Minutes of Meeting

Subject : 7th Peatlands Working Group 2 (PLWG-2) Meeting
Date : September 13th & 14th, 2018
Venue : VE Hotel, Kuala Lumpur

Name	Organisation	Status
Dr. Faizal Parish	GEC	Substantive
Dr. Joshua Mathews	Bumitama Gunajaya Agro	Substantive
Dr. Shahrakbah Yacob	Sime Darby	Substantive
Jason Foong	KLK	Substantive
Dr.Raymond Alfred (14th September only)	IOI Group	Substantive
Dato' Keizrul Abdullah	Wetlands International (Malaysia)	Substantive
Almo Pradana	World Resource Institute (WRI)	Alternate
Jason Hon	WWF Malaysia	Alternate
Muhamad Faizuddin Zainuddin	GEC	Alternate
Lim Sian Choo	Bumitama Gunajaya Agro	Alternate
Richard Kan	Golden Agri	Alternate
Jason Foong	KLK	Substantive
Arig Sugandi	AAR (KLK)	Alternate
Ian Orrell	NBPOL	Substantive
Sin Chuan Eng	KLK	Observer
Eli N.Sari	IOI Group	Drainability assessment tester
Dipa Rais	Wetlands International Indonesia	Consultant
Amir Afham	RSPO Secretariat	Secretariat
Devaladevi Sivaceyon	RSPO Secretariat	Secretariat
Absent with apologies:		
Chin Kai Xiang	Bunge Loders Croklaan	Substantive
Gotz Martin	Golden Agri	Substantive
Rianto Sitanggang	Bunge Loders Croklaan	Alternate
Harizajudin	Sawit Watch	Alternate

No	Item description	Main Discussion Points	Action Points	Progress Update
September 13th 2018 (Thursday)				
1.	Welcome of new members and testers. Review of meeting agenda followed by previous minutes of meeting.	Amir started the meeting by introducing and welcoming new comers, existing working group (WG) member introduced themselves as well. Under AOB discussion, Faizal added P&C 2018 to discuss on peat and other relevant topics that can be anticipated during P&C Taskforce (TF). The next and final meeting for P&C TF meeting will be next week at Indonesia. Sian Choo suggested that BMP, Audit checklist and drainability assessment procedure should also be the focus for this meeting. Sian Choo also suggested that audit checklist needs to have clarity on what are the major and minor components that must be audited and what concludes 'go' and no-go' in terms of compliance. For Day 1, the audit checklist and drainability assessment will be the focus of the WG. Amir moved to previous minutes of meeting to explain on action points as below: • Peat map from Wetlands International and Richard (for GAR) has been received. The initial findings are found to be a bit sketchy. Amir mentioned that these maps will only be used for WG purpose, until and unless permission granted by WG it won't be shared to external parties. Amir suggested that should maps be needed for auditors, then perhaps a login id for individual auditors should be created. Jason brought the point that once it can be viewed, auditors can always make a screen shot. Instead of this, it was preferred if maps can only be revealed upon request during audit by company themselves. Sian Choo added that it was previously agreed that the WG did not agree to making it available publicly. Richard informed the group that he will be sharing a total of 8 maps in which 4 maps has been shared, he is also working on getting the maps in		

		shapefile instead of pdf format. Faizal confirmed that the intent of the peat mapping was to confirm extent of planting on peat by members in comparison to the rest of the industry. • Amir has shared monitoring results from GHG Assessments conducted during NPP with Faizal, if time permit this will be presented over AOB. • On drainability assessment, Amir updated that 3 external reviewers have been engaged, they are Prof Susan Page, Dr Rahmadi (Indonesia's Ministry of Public Work) and Dr Charles (UniMAS). Review process are expected to be done by end of September'2018. • On smallholder's academy, peat module has been circulated with WG. Amir has also circulated and amended comments for draft of TOR for Smallholder consultant. This will be discussed during AOB given time permits. • For RT 2018, GHG unit was allocated a prep cluster session. BoG's request is to have peat related agenda during this prep cluster. This will also be discussed during AOB.		
2.	Audit checklist for BMP on existing cultivation on peat & guidance (Annex 2)	Faizal explained that since the wording from P&C states in line with RSPO BMP, there could be instances where auditor refers to a random page from BMP verifying for compliance when the intention of the BMP is not this. Some components like fertiliser regime can be adopted as per company's practise. Therefore, it's best if the BMP can also mention which components needs to be audited and the condition of applicability, thus the need for this checklist. In the last meeting, the discussion was to select 10-12 items that is considered important and give audit guidance based on these items. Joshua spoke of his concern over peat mapping and peat depth which is not be practical for audit. Faizal suggested to go through the critical items and then to discuss in detail given not all criteria will be used for auditing.		Audit guidance has been amended based on the meeting & revised based on the final version of the P&C 2018

		Joshua also suggested items like elevation to be placed under drainability assessment and not BMP audit checklist. Elements that are being covered by other criteria from P&C such as on legality and good agricultural practices should be removed from this list to avoid repetition. For flooding susceptibility, question raised was how to define flooding since some concession experience flooding during monsoon but oil palm cultivation is not impaired. Faizal suggested to categorize the topics from audit checklist based on which is critical, indicative, optional, auditable and non-auditable criteria. Significant focus for drainability is needed, relating to replanting practices, a separate section was created for this in the checklist. The checklist was rearranged based on the order of indicators in the current draft P&C 2018, should there be changes during adoption that this list will be revised accordingly. As for extent of peatland, comment from PLWG was to include planted, conserved and other (other here from this discussion was community land (tanah masyarakat) that is under the management of company. Specific guidance on this shall come later. Type of peat can be by sub-type, depending on the company if they want to be detailed, the important part is to show location with peat. It is good to know type of peat since the BMP manual will include practices such as how to manage fibric/woody peat type which is not suitable to cultivate oil palm. Based on this, record of main peat type was decided for checklist purpose. For water management, key is for auditors to ensure water management plan is in place and operational, details will be included in BMP manual. Auditors are ideally needed to check if companies are		

		monitoring their water level. Operational procedure for water management will be added in BMP. Leaning palm was discussed if it should be measured and monitored as well as do auditors need to check on this. For replanting, at least compaction or hole in hole planting should be practised. Proposed changes were then aligned with latest draft P&C 2018 as shows in Annex 3.		
3.	Review of drainability assessment procedure	Dipa presented progress update on drainability assessment procedure. Refer to Appendix 4 for the presentation slides and drainability procedure. The drainability pilot testing results from KLK has been shared by Amir to Dipa but given it was in a pdf report, copying to excel messed up the tables and figures hence testing the calculation has not been completed yet. Dipa mentioned that in general, the testing conducted at Pelalawan by KLK is good, some issues such as data which however is not within testers control. Firstly, is the unit of data and actual meaning of data. For example, some water level was found to be 1-3 metres. This is not possible because it means that water measurement was taken at place with structure or abatement, what is needed is water level above mean sea level. There are also some rules when interpolating peat and classifying subsidence according to Dipa. Another challenge is availability of initial data such as elevation data and subsidence hence there is a need to make sure testers has these data. Currently Dipa has added an Annex on this to the procedure. The 4 classes of drainability is in page 9 of the procedure. In future the fate of the peatland should it can't be planted anymore must be well considered based on potential effects such as salt-water intrusion. The		External review from the 3 expert reviewers completed Oct'18. Currently awaiting final version from Wetlands International.

		peatland will gradually become mangrove as a result of this and this is considered changing the ecosystem and not returning it 'back to nature'. This will then have implication on what water level to be chosen as reference water level. In the present drainability situation, the worse drainability situation is when tester needs low water level to discharge the water by using flood gate. For non-tidal area, it's not much of problem even during dry and wet season. For tidal area, in Option 1(high water level) the drainage limit will be the highest and this means that you will be given a restriction that subsidence cannot go beyond this level. Option 3 (low water level) means that the calculated drainage limit may or may not be below sea level. So, then there will be situation where the allowable drop in land is below sea level. Any peatland below sea level will not be affected by back flow directly but indirectly such as through open channels. So, there is no way salt water intrusion can occur through back flow. The compromise between this 2 is Option 2 (mean water level). Jason Hon shared his point of view voting for mean water level reading. Richard asked if given a plantation has assisted drainage (pump) in place will it be able to maintain the peatland without subsidence? Secondly, since there is no way to actually return the land to its natural state should company return this piece of land for example to community with assistance drainage and by teaching them how to maintain the water level? Faizal answered that this is not practical as could then lead to scenario experienced by Netherlands where there are several metres under sea level and need to have sea defence in place which can cost billion per kilometre. Richard again asked should maintenance be practised from now onwards is there a way to sustain the land and Faizal explain that theoretically it may work but practically it's not economically viable. Dipa also added that maintaining peat is about balance of both water and carbon. Returning just one will not mean putting it back as a whole. For carbon balance, only intact peat has such high carbon level which is extremely difficult for cultivated		

		peat to gain back. So, by maintaining water level, reducing subsidence may happen but not stopping. There was a question raised in the last meeting in the consequences of using low water level, in which the potential is higher for company's land to go below sea level. The worst case is abandoned land and salt water intrusion depleting community's source to clean water. The issue of freehold and leasehold in the context of Malaysia was brought up, where the land owner has right on the fate of the land. Anyhow given the final call will be from Department of Land so this will not be an issue. At this point, the concern is not so much on to finalising which water level but more to confirming on the methodology to report back to P&C TF. Ariff from KLK shared his experience as tester for drainability assessment, slides are provided in Annex 5. Their test is more on Tier 2. Suggestion from Dipa and Faizal suggested to relook at the water level data because the national river level measured was taken for navigation of boat to pass by the river which can't be used as it could potentially be referencing the river bed and not sea level which is what is required by the procedure. When land elevation is re-done based on sea level lesser area will be shown as 'red' (flooded). Ariff added that this can easily be resolved though adjustment. Concern was raised on possibility of incorrectly selecting data used for calculation. Faizal said that this issue needs to be resolved before launching of the methodology. There was discussion saying if auditors may misinterpret the 'red' area as no-planting area. Richard also asked if the reports need to be peer reviewed. Dato'Kheizrul stated his opinion that there could be a possible misconnect in this methodology. One is, when high water level data is taken, we assume that is the water level for the whole area. It's	Guidance on correct selection of reference data (e.g. reference water body, water level) should be included in the Drainability assessment procedure.	

		true that when an area is flooded the whole area gets impacted but when an area is opened up for cultivation, the water is stopped from flowing into the area. There will still be effect from high tide and low tide, so water gate is put in place. Water is allowed to fill the area until a certain level then the water gate will be locked, likewise if too low will open back, it's called routing through. In this process there will also be an area to temporarily store the water. Therefore, it can be said that this methodology does not apply to area with mechanical structure/drainage system. Dipa explained that this methodology was created to stimulate gravity flow whereby to depict the future to naturally control the water, without pumping. Companies currently already have assisted drainage in place so there was a bit of confusion on how to go about this methodology once adopted. Dr.Shah feels that the WG should put a recommendation to TF saying that legacy issues with some companies demonstrating good water management on peat with the aid of assistant drainage system in place be allowed to replant. WG feels that method and testing should still be continued. Richard presented GAR's results for testing, as shown in Annex 6. Dr.Shah proposed to have 1 year trial period for the calculations and methodology. On the drainability assessment procedure, Faizal commented that there are still gaps in the glossary. RSPO definition on peat should also be added. Further comments were captured on the go and shared with Dipa. Richard recommended that guideline for post drainability assessment should also be considered. The draft once firmed up may also go for public consultation.		No public review is planned for the Drainability assessment procedure as it is a technical document and requires expert opinions. However, there will be a 12-month period for initial implementation and feedback in which the PLWG will refine the methodology if required.

No	Item description	Main Discussion Points	Action Points	Progress Update
September 14th 2018 (Friday)				
4.	(Cont) Draft Audit checklist for BMP on existing cultivation on peat & guidance	Sian Choo asked if there was any question or feedback received on peat definition. Faizal answered that there was some question raised over taskforce which can be discusses in AOB given time permits. One being the definition was not put up for public consultation. WG went through audit checklist to add clarity and add further guideline on what has to be audited. Amir concurrently made changes to the document. Dr Shah suggested it's best to have clear quantitative guideline on the number of piezometer or subsidence pole that is needed. Also, for the extent to either be by block or percentage by hectarage. On drainability assessment, Faizal suggested perhaps to consider having elevation data (even though once depth of drainage is available, elevation data should also be in place). But since the availability of elevation data was mentioned yesterday so detailing it could be considered. WG member suggested to consider specifying which collection drain will be used for water level monitoring. Faizal mentioned that the detailed specification will come from BMP, at guidance stage it's too much of details. Faizal mentioned that in BMP it needs to be clear guidance on leaning palm and in the checklist clarity for auditors as to how to rate this scenario as 'observation' or non-compliance. Sian Choo raised how this peat checklist will be interpreted in terms on compliance. One suggestion was to call this document as audit guidance and not checklist.	WG to look into how the wording for announcement will go about. Note to make sure it's not confused with certification process. Secretariat to have a joined workshop between growers and auditors to align how peat guidelines should be audited. WG strictly recommended that awareness on peat is created among CBs.	In discussion with assurance team on a series of workshops & webinars for auditors & growers.

		There was also a suggestion when this guideline comes out to make sure there are joined training between growers and CBs to make sure both are in the same page when it comes to auditing. Faizal mentioned that clear communication should also be done on this in future. Faizal state that those in P&C TF and BoG to raise the need for secretariat's support in conducting more training.		
5.	Peat Inventory	Amir presented on a draft peat reporting template as in Annex 6. WG mentioned that condition at Indonesia may cause distortion in the figure reported due to larger area under Izin Usaha Pertambangan (IUP) versus Hak Guna Usaha. To include remark area for source of information (e.g. HGU, IUP etc.) Ian mentioned that the word concession carries different meaning at different region. Hence suggested to rename it. This inventory cut across more than the planted area hence Co-chair recommended that BoG members need to support on this to gain collective support from members.	In peat inventory, Amir to change peat depth to conservation and peat type to others area. Only peat is reported not mineral soil. Amir will clean up the document and circulate to the WG.	Revised draft of peat inventory circulated to PLWG on 17 Sept 2018.
6.	(Con't) Drainability assessment procedure	WG said that the use of default should not be rigid, flexibility for custom value should be allowed. WG suggested to amend the wording in Criteria 7.8.4 of draft P&C2018. Proposed changes are to add 'gravity drainage (without water structure)'. Another suggestion is for 7.8.5, to add '……. the managed are using control managed system….'. Faizal feels that adding 'without water structure' is a bit confusing. The aspects of future fate of the land that needs to be rehabilitated (phase out from being plated by OP) needs to be determined in future meeting.		

		WG stated that there is no check point if drainability assessment has been done for replanting given for now if replanting done less than 3 years' time does not require NPP. So, this is left unresolved for now. The general perception when the place is no-go for OP plantation, then it needs to be changed to other economically viable crop or afforested. Co-chair suggested for 2 years learning period to receive summary of testing for drainability from company to RSPO. Suggested to add the cost implication of conducting the drainability assessment in BMP.	PLWG to discuss on viable options post drainability assessment in cases it shows phasing out is required. WG suggested to check with testers the resulting cost to conduct drainability assessment. To add a table, methodology versus cost per ha.	
7.	(Con't) Review of BMP for existing oil palm cultivation on peat and BMP on rehabilitation	Amir concurrently made changes to the working document, it was later shared with Faiz (GEC). Jason Hon informed the WG that POIG had done some work relating to paludiculture & it would be good if the WG could get some info on the initiative. Both BMPs was initially to be finalised by end of this year. However, to allow for designing and photo the target for launching is set to January 2019. 1 month will be given for public comment, tentatively from mid-October to mid-November. 1 more month from mid-November to mid-December will be the period to consolidate all comments.	Secretariat to check if there are any contacts involved in POIG work on paludiculture.	Public consultation done from 1-30 November 2018. To date 3 feedback forms have been received.
8.	AOB	1) Peat mapping update by Amir Amir presented update from peat mapping comparing to 3 different base maps. Slide as shown in Annex 7. Map received from Wetlands International is not ground truth completely. Sumatera's side was done with ground truth. Kalimantan side is done using satellite imaging.	Richard to email shape file of GAR's peat map to Amir.	Richard has sent in peat shapefiles to secretariat. The initial analysis of the maps have been circulated to the WG through email.

		Gumbricht's map is based on a model. To verify further, Richard will share GAR's map with Amir. 2) NPP submission update Amir presented updates from NPP submission as shown in Annex 8. The figures are up to April 2018 showing an increase in 30,00 ha in overall. Conserved area for peat is now at 7480 ha. 3) ToR for SH Academy peat module (Annex 9) Amir is not certain as to when smallholder's standard will be launched as there could be another public consultation planned. WG's target is to finish the SH BMP by end of 2019 in an interactive manner. This shall be looked at in the next meeting. 4) RT -16 Topics on peat Amir briefed everyone that there will be two prep cluster on peat and no deforestation. Request from BoG is to have something relating to P&C 2018. The session is about 1 hour 30 minutes.		
9.	Next meeting	WG felt that the next meeting should be scheduled based on the agenda and key items to be discussed. There will not be any meeting over RT's period. Next meeting is potentially on either the 3rd or 4th week of January (2days) and to be held in either Kuala Lumpur or Jakarta based on the WG's preference. Amir will communicate on this with working group. Key agenda will be to finalise BMP, drainability assessment, smallholder's guidance, audit guideline and trainings.	Amir will clean-up the audit guidance and pass it to Faizal to be used at P&C TF.	Audit guidance has been revised.

Annex 1: Meeting agenda and attendance sheet

7th PLWG meeting

Venue: H-Venture, Level 3, VE Hotel & Residence, Kuala Lumpur

Day 1, 13th September 2018 (Thursday)

Time	Agenda
9.00am – 9.15 am	1. Review of previous meeting's minutes and progress on actions
9.15am – 10.30 am	2. BMP Audit checklist & guidance a. Review of audit checklist b. Identify critical issues in BMP (auditable against P&C)
10.30am – 11.00 am	Coffee break
11:00am – 12:00 pm	3. Cont'd BMP Audit checklist & guidance
12:00 pm – 1:00 pm	Lunch
1.00pm – 3:00 pm	4. Review of Drainability assessment guidelines
3.00pm – 3.30 pm	Coffee break
3.30pm – 4.30 pm	5. Cont'd Drainability assessment
4.30 pm – 5.30 pm	6. Peat Inventory
5:30pm	**End Day 1**

Day 2, 14th September 2018 (Friday)

Time	Agenda
9.00 am – 10.30 am	7. Review of BMP manuals (Existing cultivation)
10.30am – 11:00 am	Coffee break
11.00 am – 11.30 am	8. Cont'd review of BMP manuals (Existing cultivation)
11:30 am – 12.30 pm	9. Review of BMP manuals (Rehabilitation)
12.30 pm – 2.30 pm	Lunch & Friday prayer break
2.30 pm – 3.30 pm	10. Cont'd review of BMP manual (Rehabilitation)
3.30 pm – 4.00 pm	Coffee break
4.00pm – 4.30pm	11. AOB
4.30pm – 5.00pm	12. Confirmation of next meeting
5.00pm	**End Day 2**

7th PLWG Meeting, 13th – 14th September 2018
VE Hotel, Malaysia

No	Name	Organisation	Signature 13th Sept'18	Signature 14th Sept'8
1.	Faizal Parish (co-chair)	GEC		
2.	Joshua Mathews (co-chair)	Bumitama Gunajaya Agro		
3.	Muhamad Faizuddin Zainuddin	GEC		
4.	Sian Choo Lim	Bumitama Gunajaya Agro		
5.	Shahrakbah	Sime Darby		
6.	Jason Foong	Kuala Lumpur Kepong Bhd (KLK)		
7.	Arif Sugandi	Kuala Lumpur Kepong Bhd (KLK) /PT AAR		
8.	Sin Chuan Eng (Observer)	Kuala Lumpur Kepong Bhd (KLK)		14 days
9.	Jason Hon	WWF		
10.	Kai Xiang Chin	Bunge Loders Croklaan		
11.	Rianto Sitanggang	BLC		
12.	Gotz Martin	Sinarmas-Agri	—	—
13.	Richard Kan	Golden Agri		
14.	Dipa Rais	Wetland International	(on behalf)	
15.	Keizrul Abdullah	Wetland International		
16.	Almo Pradana	World Resources Institute (WRI)		
17.	Harizajudin	Sawit Watch		
18.	Amir Afham	RSPO Secretariat		
19.	Devaladevi Sivaceyon	RSPO Secretariat		
20.	IAN ORGEL	NBPOL		
21.	ELI H. SARI	[illegible]		
22.	Dr Raymond Alfred	101 Group		
23.				

Annex 2: Components from BMP on existing cultivation on peat that will be used to develop audit checklist

BMPs for oil palm cultivation on peatland				
BMP	**Issues**	**Requirements**	**Auditable (Y/N)**	**Comments**
Map and nature of peat (also for criteria 7.8.2)	Extent	Map to show and record (ha) of the extent of peatland	C	Planted, conserved and other (TBD)
	Depth ranges	Map or records to show peatland depth ranges	C	Indicative depth range to be captured (planted area
	Type	records of main peat type (Fibric, Hemic, Sapric)	O	In planted areas. To record type of peat inc. dominant type. Maps etc optional.
	Underlying parent material	Record of subsoil and mgt measures if acid sulphate or sand	C	In planted areas
	Elevation	Peatland elevation above mean sea level	Drainability	This is required in the Drainability assessment procedure
	Legal status	License and function status according to national law		Especially important for Indonesia as peatland is being gazetted for "protection" and "utilization" function. (Zone status)
	Drainage limit	Depth to drainage limit	Drainability	For peatland that was assessed using the Drainage assessment procedure
	Fire	Peatland degradation by fire		Maps classifying peatlands in degradation classes using fire history incl. duration, frequency
Water management				
	rainfall data	Maintain daily records	optional	Or use district/provincial rainfall data

Commented [LSC1]: Kindly indicate separately what is the general checklist and what is the indicator for the P&C. We cannot have multiple items like this under 1 indicator. It is not possible to mark a score…. what does it mean to have 3 out of 5 items….fail or pass; which is more important of the 5 and etc….please be mindful not to create issues for the audit process

Commented [AA2R1]: The purpose of this specific document is to help WG members comment on the items on the audit checklist created by GEC only.

Once all critical items identified, like previously mentioned WG can opt to:

-Separate critical (compulsory/auditable) items in a separate document, while the audit checklist serves as a guide for growers/CBs. **OR,**

-Add another column in the audit checklist specifying whether the item is auditable or voluntary (with Indicator reference)

Commented [AA3]: Separate to drainability assessmernt

- effectively maintaining water level of 50-70cm (below the bank in collection drain) or 40-60cm (groundwater piezometer reading)				
	Water mgt/ drainage system	Parallel or contour drainage system clearly marked in maps	Critical	There is a system & its operational. (TBD)
	Drainability (7.8.4)	Drainability assessment according to RSPO Drinability Assessment Procedure to be completed. No drainage below drainage limit using pump operated systems. 'Legacy' cases which already started pumping below the drainage base before the P&C 2013 was adopted should consider to stop pumping in a socio-economic allowable manner.	Critical (Replanting on peat only)	Must follow the guidelines: 1) Assumptions must be clear 2) Must choose correct reference water body 3) Elevation map and peat map must meet minimum requirements It must be noted that drainability assessment is not merely a simple check list. It goes through some critical processes, that honestly demands technical audit. Self-reporting solely cannot track possible faults and misstep. We suggest: 1. To implement a (certified) 3rd party technical audit system, or 2. To develop/empower technical peoples within RSPO itself (by sufficient trainings) to do this technical audit by themselves
	Outlet controls	Adjustable Gates at inlet/outlet	C Water mgmnt	-Water management system is in place and operationaloperationalg - Map of water management system - SOP on water management
	water control structures		C Water mgmnt	- Water control structures in the collection and outlets are regularly maintained

	Drain water level monitoring	Peiscales at regular intervals in collection drains/main drains	C Water mgmnt	- Water levels are regularly (to give guidance) monitored in the collection drain and in-field
	Active water management	Water level at 50-70cm in collection drains through stop-off/gate level adjustment	C Water mgmnt	- Records of monitoring
	In field water levels	Water level between 40 – 60 cm. At least two piezometers per block, one in the center and one 10 – 20 meters from the drain - reading weekly. Water levels used for water management	C Water mgmnt	
	subsidence monitoring (7.8.3)	At least one subsidence post per block	C Monitoring & management	- Follow number of piezometers?
	Flooding	Flooding susceptibility	C Monitoring & management	Flooding history incl. flood duration, area flooded, maximum water height during flood
Fertilizer & nutrients management (7.8.5?)	Regular assessment of fertilizer needs	Foliar analysis on annual basis	P&C	
	Nutrient deficiencies	Periodic checking of leaves for signs of significant deficiencies	P&C	

Commented [AA4]: q[WG] One piezometer not feasible. To discuss how many would be considered viable?

Commented [AA5]: How many would be feasible

Commented [TB6R5]: Wetlands International position is that you need at least 1 but preferably 2 for control. If growers want to apply tier 2/3 of the drainability assessment at least 1 per block is necessary. If this is not possible tier 1 subsidence rates, which are more conservative, should be used.

Commented [AA7]: What documented evidence to prove this is done if auditable?

	Micro nutrients	Regular application of Zn, Cu and B (in line with agronomist recommendation)	P&C	
Integrated Pest and Disease Esp ganoderma, rhinoceros beetle, termite, rat, Tirathaba bunch moth	IPM Plan	Clear IPM plan (Criteria 7.1 P&C 2018)	P&C	
	Beneficial plants	Beneficial plants planted in each block along main roads	P&C	
	Surveys	Regular surveys for pests and diseases and record of incidence	P&C	
	Control	Use of appropriate control and avoidance of restricted pesticides	P&C	
	Ganoderma	Minimal presence or active control	P&C	
	Other significant disease problems	Identify issues and control methods	P&C	
	Gaps and supply (vacant area)	Number of gaps/supply per ha	P&C	
Effective weed management	Herbicide use	Focus on planting circle and harvesting path. No blanket spraying. Avoidance of class I pesticide/herbicide.	P&C	
Management of leaning and fallen palms	Evidence of appropriate planting approach	Compaction and/or hole-in-hole planting	C monitoring & management (sub. Leaning palm)	- Is there documentation or action plan on leaning palm? - To detail out in BMP - 3-5 year review of the management plan
	Leaning palms	Record of proportion of leaning palms and severity		To consider period of planting?

Commented [AA8]: [WG] According micronutrient analysis

Commented [AA9]: This is subjective and would be hard to audit.

Commented [AA10]: To put reference to BMP?

Commented [AA11]: [WG] All highlighted by PLWG for discussion

				Management & action plan?
	Treatment of palms	Soil mounding and other approaches to address leaning palms		
Replanting	Age of replanting	replanting age for peat 20 years	P&C	Yield profile
	Long-term management plan	Long-term plantation management plan developed including with plans for areas where drainage is phased out, rewetted and rehabilitated for nature or productive land-use (paludiculture).	Drainability	
	Drainability assessment (7.8.4)	Drainability assessment according to RSPO Drinability Assessment Procedure to be completed before replanting	Drainability	
	Compaction and/or hole-in hole	mechanical soil compaction before replanting if low bulk density	C Replanting	
	Planting	hole in hole planting 10-15cm below surface		
		BMPs operational issues		
Yield	Records	Record of yield by block		
	Enhancement	Measures taken to enhance yield	O	
Transport system		Record system used (buffalo, wheelbarrow, tractor, truck, water)	O	

Training and field supervision	BMP	Record of specialised training on peat and monitoring/supervision of BMPs	O	
		BMPs Environmental and social issues		
conservation, maintenance and rehabilitation of natural vegetation and river reserves	water quality	No spraying near drains or buffers	P&C	
	HCV	HCV areas in peat identified and managed appropriately (management and monitoring plan)	P&C	
	Other conservation areas (HCS, Peat, Buffer etc)	identified and managed appropriately including monitoring of water level showing no off-side impacts on the water table (management and monitoring plan)	P&C	Water table
	Endangered and endemic species	Presence of rare and endangered species documented and protection measures in place	P&C	
	Wildlife corridor and buffer zone	Where animal movement through estate or HCV – no inappropriate barriers to movement placed	P&C	
	Prevention of hydrological disruptions to adjacent peatland	Documented sufficient measurements taken inside the plantations boundary (hydrological buffer, water table adjusted higher, etc.) that avoids off-site plantation impacts (emissions, fire, lower watertable) to HCV, HCS, paludiculture or other peatland set-aside area due to on-site activities (such as drainage).	C Monitoring & management of peat conservation area	- Monitoring water level of boundary drain - Buffer -
	riverbank	Adequate buffer (10-40m) along waterways, vegetated with appropriate natural vegetation,	P&C	

Commented [AA12]: Again, would be hard to audit despite 10-40m being mentioned. To elaborate further?

Fire prevention and control	Fire risk	Fire risk maps for peatland prepared for plantation and adjacent areas	C (Fire prevention and control	- Fire prevention & control plan - Adequate firefighting equipment - trained personnel to respond to fire - Active patrols and monitoring - Above specialized for fires on peat
	FDRS	FDRS warning signs and system		
	Patrols	Regular patrols of fire prone areas		
	Control	Available equipment for fire control (pumps, hoses etc) and trained staff		
minimization of greenhouse gas (GHG) emission	Monitoring and reporting	Completion of GHG report (using Palm GHG)	P&C	
	Emission reduction	Measures to minimize of reduce GHG from peat	P&C	
cooperation with local communities/stakeholders	identification	Identification of other stakeholders in peatland landscape	JAWG P&C	
	Collaboration	Collaboration and exchange on common peatland management issues at least on water and fire management.		
Others				

Annex 3: Draft audit checklist for existing cultivation on peat based on latest P&C 2018

Indicator 7.8.2 Soils within the managed areas are inventorised, documented and reported to RSPO Secretariat.			
Audit Issue	Proposed Audit Requirement	Guidance	Severity
Mapping & peat inventory	1. Verify availability of Map of peatland areas. Maps and summary table to show: a. Extent of peat area & its land use (planted, conservation & other) b. Indicative peat depth (planted areas) c. Information sources 2. Peat Inventory prepared as per RSPO template	Maps should be of adequate scale and clarity (ref other RSPO guidance on maps eg HCV) Information sources should be provided for peat extent – ie soil survey (mention date and methodology), existing soil maps etc	High
Character of peat (Planted areas)	1. Verify that records are maintained of: a. subsoil under the peat - eg clay, sand (with specific reference to Potential Acid Sulphate soil (PASS) or quartz sand) b. The main peat types (eg Fibric, Hemic, Sapric) present and relative dominance.		Moderate
Reporting to RSPO secretariat	1. Peat inventory, map & shapefile to be reported within 6 months of P&C 2018 adoption to RSPO secretariat (Status as per GA+1) 2. Updated a minimum every 3 years or when changes occur on peat areas on-site (eg. Resurvey peat, replanting, Increase rehab area etc)		High
Indicator 7.8.3 Subsidence of peat soils is monitored, documented and minimized; and a documented water and ground cover management programme is in place.			
Audit Issue	Audit Requirement	Guidance	Severity

Commented [AA13]:

Commented [AA14]: Refer to peat inventory

Commented [AA15]: Or set a specific date. To be determined by PLWG

Subsidence of peat (Monitoring)	1. A minimum of one subsidence post per block or ## ha 2. Records of minimum quarterly monitoring of subsidence available		Moderate
Water management programme	1. There is a documented water management programme which is actively implemented (refer Indicator 7.8.5 of guidance table) 2. Map of water management system (including canals, outlets and water control structures and monitoring points)		High
Ground cover management programme	1. There is a documented ground cover management programme that ensures good vegetation cover in the plantation.	This is critical in the young plantation (0-5 years) to protect the peat surface and maintain humidity.	Moderate
Indicator 7.8.4 Drainability assessments are undertaken in line with the RSPO Drainability Assessment Procedure prior to replanting on peat and the result is used to determine the long-term viability of the gravity drainage of oil palm growing areas. or whether the oil palm needs to be replaced with alternative, more water tolerant, crops or rehabilitated with natural vegetation.			
Audit Issue	Audit Requirement	Guidance	Severity
Drainability assessment (replanting on peat only)	1. Drainability assessment to be prepared according to RSPO Drainability Assessment Procedure prior to replanting and summary submitted to RSPO Secretariat 2. Detailed result of assessment to be available on-site indicating: a. Depth to drainage limit b. Drainage limit time (DLT) in years	Auditor to check that Drainability assessment has been undertaken for any recent replanting and that assessment is being planned prior to any upcoming replanting.	High

Commented [AA16]: This was discussed, but no conclusion on requirements. Follow Indonesian govt rule?

Commented [AA17]: Props

Flooding susceptibility	1. Record is maintained of flooding history including area affected, duration and max water height during flood.		Moderate
Long term Management plan for rewetted areas	1. A management plan is developed; including with plans for areas where drainage is phased out, rewetted and rehabilitated for nature or productive land-use (paludiculture) for areas near or meeting DLT < 40 years.		Moderate
Indicator 7.8.5 All existing planting on peat within the managed area is managed at least to the standard in the 'RSPO Manual on Best Management Practices (BMPs) for existing oil palm cultivation on peat', version 2, revised xx 2018 (cross ref to audit guidance)			
Audit Issue	Audit Requirement	Guidance	Severity
Water Management	1. Water management system is in place as per water management plan (refer to Indicator 7.8.2 of guidance table) and is operational		High
Water control structures	1. Water control structures in the collection and outlet drains are maintained		High
Water level monitoring equipment	1. Water level monitoring post are placed at regular intervals in collection drains/main drains 2. A minimum of two piezometers pe ## ha; one in centre and one 10-20 meters to the nearest drain		High

Commented [AA18]: Add guidance

Commented [AA19]: Should follow as per subsidence post?

Commented [AA20]: Refer to Indonesian regulation for guidance

Water level monitoring	1. Water levels monitored weekly in the collection drain and in-field. To ensure: a. Water level maintained at 50-70 cm in collection drains b. In-field water levels are between 40-60 cm 2. Records of monitoring for both available.		High
Fire prevention and control	1. Fire prevention and control plan available. 2. Fire Danger Rating System (FDRS) warning signs and system in place. 3. Adequate firefighting equipment specialized for peat fires available. 4. Trained personnel to respond to peat fires. 5. Active patrols and monitoring.		High
Replanting	1. Compaction and/or hole-in-hole method prior to replanting on peat areas.		High
Leaning palms	1. Record proportion and severity of leaning palms. 2. Availability of action plan on leaning palms.		Moderate

Commented [AA21]: To add additional text on longer minimum monitoring period once enough historical data

Commented [AA22]: To reconsider wording. To indicate it as a symptom of poor management

Indicator 7.8.6 All areas of undeveloped peatlands in the managed area (regardless of depth) are protected; new drainage, road building and power lines on peat soils is prohibited; and peatlands are managed at least to the standard in the RSPO Best Management Practices for Management and Rehabilitation of Natural Vegetation associated with Oil Palm cultivation on Peat ("BMP") - version 2 (cross ref audit guidance)

Audit Issue	Audit Requirement	Guidance	Severity
Conservation of peatland set asides	1. Report is available for assessment of peatland conservation areas to describe peat nature and		High

	extent, vegetation cover, degradation status and key natural values. 2. Management plan has been prepared and is being implemented for peatland conservation areas either separately or as part of an integrated management plan for all conservation areas.		
Rehabilitation of degraded peatlands	1. Degraded peatlands are being rehabilitated through restoration of hydrology, natural revegetation or planting of indigenous trees.		Medium
Maintenance of natural water regimes in conservation areas and adjacent lands	1. Documented sufficient measures taken inside the plantation's boundary that avoids drainage of peatland conservation areas as well as HCV or conservation areas adjacent to the plantation. a. Water table is maintained at natural levels (20cm below soil surface) in peat conservation areas and along plantation boundaries adjacent to forest and conservation areas. b. Water management (refer to indicator 7.8.5 in audit guidance table) within the plantation should not increase the fire risk or areas outside the plantation		High
Fire prevention and control	See the above point		

Commented [AA23]: To add requirements to ensure fire control outside of plantation area (adjacent areas)

Annex 4: Review of Drainability Assessment Procedure – Dipa's Presentation and Drainability Assessment Procedure

Future Drainability Assessment Summary

Dipa Rais

1

Status So Far

- Final Drafts (Main Docs + Annexes) are in Review Stage
- Testings have been made
- No sufficient feedbacks from testers

2

Goal

- Long term goal: To prevent subsidence proceeding to drainage base
- Short term goal :
  - To calculate replanting 'headroom' that still can prevent subsidence to drainage base
  - To check whether drainability limit is close already (when there is telltale sign: e.g. frequent flood than usual, gradual but persistent water table rise, tidal drainage)

3

When should DA be ideally done?

- Initial drainage plan
- Replanting plan
- Telltale sign that drainability limit is close already

Basics

- Simple equation: involves only 2 variables
- $DL = H_{nwb} + 0.0002*dX$
- Elevations, subsidence, peat area, and peat thickness are required in this assessment. *Question*: Subsidence, peat map and elevation maps need RSPO minimum standard? Currently we had to write about peat and elevation mappings in the docs because there is no standard adopted by RSPO at present.

Present vs Future Drainability

- Present Drainability class adopted by RSPO : 4 Classes
- Future drainability class should only have 1 class : Drainability in term of 'Natural Condition' category

Tier 1 vs Tier 2

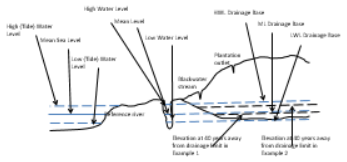
Aspects	Tier 1	Tier 2
Land Unit	Each discrete peatland replanting area (multiple blocks)	Each spatial unit/stratum, can be block or smaller than block depending on stratification used (block, peat maturity and/or subsidence rate, etc)
Subsidence rate	5 cm/y (conservative default)	As measured historically per stratum
Centroid	Centroid of each discrete peatland replanting area	Centroid of each stratum/spatial unit
Applied decision (Yes or No for Replanting)	Each discrete peatland replanting area	Each spatial unit/stratum

7

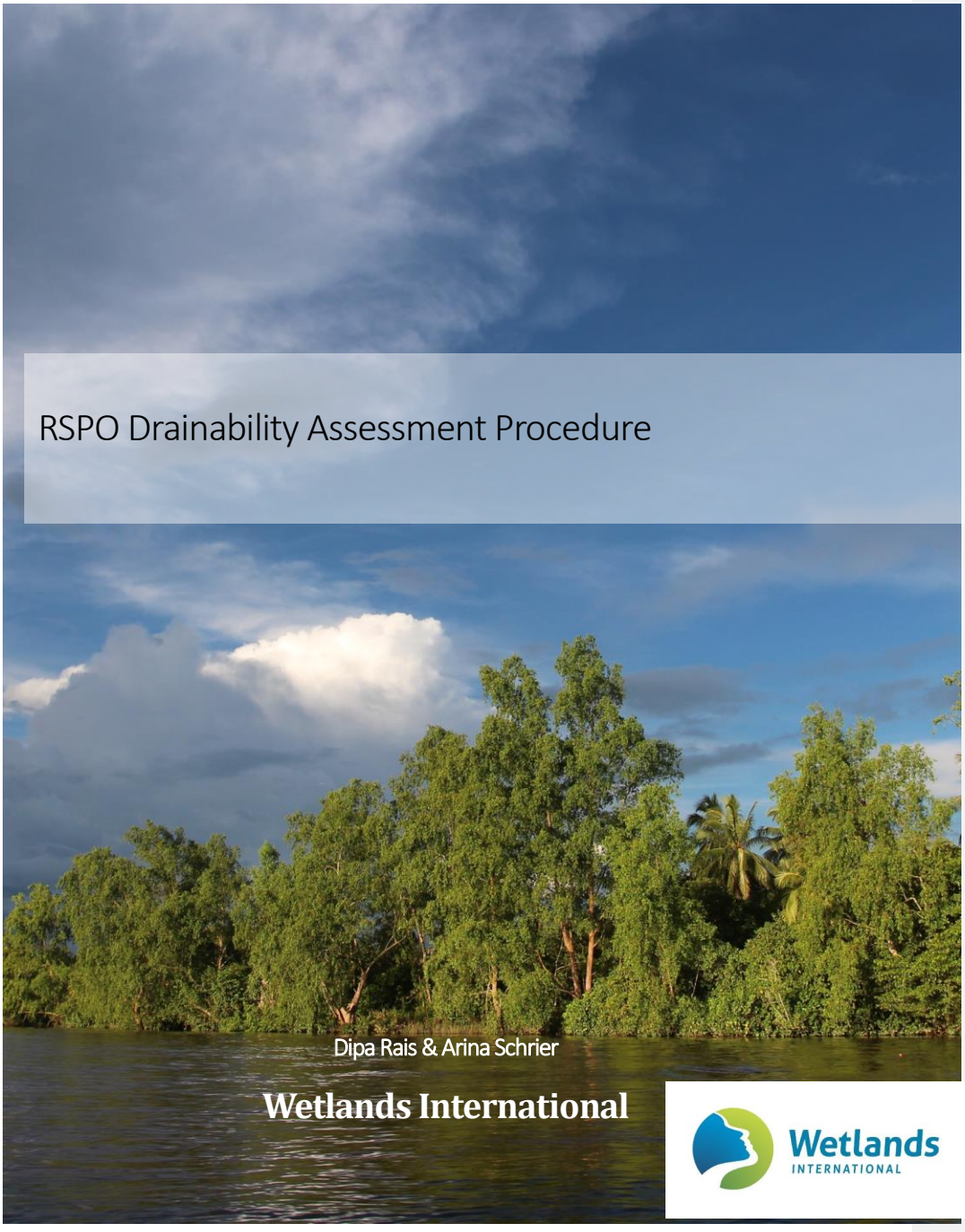
Water Level Reference

- Non Tidal area : Mean water level
- Tidal Area:
  - Option 1: High water level
  - Option 2: Mean water level
  - Option 3: Low water level

8



9



RSPO Drainability Assessment Procedure

Dipa Rais & Arina Schrier

Wetlands International

RSPO Drainability Assessment Procedure

An RSPO Guideline

This Guideline was developed by Wetlands International under the guidance of the RSPO Peatland Working Group 2, commissioned by RSPO

Author should be RSPO

Datum September 2018

Commented [F24]: Should be titled RSPO Drainability assessment Procedure

Commented [F25]: Need date of adoption by RSPO PLWG

Glossary

Tropical Peat:	tbd
Basal contact : and sand layer, etc.	Interface between two stratigraphic layers, like peat layer and clay, peat layer
Peatland delineation:	Differentiation of peatland from surrounding non-peatland on map
Natural Drainability:	Ability of a peatland do be drained by gravity, without mechanical devices such as pumps
Natural Drainage Limit:	The level below which it is no longer possible to drain the land by gravity alone
Discharge River:	River toward which drainage water is discharged
Rotation Cycle:	The life cycle of the oil palm, on peatland this is assumed 20 years
Subsidence Stratum:	Defined area of homogeneous soil subsidence rate
Replanting Peatland:	Area to be replanted
Drainage Limit Time	The time that it takes for the peat soil to subside to the natural drainage limit.

Commented [F26]: I am sure there are other terms to be defined

Commented [F27]: What does this mean

1. Introduction

Commented [F28]: Need to add section and sub section numbering

1.1. The different perspectives of drainability

There are different ways of looking at drainability. From an agronomic point of view, it is important to maintain high yields and to create a good drainage system, specifically in peat. The drainage system must be robust and effective in both dry and wet periods. In other words: the drainability, the ability of drainage by gravity alone, must be such that it enables to obtain high yields. From an environmental and economic perspective an extra dimension comes into the picture: is this drainage long-term viable and is this drainage sustainable? Peatlands emit CO_2 if drained. Peatlands also subside if they are drained, and in some cases peatlands may subside to near or below the drainage limit. If a peatland subsides near to the natural drainage limit, sufficient drainage of a peatland will become a challenge specifically in wet periods. Peatlands may become unproductive because drainage by gravity is no longer possible.

1.2. Why a Drainability Assessment

Long before an irreversible stage of land loss is reached, it is urgent to ask ourselves the question: What is the long-term viability of my drainage? Should I replant oil palm considering the long-term perspectives? To be able to answer these questions, RSPO requires a Drainability Assessment before any replanting on peat. If the assessment identifies areas unsuitable for oil palm replanting, that means, if the assessment indicates high risks for flooding and/or salt water intrusion and/or exposure (oxidation) of underlying potential acid sulphate soils or infertile quartz sand within two crop cycles, plans must be in place for appropriate rehabilitation or alternative use of such areas. Growers and planters should consider ceasing replanting and implementing rehabilitation or alternative (wet) use of these peatlands.

Commented [F29]: Need to split to current RSPO requirements and proposed 2018 requirements.

Need to wait for final outcomes P&C TF?

1.3. Drainability Assessment Guideline

This guideline provides guidance on how to assess drainability. Field observations, mapping and calculations will determine in which drainability-status a peatland is currently and it will determine the future drainability. For the future drainability the questions must be answered: what time it takes for the peat surface to subside to two crop cycles (≈40 years ≈1-2 meter, depending on the soil subsidence) above the natural drainage limit. We provide guidance at TIER 1 and TIER 2 level. It is up to companies which TIER is most appropriate for them to use. The tiered approaches provide a systematic way of determining the drainage limit depth in peatlands. The outcome of the assessment at TIER 2 level has higher precision and confidence, but also requires more resources than that of TIER 1. The outcome of a TIER 1 assessment is a quick and less costly way to determine the allowance for replanting, following RSPO regulations, but this approach is conservative, and therefore a larger caution-range is built in. The details for the TIER1 and TIER2 approaches are outlined in the Annexes 1 and 2.

2. Drainability explained

2.1. Drainability

Drainability refers to the ability to drain an area by gravity, thus drainage without mechanical devices such as pumps. In drained peatlands, the drainability may change over time because the peat soil subsides. At a certain point in time, the peat may subside to close to the natural drainage limit. The natural drainage limit (see figure) is defined as the level below which it is no longer possible to drain the land by gravity alone. In other words: the drainage of rainwater to the closest water body is limited or no longer possible by gravity alone.

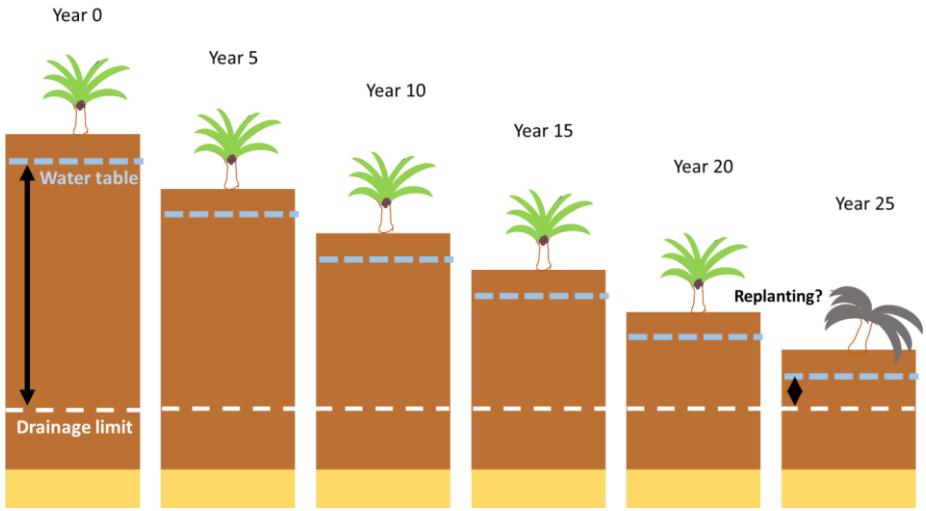


Figure 1. How soil subsidence impacts the distance to the natural drainage limit. Over time, the peat layer above the drainage limit may become too shallow to undertake replanting.

The figure explains the process over time in an example. In year zero, drainability is good, and the palms grow well. The drainage however causes the peat soil to subside, and in a period of 15 years, the peat soils has subsided closer to the drainage limit. The drainability may still be good and therefore the grower does not experience any problems in year 15. Between year 20 and 25 the grower starts to consider replanting. The question is: is the area still suitable for replanting of oil palms? What is the thickness of the peat layer above the drainage limit? And how many years will it take before problems are experienced? This guideline provides guidance on how to assess the drainage class (based on field observations) and how to determine the time that it takes to subside to 'two rotations away' from the Natural Drainage Limit. Note that plantations will rarely be flooded by sea water, and often not by river water except for relatively narrow riparian zones of a few km. Plantations are usually flooded by rain water that cannot be drained out anymore once subsidence has reduced the surface elevation and gradient below critical levels.

2.2. The natural drainage limit

The natural drainage limit inside the plantation is in most cases based on the water level in the closest water body and on the distance to this water body. If the water body is very near, the relation between the water level in the water body and the natural drainage limit inside the plantation is strong. If the closest water body is at further distance, the natural drainage limit inside the plantation will be at higher elevation than the water level in the closest water body. A general rule of thumb is that for each kilometer, the drainage limit elevation increases with 20 cm relative to mean sea level (DID Sarawak, 2001) (figure 2). In this guidance, we consider the natural drainage limit and we exclude (mechanical) pumping which may create a not-natural drainage limit in some areas.

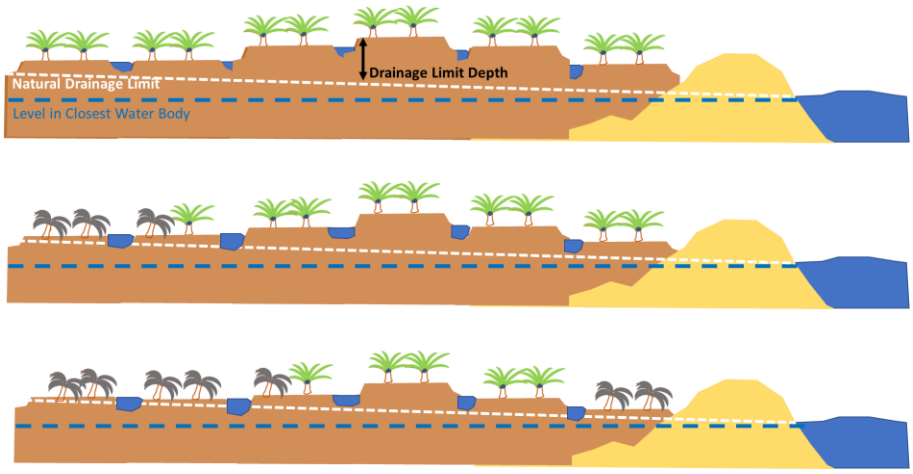


Figure 2. A cross-cut of a peat area which is close to a natural water body. The cross-cut illustrates the impact of soil subsidence on the drainability of a peatland explained in three points in time (figures a: above, b: middle and c: bottom). If the soil subsides to near to the Natural Drainage Limit, the drainability will decrease and palms that have their roots in the water for too long will dy. The land will become unsuitable for cultivation.

The figure explains how drainability problems may develop over time. It shows the Natural Drainage Limit relative to the average water level in the closest water body. Further away from the water body, means larger distance between 'the water level in the water body' and 'the natural drainage limit'. Although in the early stage (figure a) all palm may grow well and no drainage problems exist, later (figures b and c) problems may develop because of soil subsidence. The closer the soil will subside to the Natural Drainage Limit, the more difficult it will be to keep the water out. Figure 2c shows that in this example more than 50% of the plantation area subsided to near the drainage limit and as a result the palms in these areas suffer from water saturation conditions.

3. Drainability Assessment Approaches

Drainability assessments shall be required prior to replanting on peat to determine the long-term viability of the necessary drainage for oil palm growing, plans must be in place for appropriate rehabilitation or alternative use of such areas. Not only before replanting, but also in general, it is important to know the drainability status of a plantation on peat. Sometimes flood problems exist before the end of a rotation cycle or sometimes a land owner is personally interested in the long-term viability of the drainage in the peatland.

Two types of assessments are considered in this guideline:

(1) Field observations and measurements from which the 'current' drainage class can be determined, we call these Qualitative approaches. This assessment can be used to help to determine Best Practice in the plantation but does not meet the requirements for the RSPO Drainability Assessment which determines the 'long term' drainability in the plantation.

(2) TIER 1 and TIER 2 approaches for assessing the future drainability, required for compliancy to RSPO P&C before replanting, you can find detailed guidance in **Annexes 1 and 2**. We call these Quantitative approaches.

Commented [F30]: Note that these do not meet the requirements for RSPO drainability assessment as they are not predictive

Commented [AA31]: Remove mention of qualitative assessments

3.1. Current Drainability in a plantation

To get an insight into the current drainability status, it is important to know the dynamics of the water level inside the plantation relative to the water level in the nearest natural water body that can be a river, lake or sea. If the plantation is relatively close to the sea, water levels during high tide and low tide should be measured inside the estate perimeter drain relative to the level of natural water body outside the estate. As discussed earlier, at further distance to the water body, the natural drainage limit level will be higher than the water level in the water body (Figure 3).

Highest tide in river

Lowest tide in river

Water Level Gauge

Based on observations in the field and water level measurements, the following drainability classes could be distinguished:

Class 1 - Good Drainability - where the excess water in the field can be drained by gravity even during the highest tide and/or during the most wet periods.

Class 2 - Moderately Good - where excess water in the field can be drained by gravity > 50 % of the tidal cycle, sometimes with the help of bunds and flap-gates and/or where water in the plantation can be drained during the wet period before the palms start to suffer.

Class 3 - Poor Drainability - where excess water in the field can be drained by gravity < 50 % of the tidal cycle and/or where water in the plantation cannot sufficiently be drained during the wet period; palms start to suffer.

Class 4 - Very Poor Drainability - where excess water in the field cannot be drained by gravity even at lowest tide and/or where water in the plantation cannot sufficiently be drained during the wet period; palms start to suffer.

If the peat area of scope is found to be in Drainability Class 3 or 4 it is recommended to perform a Quantitative Drainability Assessment (at TIER 1 or TIER 2 level) as soon as possible, since it is very likely that the natural drainage limit is near or reached already, while over time, soil subsidence will increase the drainability problem. The Quantitative Drainability Assessment will determine the urgency of the situation.

In the situation that the peat area of scope is found to be in Drainability Class 1 or 2, it is likely that the drainage limit is not yet reached, but it is unsure when the drainability limit will be reached. A Quantitative Assessment could give an insight into the depth of the drainage limit.

Tidal influences in coastal areas can be partly prevented by bunds and flap-gates. Bunds are protective structures to prevent inflow of excess or saline water into the fields at high tide. Details on the construction and maintenance of bunds and flap-gates can be found in the RSPO BMP for existing plantations on peat (ref). In the Quantitative Drainability Assessment it is assumed that tidal influences are captured in the 'two-rotation-threshold', or in other words: it is assumed that the 1-2 meters-distance (2 crop cycles) threshold from the drainage limit is enough to cover tidal influences.

Commented [AS32]: To be specifically discussed with the external reviewers

Figure 4. System with Bund and Flap Gates. The Flap Gates closes automatically during high tide, preventing influx of tidal water (Left). The Flap Gates open automatically during low tide, allowing drainage (Right).

3.2. Future Drainability in a plantation

RSPO requires that an assessment of future drainability is undertaken before any peatland area is replanted. Such assessments can be undertaken at two levels of detail (Tier 1 and Tier 2)

At both TIER levels, drainage base, elevation and peat thickness are required to calculate depth to drainage base. The subsidence rate is used as a factor to calculate the 'time-to-natural drainage limit' (Figure 5).

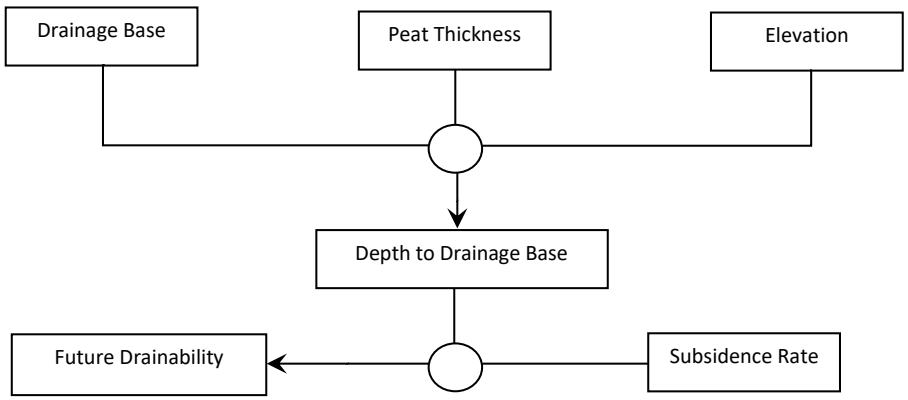


Figure 5. Future Drainability Assessment Flow

The difference between the TIER levels is the data requirement and level of confidence of the outcome. For the TIER 1 approach, for each delineated replanting peatland area, an average value is required for drainage base, peat thickness, elevation. For the TIER 2 approach, for each stratum within each delineated replanting peatland area, an average value is required for drainage base, peat thickness, elevation. For both TIER levels a company's own data must be used for soil subsidence rate, except in cases where not enough data is available (at least 2 years of monthly measurements at enough representative locations), or where data is not sufficiently reliable. In these cases a default value of 5 cm/year of soil subsidence may be used. Broadly, the degree of detail of the data at each level can be described as:

Tier1 (**Annex 1**): Assessment at **replanting-area level**. One centroid data point per delineated discrete (single) replanting peatland is needed as input data for elevation and drainage limit, and besides, a map for distance from the middle of the concession area to the most relevant, closest discharge water body is needed. The outcome can be presented in a simple excel table. For each single delineated replanting peat areas, the distance to natural drainage limit will be calculated, as well as the time that it takes to reach the natural drainage limit. For each delineated replanting peatland the drainability assessment provides a go- or no-go for replanting.

Tier2 (**Annex 2**): Assessment at **subsidence stratum**-level. One centroid data point per separated stratum for each delineated replanting peatland is needed as input data for elevation and drainage limit, besides a map for distance from the middle of each stratum to the most relevant closest discharge water body. The outcome can be presented in an excel table. For each stratum within each delineated replanting peatland, the drainability assessment provides a go or no-go for replanting.

Commented [F33]: Not clear what this means

Commented [DSR34]: Look at it in glossary

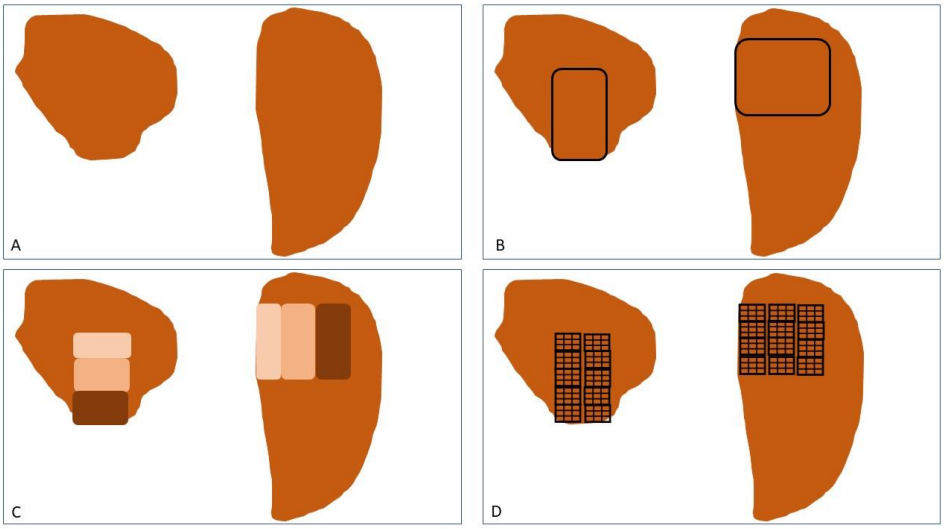


Figure 6. This figure illustrates the delineation of two separate peatlands (A) and the difference in TIER 1 (B), and TIER 2 (C) or (D).

Figure 6A shows the peatland areas within the concession. Figure 6B delineates individual replanting areas. If TIER 1 is used, just one average value for peat depth, referenced elevation (e.g. above mean sea level), distance to water body and soil subsidence rate is required per individual replanting area for calculating the distance of peat surface to drainage limit (figure 6B). If TIER 2 is used, average values are required to calculate the distance of the peat surface to drainage limit for each separated homogeneous stratum, e.g. based on soil subsidence rate and/or peat type (Figure 6C) and/or planting blocks (Figure 6D).

4. Required information

Before replanting on peat, grower companies are required to perform the drainability in the area(s) of replanting. In all other situations on peat, a grower is encouraged to perform Qualitative and Quantitative assessments to increase insight into current and future drainability of the area.

Commented [F35]: Currently there is a need to undertaken a drainability assessment not to report to RSPO

For all TIER 1 and 2 assessments the following information is required:

1. Depth of peat layer to drainage base (in meters)
2. Information on the elevation of the base of the peat layer/peat basal contact (the peat bottom) including national regulations on peat base (if there are any).
3. Drainage Limit Time (DLT, in years), based on depth of peat layer to drainage base and soil subsidence rate
4. If the DLT is below or above the two-crop cycle threshold (OK if DLT>40 years, or N if DL <40 years)

Commented [AS36]: Added to glossary

Commented [F37]: The concept of the threshold and the link to P&C requirements has not been explained earlier

Made reference to paragraphs below now.

In the paragraphs below, it is explained how to calculate the depth to drainage base, the basal contact elevation and the drainage limit time. It is also explained how to deal with the two-crop-rotations threshold.

Descriptions, detailed calculations and data must be given in the Report Document as well as justification of the calculations, any assumptions and use of defaults and data analyses.

Commented [AS38]: Discussion needed on what must be reported to RSPO, what should be available for auditors etc.

4.1. Depth to drainage base

The depth to the drainage base is the vertical distance between the present land surface to the position of drainage base, as illustrated in figure 7. Depth to drainage base is the outcome of the TIER 1 or TIER 2 methods. TIER 1 uses one-point averages per delineated replanting area, TIER 2 uses one-point average per separated stratum in each replanting area. Under all TIERS:

$$D_{DB} = Z_S - Z_{DB}$$

Where
D_{DB} : Depth to drainage base (m)
Z_S : Land elevation, i.e. from site DEM (m-msl)
Z_{DB} : Drainage base elevation, i.e. from drainage base map

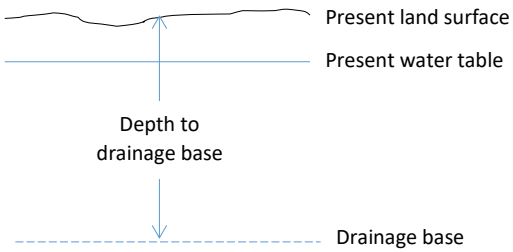


Figure 7. Illustration of positions of land surface, drainage base, and depth to drainage base

4.2. Basal contact elevation

Commented [F39]: Not in deninitions

Where the base of the peat layer is above the drainage limit, the peat layer may disappear completely before the two-crop cycle threshold is reached. This needs to be checked. This is a comparison of the peat depth to the distance to drainage limit.

Basal contact) of peat or peat base (ie the elevation of the base of the peat layer) can for example be mapped by overlaying site DEM against peat map, by using simple arithmetic:

$$Z_{BC} = Z_S - D_P$$

Where
Z_{BC} : Basal contact elevation (m-msl)
Z_S : Land elevation, i.e. from site DEM (m-msl)
D_P : Peat thickness, i.e. from site peat map (m)

Some countries apply regulations related to peat basal contacts drainage or exposure of the underlying mineral soil in certain conditions. For example, in Indonesia, wherever the mineral subsoil beneath the peat layer contains quartz sand or acidic clay (categorized as Potential Acid Sulphate Soil, PASS) basal contact exposure or drainage is prohibited. From the same perspective, other regulations render drainage of acidic clay as damaging the environment.

Basal contact positions also determine future fate of the peat soil. In shallow basal contact, drainage and subsidence may continue without land ever reaching its drainage base. So, future drainability may not be an issue but there is a risk of complete peat depletion (see figure 8).

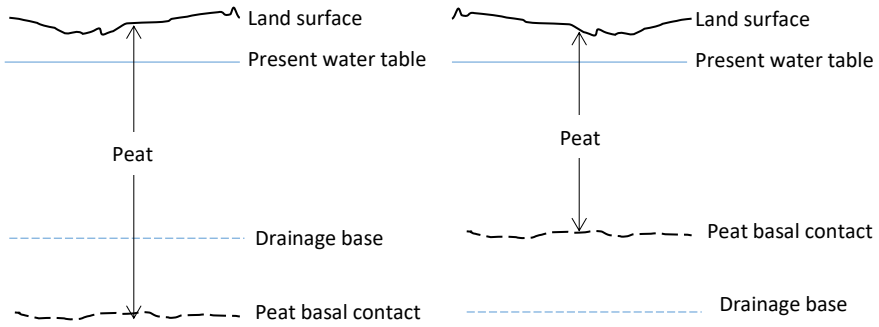


Figure 8. Illustration of vertical profile of peat soils showing relative positions of peat basal contacts against drainage bases: deep basal contact (left) and shallow basal contact (right).

4.3. Drainage Limit Time

The Drainage Limit Time (DLT) is the time required, with continuing subsidence, for land surface to subside to the position of the drainage base. DLT can be calculated, and can be mapped with raster arithmetic, by the following formula:

$$DLT = \frac{D_{DB}}{S}$$

Where
DLT : Drainage Limit Time (year)
D_{DB} : Depth to drainage base (cm)
S : Subsidence rate (cm/year)

Commented [F40]: Why in m not eg cm or mm?

Commented [DSR41]: Because all units must be consistent, all in meter all in centimeter.

For areas within shallow basal contact zone *DLT* must be calculated based on D_P instead of D_{DB} :

$$DLT = \frac{D_P}{S}$$

Where
DLT : Drainage Limit Time (year)
D_P : Peat thickness (cm)
S : Subsidence rate (cm/year)

4.4. Two-crop cycle threshold map or table

For TIER 1 and TIER 2 a Summary Table at least for the following information must be submitted (Table 1)

Commented [F42]: Need to discuss if this is the only information needed or do we need a proper report, map and explanation

Yes agree, we must discuss this, and perhaps also what is required to be available for auditors.

Table 1. Summary Table for Tier 1 Drainability Limit Assessment Report Summary

Peatland Area	Depth to Drainage Base (Meters)	Drainage Limit Time (Years)	DLT<40 years (Y/N)
A			
B			
C			
etc			

[Better to include some illustrative examples of drainability assessment results]

Commented [AS43]: We could use one of our test-cases as a real case example.

Commented [DSR44]: We can include an example result from our testers

Appendix: Assumptions Used in the Assessment

Commented [F45]: Could be an annex

Commented [AS46]: Views and assumptions will be checked with external reviewers.

Tidal influence

Drainability problems mostly exist because excess water cannot be drained to discharge rivers/sea in wet periods. In tidal areas, high tides may present as the dominant wet period. Tidal influences may add impact in areas up to 30 km from the sea. For the calculation of the drainage limit, average water level referred to standard datum (the mean sea level) is used.

There are several landmark water levels in tidal system: Highest Astronomical Tide (HAT), Mean High Water Springs (MHWS), Mean High Water Neaps (MHWN), Mean Sea Level (MSL), Mean Low Water Neaps (MLWN), Mean Low Water Springs (MLWS), and Lowest Astronomical Tide (LAT). Basically any of these landmark water levels can be used in defining reference water level for Drainability Limit calculation, and the choice actually depends on perspective and purpose, which adds complication to the calculation. Even after simplifying landmark water levels into just three: High Water Level (HWL), Mean Level (ML) and Low Water Level (LWL), there still needs to be defined what to use and why.

From agronomic point of view LWL can be chosen, since by installing flap-gate(s), or similar structures, tidal drainage can still be applied. But tidal-drainage is not a pure gravity drainage. With flap-gate there is no more free flowing water in the system. The premise is no different than that of mechanical-pumping drainage. Whenever pumping fails the land may be flooded. Similarly, whenever flap-gate fails the land may be flooded. From environmental point of view HWL can be chosen since this provides far better safeguard against peatland degradation. The two point of views are opposite each other, but still can reach a compromise by choosing ML as reference water level.

Subsidence

The current RSPO P&C requires that that subsidence of peat soils shall be minimized and monitored. Therefore, it is assumed that growers measure soil subsidence at reliable spatial and temporal intervals. In the case that less than 2 years of data is available (at minimum required), or the design to determine the peat soil subsidence rate does not reflect the requirements, a scientifically robust default value can be assumed for peat soil subsidence in SE Asia.

For this default we assume a soil subsidence rate based on science. **Carlson *et al* 2015** performed an independent study commissioned by the RSPO Emission Reduction Working Group. They studied 66-peer reviewed papers that were available in 2015 and selected 24 site studies based on accuracy criteria the studies that where suitable for the meta-analysis. The average soil subsidence rate in these 24 sites (Riau, Johor and Sabah) was **4.7 cm per year with an average confidence interval of 1.8 cm**. That means a **range of 2.9 cm/yr to 6.5 cm/yr**.

Based on this study, a **default value for soil subsidence rate of 5 cm/yr** is assumed and shall be used in the calculations if a company's own data is not available or is not sufficient.

Delineation of replanting area

Replanting of oil palm trees is often a gradual process, documented in a long-term replanting plan. Before any replantings on peat are done, a drainability assessment is required by RSPO. A drainability

assessment has a validity of maximum of 5 years. If the assessment is older than 5 years, it needs to be updated with new data (soil subsidence rate, DEM and peat thickness based on soil subsidence etc) . If the entire concession is planned to be replanted, each peatland unit (illustrated as A, B, C, and D in Figure 9) must be delineated separately. This means the borders of each of the brown areas (Figure 9) must be drawn. Then for the TIER 1 method, the centroid of each peatland can be calculated.

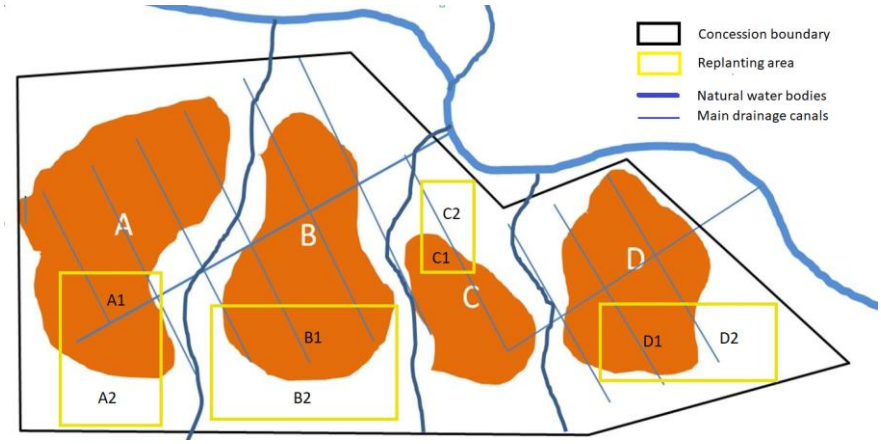


Figure 9. Illustration of an Oil Palm concession consisting of several peatland areas (A, B, C, and D) and several planned replanting areas

But, if only part of the peatland is planned (partial replanting) to be replanted (and the other part is not going to be replanted within 5 years), then only part of the peatland needs to be delineated. In the above example replanting is planned to take place in the areas delineated by yellow, thus only brown areas in yellow boxes need to be delineated. In this case the centroid points, as used in the TIER 1 method, will be different from the previous example, as illustrated in the following figure.

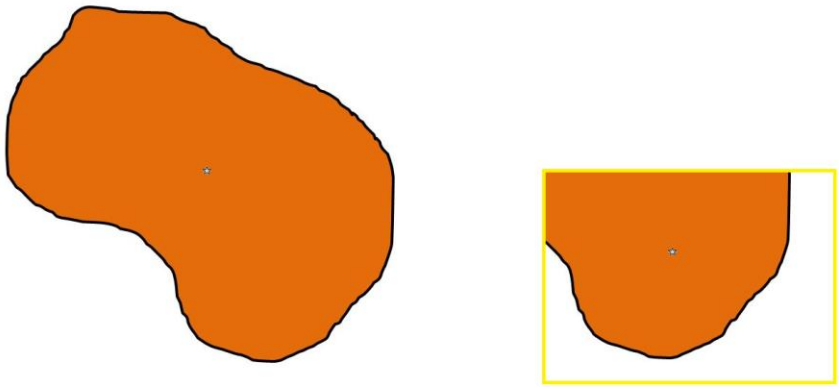


Figure 10. Illustration of delineation of peatland area (brown) and centroid (star). Left: For whole peatland area, Right: For partial replanting

The above rule applies for gradual replanting as well. In gradual replanting each boundary of peatland in replanting areas at each phase must be drawn, and the centroid must be calculated individually.

National regulations

It is assumed that National Regulations have precedence in any case.

Choice of closest relevant water body

At the start of peat formation there were no black-water streams. As the peat-forming process continues, peat domes grew taller and taller, and water table dynamics followed accordingly. However, there is a slope limit for the water table to follow the growth of a peat dome. If the so called 'water dome' inside a peat dome reaches its limit of slope stability, the water started flowing out of the dome. The water does not possess shear strength and cannot maintain sheer slope of the elevated dome. Water gradually carved out flow paths in the peat surface, and eventually, formed into black-water streams. From a watershed perspective, from this point onward the peat domes divided into several sub-domes. Therefore, most black-water streams are not situated on the lowest-possible-elevation part of their landscape. Also, in many cases, engineers do reworking on this type of streams by deepening and straightening their channels, which would not work if the channels were situated on the lowest part of location in the landscape.

Based on the above explained history, it is apparent that black-water streams are usually younger than their associated peat domes, and their positions are higher than natural discharge rivers. That means that black water rivers are not the right references for drainage limit calculations, and therefore it is assumed that black water rivers are not preferably chosen as reference water body.

Commented [F47]: This is less critical as in revised assessment we still give companies the option to use such streams for the calculations if they are already the outlets from their plantations.

Commented [DSR48]: Actually this is critical, because when they use blackwater stream as the reference they will hit drainage limit earlier. This is good from conservation point of view, because they may phase out earlier. But still we present this for fairness reason and that we speak the truth and we hide nothing. Whoever choose blackwater stream as their reference, do it at own risk.

Stream order

Stream order is a parameter that shows relative degree of directional-accumulations of water within a natural drainage network. Low order streams discharge their water into higher order streams since the

latter are situated on lower elevations. Therefore, the higher the order of a stream the higher the probability that it acts as limiting feature in determining drainage base. For our purpose, we only consider high order streams which are situated on mineral soils (with mineral river bed).

Conservativeness

The TIER 1 method is a simplified method. That means automatically that the TIER 1 method should also be the most conservative. The simplification includes that it is a **Lumped method**: Replanting area is not partitioned spatially, instead is treated as single lumped area, or group of areas. Secondly, it is a **Static method**: Subsidence rate for example is assumed to not vary year to year, but instead assumed to be constant by using site-specific, historical subsidence rates or a conservative default value of 5 cm/yr. **A certain conservativeness** is built in, because simplification always comes with a loss of accuracy. Conservativiness includes the assumtions that will be explained more under 'Landscape Management'. The choice of the assumptions sets the degree of conservativeness and has consequences in the choice of relevant reference natural water body for the calculation in the assessment. Growers must explain their assumptions in their report.

Mechanical pumping

It is assumed that no mechanical pumping is applied to lower the Natural Drainage Limit. In this method all calculations are based on the Natural Drainage Limit, relative to the mean sea level. In using mechanical pumping there is almost no drainage limit. People can drain water out of polder as long as machine capacity allow and as long as power is available. Once pumping is below the natural drainage limit, forever-pumping is required to keep the water out which will result in considerable pumping costs, and impact on the surroundings.

Landscape management.

Before choosing the most relevant reference natural water body growers need to choose their assumptions:

Assumption 1

Grower(s) has no power, and/or right, and/or ability, and/or capacity to do or get involved in drinage related water management effort in the landscape outside its own concession area; **AND** Relevant authority has no power, and/or ability, and/or capacity to do or get involved in drinage related water management effort in the landscape. With this assumption stakeholders within the landscape, notably relevant authority, are not going to react accordingly to changes in drainability problem within the landscape. When most of the landscape have experienced severe flood problem, no stakeholder, including relevant authority, is going to conduct river engineering.

As a consequence of choosing this assumption the choice of relevant water body must be the closest one(s) to the concession area, which is most likely to be low order streams with higher water level. With high water level at reference water body the resulted drainage base will be close to peat surface.

Growers must demonstrate that relevant authority is not going to mitigate flood problem in the future, by referring to official written regulations, roles and duty, historical examples, etc. Growers must also demonstrate that landscape stakeholder does not react to flood problem, that downstream stakeholders are not doing dredging and that it does not pave the way for upstream stakeholders.

Assumption 2

Grower(s) has power, and/or right, and/or ability, and/or capacity to do or get involved in drainage related water management effort in the landscape outside its own concession area; **OR** Relevant authority has power, and/or ability, and/or capacity to do or get involved in drainage related water management effort in the landscape. Growers are assumed to have some degree of control or indirect control on drainage management of the landscape surrounding the plantation. When regular flood problems begin to emerge, stakeholders located close to the main water body are assumed to perform dredging. This provides benefit to stakeholders further inland. Alternatively, it is assumed that relevant authorities react accordingly to drainability problems within the landscape. When most of the landscape have experienced severe flood problem, relevant authority conducts river engineering. An example is the responsibility of the Ministry of Public Works of Indonesia in maintaining flood mitigation and prevention functions of all drainage structures and rivers in Indonesia. Land subsidence and reduced river capacity has been a major problem in Jakarta. Ministry of Public Works reacts to this problem by conducting river dredging or engineering, e.q. at Krukut river, Ciliwung river, and many other rivers. In future, if flood problem becomes a major issue on peatland and affects many stakeholders of the landscape the Ministry of Public Works must respond appropriately.

As a consequence of choosing this assumption, the choice of relevant water body must be the correct one(s), which is most likely to be high order streams with lower water level. With low water level at reference water body the resulted drainage base will be deeper from peat surface.

Growers must demonstrate that relevant authority is going to mitigate flood problem in the future, by referring to official written regulations, roles and duty, historical examples, etc. Growers can also demonstrate that landscape stakeholder reacts to flood problem, that downstream stakeholders are doing dredging and that it paves the way for upstream stakeholders.

References

Commented [F49]: incomplete

Guilford, J.P. and B. Frucher. 1973. Fundamental Statistics in Psychology and Education. MC Graw-Hill. New York.

Yamane, Taro. 1967. Statistics: An Introductory Analysis, 2nd Edition. Harper and Row. New York.

University of Colorado. Web page: http://www.uccs.edu/~bvogt/courses/ges4050/helpful_stuff/las_to_dem.html

ESRI documentation web page 1: http://pro.arcgis.com/en/pro-app/help/analysis/geostatistical-analyst/performing-cross-validation-and-validation.htmvalidation

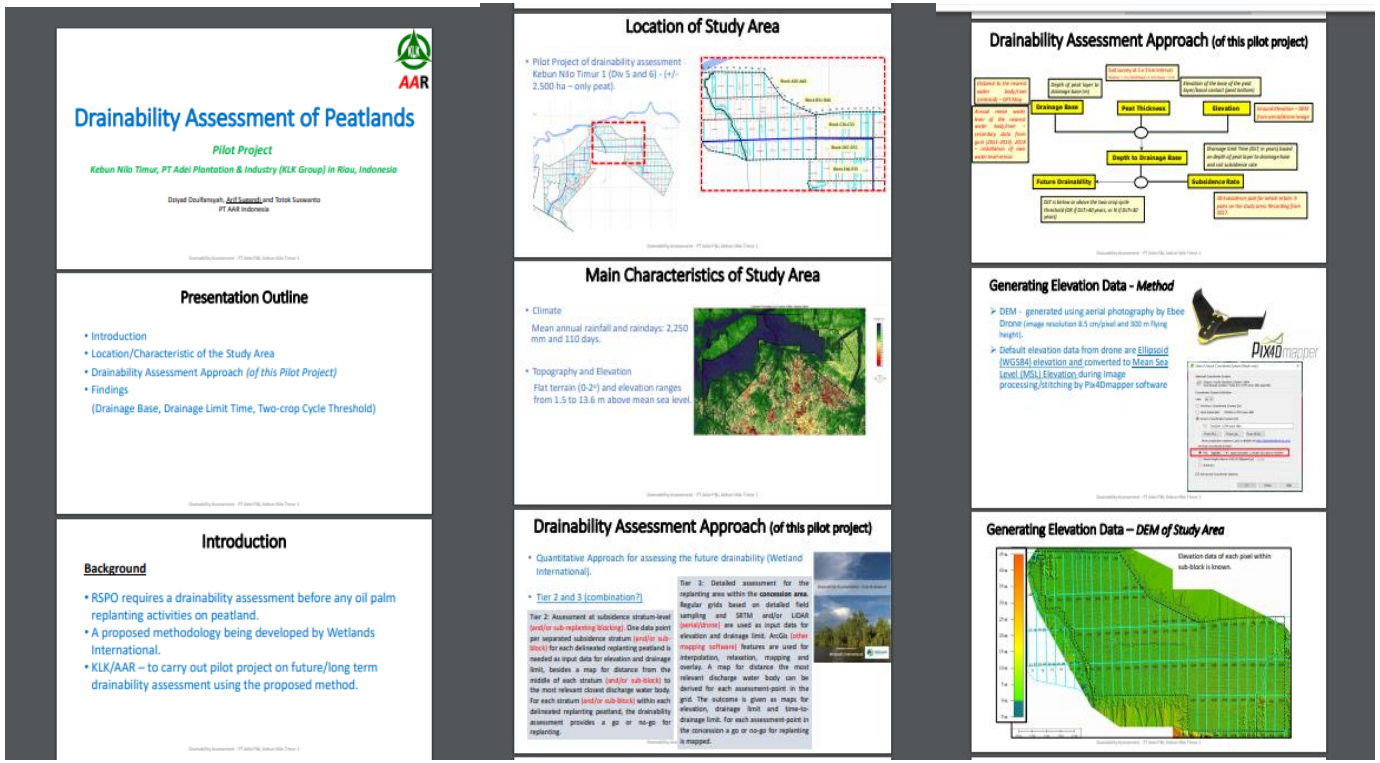
ESRI documentation web page 2: http://help.arcgis.com/en/arcgisdesktop/10.0/pdf/geostatistical-analyst-tutorial.pdf

Carlson et al 2015, …….

Others???

No list of annexes etc

Annex 5: Drainability Assessment for Peatlands by KLK Group

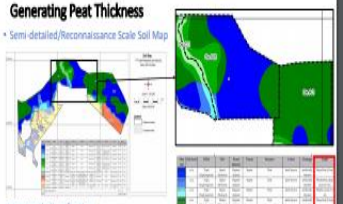


Generating Elevation Data – *Elevation of each sub-block*

- *Average elevation data (and centroid elevation data for comparison) for each sub-blocks*
- *Generated by Global Mapper software.*
- *Average – 30 ha/45 cm pixel.*

Generating Peat Thickness

- Semi-detailed/Reconnaissance Scale Soil Map

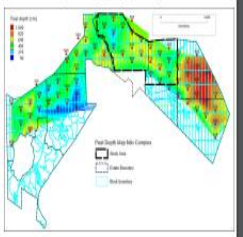


Peat Depth Classification:

- Shallow - <1 m
- Moderately Deep – 1-3 m
- Deep - >3 m (not necessary to get the depth to the sub-stsratum mineral layer)

Generating Peat Thickness – *spatial analysis of peat depth*

- Special survey of peat depth was carried out to get actual organic layer until the substratum layer.
- Spatial Analysis (interpolation) of peat depth.



Generating Peat Thickness – *Peat Depth of each sub-block from the spatial analysis*

Block	Peat Depth (m)	
	Average	Centroid
A30	4.8	4.8
A31	4.5	4.5
A32	4.3	4.3
A33 (1&2)	4.2	4.3
A34 (3&4)	4.3	4.5
A35 (5&6)	4.6	4.9
A36 (7&8)	4.6	4.9
A37	4.7	4.9
A38	4.7	4.8
A39	4.8	4.8
A40	5.1	5.2
A41	5.5	5.5
B01	4.2	4.2
B02	4.1	4.0
B03	4.3	4.2
B04	3.6	3.5
B05	3.0	2.8
B06	3.2	3.1
B07	3.8	3.9
B08	4.7	4.7
B09	5.2	5.2
B10	5.5	5.5
B11	5.8	6.0
B12	6.2	6.2
B13	6.1	6.2
B14	6.0	6.1
B15	5.9	5.9
C01	4.8	4.6
C02	4.9	4.9
C03	5.1	5.0
C04	4.8	4.6
C05	5.0	4.8
C06	5.3	5.4
C07	5.8	5.9
C08	6.1	5.9
C09	5.7	5.8
C10	6.5	6.2
C11	6.5	6.6
C12	6.6	6.7
C13	6.4	6.5
C14	6.2	6.2
C15	6.0	6.0
C16	6.4	6.5
C17	6.2	6.2
C18	5.8	6.0
C19	5.5	5.7
C20	5.5	5.6
C21	5.1	5.1
C22	5.1	5.1
C23	5.0	5.0
C24	4.9	4.9
C25	4.8	4.8
C26	4.8	4.6
C27	5.0	4.8
C28	5.3	5.4
C29	5.6	5.6
C30	5.7	5.8
C31	5.8	5.9
C32	6.1	6.2
C33	6.5	6.6
C34	6.6	6.7
C35	6.6	6.7
C36	6.4	6.5
C37	6.2	6.2
C38	5.8	5.8
C39	5.5	5.7
C40	5.5	5.6
C41	5.1	5.1
C42	5.1	5.1
C43	5.0	5.0
C44	4.9	4.9
C45	4.8	4.8
C46	4.8	4.6
C47	5.0	4.8
C48	5.3	5.4
C49	5.6	5.6
C50	5.7	5.8
C51	5.8	5.9
C52	6.1	6.2
C53	5.7	5.9
C54	6.0	6.1
C55	6.0	6.1
C56	5.4	5.5
C57	5.2	5.3
C58	4.9	5.0
C59	4.7	4.7
C60	4.5	4.5
C61	4.4	4.4
C62	4.5	4.4
C63	4.6	4.7
C64	4.9	4.9
D01	5.2	5.3
D02	5.6	5.8
D03	6.0	6.1
D04	6.2	6.4
D05	5.8	6.1
D06	5.2	5.3
D07	4.6	4.6
D08	4.4	4.4
D09	4.5	4.5
D10	4.5	4.5
D11	4.5	4.5
D12	4.6	4.6
D13	4.8	4.8
D14	4.8	4.8
D15	4.8	4.8
D16	4.8	4.8
D17	4.8	4.8
D18	4.8	4.8
D19	4.8	4.8
D20	4.8	4.8
D21	4.8	4.8
D22	4.8	4.8
D23	4.8	4.8
D24	4.8	4.8
D25	4.8	4.8
D26	4.8	4.8
D27	4.8	4.8
D28	4.8	4.8
D29	4.8	4.8
D30	4.8	4.8
D31	4.8	4.8
D32	4.8	4.8
D33	4.8	4.8
D34	4.8	4.8
D35	4.8	4.8
D36	4.8	4.8
D37	4.8	4.8
D38	4.8	4.8
D39	4.8	4.8
D40	4.8	4.8
D41	4.8	4.8
D42	4.8	4.8
D43	4.8	4.8
D44	4.8	4.8
D45	4.8	4.8
D46	4.8	4.8
D47	4.8	4.8
D48	4.8	4.8
D49	4.8	4.8
D50	4.8	4.8
D51	4.8	4.8
D52	4.8	4.8
D53	4.8	4.8
D54	4.8	4.8
D55	4.8	4.8
D56	4.8	4.8
D57	4.8	4.8
D58	4.8	4.8
D59	4.8	4.8
D60	4.8	4.8
D61	4.8	4.8
D62	4.8	4.8
D63	4.8	4.8
D64	4.8	4.8
D65	4.8	4.8
D66	4.8	4.8
D67	4.8	4.8
D68	4.8	4.8
D69	4.8	4.8
D70	4.8	4.8
D71	4.8	4.8
D72	4.8	4.8
D73	4.8	4.8
D74	4.8	4.8
D75	4.8	4.8
D76	4.8	4.8
D77	4.8	4.8
D78	4.8	4.8
D79	4.8	4.8
D80	4.8	4.8
D81	4.8	4.8
D82	4.8	4.8
D83	4.8	4.8
D84	4.8	4.8
D85	4.8	4.8
D86	4.8	4.8
D87	4.8	4.8
D88	4.8	4.8
D89	4.8	4.8
D90	4.8	4.8
D91	4.8	4.8
D92	4.8	4.8
D93	4.8	4.8
D94	4.8	4.8
D95	4.8	4.8
D96	4.8	4.8
D97	4.8	4.8
D98	4.8	4.8
D99	4.8	4.8
E01	4.8	4.8
E02	4.8	4.8
E03	4.8	4.8
E04	4.8	4.8
E05	4.8	4.8
E06	4.8	4.8
E07	4.8	4.8
E08	4.8	4.8
E09	4.8	4.8
E10	4.8	4.8
E11	4.8	4.8
E12	4.8	4.8
E13	4.8	4.8
E14	4.8	4.8
E15	4.8	4.8
E16	4.8	4.8
E17	4.8	4.8
E18	4.8	4.8
E19	4.8	4.8
E20	4.8	4.8
E21	4.8	4.8
E22	4.8	4.8
E23	4.8	4.8
E24	4.8	4.8
E25	4.8	4.8
E26	4.8	4.8
E27	4.8	4.8
E28	4.8	4.8
E29	4.8	4.8
E30	4.8	4.8
E31	4.8	4.8
E32	4.8	4.8
E33	4.8	4.8
E34	4.8	4.8
E35	4.8	4.8
E36	4.8	4.8
E37	4.8	4.8
E38	4.8	4.8
E39	4.8	4.8
E40	4.8	4.8
E41	4.8	4.8
E42	4.8	4.8
E43	4.8	4.8
E44	4.8	4.8
E45	4.8	4.8
E46	4.8	4.8
E47	4.8	4.8
E48	4.8	4.8
E49	4.8	4.8
E50	4.8	4.8
E51	4.8	4.8
E52	4.8	4.8
E53	4.8	4.8
E54	4.8	4.8
E55	4.8	4.8

Water elevation level of Sg Kampar (2011-2013)

Average monthly water elevation level of Sg Kampar (2011-2013)*

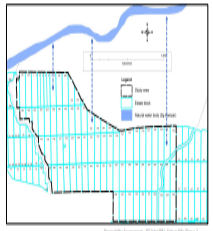
Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	135	183	148	130	159	116	66	125	148	177	246	299
2012	240	198	216	239	228	154	169	145	165	194	370	418
2013	267	278	264	261	261	189	162	130	164	210	344	343
Mean	214	220	209	210	216	153	132	133	159	194	320	353

*Data from Direktorat Jenderal Sumberdaya Air dan Pekerjaan Umum, recorded from a field station near the estate

Based on the normal curve of daily records of Sg Kampar water level and quartile analysis, estimated Average HWL (high water level), MWL (mean water level) and LWL (low water level) are as follows:

- HWL 367 cm amsl = 3.67 m amsl
- MWL 209 cm amsl = 2.09 m amsl
- LWL 85 cm amsl = 0.85 m amsl

Distance to the Nearest Natural Water Body/River (i.e. Sg Kampar)



Distance to Sg Kampar for each sub-blocks (from Centroid)

Block	Dist. to Sg Kampar (m)
A30	1,000
A31	940
A32	1,110
A33 (1&2)	1,270
A34 (3&4)	1,390
A35 (5&6)	1,590
A36 (7&8)	1,660
A37	1,800
A38	1,930
A39	2,080
A40	2,290
A41	2,380
B01	1,810
B02	1,930
B03	2,300
B04	2,530
B05	2,620
B06	2,700
B07	2,870
B08	2,980
B09	3,020
B10	3,020
B11	3,050
B12	3,010
B13	2,950
B14	2,970
B15	3,020
C01	3,260
C02	3,240
C03	3,590
C04	3,740
C05	3,870
C06	3,980
C07	4,010
C08	3,990
C09	4,050
C10	3,970
C11	3,730
C12	3,710
C13	3,700
C14	3,880
C15	3,960
C16	4,010
C17	4,160
C18	4,160
C19	4,190
C20	4,190
C21	4,140
C22	4,170
C23	4,180
C24	4,200
C25	4,220
C26	4,400
C27	4,640
C28	4,790
C29	4,910
C30	5,020
C31	5,010
C32	4,980
C33	4,880
C34	4,710
C35	4,720
C36	4,810
C37	4,560
C38	4,510
C39	4,500
C40	4,590
C41	4,530
C42	4,560
C43	4,580
C44	4,570
C45	4,510
C46	4,400
C47	4,680
C48	4,790
C49	4,910
C50	5,020
C51	5,010
C52	4,980
C53	4,880
C54	4,710
C55	4,720
D01	4,720
D02	4,810
D03	5,280
D04	5,130
D05	5,640
D06	5,640
D07	5,640
D08	5,640
D09	5,640
D10	5,640
D11	5,640
D12	5,640
D13	5,640
D14	5,640
D15	5,640
D16	5,640
D17	5,640
D18	5,640
D19	5,640
D20	5,640
D21	5,640
D22	5,640
D23	5,640
D24	5,640
D25	5,640
D26	5,640
D27	5,640
D28	5,640
D29	5,640
D30	5,640
D31	5,640
D32	5,640
D33	5,640
D34	5,640
D35	5,640
D36	5,640
D37	5,640
D38	5,640
D39	5,640
D40	5,640
D41	5,640
D42	5,640
D43	5,640
D44	5,640
D45	5,640
D46	5,640
D47	5,640
D48	5,640
D49	5,640
D50	5,640
D51	5,640
D52	5,640
D53	5,640
D54	5,640
D55	5,640
D56	5,640
D57	5,640
D58	5,640
D59	5,640
D60	5,640
D61	5,640
D62	5,640
D63	5,640
D64	5,640
D65	5,640
D66	5,640
D67	5,640
D68	5,640
D69	5,640
D70	5,640
D71	5,640
D72	5,640
D73	5,640
D74	5,640
D75	5,640
D76	5,640
D77	5,640
D78	5,640
D79	5,640
D80	5,640
D81	5,640
D82	5,640
D83	5,640
D84	5,640
D85	5,640
D86	5,640
D87	5,640
D88	5,640
D89	5,640
D90	5,640
D91	5,640
D92	5,640
D93	5,640
D94	5,640
D95	5,640
D96	5,640
D97	5,640
D98	5,640
D99	5,640
E01	5,640
E02	5,640
E03	5,640
E04	5,640
E05	5,640
E06	5,640
E07	5,640
E08	5,640
E09	5,640
E10	5,640
E11	5,640
E12	5,640
E13	5,640
E14	5,640
E15	5,640
E16	5,640
E17	5,640
E18	5,640
E19	5,640
E20	5,640
E21	5,640
E22	5,640
E23	5,640
E24	5,640
E25	5,640
E26	5,640
E27	5,640
E28	5,640
E29	5,640
E30	5,640
E31	5,640
E32	5,640
E33	5,640
E34	5,640
E35	5,640
E36	5,640
E37	5,640
E38	5,640
E39	5,640
E40	5,640
E41	5,640
E42	5,640
E43	5,640
E44	5,640
E45	5,640
E46	5,640
E47	5,640
E48	5,640
E49	5,640
E50	5,640
E51	5,640
E52	5,640
E53	5,640
E54	5,640
E55	5,640

Generating Drainage Base – at Low/Mean/High Water Level of the river

$$Z_{DB} = Z_{MWR} + 0.0002 \times \Delta X_{MWR}$$

Where

Z_{DB} : Drainage Base (m-msl)

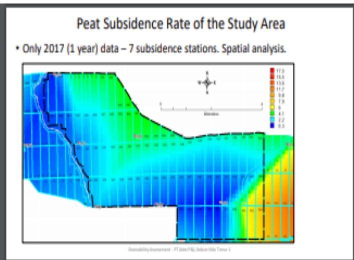
Z_{MWR} : Annual mean water level elevation at nearest natural water body (m-msl)

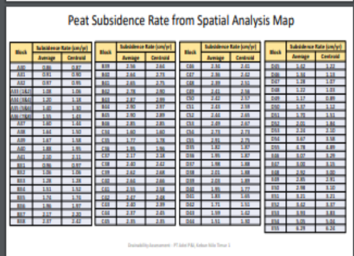
ΔX_{MWR} : Distance to the nearest natural water body (meters)

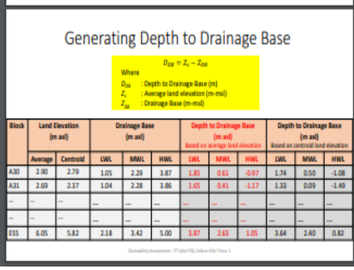
Block	Annual Water Level Elevation of Sg Kampar (m asl)			Distance to Sg Kampar (m)	Drainage Base (m asl)		
	LWL	MWL	HWL		LWL	MWL	HWL
A30	0.85	2.09	3.67	1,000	1.05	2.29	3.87
A31	0.85	2.09	3.67	940	1.04	2.28	3.86
...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...
E55	0.85	2.09	3.67	6,650	2.18	3.42	5.00

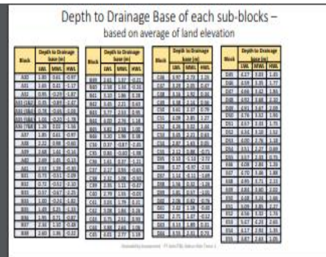
Drainage Base of each sub-blocks – at Low/Mean/High Water Level of the river

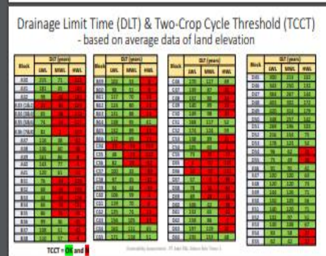
Block	Drainage base (m asl)		
	LWL	MWL	HWL
A30	1.05	2.29	3.87
A31	1.04	2.28	3.86
A32	1.07	2.31	3.89
A33 (1&2)	1.10	2.34	3.92
A34 (3&4)	1.13	2.37	3.95
A35 (5&6)	1.17	2.41	3.99
A36 (7&8)	1.18	2.42	4.00
A37	1.21	2.45	4.03
A38	1.20	2.44	4.04
A39	1.27	2.51	4.09
A40	1.31	2.55	4.13
A41	1.35	2.57	4.15
B01	1.21	2.45	4.03
B02	1.29	2.49	4.06
B03	1.31	2.55	4.13
B04	1.36	2.60	4.18
B05	1.37	2.61	4.19
B06	1.41	2.65	4.23
B07	1.42	2.66	4.24
B08	1.45	2.69	4.27
B09	1.45	2.69	4.27
B10	1.48	2.70	4.28
B11	1.49	2.71	4.29
B12	1.48	2.70	4.28
B13	1.48	2.69	4.26
B14	1.51	2.68	4.26
B15	1.45	2.69	4.27
C01	1.50	2.74	4.32
C02	1.53	2.73	4.31
C03	1.52	2.81	4.40
C04	1.49	2.84	4.43
C05	1.52	2.86	4.45
C06	1.49	2.85	4.47
C07	1.49	2.85	4.47
C08	1.49	2.85	4.47
C09	1.49	2.85	4.47
C10	1.49	2.85	4.47
C11	1.49	2.85	4.47
C12	1.49	2.85	4.47
C13	1.49	2.85	4.47
C14	1.49	2.85	4.47
C15	1.49	2.85	4.47
C16	1.49	2.85	4.47
C17	1.49	2.85	4.47
C18	1.49	2.85	4.47
C19	1.49	2.85	4.47
C20	1.49	2.85	4.47
C21	1.49	2.85	4.47
C22	1.49	2.85	4.47
C23	1.49	2.85	4.47
C24	1.49	2.85	4.47
C25	1.49	2.85	4.47
C26	1.49	2.85	4.47
C27	1.49	2.85	4.47
C28	1.49	2.85	4.47
C29	1.49	2.85	4.47
C30	1.49	2.85	4.47
C31	1.49	2.85	4.47
C32	1.49	2.85	4.47
C33	1.49	2.85	4.47
C34	1.49	2.85	4.47
C35	1.49	2.85	4.47
C36	1.49	2.85	4.47
C37	1.49	2.85	4.47
C38	1.49	2.85	4.47
C39	1.49	2.85	4.47
C40	1.49	2.85	4.47
C41	1.49	2.85	4.47
C42	1.49	2.85	4.47
C43	1.49	2.85	4.47
C44	1.49	2.85	4.47
C45	1.49	2.85	4.47
C46	1.49	2.85	4.47
C47	1.49	2.85	4.47
C48	1.49	2.85	4.47
C49	1.49	2.85	4.47
C50	1.49	2.85	4.47
C51	1.49	2.85	4.47
C52	1.49	2.85	4.47
C53	1.49	2.85	4.47
C54	1.49	2.85	4.47
C55	1.49	2.85	4.47
D01	1.49	2.85	4.47
D02	1.49	2.85	4.47
D03	1.49	2.85	4.47
D04	1.49	2.85	4.47
D05	1.49	2.85	4.47
D06	1.49	2.85	4.47
D07	1.49	2.85	4.47
D08	1.49	2.85	4.47
D09	1.49	2.85	4.47
D10	1.49	2.85	4.47
D11	1.49	2.85	4.47
D12	1.49	2.85	4.47
D13	1.49	2.85	4.47
D14	1.49	2.85	4.47
D15	1.49	2.85	4.47
D16	1.49	2.85	4.47
D17	1.49	2.85	4.47
D18	1.49	2.85	4.47
D19	1.49	2.85	4.47
D20	1.49	2.85	4.47
D21	1.49	2.85	4.47
D22	1.49	2.85	4.47
D23	1.49	2.85	4.47
D24	1.49	2.85	4.47
D25	1.49	2.85	4.47
D26	1.49	2.85	4.47
D27	1.49	2.85	4.47
D28	1.49	2.85	4.47
D29	1.49	2.85	4.47
D30	1.49	2.85	4.47
D31	1.49	2.85	4.47
D32	1.49	2.85	4.47
D33	1.49	2.85	4.47
D34	1.49	2.85	4.47
D35	1.49	2.85	4.47
D36	1.49	2.85	4.47
D37	1.49	2.85	4.47
D38	1.49	2.85	4.47
D39	1.49	2.85	4.47
D40	1.49	2.85	4.47
D41	1.49	2.85	4.47
D42	1.49	2.85	4.47
D43	1.49	2.85	4.47
D44	1.49	2.85	4.47
D45	1.49	2.85	4.47
D46	1.49	2.85	4.47
D47	1.49	2.85	4.47
D48	1.49	2.85	4.47
D49	1.49	2.85	4.47
D50	1.49	2.85	4.47
D51	1.49	2.85	4.47
D52	1.49	2.85	4.47
D53	1.49	2.85	4.47
D54	1.49	2.85	4.47
D55	1.49	2.85	4.47
D56	1.49	2.85	4.47
D57	1.49	2.85	4.47
D58	1.49	2.85	4.47
D59	1.49	2.85	4.47
D60	1.49	2.85	4.47
D61	1.49	2.85	4.47
D62	1.49	2.85	4.47
D63	1.49	2.85	4.47
D64	1.49	2.85	4.47
D65	1.49	2.85	4.47
D66	1.49	2.85	4.47
D67	1.49	2.85	4.47
D68	1.49	2.85	4.47
D69	1.49	2.85	4.47
D70	1.49	2.85	4.47
D71	1.49	2.85	4.47
D72	1.49	2.85	4.47
D73	1.49	2.85	4.47
D74	1.49	2.85	4.47
D75	1.49	2.85	4.47
D76	1.49	2.85	4.47
D77	1.49	2.85	4.47
D78	1.49	2.85	4.47
D79	1.49	2.85	4.47
D80	1.49	2.85	4.47
D81	1.49	2.85	4.47
D82	1.49	2.85	4.47
D83	1.49	2.85	4.47
D84	1.49	2.85	4.47
D85	1.49	2.85	4.47
D86	1.49	2.85	4.47
D87	1.49	2.85	4.47
D88	1.49	2.85	4.47
D89	1.49	2.85	4.47
D90	1.49	2.85	4.47
D91	1.49	2.85	4.47
D92	1.49	2.85	4.47
D93	1.49	2.85	4.47
D94	1.49	2.85	4.47
D95	1.49	2.85	4.47
D96	1.49	2.85	4.47
D97	1.49	2.85	4.47
D98	1.49	2.85	4.47
D99	1.49	2.85	4.47
E01	1.49	2.85	4.47
E02	1.49	2.85	4.47
E03	1.49	2.85	4.47
E04	1.49	2.85	4.47
E05	1.49	2.85	4.47
E06	1.49	2.85	4.47
E07	1.49	2.85	4.47
E08	1.49	2.85	4.47
E09	1.49	2.85	4.47
E10	1.49	2.85	4.47
E11	1.49	2.85	4.47
E12	1.49	2.85	4.47
E13	1.49	2.85	4.47
E14	1.49	2.85	4.47
E15	1.49	2.85	4.47
E16	1.49	2.85	4.47
E17	1.49	2.85	4.47
E18	1.49	2.85	4.47
E19	1.49	2.85	4.47
E20	1.49	2.85	4.47
E21	1.49	2.85	4.47
E22	1.49	2.85	4.47
E23	1.49	2.85	4.47
E24	1.49	2.85	4.47
E25	1.49	2.85	4.47
E26	1.49	2.85	4.47
E27	1.49	2.85	4.47
E28	1.49	2.85	4.47
E29	1.49	2.85	4.47
E30	1.49	2.85	4.47
E31	1.49	2.85	4.47
E32	1.49	2.85	4.47
E33	1.49	2.85	4.47
E34	1.49	2.85	4.47
E35	1.49	2.85	4.47
E36	1.49	2.85	4.47
E37	1.49	2.85	4.47
E38	1.49	2.85	4.47
E39	1.49	2.85	4.47
E40	1.49	2.85	4.47
E41	1.49	2.85	4.47
E42	1.49	2.85	4.47
E43	1.49	2.85	4.47
E44	1.49	2.85	4.47
E45	1.49	2.85	4.47
E46	1.49	2.85	4.47
E47	1.49	2.85	4.47
E48	1.49	2.85	4.47
E49	1.49	2.85	4.47
E50	1.49	2.85	4.47
E51	1.49	2.85	4.47
E52	1.49	2.85	4.47
E53	1.49	2.85	4.47
E54	1.49	2.85	4.47
E55	1.49	2.85	4.47

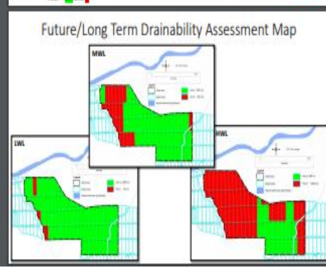

Peat Subsidence Rate of the Study Area
• Only 2017 (1 year) data – 7 subsidence stations. Spatial analysis.

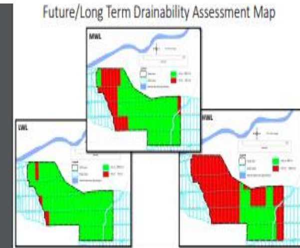

Peat Subsidence Rate from Spatial Analysis Map

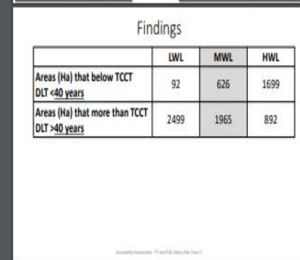

Generating Depth to Drainage Base
$D_{DB} = Z_L - Z_{DB}$
Where
D_{DB} : Depth to Drainage Base (m)
Z_L : Average land elevation (m-msl)
Z_{DB} : Drainage Base (m-msl)
Block | Land Elevation (m asl) | Drainage Base (m asl) | Depth to Drainage Base (m asl) Based on average land elevation | Depth to Drainage Base (m asl) Based on centroid land elevation
Average | Centroid | LWL | MWL | HWL | LWL | MWL | HWL | LWL | MWL | HWL
A30 | 2.90 | 2.79 | 1.05 | 2.29 | 3.87 | 1.85 | 0.61 | -0.97 | 1.74 | 0.50 | -1.08
A31 | 2.69 | 2.37 | 1.04 | 2.28 | 3.86 | 1.65 | 0.41 | -1.17 | 1.33 | 0.09 | -1.49
E55 | 6.05 | 5.82 | 2.18 | 3.42 | 5.00 | 3.87 | 2.63 | 1.05 | 3.64 | 2.40 | 0.82


Depth to Drainage Base of each sub-blocks –
based on average of land elevation


Drainage Limit Time (DLT) & Two-Crop Cycle Threshold (TCCT)
- based on average data of land elevation

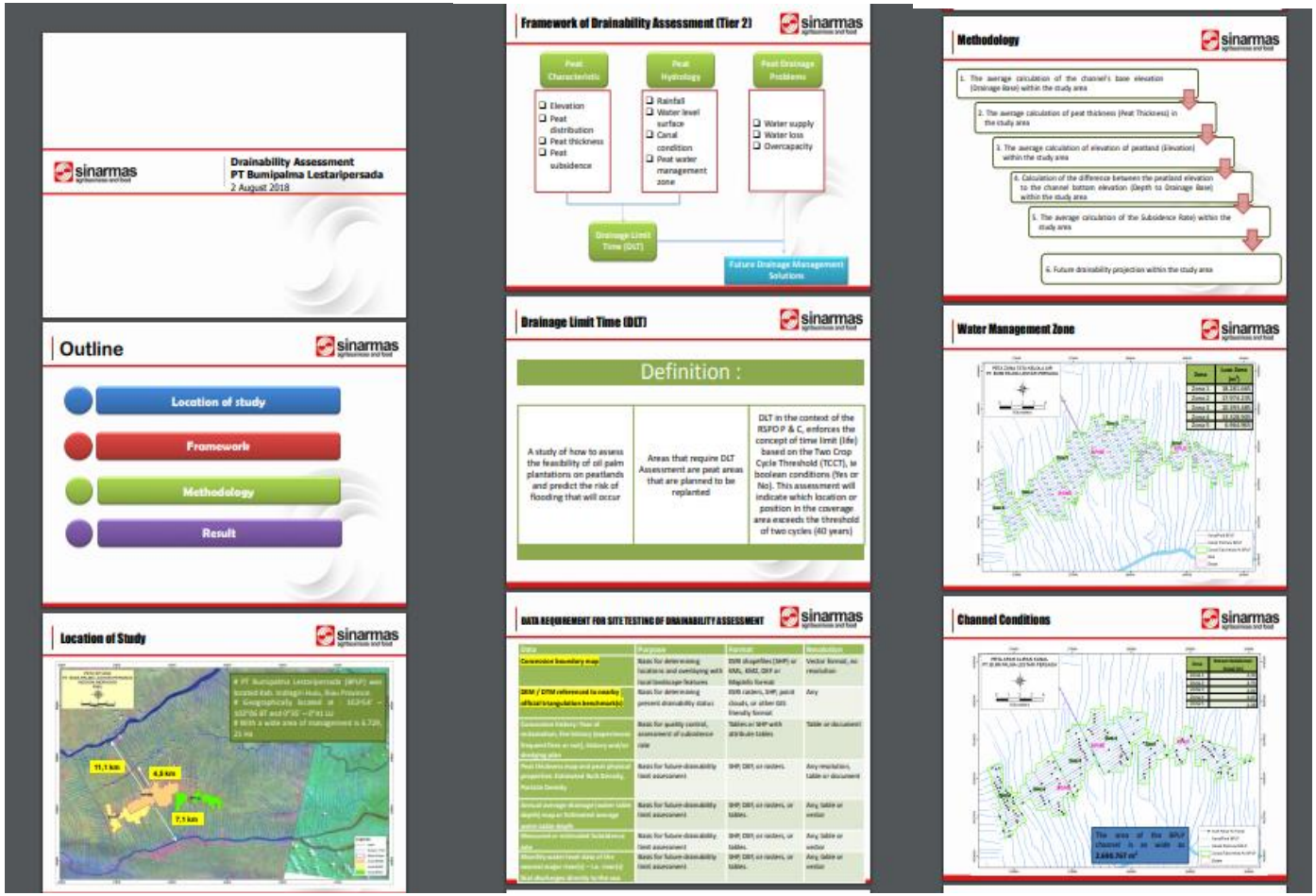

Future/Long Term Drainability Assessment Map
MWL
LWL
HWL


Future/Long Term Drainability Assessment Map
MWL
LWL
HWL


Findings
| LWL | MWL | HWL
Areas (Ha) that below TCCT DLT <40 years | 92 | 626 | 1699
Areas (Ha) that more than TCCT DLT >40 years | 2499 | 1965 | 892


TERIMA KASIH

Annex 6: GAR's results from pilot-testing on drainability assessment procedure

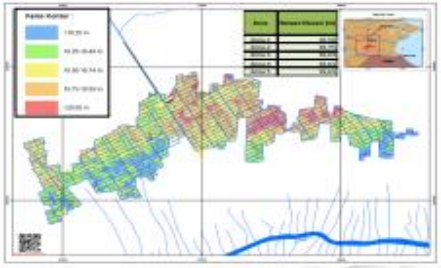


Channel Conditions

- BPLP consists of 5 (five) water and peat management zones
- BPLP has an inlet from the Indragiri River which is channeled through a canal and at the pump into the field
- In general, BSNE has a higher condition, while BPLE has the lowest altitude
- The outline of the flow direction shows the flow from BSNE flowing through BPME to BPLL, and so forth through the BPLL sluice.

Peat Thickness

Elevation



Subsidence

Drainage Limit Time (DLT)

ZONA	Average Elevation (A) (meter)	Average Drainage Thickness (Dw) (meter)	Average Peat Thickness (Dp) (meter)	Average Drainage Base (Db) (meter)	Depth of Drainage Base* (Dwa) (meter)	Average Subsidence Rate (S) (cm/year)	Drainage Limit Time (DLT) (year)	Two-Crop Cycle Threshold (DLT > 40 = Y; DLT ≤ 40 = N) (OK/N)
	A	B	C	D = A - C	E = A - D	F	G = B/F or E/F	H
1	19,50	2,39	2,00	14,11	5,39	2,83	105,88	OK
2	19,75	2,73	2,00	14,02	5,73	3,63	82,57	OK
3	19,63	2,03	2,00	14,60	5,03	1,07	281,25	OK
4*	19,63	2,47	2,00	14,16	5,47	1,07	281,25	OK
5*	19,63	2,28	2,00	14,35	5,28	1,07	281,25	OK

Annex 6: Draft Peat Inventory

[Draft] Peat Inventory reporting

A. Guidance on Peat Inventory for RSPO reporting

Estate Peat Inventory

1) Only cells highlighted in to be filled by grower.

2) Fill in the unplanted areas on mineral soil (refer to pic below). Unplanted areas are defined as areas not planted with Oil Palm including infrastructure, buildings, HCS, HCV and Conservation areas on mineral soil.

Summary of area (Ha)		
Total Area	**Mineral**	**Peat**
Planted area	-	-
Unplanted		
Unplanted		-

Unplanted area(ha) on mineral soil. Includes infrastructure & buildings

3) Fill in the "planted area" table. Please note that all fields **including 100% mineral fields** to be included. This is to ensure consistency with estates' area statement.

Field ID / Name	Planting year	Area (Ha)			Average Peat depth, cm (if any)	Peat Type (fibri, hemic, sapric)
		Total Field				
		Mineral	Peat	Total		

Name/ID of field

Planting year of field (eg 1997 etc)

Planted area(ha)of mineral & peat soil

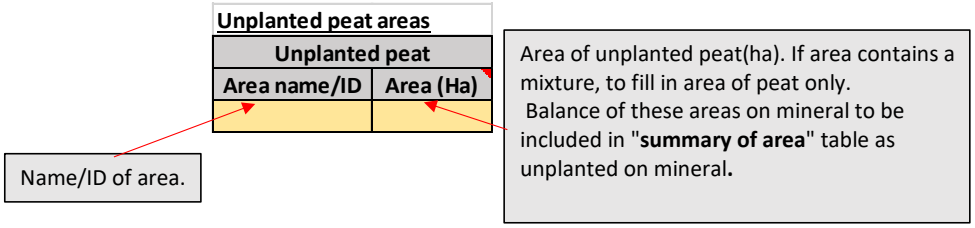
To be filled only for fields with peat. If not, leave empty

4) Please note the following:

i) Avg. peat depth: *to be decided whether indicative or actual based on audit checklist

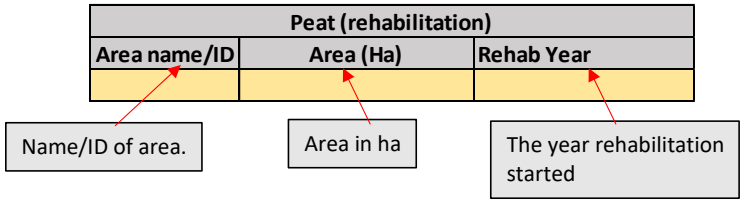
ii) Peat type: Indicative as per available maps

5) Fill in unplanted peat areas. This **includes areas within HCV,HCS & Conservation areas**. To fill the area(ha) containing peat only.



6) NOTE: For unplanted areas with infrastructure and/or buildings to include as area(ha) as one area with ID "I**nfrastructure & buildings**".

7) Fill in rehabilitation table (if any). This table is specifically for peat areas previously planted with OP which have been rehabilitated as per ***Insert full BMP (rehab) guideline, year*.**



Company summary

1) Fill in Company name, RSPO membership number and year of reporting

Company Name :						Year:	
Membership Number:							

2) Copy the values in "**Summary of area 2(ha)**" table in each respective estate inventory. Paste values in Company summary table (refer pic below).

In estate inventory (figures are for example only)

Summary of Area 2 (Ha)				
Total Estate Area		Planted Peat	Unplanted Peat (exc. Rehab areas)	Peat (Rehab)
Planted	Unplanted			
100.00	66.00	68.00	16.00	36.00

Copy

3) Paste the copied cells "as values".

In Company summary tab (figures are for example only)

Estate Name	Country	Area (Ha)				
		Total Estate Area		Planted Peat	Unplanted Peat (exc. Rehab areas)	Peat (Rehab)
		Planted	Unplanted			
Estate A	Malaysia	100	66	68	16	36

Fill in name & country

Paste "as values"

4) Fill in respective estate name & country.
5) Repeat for all estates within the company in the consecutive rows.

Reporting requirements

1) Reporting of the estate inventory is to be done and compiled companywide on an **annual basis** and the "Company Summary" report is to be reported through **ACOP.**

2) The "estate inventory" must be available on-site for each respective estate for audit purposes.

B. Company Summary

Company Name:
Membership Number:

Year:

Summary of estates containing peat (Ha)		
Total Area	**Planted**	**Unplanted**
Concession area	100	66
Peat areas	68	16
Peat (Rehabilitation)		36

Estate Name	Country	Area (Ha)				
		Total Estate Area		Planted Peat	Unplanted Peat (exc. Rehab areas)	Peat (Rehab)
		Planted	Unplanted			
Estate A	Malaysia	100	66	68	16	36

C. Estate Inventory

Estate/Plantation Name:		**Year:**	
Region:			

Summary of area 1 (Ha)		
Total Area	**Mineral**	**Peat**
Planted area	-	-
Unplanted		
Unplanted	50.00	-

Summary of Area 2 (Ha)				
Total Estate Area		**Planted Peat**	**Unplanted Peat (exc. Rehab areas)**	**Peat (Rehab)**
Planted	**Unplanted**			
-	50.00	-	-	-

Planted area

Field ID / Name	Planting year	Area (Ha)			Average Peat depth (m) (if any)	Peat Type (fibric, hemic, sapric) (if avail)
		Total Field				
		Mineral	Peat	Total		

Unplanted peat areas

Unplanted peat (inc. HCV,HCS,CSA)	
Area name/ID	**Area (Ha)**

Rehabilitation areas

Peat (rehabilitation)		
Area name/ID	**Area (Ha)**	**Rehab Year**

Annex 7: Update on peat mapping

Peat Mapping Update

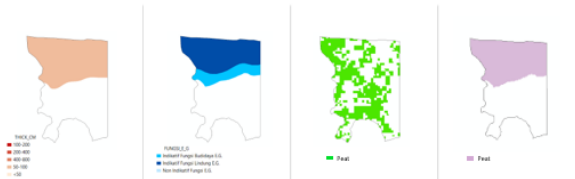
Peat Data Comparison

Sept 10, 2018

1

Cargill Incorporated

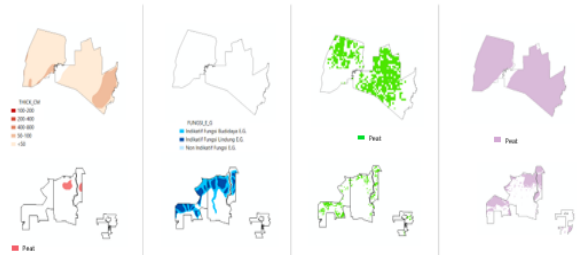
PT Hindoli - Mukut



Gunarso et al (2013)	Badan Restorasi Gambut	Gumbricht et al (2017)	Wetlands International
3,578 ha	3,395 ha	3,173 ha	3,456 ha

2

PT Agrowiratama



Gunarso et al (2013)	Badan Restorasi Gambut	Gumbricht et al (2017)	Wetlands International
8,509 ha	7,215 ha	5,249 ha	13,476 ha

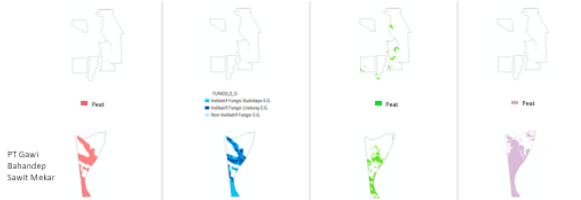
3

M.P. Evans

Gunarso et al (2013)	Badan Restorasi Gambut	Gumbricht et al (2017)	Wetlands International
5,501 ha	0 ha	5,403 ha	13,294 ha

4

PT Triputra Agro Persada



Gunarso et al (2013)	Badan Restorasi Gambut	Gumbricht et al (2017)	Wetlands International
8,642 ha	8,642 ha	3,991 ha	12,957 ha

5

Initial Findings Summary (Peat Area)

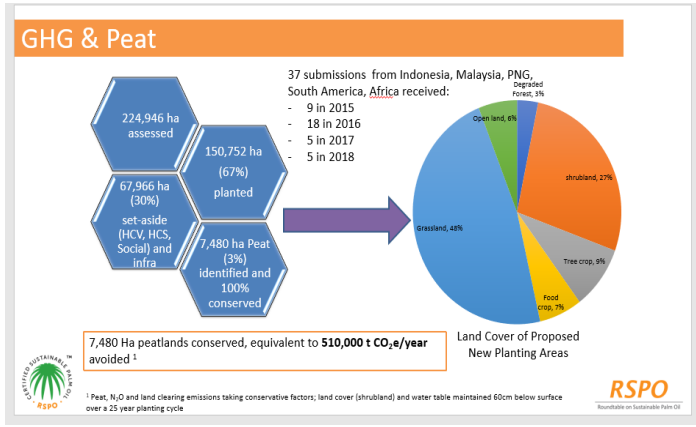
Area	Peat Area (Ha); Difference (%)			
	WI (reference map)	Gunarso	BRG	Gumbricht
PT Hindoli-Mukut	3,456	3,578 (+4%)	3,395 (-2%)	3,173 (-8%)
PT Agrowiratama	13,476	8,509 (-37%)	7,215 (-46%)	5,249 (-61%)
MP Evans	13,294	5,507 (-59%)	0	5,403 (-59%)
PT TAP	12,957	8,642 (-33%)	8,642 (-33%)	3,991 (-69%)

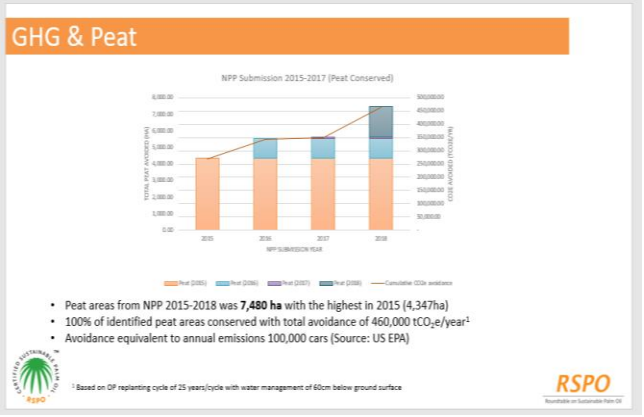
6

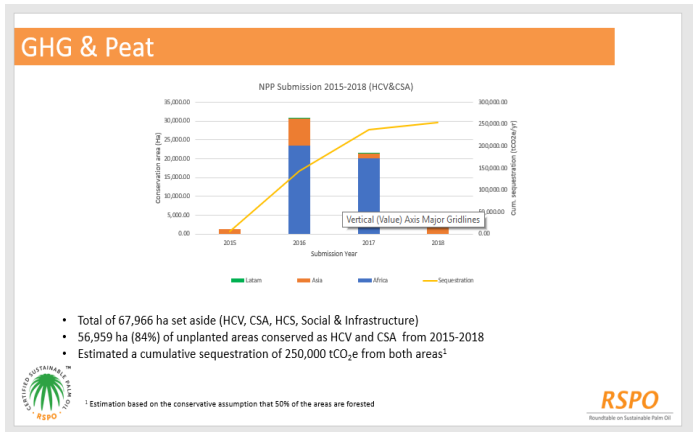
Methodology Comparison

Gunarso et al (2013)	Badan Restorasi Gambut	Gumbricht et al (2017)	Wetlands International
The spatial distribution and extent of peat soils was obtained from Wetlands International for Indonesia (Wahyunto & Suryadiputra, 2008) and from a Harmonised World Soil Map for Malaysia (FAO, 2009), which were used to guide the delineation of swamp forest and other wetland habitats. Nonetheless, the identification and delineation of swamp forest, swamp shrub and swamp grassland were based on multiple criteria, which included the spectral and spatial attributes of the satellite images, as well as the landscape context of the area being evaluated. Although there is considerable overlap, swamp categories were not entirely nested within the peat polygon. Consequently, data summaries for the four swamp vegetation classes (undisturbed swamp forest, disturbed swamp forest, swamp shrub land and swamp grassland) include both mineral and peat soils; however, data summaries for peat soils were constrained by the Wetlands International peat soil map polygons.	BRG maps have priority classes consist of 4 sources data as parameters: burned area, peat ecosystem function (protection and cultivation), canal area and land cover. Based on BBSDLP (Kementrian Pertanian) data (which BRG used) peat should have depth more than >50 cm, so if there is peat with depth <50 cm, it is not classified as peat.	The peat data was mapped in 231 meters spatial resolution by combining a hydrological model and annual time series of satellite-derived estimates of soil moisture to represent water flow and surface wetness that are then combined with geomorphological data. Peat is here defined as any soil having at least 30cm of decomposed or semi-decomposed organic material with at least 50% of organic matter. This corresponds to 29% of carbon content using 1.72 as the transformation factor. The peatland map is produced by adding the peat forming wetlands: mangrove (20), swamp/bog (30), fen (40), riverine (50), and floodswamps (60) (note: the number in parentheses refer to pixel code of each class in Wetlands dataset).	

Annex 8: Updates from NPP monitoring







Annnex 9:ToR for RSPO Smallholder Best Management Practise manual for existing oil palm cultivation on peat.

Terms of Reference

RSPO Smallholders (SH) Best Management Practise (BMP) Manual for Existing Oil Palm (OP) Cultivation on Peat

1. Background

The 2nd Peatland Working Group (PLWG-2) was established in 2017 to address the current issues and concerns pertaining to OP cultivation on peatlands and update two BMP manuals (existing OP cultivation on peat and management & rehabilitation of natural vegetation associated with OP palm cultivation on peat) previously published by the 1st PLWG.

In support to RSPO's Theory of Change (ToC) towards increase in smallholder participation and development of training modules for smallholders (SH) with regards to OP plantations on peat, during the 2nd PLWG-2 meeting, it was decided to expanded the development of a BMP guidance manual specifically for smallholders. It was also decided that a consultant with extensive experience working with smallholders was to be engaged, with oversight and input from the PLWG2 to ensure applicability of the manual.

2. Scope of work

a. Study BMPs for OP cultivation on peat which are applicable and implementable by SH taking into consideration their technical and financial limitations.

b. To develop SH BMP manual, in line with the SH Standard and revised RSPO BMP manuals (existing OP cultivation on peat and management & rehabilitation of natural vegetation associated with OP cultivation on peat) which includes, but not limited to simplified pictorial guidance, flow chart, step-by-step procedure, case studies and documentation templates.

c. To develop guidance on the alternative use of peatlands with lower environmental and social impacts, such as paludiculture.

d. To develop simplified content according to the curriculum of Smallholder Academy training modules and support matters regarding SH BMP manual.

e. To support in capacity building (if any) for better understanding of smallholder on these BMPs.

3. Expected Outputs

a. Smallholders BMP guidance manual for existing OP cultivation on peat, alternative use and rehabilitation.
b. Complete content for SH Academy module based on the SH BMP guidance manual developed.

4. Timeline

Expected output *a* and *b* to be completed 6 months upon commencement of contract.