APPENDIX C
Additional Risk Management Measures Evaluation Process Scenario Results (Scenarios 5 to 10)

MEMORANDUM

TO: Project Team, Guelph/Guelph-Eramosa Water Quantity Policy Development Study

FROM: David Van Vliet, Paul Chin and Jeff Melchin, Matrix Solutions Inc.

SUBJECT: Memo #3 – Additional RMMEP Scenario Results
Guelph/Guelph-Eramosa WHPA-Q1 Risk Management Measures Evaluation Process

DATE: June 14, 2018

1 ADDITIONAL RISK MANAGEMENT MEASURES SCENARIOS

Matrix Solutions Inc. (Matrix) previously conducted four preliminary Risk Management Measure (RMM) scenarios as part of the Risk Management Measures Evaluation Process (RMMEP). The purpose of these scenarios was to evaluate the potential for RMMs to mitigate the water quantity threats and reduce the water quantity risk level identified through the Guelph/Guelph-Eramosa Tier Three Assessment (Tier Three Assessment, Matrix 2017). These scenarios were based on RMMs selected from the RMMs Catalogue (TRCA 2013) and the results of the Threats Ranking, as reported in Memo #1 to the Project Team dated October 20, 2017. A description of these preliminary four scenarios and their results are summarized in Memo #2 to the Project Team dated November 13, 2017.

The preliminary RMM scenarios did not result in a reduction of the water quantity risk level and an additional six RMM scenarios were developed. These additional RMM scenarios are described below.

1.1 Risk Management Measures Scenario #5

RMM Scenario #5 was conducted under RMM "Optimization of Pumping Rates for Sustainable Yield" to further optimize municipal pumping and minimize drawdown at Arkell 1. This scenario incorporated the Tier Three Assessment Allocated rate of 73,450 m^3/d during average conditions, but was reduced to a minimum of 71,597 m^3/d during drought conditions. This lower rate meets the projected water demand for 2031 (71,595 m^3/d) reported in the Tier Three Assessment and based on the Water Conservation and Efficiency Strategy Update (RMSi 2009). Pumping at municipal wells was varied during drought conditions according to the simulated yield of the Glen Collector which drops to 1,892 m^3/d at the peak of the drought (1964), requiring higher pumping rates at some wells to supplement the loss of yield from the collector.

Table 1 shows pumping rates for individual municipal wells. The relative distribution of pumping was optimized in consultation with the City of Guelph's (the City) Water Services staff for all the scenarios. These rates were established considering the following:

1) Individual well capacities - some wells may be able to accommodate additional drawdown but they are already simulated at their maximum identified pumping capacity.

2) Mutual drawdown interference – some wells may be able to accommodate additional drawdown and have additional pumping capacity; however, the ability to increase pumping is limited where these wells create additional drawdown at other municipal wells that lack the ability to accommodate additional drawdown.

There may be other economic, operational and infrastructure constraints on the water supply system that are not explicitly considered in these model predictions.

1.2 Risk Management Measures Scenario #6

RMM Scenario #6 was conducted under RMM "Water conservation education systems" and RMM "Optimization of Pumping Rates for Sustainable Yield". The scenario incorporates a reduced demand of 69,872 m^3/d during average and drought conditions. This is the projected average day demand in the Water Supply Master Plan Update (WSMPU; AECOM and Golder 2014) for 2038. Similar to RMM Scenario #5, pumping rates were optimized at municipal wells to minimize drawdown at wells with limited ability to accommodate additional drawdown. This optimization includes completely removing pumping at the Arkell 1 Well. Table 1 summarizes the pumping rates simulated for each municipal well for this scenario under average and drought conditions.

1.3 Risk Management Measures Scenario #7

RMM Scenario #7 was conducted under RMM "Land Securement" and RMM "Optimization of Pumping Rates for Sustainable Yield" and tested the impacts of eliminating dewatering from the Dolime Quarry. The scenario incorporated the Tier Three Allocated drought rate of 73,542 m^3/d and maintained this rate during both average and drought conditions. Pumping rates were optimized at municipal wells to shift demand away from wells with limited ability to accommodate additional drawdown. Pumping was increased at wells with higher historical capacity or wells that may have increased capacity as a result of a water level rise associated with the cessation of quarry dewatering. Table 1 summarizes the pumping rates simulated for each municipal well for this scenario under average and drought conditions.

1.4 Risk Management Measures Scenario #8

RMM Scenario #8 was conducted under RMM "Increase of supply - addition of new supplies" and RMM "Optimization of Pumping Rates for Sustainable Yield" with the objective of shifting pumping away from at-risk wells, to potential new water supply wells identified in the WSMPU. The scenario included shifting some demands to the location of the Logan Test Well situated northeast of the City, while maintaining the Tier Three Assessment Allocated drought rate of 73,542 m^3/d during average and drought conditions. Table 1 summarizes the pumping rates simulated for each municipal well for this scenario under average and drought conditions.

1.5 Risk Management Measures Scenario #9

RMM Scenario #9 was identical to RMM Scenario #8, except that some demands were shifted to the location of GSTW-01-08 test well in south Guelph instead of the Logan Test Well location. This scenario was conducted under RMM "Increase of supply - addition of new supplies" and RMM "Optimization of Pumping Rates for Sustainable Yield" and maintained the Tier Three Assessment Allocated drought rate.

(73,542 m^3/d) during average and drought conditions. Table 1 summarizes the pumping rates simulated for each municipal well for this scenario under average and drought conditions.

1.6 Risk Management Measures Scenario #10

RMM Scenario #10 was similar to RMM scenarios #8 and #9, except that some demands were shifted to Ironwood and Steffler Park Test Wells in the core of the City instead of the locations of Logan Test Well or GSTW-01-08. This scenario was conducted under RMM "Increase of supply - addition of new supplies" and RMM "Optimization of Pumping Rates for Sustainable Yield" and maintained the Tier Three Assessment Allocated drought rate (73,542 m^3/d) during average and drought conditions. This scenario included additional reduction in pumping at wells in the core of the City that had limited capacity to accommodate additional drawdown (i.e., Water St. and Burke wells). Table 1 summarizes the pumping rates simulated for each municipal well for this scenario under average and drought conditions.

TABLE 1 Additional RMMEP Scenario Pumping Rates

Well	Estimated Individual Well Capacity*	Typical Pumped Rates (2008)	T3 Risk Assessment Allocated Rates (Average)	T3 Risk Assessment Allocated Rates (Drought)	RMM Scenario #5 Future Rates (Average)	RMM Scenario #5 Future Rates (Drought)	RMM Scenario #6 Future Rates (Average)	RMM Scenario #6 Future Rates (Drought)	RMM Scenario #7 Future Rates (Average)	RMM Scenario #7 Future Rates (Drought)	RMM Scenario #8 Future Rates (Average)	RMM Scenario #8 Future Rates (Drought)	RMM Scenario #9 Future Rates (Average)	RMM Scenario #9 Future Rates (Drought)	RMM Scenario #10 Future Rates (Average)	RMM Scenario #10 Future Rates (Drought)
	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
Arkell 1	2,000	730	1,400	1,400	600	155	0	0	0	0	0	0	0	0	0	0
Arkell 14	7,000	-	3,300	4,400	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300
Arkell 15	7,000	-	3,300	4,400	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300	3,300	4,300
Arkell 6	8,000	3,774	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300
Arkell 7	8,000	3,689	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300	4,900	5,300
Arkell 8	7,000	3,694	4,900	4,900	4,800	4,800	4,500	4,700	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800
Burke	6,500	5,385	6,000	6,300	5,500	5,800	5,500	5,800	5,500	5,800	5,500	5,800	5,500	5,800	5,300	5,600
Calico	1,400	748	1,100	1,100	1,400	1,400	1,100	1,100	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Carter Wells	5,500	3,400	4,000	4,400	4,000	4,000	3,400	3,800	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Clythe Creek	3,395	-	2,200	2,200	2,900	2,900	2,450	2,650	2,900	2,900	2,900	2,900	2,900	2,900	2,900	2,900
Dean Ave.	1,500	1,215	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Downey Rd.	5,236	3,940	5,100	5,200	5,200	5,200	5,100	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Emma	2,800	2,600	2,100	2,400	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
Helmar	1,500	800	1,100	1,200	1,500	1,500	1,100	1,200	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Membro	6,000	3,036	4,200	4,300	4,300	4,300	4,200	4,300	4,600	6,000	4,300	4,300	4,300	4,300	4,300	4,300
Paisley	1,400	762	800	1,000	1,400	1,400	800	1,000	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Park 1 & 2	8,000	6,400	6,400	6,900	6,400	6,900	6,400	6,900	6,400	6,900	6,400	6,900	6,400	6,900	6,400	6,900
Queensdale	1,100	702	2,000	2,000	1,100	1,100	1,100	1,100	1,500	1,500	1,100	1,100	1,100	1,100	1,100	1,100
Sacco	1,150	-	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
Smallfield	1,408	-	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
University	2,500	1,648	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Water Street	2,700	1,184	2,300	2,400	2,400	2,400	2,300	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,000	2,000
Logan	-	-	-	-	-	-	-	-	-	-	700	2,100	-	-	-	-
GSTW01-08	-	-	-	-	-	-	-	-	-	-	-	-	700	2,100	-	-
Ironwood	-	-	-	-	-	-	-	-	-	-	-	-	-	-	650	1,300
Steffler Park	-	-	-	-	-	-	-	-	-	-	-	-	-	-	650	1,400
Subtotal			66,550	71,650	66,550	69,705	63,000	68,000	66,650	71,650	66,650	71,650	66,650	71,650	66,650	71,650
Glen Collector			6,900	1,892	6,900	1,892	6,900	1,892	6,900	1,892	6,900	1,892	6,900	1,892	6,900	1,892
Total			73,450	73,542	73,450	71,597	69,900	69,892	73,550	73,542	73,550	73,542	73,550	73,542	73,550	73,542
Target Water Demand			71,595	71,595	71,595	71,595	69,872	69,872	71,595	71,595	71,595	71,595	71,595	71,595	71,595	71,595
Excess			1,855	1,947	1,855	2	28	20	1,955	1,947	1,955	1,947	1,955	1,947	1,955	1,947

Legend:

Wells at Significant Risk Level

Well close to Safe Water Level

Rates decreased from Risk Assmt.

Rates increased from Risk Assmt.

Notes:

* - Estimated capacity needs to be confirmed by the City of Guelph and could vary based on wellfield interactions

2 ADDITIONAL RISK MANAGEMENT MEASURE SCENARIO RESULTS

2.1 Drawdown Impacts

The drawdown results of the six additional RMM scenarios are summarized in Table 2 and compared with the Risk Assessment H1 Scenario result that incorporated drought conditions, future (Allocated) pumping, and future land cover. Detailed results are provided for the Risk Assessment H1 Scenario and RMM scenarios #5 to #10 in Appendix A.

The Risk Assessment results led to a *significant* risk level being assigned to WHPA-Q1-A due to the drawdown at the Queensdale Well exceeding the Safe Water Level (SWL) under the drought scenario. The water level at Arkell 1 Well came within 0.5 m of the SWL during the drought scenario, and because the Risk Assessment was assessed as having high uncertainty with respect to the result at Arkell 1, that contributed to the *significant* risk level assignment.

TABLE 2 Additional RMM Scenario Drawdown Results

Scenario	Future Rate (Average) m^3/d	Future Rate (Drought) m^3/d	Wells Triggering Risk	WHPA-Q1-A Risk Level
H1 Risk Assessment: Allocated Rate + Future Land Use	73,450	73,542	Queensdale, Arkell 1	*Significant*
RMM Scenario #5: Allocated with Reduced Drought Rates + Optimization	73,450	71,597	None	*Low*
RMM Scenario #6: WSMPU Rate + Optimization	69,900	69,892	None	*Low*
RMM Scenario #7: Allocated Rate + Optimization - Dolime Taking	73,550	73,542	None	*Low*
RMM Scenario #8: Allocated Rate + Optimization + Logan Test Well	73,550	73,542	None	*Low*
RMM Scenario #9: Allocated Rate + Optimization + GSTW-01-08	73,550	73,542	None	*Low*
RMM Scenario #10: Allocated Rate + Optimization + Ironwood + Steffler Park Test Wells	73,550	73,542	None	*Low*

In all six additional RMM scenarios, the water levels did not drop below the SWL during the drought at Queensdale, and the water levels at Arkell 1 were more than 0.5 m above the SWL. Therefore, the risk level for WHPA-Q1-A would be reduced to *low* for all scenarios due to lack of drawdown impacts. Note that while the water level did not fall below the SWL for any of the municipal wells, some of them remain within 1.0 m of the SWL (e.g., Arkell 1, Arkell 14, Arkell 15, Arkell 8, Burke, Carter, and Helmar wells; Appendix A).

2.2 Reduction in Groundwater Discharge to Coldwater Streams

The risk level of WHPA-Q1-A assessed in the Tier Three Assessment also considered the simulated impacts of reduced groundwater discharge to coldwater streams. Under the Tier Three Assessment, any baseflow reductions to coldwater streams greater than or equal to 10% would result in a water quantity risk level of *moderate* for the vulnerable area (MOE 2013). The Risk Assessment results would have resulted in a minimum *moderate* risk level for WHPA-Q1-A due to reduced groundwater discharge at the following coldwater streams:

- Blue Springs Creek at 28th Side Rd.
- Chilligo/Ellis Creek at Wellington Rd. 32
- Hanlon Creek at Waterfowl Park
- Hanlon Creek at Hwy. 6
- Hanlon Creek South Tributary at Hwy. 6

Reduction in groundwater discharge to coldwater streams was assessed for each of the six additional RMM scenarios, considering long-term, average climate. Table 3 summarizes these results.

TABLE 3 Reduction in Groundwater Discharge to Coldwater Streams

Scenario	Future Rate (Average) m^3/d	Future Rate (Drought) m^3/d	Addition / Removal of Streams with >10% Reduction in GW Discharge Relative to Risk Assessment	WHPA-Q1-A Risk Level
H1 Risk Assessment: Allocated Rate + Future Land Use	73,450	73,542	Blue Springs Ck. at 28th Side Rd. Chilligo/Ellis Ck. at Wellington Rd. 32 Hanlon Ck. at Waterfowl Park Hanlon Ck. at Hwy. 6 Hanlon Ck. South Trib. at Hwy. 6	*Moderate*
RMM Scenario #5: Allocated with Reduced Drought Rates + Optimization	73,450	71,597	+ Chilligo/Ellis Ck. at Kossuth Rd.	*Moderate*
RMM Scenario #6: WSMPU Rate + Optimization	69,900	69,892	NC	*Moderate*
RMM Scenario #7: Allocated Rate + Optimization - Dolime Taking	73,550	73,542	- Hanlon Ck. at Waterfowl Park - Hanlon Ck. at Hwy. 6 - Hanlon Creek South Trib. at Hwy. 6	*Moderate*
RMM Scenario #8: Allocated Rate + Optimization + Logan Test Well	73,550	73,542	+ Chilligo/Ellis Ck. at Kossuth Rd.	*Moderate*
RMM Scenario #9: Allocated Rate + Optimization + GSTW-01-08	73,550	73,542	+ Chilligo/Ellis Ck. at Kossuth Rd.	*Moderate*
RMM Scenario #10: Allocated Rate + Optimization + Ironwood + Steffler Park Test Wells	73,550	73,542	+ Chilligo/Ellis Ck. at Kossuth Rd.	*Moderate*

NC = no change in which coldwater streams have >10% reduction relative to those identified in Tier Three Assessment
+ = addition of coldwater streams with >10% reduction in GW discharge relative to those identified in Tier Three Assessment
- = removal of coldwater streams that no longer have >10% reduction in GW discharge relative to those identified in Tier Three Assessment

In all six additional RMM scenarios, the number of coldwater streams with more than a 10% reduction in groundwater discharge has remained the same or increased, with the exception of Scenario #7. With the removal of the Dolime dewatering in Scenario #7, the groundwater discharge reduction is less than 10% for all three watercourses assessed along Hanlon Creek. Where pumping at the Calico municipal well increased as the result of well optimization in Scenario #5, #7, #8, #9, and #10, an additional coldwater stream reach (Chilligo/Ellis Creek at Kossuth Rd) was simulated as having more than 10% reduction in groundwater discharge. However, because all scenarios have at least one coldwater stream with greater than 10% reduction in groundwater discharge, a *moderate* risk level would still apply to WHPA-Q1-A.

3 RECOMMENDATION FOR ADDITIONAL SCENARIO

An additional RMM scenario (RMM Scenario #11) is proposed to examine the potential impacts of future increases in pumping from existing non-municipal permits in WHPA-Q1-A. While this scenario will not evaluate RMMs to reduce the water quantity risk level of WHPA-Q1-A from *significant*, it will provide insight into the sensitivity of water levels in municipal wells relative to increases in non-municipal demands. The inherent assumption in this scenario is that non-municipal water taking will increase as there is population and economic growth within the WHPA-Q area. If this potential growth is not evaluated and considered in the RMMEP, it may negate the RMMs evaluated above.

This scenario will incorporate the municipal pumping distribution considered for Scenario 6, which assumes the lower demand of at least 69,872 m^3/d during average and drought conditions corresponding to the WSMPU future demand for 2038 (AECOM and Golder 2014). Scenario 6 will represent the reference condition for the sensitivity scenario. The scenario will be evaluated by progressively increasing the demand of each existing non-municipal Permit to Take Water (PTTW) in WHPA-Q1-A from the Scenario 6 rate and increasing the rate at increments of 10% of the remaining capacity between the initial rate and the maximum permitted rate (modified by a consumptive factor). The first sensitivity step will add 10% of the remaining consumptive capacity of each non-municipal PTTW, the second step will add 20% to the base pumping rate, etc. The additional steps will progress accordingly to evaluate the effect of increased non-municipal pumping on the ability for the City's municipal wells to meet the WSMPU demand.

4 CLOSURE

This memorandum has been prepared to meet the requirements of the City of Guelph. Any questions or comments should be directed to the either of the undersigned at 519.772.3777.

Yours truly,

Matrix Solutions Inc.

June 14, 2018

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Appendix A
Drawdown Results for the Additional RMM Drought Scenarios

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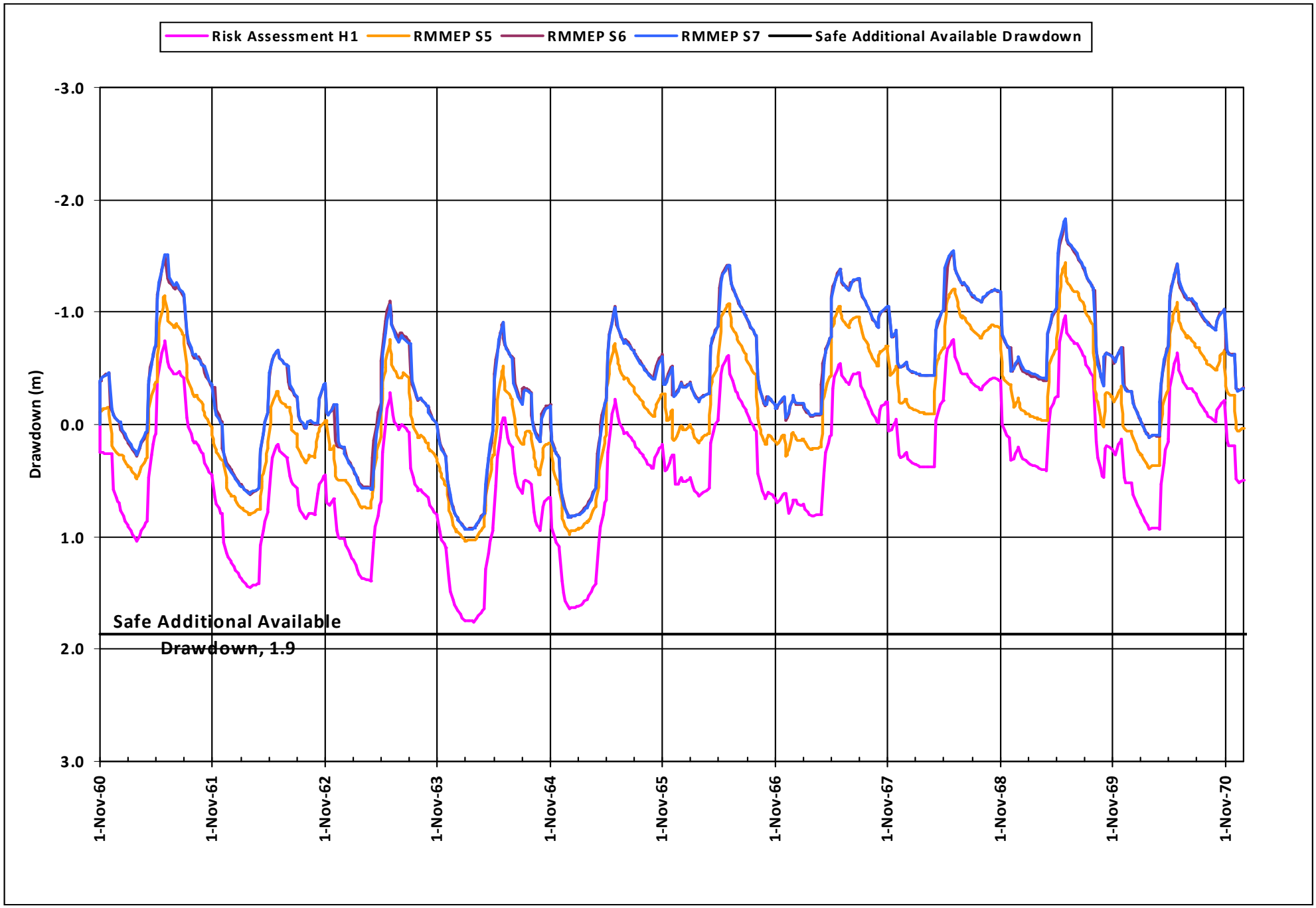

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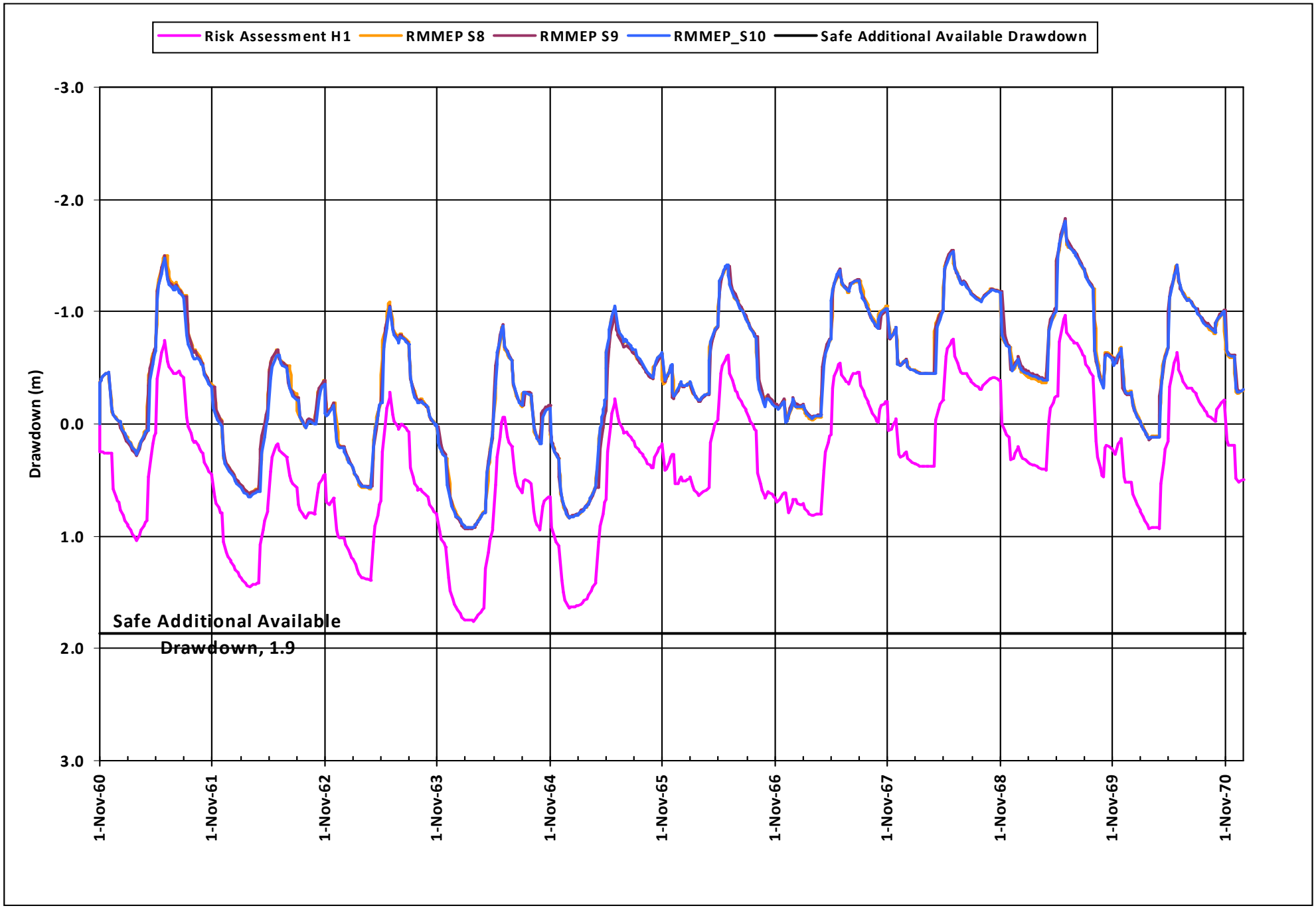

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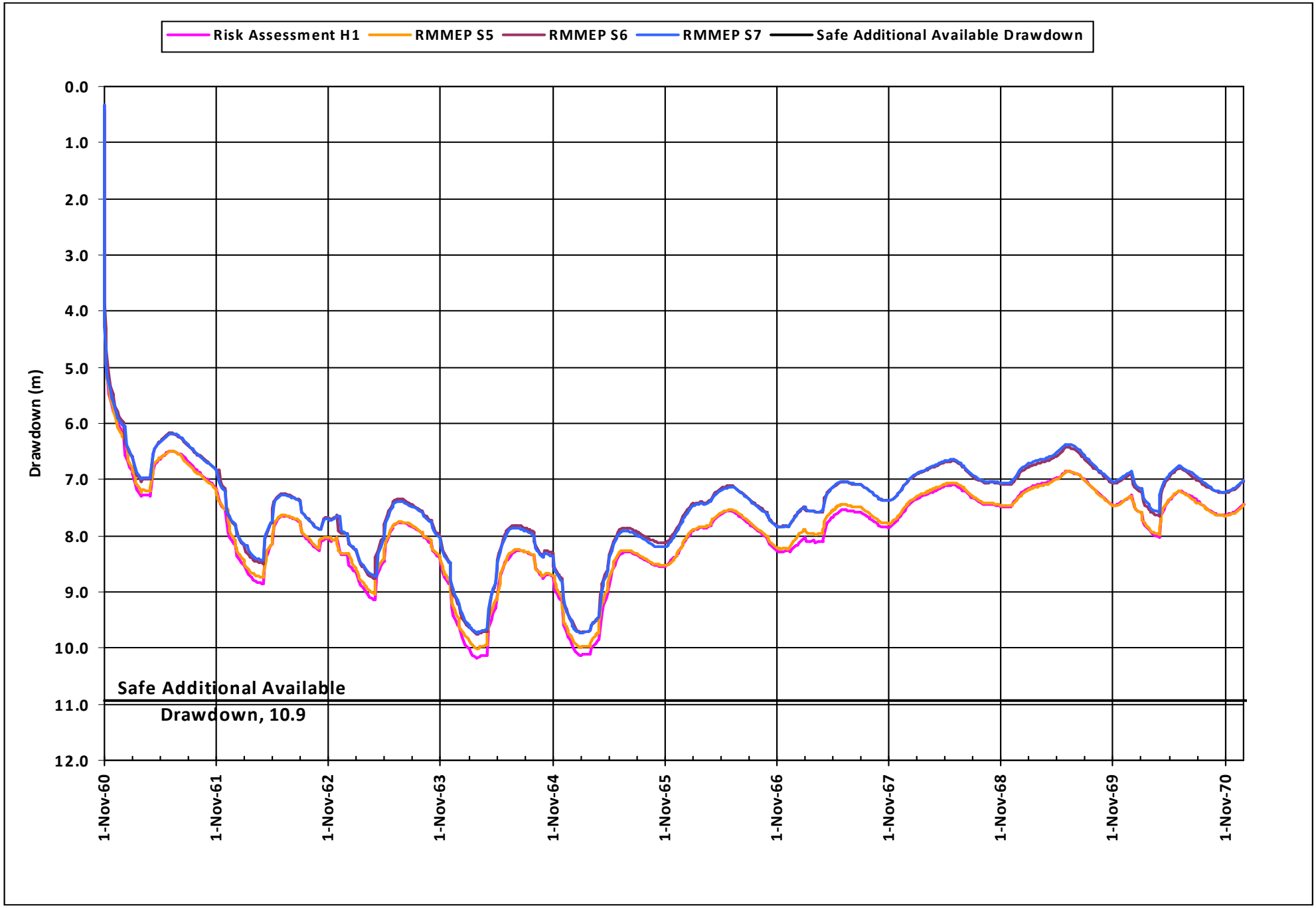

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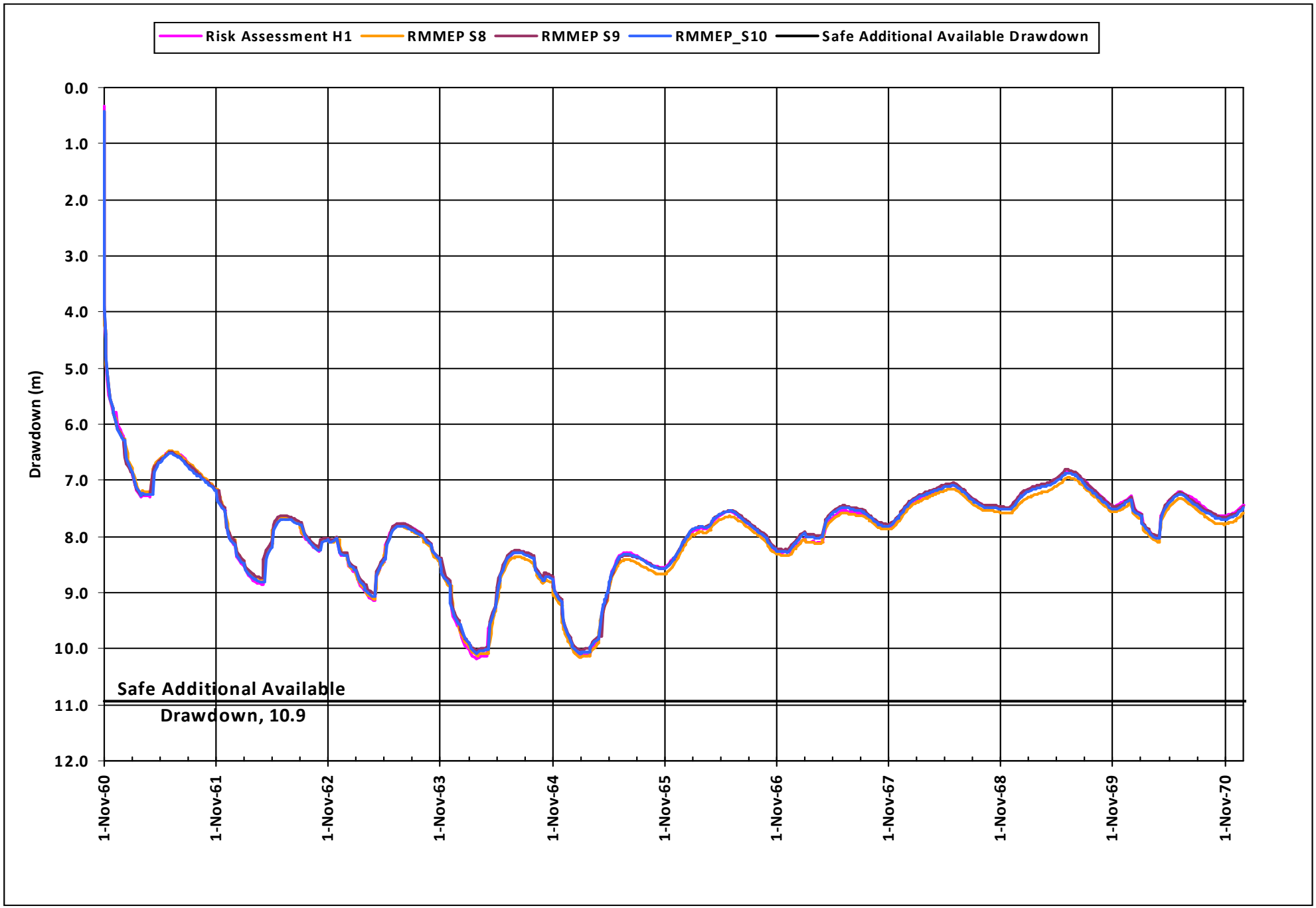

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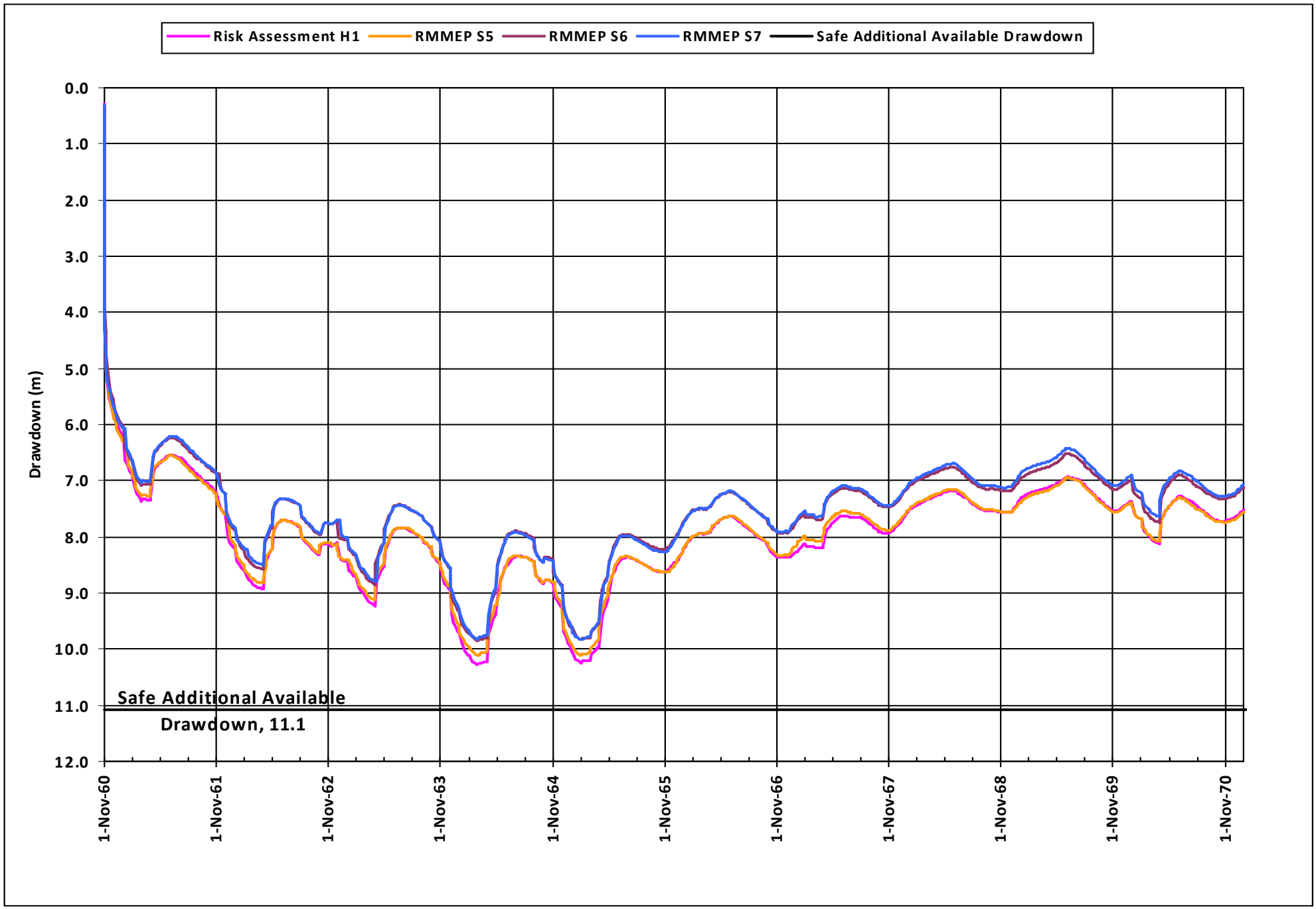

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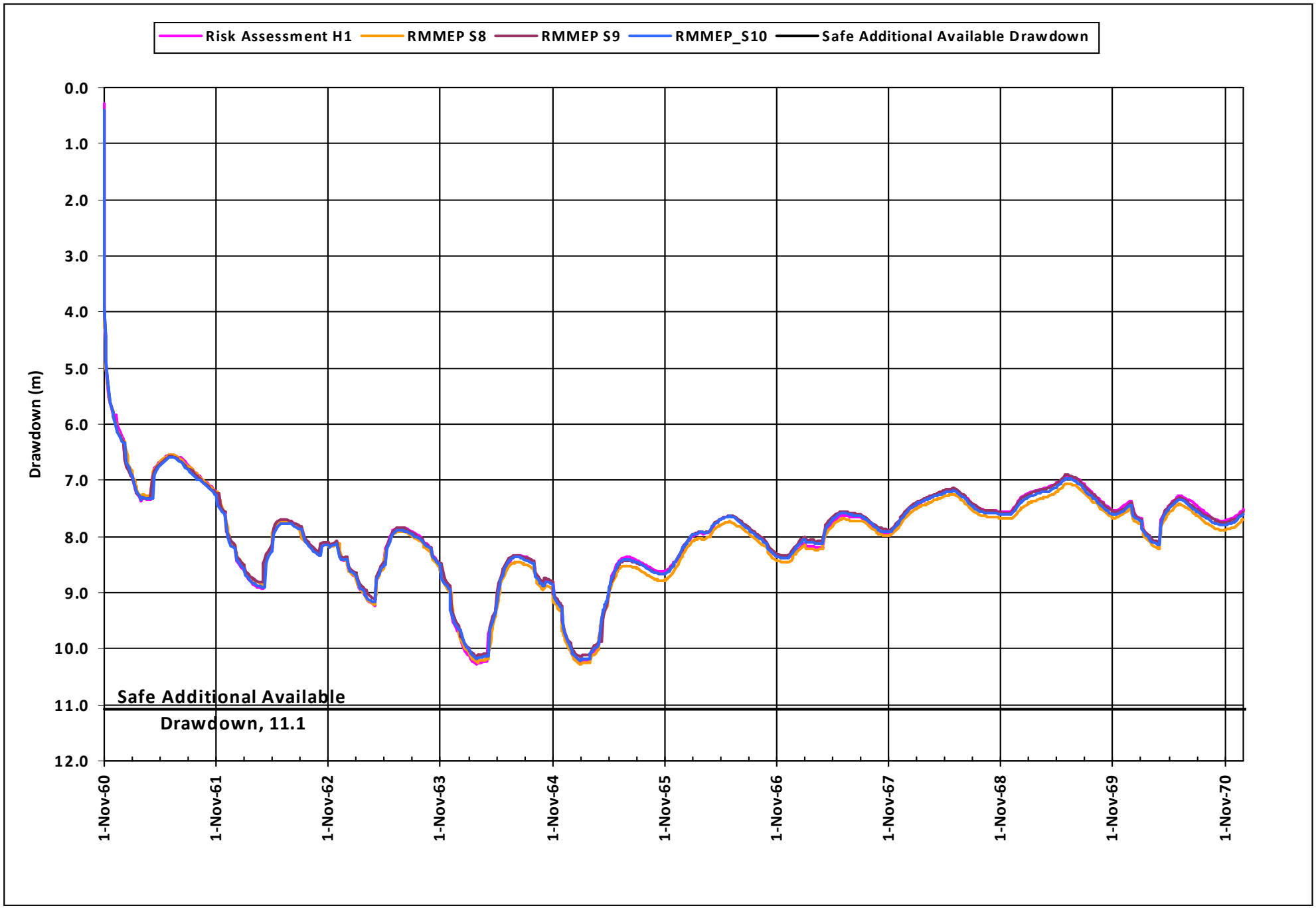

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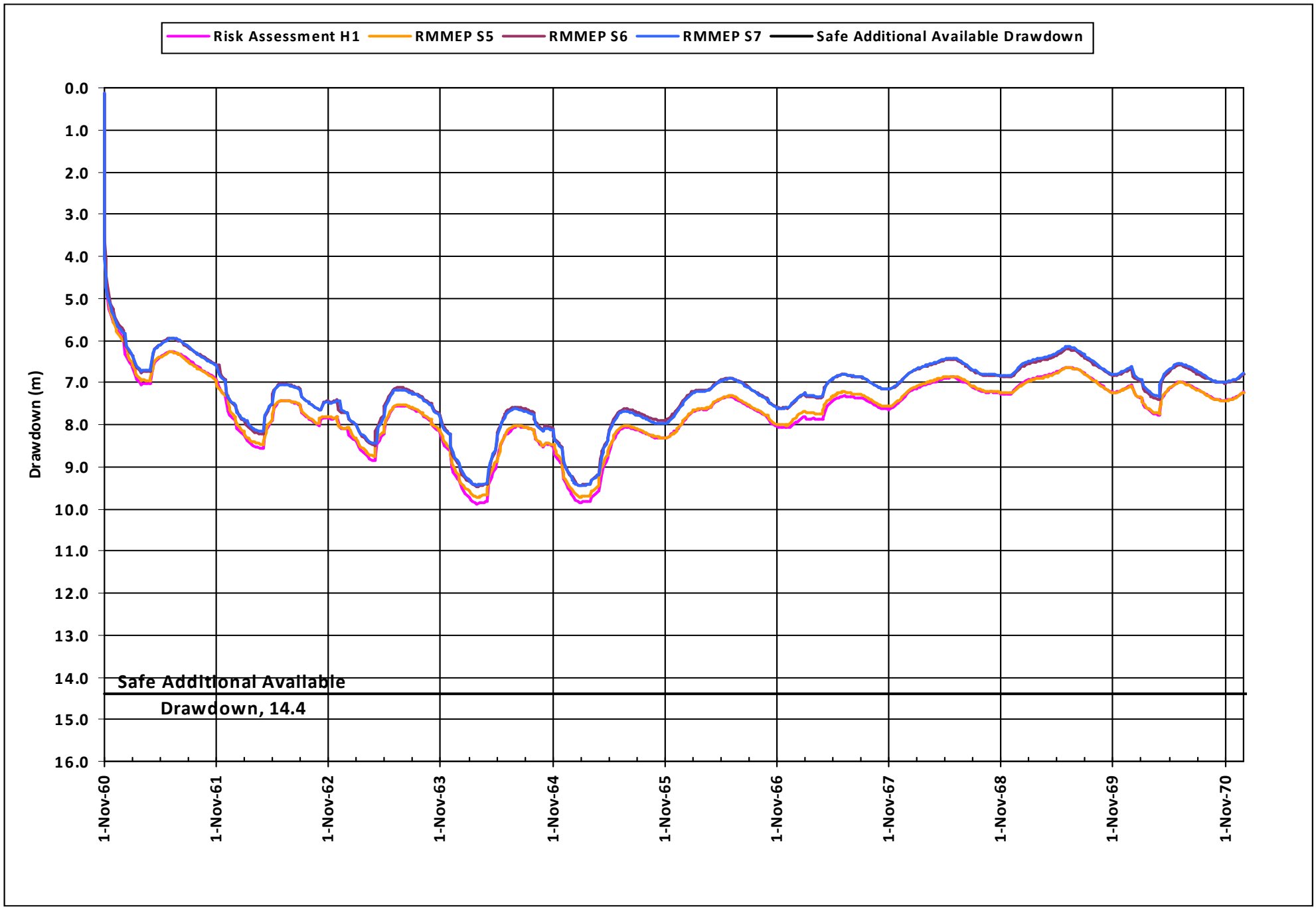

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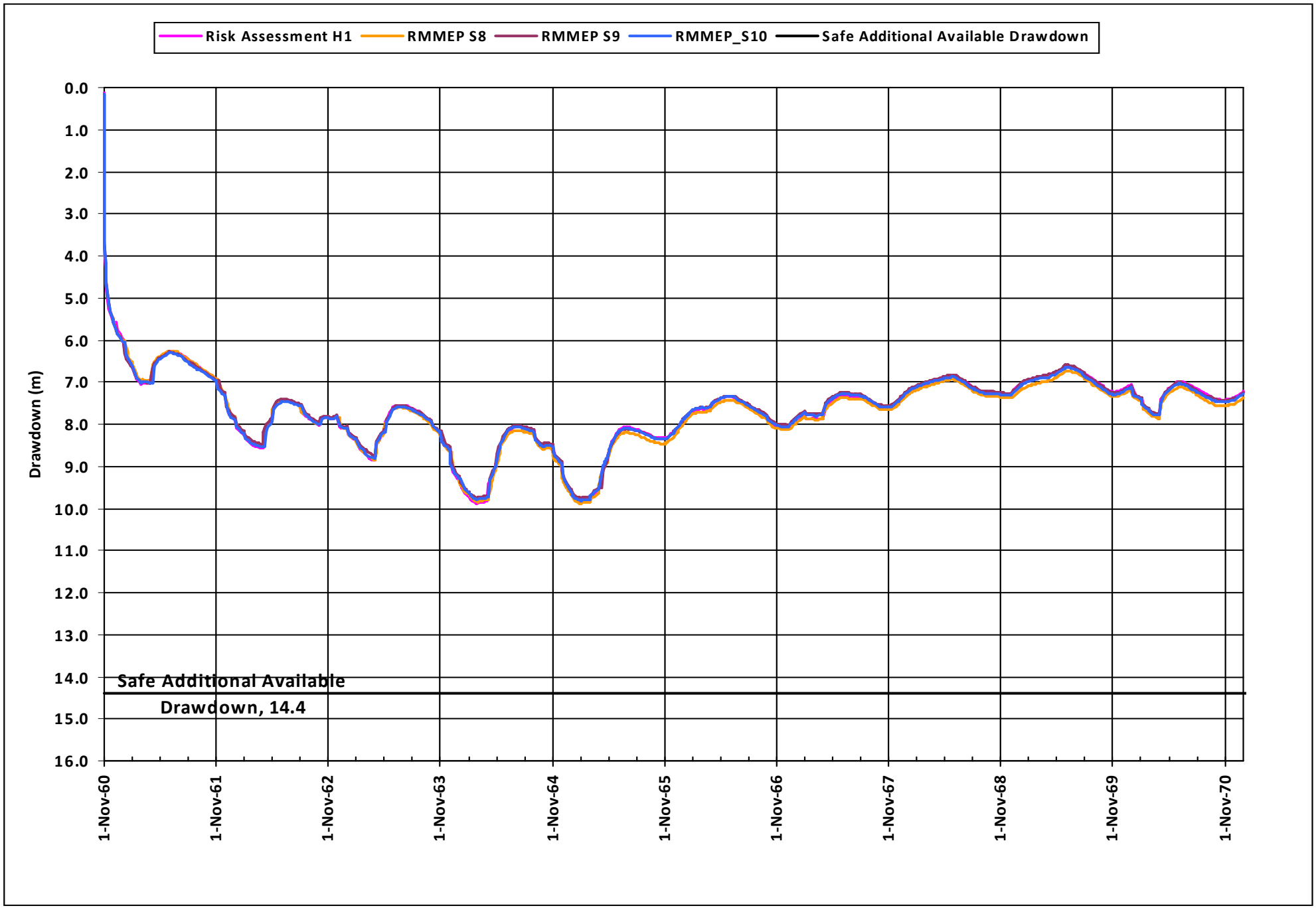

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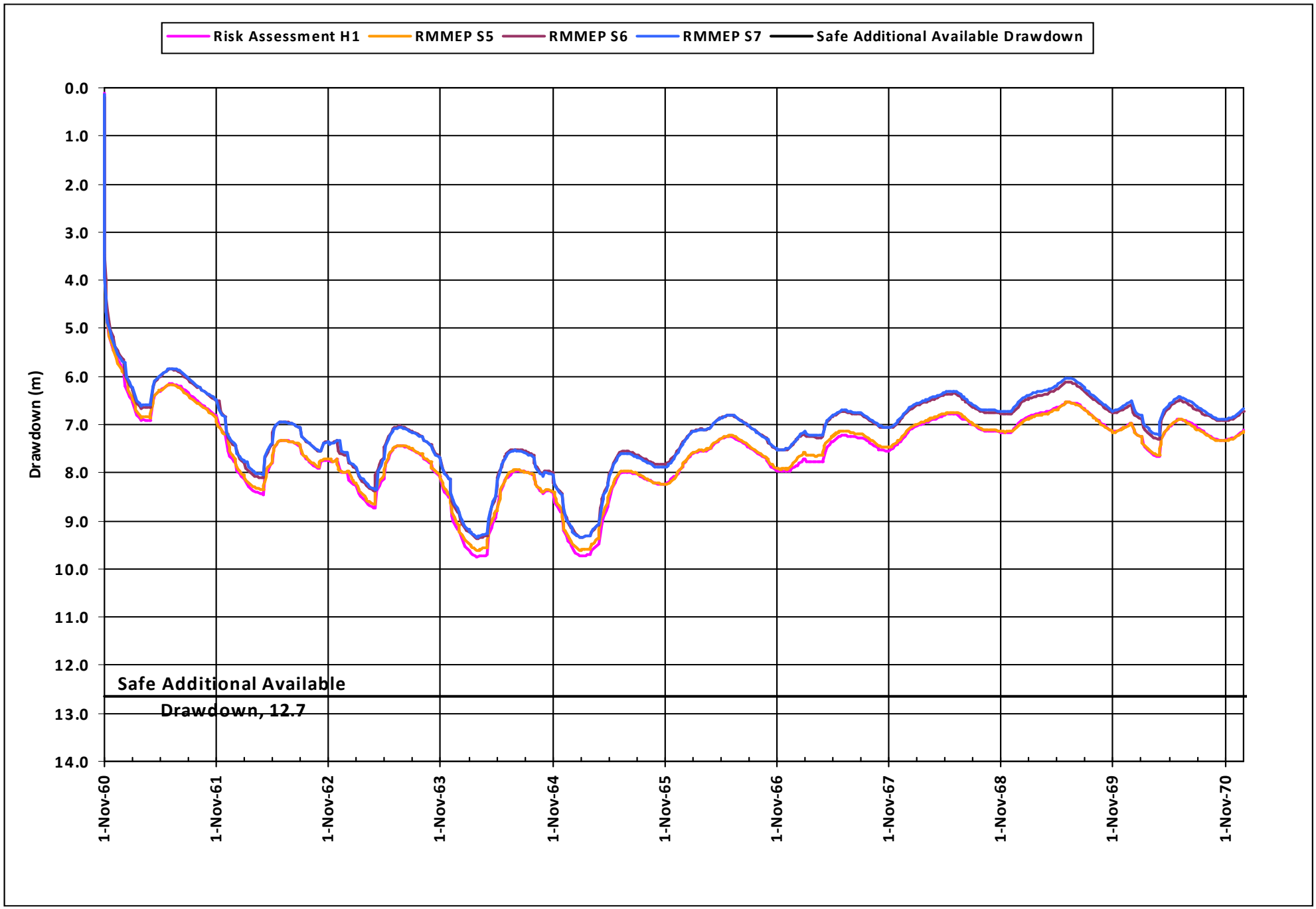

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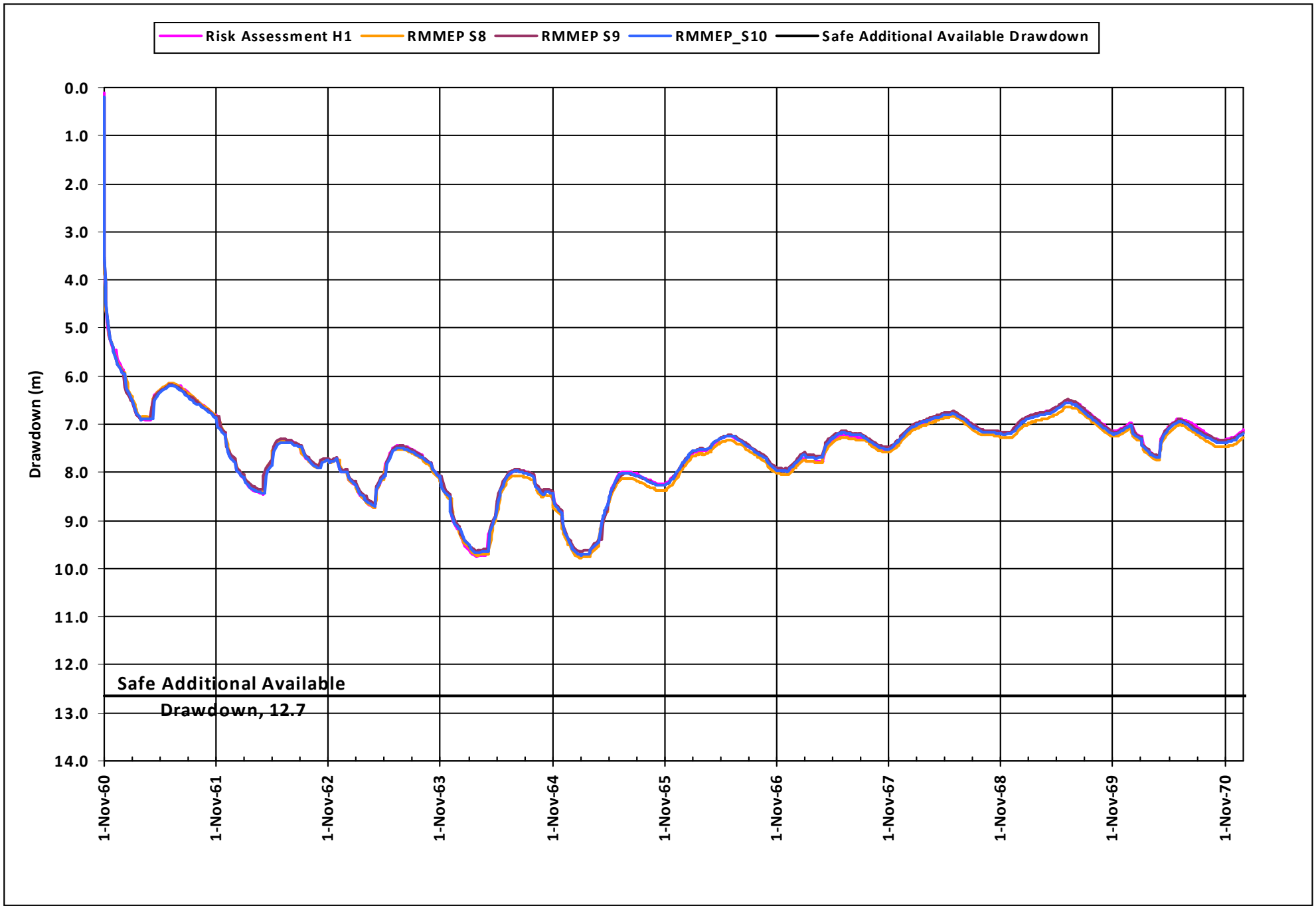

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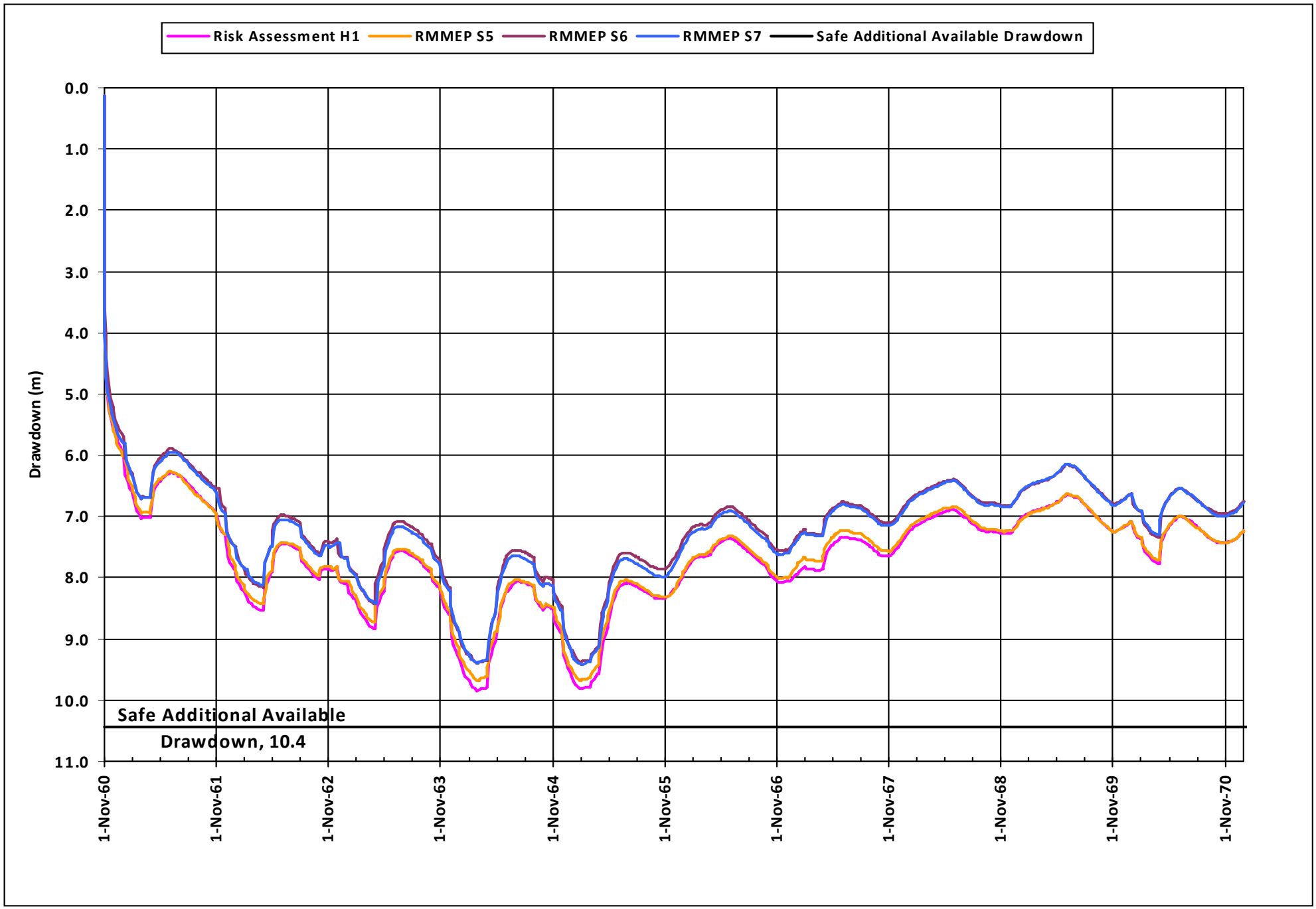

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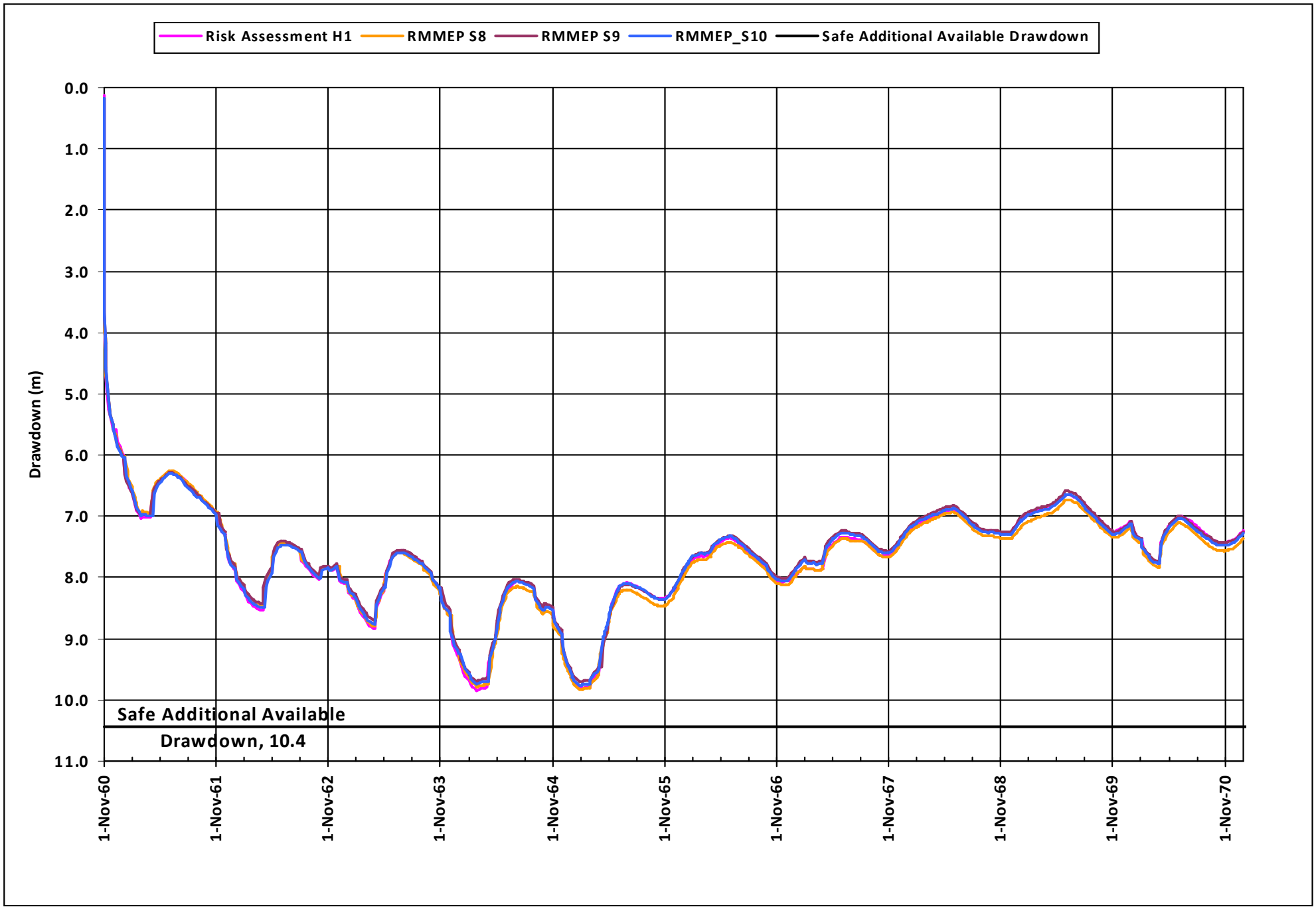
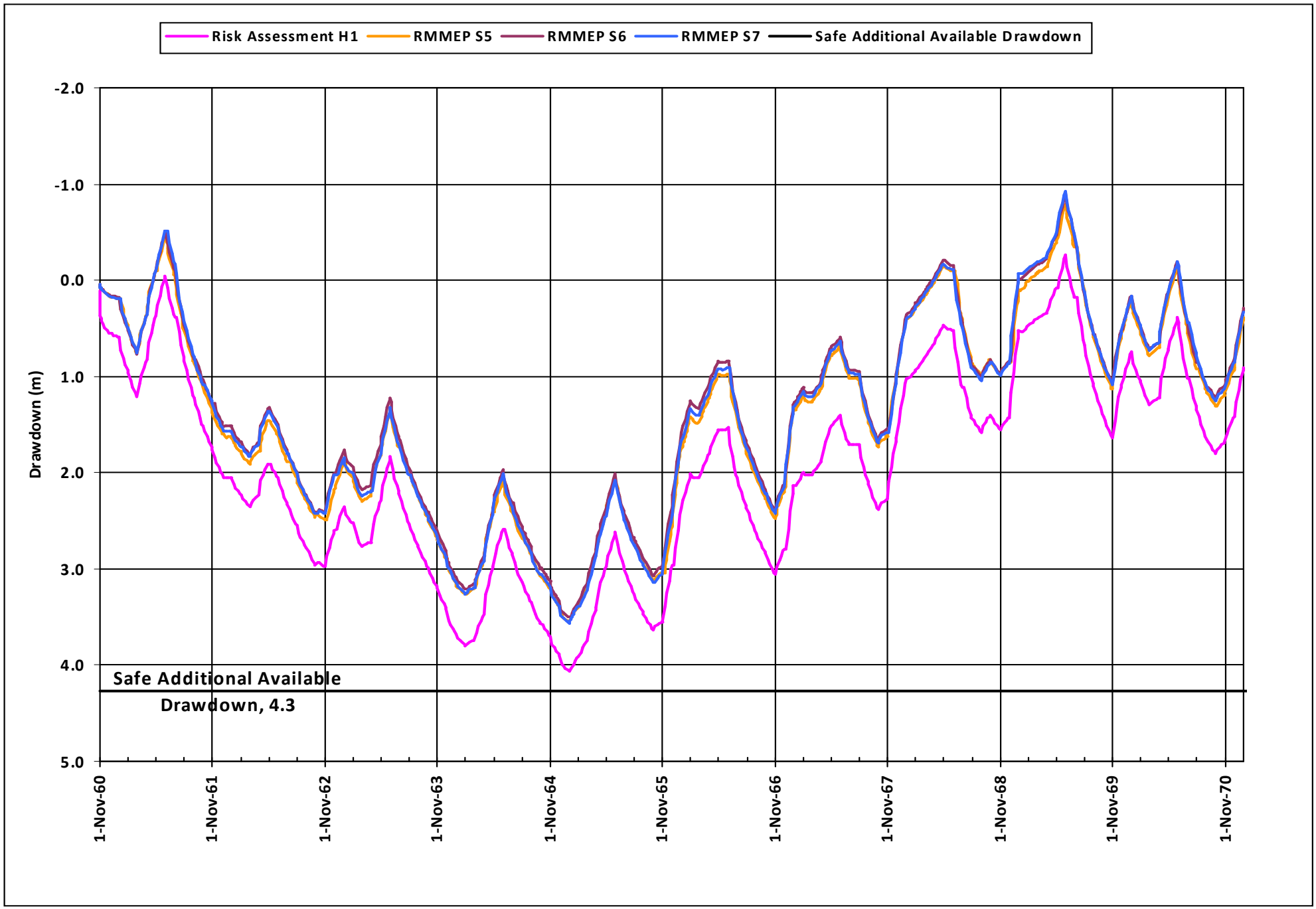
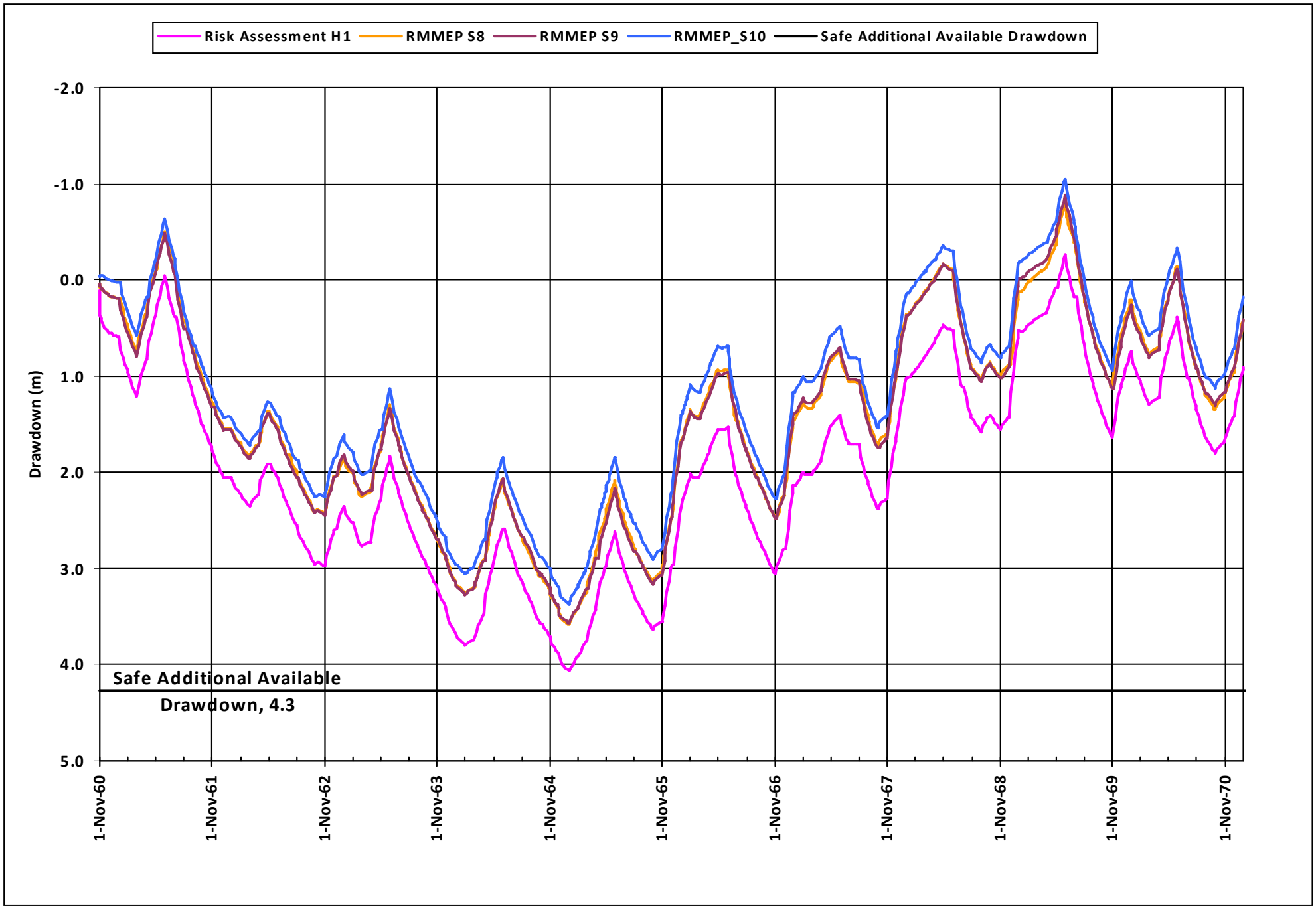


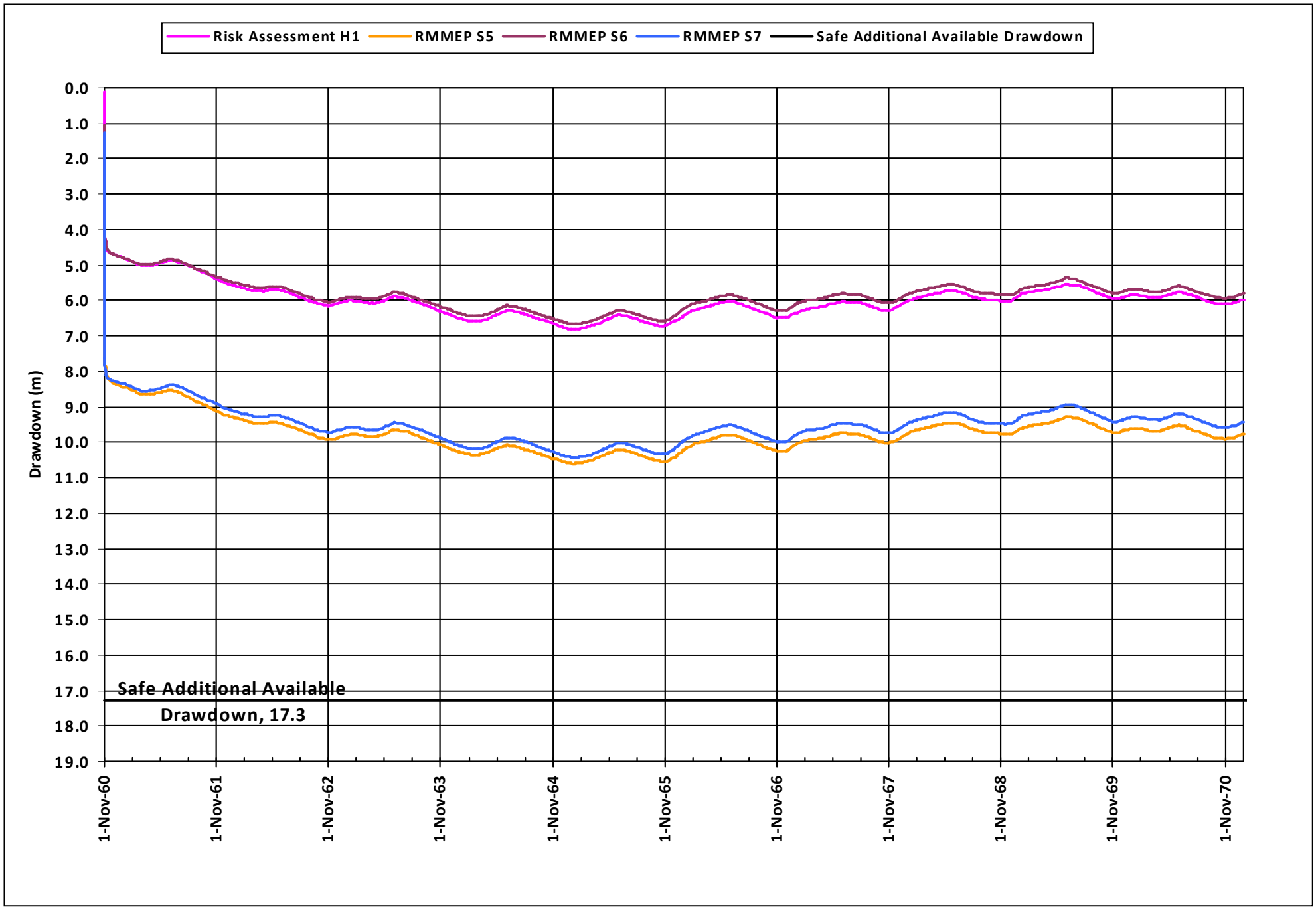
Well: Burke_PW



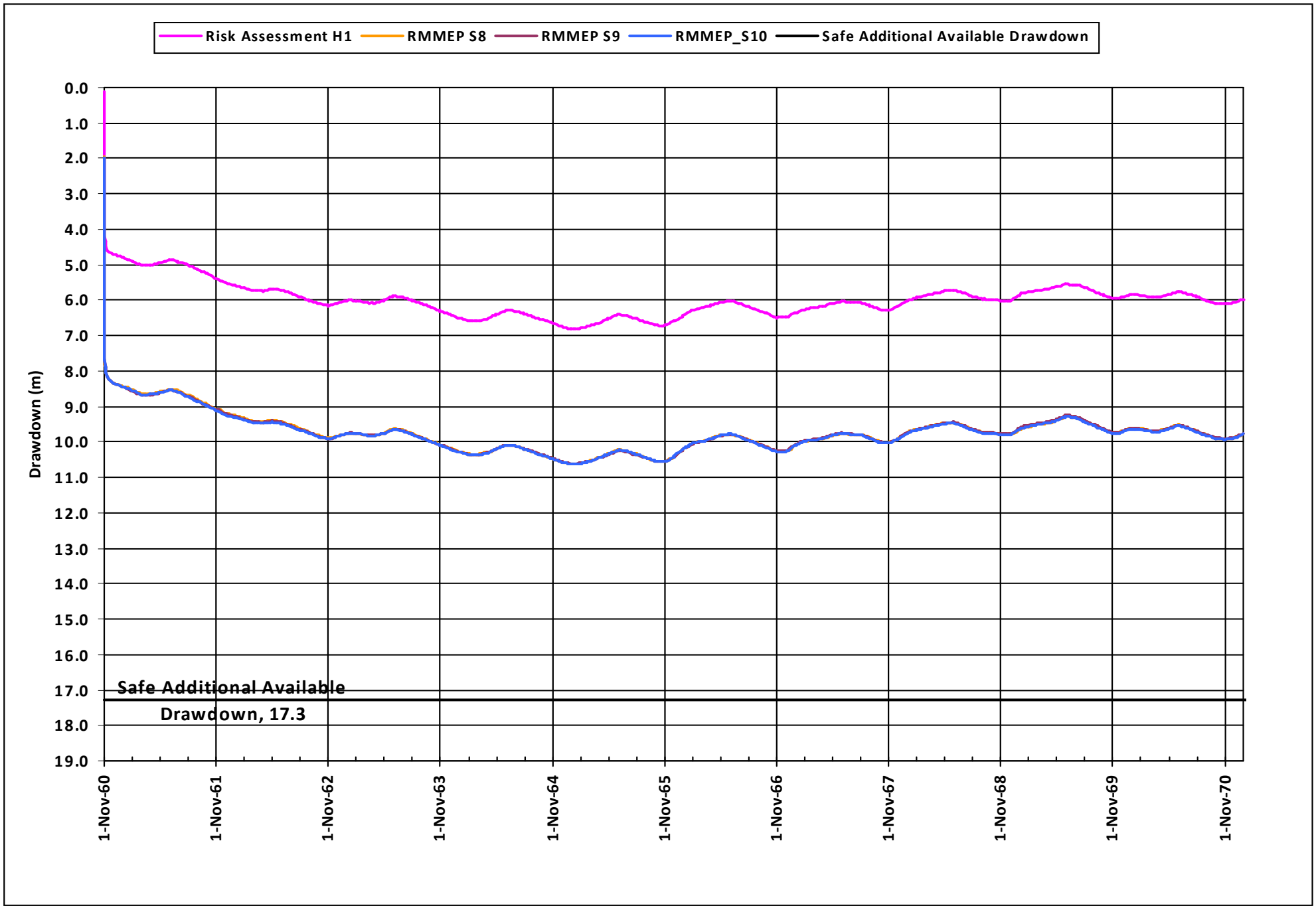
Well: Burke_PW



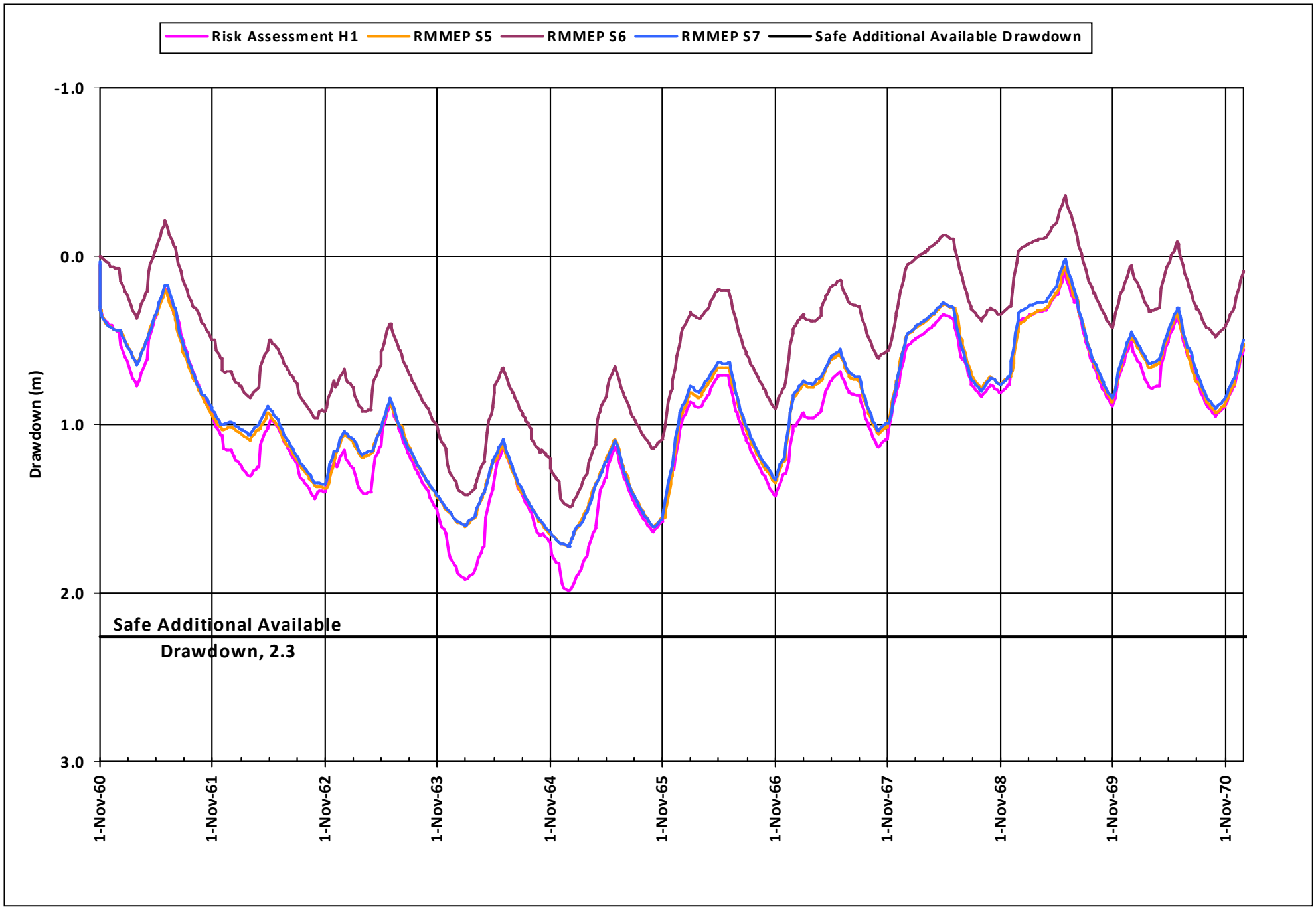
Well: Calico_PW



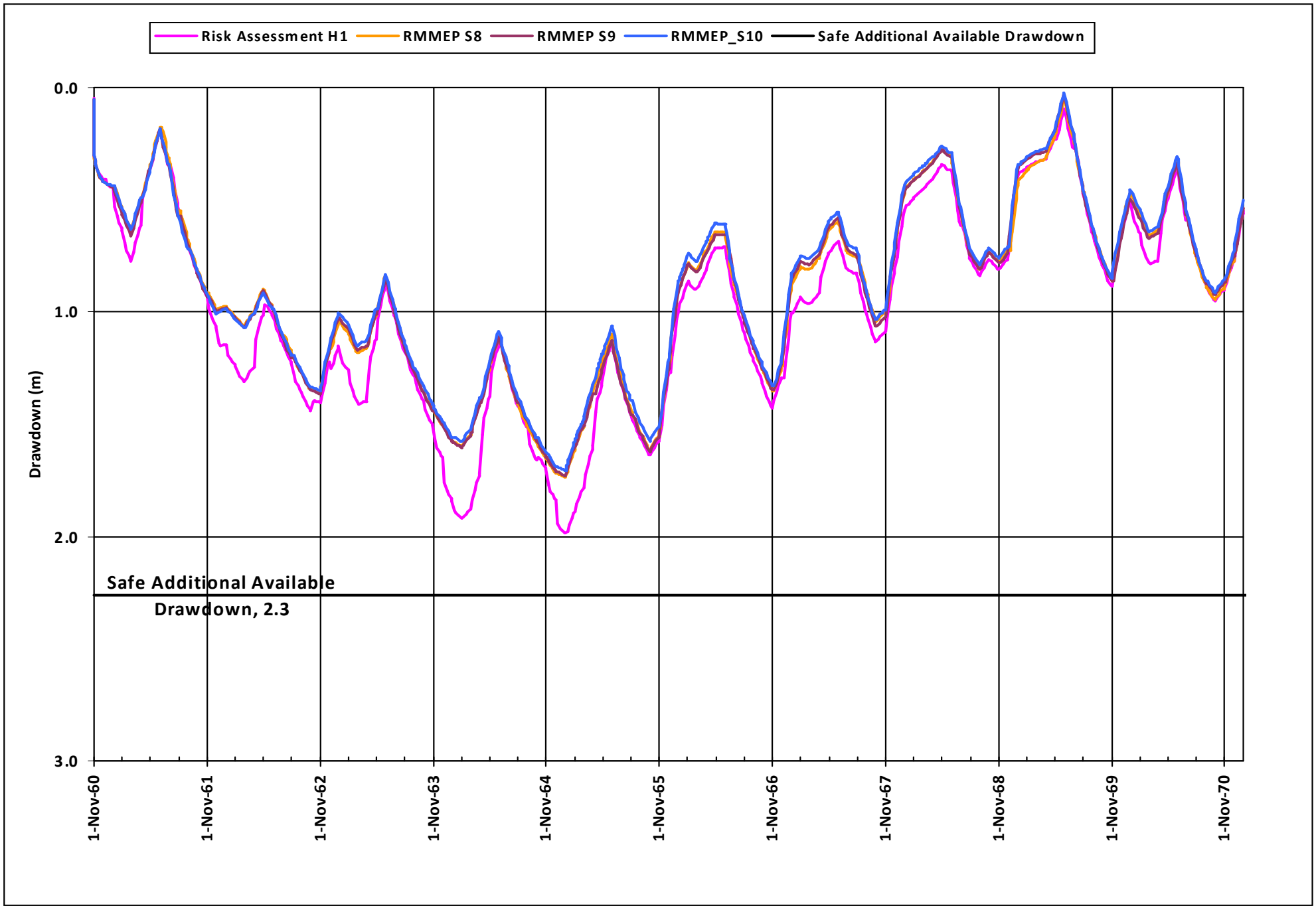
Well: Calico_PW



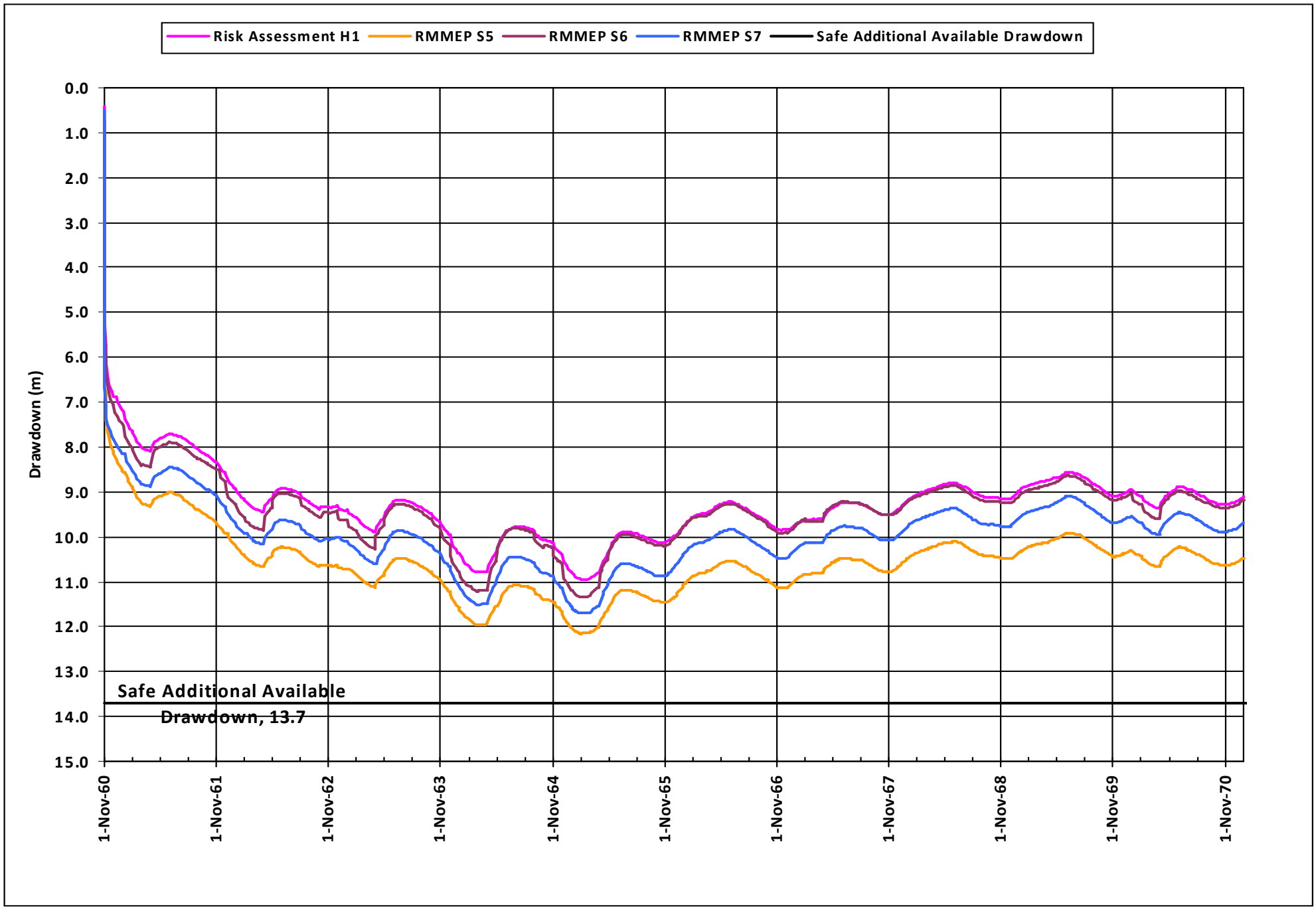
Well: Carter_Wells_PW



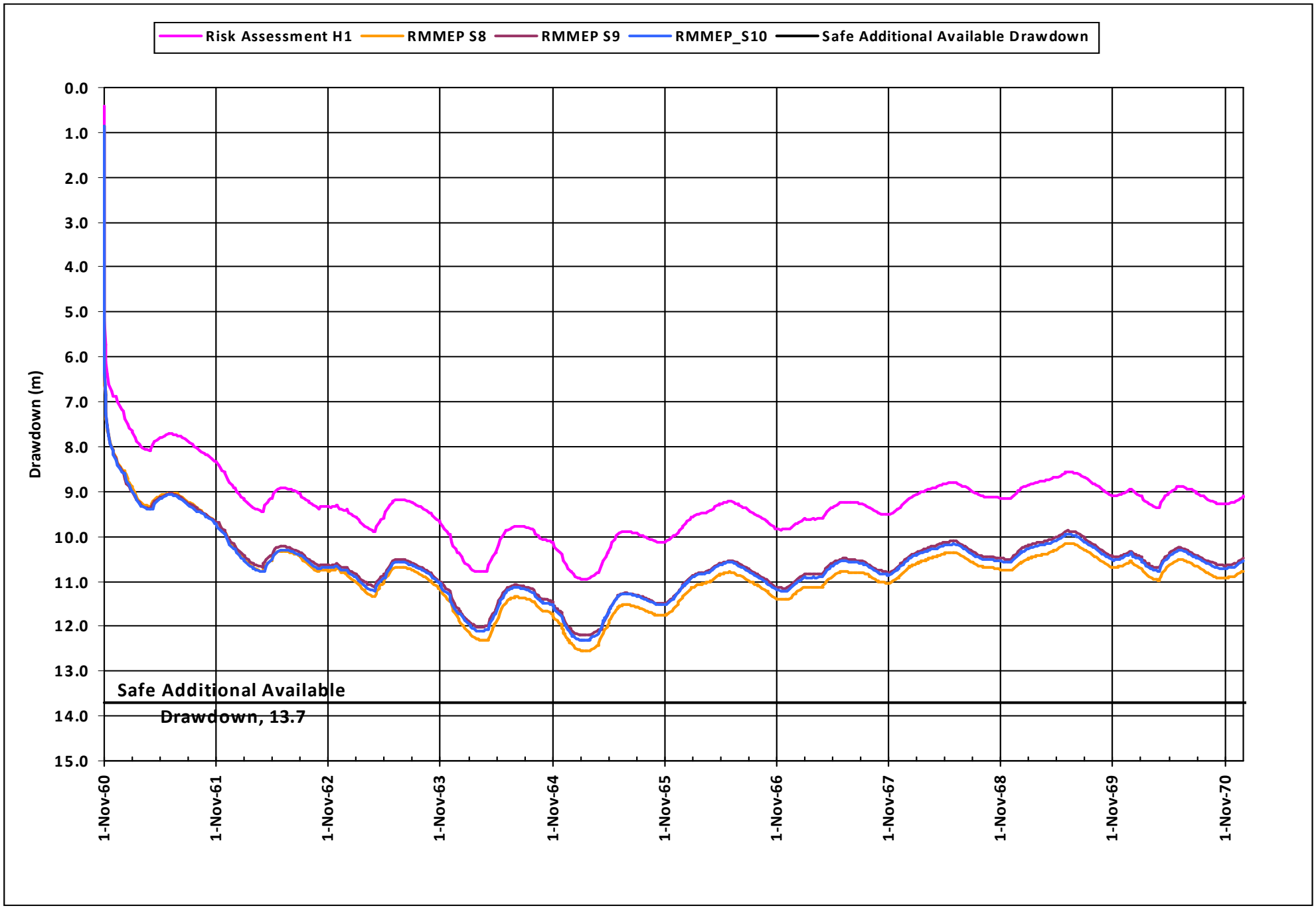
Well: Carter_Wells_PW



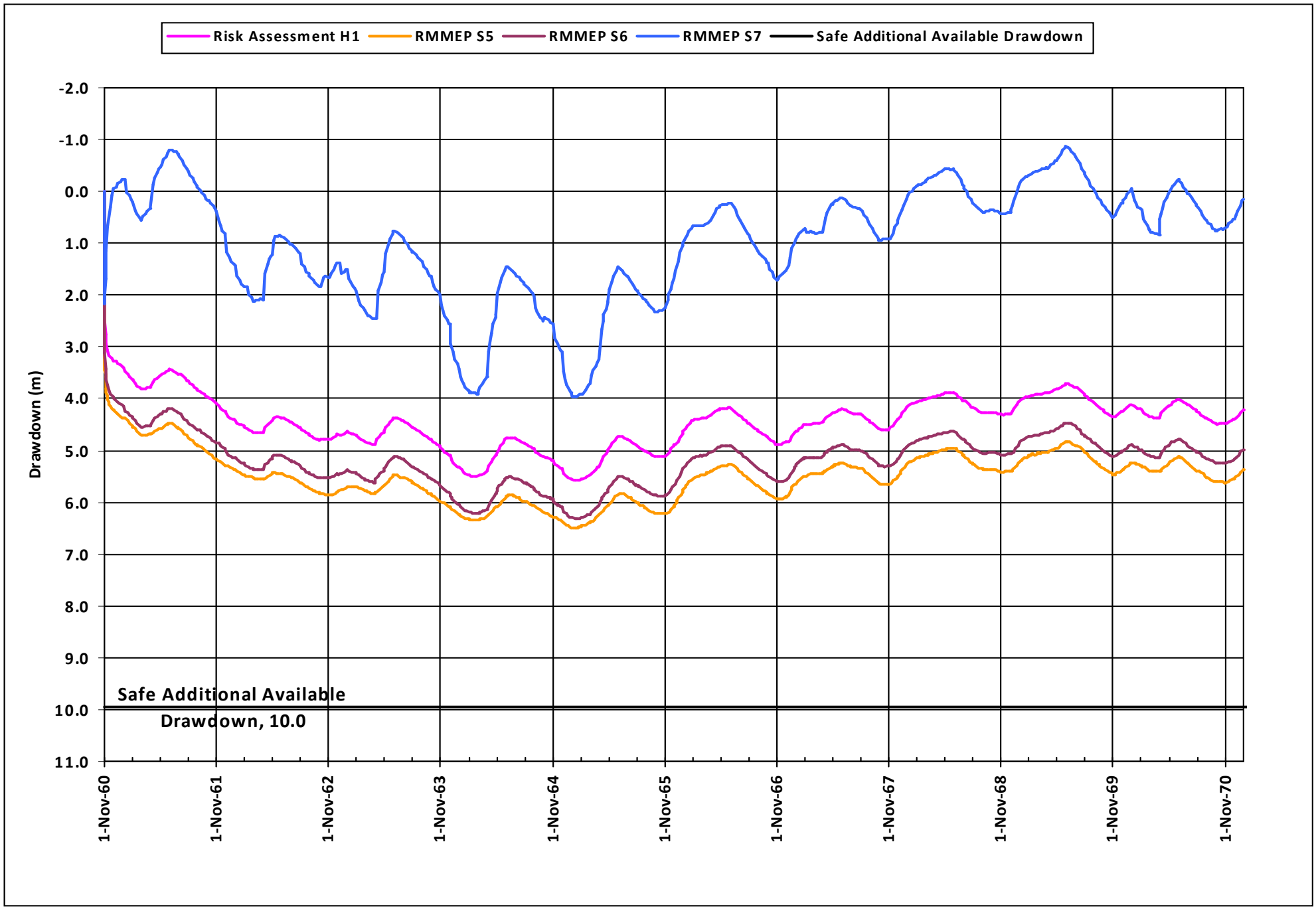
Well: Clythe_Creek_PW



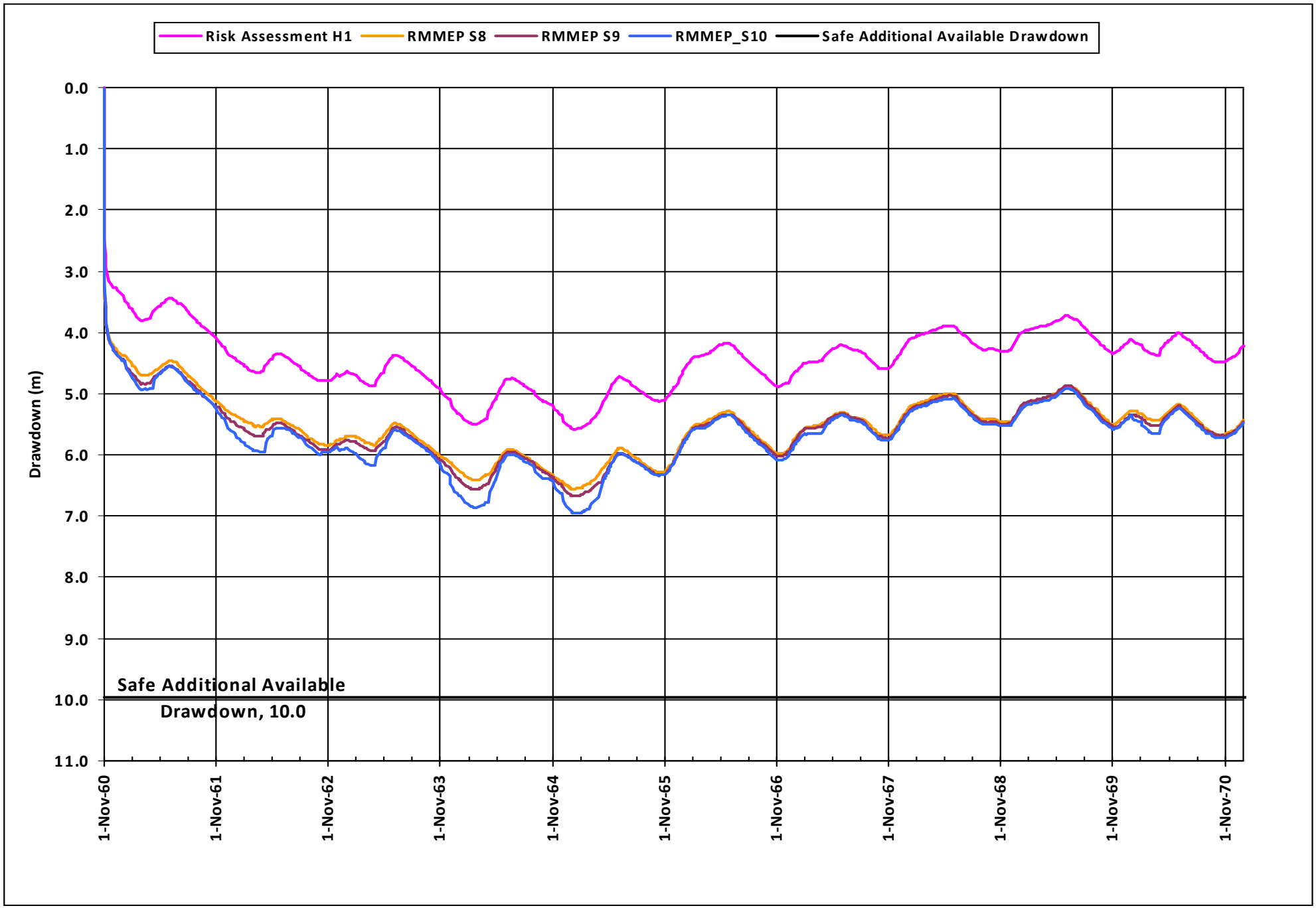
Well: Clythe_Creek_PW



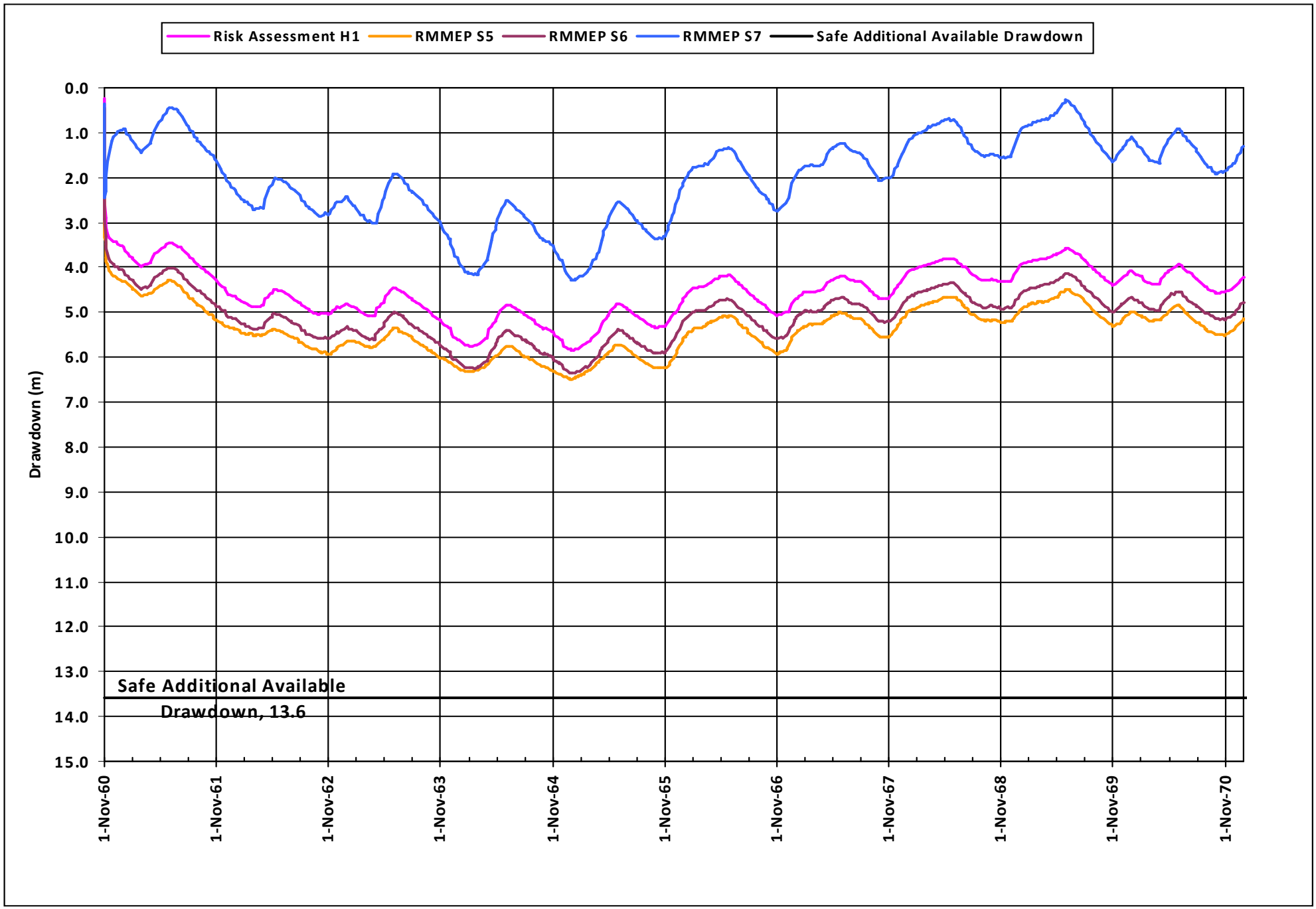
Well: Dean_Ave._PW



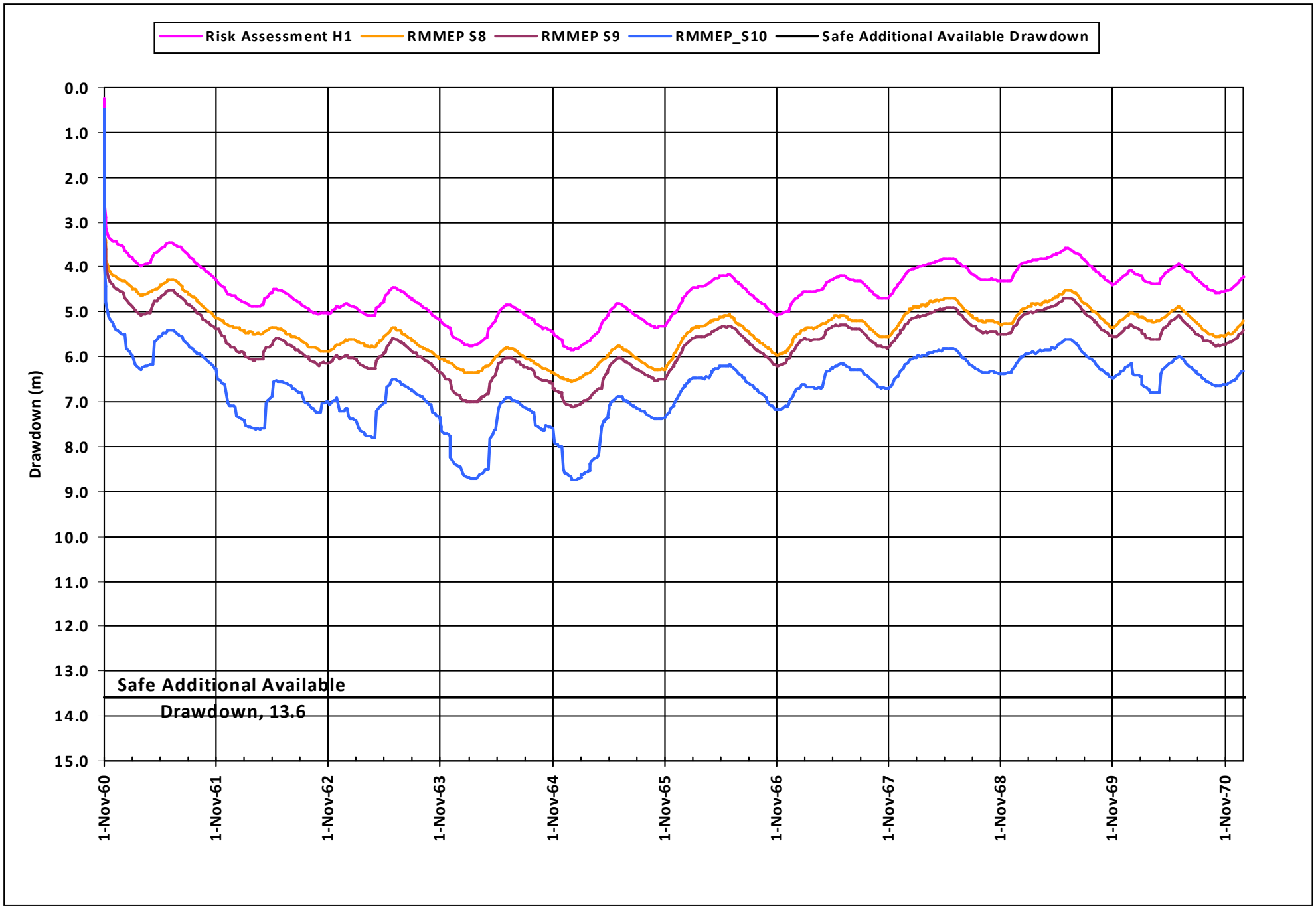
Well: Dean_Ave._PW



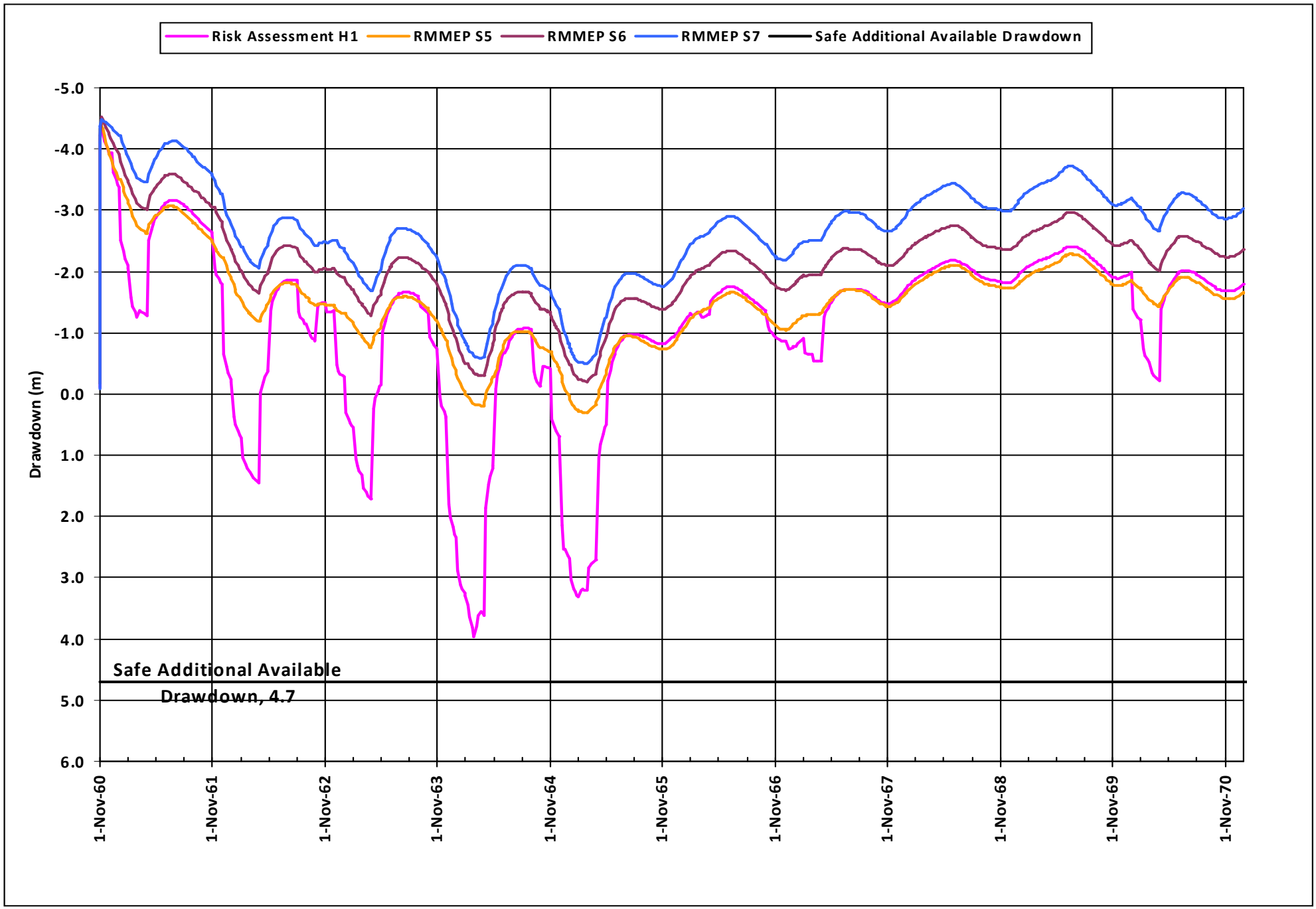
Well: Downey_Road_PW



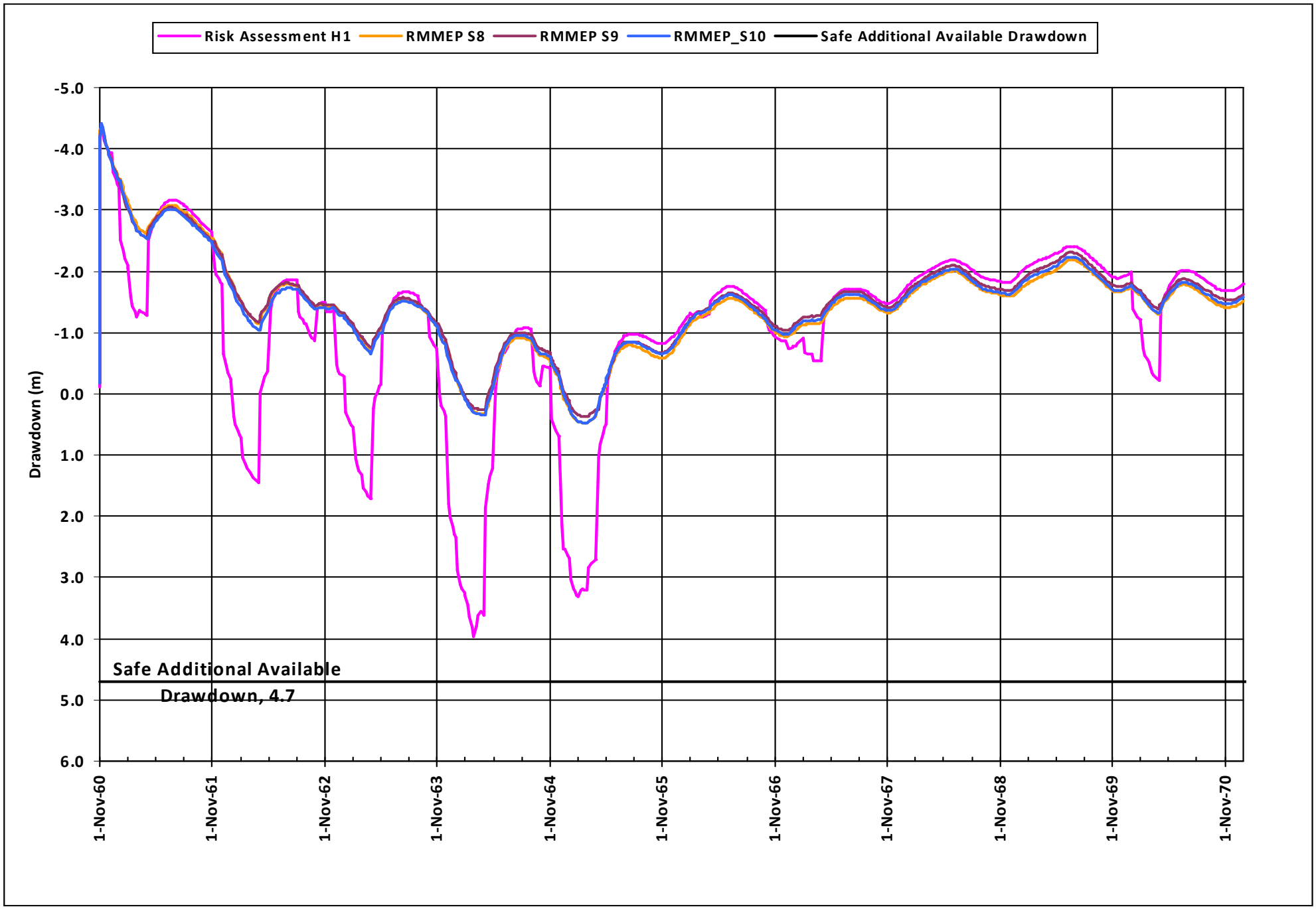
Well: Downey_Road_PW



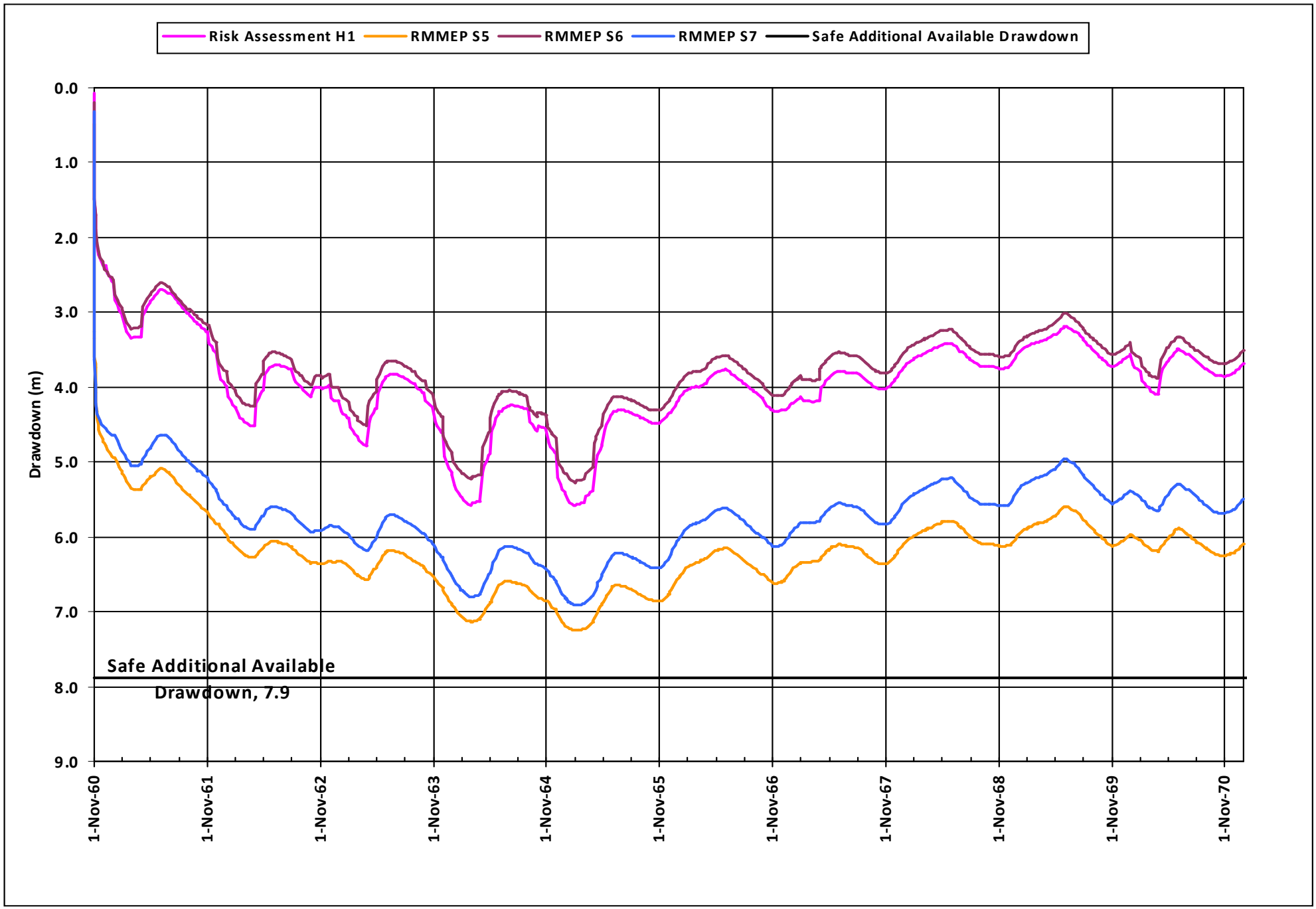
Well: Emma_PW


Risk Assessment H1
RMMEP S5
RMMEP S6
RMMEP S7
Safe Additional Available Drawdown
Drawdown (m)
-5.0
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Safe Additional Available Drawdown, 4.7
1-Nov-60
1-Nov-61
1-Nov-62
1-Nov-63
1-Nov-64
1-Nov-65
1-Nov-66
1-Nov-67
1-Nov-68
1-Nov-69
1-Nov-70

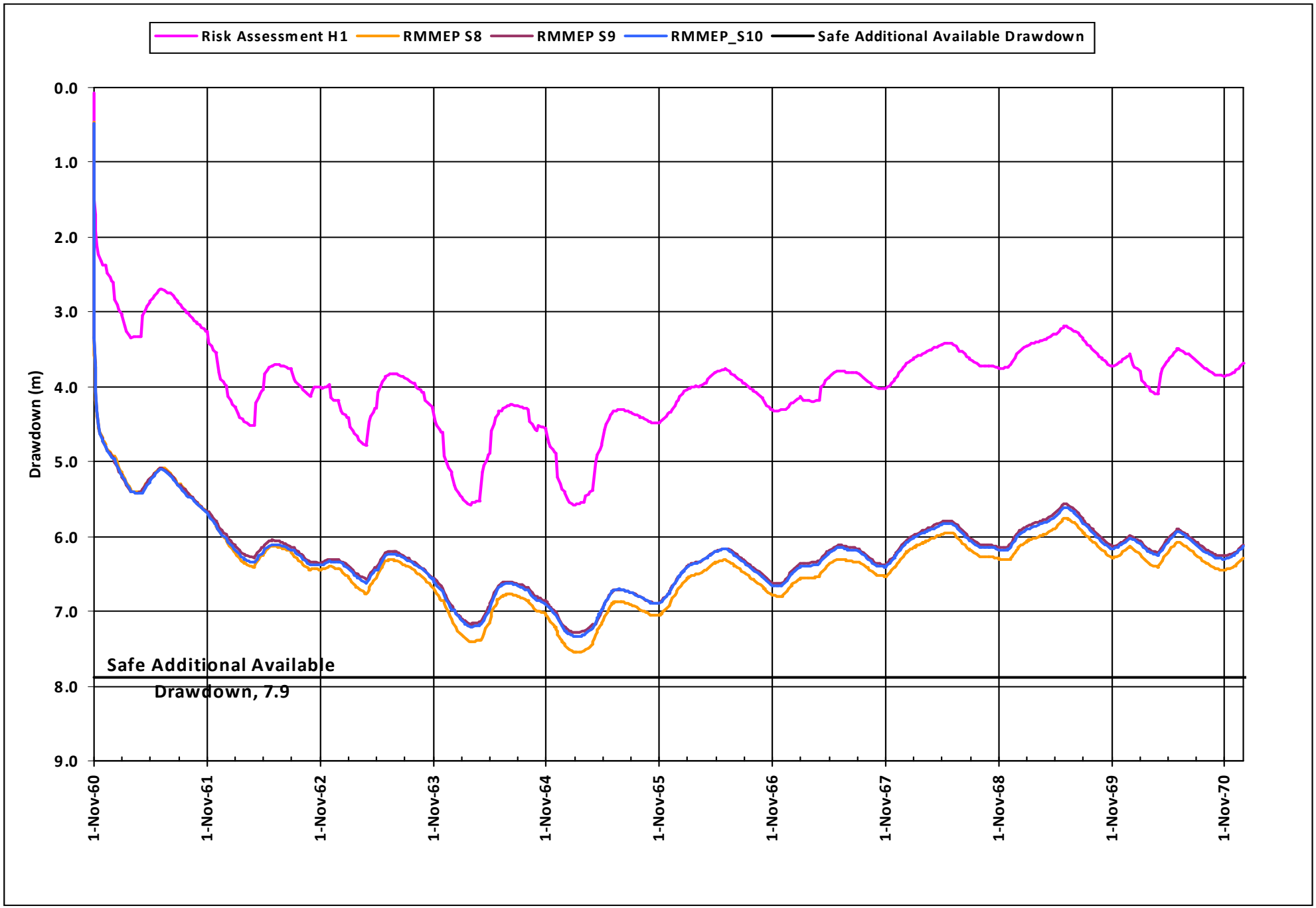
Well: Emma_PW


Risk Assessment H1
RMMEP S8
RMMEP S9
RMMEP_S10
Safe Additional Available Drawdown
Drawdown (m)
-5.0
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Safe Additional Available Drawdown, 4.7
1-Nov-60
1-Nov-61
1-Nov-62
1-Nov-63
1-Nov-64
1-Nov-65
1-Nov-66
1-Nov-67
1-Nov-68
1-Nov-69
1-Nov-70

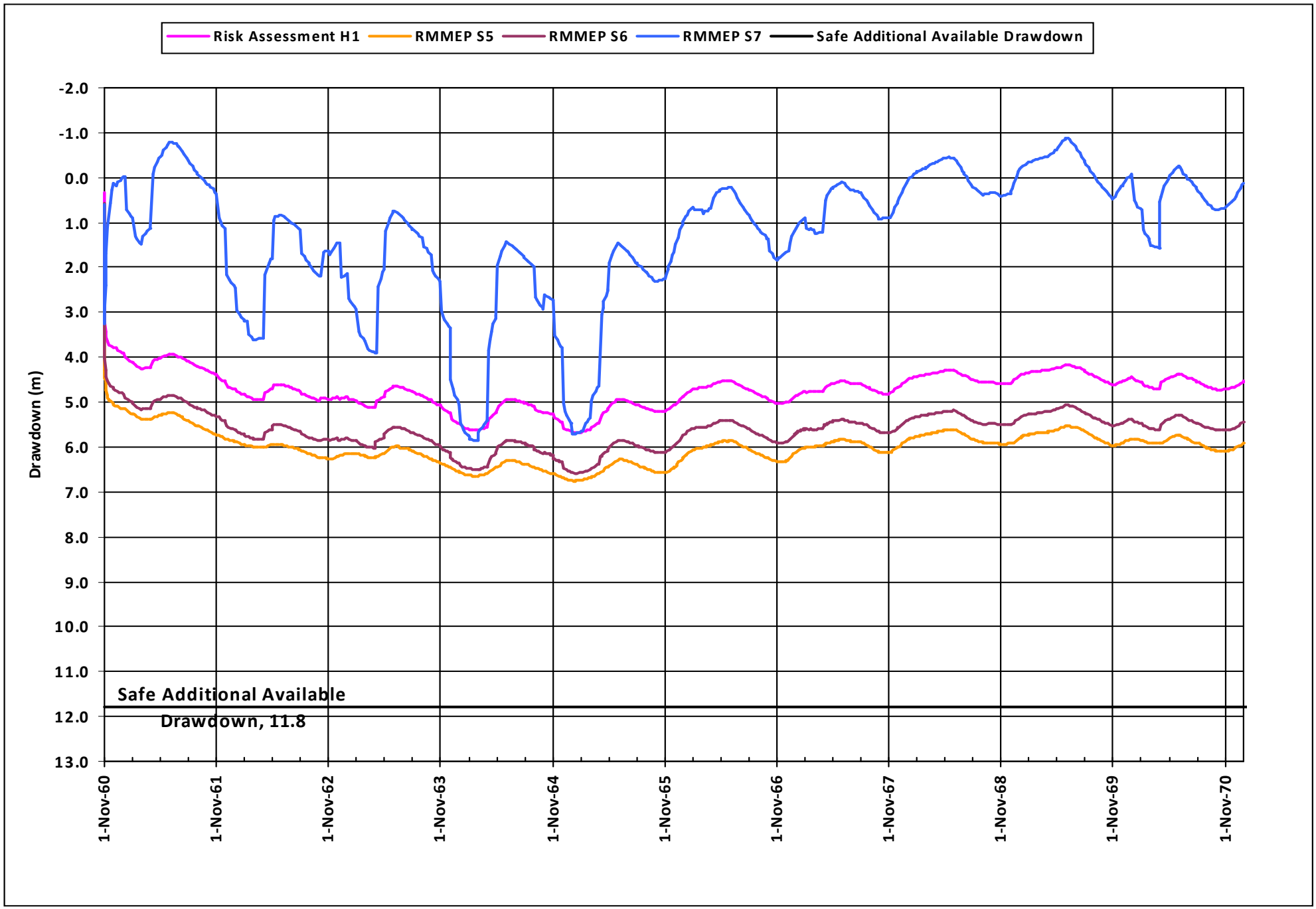
Well: Helmar_PW



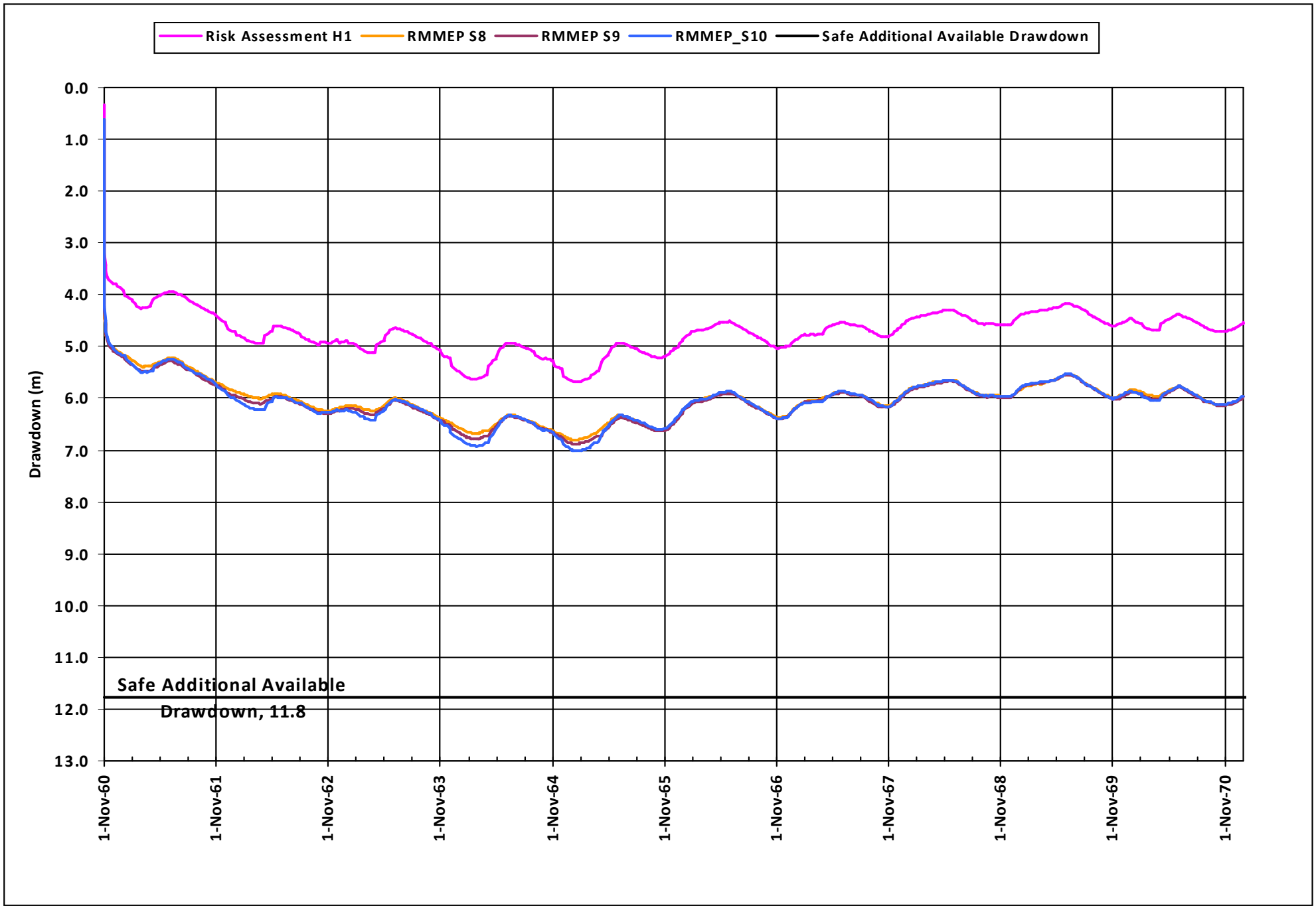
Well: Helmar_PW



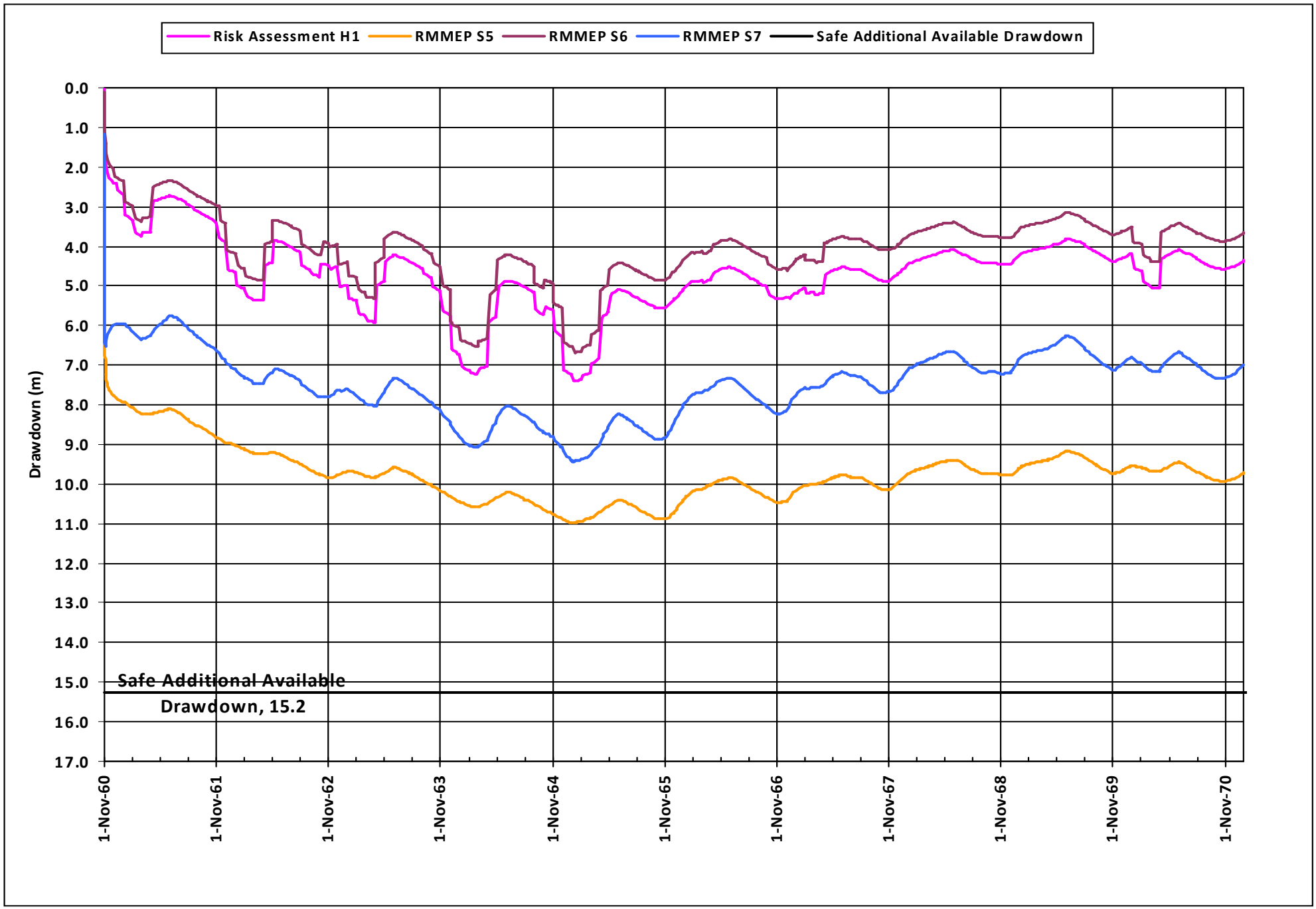
Well: Membro_PW



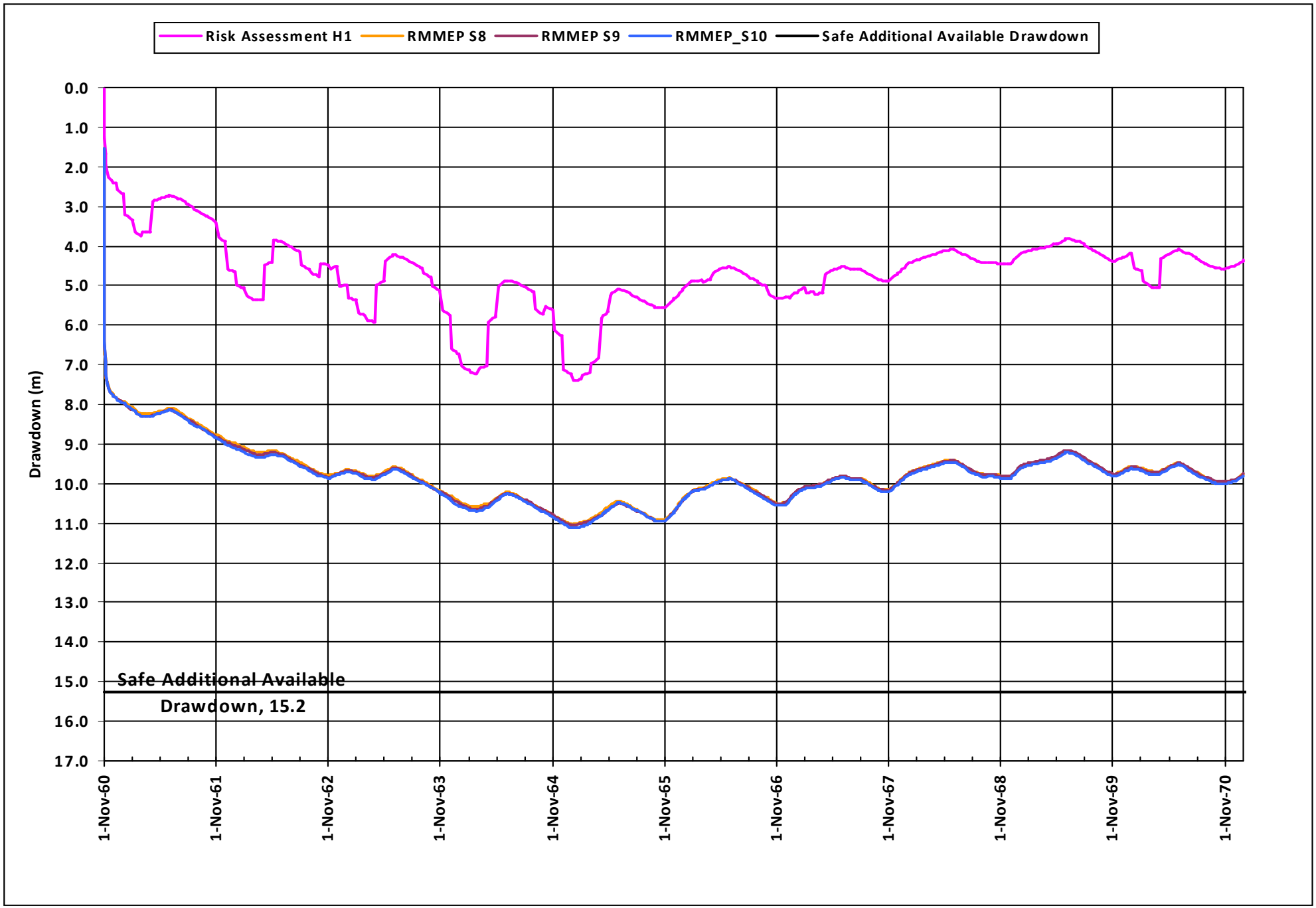
Well: Membro_PW



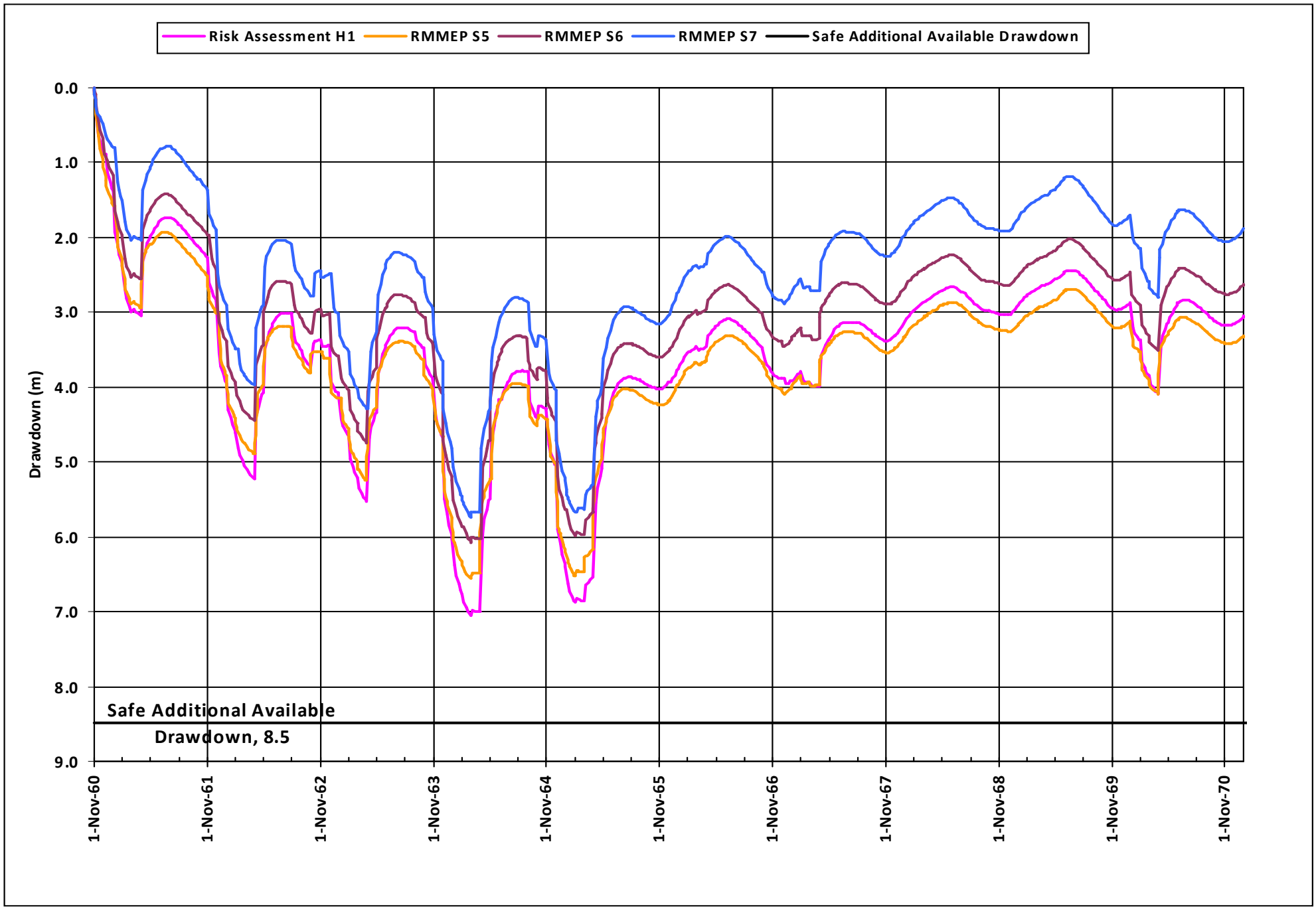
Well: Paisley_PW



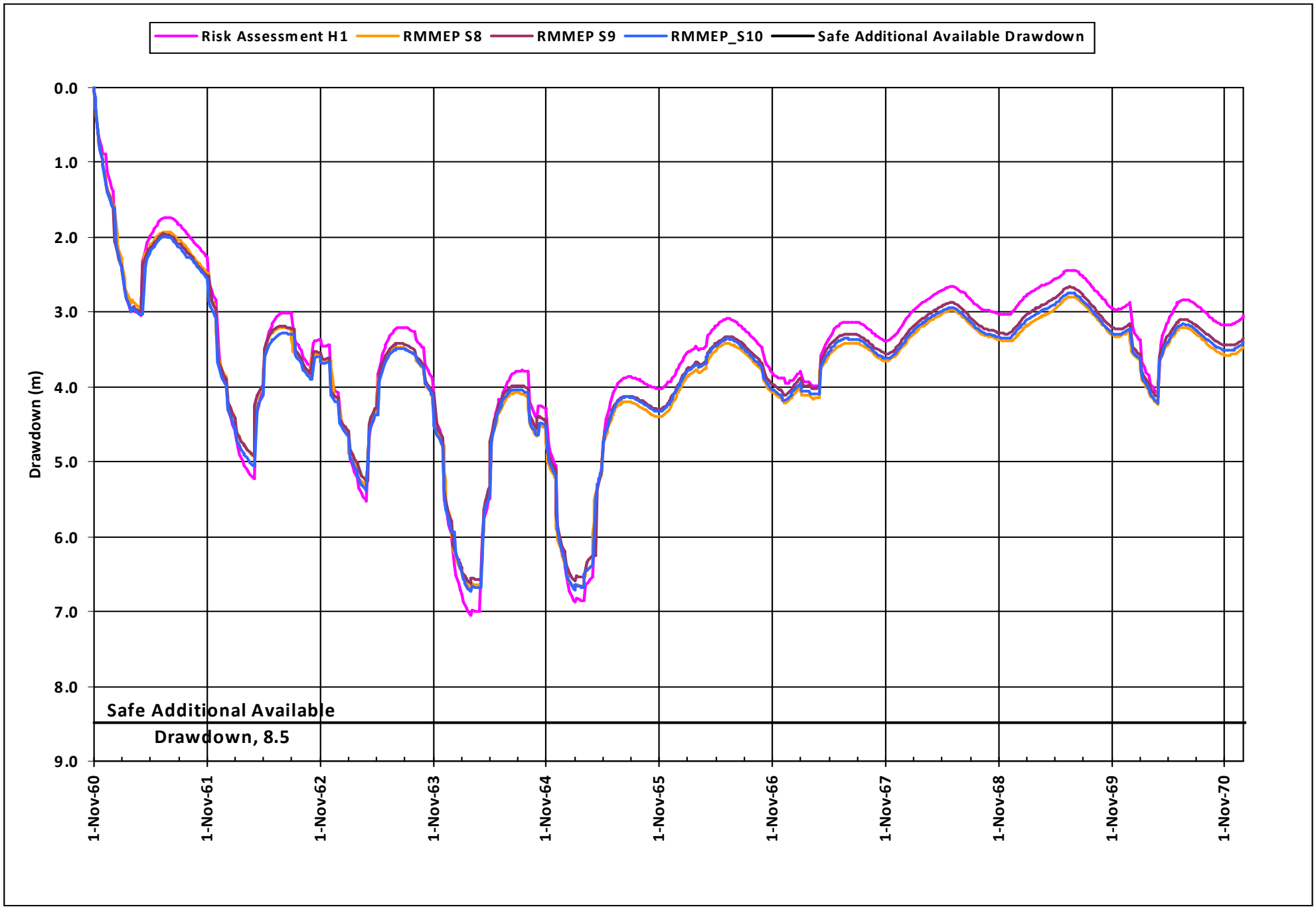
Well: Paisley_PW



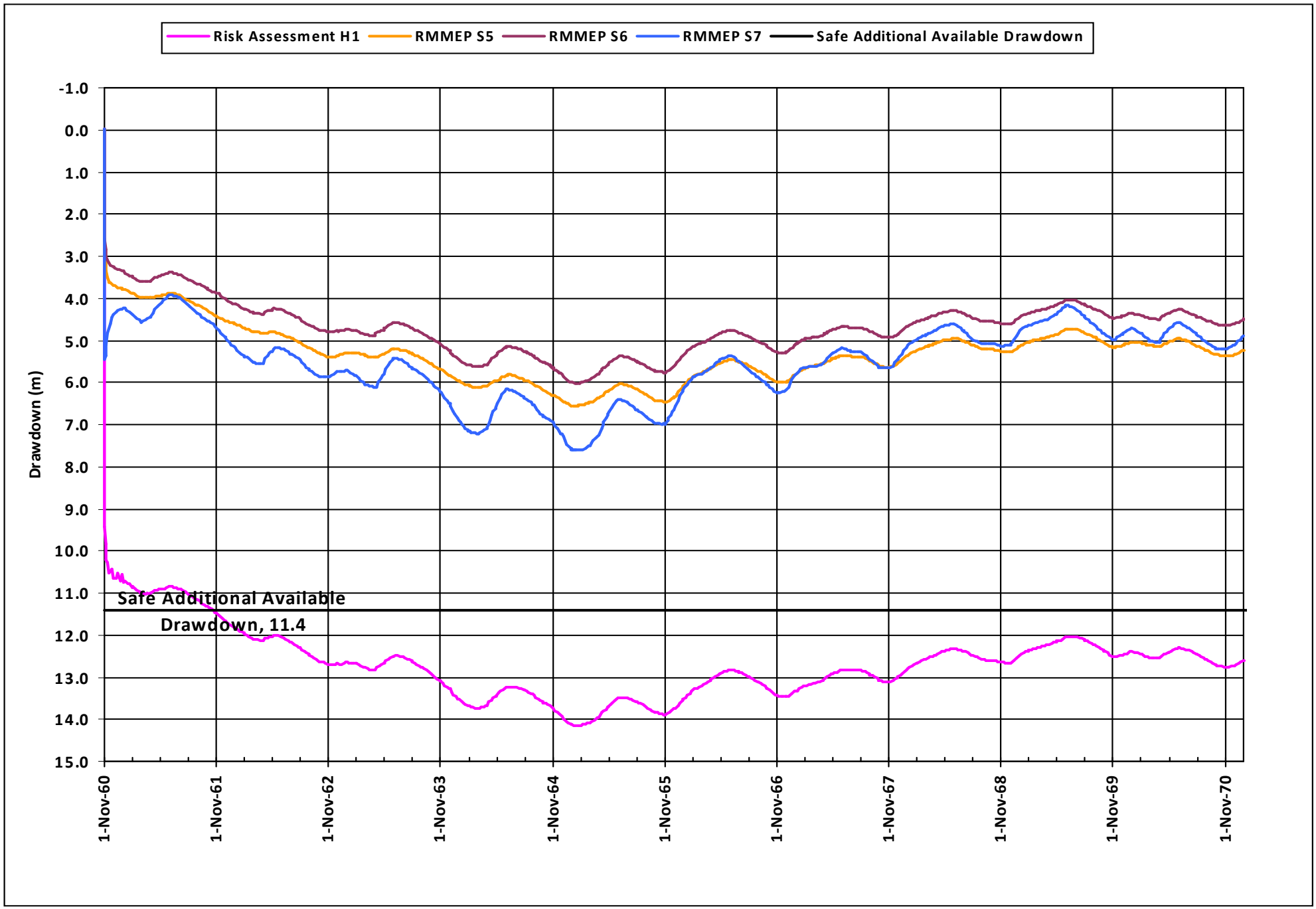
Well: Park_1_2_PW



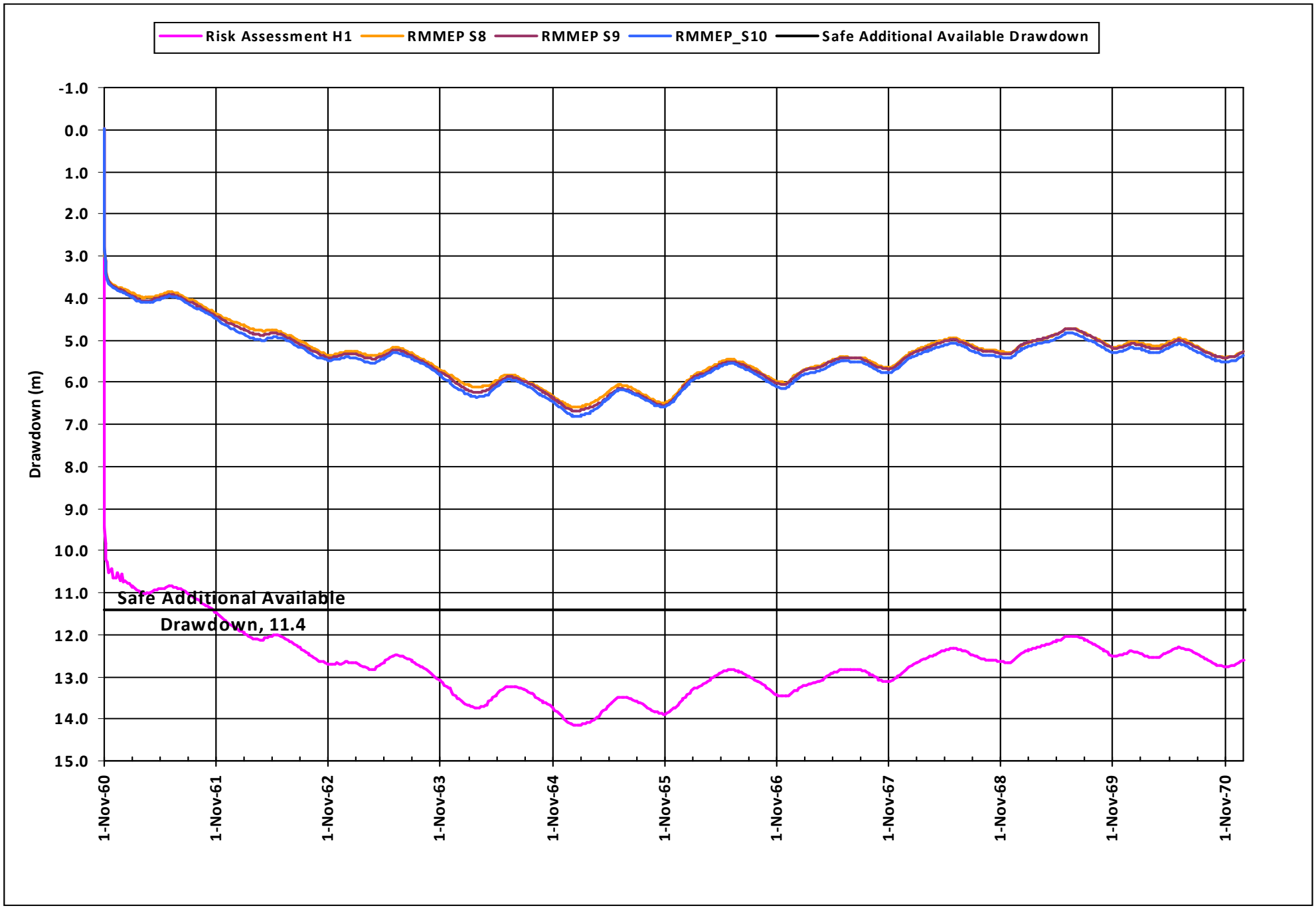
Well: Park_1_2_PW



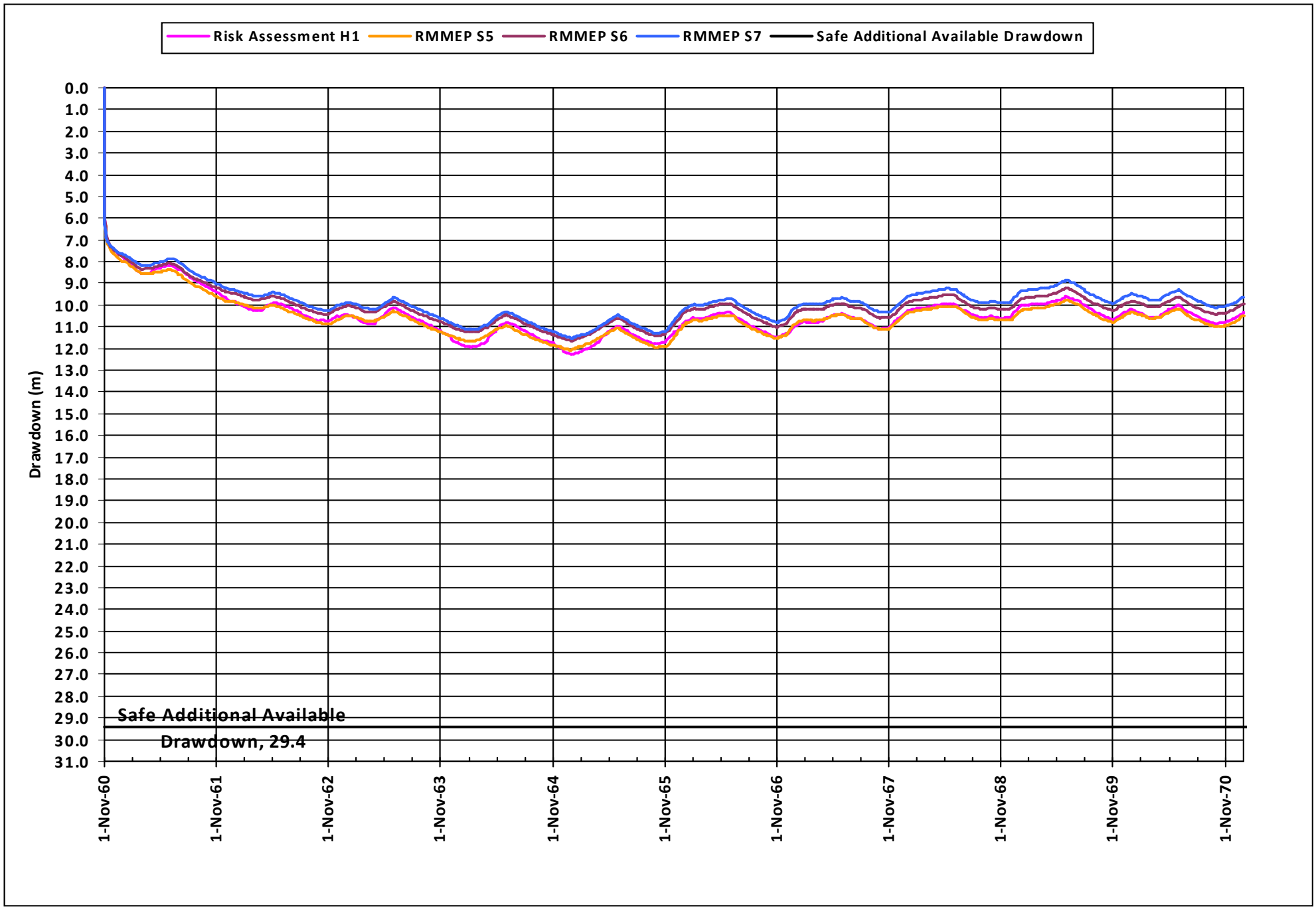
Well: Queensdale_PW



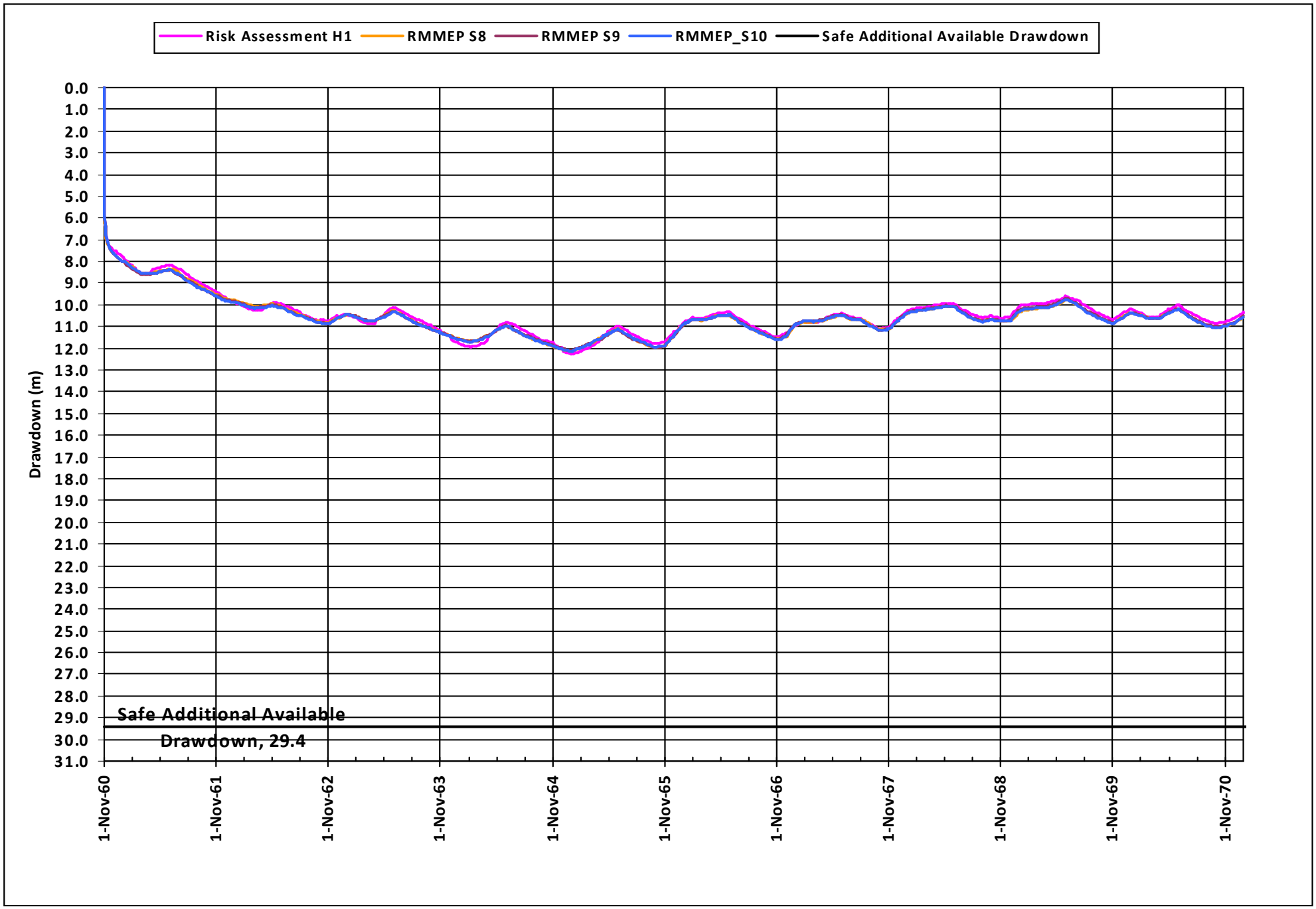
Well: Queensdale_PW



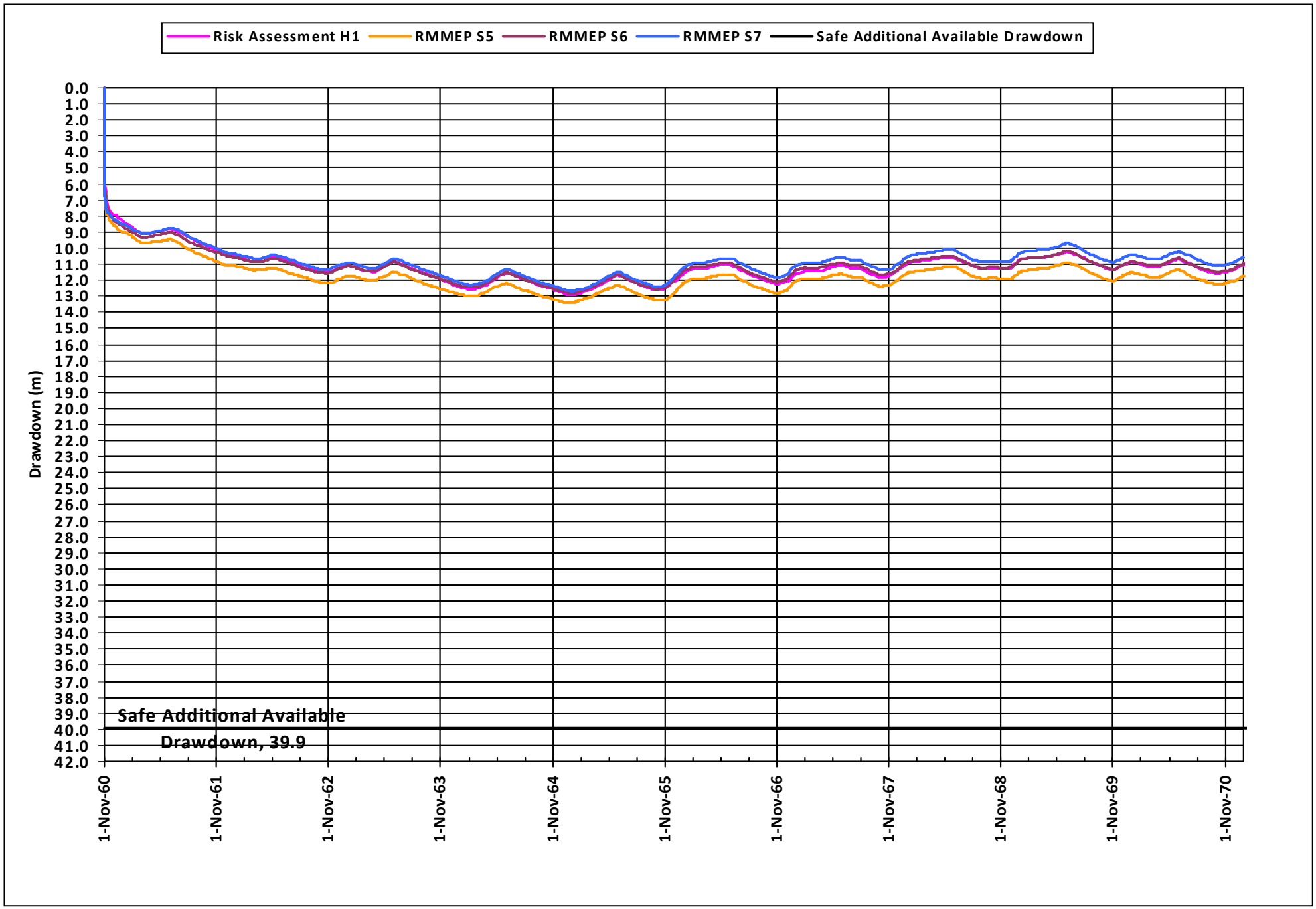
Well: Sacco_PW



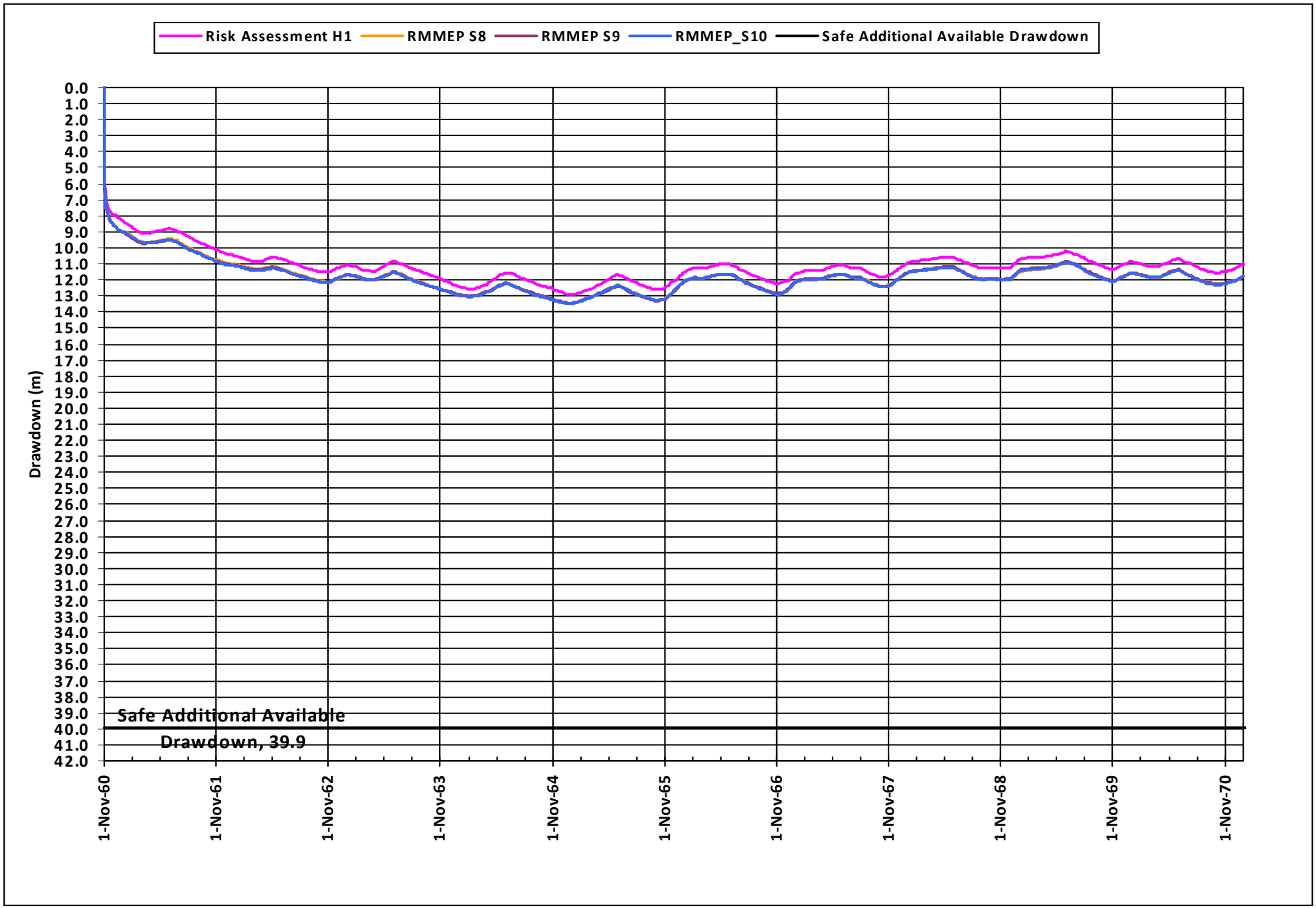
Well: Sacco_PW



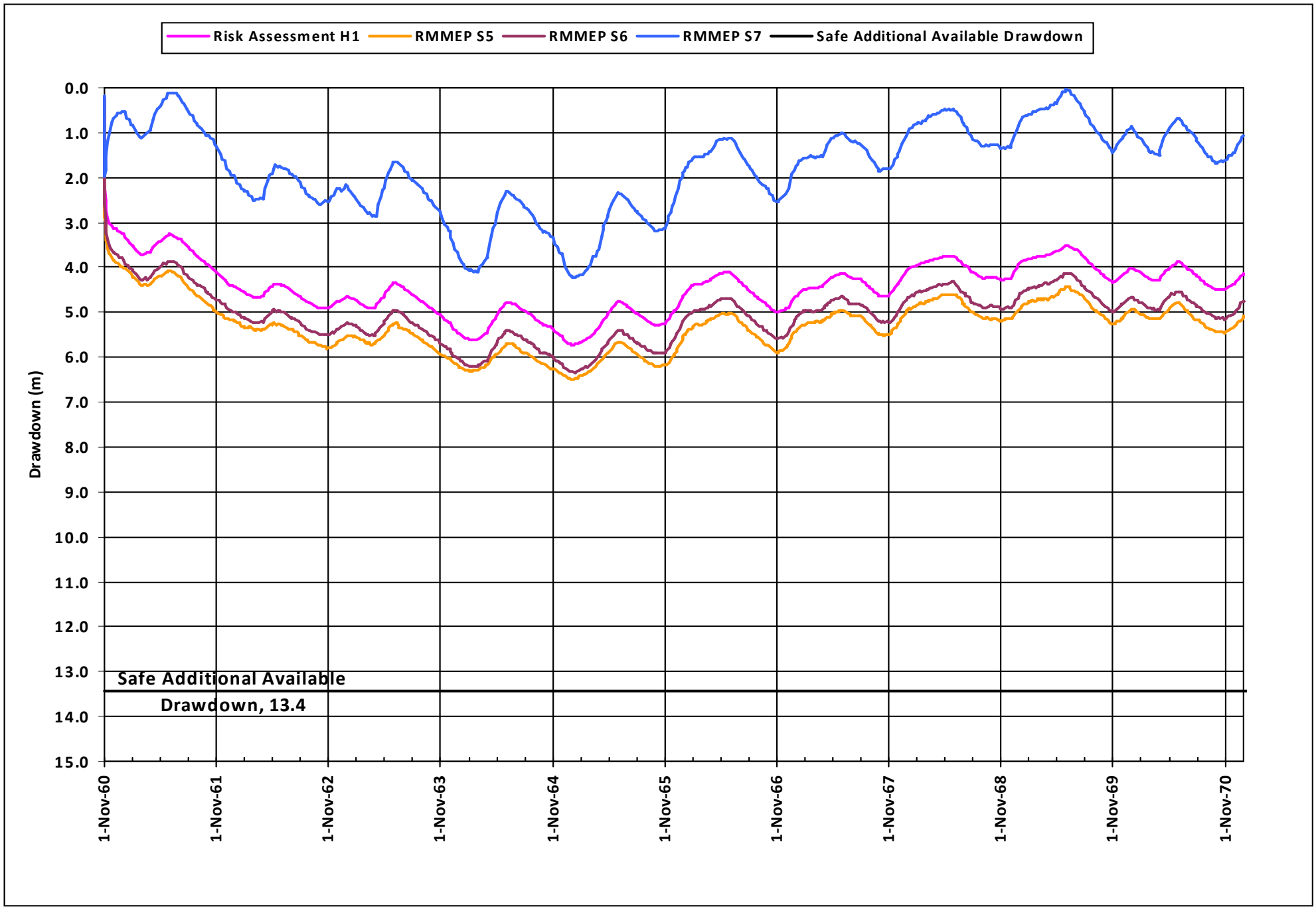
Well: Smallfield_PW



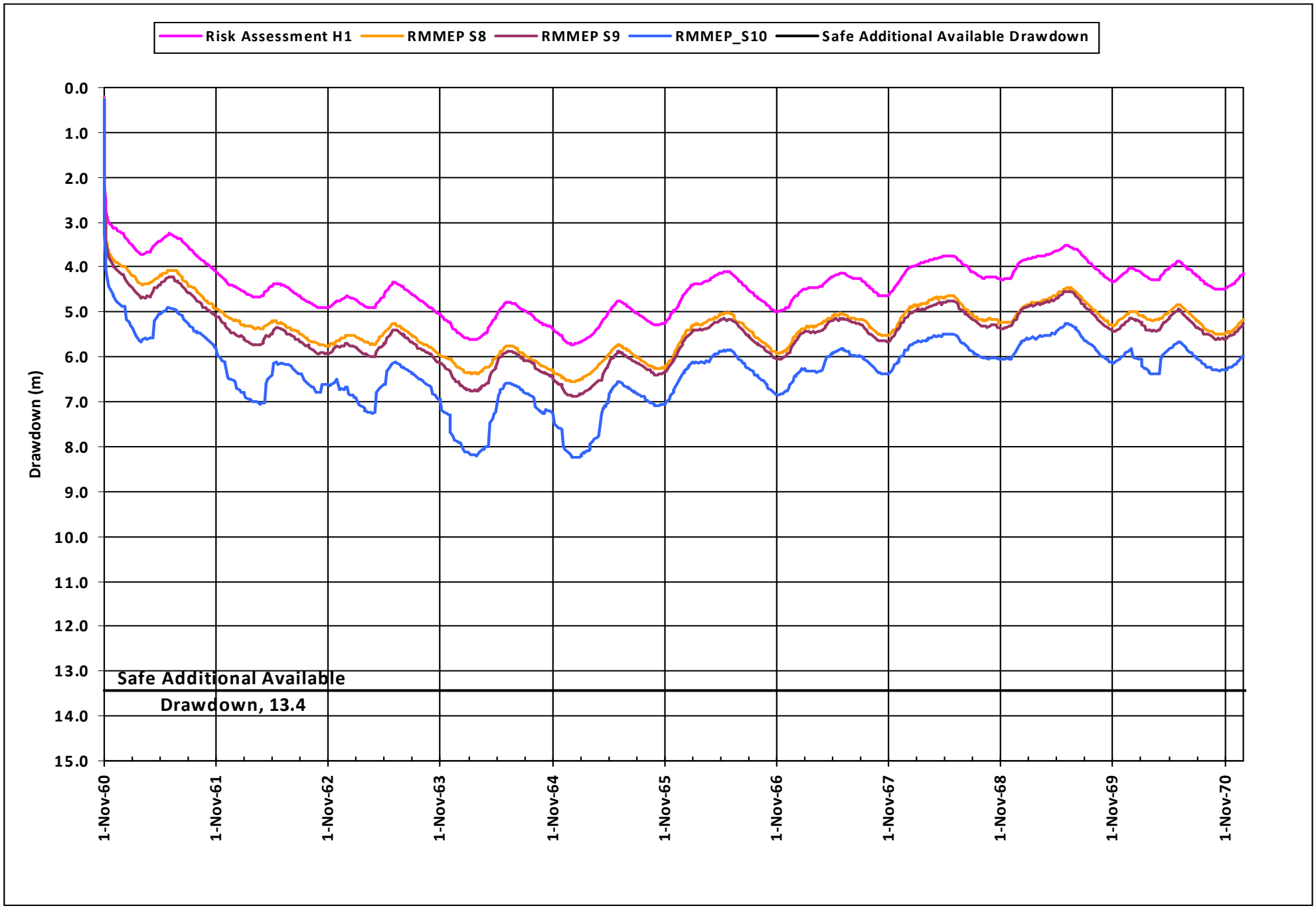
Well: Smallfield_PW



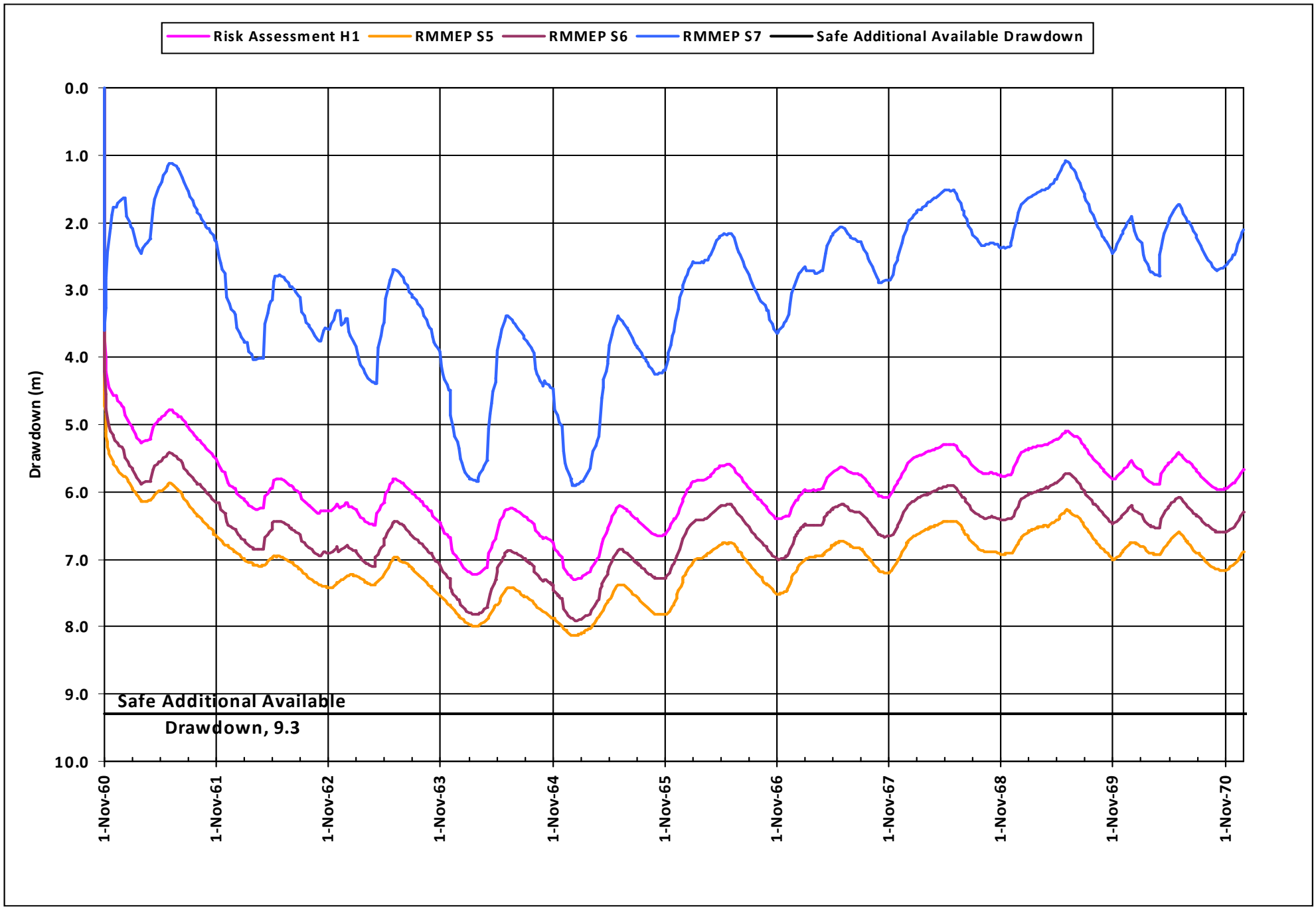
Well: University_PW



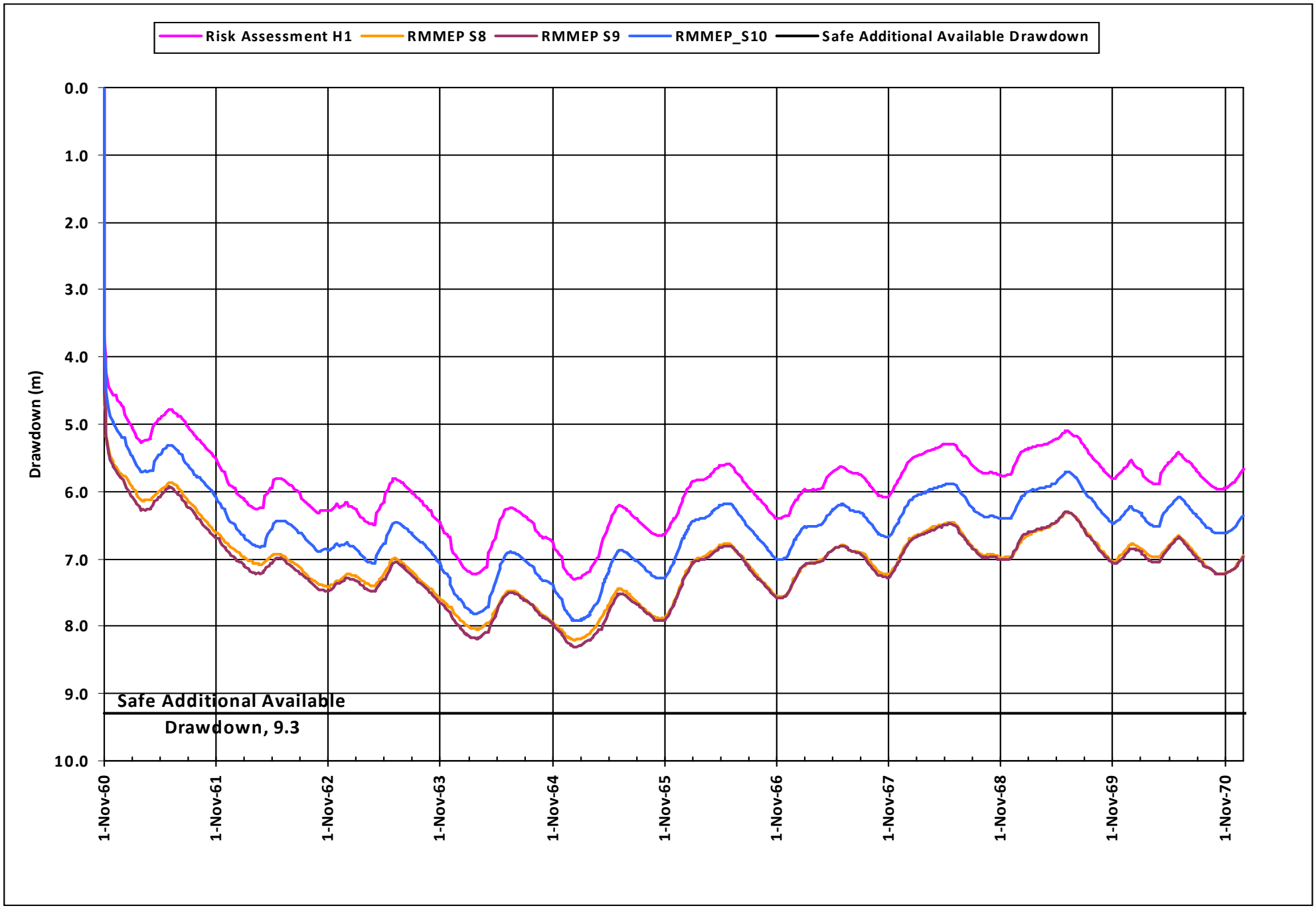
Well: University_PW



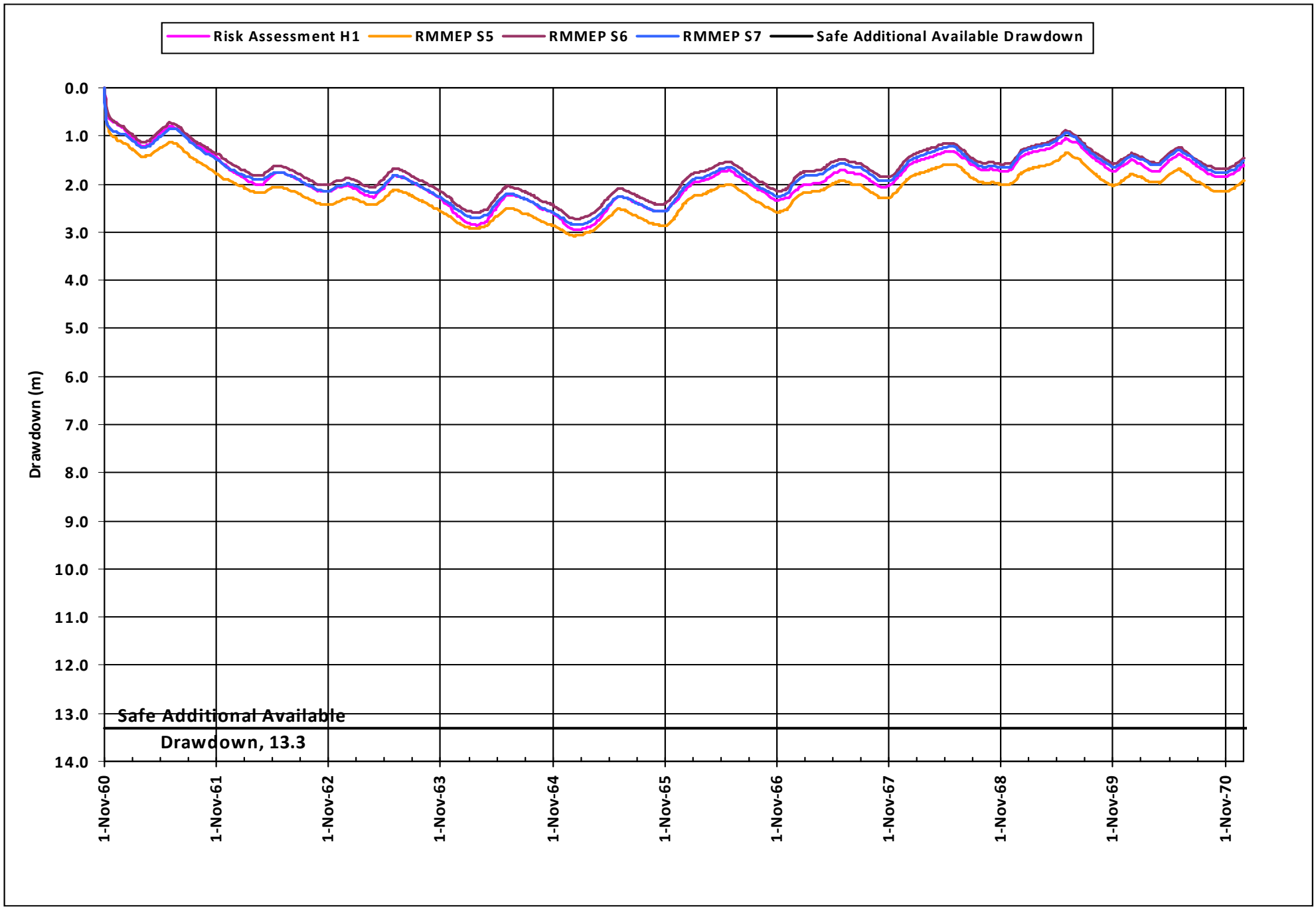
Well: Water_Street_PW



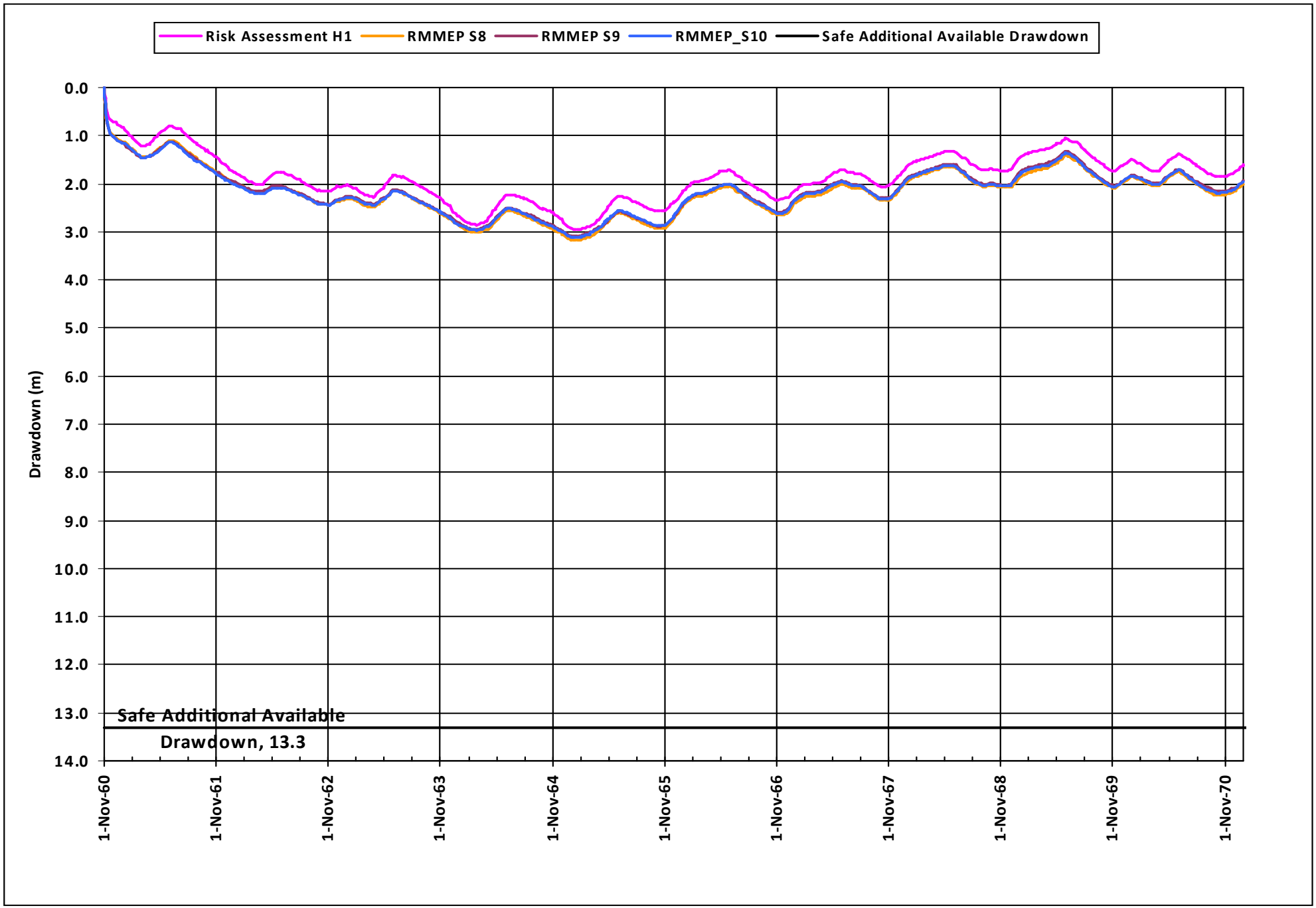
Well: Water_Street_PW



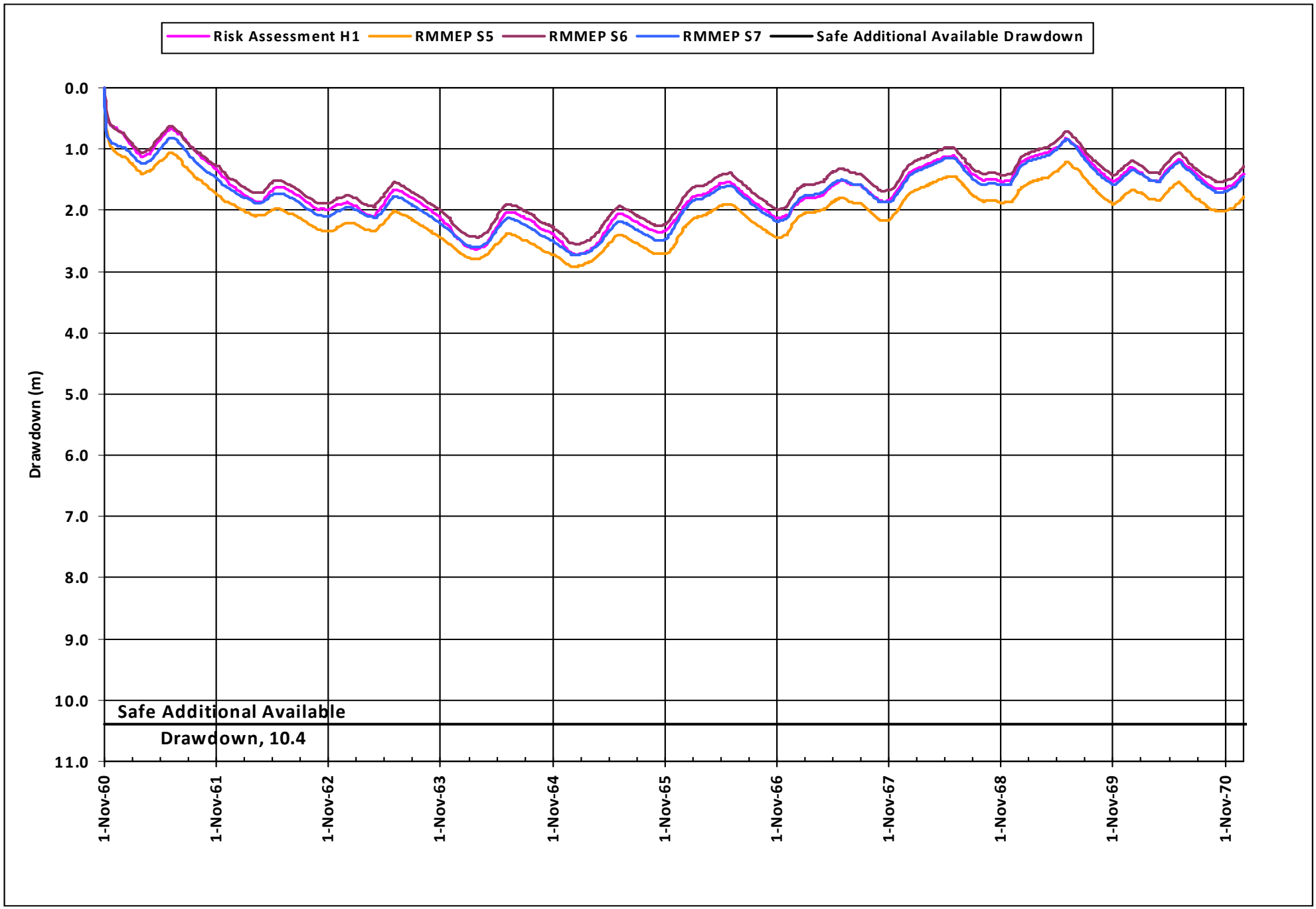
Well: CrossCreekWell



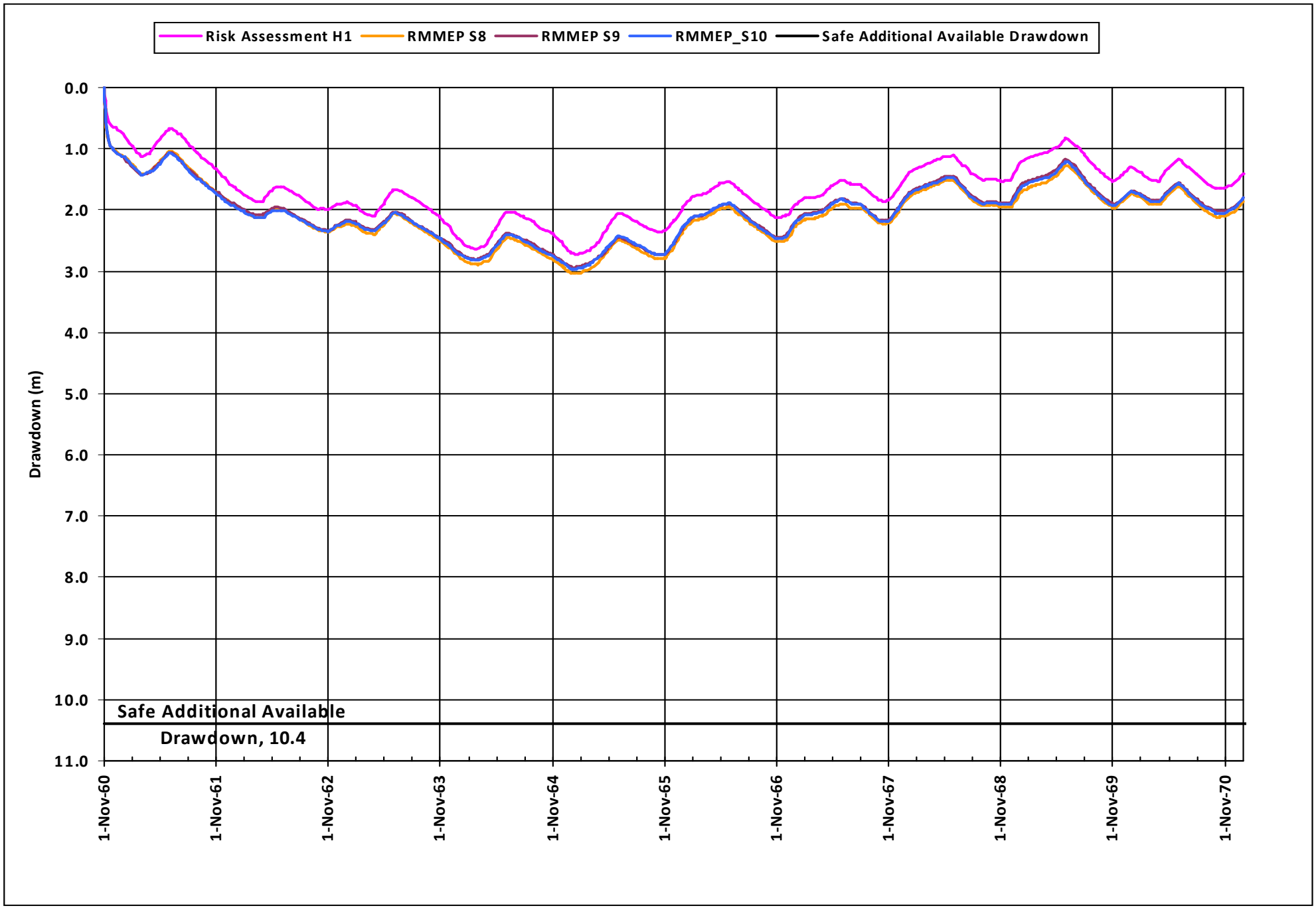
Well: CrossCreekWell



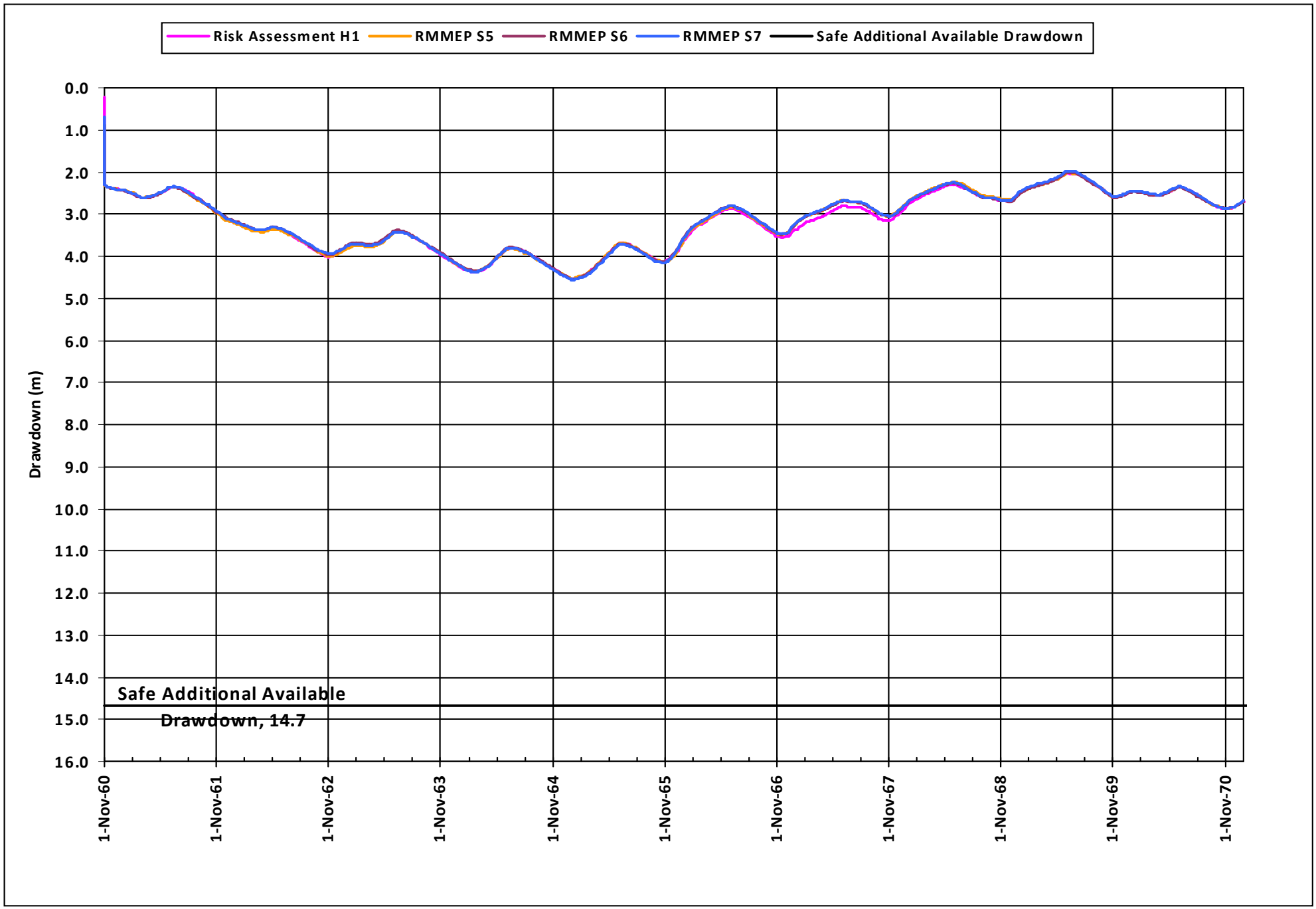
Well: HuntingtonEstatesWell



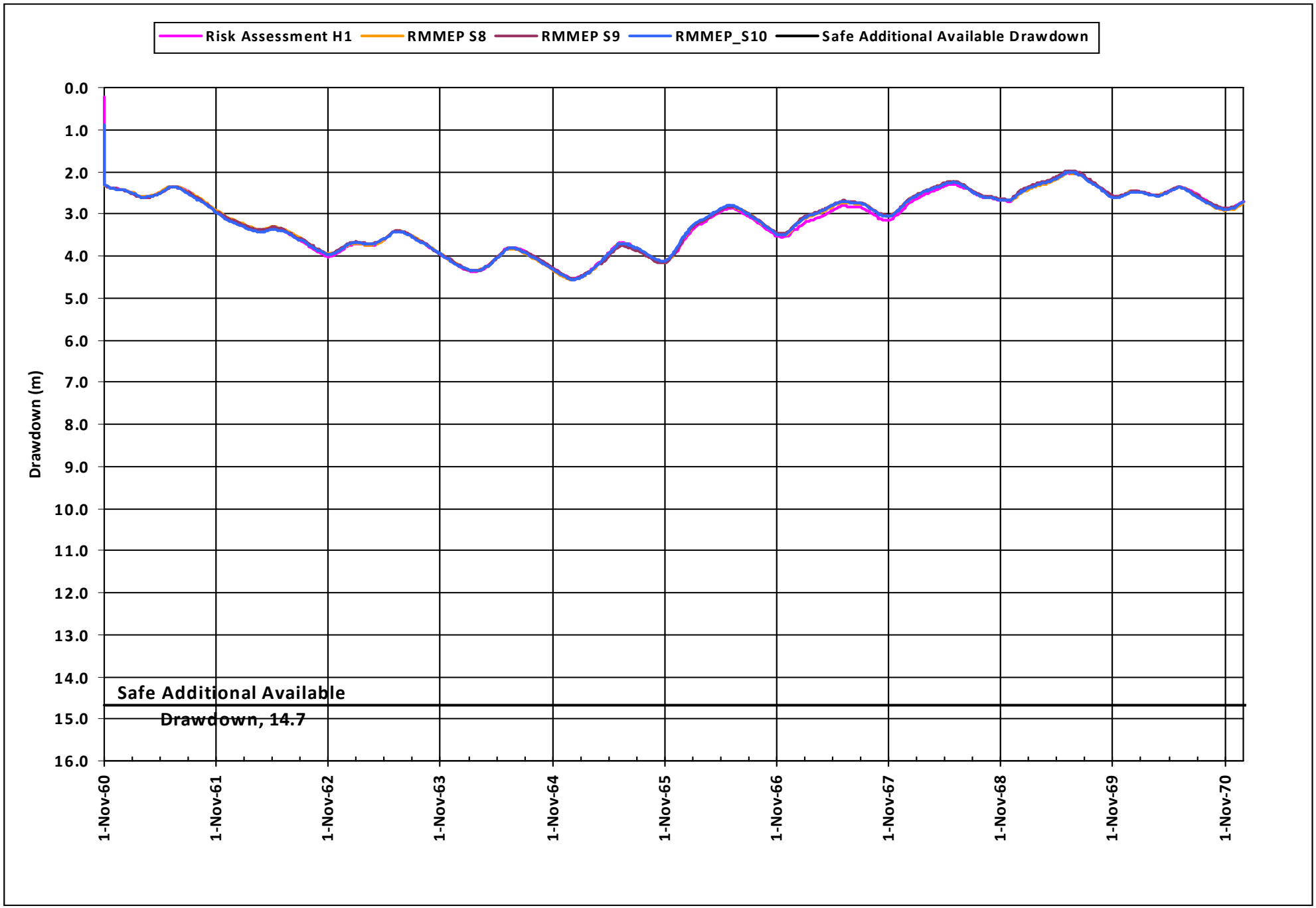
Well: HuntingtonEstatesWell



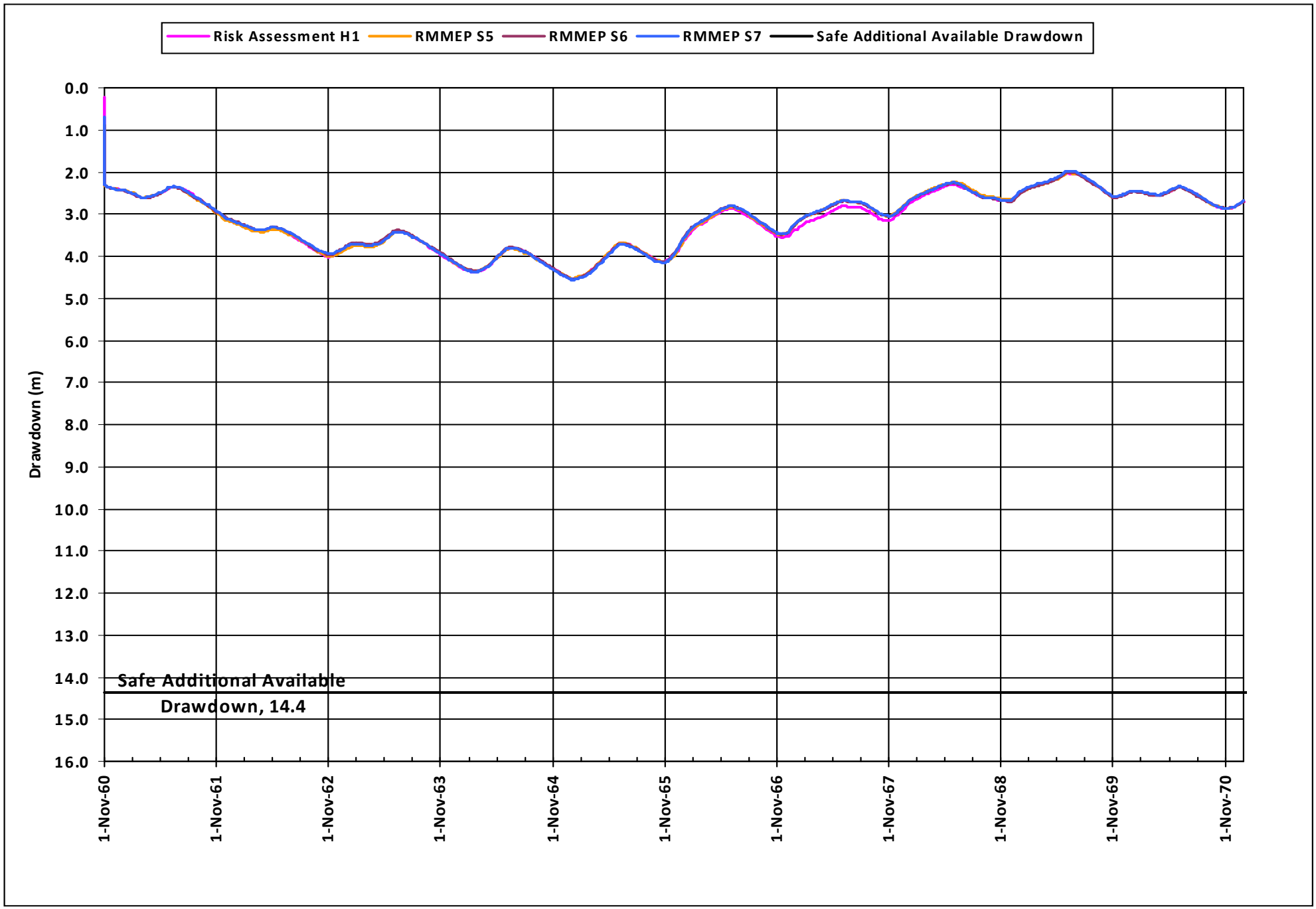
Well: Well1(TW1-67)



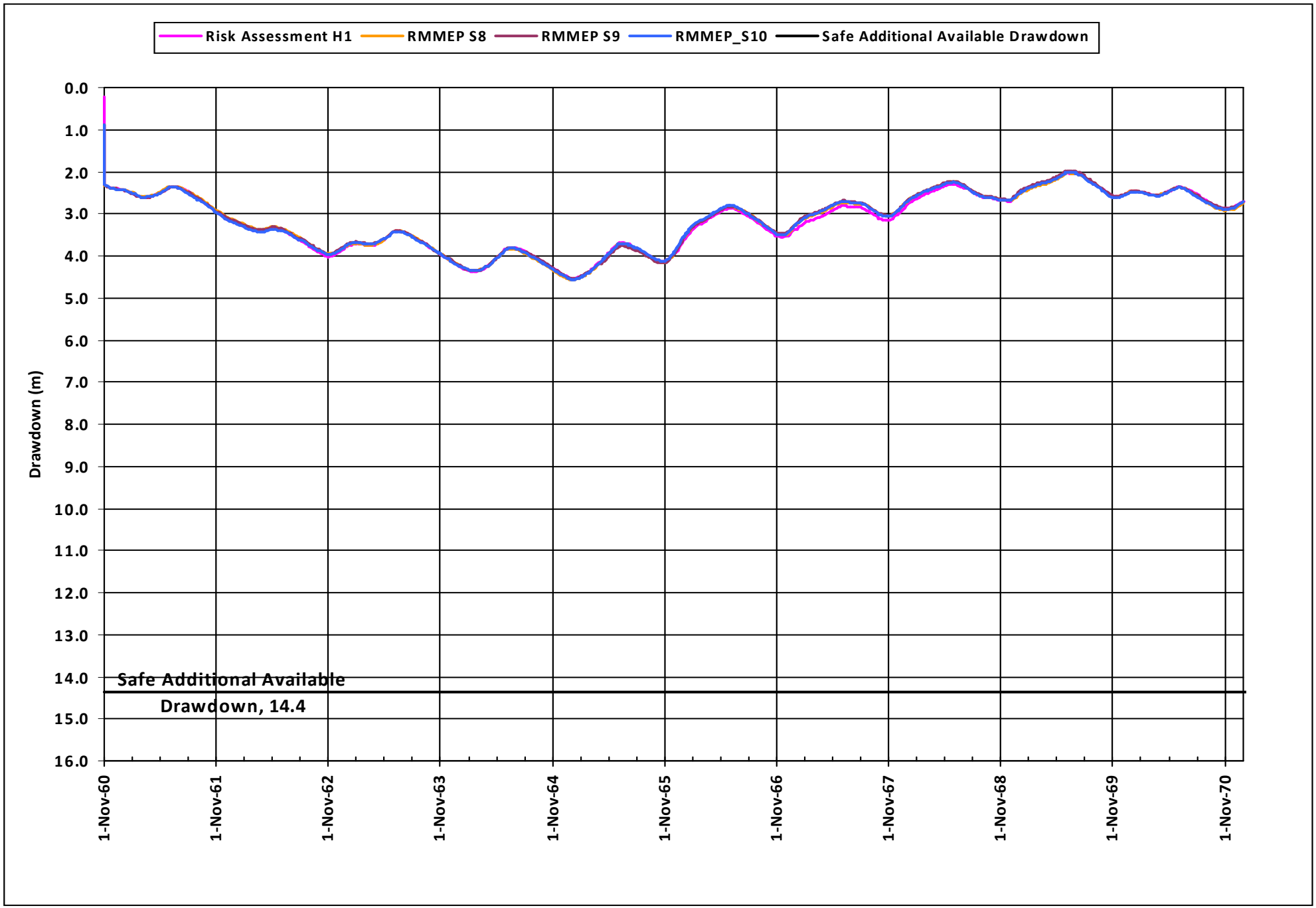
Well: Well1(TW1-67)



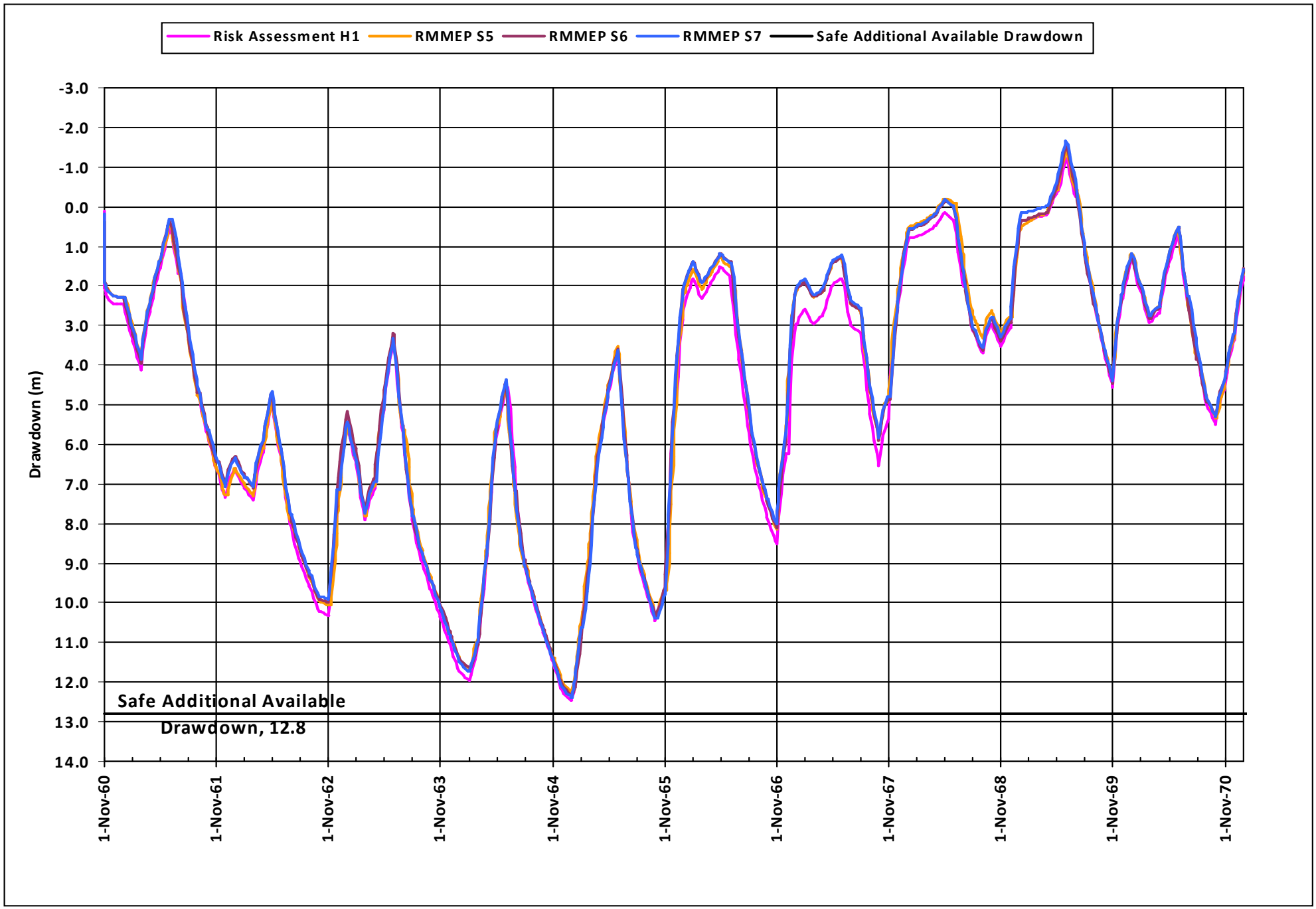
Well: Well2(TW1-76)



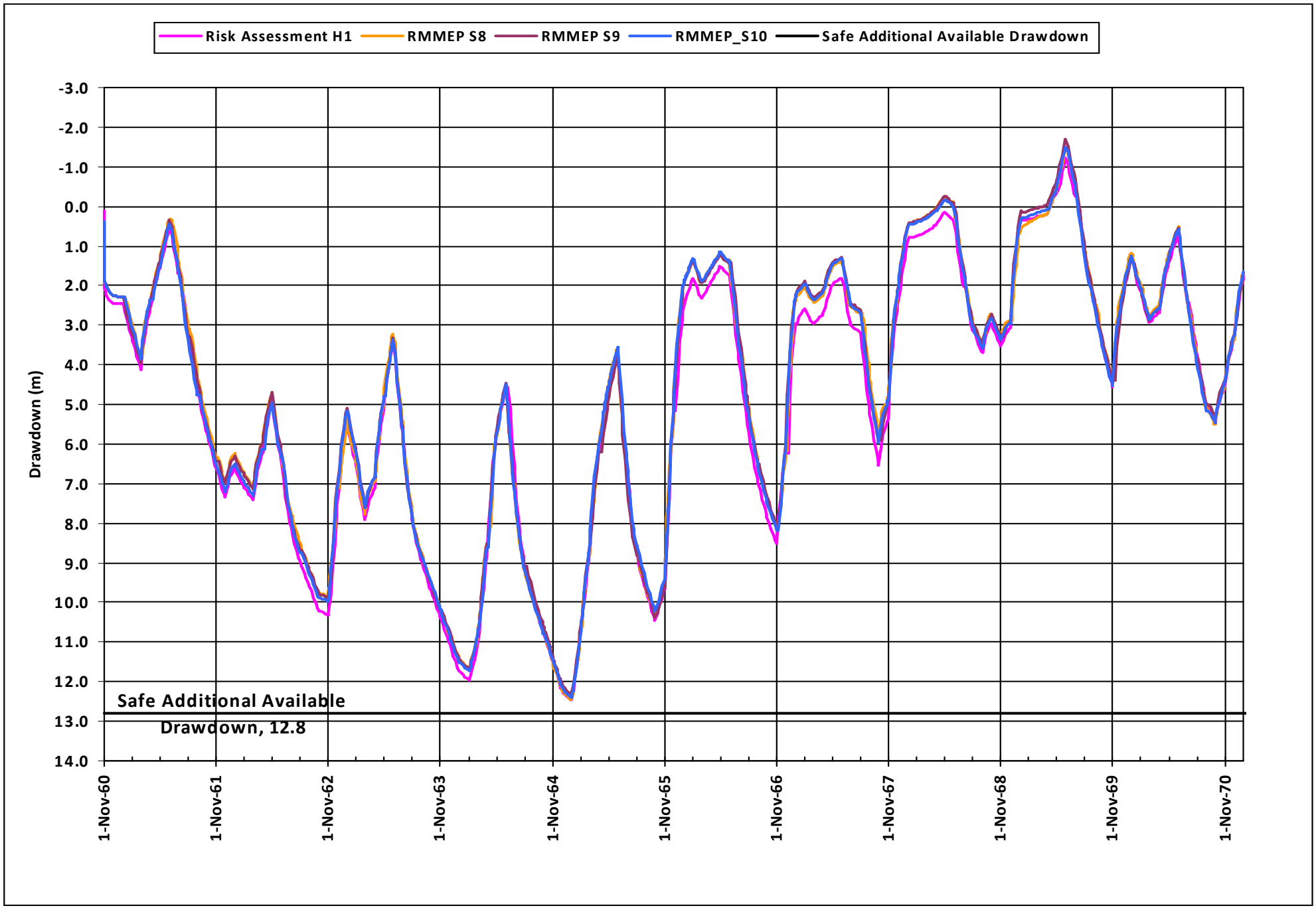
Well: Well2(TW1-76)



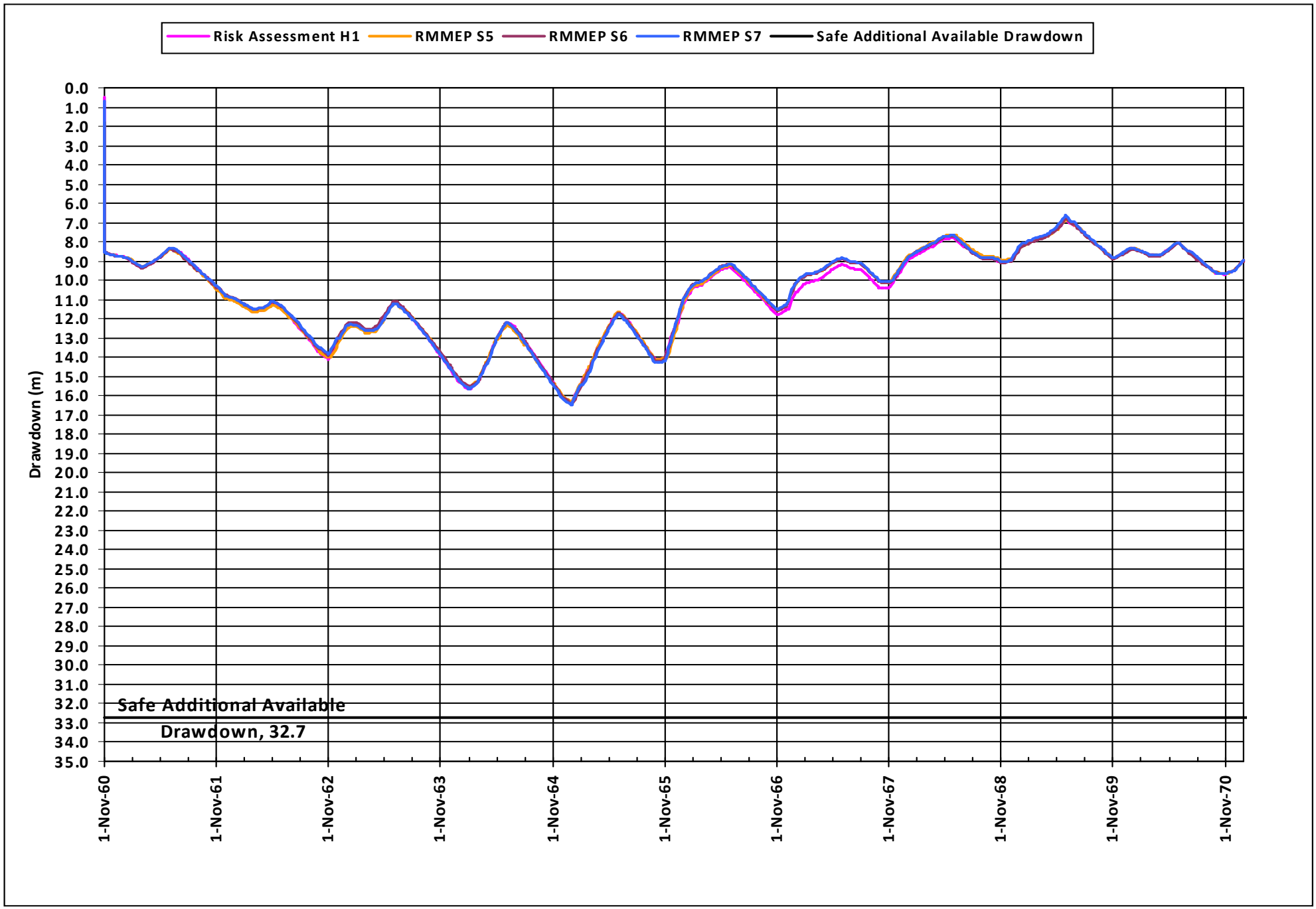
Well: BernardiWell3(TW3-02)



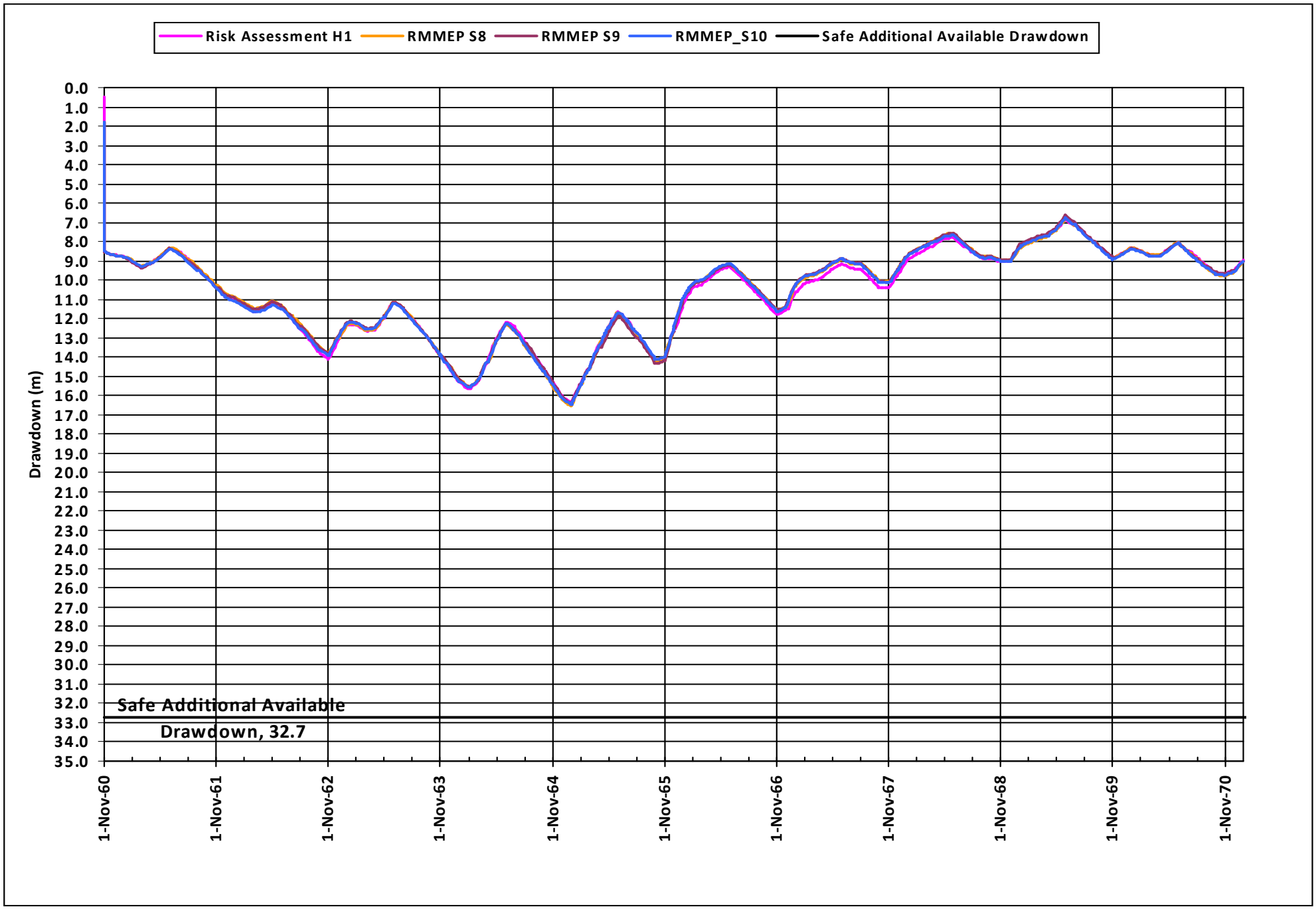
Well: BernardiWell3(TW3-02)



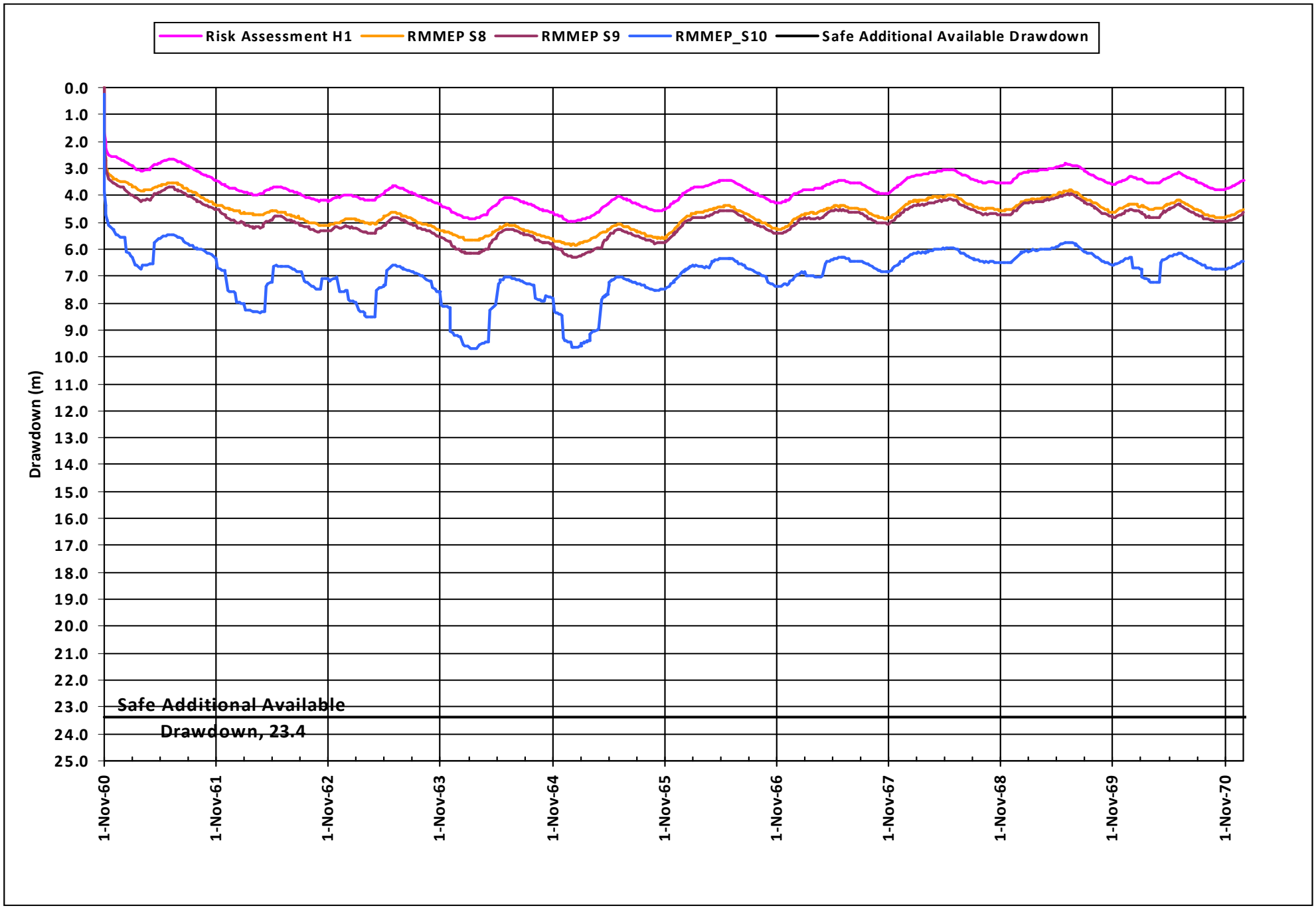
Well: RockwoodWell4



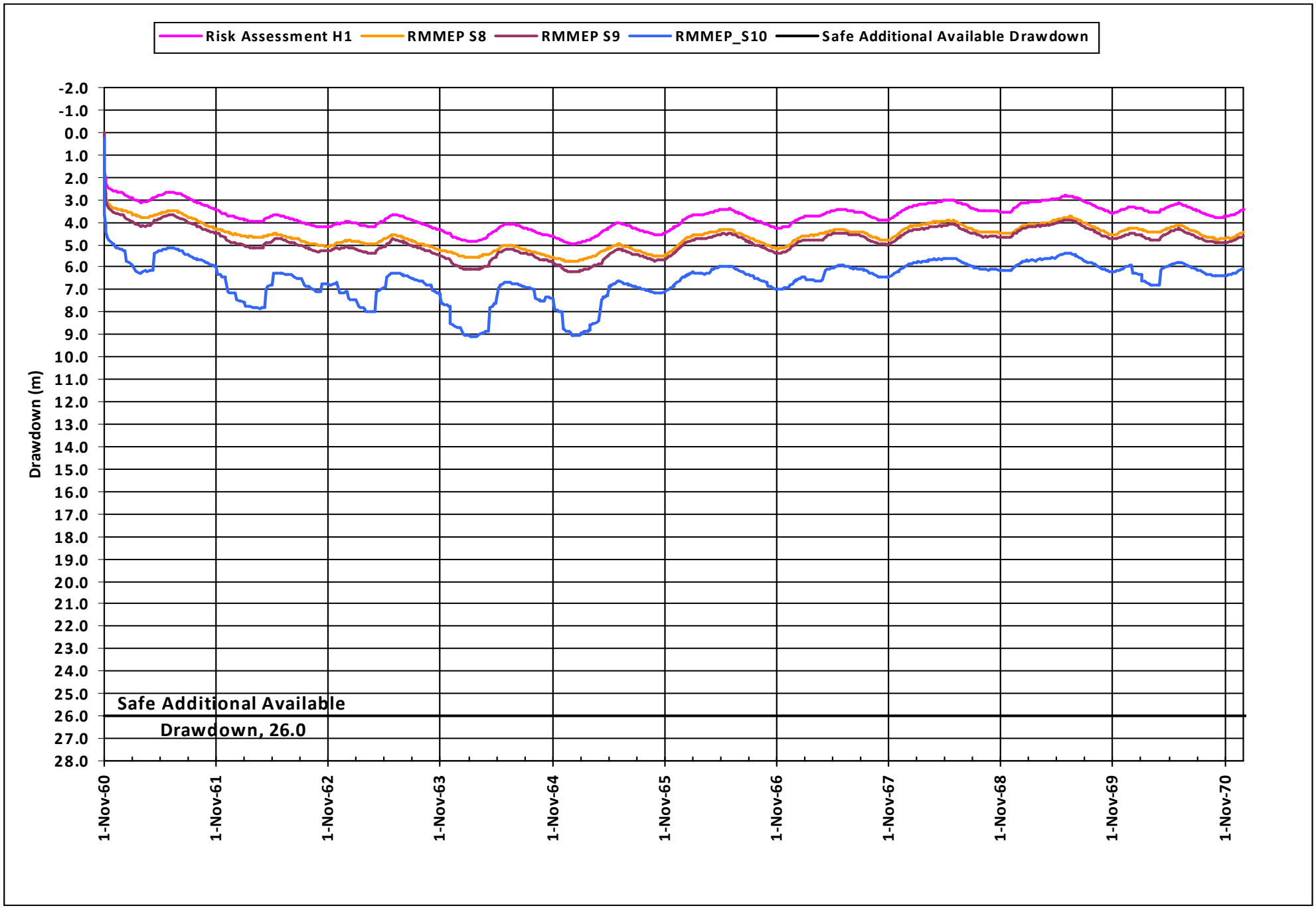
Well: RockwoodWell4



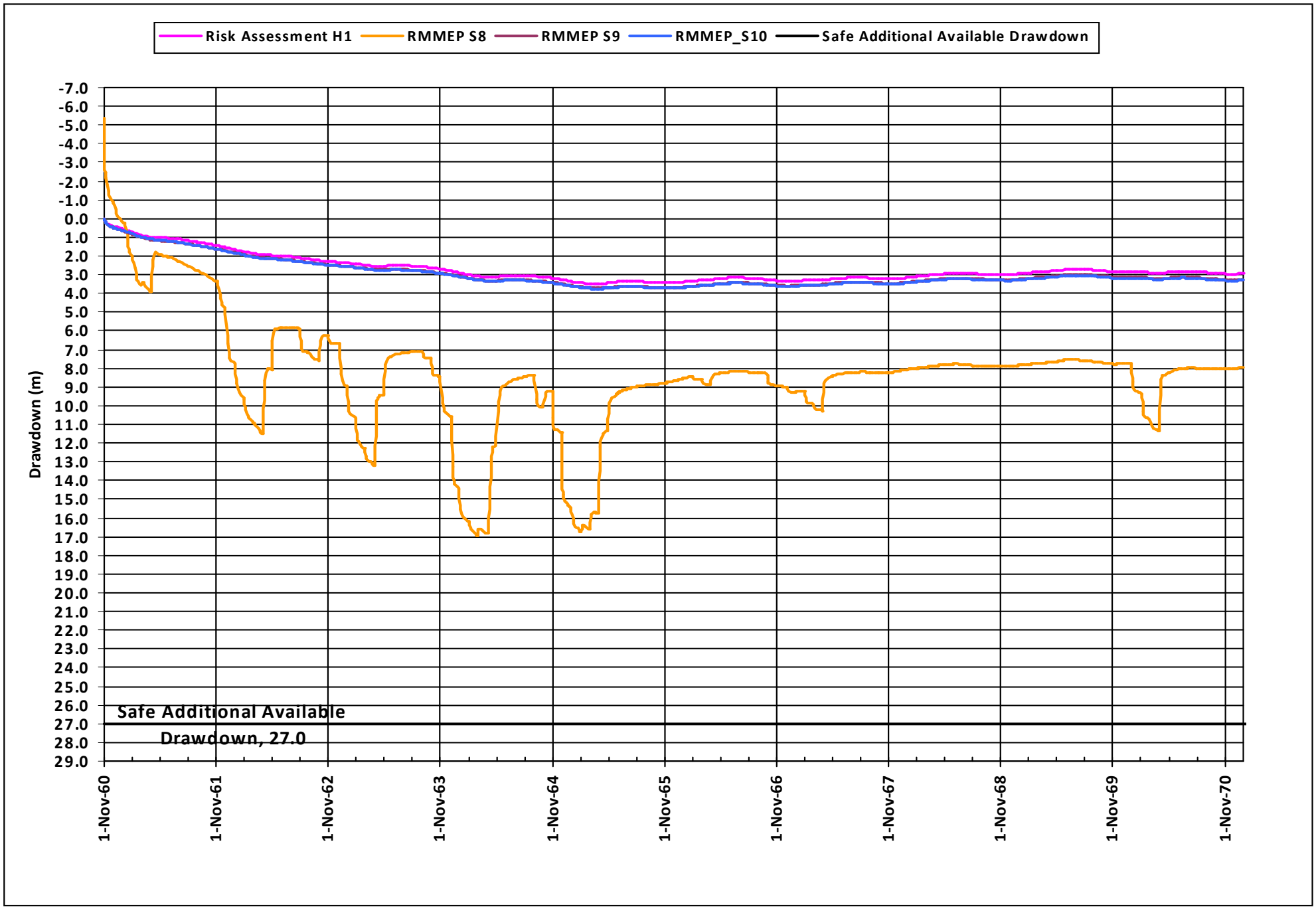
Well: Ironwood



Well: Steffler_Park



Well: Logan


Risk Assessment H1
RMMEP S8
RMMEP S9
RMMEP_S10
Safe Additional Available Drawdown
Drawdown (m)
-7.0
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
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25.0
26.0
27.0
28.0
29.0
Safe Additional Available
Drawdown, 27.0
1-Nov-60
1-Nov-61
1-Nov-62
1-Nov-63
1-Nov-64
1-Nov-65
1-Nov-66
1-Nov-67
1-Nov-68
1-Nov-69
1-Nov-70

Well: GSTW1_08