Evaluating Release Rates for Specific Watersheds in Cook County

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IAFSM March 13, 2019



Summary of MWRD Facilities

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7 Water Reclamation Plants

(including one of the worlds largest)
554 Miles of Interceptors
109 Miles of Deep Tunnels
10.6 Billion Gallons of CSO Storage

Includes Thornton Reservoir online in 2015





McCook Reservoir Phase I - 3.5 BG Online in 2017 Phase 2 - 6.5 BG Online in 2029



Watershed Management Ordinance (WMO) became effective May 1, 2014

- Applies to all development within the boundaries of Cook County, Illinois, and qualified sewer construction within the District's corporate boundaries or service agreement areas
- Components which are regulated under the WMO include:
 - Qualified Sewer Construction
 - Drainage and Detention
 - Volume Control
 - Floodplain Management
 - Isolated Wetland Protection
 - Riparian Environment Protection
 - Soil Erosion and Sediment Control
- Provides uniform stormwater management regulations to prevent future commercial, municipal, and residential development and redevelopment projects from exacerbating flooding and protects environmentally sensitive areas



WMO Article 5. Requirements for Stormwater Management

§504: Site Detention Requirements

- 3. The allowable release rate for a development shall be determined at the time a complete Watershed Management Permit application is accepted by the District and shall be:
 - A. 0.30 cfs/acre of development for the storm event having a one percent probability of being equaled or exceeded in a given year (100-year storm event) until April 30, 2019; and
 - B. Based on a watershed specific release rate after and including May 1, 2019 as specified in Appendix B. The watershed specific release rate shall not be less than 0.15 cfs/acre of development.



Release rate selection objective:

Determine regulatory release rates that mitigate the impacts of development by maintaining the 1% annual-chance flood event elevations at or below current levels.



Methodology

- Phase I
 - Evaluate two pilot study areas
 - Develop streamlined methodology and set of assumptions
 - Evaluate release rates for pilot study areas and garner technical feedback

Phase II

- Apply the methodology developed in Phase I in each Watershed Management Area
- Evaluate release rates for watersheds under WMO regulation





Selected Method



Model Elements

- Watershed
- Subwatershed
- Subbasin

Subwatershed Selection

- Identify key, selection controlling subwatersheds based on Phase 1 results
- Unnecessary to model every last acre



Selected Methodology

Base Model

 DWP Unsteady State HEC-HMS and HEC-RAS Models, analyzed at critical duration

• Future Development

 Uniform 40% Development/Redevelopment Meeting the WMO (with adjustments for preserve lands)

Detention

 Modeled reservoirs meeting various Watershed Release Rates for the 100-year 24-hour storm with separate control volume

Release Rate

• 0.15, 0.2, 0.25, and 0.3 cfs/acre were analyzed

 Updated for recent major stormwater projects

 Uniform development was selected to evaluate release rates. 40% was supported by land use change analysis

• Linear hydrograph modeled with storage-discharge functions.

 Outside of the WMO regulatory area the release rate of the adjoining jurisdiction was applied



Modeled Subwatersheds:

- Poplar Creek
- Poplar Creek South Branch
- Poplar Creek Lord's Park Tributary
- Poplar Creek Railroad Tributary

- Poplar Creek Schaumburg Branch
- Poplar Creek East Branch
- Poplar Creek Tributary A

		24	nour	
	Subwatershed	Average Base Conditions Peak Runoff Rate (cfs/acre)	Subbasin Base Conditions Peak Runoff Rate Range (cfs/acre)	Critical duration event
Poplar Creek	Tributary A	0.43	0.27 - 0.73	24 hr
	East Branch	0.44	0.22 - 0.67	24 hr
	Schaumburg	0.55	0.38 - 0.74	24 hr
	Railroad Tributary	0.35	0.27 - 0.71	24 hr
	South Branch	0.49	0.24 - 0.75	24 hr
	Lord's Park Tributary	0.39	0.29 - 0.71	24 hr
	Main stem Poplar Creek	0.37	0.14 - 0.67	24 hr

Base Runoff Rates



Future Model Results





Future Model Results





Modeled Subwatersheds:

- Upper Salt Creek Mainstem
- Upper Salt Creek West Branch
- Upper Salt Creek Arlington Heights Branch

Base Runoff Rates

		24 hour		
	Subwatershed	Average Base Conditions Peak Runoff Rate (cfs/acre)	Subbasin Base Conditions Peak Runoff Rate Range (cfs/acre)	Critical duration event
àalt <	Upper Salt Creek Mainstem	0.36	0.11 - 0.68	24 hr
per S Creek	Arlighton Heights Branch	0.35	0.14 - 0.63	24 hr
) Up	West Branch	0.26	0.11 - 0.55	24 hr



Future Model Results

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Future Model Results

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				WMO release rate			
Cal-Sag	shed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length
	/ater	Stream length with increase in peak WSEI> 0.1' (ft)	0	0	0	0	
	3	Stream length with increase in peak WSEl> 0.1' (%)	0.0%	0.0%	0.0%	0.0%	166,027
		Reservoirs in RAS model with increases > 0.5'	0	0	0	0	

go				WMO release rate			
ch Chica	itershed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length
sranc	r Wa	Stream length with increase in peak WSEl> 0.1' (ft)	0	108	108	0	
rthE	Rive	Stream length with increase in peak WSEl> 0.1' (%)	0.0%	0.0%	0.0%	0.0%	286,663
No		Reservoirs in RAS model with increases > 0.5'	0	0	0	0	



				WMO release rate				
Creek	hed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length	
Poplar (Iters	Stream length with increase in peak WSEl> 0.1' (ft)	0	0	0	2,448		
	Ma	Stream length with increase in peak WSEl> 0.1' (%)	0.0%	0.0%	0.0%	1.2%	203,498	
		Reservoirs in RAS model with increases > 0.5'	0	0	0	0		

L				WMO release rate				
net Rive	hed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length	
alun	Iters	Stream length with increase in peak WSEl> 0.1' (ft)	1,066	1,066	1,066	10,796		
ittle Ci	Wa	Stream length with increase in peak WSEl> 0.1' (%)	0.4%	0.4%	0.4%	4.2%	256,719	
		Reservoirs in RAS model with increases > 0.5'	0	1	0	1		



		١	Total			
llt Creek shed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length
er Sa 'ater	Stream length with increase in peak WSEI> 0.1' (ft)	2,200	2,530	15,794	83,964	
aq⊄ V	Stream length with increase in peak WSEI> 0.1' (%)	0.8%	0.9%	5.6%	29.7%	282,780
	Reservoirs in RAS model with increases > 0.5'	2	2	3	3	

		N	WMO release rate			
s River hed	Criteria	0.15 cfs/ac	0.20 cfs/ac	0.25 cfs/ac	0.30 cfs/ac	Stream length
alaine: atersl	Tributary stream length with increase in peak WSEI> 0.1' (ft)	0	0	9,727	52,483	530,318
Des F W	Tributary stream length with increase in peak WSEI> 0.1' (%)	0.0%	0.0%	1.8%	9.9%	
	Reservoirs with increases > 0.5'	0	0	0	2	



Study Results

Methodology

 Provides a robust, consistent, and objective tool for evaluating Watershed Specific Release Rates

Key Findings

- Selection of Watershed Release Rates are able to mitigate future increases in water surface elevation due to future development in some watersheds
- The study results support the principles of the 1991 NIPC study
 - The effectiveness of detention decreases with watershed size
 - Urbanization without detention causes dramatic increases in flooding
 - Runoff volume is not significantly impacted by release rate

Basis for Future Management Decisions

 The results provide a tool for the District to consider stormwater and watershed management strategies consistent with the goal of the WMO



Appendix B – Watershed Specific Release Rates

(Based on Watershed Planning Areas depicted in Appendix E)

- Upper Salt Creek: 0.20 cfs/acre
- *Poplar Creek:* 0.25 cfs/acre
- Lower Des Plaines: 0.20 cfs/acre
- Calumet Sag Channel: 0.30 cfs/acre
- Little Calumet River:
- North Branch:

0.25 cfs/acre

0.30 cfs/acre



Watershed Specific Release Rates

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- Recently Closed WMO Public Comment
 - January 7 February 7, 2019
 - 105 attendees at 7 public meetings
 - 17 entities submitted approx. 220 comments
- Currently making final changes from Public Comment & TAC
- Anticipate seeking MWRD Board Approval in April
- Drafted with WSRR Effective in January 1, 2020
- Further TGM and permit form updates over the summer
- Amendment available on website: WMO.MWRD.ORG

Effective Date

• Recommended WSRR effective date: January 1, 2020

A reasonable transition time allows project planning already contemplated under current design standards to move forward, smoothly transitioning to new standards without onerous impacts that could require redesign.

State Water Survey







2015

| 2014



Quarterly Volume ----Cumulative Volume

2016

2018



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Questions?





Reference Slides Follow



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NOTEWORTHY CHANGES



TO THE WMO



Article 5 – Stormwater Management

- Green Infrastructure as Non-Qualified Development:
 - New § 501.3 Green infrastructure that replaces what would otherwise be in-kind maintenance can be considered non-qualified and detention is not required





Article 5 – Stormwater Management:

§ 505 Development and Redevelopment Tributary to Existing Detention Facilitates

- Current allowances for redevelopment only consider adequacy of detention volume by comparing runoff coefficient / curve number
- Allowances are revised, for the watershed specific release rate requirements for the redevelopment area
 - Deleted former § 505.2.B "0.10 ac-ft or within 2%" allowance deleted and replaced with a new allowance for existing control structures
 - Added § 505.2.A Added to verify the release rate of existing control structures
 - Clarify new § 505.2.B Verify the volume of existing detention facilities



Article 5 – Stormwater Management:

New § 505.4.A – After January 1, 2020, development tributary to an existing detention facility must provide additional detention volume at the new release rate using Bulletin 70 rainfall data and the design methodology originally permitted as a proportion of the detention service area







Article 5 – Stormwater Management:

- Added § 505.4.B Replaces the old "0.10 ac-ft or 2%" volume allowance with requiring the control structure be updated every 40% of detention service area redevelopment or any individual redevelopment that is 25% of the detention service area
- Added § 505.4.C&D Requires that release rates of existing detention facilities be modified based on the Watershed Specific Release Rate on a pro-rated basis