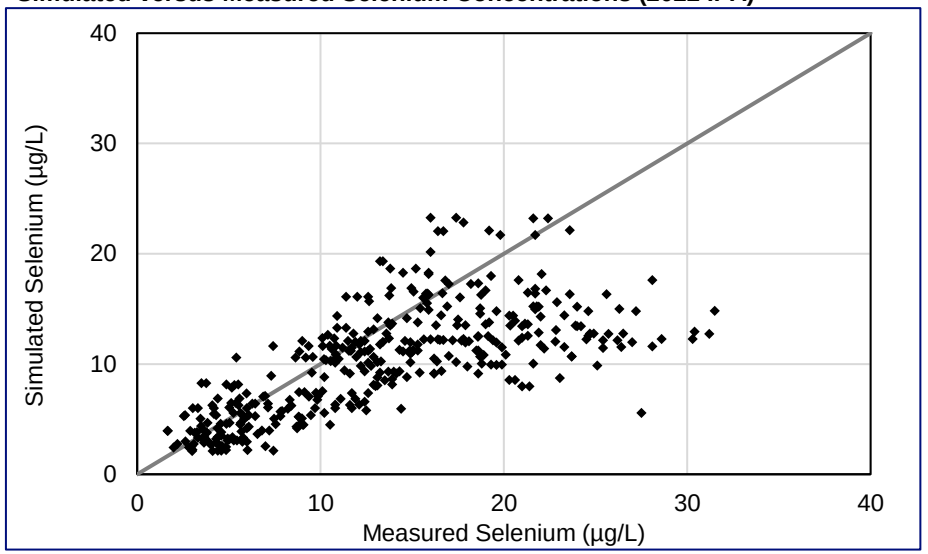
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-36: Selenium Calibration Information for Node EV_MC2 - EVO Michel Creek Compliance Point (EMS E300091)

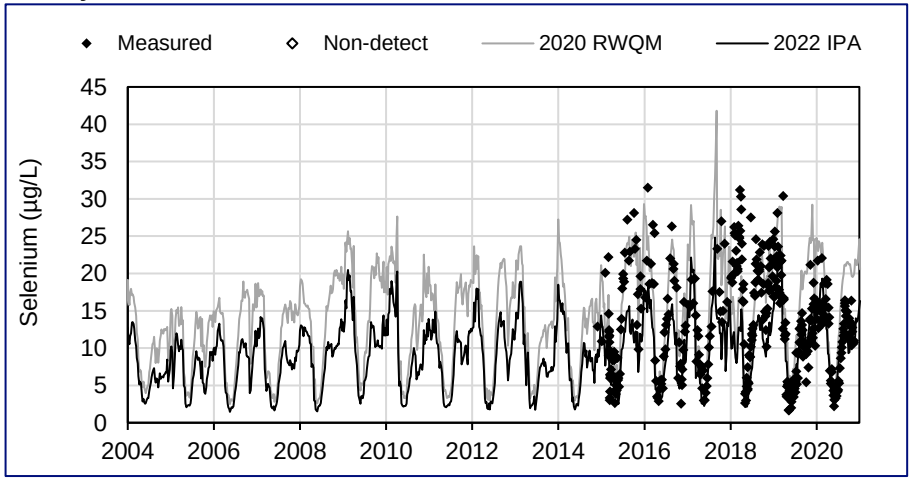
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/3/2014	12/3/2014
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	217	217
Non-Detect Count	0	0
Measured Mean (µg/L)	14	14
Simulated Mean (µg/L)	9.4	9.1
Bias (µg/L)	-4.9	-5.2
Relative Bias	0.66	0.64
Error (µg/L)	5.3	5.5
Percent Error	37%	39%

Simulated versus Measured Selenium Concentrations (2022 IPA)

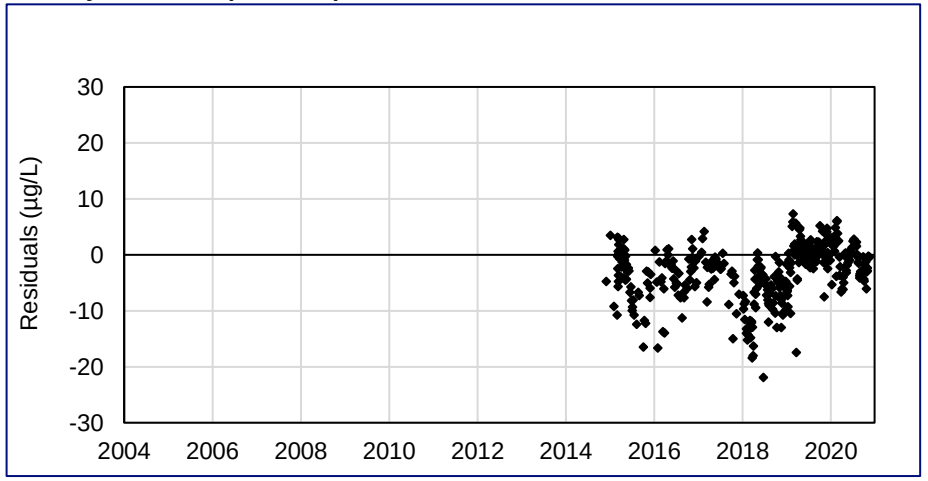


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



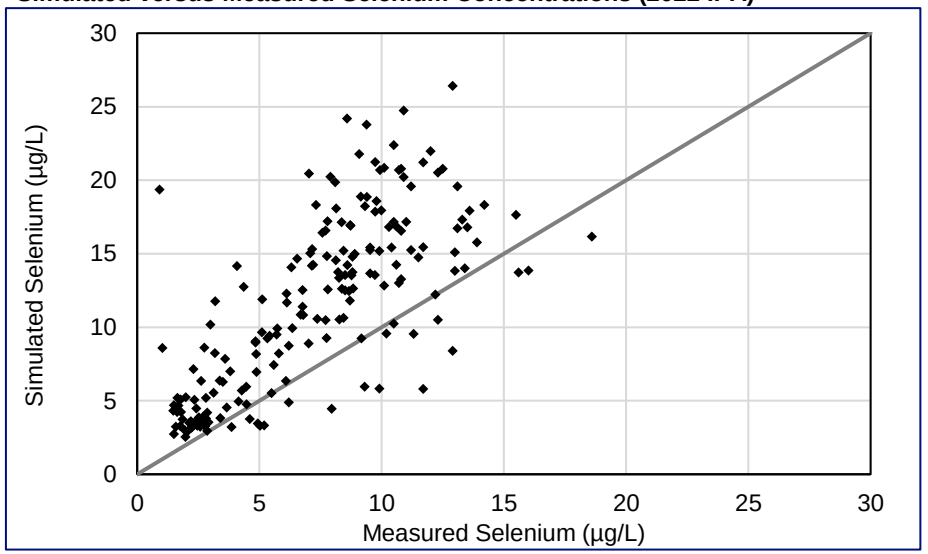
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-37: Selenium Calibration Information for Node EV_MC1 - Michel Creek u/s of Highway 43 Bridge (EMS 0200425)

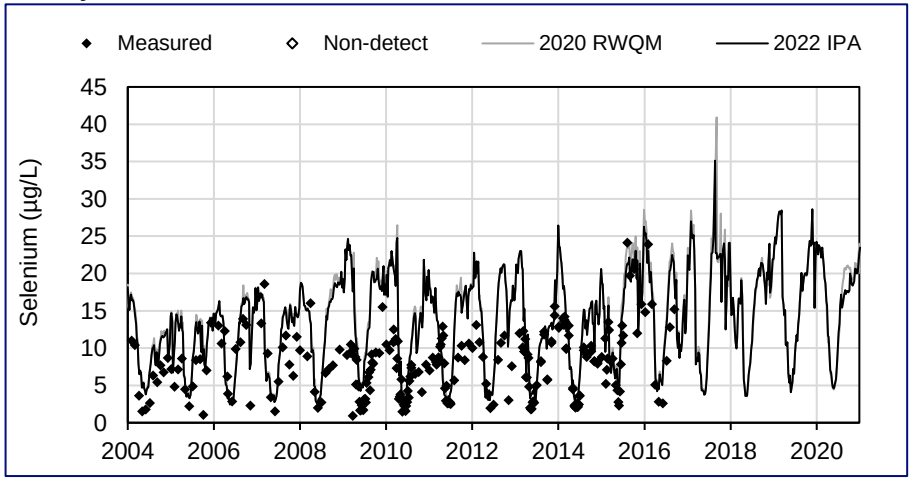
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/3/2004	2/3/2004
Last Measured Sample	9/13/2016	9/13/2016
Data Points Available for Comparison, n	227	227
Non-Detect Count	0	0
Measured Mean (µg/L)	7.7	7.6
Simulated Mean (µg/L)	12	12
Bias (µg/L)	4.3	4.1
Relative Bias	1.6	1.5
Error (µg/L)	4.6	4.5
Percent Error	60%	59%

Simulated versus Measured Selenium Concentrations (2022 IPA)

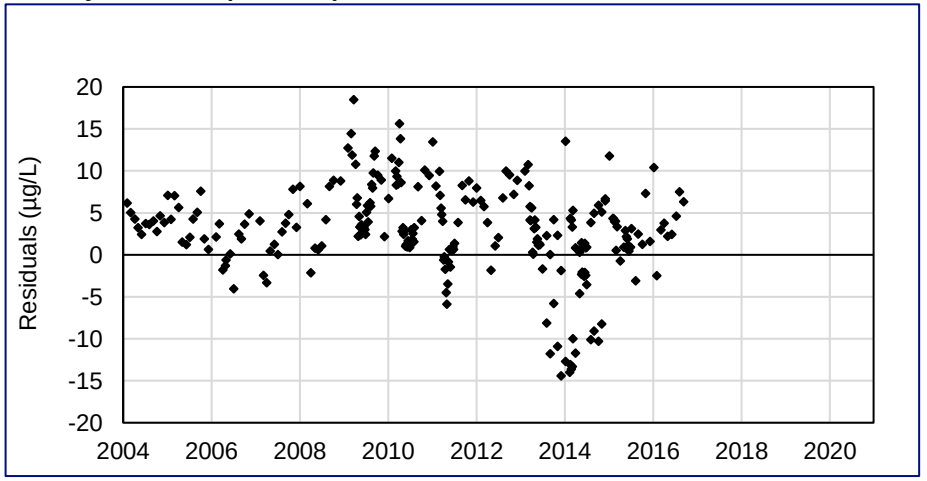


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



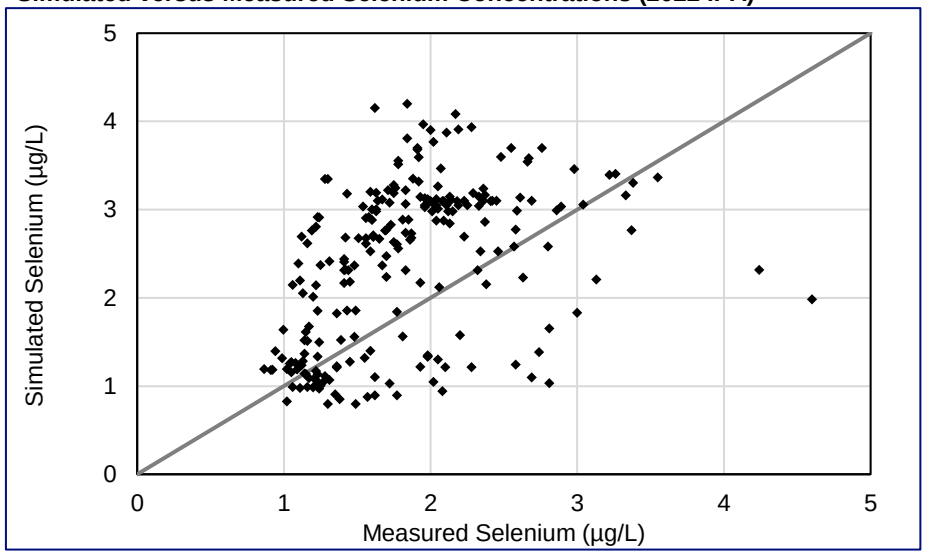
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-38: Selenium Calibration Information for Node GH_ERC - GHO Elk River Compliance Point (EMS E300090)

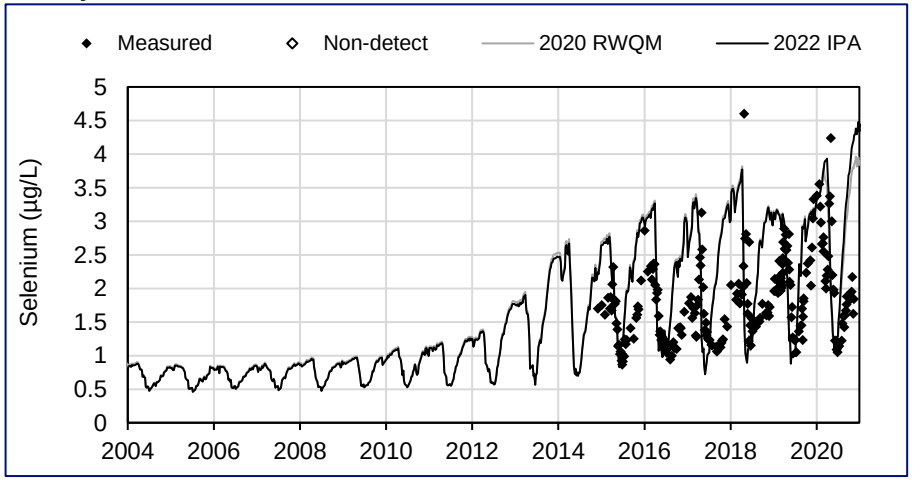
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/4/2014	12/4/2014
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	136	136
Non-Detect Count	0	0
Measured Mean (µg/L)	1.6	1.6
Simulated Mean (µg/L)	2.2	2.2
Bias (µg/L)	0.56	0.53
Relative Bias	1.3	1.3
Error (µg/L)	0.85	0.82
Percent Error	52%	51%

Simulated versus Measured Selenium Concentrations (2022 IPA)

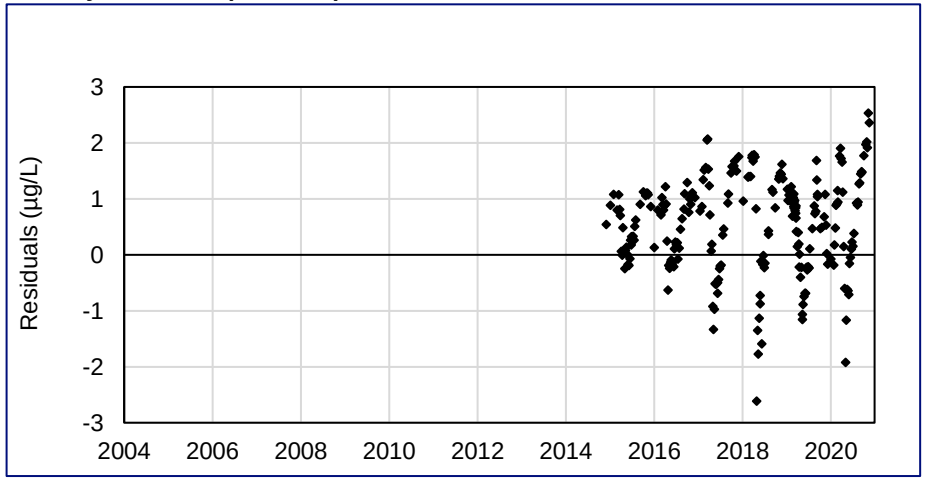


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



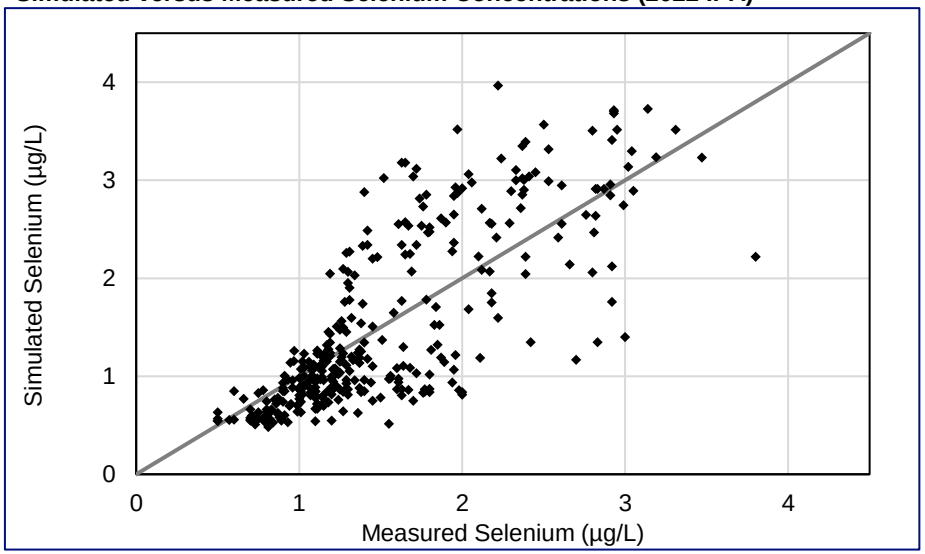
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-39: Selenium Calibration Information for Node GH_ER1 - Elk River u/s of Boivin Creek (u/s of Fording River) (EMS E206661)

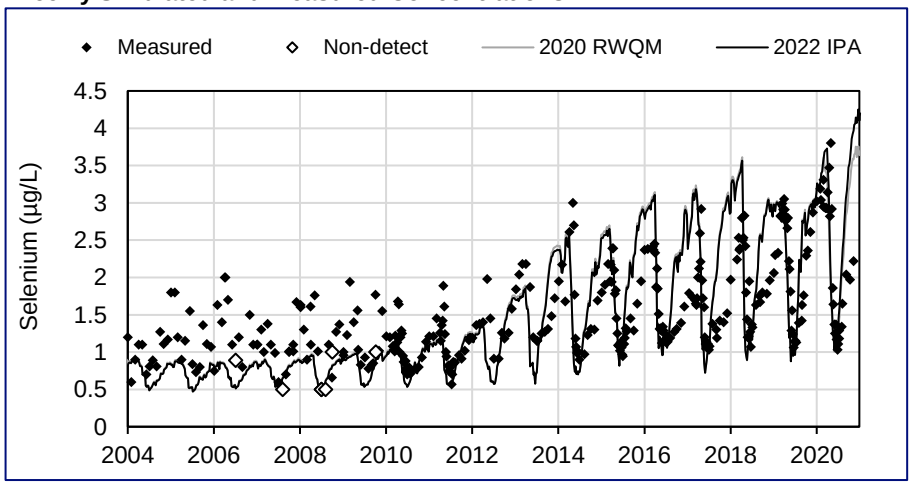
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/2/2004	1/2/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	285	285
Non-Detect Count	7	7
Measured Mean (µg/L)	1.4	1.4
Simulated Mean (µg/L)	1.3	1.3
Bias (µg/L)	-0.031	-0.05
Relative Bias	0.98	0.96
Error (µg/L)	0.42	0.41
Percent Error	30%	30%

Simulated versus Measured Selenium Concentrations (2022 IPA)

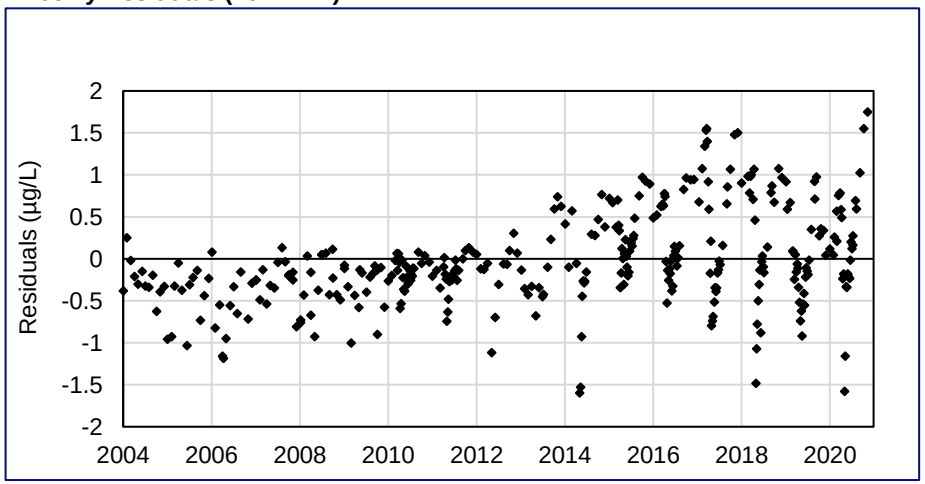


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



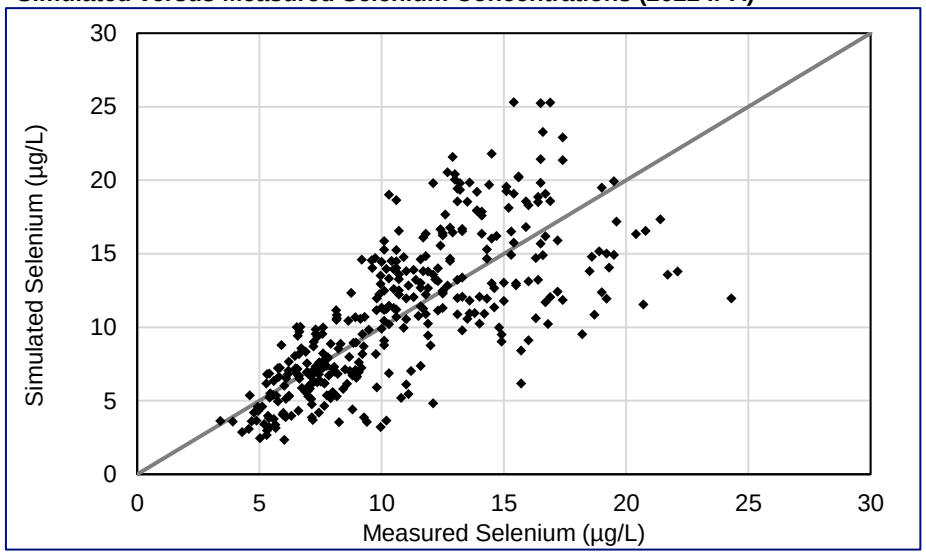
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-40: Selenium Calibration Information for Node EV_ER4 - Elk River u/s of Grave Creek (EMS 0200027)

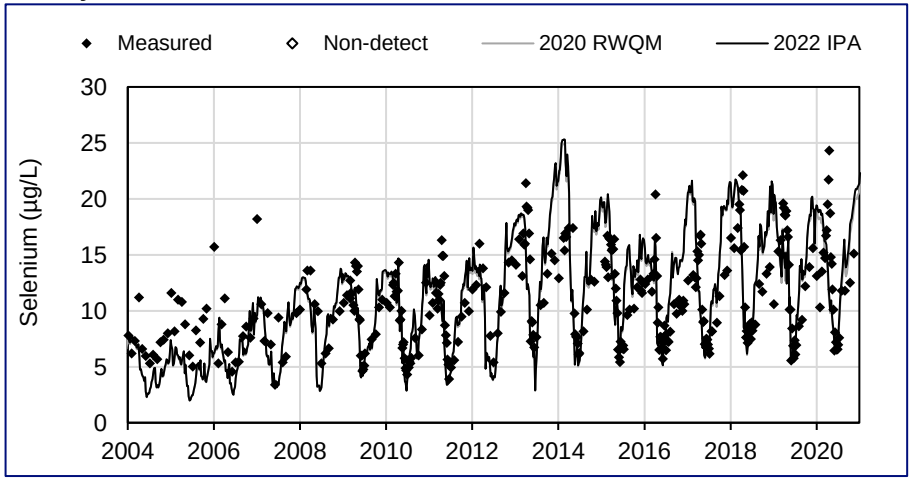
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	304	304
Non-Detect Count	0	0
Measured Mean (µg/L)	10	10
Simulated Mean (µg/L)	10	11
Bias (µg/L)	-0.017	0.11
Relative Bias	1.0	1.0
Error (µg/L)	2.5	2.6
Percent Error	24%	25%

Simulated versus Measured Selenium Concentrations (2022 IPA)

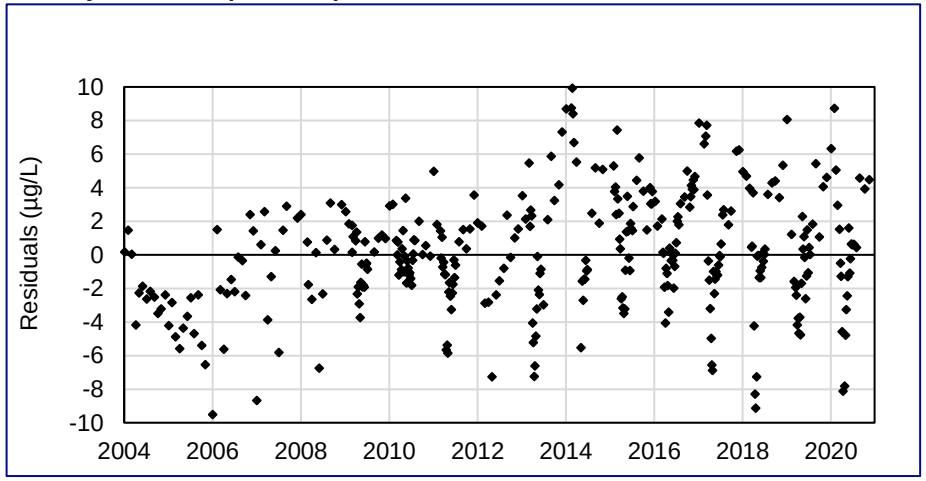


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



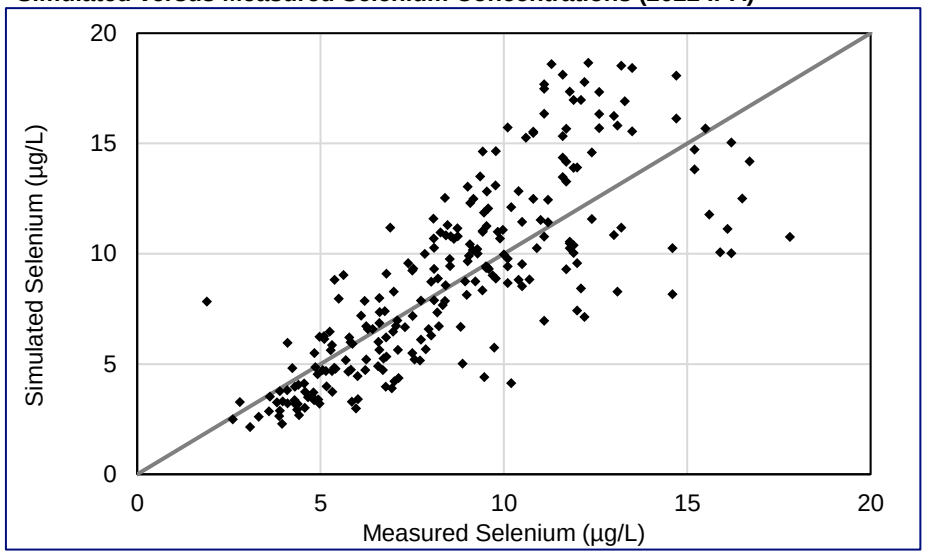
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-41: Selenium Calibration Information for Node EV_ER2 - Elk River u/s of Michel Creek (EMS 0200111)

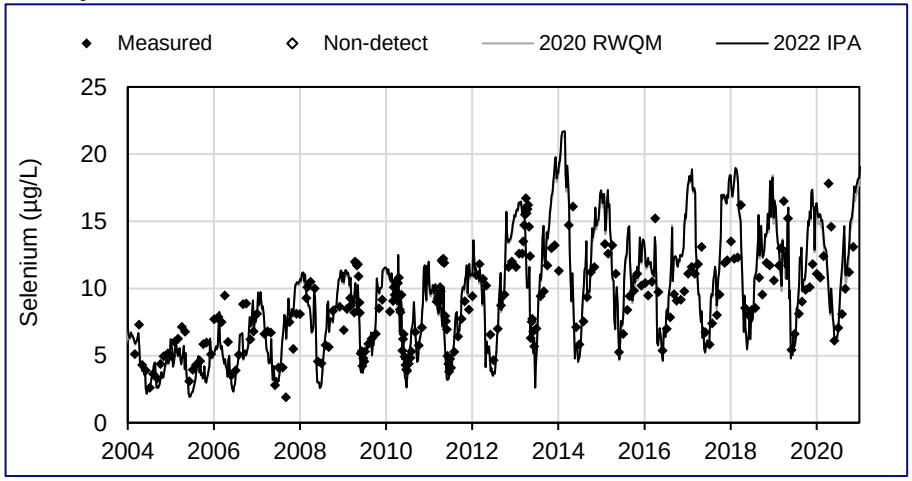
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	3/2/2004	3/2/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	220	220
Non-Detect Count	0	0
Measured Mean (µg/L)	8.4	8.4
Simulated Mean (µg/L)	8.5	8.6
Bias (µg/L)	0.11	0.21
Relative Bias	1.0	1.0
Error (µg/L)	1.9	1.9
Percent Error	23%	23%

Simulated versus Measured Selenium Concentrations (2022 IPA)

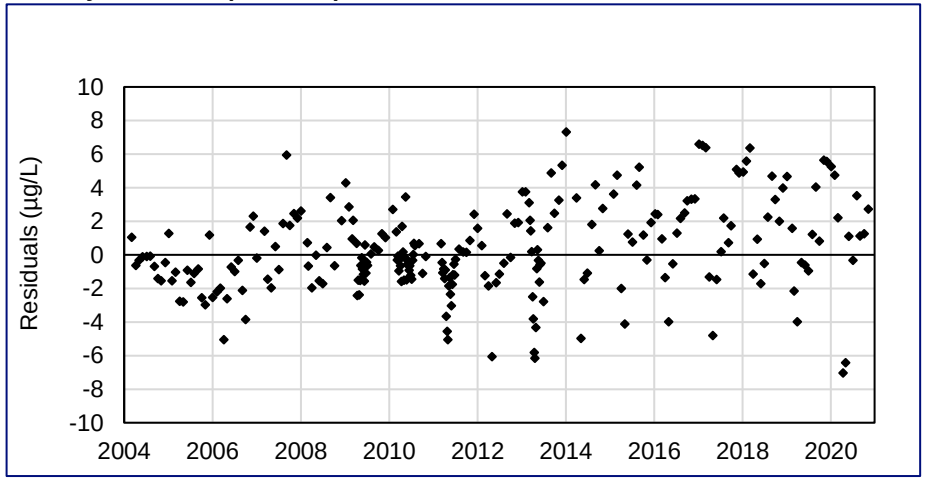


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



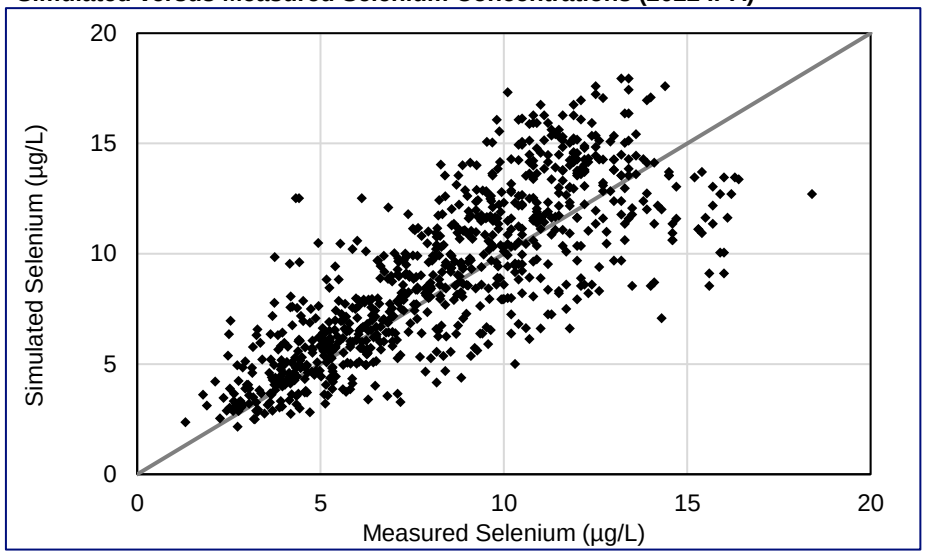
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-42: Selenium Calibration Information for Node EV_ER1 - Elk River d/s of Michel Creek (EMS 0200393)

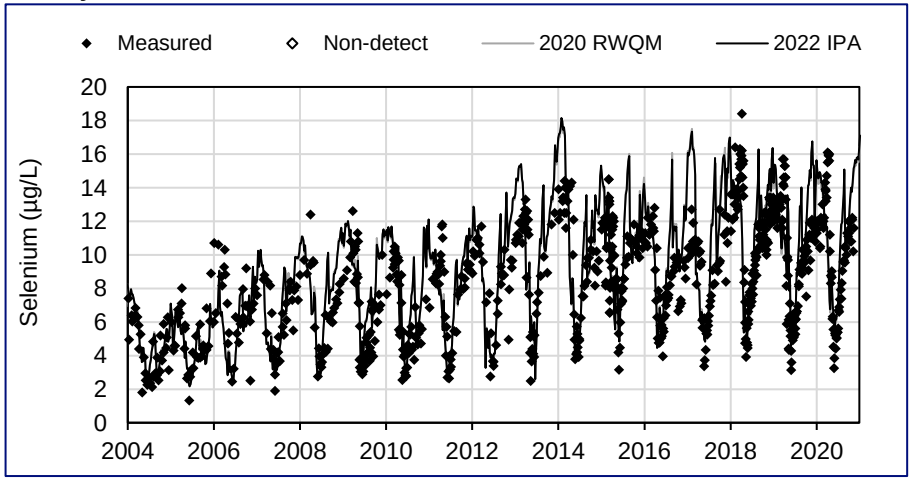
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	672	672
Non-Detect Count	0	0
Measured Mean (µg/L)	8.1	8.1
Simulated Mean (µg/L)	8.7	8.7
Bias (µg/L)	0.63	0.62
Relative Bias	1.1	1.1
Error (µg/L)	1.7	1.7
Percent Error	21%	21%

Simulated versus Measured Selenium Concentrations (2022 IPA)

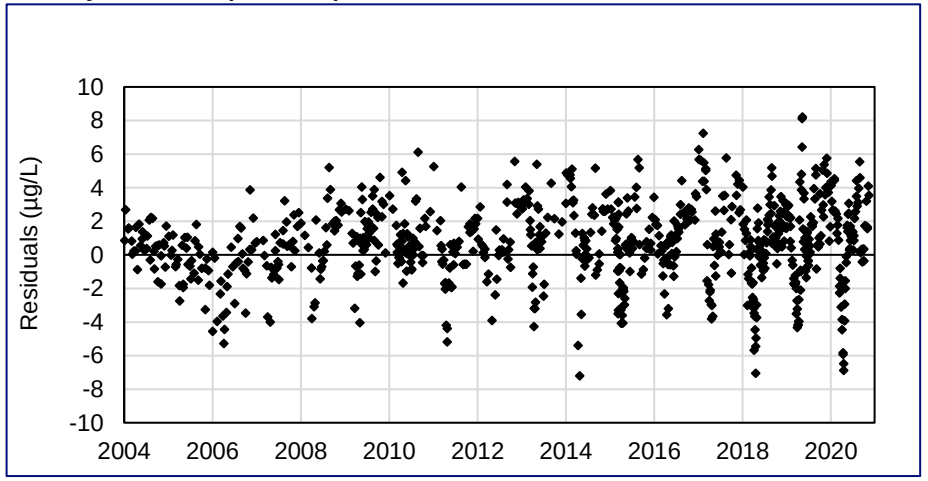


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



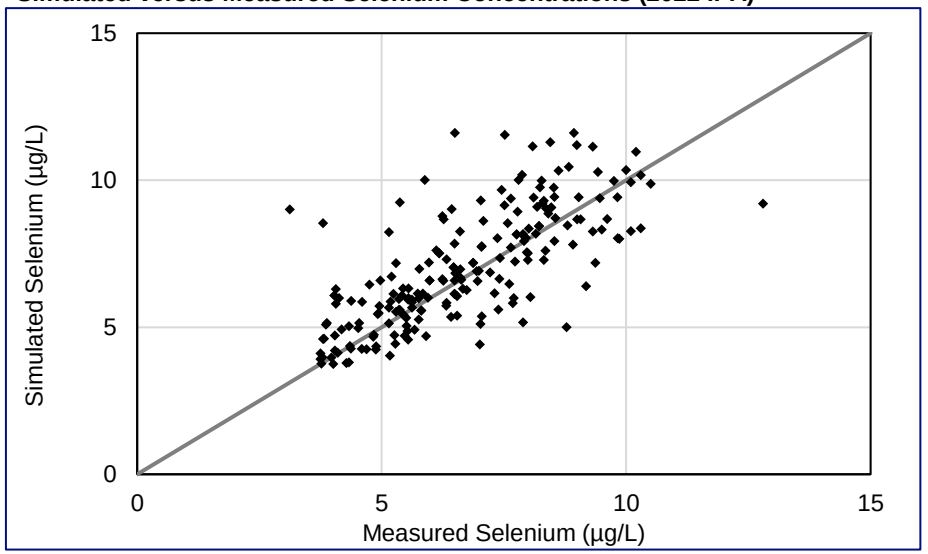
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-43: Selenium Calibration Information for Node RG_ELKORES - Elk River at Elko Reservoir (EMS E294312)

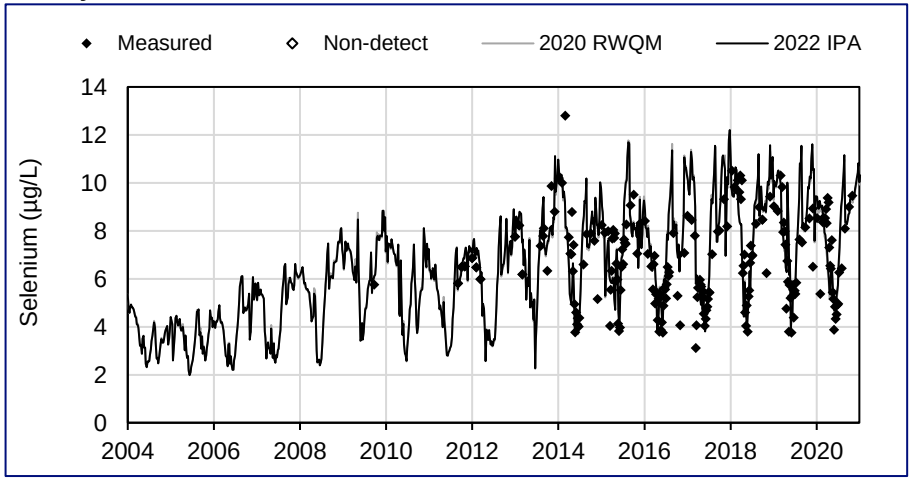
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	9/23/2009	9/23/2009
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	155	155
Non-Detect Count	0	0
Measured Mean (µg/L)	6.6	6.6
Simulated Mean (µg/L)	6.9	6.9
Bias (µg/L)	0.29	0.28
Relative Bias	1.0	1.0
Error (µg/L)	0.9	0.92
Percent Error	14%	14%

Simulated versus Measured Selenium Concentrations (2022 IPA)

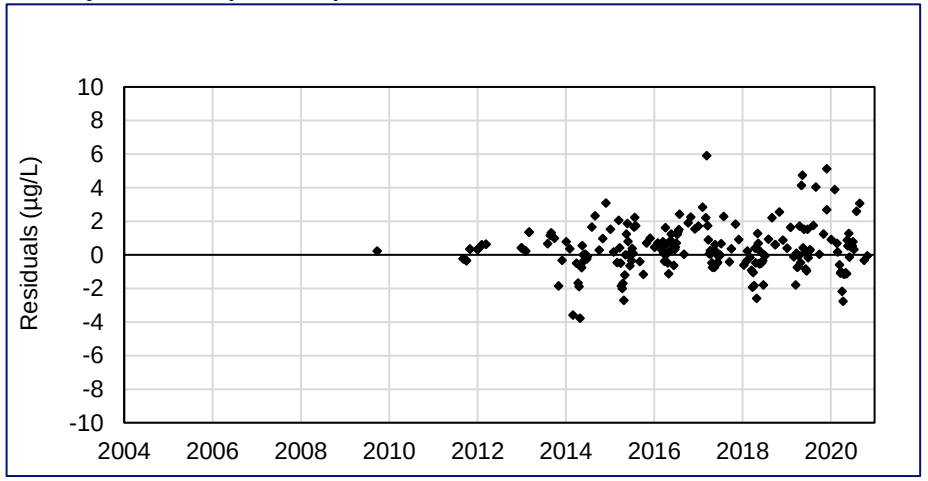


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



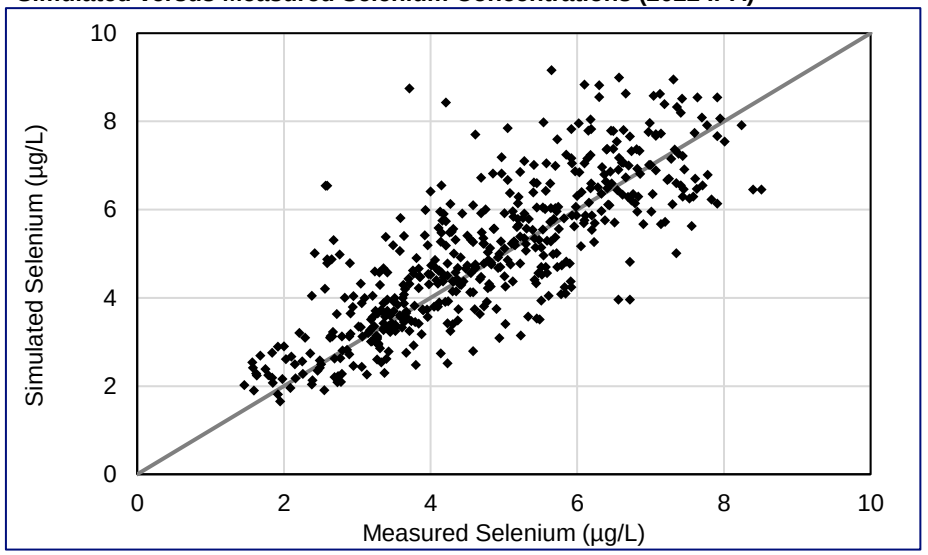
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-44: Selenium Calibration Information for Node RG_ELKMOUTH - Elk River at Highway 93 near Elko

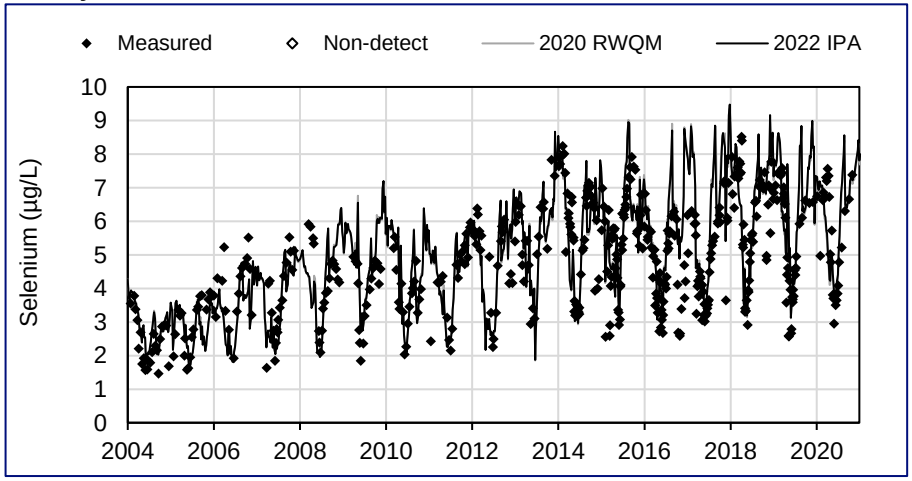
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/26/2004	1/26/2004
Last Measured Sample	12/16/2018	12/16/2018
Data Points Available for Comparison, n	433	433
Non-Detect Count	0	0
Measured Mean (µg/L)	4.7	4.7
Simulated Mean (µg/L)	4.9	4.9
Bias (µg/L)	0.23	0.22
Relative Bias	1.0	1.0
Error (µg/L)	0.76	0.75
Percent Error	16%	16%

Simulated versus Measured Selenium Concentrations (2022 IPA)

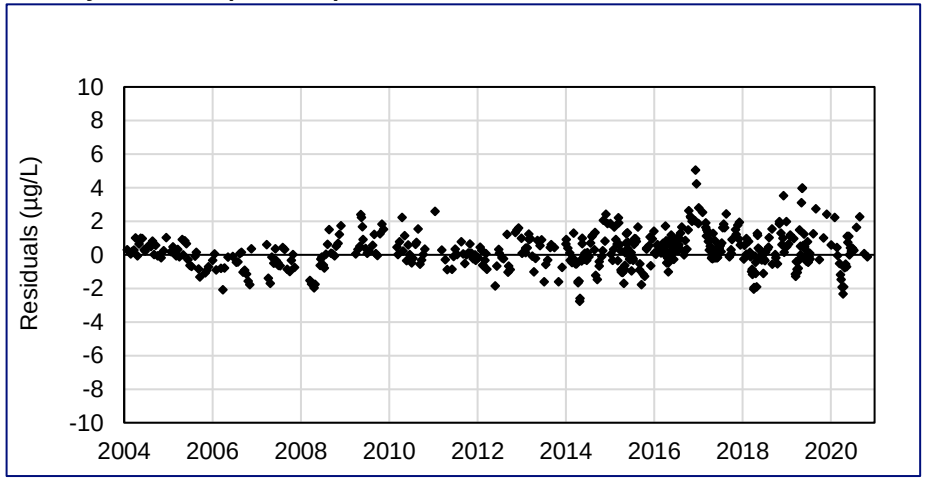


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



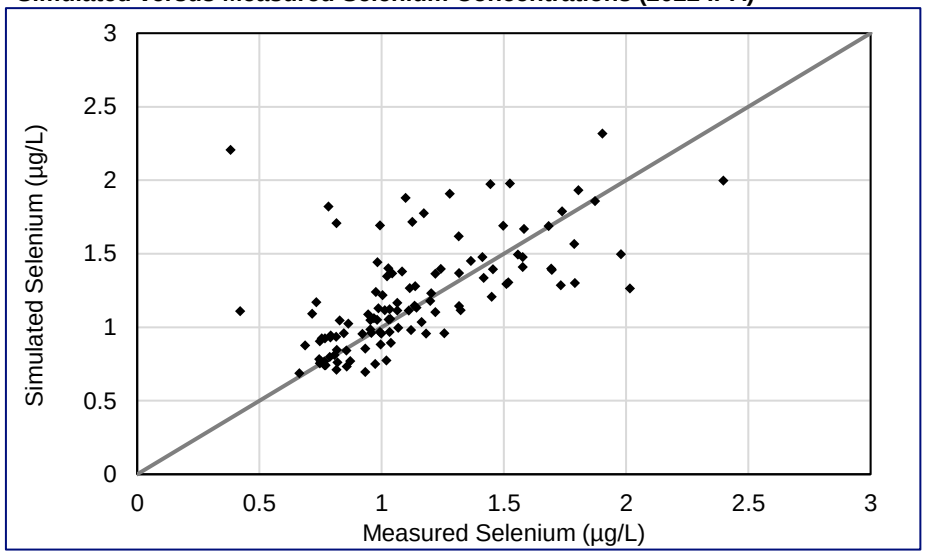
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

B1-45: Selenium Calibration Information for Node RG_DSELK - Koocanusa Reservoir - South of the Elk River (EMS E300230)

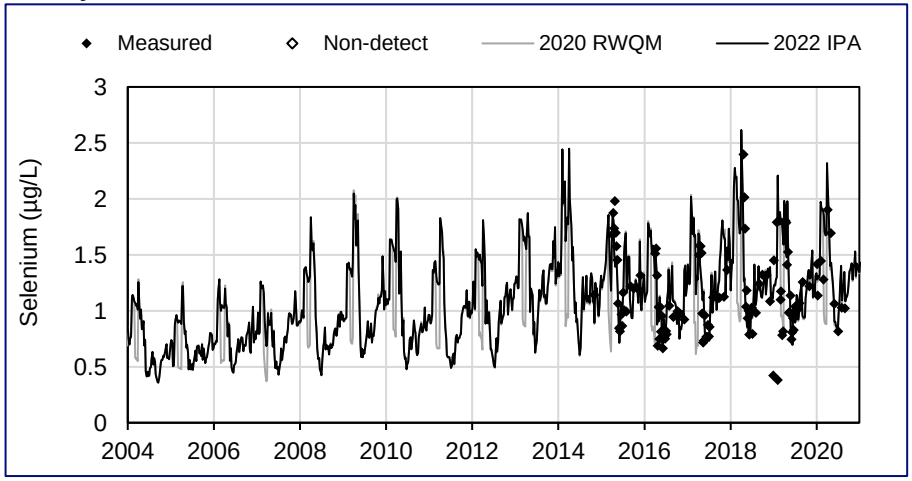
Measured and Simulated Selenium Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	11/5/2014	11/5/2014
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	77	77
Non-Detect Count	0	0
Measured Mean (µg/L)	1.1	1.1
Simulated Mean (µg/L)	1.2	1.1
Bias (µg/L)	0.012	0.012
Relative Bias	1.0	1.0
Error (µg/L)	0.16	0.15
Percent Error	14%	14%

Simulated versus Measured Selenium Concentrations (2022 IPA)

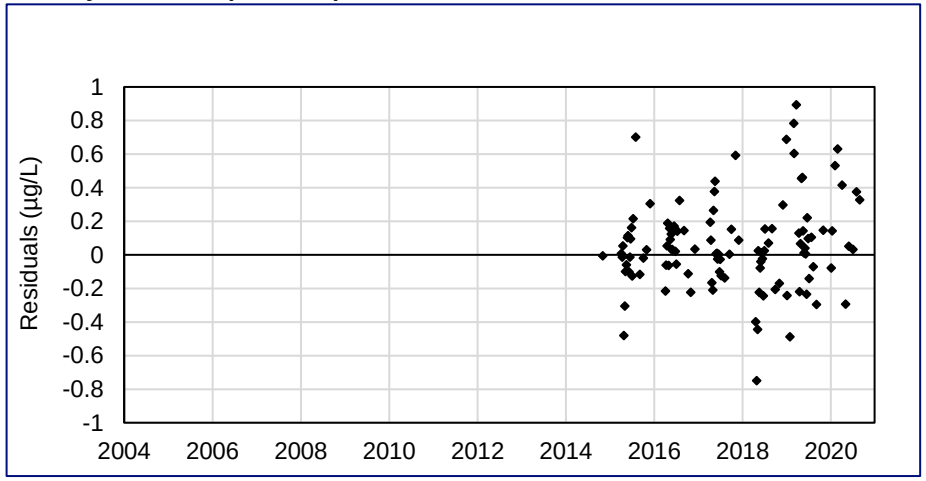


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

APPENDIX C

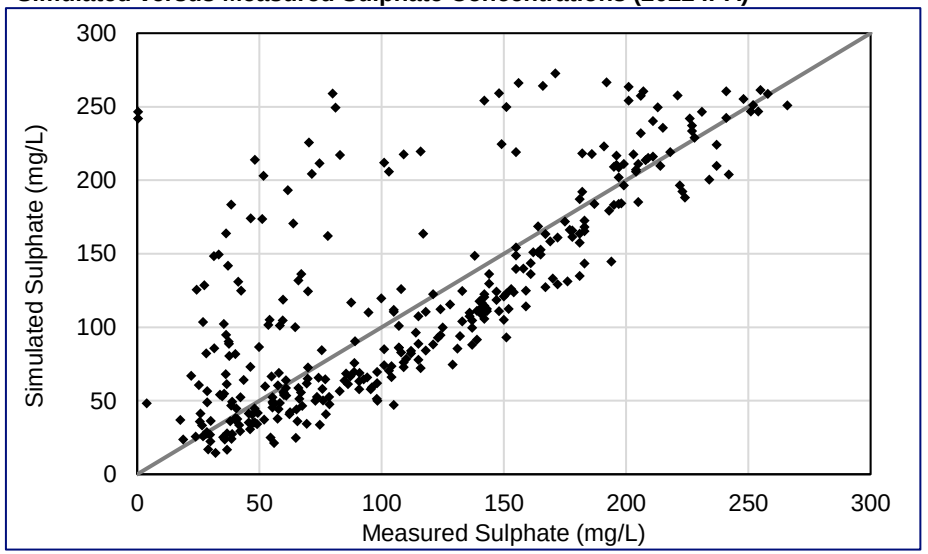
Model Calibration Results for Sulphate

C1-1: Sulphate Calibration Information for Node FR_HC1 - Henretta Creek u/s of Fording River (EMS E216778)

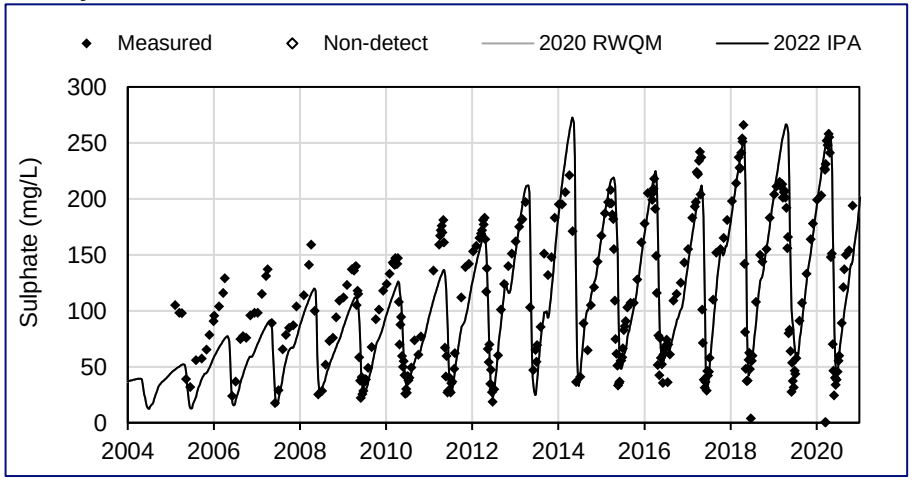
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/7/2005	2/7/2005
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	276	276
Non-Detect Count	0	0
Measured Mean (mg/L)	107	107
Simulated Mean (mg/L)	109	109
Bias (mg/L)	1.6	1.6
Relative Bias	1.0	1.0
Error (mg/L)	30	30
Percent Error	28%	28%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

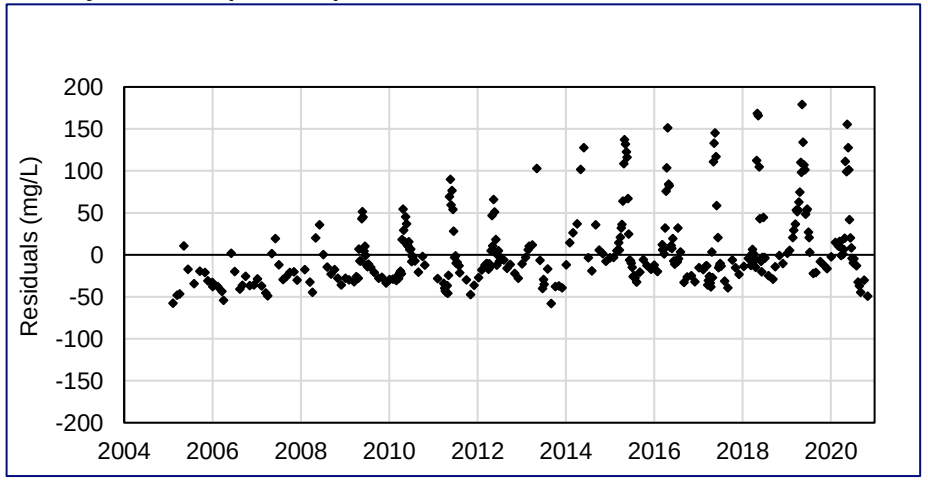


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



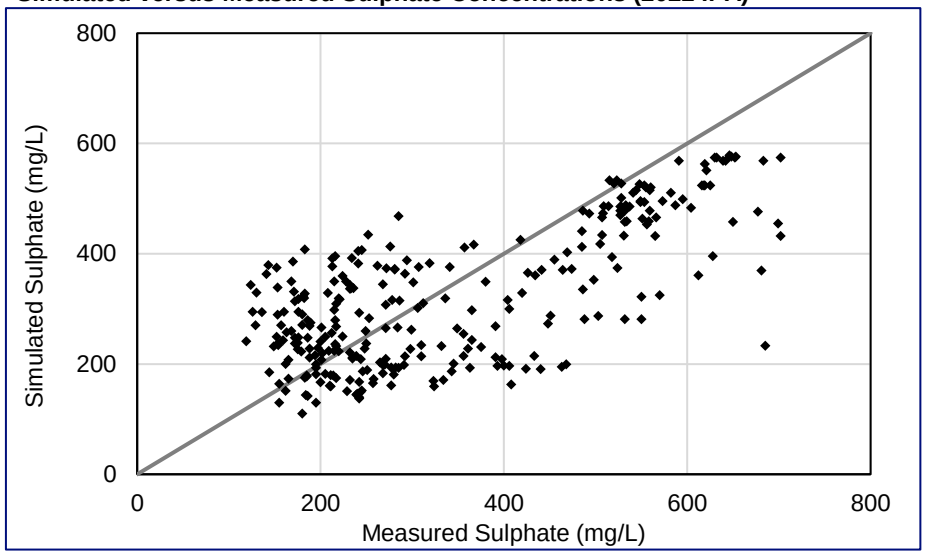
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-2: Sulphate Calibration Information for Node FR_CC1 - Clode Creek Sediment Pond Decant (EMS E102481)

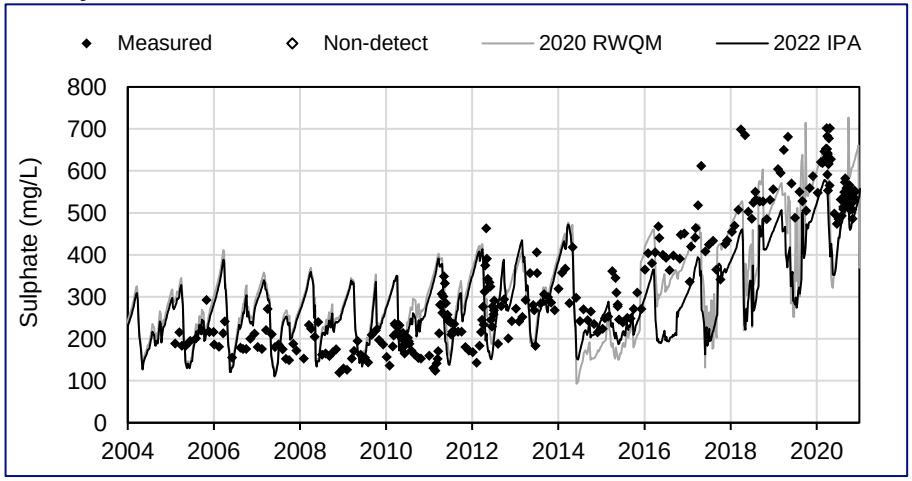
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/7/2005	2/7/2005
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	219	219
Non-Detect Count	0	0
Measured Mean (mg/L)	273	273
Simulated Mean (mg/L)	293	269
Bias (mg/L)	20	-3.9
Relative Bias	1.1	0.99
Error (mg/L)	91	97
Percent Error	34%	36%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

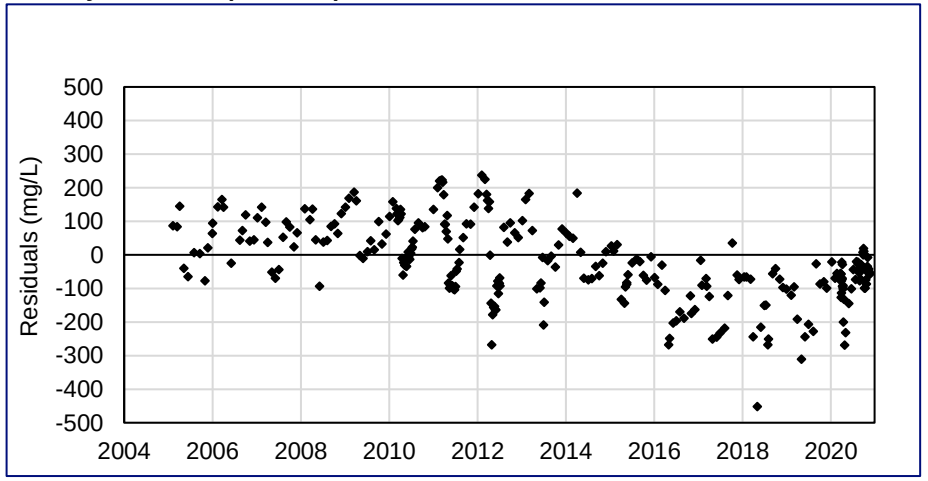


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



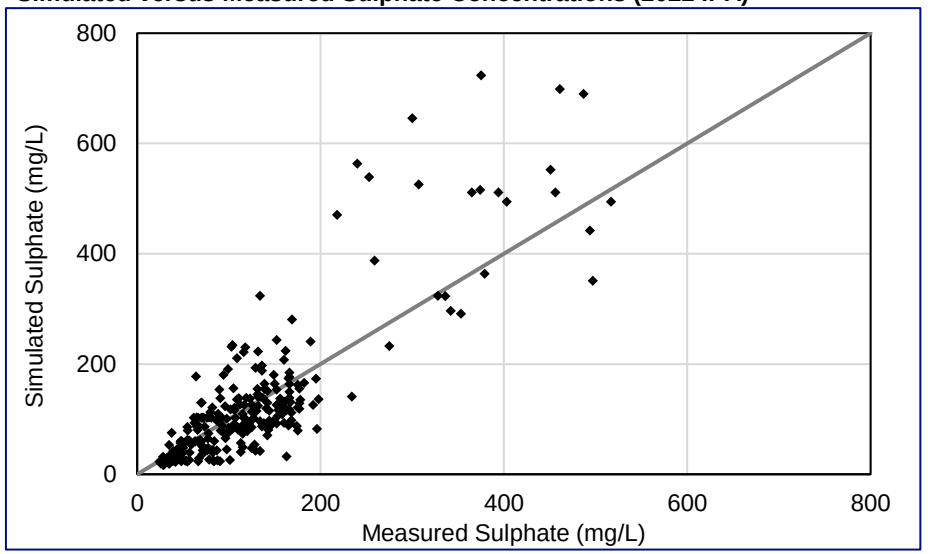
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-3: Sulphate Calibration Information for Node FR_LMP1 - Lake Mountain Pond

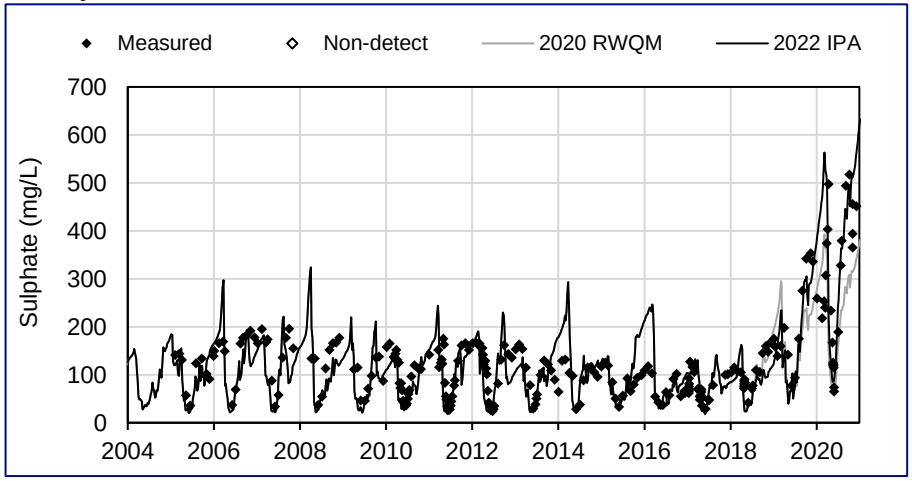
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/7/2005	2/7/2005
Last Measured Sample	12/10/2018	12/10/2018
Data Points Available for Comparison, n	227	227
Non-Detect Count	0	0
Measured Mean (mg/L)	98	98
Simulated Mean (mg/L)	92	91
Bias (mg/L)	-5.5	-6.3
Relative Bias	0.94	0.94
Error (mg/L)	32	32
Percent Error	32%	33%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

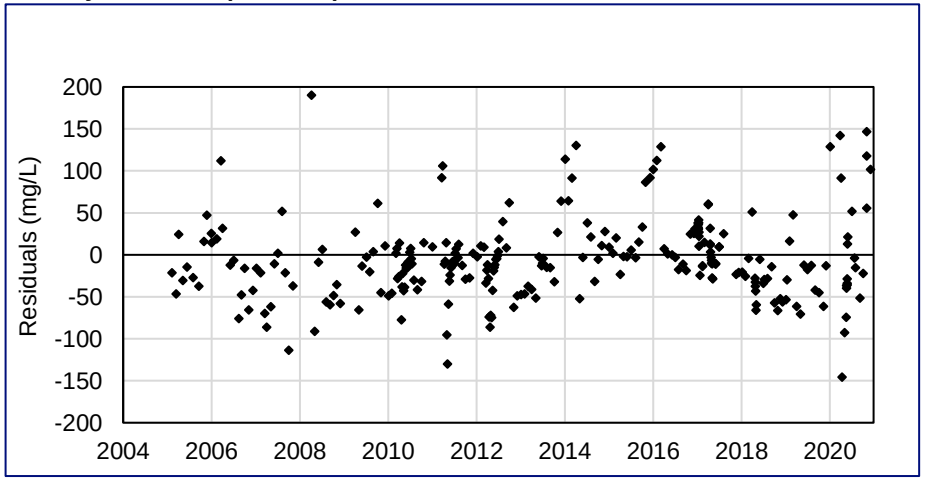


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



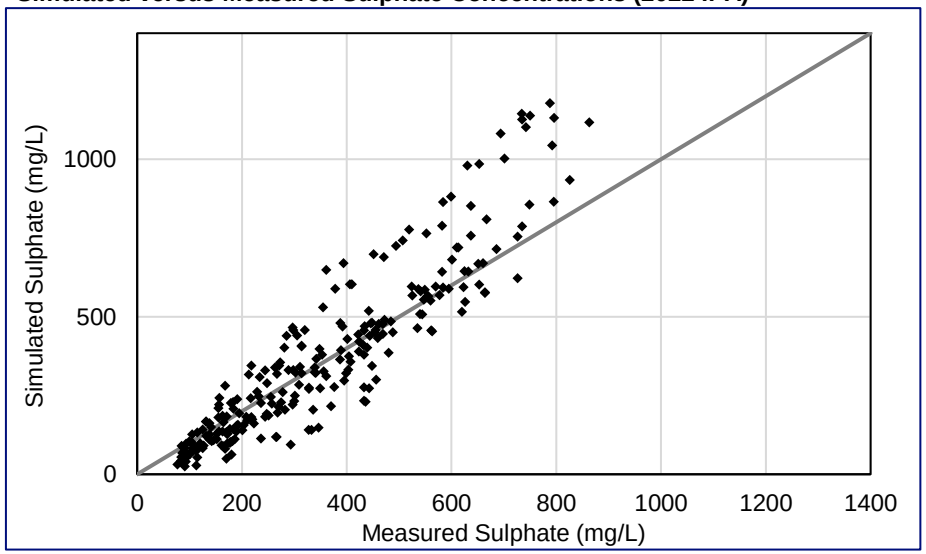
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-4: Sulphate Calibration Information for Node FR_KC1 - Kilmarnock Creek d/s of Rock Drain (EMS 0200252)

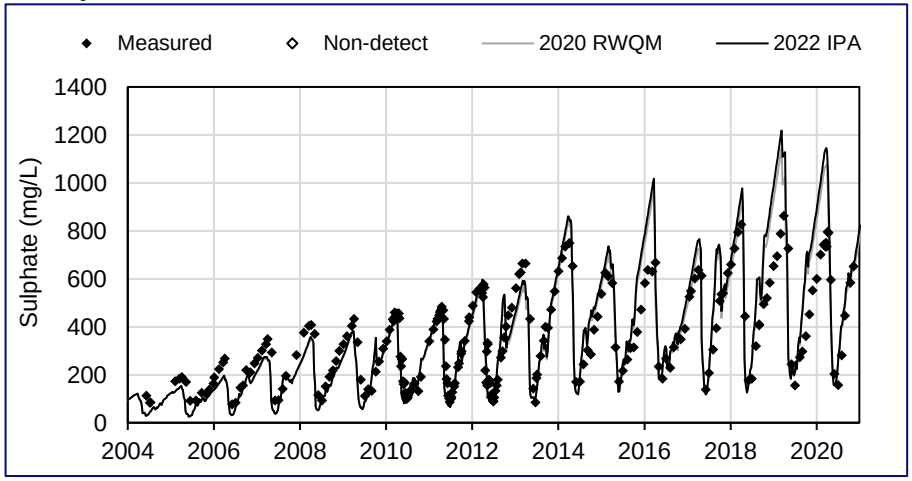
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	6/7/2004	6/7/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	231	231
Non-Detect Count	0	0
Measured Mean (mg/L)	322	322
Simulated Mean (mg/L)	308	319
Bias (mg/L)	-14	-2.8
Relative Bias	0.96	0.99
Error (mg/L)	61	65
Percent Error	19%	20%

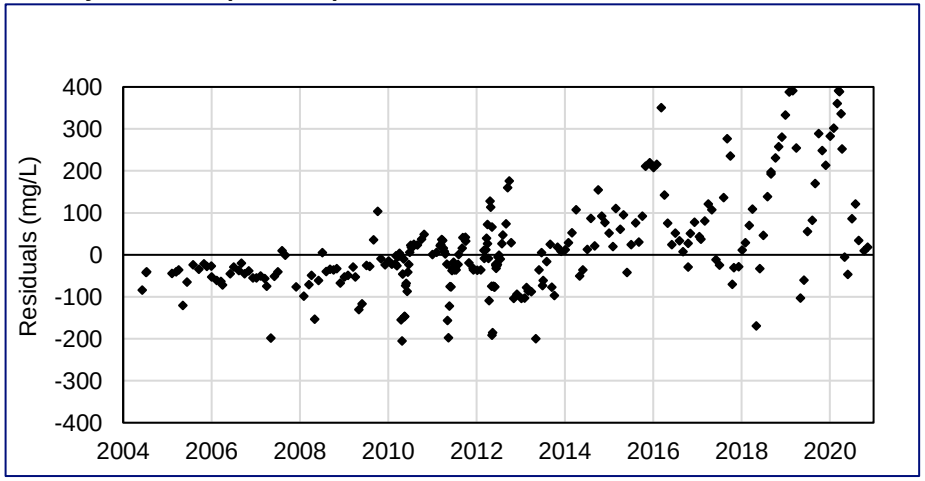
Simulated versus Measured Sulphate Concentrations (2022 IPA)



Weekly Simulated and Measured Concentrations



Weekly Residuals (2022 IPA)



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

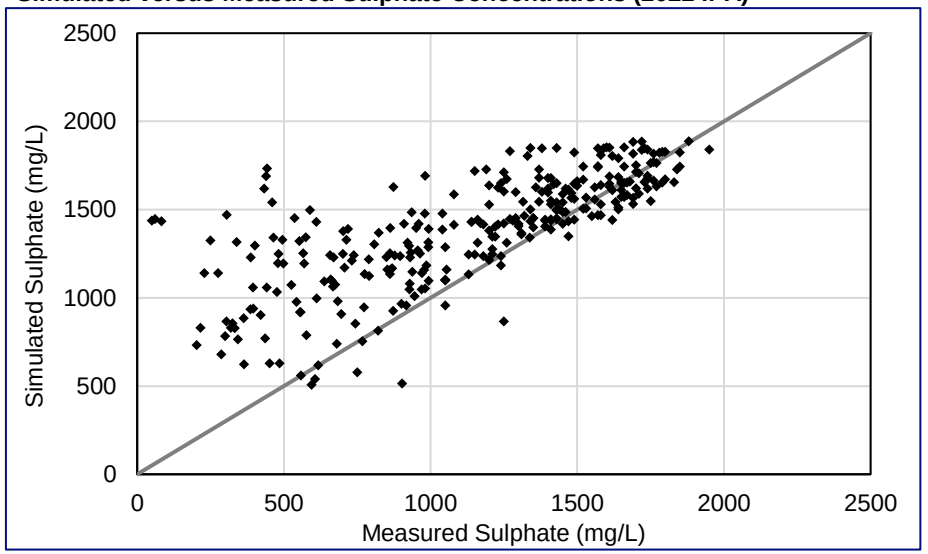
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-5: Sulphate Calibration Information for Node GH_SC1 - Swift Creek Sediment Pond Decant (EMS E221329)

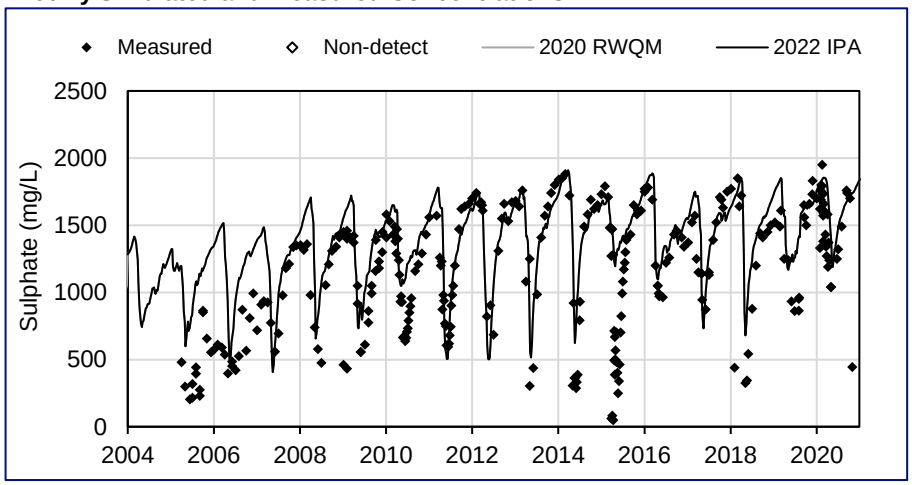
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/10/2018	12/10/2018
Data Points Available for Comparison, n	258	258
Non-Detect Count	0	0
Measured Mean (mg/L)	1083	1083
Simulated Mean (mg/L)	1337	1337
Bias (mg/L)	254	254
Relative Bias	1.2	1.2
Error (mg/L)	287	287
Percent Error	27%	27%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

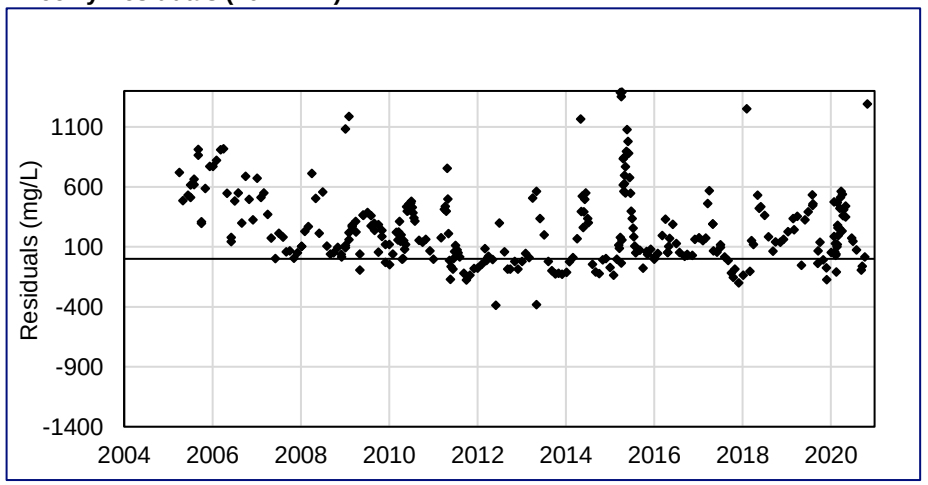


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



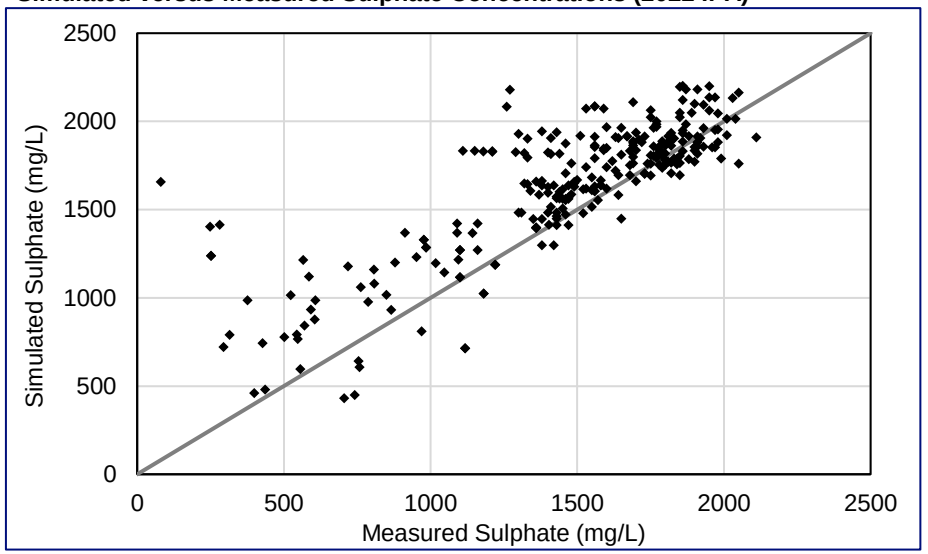
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-6: Sulphate Calibration Information for Node GH_CC1 - Cataract Creek Sediment Pond Decant (EMS 0200384)

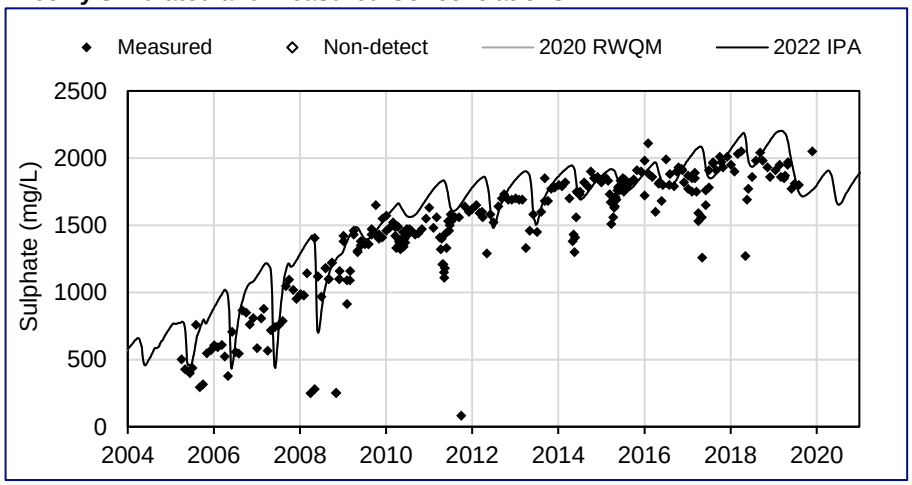
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	260	260
Non-Detect Count	0	0
Measured Mean (mg/L)	1440	1440
Simulated Mean (mg/L)	1611	1611
Bias (mg/L)	170	170
Relative Bias	1.1	1.1
Error (mg/L)	210	210
Percent Error	15%	15%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

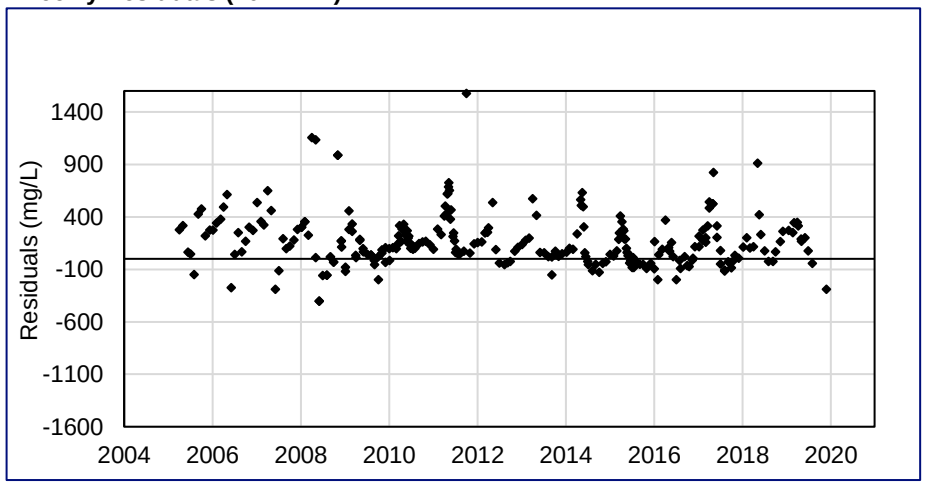


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



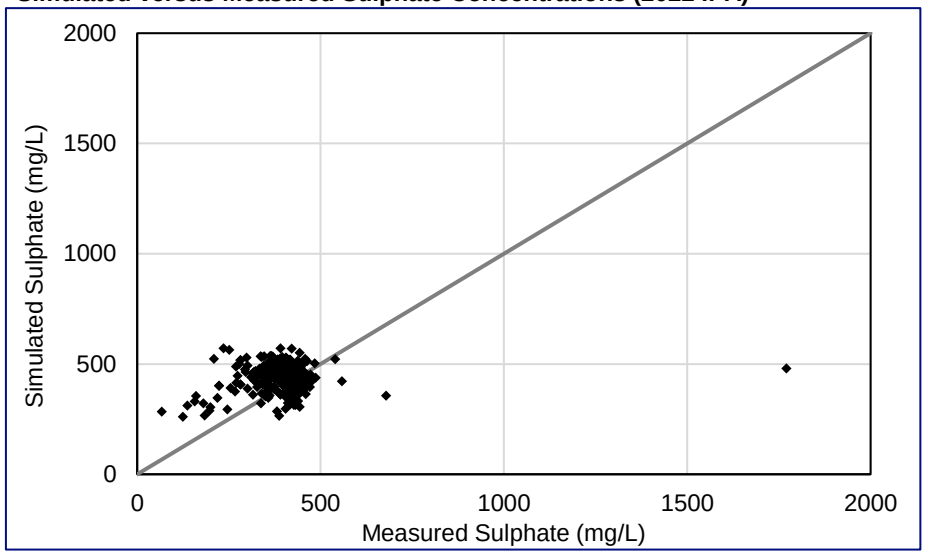
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-7: Sulphate Calibration Information for Node GH_PC1 - Porter Creek Sediment Pond Decant (EMS 0200385)

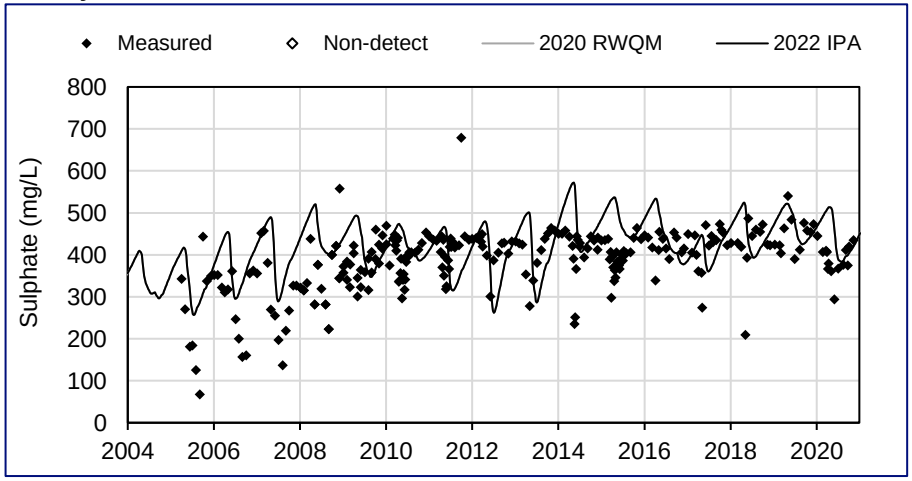
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	246	246
Non-Detect Count	0	0
Measured Mean (mg/L)	389	389
Simulated Mean (mg/L)	432	432
Bias (mg/L)	43	43
Relative Bias	1.1	1.1
Error (mg/L)	84	84
Percent Error	22%	22%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

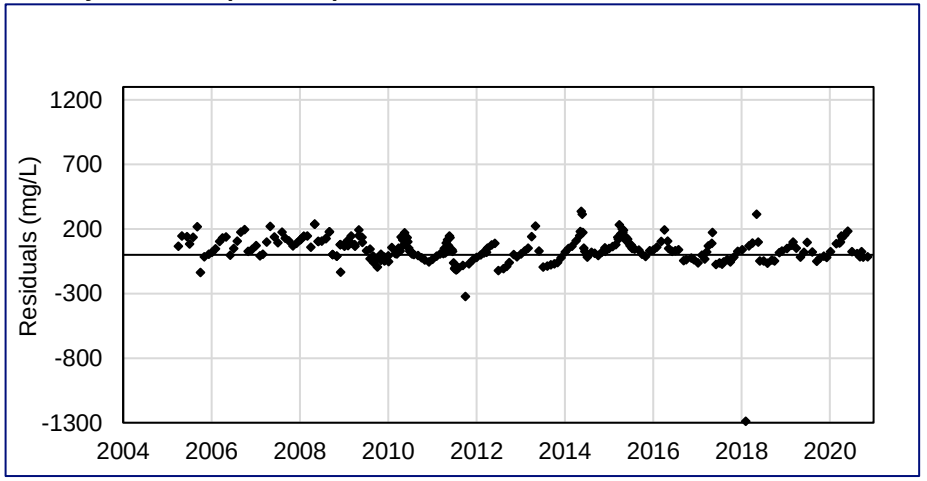


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



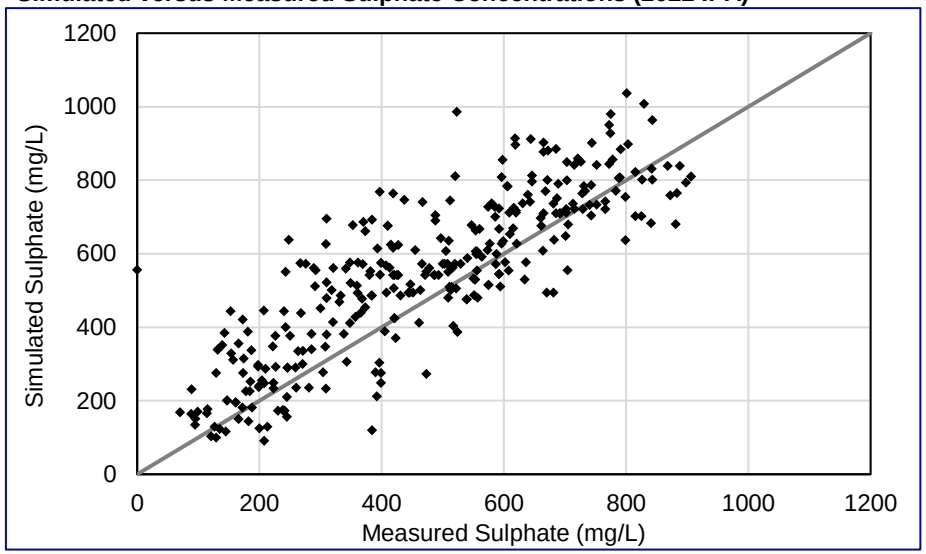
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-8: Sulphate Calibration Information for Node GH_GH1 - Greenhills Creek Sediment Pond Decant (EMS E102709)

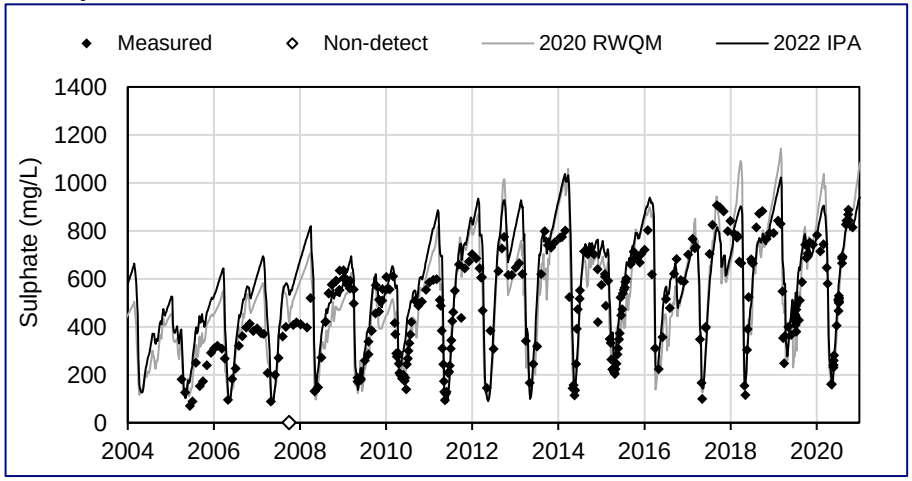
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	253	253
Non-Detect Count	1	1
Measured Mean (mg/L)	449	449
Simulated Mean (mg/L)	470	529
Bias (mg/L)	21	80
Relative Bias	1.0	1.2
Error (mg/L)	96	120
Percent Error	21%	27%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

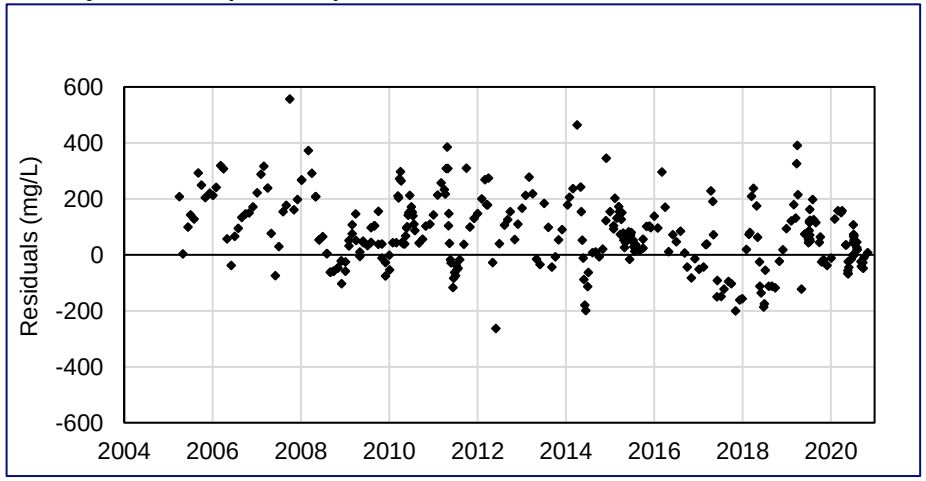


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



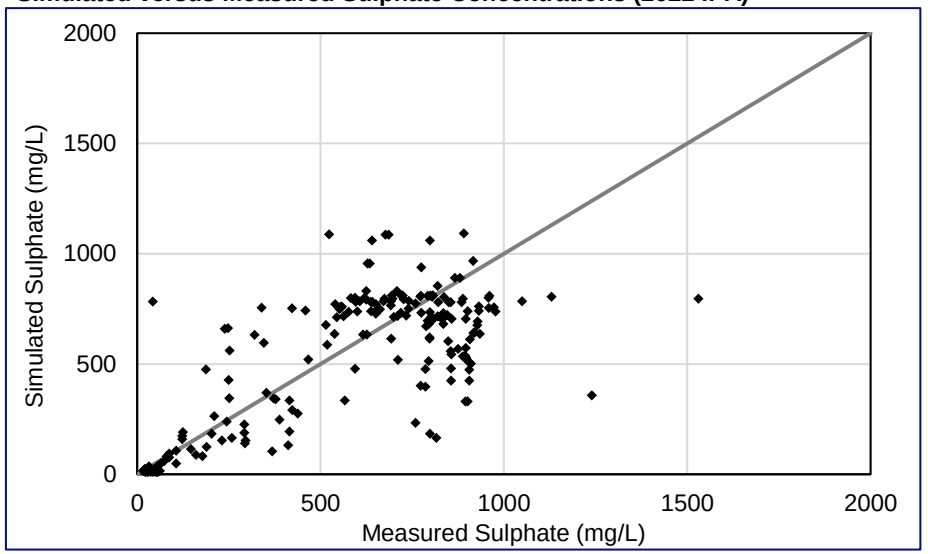
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-9: Sulphate Calibration Information for Node GH_LC1 - Leask Creek Sediment Pond Decant (EMS E257796)

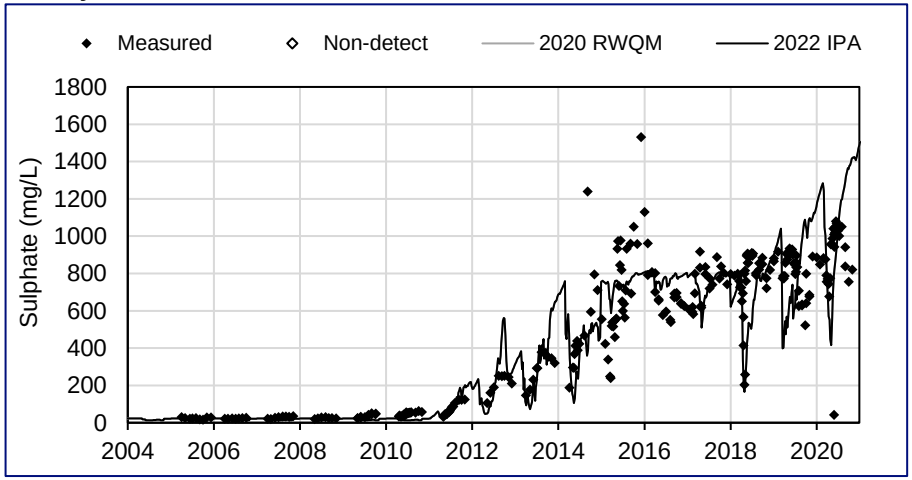
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	213	213
Non-Detect Count	0	0
Measured Mean (mg/L)	426	426
Simulated Mean (mg/L)	390	390
Bias (mg/L)	-36	-36
Relative Bias	0.91	0.92
Error (mg/L)	117	117
Percent Error	28%	28%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

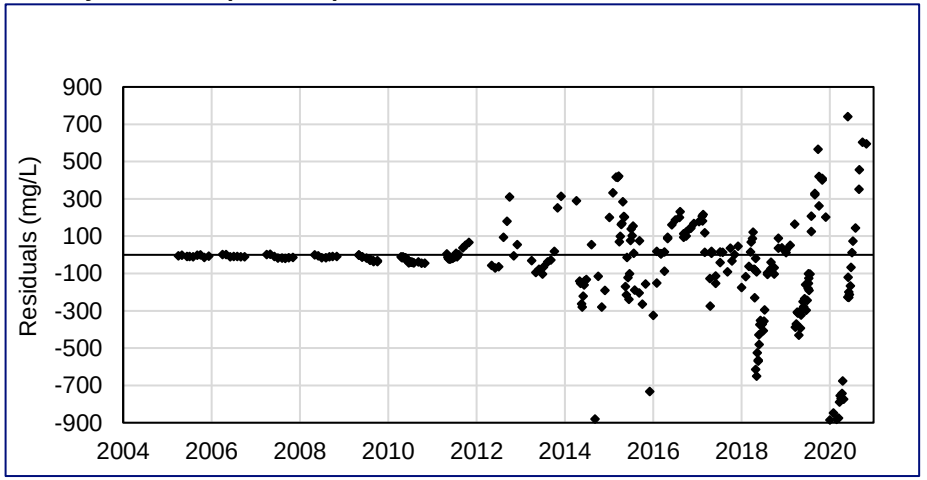


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



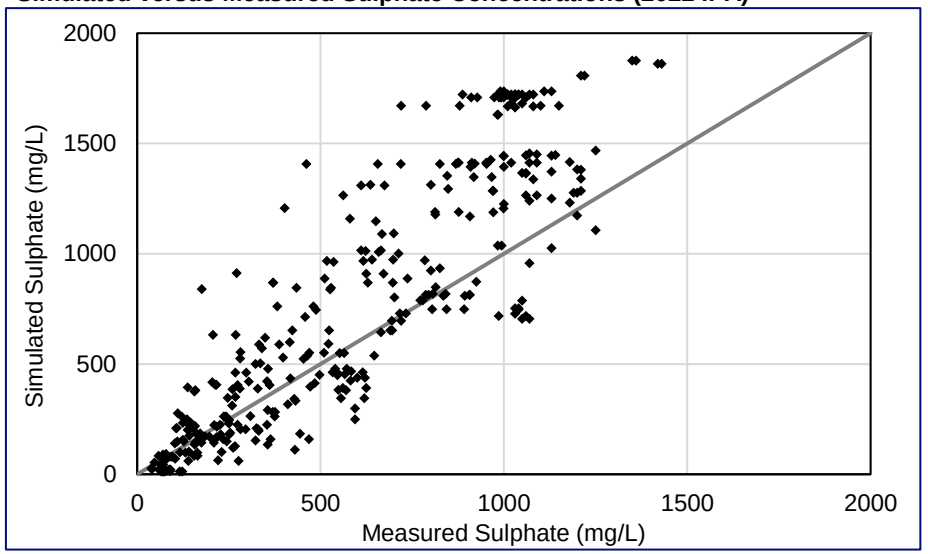
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-10: Sulphate Calibration Information for Node GH_WC1 - Wolfram Creek Sediment Pond Decant (EMS E257795)

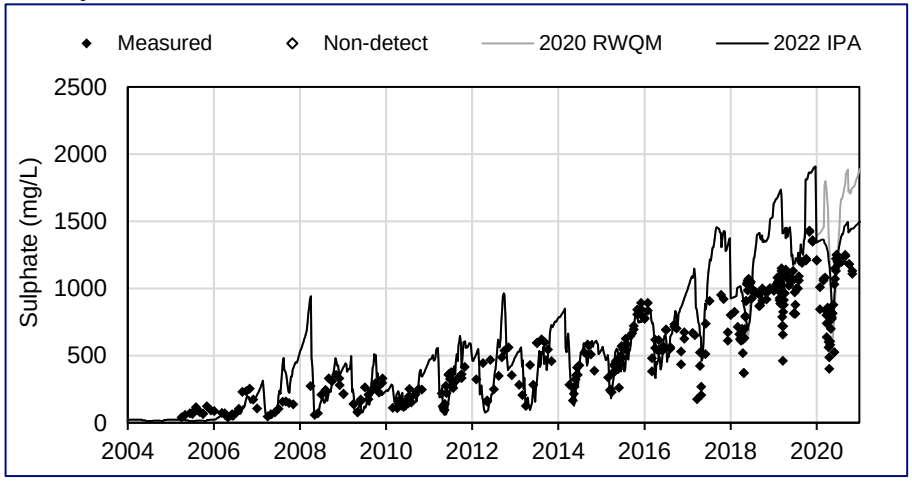
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	248	248
Non-Detect Count	0	0
Measured Mean (mg/L)	431	431
Simulated Mean (mg/L)	484	485
Bias (mg/L)	53	53
Relative Bias	1.1	1.1
Error (mg/L)	157	156
Percent Error	36%	36%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

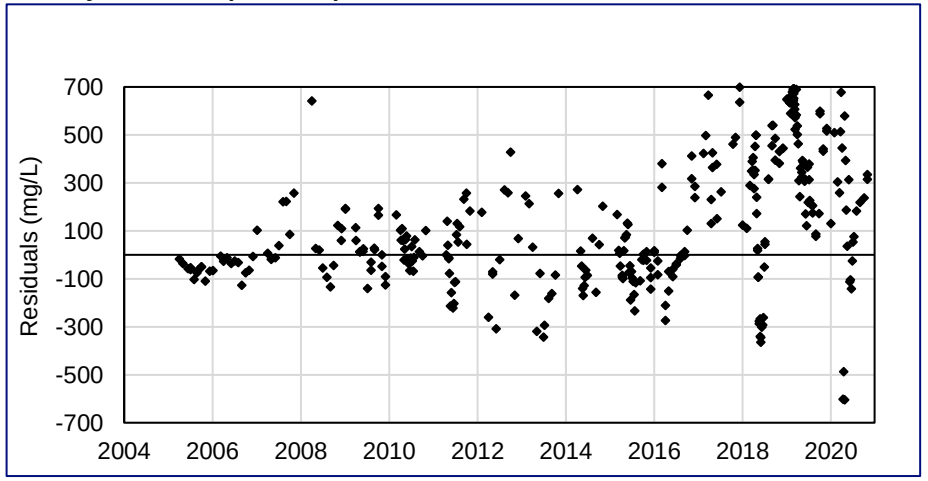


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



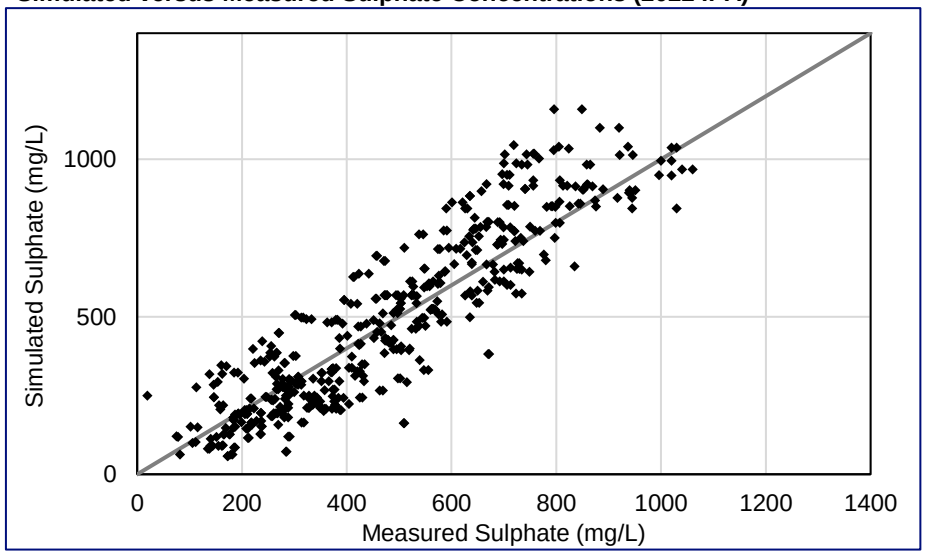
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-11: Sulphate Calibration Information for Node GH_TC1 - Thompson Creek at LRP Road (EMS E102714)

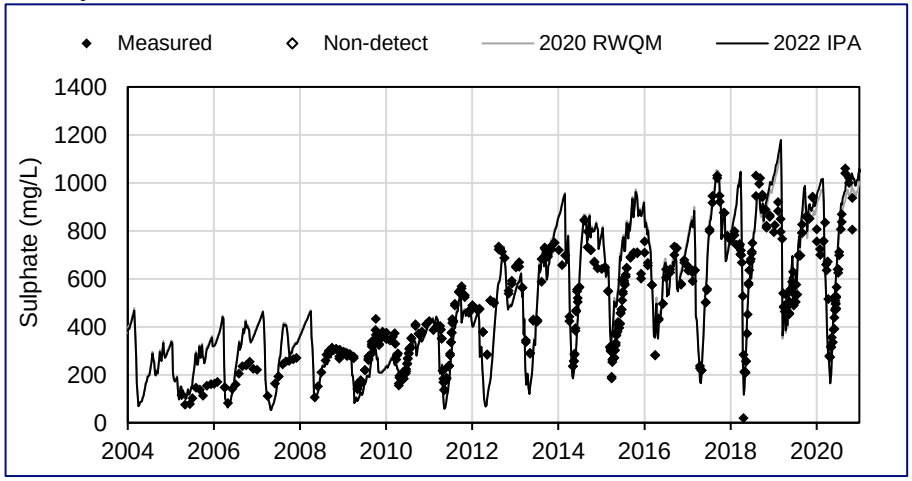
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	404	404
Non-Detect Count	0	0
Measured Mean (mg/L)	438	438
Simulated Mean (mg/L)	450	443
Bias (mg/L)	11	4.9
Relative Bias	1.0	1.0
Error (mg/L)	93	92
Percent Error	21%	21%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

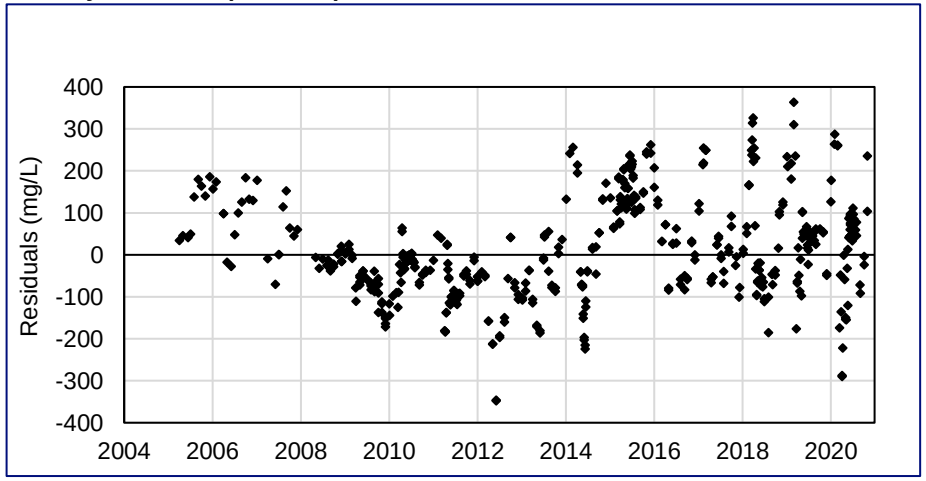


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



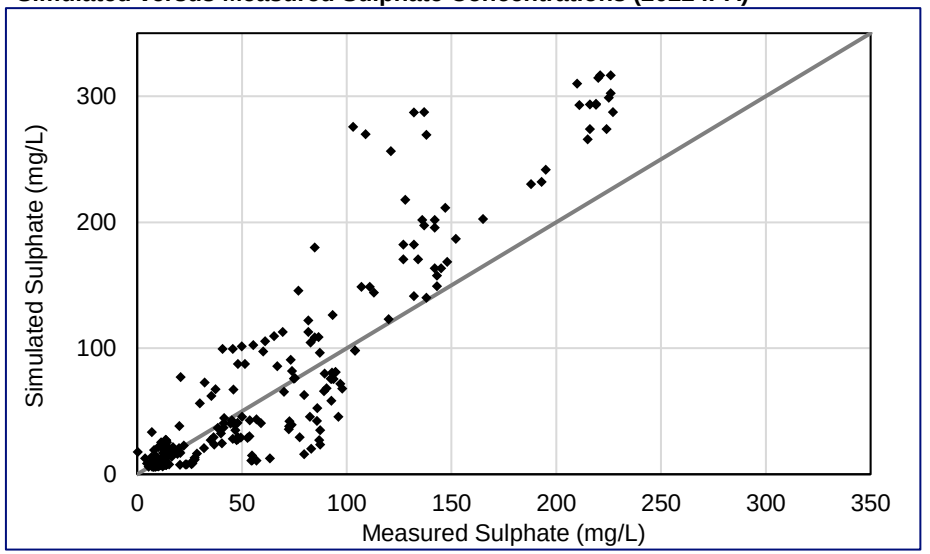
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-12: Sulphate Calibration Information for Node LC_DC3 - Dry Creek u/s of East Tributary (EMS E288273)

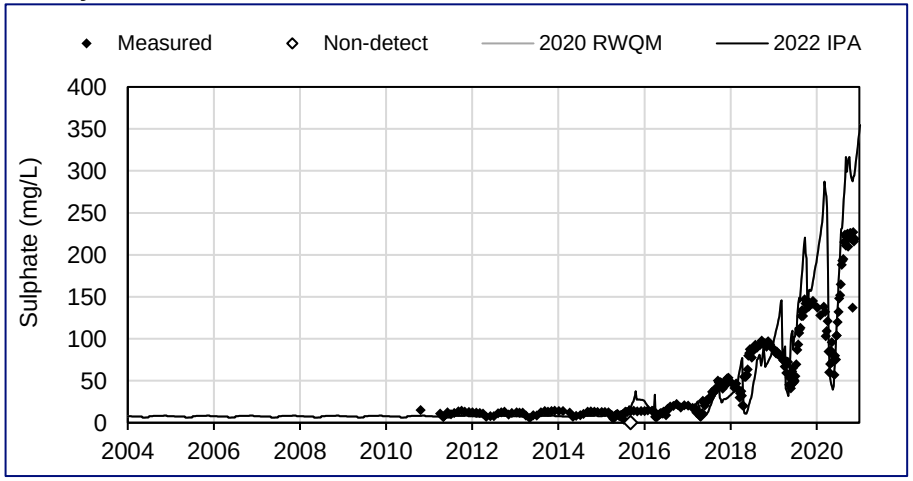
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	10/21/2010	10/21/2010
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	178	178
Non-Detect Count	1	1
Measured Mean (mg/L)	27	27
Simulated Mean (mg/L)	21	21
Bias (mg/L)	-5.9	-5.9
Relative Bias	0.78	0.78
Error (mg/L)	11	11
Percent Error	40%	40%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

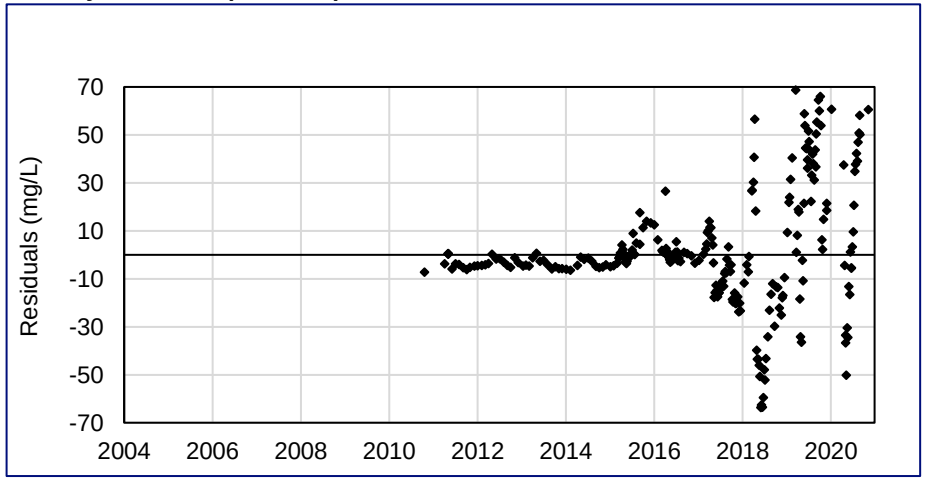


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



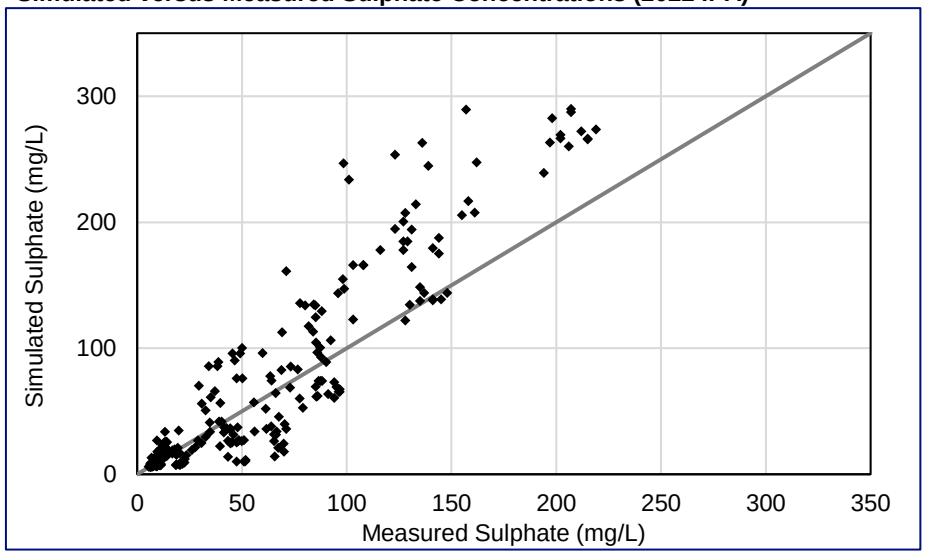
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-13: Sulphate Calibration Information for Node LC_DCDS - Dry Creek d/s of Sedimentation Ponds (EMS E295210)

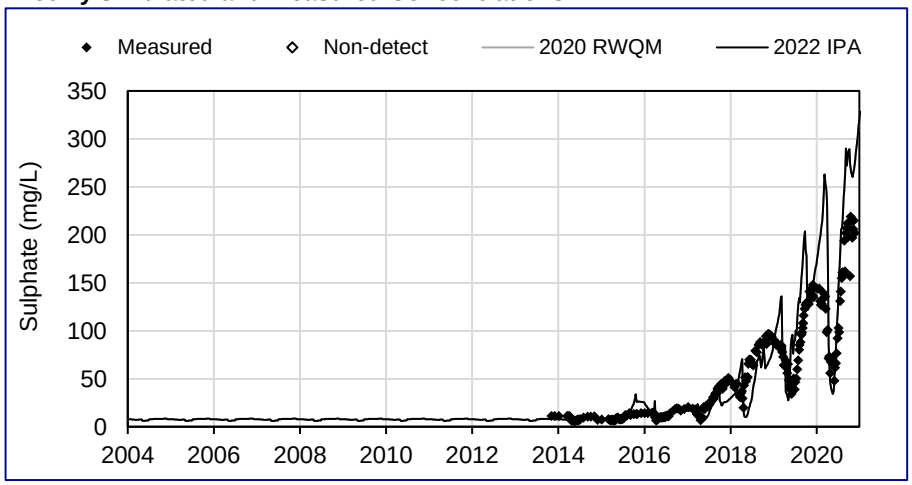
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	11/6/2013	11/6/2013
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	162	162
Non-Detect Count	0	0
Measured Mean (mg/L)	27	27
Simulated Mean (mg/L)	22	22
Bias (mg/L)	-5.5	-5.5
Relative Bias	0.8	0.8
Error (mg/L)	10	10
Percent Error	37%	37%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

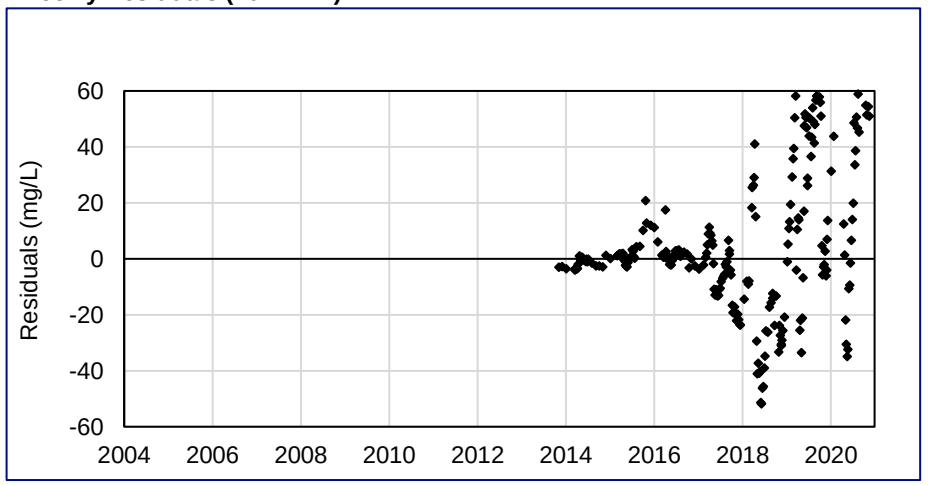


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



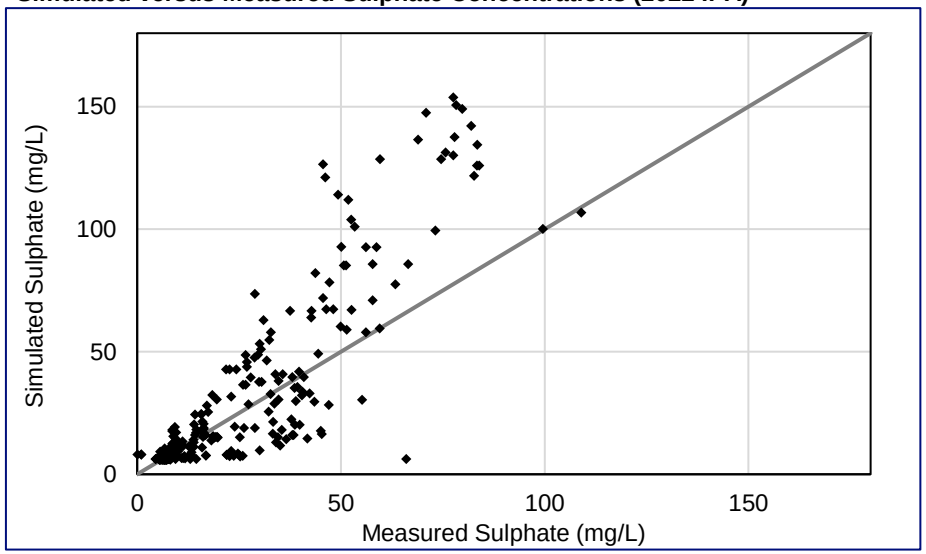
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-14: Sulphate Calibration Information for Node LC_DC1 - Dry Creek near mouth (at bridge) (EMS E288270)

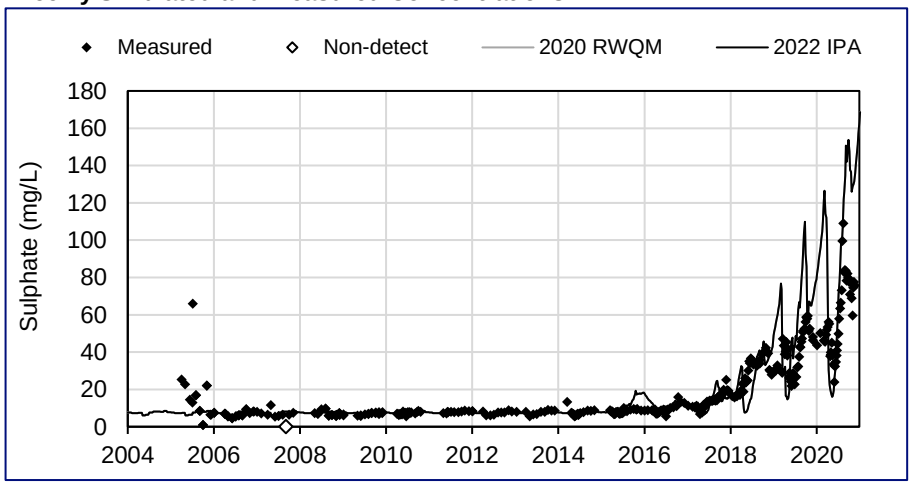
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/18/2018	12/18/2018
Data Points Available for Comparison, n	278	278
Non-Detect Count	1	1
Measured Mean (mg/L)	12	12
Simulated Mean (mg/L)	11	11
Bias (mg/L)	-0.71	-0.71
Relative Bias	0.94	0.94
Error (mg/L)	3.3	3.3
Percent Error	28%	28%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

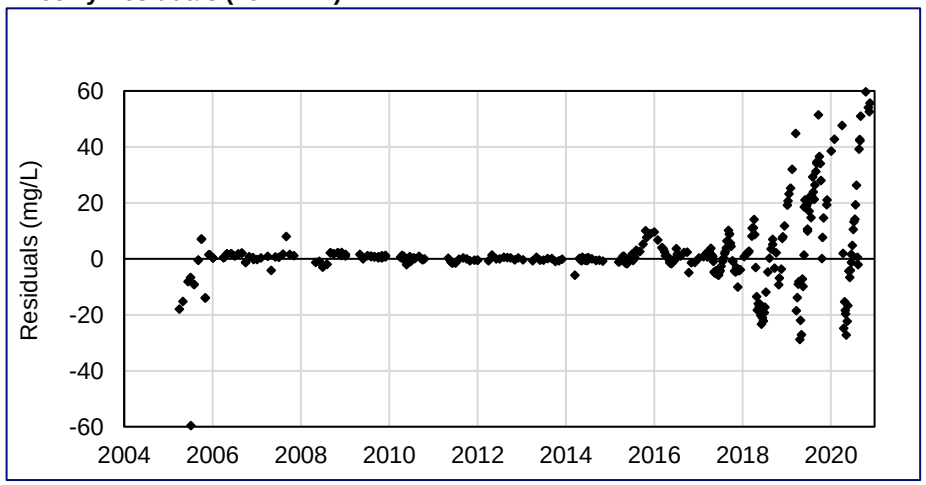


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



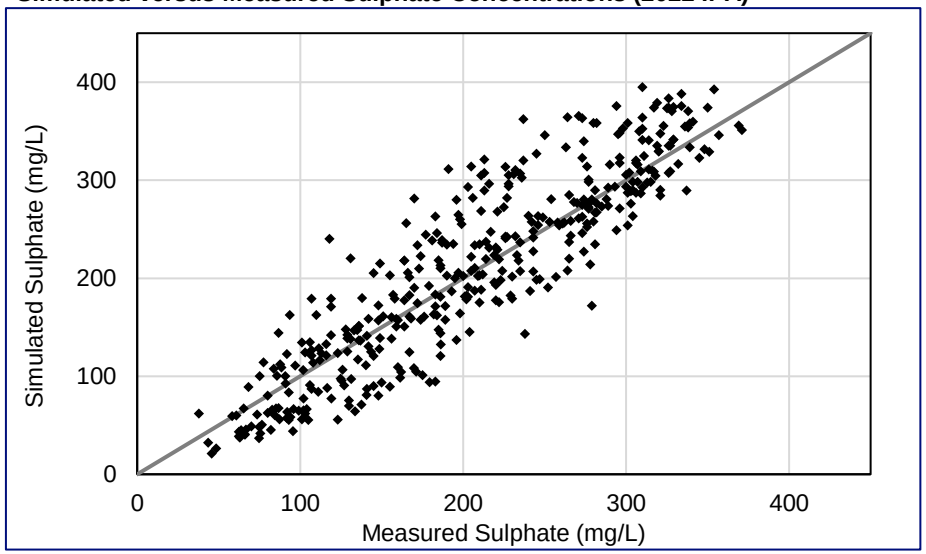
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-15: Sulphate Calibration Information for Node LC_LCUSWLC - Line Creek u/s of West Line Creek (EMS E293369)

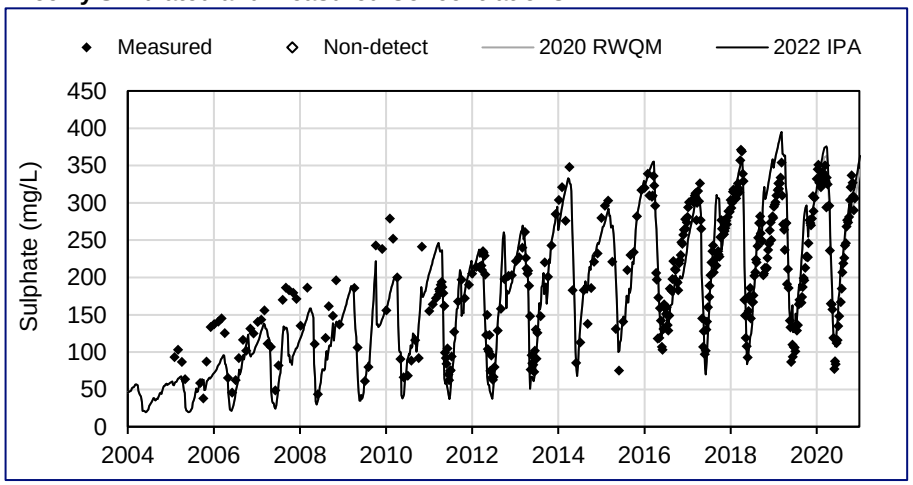
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	304	304
Non-Detect Count	0	0
Measured Mean (mg/L)	194	194
Simulated Mean (mg/L)	190	190
Bias (mg/L)	-3.7	-3.7
Relative Bias	0.98	0.98
Error (mg/L)	31	31
Percent Error	16%	16%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

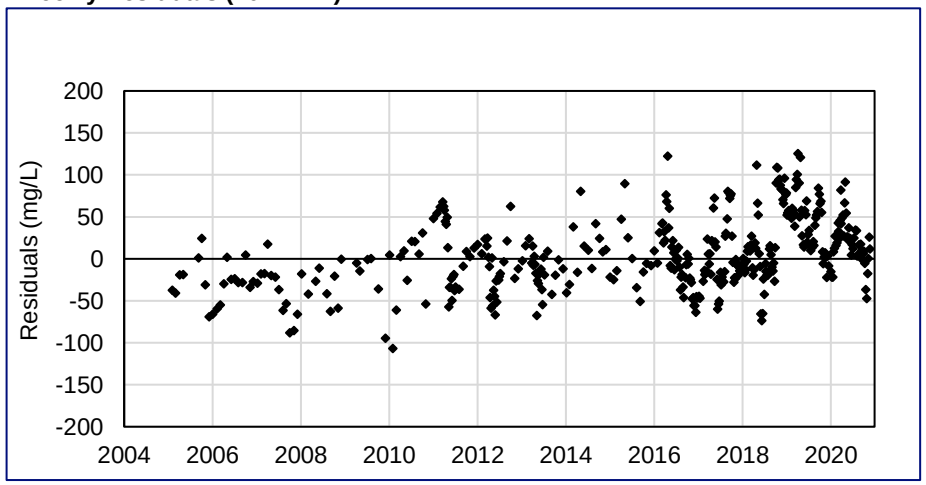


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



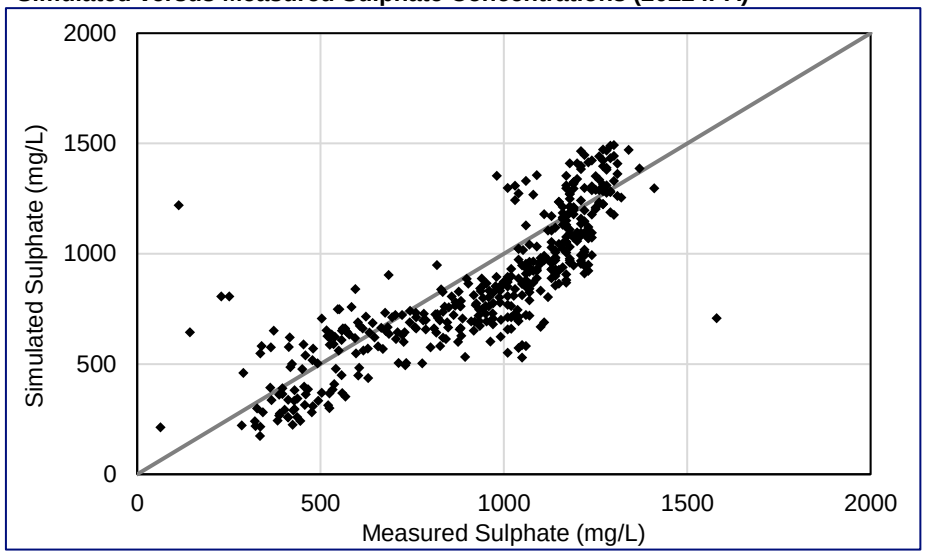
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-16: Sulphate Calibration Information for Node LC_WLC - West Line Creek (EMS E261958)

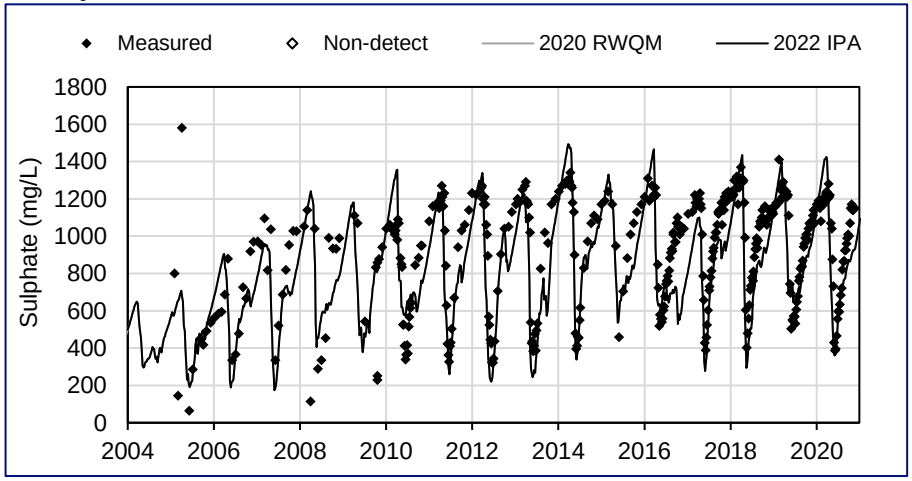
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	333	333
Non-Detect Count	0	0
Measured Mean (mg/L)	914	914
Simulated Mean (mg/L)	833	833
Bias (mg/L)	-81	-81
Relative Bias	0.91	0.91
Error (mg/L)	158	158
Percent Error	17%	17%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

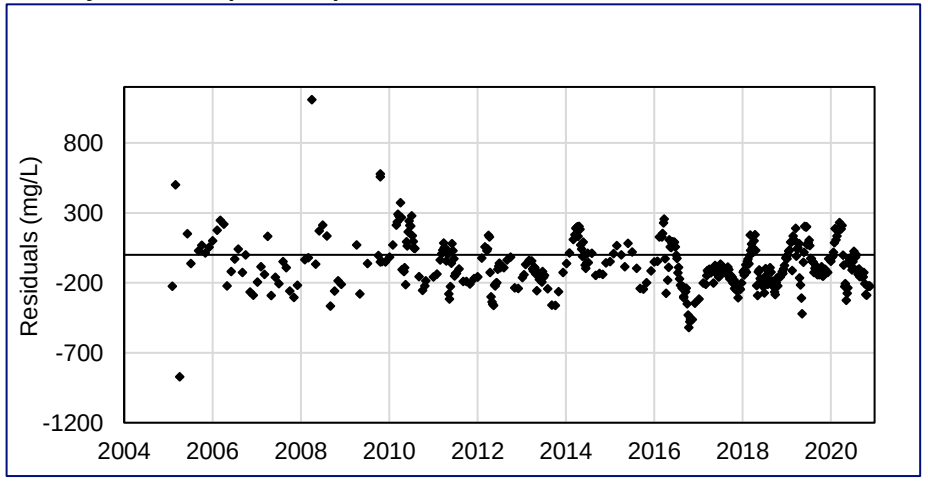


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



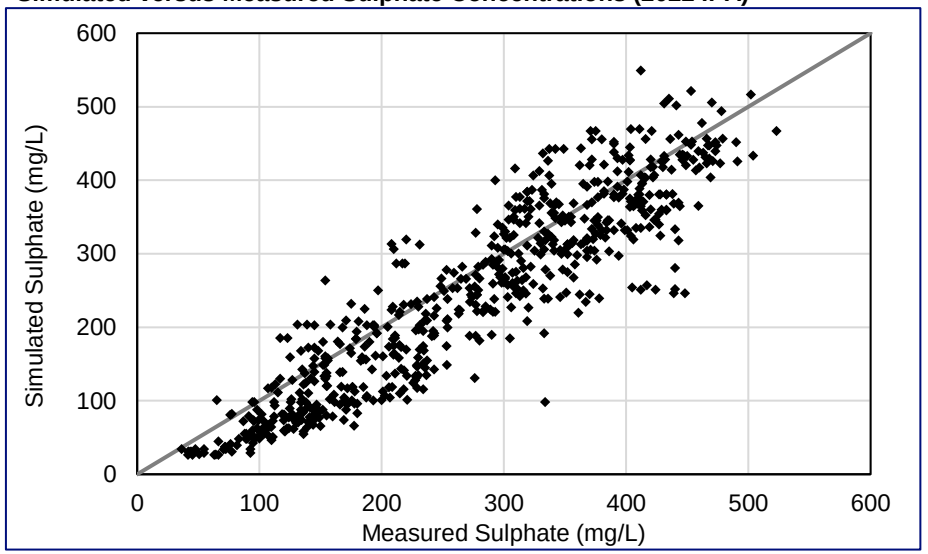
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-17: Sulphate Calibration Information for Node LC_LC3 - Line Creek d/s of West Line Creek (EMS 0200337)

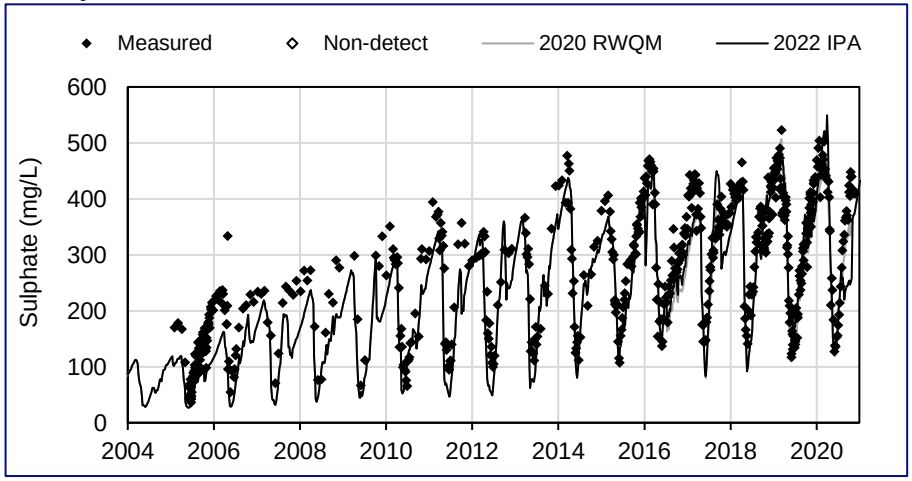
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	495	495
Non-Detect Count	0	0
Measured Mean (mg/L)	253	253
Simulated Mean (mg/L)	219	222
Bias (mg/L)	-34	-31
Relative Bias	0.87	0.88
Error (mg/L)	47	47
Percent Error	18%	19%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

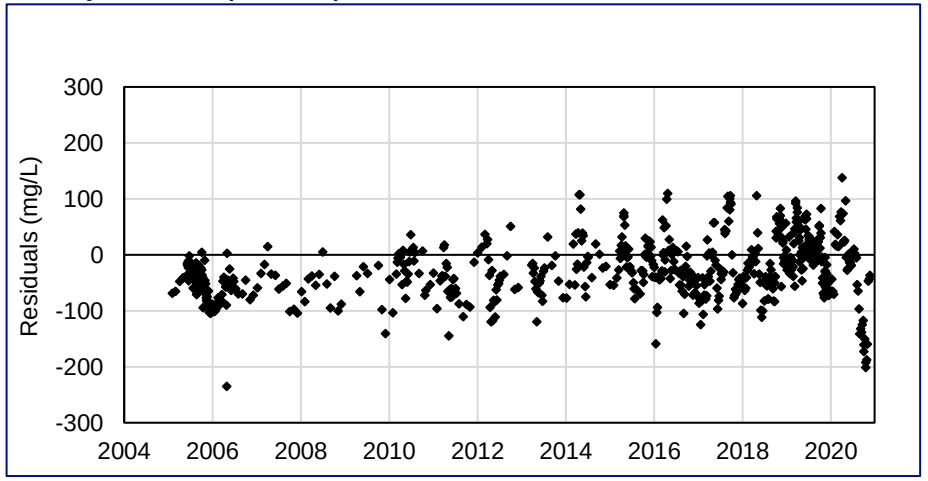


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



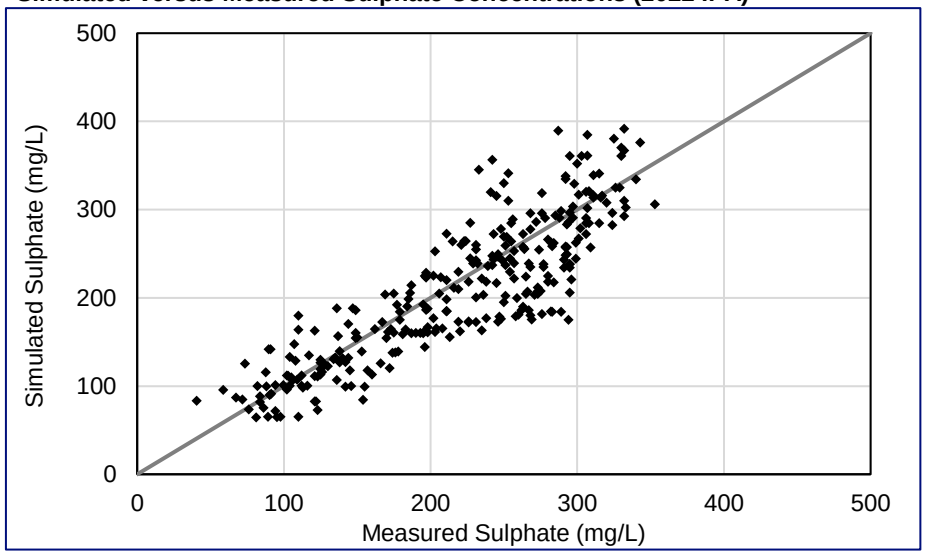
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-18: Sulphate Calibration Information for Node LC_LCDSSLCC - LCO Compliance Point - Line Creek d/s of South Line Creek Confluence (EMS E297110)

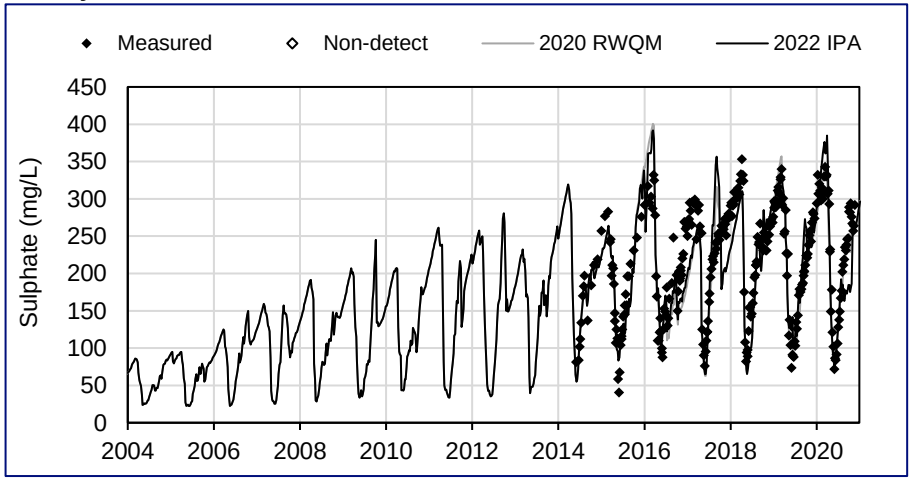
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	6/4/2014	6/4/2014
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	196	196
Non-Detect Count	0	0
Measured Mean (mg/L)	212	212
Simulated Mean (mg/L)	195	200
Bias (mg/L)	-17	-12
Relative Bias	0.92	0.94
Error (mg/L)	35	34
Percent Error	17%	16%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

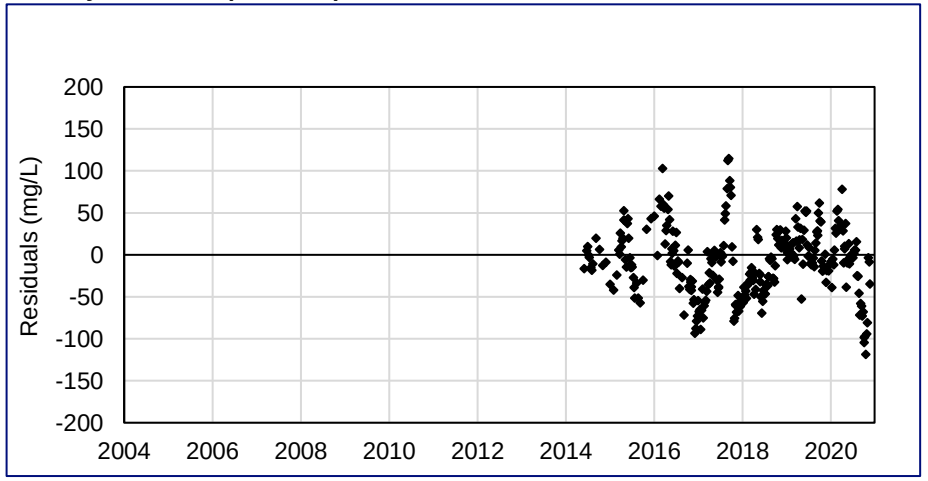


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



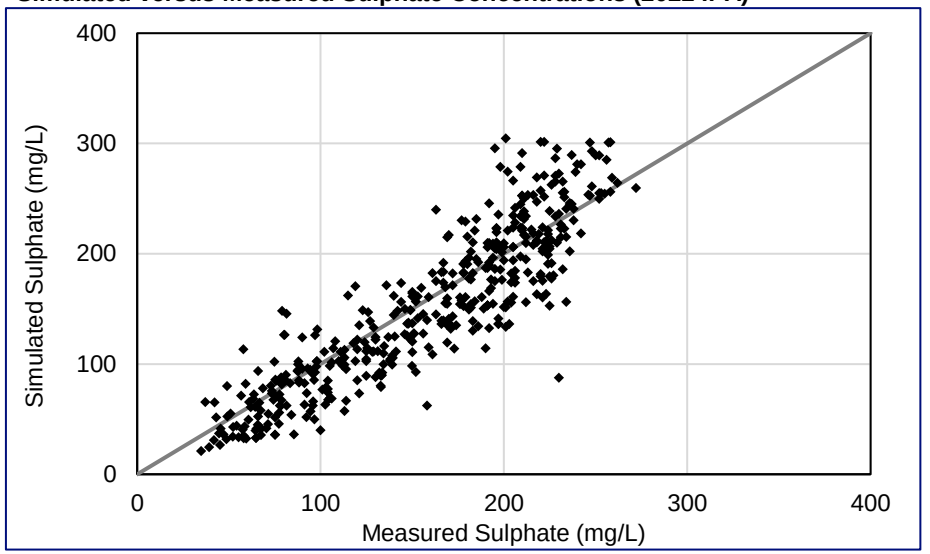
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-19: Sulphate Calibration Information for Node LC_LC4 - Line Creek u/s of Process Plant (EMS 0200044)

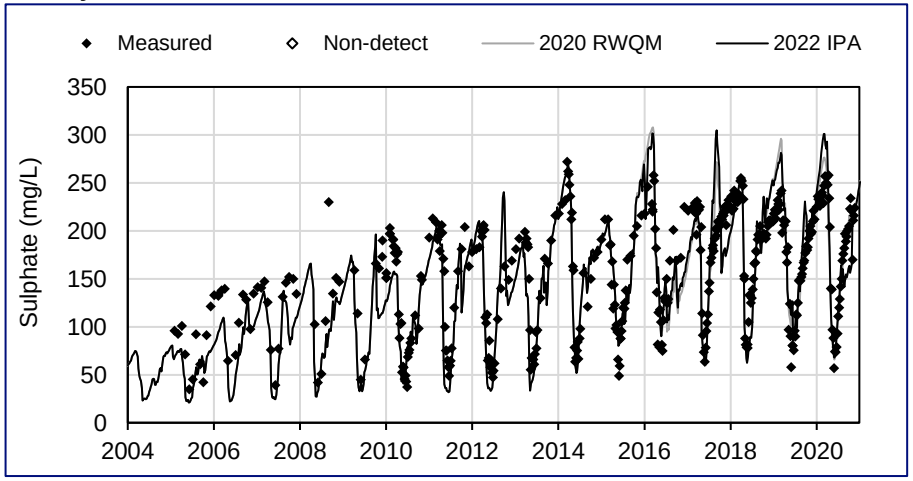
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/27/2018	12/27/2018
Data Points Available for Comparison, n	347	347
Non-Detect Count	0	0
Measured Mean (mg/L)	151	151
Simulated Mean (mg/L)	140	142
Bias (mg/L)	-11	-9.0
Relative Bias	0.93	0.94
Error (mg/L)	24	25
Percent Error	16%	16%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

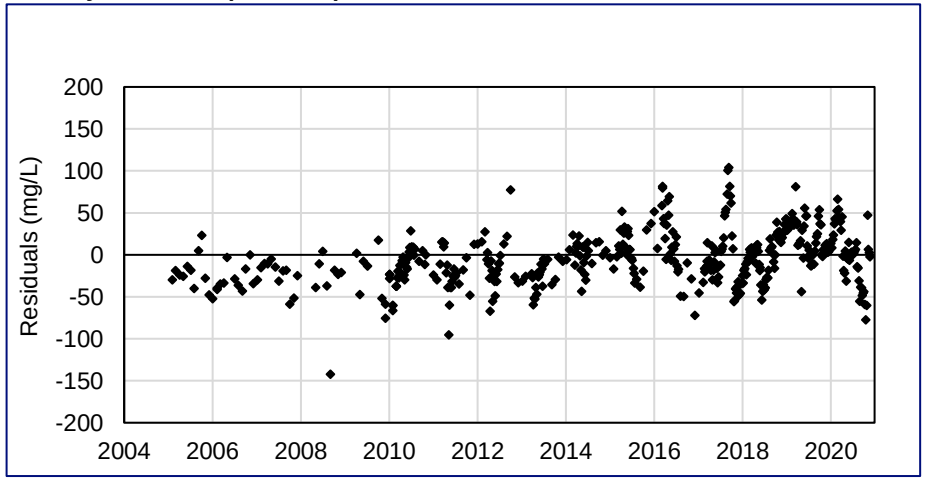


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



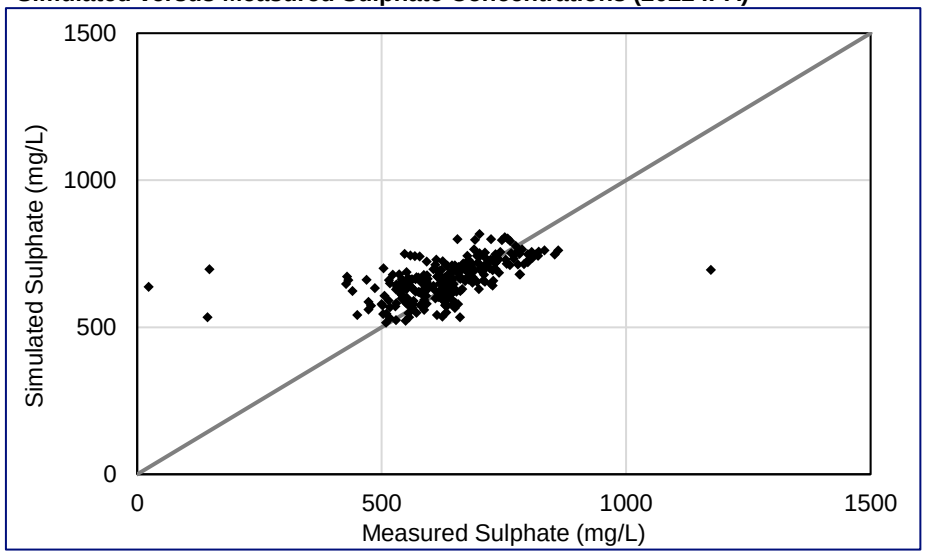
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-20: Sulphate Calibration Information for Node EV_EC1 - Erickson Creek at Mouth (EMS 0200097)

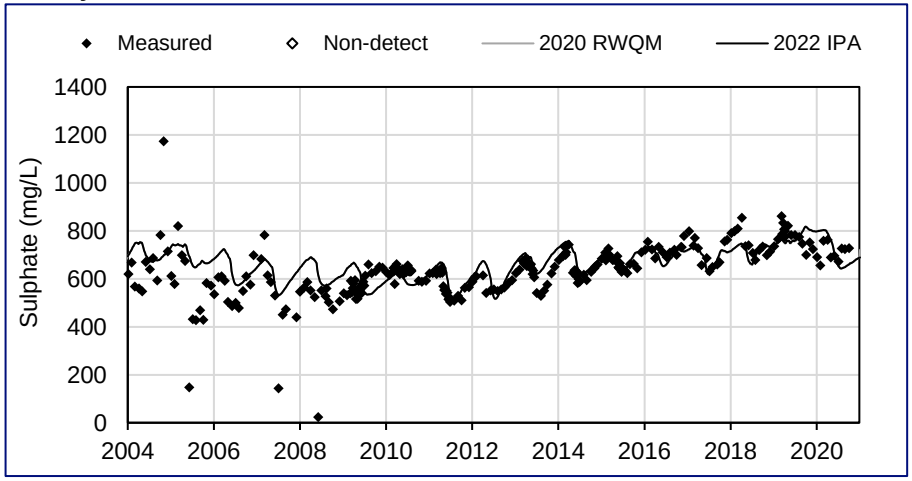
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	252	252
Non-Detect Count	0	0
Measured Mean (mg/L)	620	620
Simulated Mean (mg/L)	653	654
Bias (mg/L)	33	33
Relative Bias	1.1	1.1
Error (mg/L)	62	62
Percent Error	10%	10%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

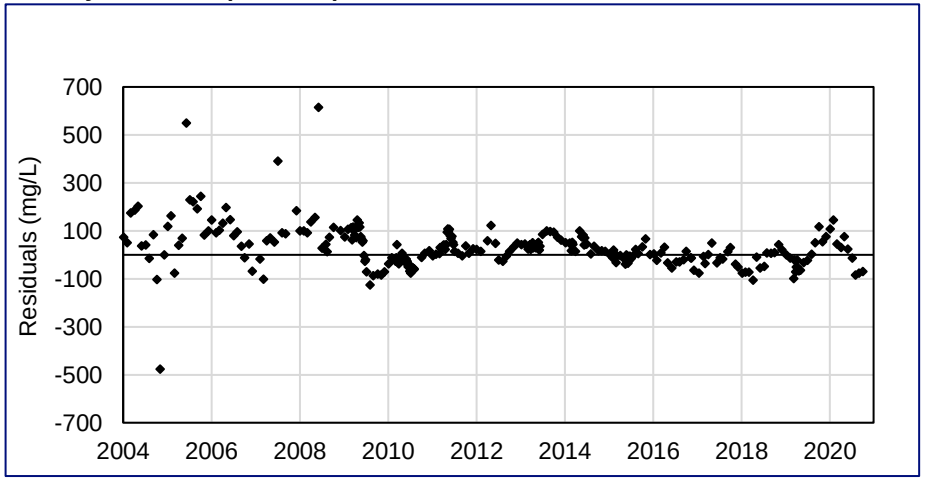


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



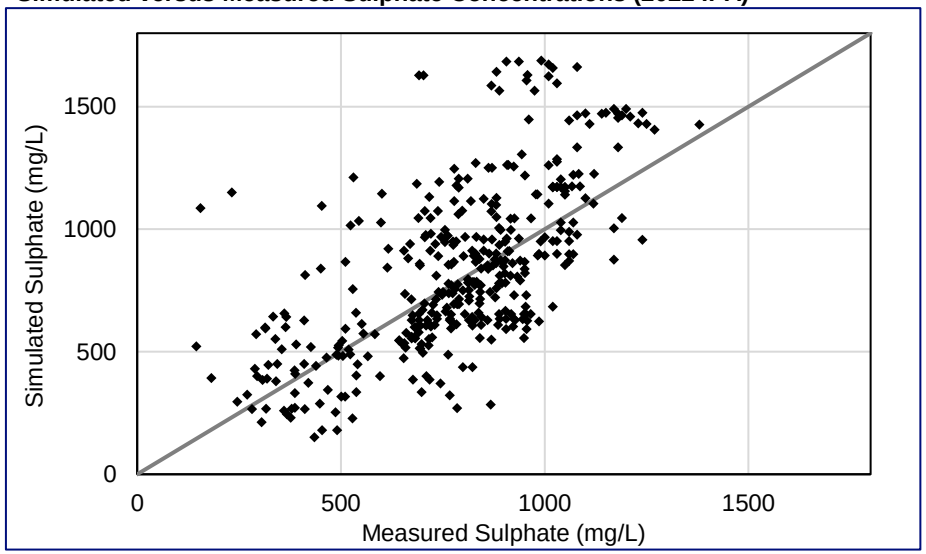
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-21: Sulphate Calibration Information for Node EV_GT1 - Gate Creek Sediment Pond Decant (EMS E206231)

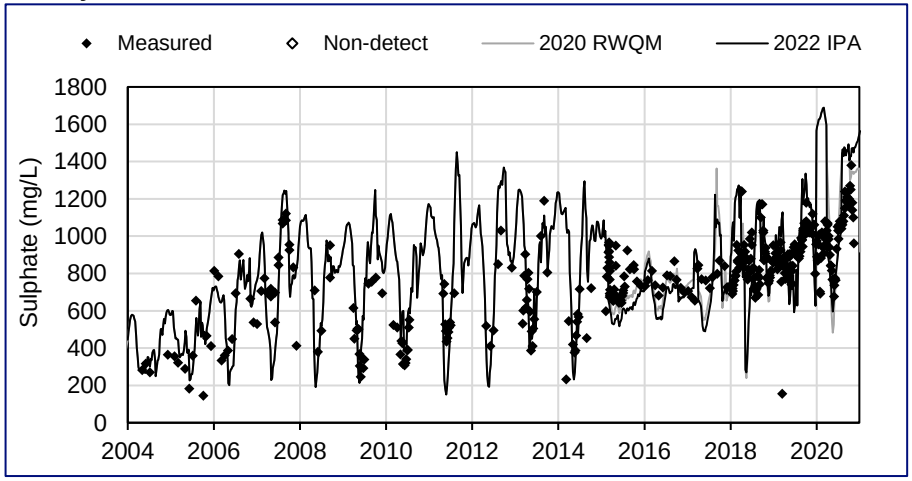
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	5/4/2004	5/4/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	259	259
Non-Detect Count	0	0
Measured Mean (mg/L)	695	695
Simulated Mean (mg/L)	723	709
Bias (mg/L)	28	15
Relative Bias	1.0	1.0
Error (mg/L)	175	184
Percent Error	25%	26%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

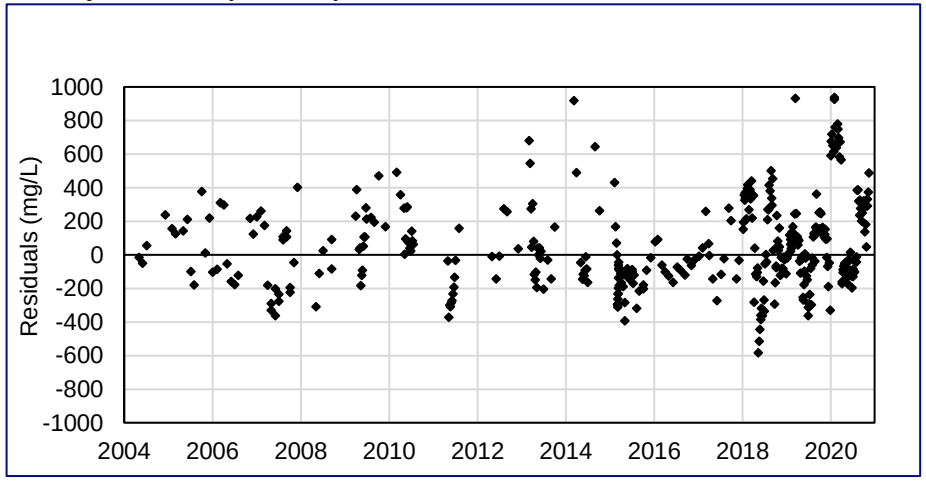


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



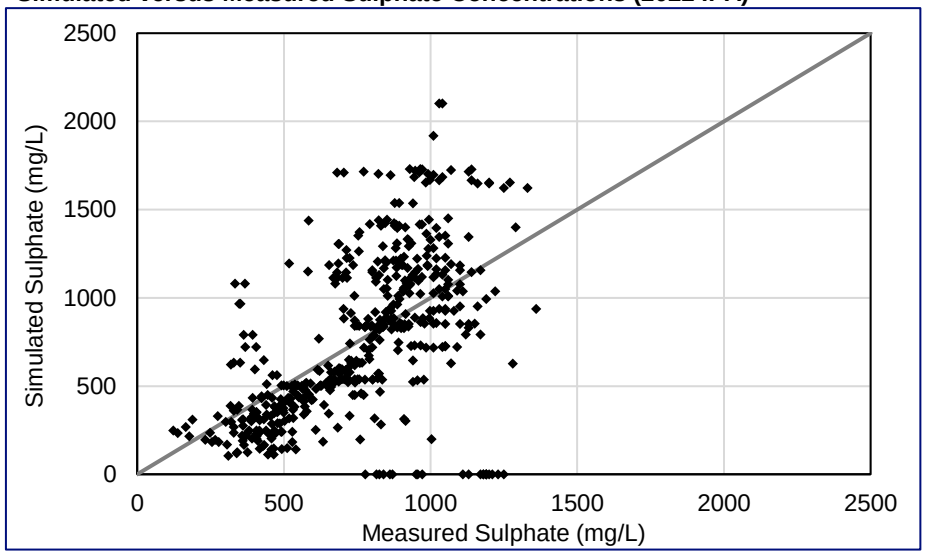
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-22: Sulphate Calibration Information for Node EV_BC1 - Bodie Creek Sediment Pond Decant (EMS E102685)

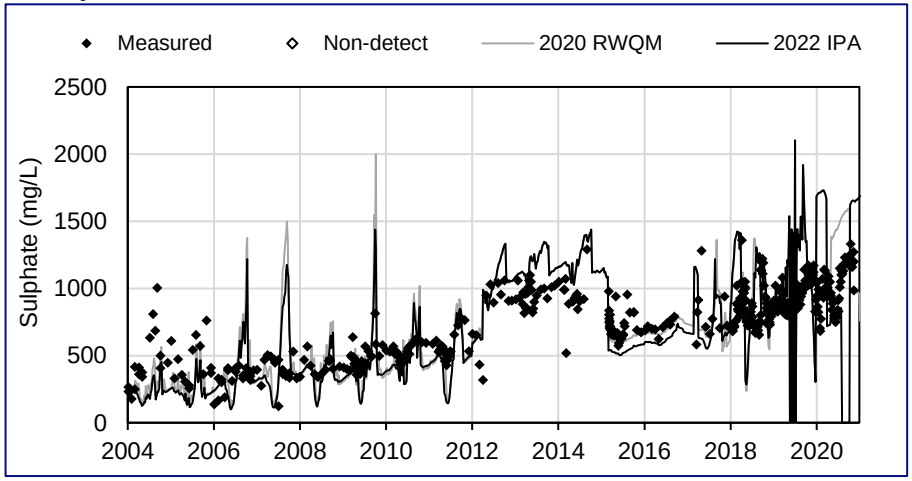
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	347	347
Non-Detect Count	0	0
Measured Mean (mg/L)	658	658
Simulated Mean (mg/L)	696	655
Bias (mg/L)	38	-2.9
Relative Bias	1.1	1.0
Error (mg/L)	198	206
Percent Error	30%	31%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

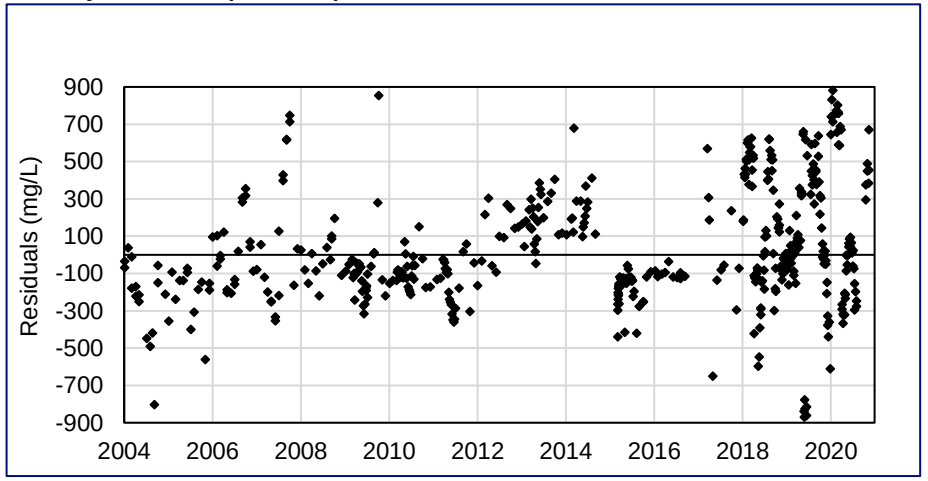


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



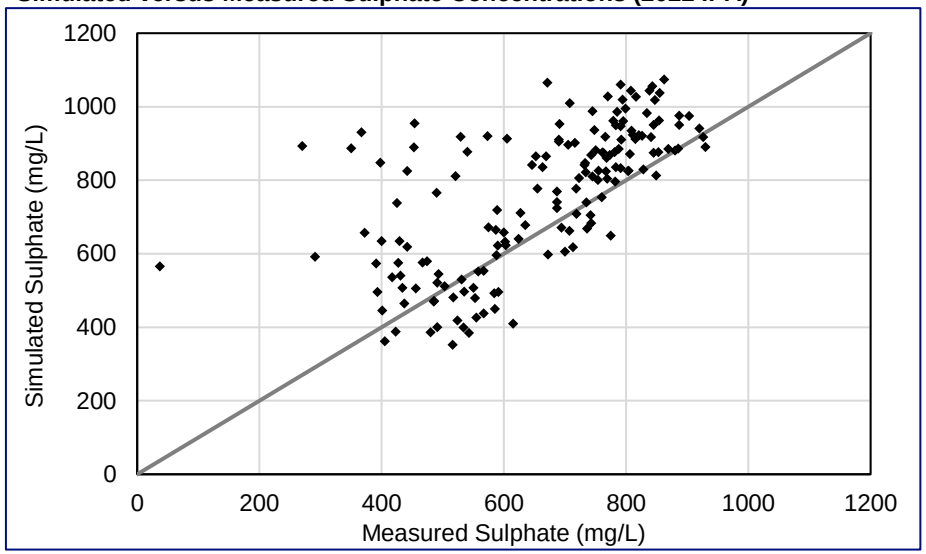
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-23: Sulphate Calibration Information for Node EV_DC1 - EVO Dry Creek Sediment Pond Decant (EMS E298590)

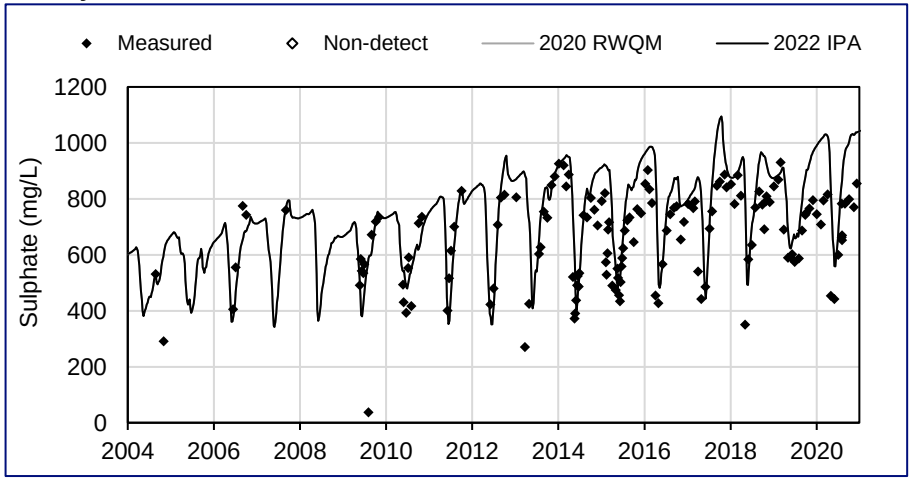
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	8/26/2004	8/26/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	122	122
Non-Detect Count	0	0
Measured Mean (mg/L)	648	648
Simulated Mean (mg/L)	725	725
Bias (mg/L)	77	77
Relative Bias	1.1	1.1
Error (mg/L)	118	118
Percent Error	18%	18%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

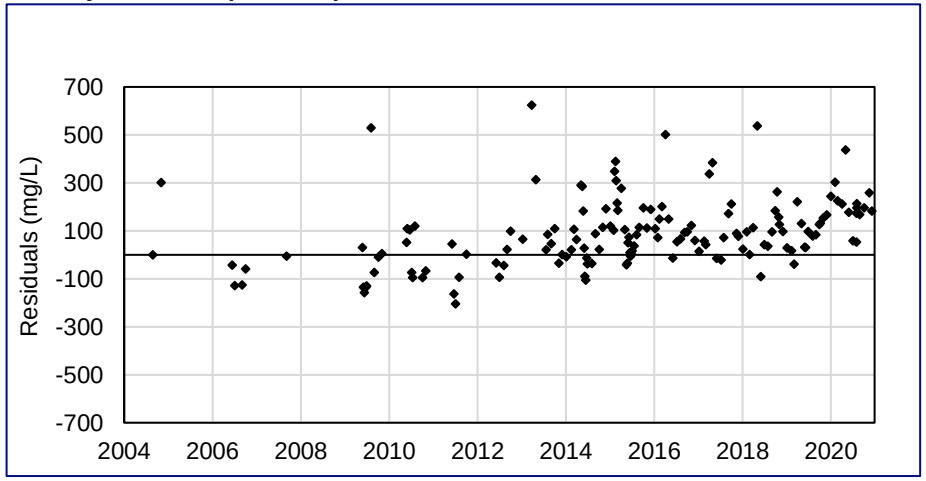


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



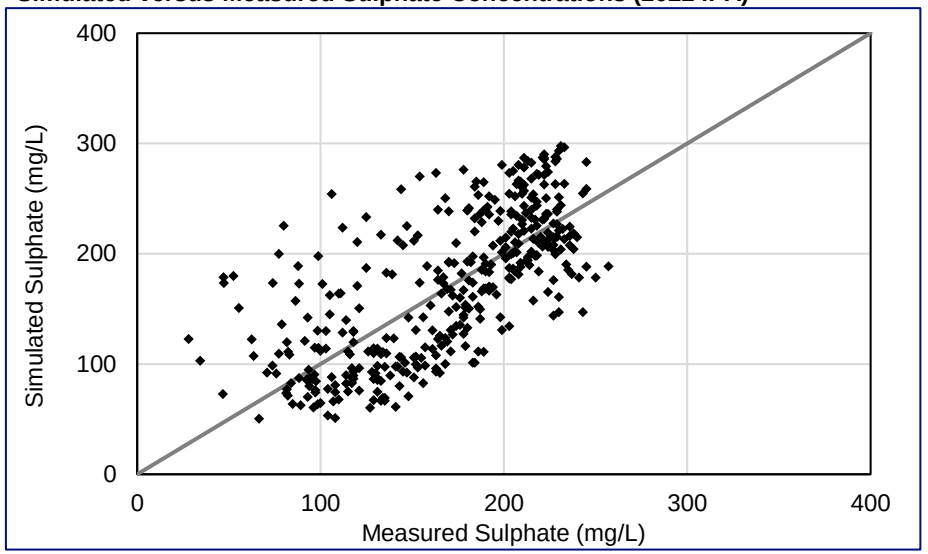
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-24: Sulphate Calibration Information for Node EV_HC1 - EVO Harmer Compliance Point (Harmer Creek Dam Spillway) (EMS E102682)

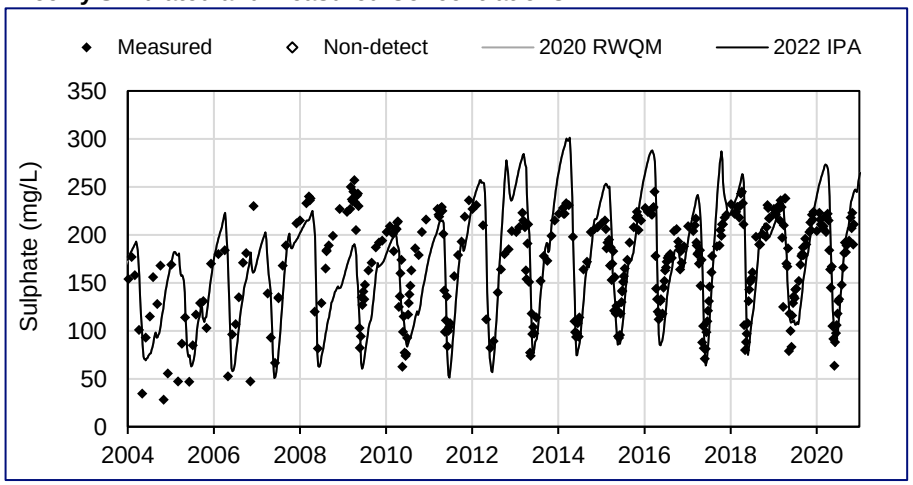
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	315	315
Non-Detect Count	0	0
Measured Mean (mg/L)	166	166
Simulated Mean (mg/L)	168	168
Bias (mg/L)	2.0	2.0
Relative Bias	1.0	1.0
Error (mg/L)	41	41
Percent Error	25%	25%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

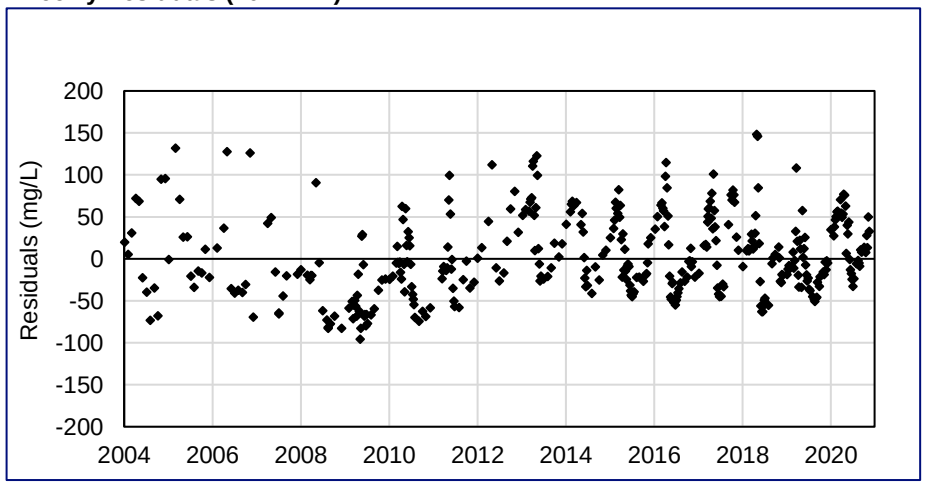


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



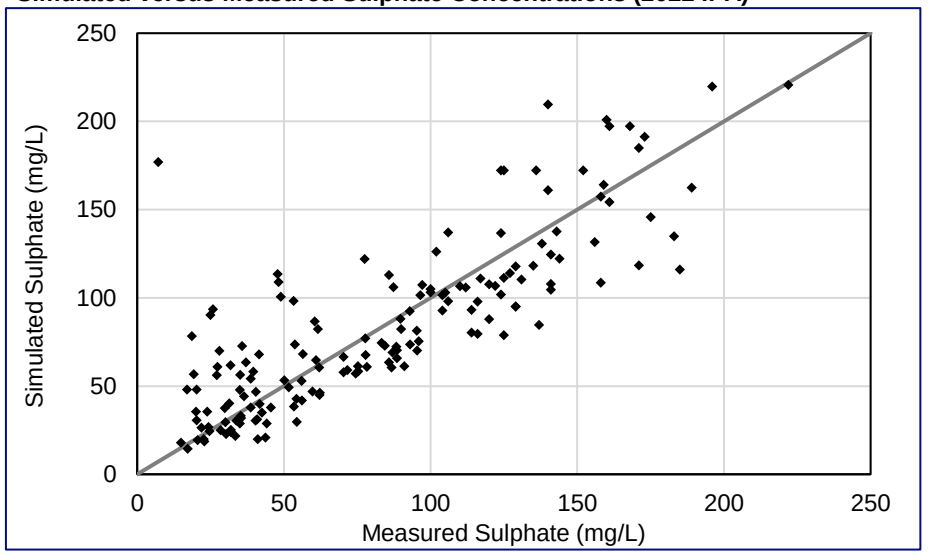
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-25: Sulphate Calibration Information for Node FR_FR1 - Fording River d/s of Henretta Creek (EMS 0200251)

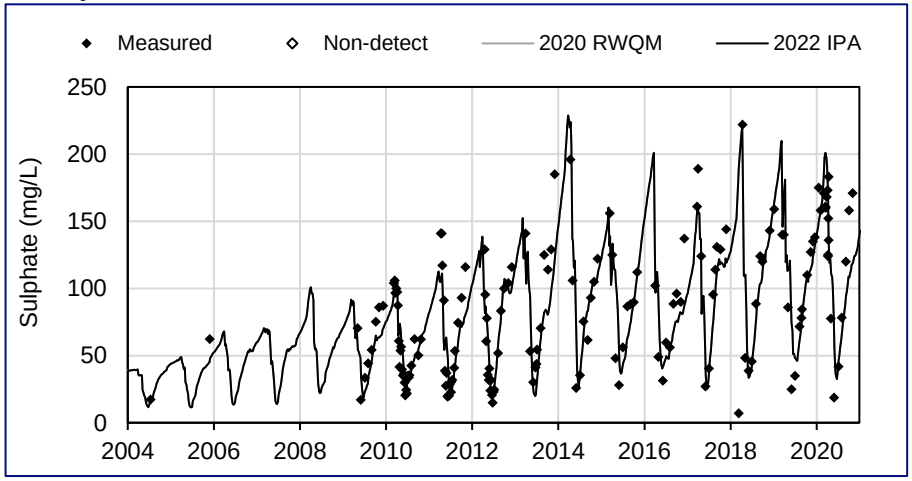
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/13/2004	7/13/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	128	128
Non-Detect Count	0	0
Measured Mean (mg/L)	73	73
Simulated Mean (mg/L)	73	73
Bias (mg/L)	-0.76	-0.77
Relative Bias	0.99	0.99
Error (mg/L)	19	19
Percent Error	25%	25%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

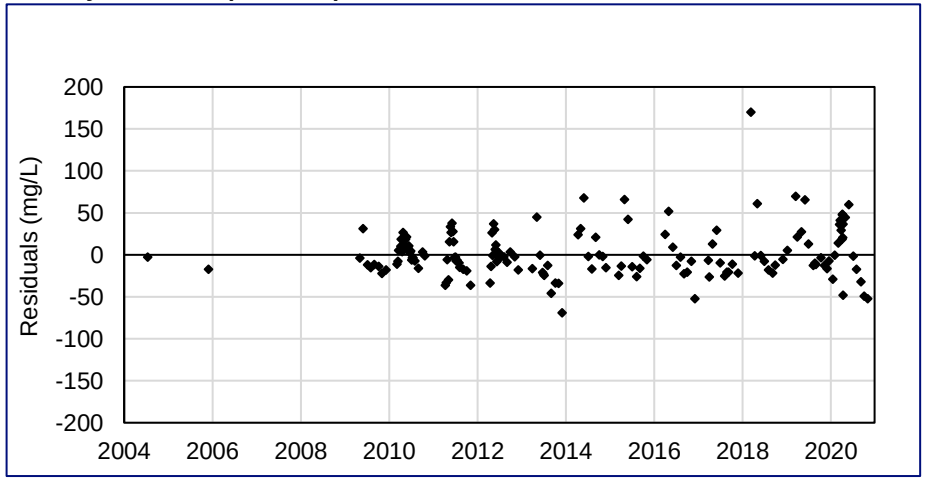


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



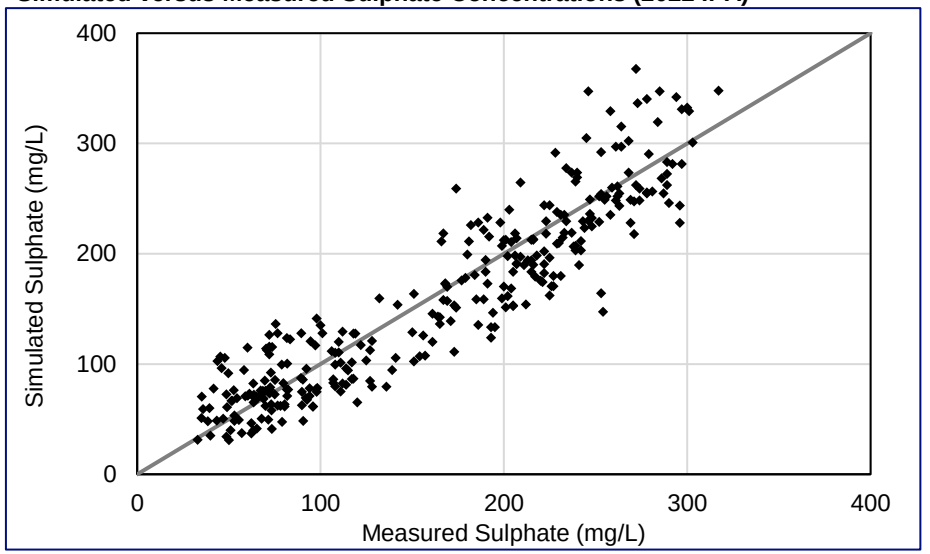
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-26: Sulphate Calibration Information for Node FR_FR2 - Fording River u/s of Kilmarnock Creek (EMS 0200201)

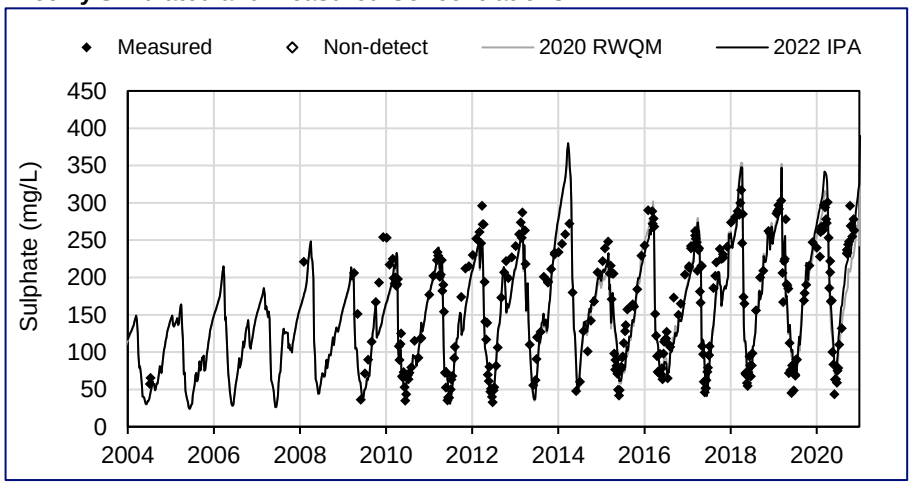
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/7/2004	7/7/2004
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	242	242
Non-Detect Count	0	0
Measured Mean (mg/L)	155	155
Simulated Mean (mg/L)	147	148
Bias (mg/L)	-8.2	-7.4
Relative Bias	0.95	0.95
Error (mg/L)	27	26
Percent Error	17%	17%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

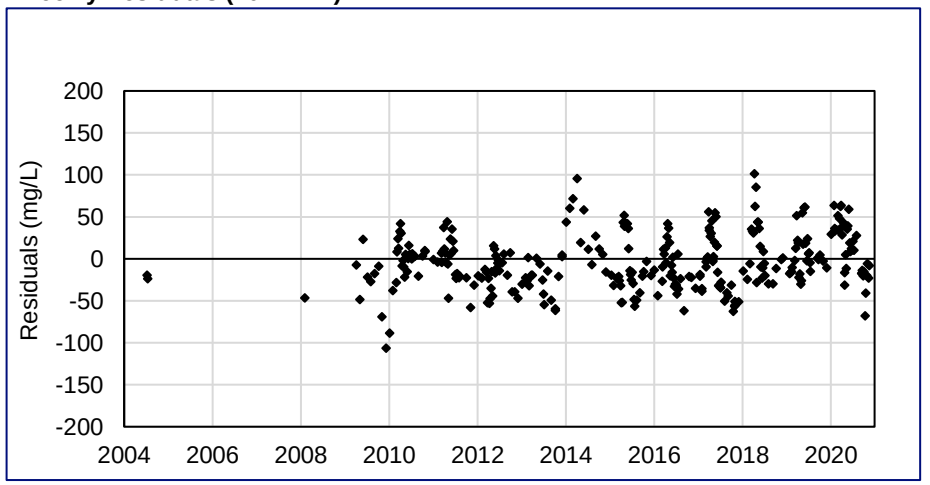


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



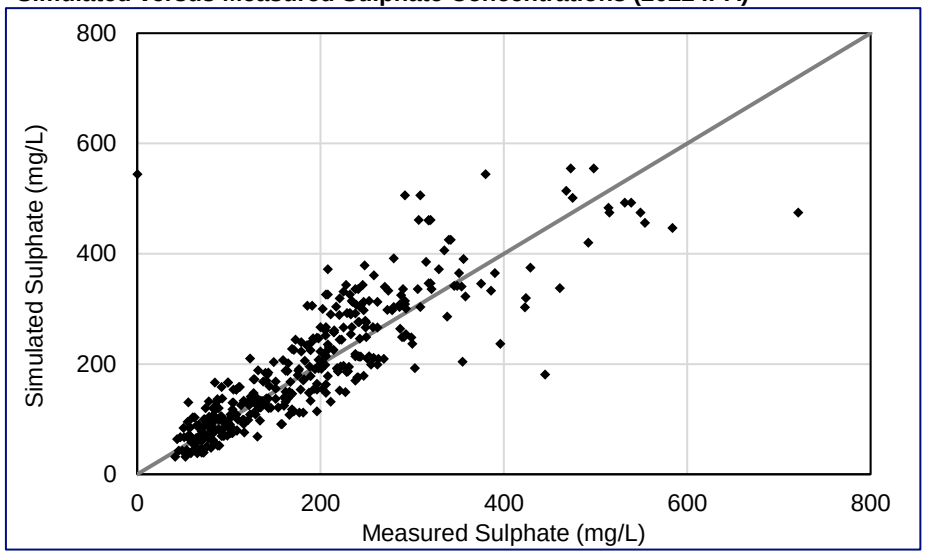
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-27: Sulphate Calibration Information for Node FR_FR4 - Fording River between Swift and Cataract Creeks (EMS 0200311)

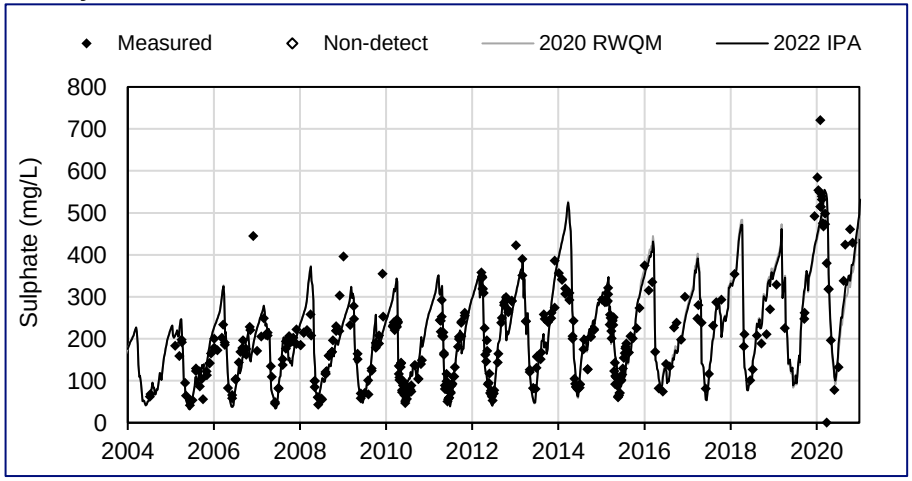
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	7/7/2004	7/7/2004
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	356	356
Non-Detect Count	0	0
Measured Mean (mg/L)	170	170
Simulated Mean (mg/L)	178	178
Bias (mg/L)	7.8	8.2
Relative Bias	1.0	1.0
Error (mg/L)	37	37
Percent Error	22%	22%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

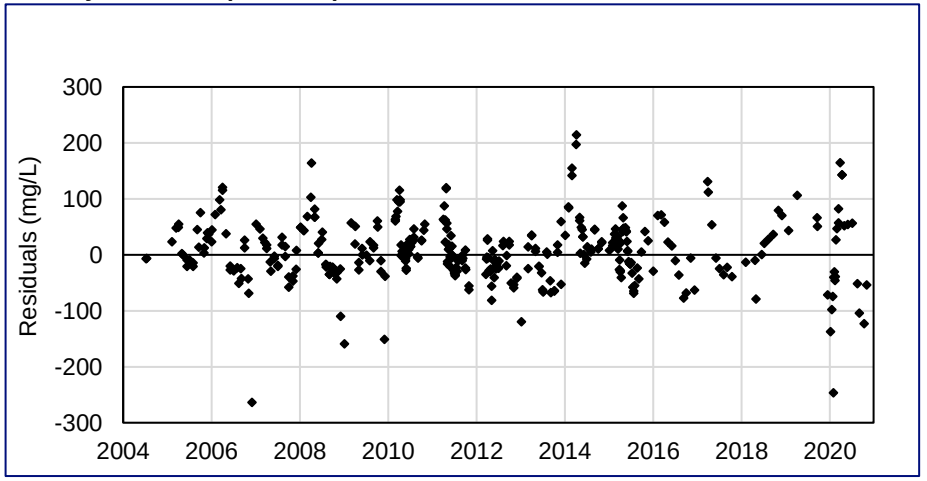


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



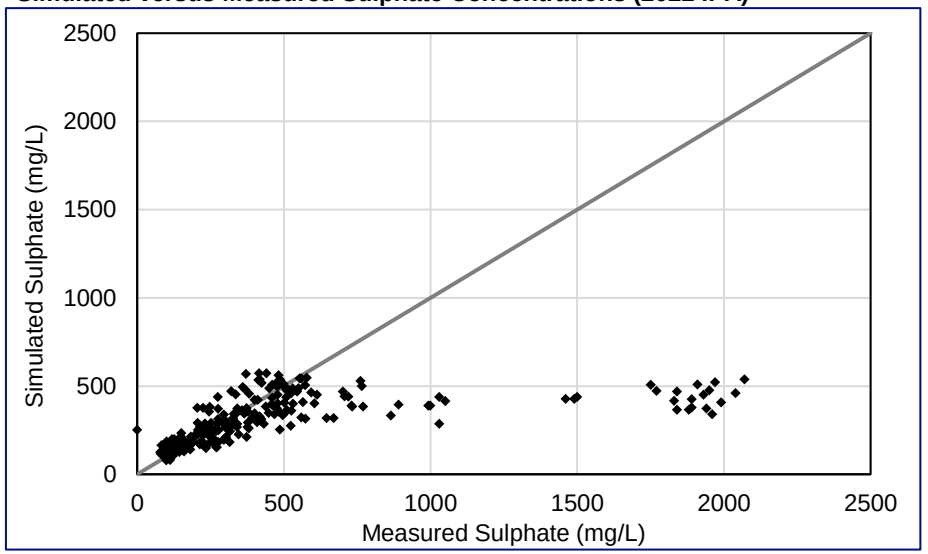
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-28: Sulphate Calibration Information for Node FR_FRCP1 - Fording River, 525 m d/s of Cataract Creek (EMS E300071)

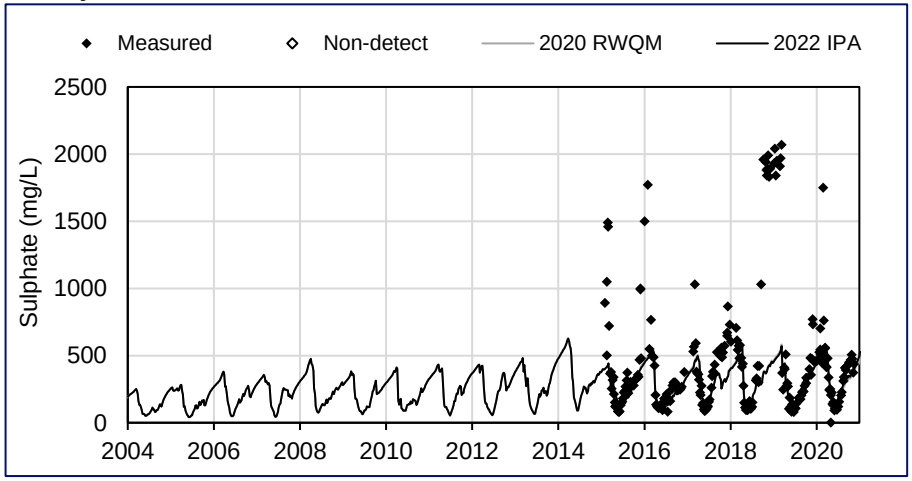
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/3/2015	2/3/2015
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	155	155
Non-Detect Count	0	0
Measured Mean (mg/L)	446	446
Simulated Mean (mg/L)	288	285
Bias (mg/L)	-158	-162
Relative Bias	0.65	0.64
Error (mg/L)	202	203
Percent Error	45%	45%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

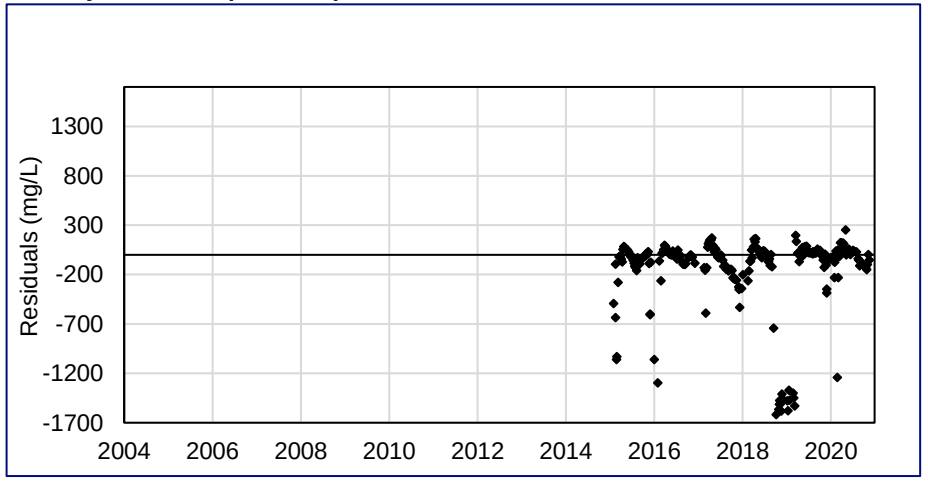


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



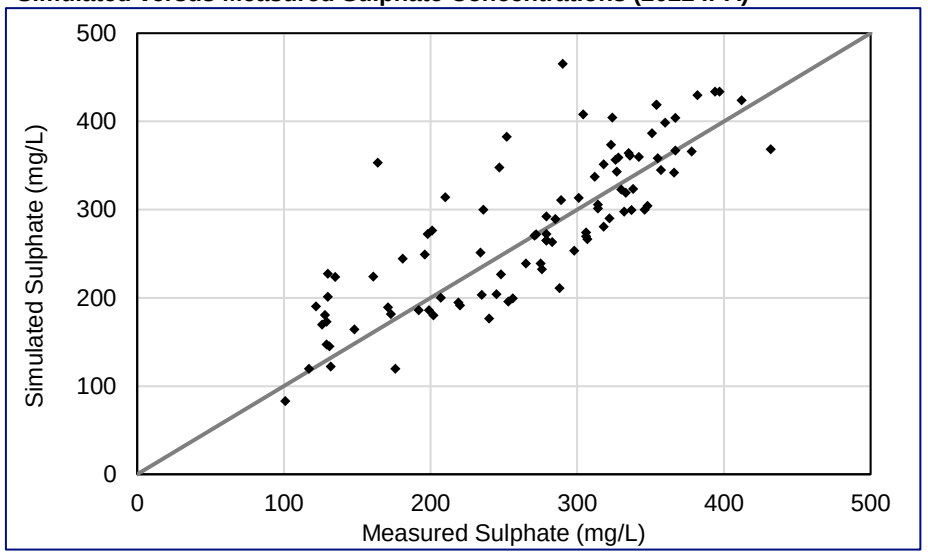
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-29: Sulphate Calibration Information for Node GH_PC2 - Fording River d/s of Porter Creek (EMS E287431)

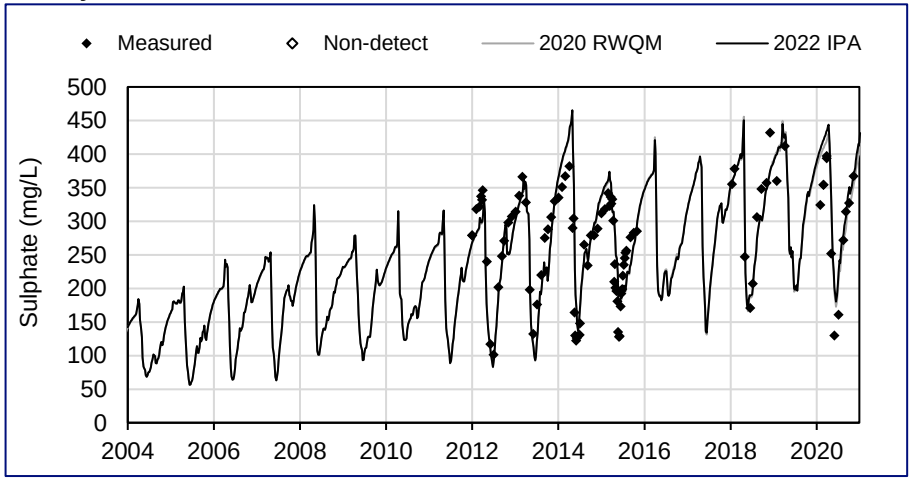
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/3/2012	1/3/2012
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	81	81
Non-Detect Count	0	0
Measured Mean (mg/L)	259	259
Simulated Mean (mg/L)	267	268
Bias (mg/L)	7.6	8.5
Relative Bias	1.0	1.0
Error (mg/L)	39	39
Percent Error	15%	15%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

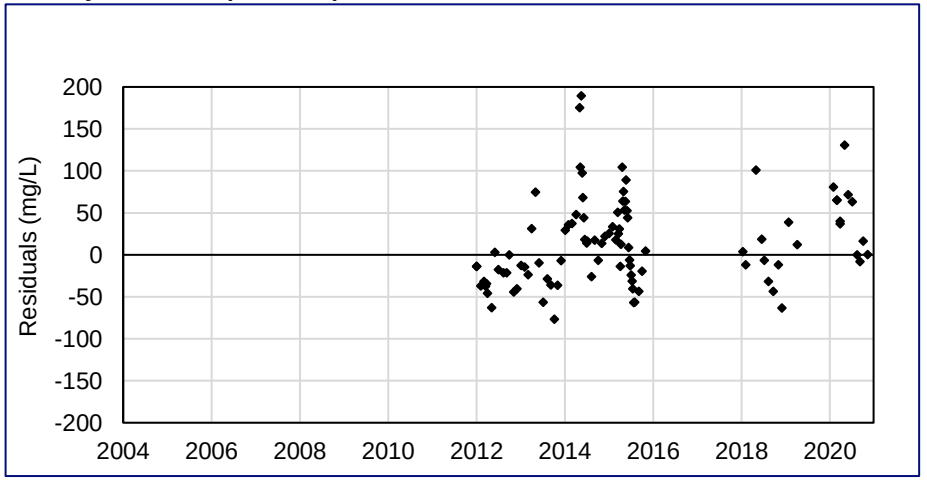


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



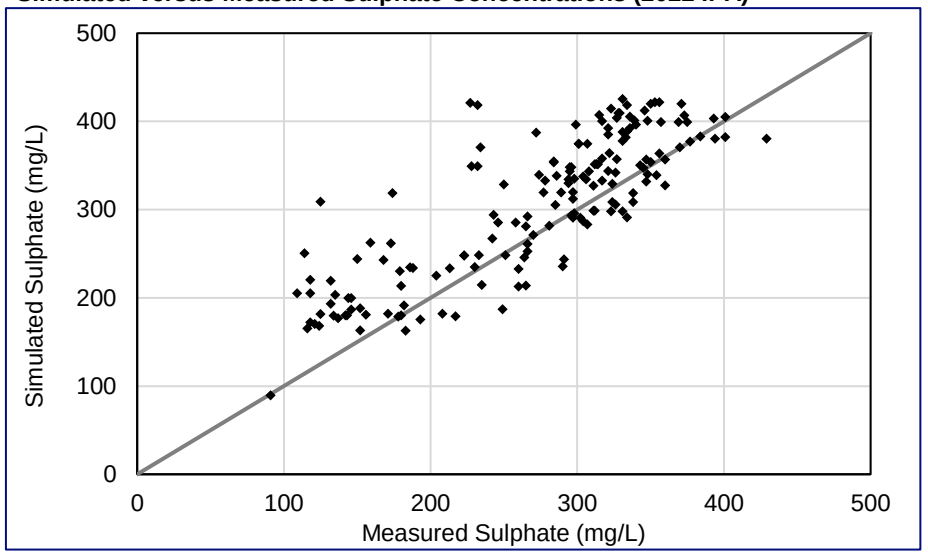
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-30: Sulphate Calibration Information for Node FR_FRABCH - FRO Compliance Point (Fording River, 100 m u/s of Chauncey Creek) (EMS E223753)

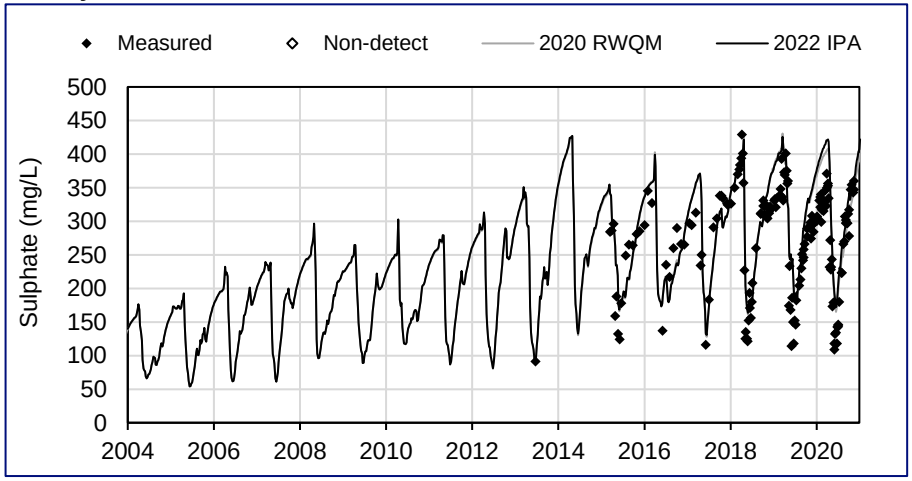
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	6/24/2013	6/24/2013
Last Measured Sample	12/6/2018	12/6/2018
Data Points Available for Comparison, n	71	71
Non-Detect Count	0	0
Measured Mean (mg/L)	266	266
Simulated Mean (mg/L)	281	281
Bias (mg/L)	15	15
Relative Bias	1.1	1.1
Error (mg/L)	37	36
Percent Error	14%	14%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

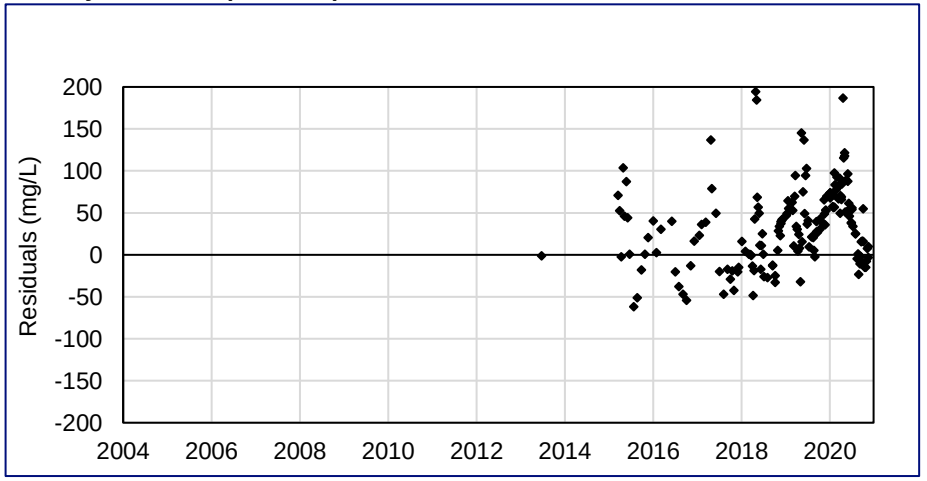


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



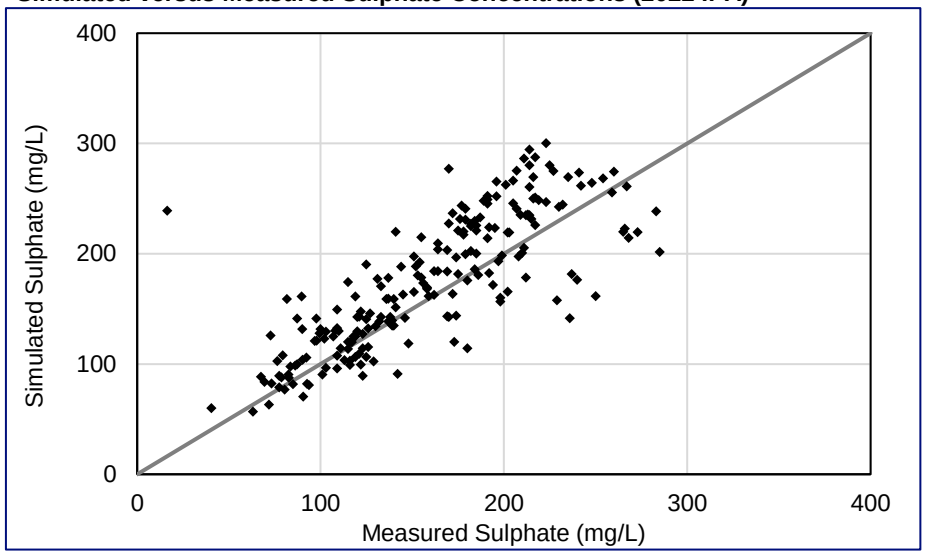
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-31: Sulphate Calibration Information for Node LC_FRDSDC - Fording River d/s of Dry Creek (EMS E288272)

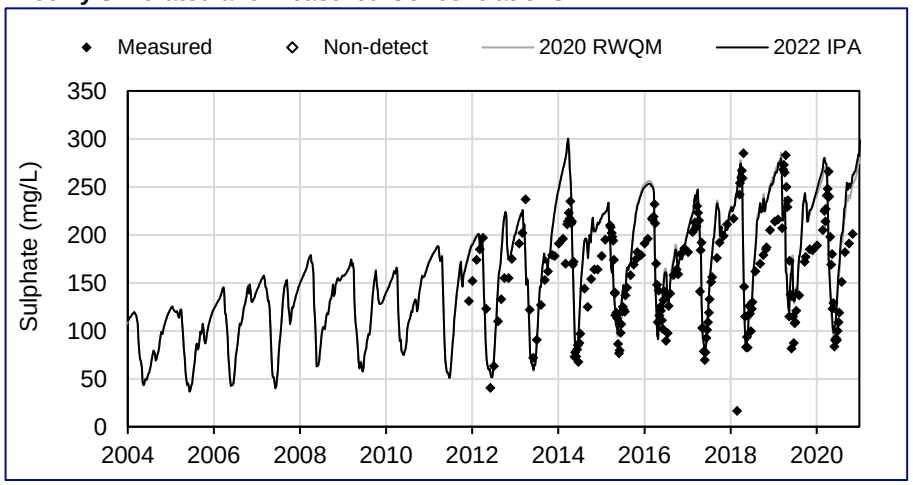
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/7/2011	12/7/2011
Last Measured Sample	12/5/2018	12/5/2018
Data Points Available for Comparison, n	160	160
Non-Detect Count	0	0
Measured Mean (mg/L)	154	154
Simulated Mean (mg/L)	171	170
Bias (mg/L)	18	17
Relative Bias	1.1	1.1
Error (mg/L)	26	26
Percent Error	17%	17%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

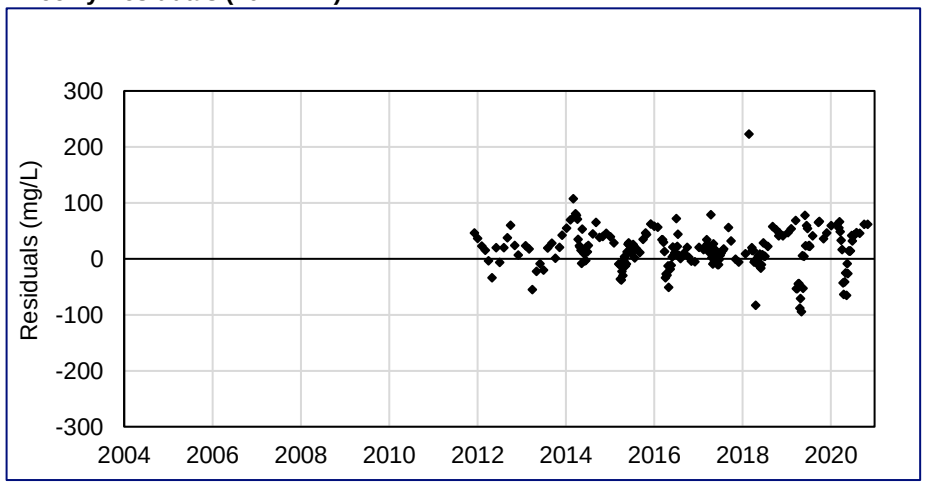


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



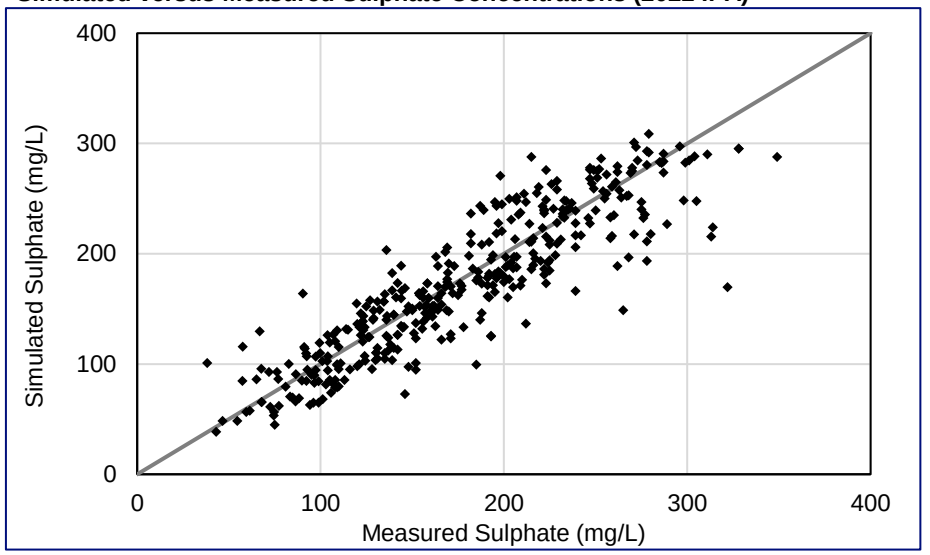
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-32: Sulphate Calibration Information for Node GH_FR1 - GHO Fording River Compliance Point (EMS 0200378)

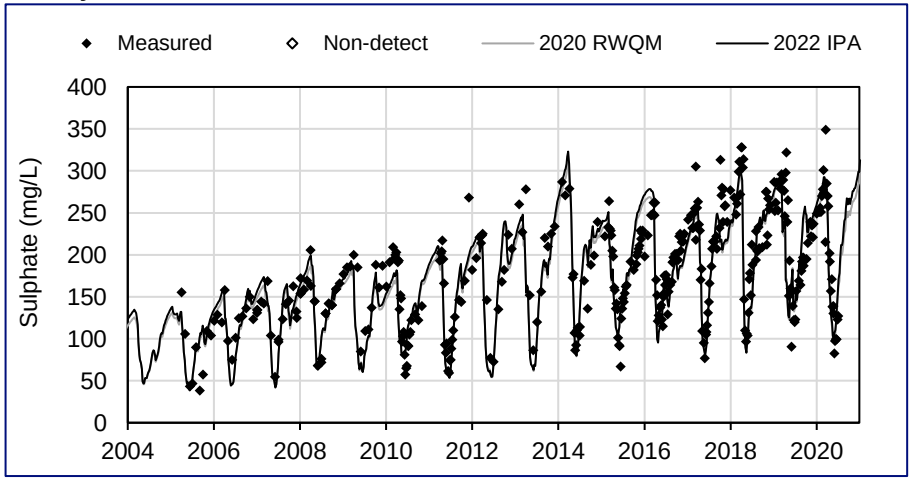
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	316	316
Non-Detect Count	0	0
Measured Mean (mg/L)	171	171
Simulated Mean (mg/L)	162	166
Bias (mg/L)	-8.8	-5.2
Relative Bias	0.95	0.97
Error (mg/L)	22	22
Percent Error	13%	13%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

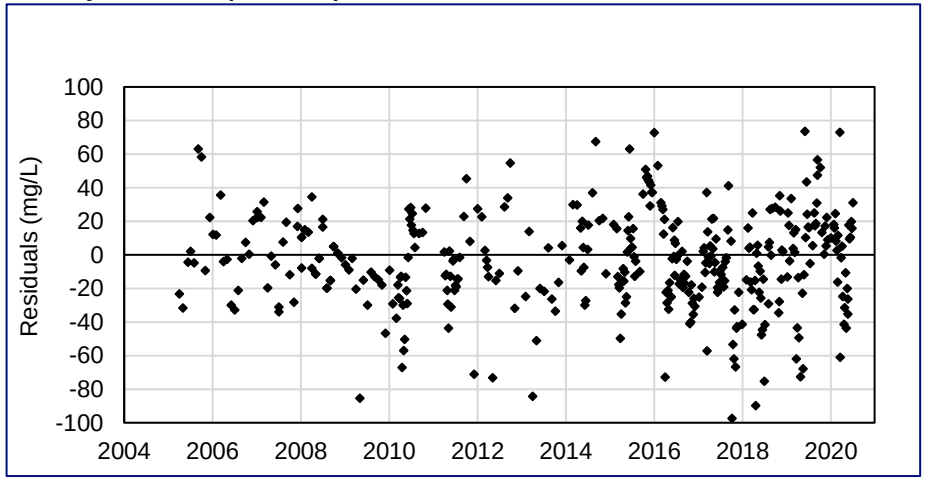


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



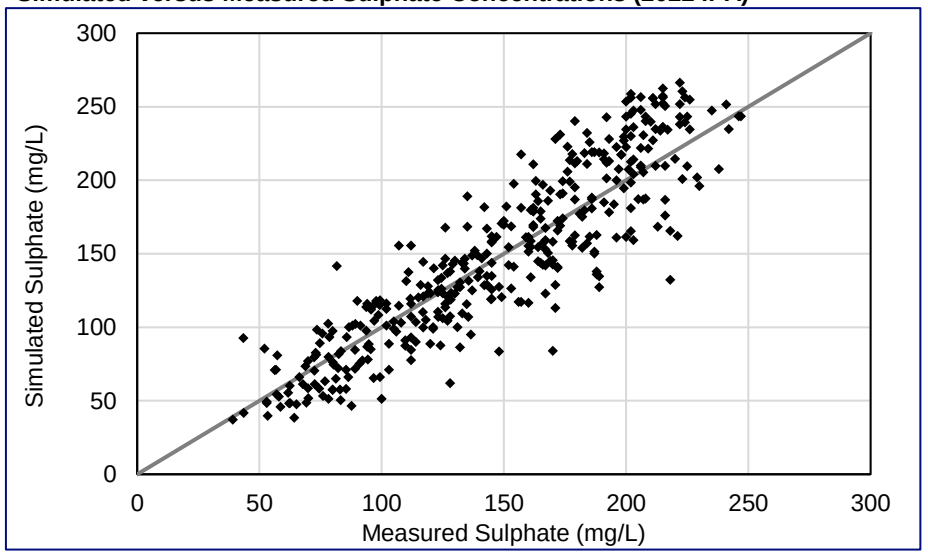
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-33: Sulphate Calibration Information for Node LC_LC5 - Fording River d/s of Line Creek (EMS 0200028)

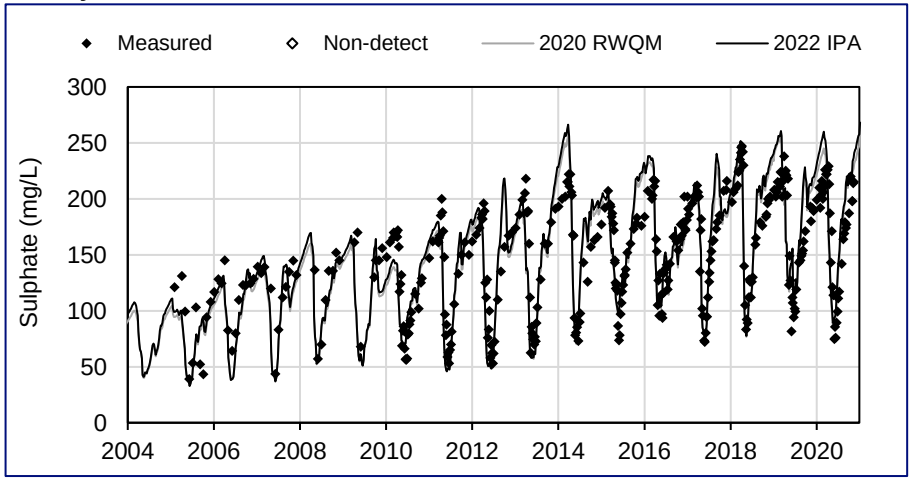
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/2/2005	2/2/2005
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	309	309
Non-Detect Count	0	0
Measured Mean (mg/L)	141	141
Simulated Mean (mg/L)	136	139
Bias (mg/L)	-5.8	-2.1
Relative Bias	0.96	0.98
Error (mg/L)	18	19
Percent Error	13%	13%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

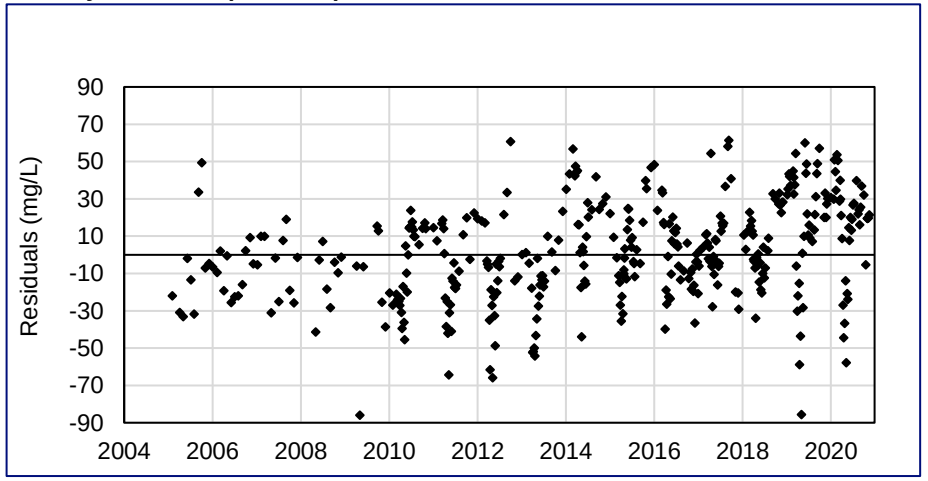


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

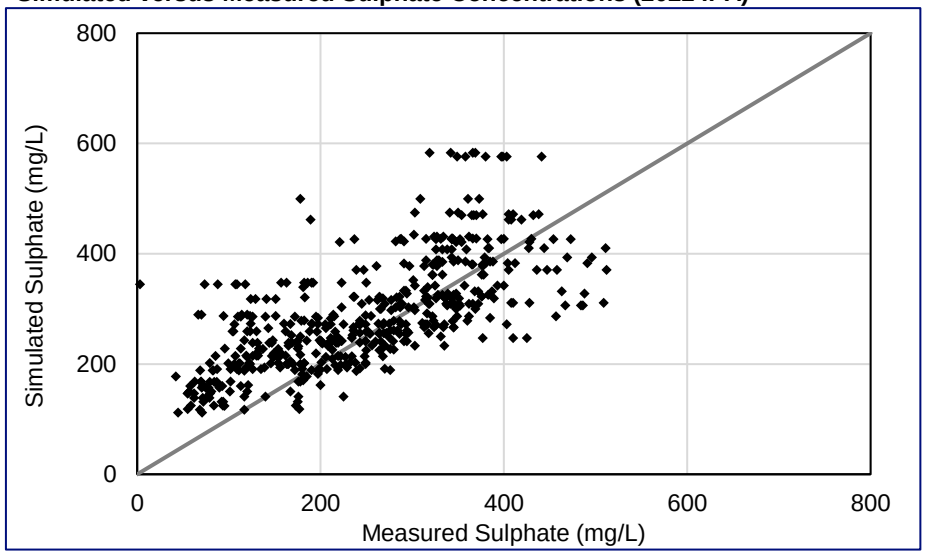
C1-34: Sulphate Calibration Information for Node CM_MC2 - CMO Compliance Point (EMS E258937)

Measured and Simulated Sulphate Data and Calibration Statistics

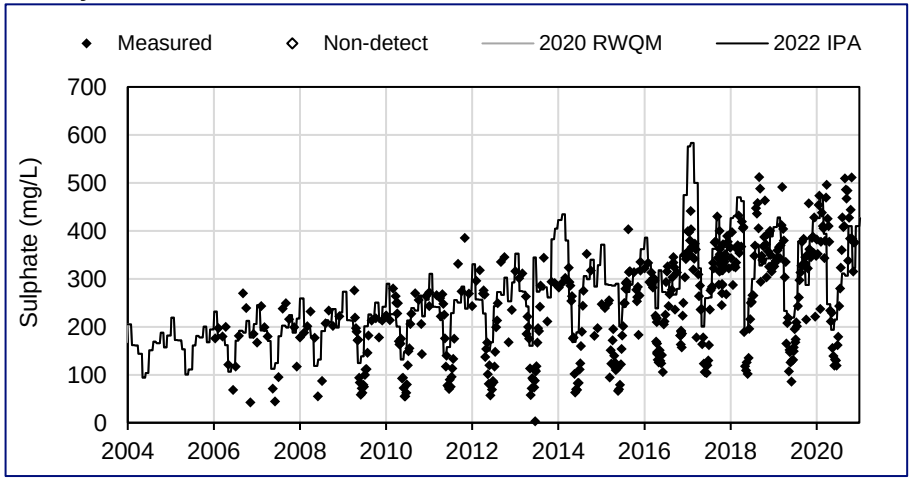
Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/11/2006	1/11/2006
Last Measured Sample	12/28/2018	12/28/2018
Data Points Available for Comparison, n	399	399
Non-Detect Count	0	0
Measured Mean (mg/L)	230	230
Simulated Mean (mg/L)	279	279
Bias (mg/L)	49	49
Relative Bias	1.2	1.2
Error (mg/L)	72	72
Percent Error	31%	31%

Note: Simulated data are from the CMO Water and Load Balance Model.

Simulated versus Measured Sulphate Concentrations (2022 IPA)

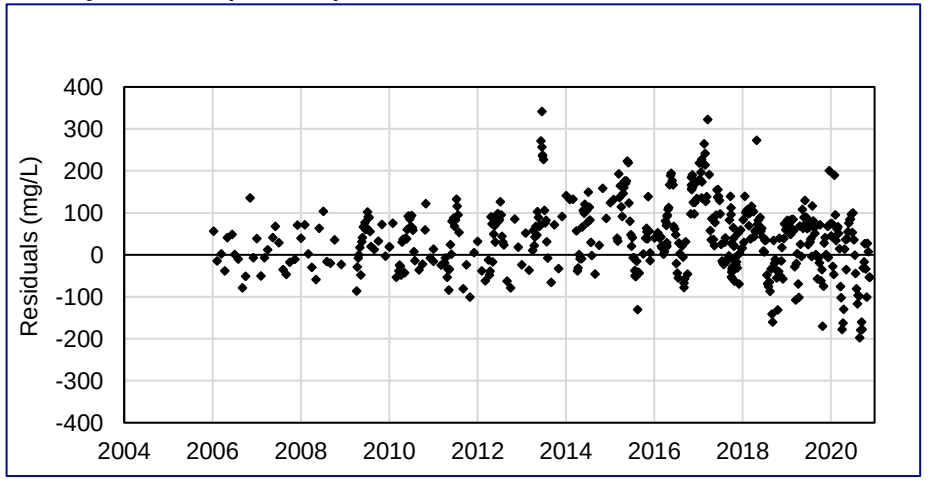


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



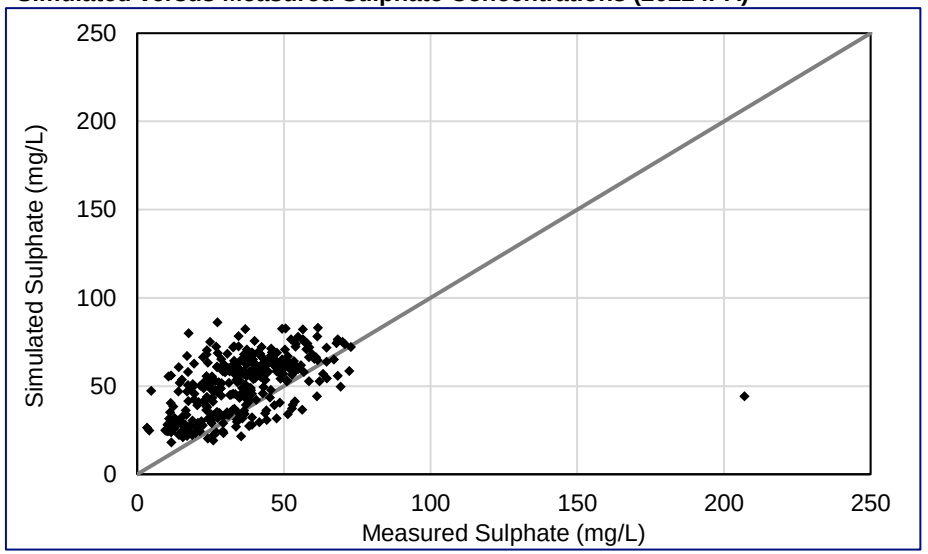
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-35: Sulphate Calibration Information for Node EV_MC3 - Michel Creek u/s of Erickson Creek (EMS 0200203)

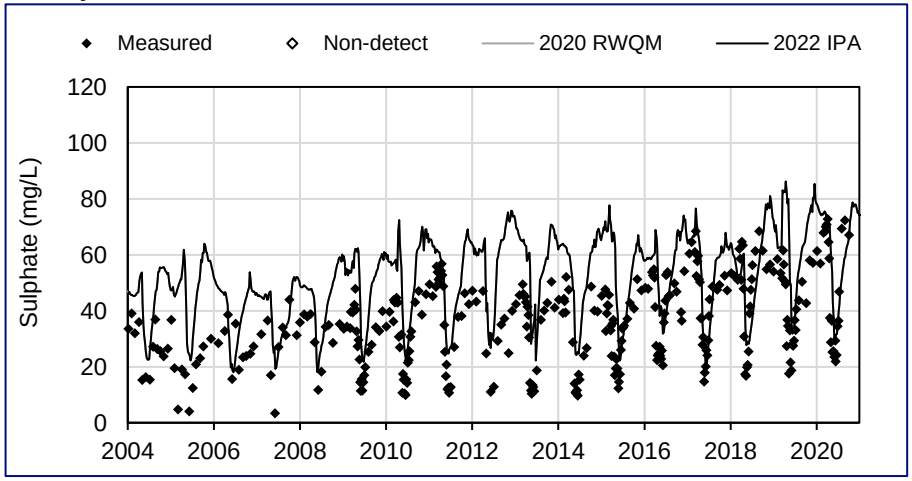
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	298	298
Non-Detect Count	0	0
Measured Mean (mg/L)	35	35
Simulated Mean (mg/L)	49	49
Bias (mg/L)	15	15
Relative Bias	1.4	1.4
Error (mg/L)	18	18
Percent Error	51%	51%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

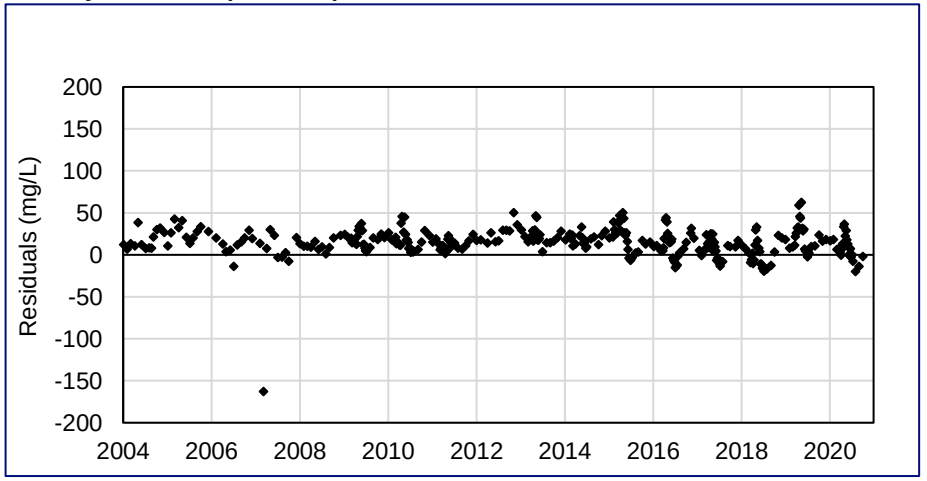


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



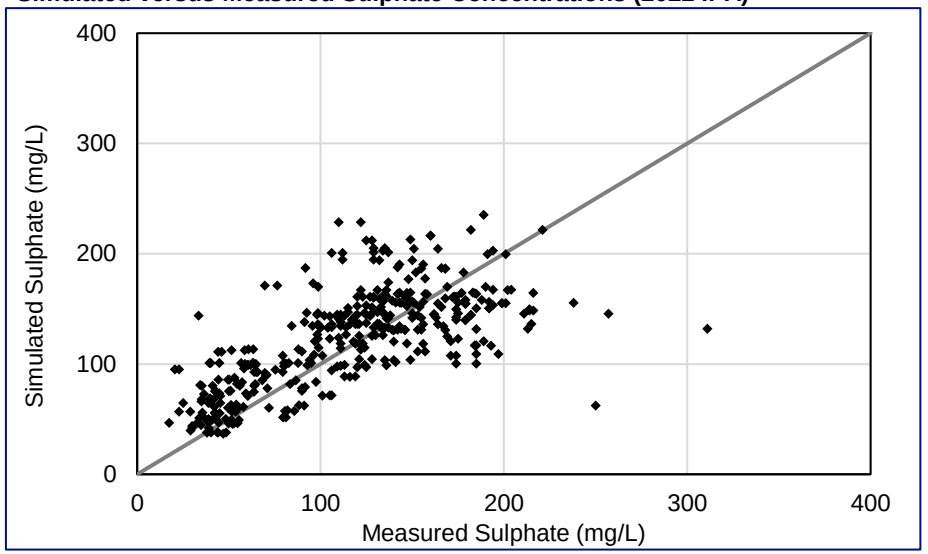
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-36: Sulphate Calibration Information for Node EV_MC2 - EVO Michel Creek Compliance Point (EMS E300091)

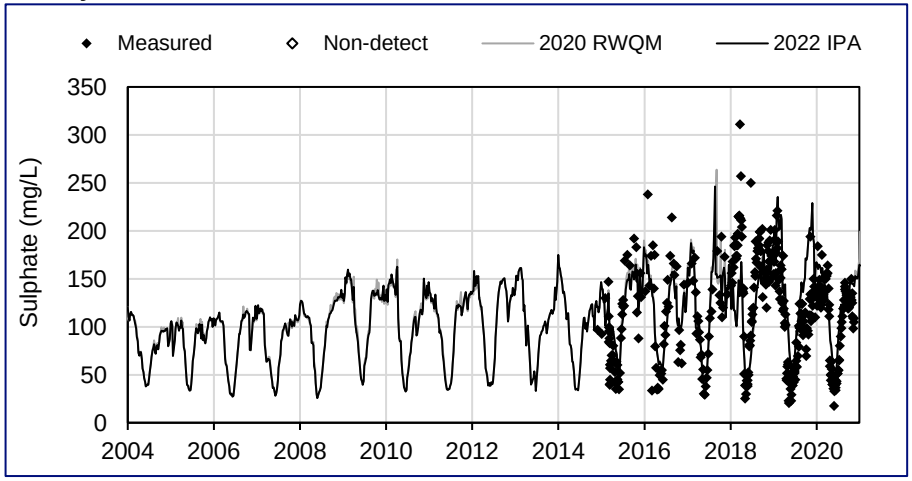
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	12/3/2014	12/3/2014
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	210	210
Non-Detect Count	0	0
Measured Mean (mg/L)	122	122
Simulated Mean (mg/L)	114	113
Bias (mg/L)	-7.7	-9.1
Relative Bias	0.94	0.93
Error (mg/L)	30	29
Percent Error	24%	24%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

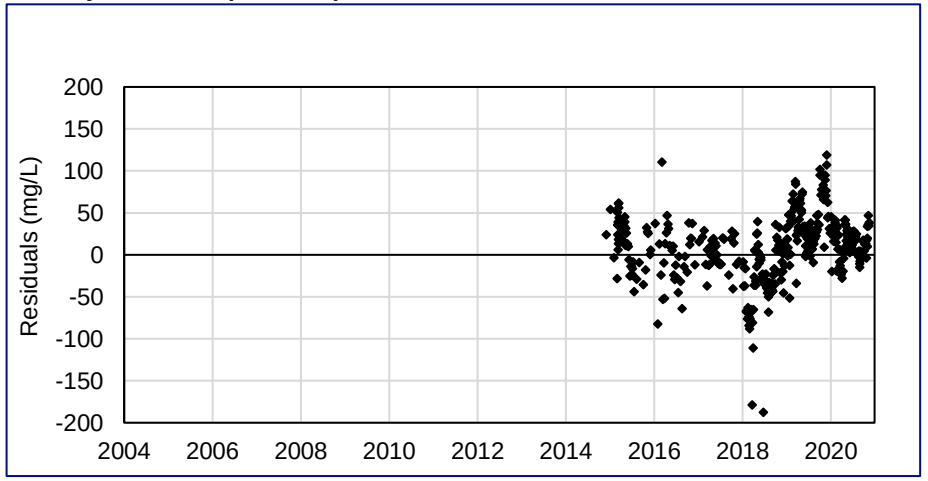


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



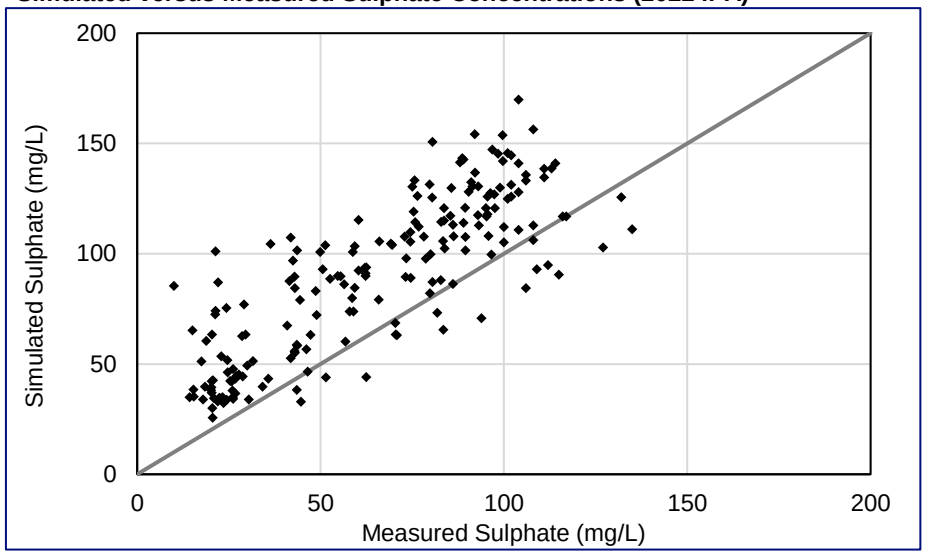
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-37: Sulphate Calibration Information for Node EV_MC1 - Michel Creek u/s of Highway 43 Bridge (EMS 0200425)

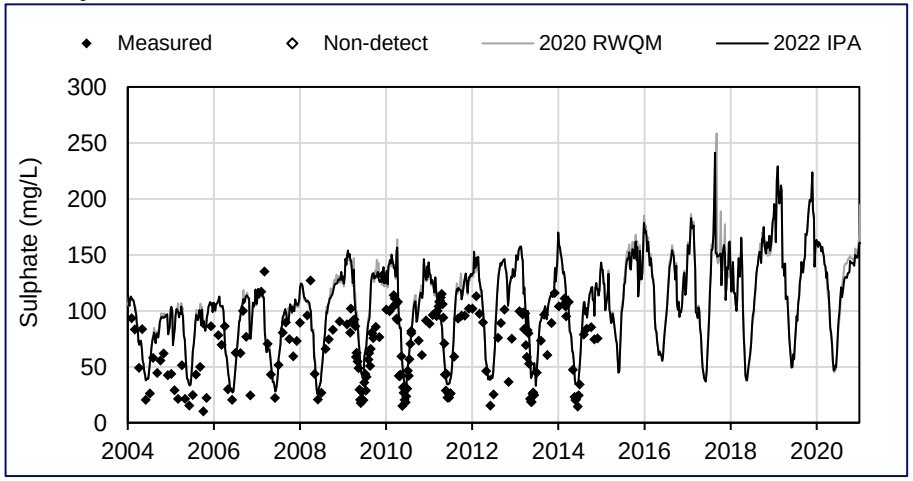
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2/3/2004	2/3/2004
Last Measured Sample	12/3/2014	12/3/2014
Data Points Available for Comparison, n	193	193
Non-Detect Count	0	0
Measured Mean (mg/L)	65	65
Simulated Mean (mg/L)	90	90
Bias (mg/L)	26	25
Relative Bias	1.4	1.4
Error (mg/L)	28	28
Percent Error	44%	43%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

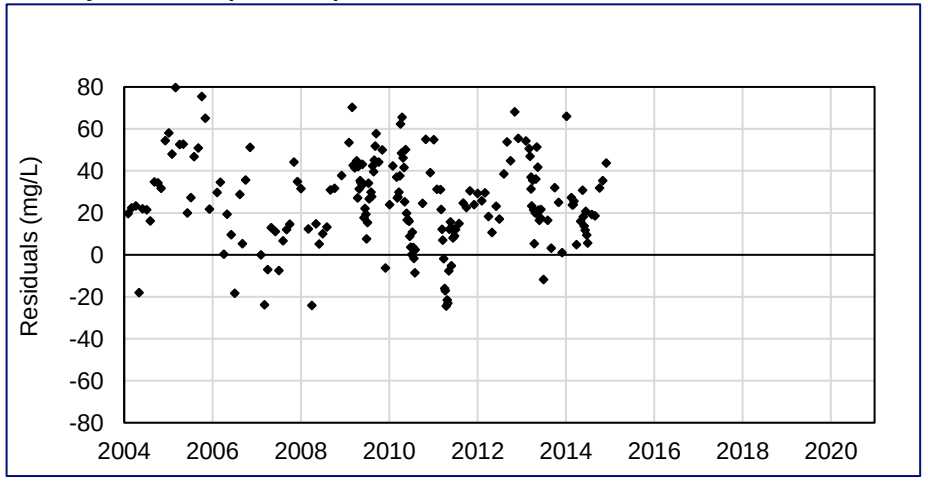


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



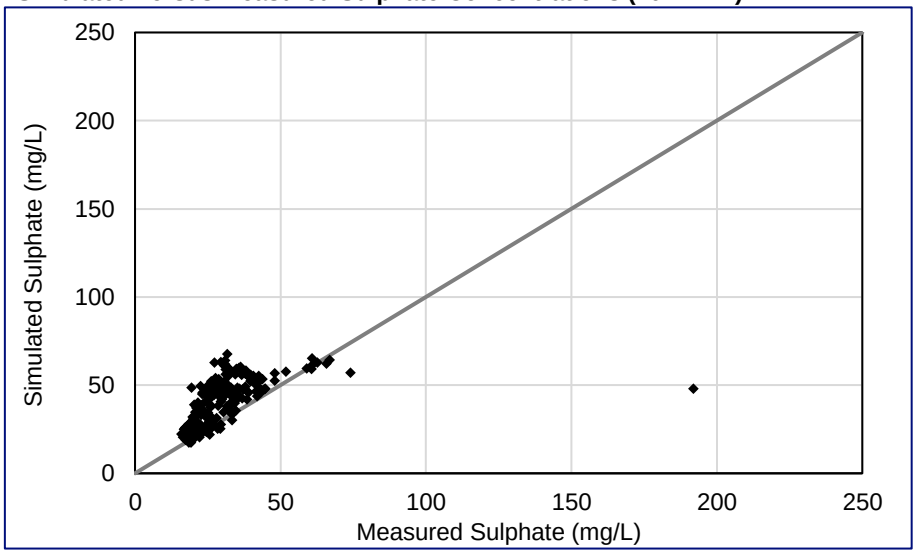
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-38: Sulphate Calibration Information for Node GH_ERC - GHO Elk River Compliance Point (EMS E300090)

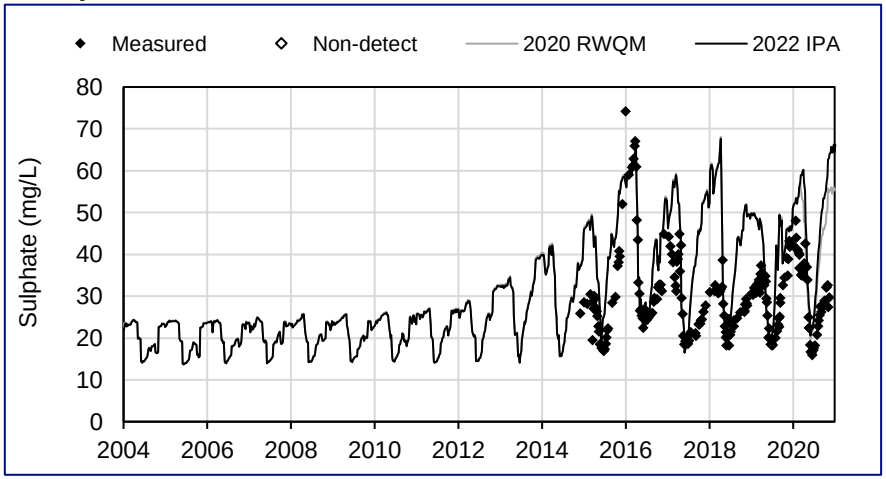
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	2014-12-04	2014-12-04
Last Measured Sample	2018-12-03	2018-12-03
Data Points Available for Comparison, n	135	135
Non-Detect Count	0	0
Measured Mean (mg/L)	30	30
Simulated Mean (mg/L)	41	40
Bias (mg/L)	11	11
Relative Bias	1.4	1.4
Error (mg/L)	11	11
Percent Error	38%	38%

Simulated versus Measured Sulphate Concentrations (2022 IPA)



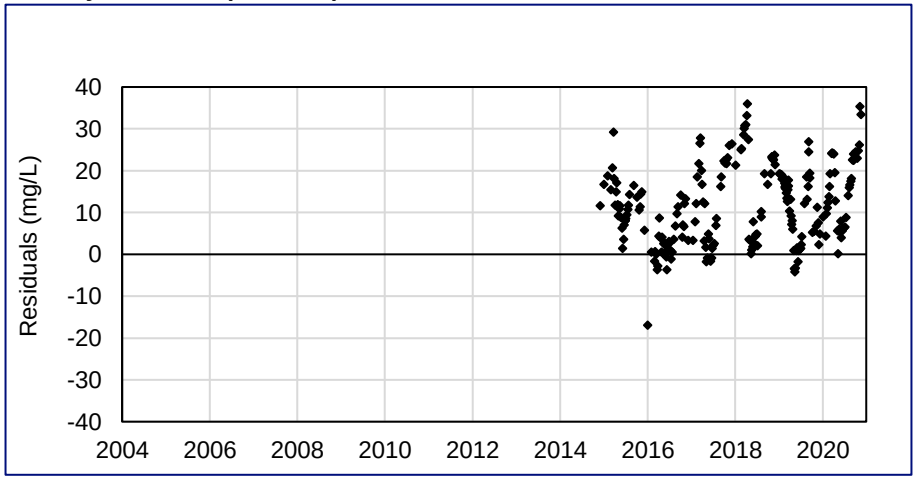
Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.

In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



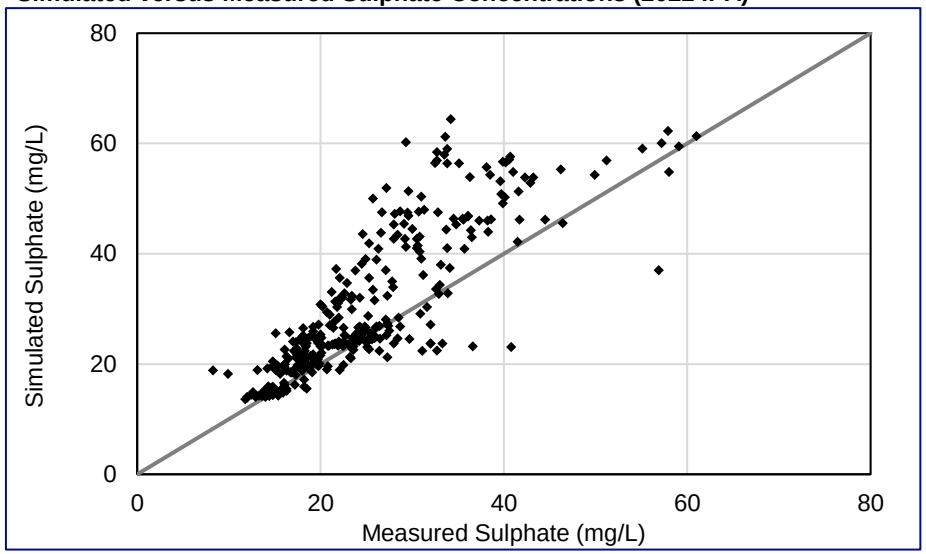
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-39: Sulphate Calibration Information for Node GH_ER1 - Elk River u/s of Boivin Creek (u/s of Fording River) (EMS E206661)

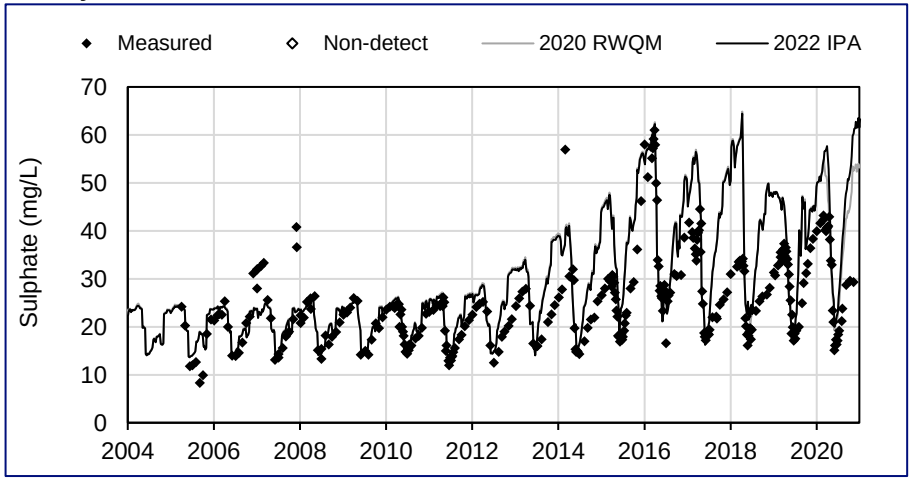
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	4/3/2005	4/3/2005
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	265	265
Non-Detect Count	0	0
Measured Mean (mg/L)	24	24
Simulated Mean (mg/L)	29	29
Bias (mg/L)	4.6	4.4
Relative Bias	1.2	1.2
Error (mg/L)	5.8	5.7
Percent Error	24%	23%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

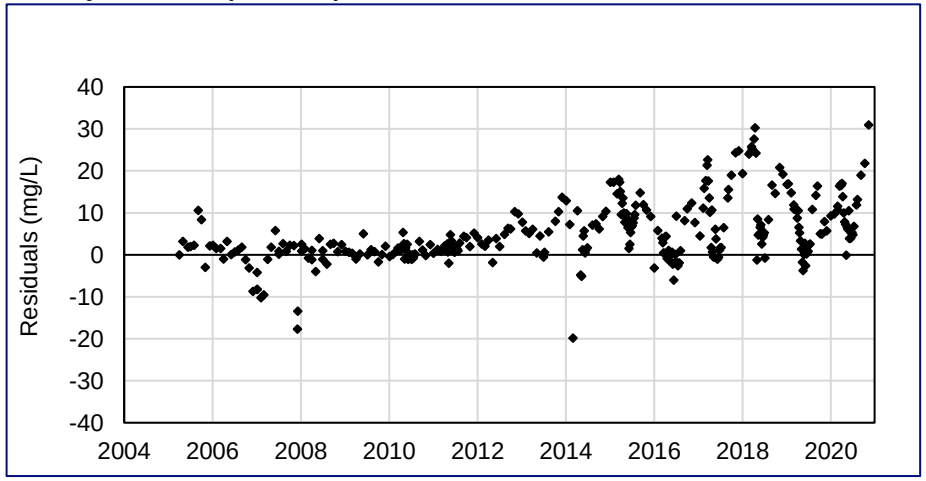


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



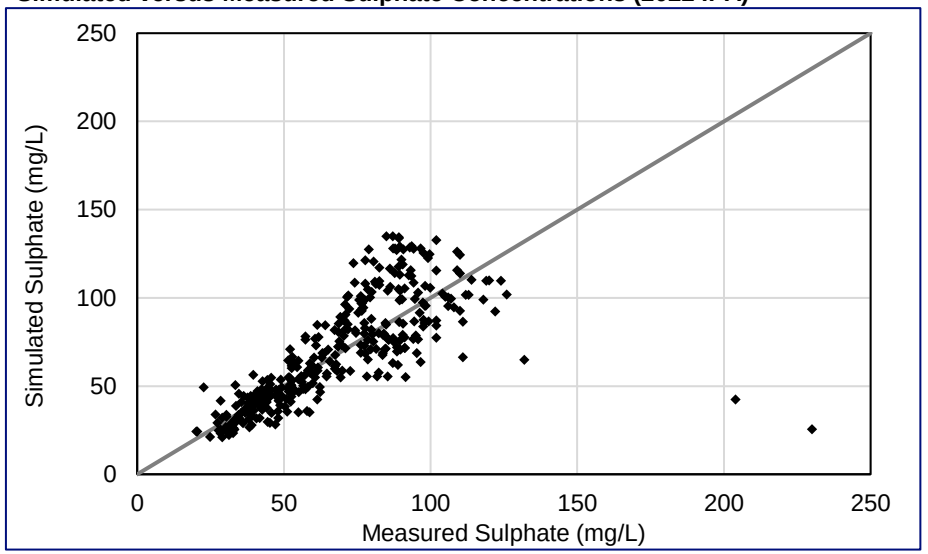
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-40: Sulphate Calibration Information for Node EV_ER4 - Elk River u/s of Grave Creek (EMS 0200027)

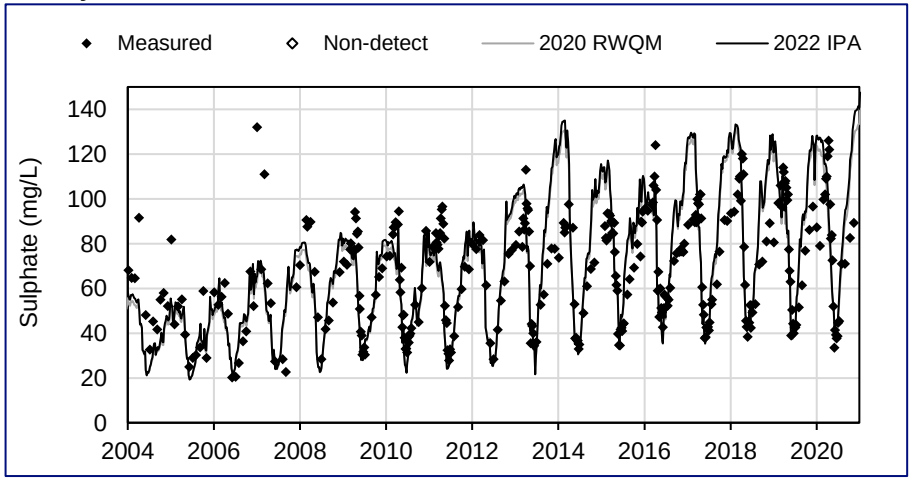
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	303	303
Non-Detect Count	0	0
Measured Mean (mg/L)	66	66
Simulated Mean (mg/L)	66	67
Bias (mg/L)	-0.9	0.54
Relative Bias	0.99	1.0
Error (mg/L)	13	13
Percent Error	19%	20%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

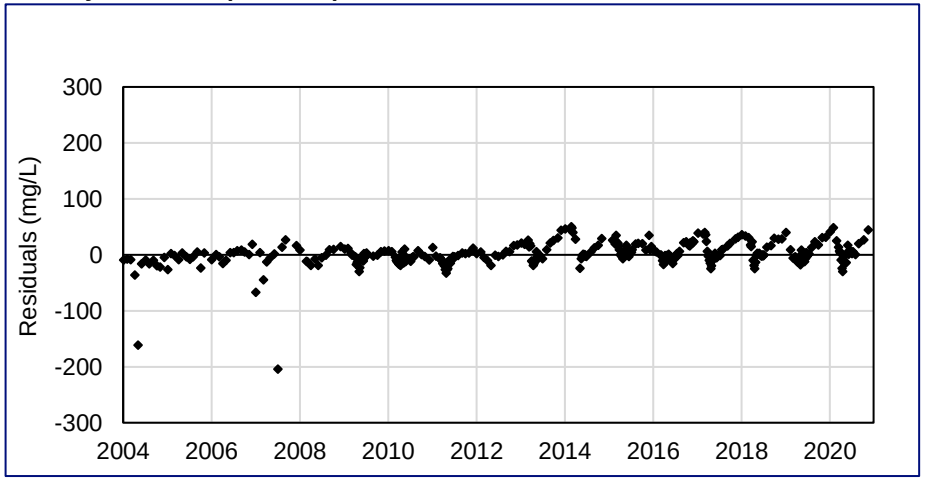


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



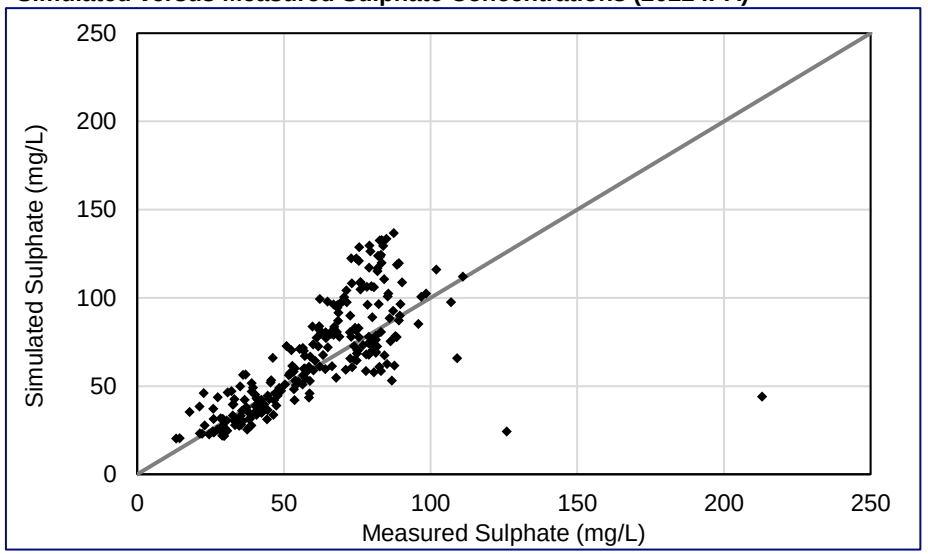
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-41: Sulphate Calibration Information for Node EV_ER2 - Elk River u/s of Michel Creek (EMS 0200111)

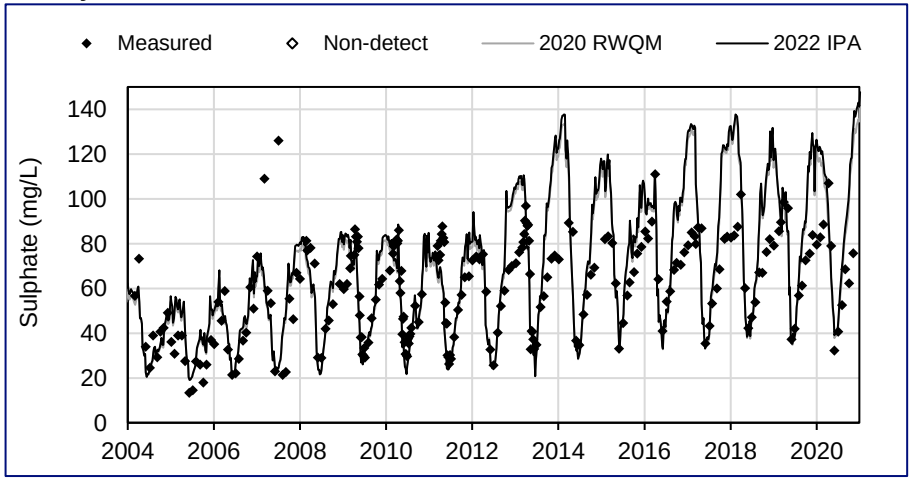
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	3/2/2004	3/2/2004
Last Measured Sample	12/3/2018	12/3/2018
Data Points Available for Comparison, n	221	221
Non-Detect Count	0	0
Measured Mean (mg/L)	59	59
Simulated Mean (mg/L)	62	63
Bias (mg/L)	2.8	4.1
Relative Bias	1.0	1.1
Error (mg/L)	13	14
Percent Error	22%	23%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

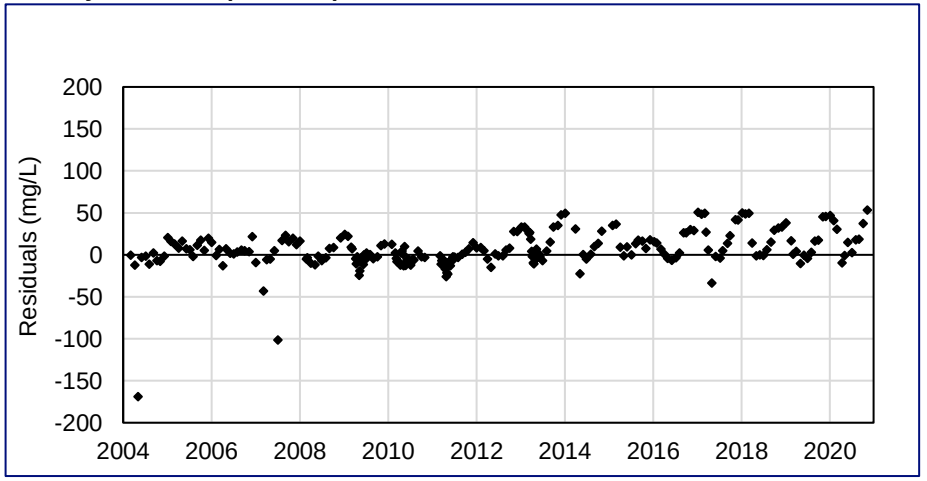


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



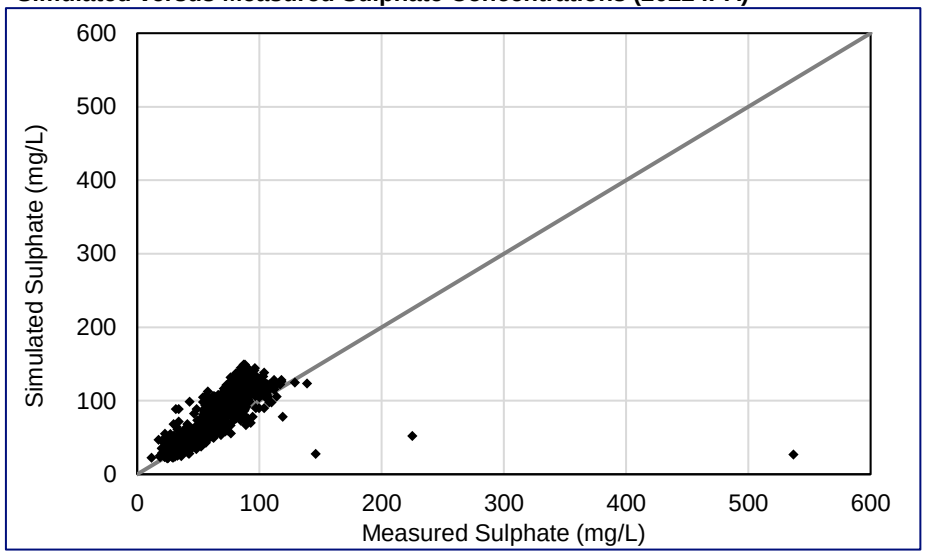
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-42: Sulphate Calibration Information for Node EV_ER1 - Elk River d/s of Michel Creek (EMS 0200393)

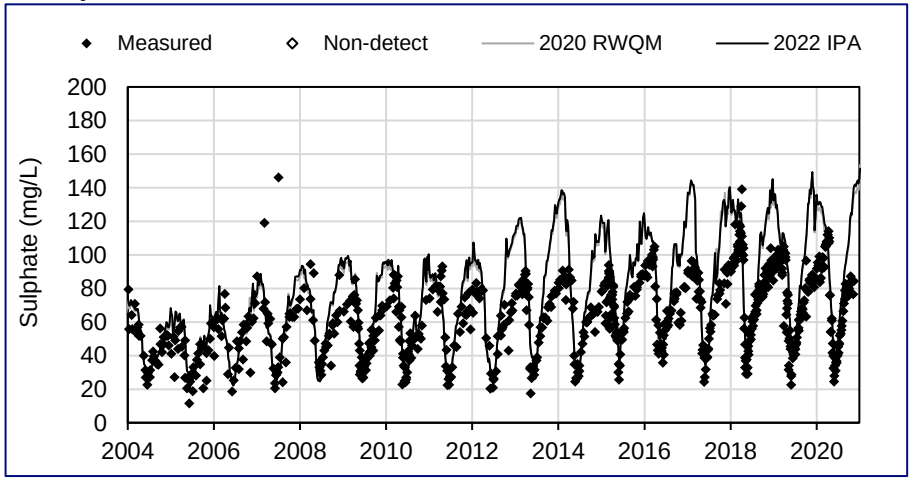
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/6/2004	1/6/2004
Last Measured Sample	12/31/2018	12/31/2018
Data Points Available for Comparison, n	686	686
Non-Detect Count	0	0
Measured Mean (mg/L)	63	63
Simulated Mean (mg/L)	74	75
Bias (mg/L)	11	12
Relative Bias	1.2	1.2
Error (mg/L)	16	17
Percent Error	26%	27%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

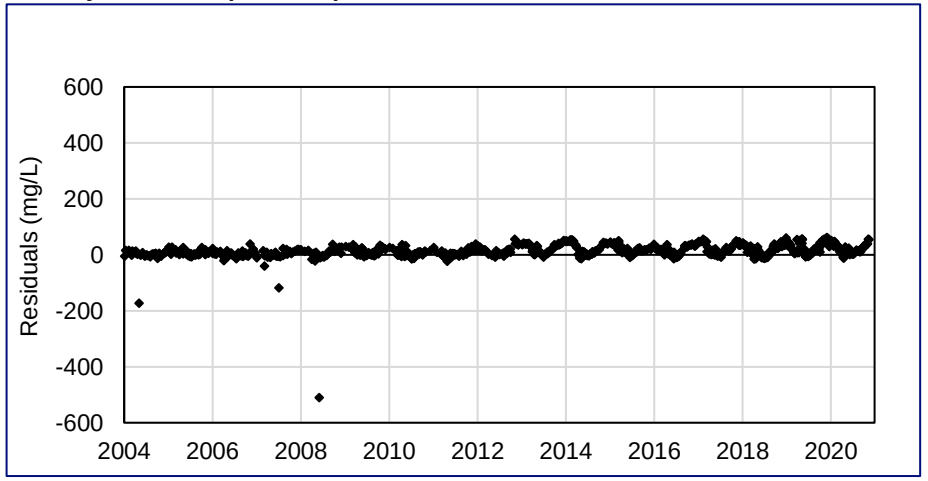


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



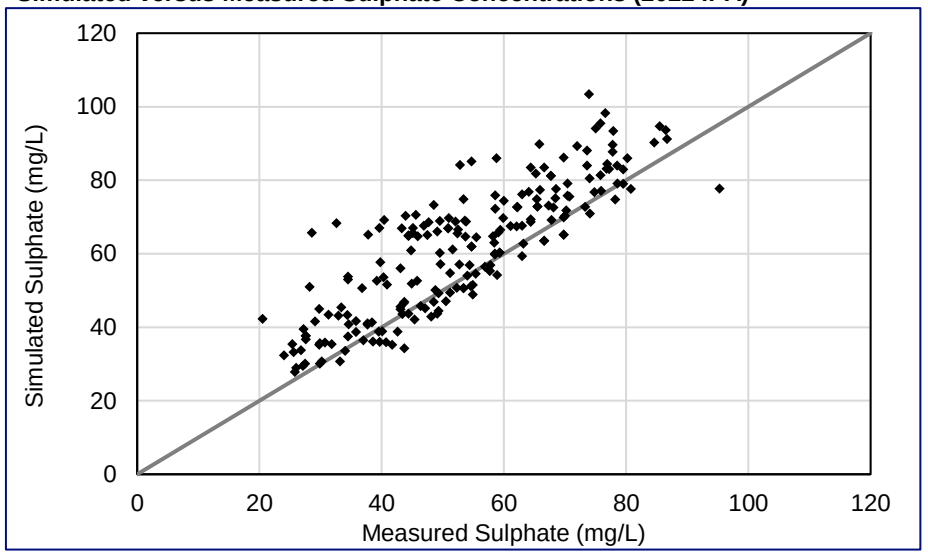
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-43: Sulphate Calibration Information for Node RG_ELKORES - Elk River at Elko Reservoir (EMS E294312)

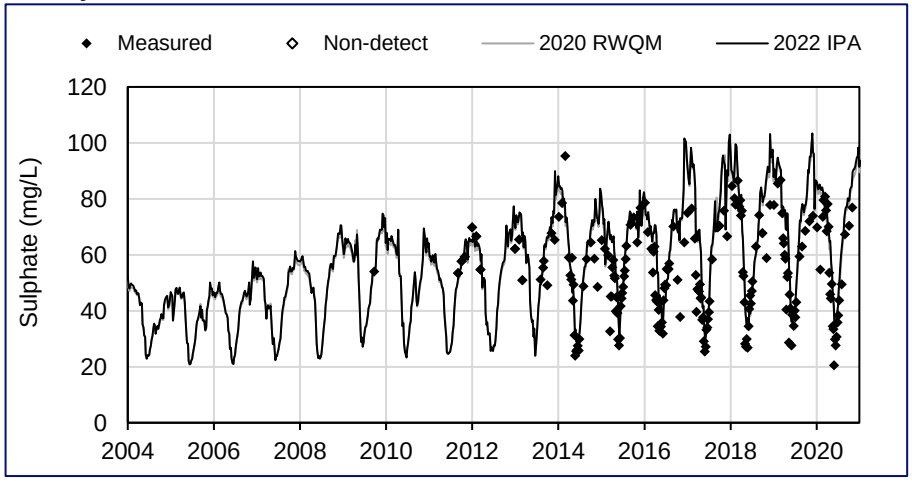
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	9/23/2009	9/23/2009
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	155	155
Non-Detect Count	0	0
Measured Mean (mg/L)	53	53
Simulated Mean (mg/L)	60	60
Bias (mg/L)	6.8	7.2
Relative Bias	1.1	1.1
Error (mg/L)	8.7	8.9
Percent Error	16%	17%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

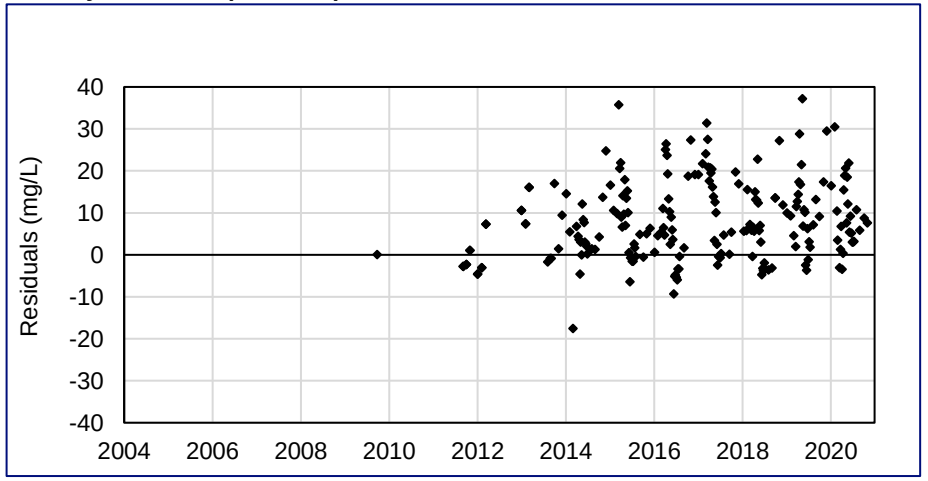


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



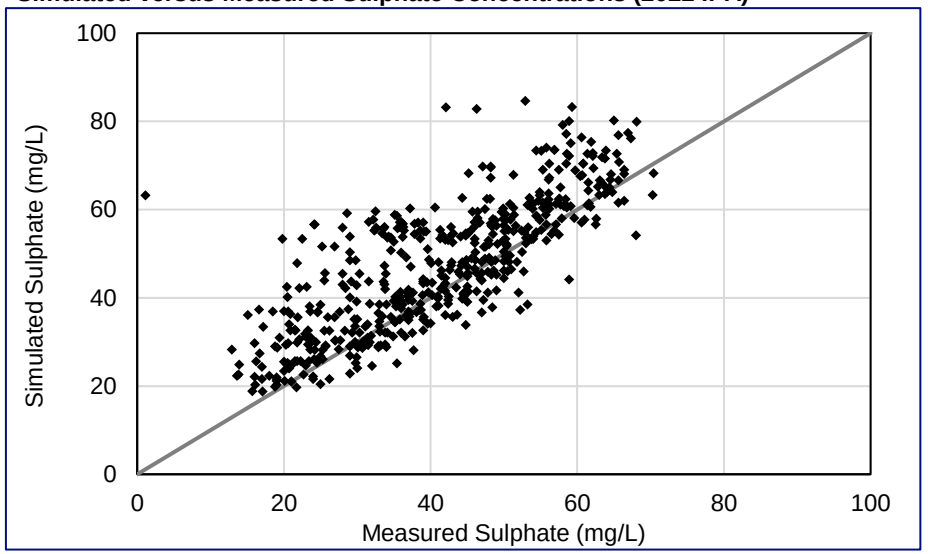
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-44: Sulphate Calibration Information for Node RG_ELKMOUTH - Elk River at Highway 93 near Elko

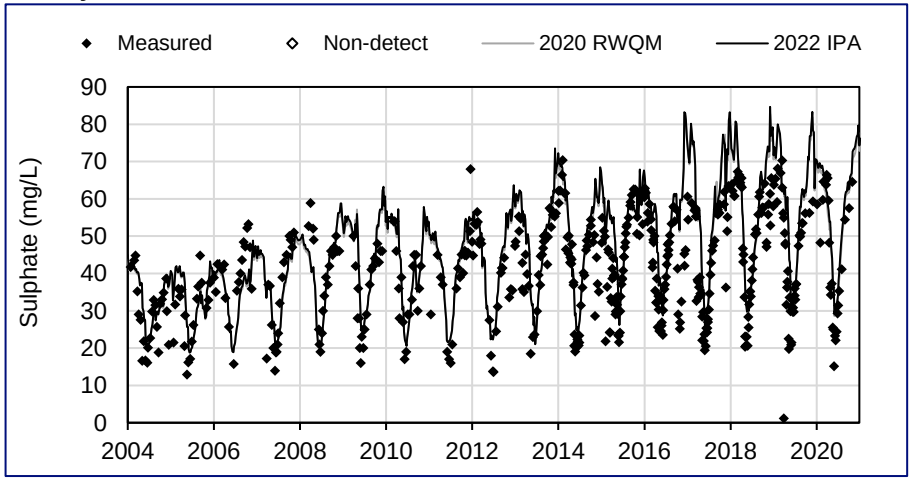
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	1/26/2004	1/26/2004
Last Measured Sample	12/16/2018	12/16/2018
Data Points Available for Comparison, n	449	449
Non-Detect Count	0	0
Measured Mean (mg/L)	40	40
Simulated Mean (mg/L)	46	46
Bias (mg/L)	5.5	5.9
Relative Bias	1.1	1.1
Error (mg/L)	7.7	7.8
Percent Error	19%	19%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

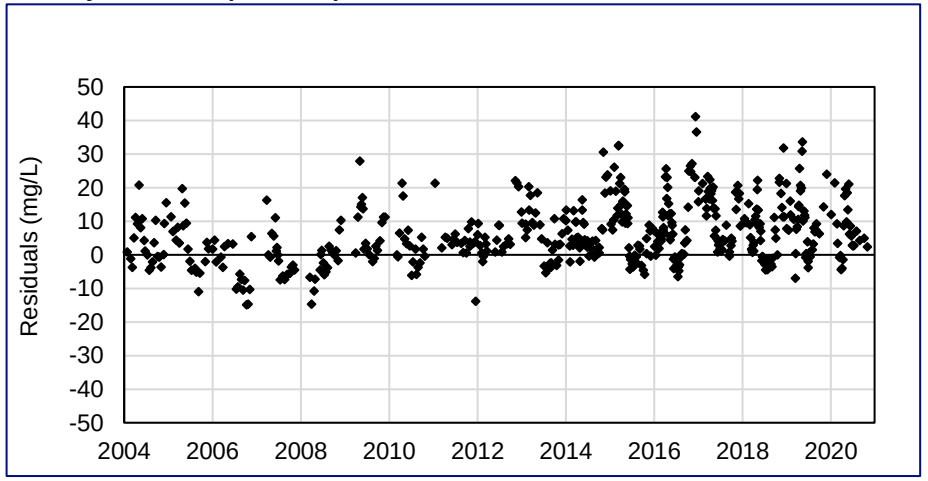


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



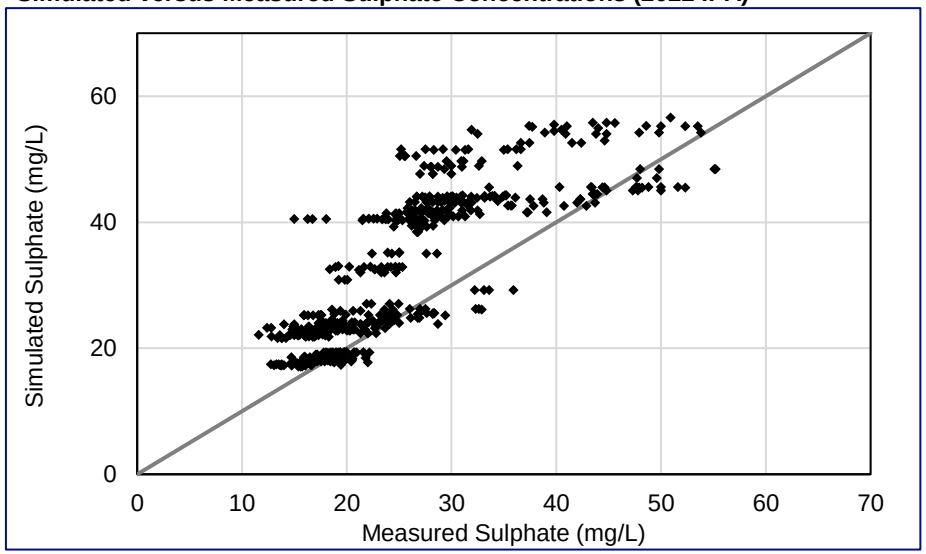
Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.

C1-45: Sulphate Calibration Information for Node RG_DSELK - Koocanusa Reservoir - South of the Elk River (EMS E300230)

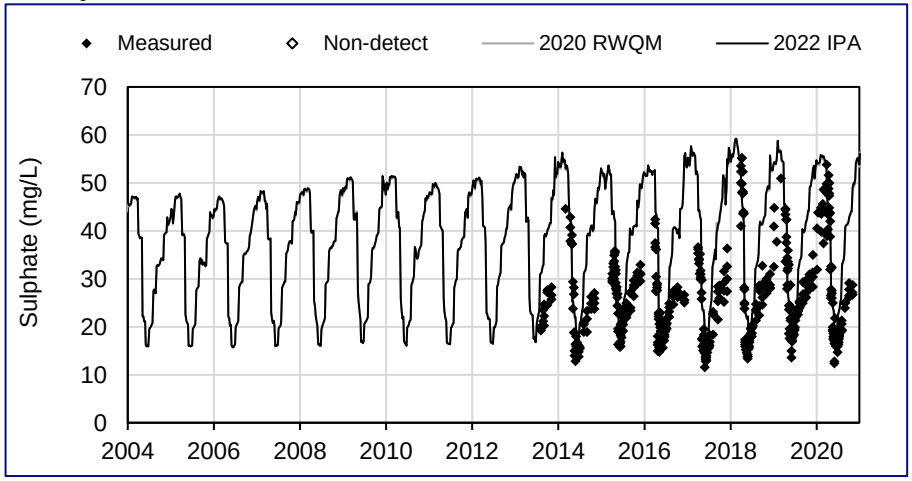
Measured and Simulated Sulphate Data and Calibration Statistics

Statistic	2020 RWQM	2022 IPA
Model Averaging Period	Weekly	Weekly
Calibration Period	2004 to 2018	2004 to 2018
First Measured Sample	8/7/2013	8/7/2013
Last Measured Sample	12/4/2018	12/4/2018
Data Points Available for Comparison, n	377	377
Non-Detect Count	0	0
Measured Mean (mg/L)	24	24
Simulated Mean (mg/L)	32	32
Bias (mg/L)	7.6	7.6
Relative Bias	1.3	1.3
Error (mg/L)	8.0	8.1
Percent Error	33%	33%

Simulated versus Measured Sulphate Concentrations (2022 IPA)

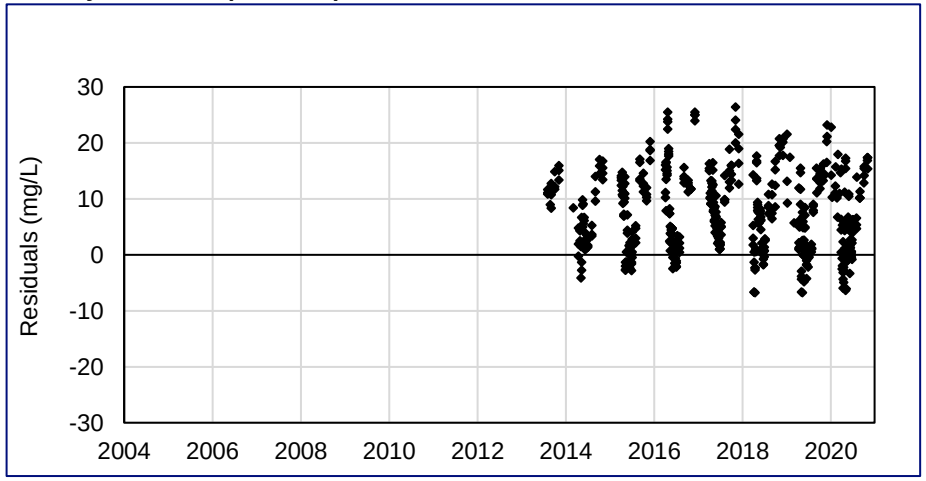


Weekly Simulated and Measured Concentrations



Notes: Measured data are individual sample results.
In 2020, projected median weekly concentrations are presented.

Weekly Residuals (2022 IPA)



Note: Weekly Residual = Weekly Simulated Value - Instantaneous Measured Value.