3. IDENTIFICATION AND DESCRIPTION OF THE PROBLEM

Due to the environmental impact of untreated stormwater entering natural receiving waters from the the Park, and ongoing issues with flooded roadways, localized surface ponding and stormwater pooling at depths that block vehicular and pedestrian access routes the City of Parksville has requested a Storm Water Management Master Plan for the Park (PCPSWMMP) to mitigate storm related flooding, provide treatment to stormwater runoff and plan for future precipitation and sea level conditions at the site. Performance of the existing stormwater management system's quality and quantity controls, deficiencies in the system, and the resulting implications for park usage and protection of the built, cultural and natural environment, are evaluated and discussed in this section, and summarized in Table 7. The system assessment is used to identify and prioritize specific deficiencies in the system such that strategic improvements may be implemented to increase the capacity and resiliency of the system to extreme weather events and coastal inundation. Current and future trends are discussed in relation to meeting the expected level of service for stormwater management as the Park continues to develop. The issues in the study area are summarized at the end of this section in a problem statement, which leads into the planning and performance objectives of the Stormwater Management Master Plan informing the strategic improvements in each subcatchment.

3.1. Water Quality

Currently, runoff from approximately 35% of the Park, serviced by storm sewers, does not receive treatment to reduce pollutants discharged into Parksville Bay and the Englishman River Estuary. Runoff from the remaining 65% of the Park is managed by isolated systems that retain the majority of rainfall events each year. Activities within Parksville Community Park include passive and active recreation, low velocity roadways, parking areas, street sweeping, pruning and mowing. Potential sources of pollutants include vehicular contaminants such as oil, metals and rubber, fertilizer for turf maintenance, and sediments from exposed or eroding surfaces.

3.2. Water Quantity

The Park's stormwater system is intended to convey drainage away from frequently used park amenities however ponding, at times significant, is occurring on roadways, pathways and in vegetated areas even during smaller rainfall events. Continued development of the Park will increase impervious cover, runoff volumes and associated pollutants. Existing inland flooding issues will be exacerbated by climate change, including higher sea levels, more rainfall and potential additional impacts that have not yet been assessed, such as groundwater flooding. In addition, extreme sea levels are anticipated to inundate a substantial extent of the Park based on late-century climate change projections while higher "normal" tides will reduce discharge capacity.

3.3. Storm Sewer System Deficiencies

Treatment of runoff and ponding water during storm events are directly tied to the condition and design of the storm sewer system in the Park such as inlet capacity, pipe size, invert elevations and sizing of infiltration facilities. Modeling of the existing storm sewer infrastructure revealed that the

24-hour SCS Type 1A Pacific Coast storm is critical for both the minor system (10-year return period) and the major system (100-year return period), causing more ponding than shorter duration, more intense events. System deficiencies during both events are summarized in Table 6 and illustrated in Figure 21 and Figure 22. Ponding depths in Figure 21 and Figure 22 were derived from 2D modeling estimates of water depth across the ground surface represented by the digital elevation model (DEM). In support of anecdotal evidence, the continuous simulation model highlighted that late summer short duration, high intensity events exceed the inlet and pipe capacity of the system.

Table 6: Deficiencies in Existing Stormwater Management System

Rainfall Event	% of CBs & MHs Flooded	% of Pipe Length with Limited Capacity	Total Area of Road Flooding
10-year 24-hour SCS Type 1A Pacific Coast	37.5	13.5	1843 m^2 > 0.06 m deep
100-year 24-hour SCS Type 1A Pacific Coast	45.8	28.2	1384 m^2 > 0.15 m deep

Infiltration facilities (rock pits) within the Park, shown on Figure 17, have many uncertainties associated with them including volume, depth, inlet capacity and infiltration rate. The infiltration capacity of some of the existing rock pits is insufficient to mitigate nuisance flooding of some roads and parking areas (e.g. Ravenhill Road). This may be due to insufficient footprint area/storage, poor construction practices, clogging with fines or organic matter (lack of maintenance), limited infiltration capacity of in-situ soils, and/or shallow groundwater.

The storm sewer system at the southwest end of Sandcastle Drive does not have positive drainage to the ocean outfall due to a sag in the sewer system. An infiltration manhole located at the west corner of Sandcastle Drive and Salish Sea Drive retains all rainfall that cannot overtop the perched point in the system. Calibration of the model to observed surface flooding and water levels in the storm sewer network indicate that flood risk is primarily caused by design, installation and operational deficiencies in underground infrastructure as well as grading for overland flow routing.

Sediment clogging of the sea outfall appears to contribute to flood risk in the Park, however the frequency and mechanics of clearing the clogging is unknown. In addition, the system draining to Parksville Bay has limited free outfall capacity due to astronomical tides (i.e. when sea level rises above the invert for a portion of each day). Existing deficiencies are exacerbated by multi-day rainfall events since parts of the system cannot drain within 24 hours of an initial rainfall event.

Increased imperviousness during future infrastructure upgrades will result in increased demands on the existing, limited capacity storm sewers. As indicated in the CPMP, imperviousness is expected to increase from 31% to 33% over the next 20 years. Without stormwater management controls the planned changes to the site will further reduce capacity to manage stormwater runoff and increase pollutant loads by introducing additional impervious surfaces (e.g. pavement) and removing natural storage from the landscape (e.g. depressions, vegetated areas).

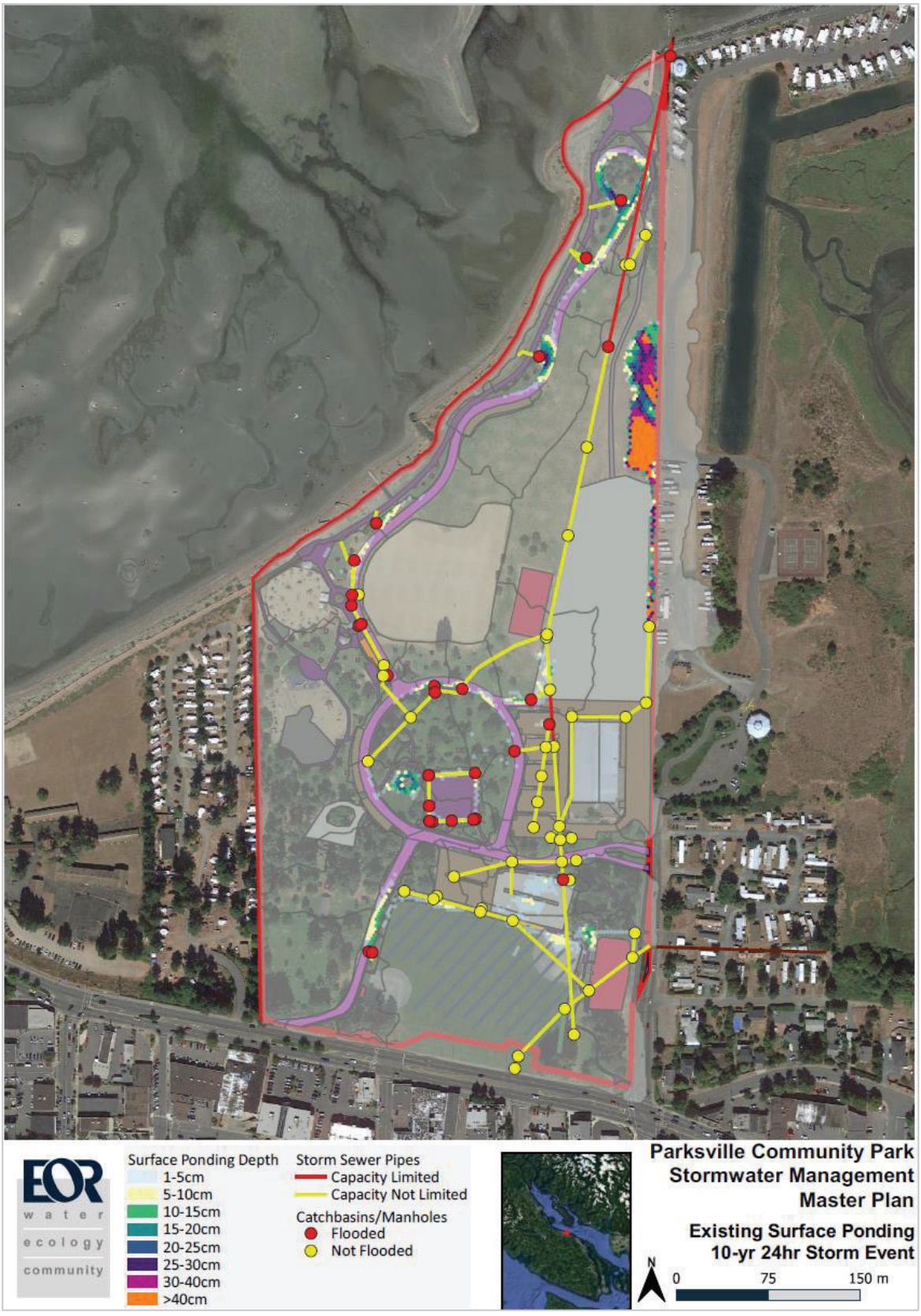

Figure 21. Existing Conditions Model Results during 10-Year 24-Hour SCS Type 1A Pacific Coast Rainfall Event

Figure 22. Existing Conditions Model Results during 100-Year 24-Hour SCS Type IA Pacific Coast Rainfall Event

Table 7. Existing and future expected subcatchment deficiencies

Name	Key Map	Existing Stormwater Infrastructure	Deficiencies /Conditions	Deficiency Description
Estuary		Storm sewer, Infiltration gallery		PRESENT DAY • The catchment currently drains to an outfall to the Englishman River Estuary. • The storm sewer between the Park and outfall crosses private property, raising concerns related to the City's liability and inability to access the pipe for maintenance. • Water quality in the Estuary is degraded from non-point source pollution and runoff from the catchment does not receive water quality treatment. • The baseball diamonds are drained by a draintile system and shallow flooding occurs in northeast diamond. • Poor infiltration potential east of lacrosse court based on organic silt identified in geotechnical analysis. • Moderate infiltration potential may exist in the wooded area north of the lacrosse courts.
Ravenhill Road		Rock Pit		PRESENT DAY • Existing infiltration rock pit serves as the only stormwater management facility servicing both the Ravenhill Road and Amphitheatre catchments. • The rock pit was not sized based on the volume required to manage runoff from the contributing area. • Design of the facility did not include pre-treatment to prevent sediment and organics from entering the system, nor the infrastructure required to clean out the inlet pipe and restore discharge capacity. • Sag in Ravenhill Road frequently floods due to the limited capacity within the infiltration rock pit. • Topography limits the emergency overflow pathway allowing considerable ponding before overtopping to flow north and into the storm sewer along Salish Sea Drive.
Amphitheatre		Ravenhill Road Rock Pit		PRESENT DAY • Much of this vegetated and treed area does not have positive overland drainage toward Ravenhill Road, resulting in surface ponding throughout. • Archaeological site DhSb-2 covers some of this catchment. FUTURE • An amphitheatre is planned in the southwest corner of the Park, increasing imperviousness and therefore runoff.
Southwest Sandcastle Drive		Infiltration Manhole, Storm Sewer		PRESENT DAY • The catchment ultimately drains to the sea outfall but a sag in the storm sewer prevents small rainfall events from draining to the trunk sewer and outfall. • Positive overland drainage exists along the roadways. • Isolated events are retained by an infiltration manhole. • The design and storage capacity of the infiltration manhole is unknown. • A small area of roadside parking consists of permeable pavers installed in 2015, and is functioning well. BY 2040 • A small increase in impervious cover is anticipated in this catchment based on future trail and amenity improvements. FUTURE

KEY: = Design Event Storm Sewer Surcharge; Future Increased Imperviousness; Design Event Surface Ponding; Isolated or Limited Overland Flow; Limited Outfall Treatment; Coastal Inundation Impacts

				• The system was not intended to drain inland flooding from coastal inundation. • Area is vulnerable to minor ponding from waves breaking along the shoreline. • Area is very vulnerable to late-century coastal inundation / associated impacts as it is located at the low point in the Park's shoreline pathway.
Tennis Court		Rock Pit		PRESENT DAY • The tennis courts drain to an underground rock pit that may be undersized or clogged. • Infiltration facility was not sized to manage runoff from the contributing area. • Runoff frequently ponds above drain inlets located around the tennis courts. FUTURE • This area will be vulnerable to late-century coastal inundation / associated impacts.
Volleyball Court		Drain pipe		PRESENT DAY • Ponding within volleyball courts occurs during large rain events. • Drain pipes direct water west, through the berm, to catchbasins along Sandcastle Drive. FUTURE • This area will be vulnerable to late-century coastal inundation / associated impacts.
Sandcastle Dr. Shoreline		Rock Pits		PRESENT DAY • The catchments drain to underground rock pits. • Infiltration facilities lack pre-treatment resulting in reduced capacity due to clogging. • Infiltration facilities were not sized to manage runoff from the contributing area, a potential cause for ponding in the roadway. • Tide fluctuations limit the discharge period through infiltration facilities. FUTURE • This area will be vulnerable to late-century coastal inundation and associated impacts.
Dry Basin		Vegetated Ditch, Dry Basin		PRESENT DAY • Surface ponding occurs in parking lot southwest of Arbutus Point, and the gravel pedestrian pathway at the north end of this key area due to creation of a berm during tree planting (alleviated with recently installed area drain). • Curling Club rooftop runoff directs water through a ditch to dry basin • Available dry basin volume is underutilized due to site grading. • Dry basin is suspected to be part of the original estuary prior to development of the Park. • Dry pond currently empties through infiltration and evapotranspiration. A hydraulic link to groundwater is suspected. • Some areas of adjacent RV Park drain to dry pond. BY 2040 • Planned roadway connection between Sandcastle Drive to Corfield Street North as part of CPMP. FUTURE • This area will be vulnerable to late-century coastal inundation / associated impacts.

KEY: = Design Event Storm Sewer Surcharge; Future Increased Imperviousness; Design Event Surface Ponding; Isolated or Limited Overland Flow; Limited Outfall Treatment; Coastal Inundation Impacts

Storm Trunk		Storm sewer, Catch basins		PRESENT DAY • Storm sewer trunk collects runoff from parking lots and roads before discharging at the ocean outfall. Diurnal tidal fluctuations, and occasional clogging with coastal sediment, limit the daily discharge period, and the overall system capacity. • Modeling indicates that the sewer surcharges to the surface during the current 10-year 24 hour storm event. BY 2040 • Pedestrian connections (pathways) are expected to add imperviousness to this catchment. FUTURE • This area will be vulnerable to late-century coastal inundation / associated impacts.

KEY: = Design Event Storm Sewer Surcharge; Future Increased Imperviousness; Design Event Surface Ponding; Isolated or Limited Overland Flow; Limited Outfall Treatment; Coastal Inundation Impacts