Development of Statewide Risk Assessment for California Wastewater Systems

ADVISORY GROUP SUMMARY – JANUARY MEETING

RISK ASSESSMENT SUMMARY

Three separate Risk Assessments will cover the three different facility and system types which meet the inclusion criteria for the WWNA, which have been detailed fully in the Phase 1 WWNA report. These assessments cover: 1) National Pollutant Discharge Elimination System (NPDES) facilities, 2) Waste Discharge Requirements (WDRs) facilities, and 3) Sanitary Sewer System General Order (SSSGO) systems. This Executive Summary details the criteria used to define a facility or system as At-Risk in the WWNA.

Risk Criteria Development

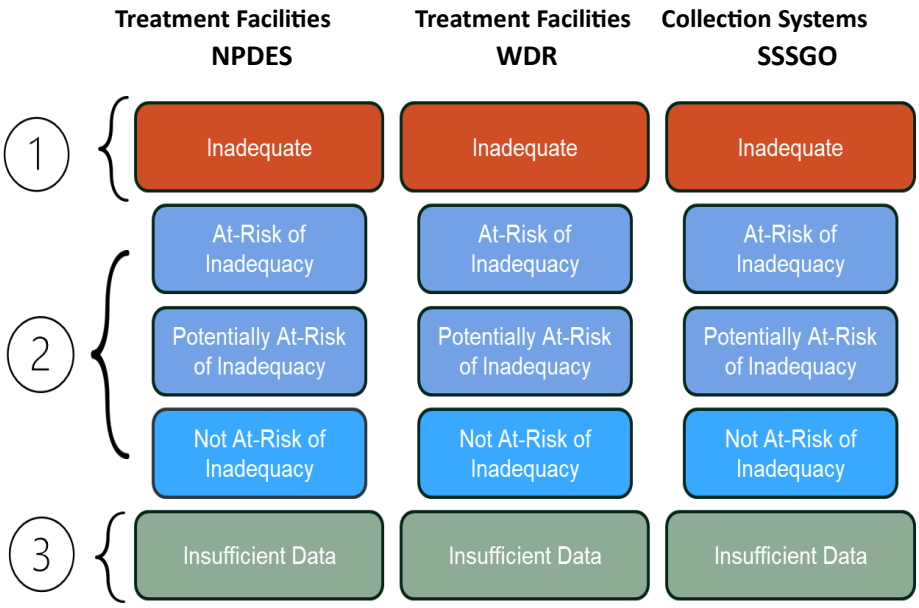
We began developing the Risk Criteria in early 2024. By July 2024, we established a Working Group of State and Regional Water Boards staff to primarily help inform the Inadequacy Assessments' criteria, but they also assisted with development of the Risk Criteria. They helped us establish variables' thresholds and weights, along with evaluating if there is sufficient data for each variable.

We have also presented our Risk Criteria at three Advisory Group meetings and within the WWNA Phase 1 report, on which we solicited feedback from the Advisory Group members. WWNA "Office Hours" have been another forum for Advisory Group members to share thoughts and ideas about specific criteria which we have done our best to incorporate into the finalized criteria.

Risk Criteria Overview

There are four risk criteria categories: socioeconomic, operational, environmental, and public health. Each category contains a unique set of variables designed to comprehensively evaluate a facility or systems risk of inadequacy. An overall risk score will be calculated for each facility or system. The top quartile (75th percentile and up) will be identified as At-Risk of Inadequacy. Those in the 50th-75th percentile will be identified as Potentially At-Risk, and all other systems and facilities will be identified as currently Not At-Risk of Inadequacy.

Figure 1. Assessments by Facility and System Type



If a facility or system is missing data for one or more risk variables, that variable will be omitted for the purposes of the first WWNA. The overall risk calculation will still be calculated with the existing risk variables unless a facility or system is missing data for multiple risk variables. This situation will be evaluated on a case-by-case basis, and these facilities or systems may have to be excluded from the Risk Assessment and included in an Insufficient Data category. Future iterations of the WWNA will hopefully be able to include data availability and quality for the Risk Assessment process.

Spatial Analysis

To apply risk variables such as socioeconomic or climate change vulnerability to facilities and system we will use GIS analysis to construct system-level profiles of the population served by that facility or system. For example, we will use demographic and income data from the U.S. Census Bureau to estimate each system's served population by racial/ethnic group or identify those with high proportions of historically marginalized populations. These system-level characteristics can then be assigned, in whole, or with additional effort to differentiate, to individual wastewater facilities or systems' service area boundaries. To conduct this spatial analysis, we are relying on sanitary sewer system service area boundaries that are submitted from the systems themselves to the State Water Board. For NPDES and WDR facilities that do not have a service area, we will rely on latitude/longitude data and street address data within CIWQS to geolocate these facilities.

Included Risk Variables

Table 1 details the risk variables that will be included in the first WWNA. Additional risk variables were considered, but ultimately excluded for a variety of reasons, described in Chapter D of the WWNA Phase 1 Report.

Thresholds

To develop thresholds for the risk variables, we considered research from the California Drinking Water Needs Assessment, academic institutions, other state agencies nation-wide, and US EPA's standards. Few exact risk indicator thresholds were derived from these additional sources given the unique goals of the WWNA. More commonly, thresholds were derived using cut points in the distribution of data, or from direct recommendations from Water Boards staff. Tiered thresholds were developed to capture more nuanced degrees of risk within variables.

Scores

To enable the evaluation and comparison of risk indicators, a standardization score between 0 and 1 will be applied to each risk variable threshold. The score normalizes the threshold and allows the Risk Assessment to assess facility and system performance across all risk variables.

Weights

Weights between 1 and 3 will be applied to individual risk variables, with a weight of 3 indicating the highest level of criticality. The individual risk variable weights were developed with the professional opinion of Water Boards staff, Advisory Group members, and our internal WWNA project team.

Table 1. Individual Risk Variable Thresholds, Scores, and Weights

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
Socioeconomic	Household Socioeconomic Burden (Poverty Prevalence)	Part 1 of composite socioeconomic burden indicator below. Percent of the population living below two times the federal poverty level.	NPDES, WDR, SSSGO	<20%	0	2	0
				20%-35%	0.125		0.25
				> 35%	0.5		1
	Household Socioeconomic Burden (Housing Burden)	Part 2 of composite socioeconomic burden indicator below. Percent of households that are both low income (making <80% of the Housing and Urban Development (HUD) Area Median Family Income) and severely burdened by housing costs (paying >50% of their income to housing costs).	NPDES, WDR, SSSGO	<14%	0	2	0
				14%-21%	0.125		0.25
				>21%	0.5		1
	Household Socioeconomic Burden (Combined)	Measures household poverty prevalence and housing burden using a composite score. Communities with high levels of poverty and high housing costs may struggle more to pay for the necessary upgrades, maintenance, and operation of wastewater facilities and systems.	NPDES, WDR, SSSGO	0-0.125	0	2	0
				.25-.5	0.5		1
				.625-1	1		2
	Disadvantaged Community Status and Severely	Identifies when a community's median household income is at or below 80 percent of the statewide median		MHI > 80% of State MHI	0	2	0

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	Disadvantaged Community Status	household income (MHI). SDAC- Identifies when a community's median household income is at or below 60 percent of the statewide MHI.	NPDES, WDR, SSSGO	MHI < 80% and > 60% of State MHI	0.5		1
				MHI < 60% of State MHI	1		2
	Race and ethnicity of community	The racial and ethnic makeup of the community served by a Wastewater System and Facility. Historically marginalized people and communities are disproportionately likely to be without access to safe water and sanitation.	NPDES, WDR, SSSGO	Population < 50% Non-Hispanic White	0	2	0
				Population > 50% Non-Hispanic White	1		2
Operational	Percent of system cleaned annually	Indicates insufficient system maintenance, increasing risk of system inefficiency or failure.	SSSGO	> 60% of system cleaned annually	0	2	0
				20 - 60% of system cleaned annually	0.5		1
				< 20% of systems cleaned annually	1		2
	Percent of system inspected annually with closed-circuit television (CCTV)	Indicates inadequate inspection practices, increasing the likelihood of undetected issues and reducing system reliability.	SSSGO	> 10% of system inspected	0	1	0
				< 10% of system inspected	1		2

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	Relative System Capacity	The system's flow relative to population served. Indicates if the system is at-risk of backups or overflows.	SSSGO	<120 gal per capita per day I&I - average dry weather flow	0	3	0
				<275 gal per capita per day I&I - average wet weather flow	0		0
			SSSGO	>120 gal per capita per day I&I - average dry weather flow	1		3
				>275 gal per capita per day I&I - average wet weather flow	1		3
	Age of system	Older systems may be more likely to experience structural failures, capacity issues, and increased maintenance needs.	SSSGO	> 50% of system built after 1980	0	1	0
				> 50% of system built before 1980	0.5		0.5
				> 50% of system built before 1940	1		1
	System Governance Type	The legal entity that manages a wastewater facility or system.	NPDES, WDR, SSSGO	System owned publicly	0	1	0
				System owned privately	1		1
	Operator Certification	Measures if a certified operator is present at a wastewater treatment facility and, if so, if the certification	NPDES, WDR, SSSGO	Sufficient operator certification	0	3	0
				Insufficient operator certification	1		3

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
		present is sufficient for the wastewater facility or system.					
	Depopulation	Measures the population decline of areas served by a wastewater system and facility. A shrinking customer base can lead to difficulties covering fixed costs and necessary upgrades.	NPDES, WDR, SSSGO	Population decline of < 10% in 5-years	0	1	0
				Population decline of 10-15% in 5-years	0.5		0.5
				Population decline of > 15% in 5-years	1		1
	Population growth	The increase in the population served by a wastewater system and facility. Rapid population growth can lead to hydraulic overloading and operational constraints.	NPDES, WDR, SSSGO	Population growth of < 10% in 5-years	0	1	0
				Population growth of 10-15% in 5-years	0.5		0.5
				Population growth of > 15% in 5-years	1		1
	Population served by system	The total number of people served by a given wastewater treatment facility or collection system. Necessary volume and capacity estimates are a function of the population served by the system.	NPDES, WDR, SSSGO	Population served by systems > 2,500	0	1	0
				Population served by system < 2,500	1		1

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	SSMP missing	Sanitary Sewer Management Plan missing not submitted for the last 6 years, or the submitted plan is from 6+ years ago.	SSSGO	SSMP submitted within the last 6 years, or existing plan is from last 6 years	0	1	0
				No SSMP submitted in the last 6 years, or existing plan is from 6+ years	1		1
	Effluent violation limits (WDR)	Builds upon WDR Inadequacy Criteria. Examples: If Inadequacy exceedance threshold is 20%, at-risk is 0–19%. If Inadequacy exceedance threshold is 40%, 20-39%. If Inadequacy exceedance threshold is 60%, at-risk is 40-59%.	WDR	System does not exceed the permit limit by up to 20% less than the established high-exceedance Inadequacy Criteria threshold in any 2 months within a 6-month period.	0	2	0
				System exceeds the permit limit by up to 20% less than the established high-exceedance Inadequacy Criteria threshold in any 2 months within a 6-month period.	1		2
	12-month and 5-year rolling average volume of spill/population	Builds upon SSSGO Inadequacy Criteria. Identifies systems in 50-75th percentile for both 12-year and 5-year rolling	SSSGO	<50th percentile for both 12-month and 5-year rolling average number of spills in system size groups	0	2	0

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	served in size category	average volume of spill/population served.		50-75th percentile for both 12-month and 5-year rolling average number of spills in system size groups	1		2
	Average spill recovery rate	Spill recovery rate = Total spill volume / spill recovered	SSSGO	>50% average spill recovery rate	0	2	0
				50-10% average spill recovery rate	0.5		1
				<10% average spill recovery rate	1		2
	Near discharge exceedance - Limit Threshold	DMR effluent value approaching limit.	NPDES	Discharge value >20% below limit.	0	1	0
				Discharge value within 11-20% of limit.	0.5		0.5
				Discharge value within 10% of limit.	1		1

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	Near discharge exceedance - Fraction Near Exceedance Threshold	The frequency of near-exceedance discharges.	NPDES	Facilities near limit exceedance <25% of discharges	0	1	0
				Facilities near limit exceedance 50-25% of discharges	0.5		0.5
				Facilities near limit exceedance >50% of discharges	1		1
	Near discharge exceedance - Slope Threshold	The minimum slope of measurements vs dates over the past 10 years.	NPDES	upward trend of <2.5% change in effluent exceedances over time	0	1	0
				upward trend of 2.5-<5% change in effluent exceedances over time	0.5		0.5
				upward trend of ≥5% change in effluent exceedances over time	1		1
	Combined near-exceedance and slope threshold	Identifies facilities that have had an upward trend of exceedance or near-exceedance over the past 10 years.	NPDES	Facility potentially at-risk or not at-risk for both or either near-exceedance limit threshold and slope threshold	0	2	0
				Facility at-risk for both near-exceedance limit threshold and slope threshold	1		2

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
Environmental	Future permit additions due to discharge to impaired waterbody	Identifies facilities discharging to waterbody added to the California Integrated Report in the past 5 years for a pollutant the facility does not currently have a limit.	NPDES	Facility not discharging to waterbody on 303(d) list	0	2	0
				Facility discharging to 303(d) waterbody and does not have a limit for regulated pollutant	1		2
	Drought	Drought impacts and associated conservation measures contribute to lower indoor water usage. Declining indoor water flows can pose risk to wastewater facilities and systems. Projected average daily precipitation during an extended drought scenario from 2023–2042.	NPDES, WDR, SSSGO	>75th percentile	0	1	0
				75-10th percentile	0.5		0.5
				<10th percentile	1		1
	Sea Level Rise	For coastal wastewater facilities or systems, sea level rise can cause flooding or block system outflows, among other negative system impacts. Projected sea level rise zone under a flood scenario in 2030.	NPDES, WDR, SSSGO	Not within projected sea level rise zone	0	1	0
				Within projected sea level rise zone during under a 50m scale median flood scenario.	0.5		0.5
				Within projected sea level rise zone during under a 2m scale median flood scenario.	1		1

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
	Extreme Precipitation	Very high precipitation levels can increase influent levels past the acute or chronic capacity of a wastewater facility or system. Projected extreme precipitation days in which daily precipitation exceeds ≥20mm in year 2030 under standard emissions (RCP 4.5) scenario.	NPDES, WDR, SSSGO	1 or 0 extreme precipitation events per year in which the 2-day rainfall total is above an extreme threshold of 1 inch	0	2	0
				2-5 extreme precipitation events per	0.5		1
				>5 extreme precipitation events per year in which the 2-day rainfall total is above an extreme threshold of 1 in	1		2
	Flooding	Flooding can lead to wastewater infrastructure damage and forced treatment bypass. Projected flood zone during a 100-year storm and projected 1.0m of Sea Level Rise in year 2030.	NPDES, WDR, SSSGO	<.5m inundation depth during a likely 100-year storm and 1.0m Sea Level Rise projection	0	2	0
				0.5-4m inundation depth during a likely 100-year storm and 1.0m Sea level Rise projection	0.5		1
				>4m inundation depth during a likely 100-year storm and 1.0m Sea Level Rise projection	1		2
	Extreme Heat	Extreme heat events can impact wastewater facilities or systems' ability		<10 extreme heat days day per year	0	1	0

Risk Category	Risk Indicator	Description	Applies to	Thresholds	Score	Weight	Max Score
		to effectively and efficiently remove contaminants. Projected extreme heat days are considered days above the 98th percentile of daily maximum temperatures in year 2030 under standard emissions (RCP 4.5) scenario.	NPDES, WDR, SSSGO	10-20 extreme heat days day per year	0.5		0.5
				>20 extreme heat days day per year	1		1
	Wildfire	Wildfires can damage wastewater infrastructure and change flow levels. Projected yearly wildfire burn area in year 2030 using a "business as usual" climate change model and standard population growth scenario.	NPDES, WDR, SSSGO	<15-hectare ft modeled annual area burned under medium emissions scenario and central population growth scenario	0	1	0
				15–60-hectare ft modeled annual area burned under medium emissions scenario and central population growth scenario	0.5		0.5
				>60-hectare ft modeled annual area burned under medium emissions scenario and central population growth scenario	1		1

*note the Constituents of Emerging Concern variable has been removed from the Risk Assessment by recommendation of the Water Boards because of insufficient information currently available across all systems regulated by the Regional Water Boards to assign thresholds, scores, or weights to determine if a facility is "at-risk" due to CECs.