

EXECUTIVE SUMMARY

Peninsula Drainage District No. 1 (PEN1), in collaboration with the City of Portland Bureau of Environmental Services (BES), has developed this *Drainage and Water Quality Master Plan (DWQMP)* to present a clear understanding of the existing internal drainage system, to document current habitat and water quality conditions, and to provide an outline of improvements that address both existing and future needs.

This DWQMP evaluates the PEN1 operations and flood management capacity provided by pump stations and conveyance system infrastructure under Multnomah County Drainage District No. 1 (MCDD) management. Habitat and water quality deficiencies and opportunities for uplift are noted throughout the PEN1 District and in the immediately adjacent stretch of its receiving waterbody—the Lower Columbia Slough.

The PEN1 conveyance system includes a series of sloughs, roadside ditches, stormwater pipes, and pump stations that convey water through and out of the PEN1 District boundaries. The primary objectives of this DWQMP are (1) to characterize the watershed function and drainage system capacity within the study area, (2) to identify conveyance and watershed deficiencies and areas with the greatest opportunity for improvement, and (3) to develop prioritized operational and capital projects that address these deficiencies and opportunities and are to be incorporated into the PEN1 and City of Portland (City) capital improvement plans.

PEN1 Overview

The PEN1 boundary includes the Columbia River to the north, I-5 to the east, the Columbia Slough to the south, and North Portland Road and the Union Pacific Railway embankment to the west. PEN1 encompasses Heron Lakes Golf Course, Portland International Raceway (PIR), Vanport Wetlands, the Expo Center, portions of Interstate 5 (I-5), and several industrial businesses. PEN1 is bound on two sides (north and south) by flood control levees, an internal cross levee separating PEN1 from the adjacent Peninsula Drainage District No. 2 (PEN2) to the east, and the railroad embankment separating PEN1 from the west. A vicinity and overview map of the PEN1 District are provided as Figures 1 and 2.

The PEN1 basin conveyance system transports surface water via open channels, pipes, culverts, and pump stations. The western side of the basin contains the Heron Lakes Golf Course. The western drainage system starts at Force Lake and collects and conveys runoff and groundwater through a series of channels, pipes, and culverts routed along the interior side of the western and southern basin borders and discharges into the forebay of the PIR pump station (PS). The northern end of the basin has a stormwater system along Marine Drive that serves the industrial and business area. The collected runoff is discharged, via outfalls, directly north to the Columbia River. The eastern side of the basin contains the Expo Center, Vanport Wetlands, and PIR. There is a weir gate and effluent structure at the Vanport Wetlands PS to allow for seasonal control of the water level within the wetlands. The Vanport Wetlands PS conveys flow leaving the Vanport Wetlands and flow from the southern end of the Expo Center. Drainage from the eastern side of the basin runs through a series of pipes, culverts, and sloughs that discharge through Mud Slough to the forebay of the PIR PS. The only way for the water to be moved out of this system into the Columbia Slough is via the PIR PS.

The movement of surface water through PEN1 is highly controlled by local pump stations. All water within the PIR PS basin is pumped out of PEN1 to the Columbia Slough. The following pump stations were considered when developing this DWQMP:

- Vanport Wetlands Pump Station
- Portland International Raceway Pump Station

PEN1's internal drainage system has mixed ownership and maintenance responsibilities of drainage infrastructure. This DWQMP concentrates primarily on a defined critical conveyance network where PEN1 focuses operations. A significant portion of PEN1's operational activities and capital project expenditures on the critical conveyance network are focused on the removal of debris and blockages that impede the movement of water through open channels and pump stations. A map of the PEN1-defined critical conveyance network is included as Figure 3.

Background and Stakeholders

The conveyance of surface water through the study area is important to protect the economic health of the region. The four drainage districts—PEN1, PEN2, MCDD and SDIC—along the Columbia River protect \$16 billion of annual economic activity and \$7.3 billion in assessed property value. The levees associated with these four drainage districts reduce flood risk from the Columbia River, and the internal drainage network moves surface water away from the managed floodplain to protect public and private property from flooding during and after storm events.

This DWQMP provides a detailed plan of projects, programs, and further areas of study to operate an internal drainage system and efficiently move surface water through the PEN1 basin while also improving habitat and water quality conditions. PEN1 and associated stakeholders will need to be proactive in maintaining and replacing aging infrastructure including the pump station and the conveyance network consisting of pipes, culverts, and open channels. PEN1 also needs additional planning to address emergency response and system resiliency as the region experiences increased uncertainty and potential risks related to a changing climate and predicted seismic events.

PEN1 is heavily reliant on partner agencies including BES, City of Portland Parks and Recreation, the Port of Portland, and Metro for management and maintenance of the conveyance infrastructure. Many of the projects proposed in this DWQMP will require joint attention to fund and construct the required upgrades. The transition of PEN1 into the Urban Flood Safety and Water Quality District¹ may yield additional resources to support these recommendations.

Drainage and Water Quality Master Plan Process

The DWQMP process included developing criteria to evaluate the conveyance system, pump stations, water quality, and habitat within the PEN1 basin. For the conveyance system and pump stations, the criteria looked at the condition and the capacity of the existing systems and set guidelines for design of capital projects. For water quality, the criteria looked at existing land cover and shade presence and set guidelines for design of capital projects. For habitat, the criteria looked at the availability and conditions

¹ <https://www.mcdd.org/who-we-are/ufswqd/>

of nesting habitat, rearing habitat, food and forage habitat, cover and protection from predators, and connectivity between habitat types for safe dispersal, and set guidelines for design of capital projects.

Technical analyses and investigations were conducted to develop an understanding of the drainage system, habitat, and water quality conditions, including the conveyance system and pump stations that move water through and out of the district. The primary technical analyses to support this plan are discussed in Sections 3 through 6 of this DWQMP, including:

- Pump station condition evaluation including development of condition ratings for mechanical, electrical, communications, piping, and structural systems at each pump station.
- Conveyance system condition evaluation including information on the age, material, and known defects of the pipes and culverts that form the primary drainage pathways through the district. A capacity analysis of the northern portion of the PEN1 District along Marine Drive that drains to the Columbia River was not included in this plan. BES has an ongoing project to improve the outfalls along Marine Drive, and the remaining stormwater system in this area was redesigned and constructed in 1992. Drainage characteristics since that time have not changed appreciably, and the pipe capacities are assumed to be adequate.
- Pump and conveyance system capacity analysis including updating PEN1's XP-SWMM hydrologic and hydraulic model to simulate the drainage network under current conditions and predict how the system might function in the future.
- Review of water quality sampling data within and surrounding the PEN1 District.
- Review of existing habitat conditions including current species observed within the PEN1 District.

The technical analyses that informed this plan were primarily completed in 2021 and 2022. Following the technical analyses, the project team identified problem areas, evaluated potential project solutions, and developed an action plan of capital projects, operational adjustments, and future studies.

The master plan process also included public outreach and coordination through surveys to all PEN1 District property owners, meetings with partner agencies, and presentations to stakeholders for input and direction.

Recommended Actions

This DWQMP considers an integrated approach to managing the conveyance and pump station systems and improving water quality and habitat conditions throughout PEN1 basin. The recommended actions provide a long-term strategy to manage the storage, movement, and condition of water and habitat in the PEN1 basin. The following actions are recommended:

- Plan for redundancy improvements and replace the PIR PS and its discharge piping.
- Plan for redundancy improvements and replace the Vanport PS and its discharge piping.
- Replace or rehabilitate failing or undersized conveyance infrastructure in the critical conveyance network.
- Reduce flood risk and improve habitat through culvert removals.
- Improve debris management (e.g., debris barriers and trash rakes).
- Actively manage sediment and erosion issues.

- Improve habitat and water quality conditions through plantings, shoreline grading, and specific habitat element improvements.
- Improve habitat and water quality conditions at the forebay of the PIR PS.
- Improve habitat along the lower Columbia Slough.
- Actively monitor water quality problem areas through regular sampling.

Table ES-1 summarizes the capital projects recommended in this DWQMP. Project locations are shown in Figure 10. The recommendations will improve the PEN1 basin internal drainage system by efficiently conveying surface water, providing flood protection during peak storm events, improving water quality conditions, and enhancing habitat for local species.

Table ES-1. Recommended Capital Projects

CIP	Stakeholder Lead	Project	Location	Preliminary Cost Estimate	
				Low	High
DR #1	PEN1	PIR PS Replacement – with permanent generator	PIR PS	\$8,630,000	\$18,480,000
		PIR PS Replacement – with portable generator		\$8,140,000	\$17,430,000
DR #2	PEN1	Vanport PS Replacement – with permanent generator	Vanport PS	\$2,230,000	\$4,770,000
		Vanport PS Replacement – with portable generator		\$2,040,000	\$4,360,000
DR #3	PEN1	Golf Course Culvert Channel Daylighting	Northwest area of Heron Lakes Golf Course, near the western boundary of the PEN1 basin	\$230,000	\$490,000
DR #4	PEN1	Force Ave Channel Daylighting	N Force Ave, north of N Broadacre Dr	\$950,000	\$2,020,000
DR #5	PEN1	Mud Lake Discharge Culvert Replacement	Northeast area of Heron Lakes Golf Course, north side of Mud Lake	\$450,000	\$950,000
HWQ #1	BES	Plantings	PEN1 basin	\$650,000	\$1,390,000
HWQ #2	BES	Shoreline Grading	PEN1 basin	\$1,530,000	\$3,270,000
HWQ #3	BES	PEN1 Habitat Improvements	PEN1 basin	\$17,000	\$36,000
HWQ #4	BES	PIR PS Forebay Improvements	PIR PS	\$2,200,000	\$4,700,000
HWQ #5	BES	Lower Slough Habitat Enhancements	Lower Columbia Slough	\$2,370,000	\$5,070,000

BES = Bureau of Environmental Services; CIP = capital improvement plans; DR = Drainage; HWQ = Habitat and water quality; PEN1 = Peninsula Drainage District #1; PIR = Portland International Raceway; PS = pump station

Table ES-2 summarizes programmatic recommendations for PEN1 and the City of Portland. These are the operational actions with an annual funding need to monitor the condition of the conveyance system, perform preventative maintenance on pump stations, prepare for emergencies, and plan for future replacements before systems reach failure conditions. Detailed information about these programs and studies is provided in Section 8, Project Selection, of this plan.

Table ES-2. Recommended Programs

Program	Timeline
CCTV Inspection and Condition Assessment Program	Conduct over 5 years
Pump Station Testing and Monitoring	Ongoing cost per year (average)
Districtwide Debris Barrier Program	10 years
Ongoing Periodic Pump Rebuilds	10 years
Sediment Management Plan	Annually
Beaver Management Program	Annually
Flow Control Requirements Evaluation	One-time study
Pump Station Structural Evaluation and Resiliency Study	One-time study – shared throughout MCDD
Access and Easement Needs Study	One-time study
Water Quality Monitoring	Ongoing cost per year (average)
Sediment Load Source Evaluation	Annually
Levee Seed Mix Evaluation	One-time evaluation
Heron Lakes Golf Course Vegetation Management Evaluation	One-time evaluation
Water Quality Sampling and Assessment of Stormwater to Marine Drive Right of Way	One-time evaluation

An important next step for PEN1, BES, and other stakeholders will be to establish a plan for funding these projects and program needs. In addition to current funding sources, PEN1 and BES should seek new revenue streams or grant funding opportunities related to emergency preparedness, flood protection, and watershed health.