Notes on the GWF Inception Meeting

Balsillie School of International Affairs
Waterloo, ON
January 21–23, 2018

Chris DeBeer

The purpose of this inception meeting was to review progress in the inception of projects and core teams, and discuss programme needs and plans for the future. As this is also the first meeting of the GWF operations committee, it will be an opportunity to review the operational status, reporting, and plans across GWF. The meeting was attended by GWF project PIs, managers, SMC and Oversight Committee members, GWF secretariat, faculty leads of GWF core teams, and core KM, data, and communications personnel of our programme.

21 January – GWF Reporting Information and Discussion Session

Ahead of the Inception Meeting, a group of GWF project managers, secretariat, and some PIs from the projects met to discuss logistics and reporting requirements. An overview presentation with information and deadlines was given, and a Q&A session followed. This included general information on project requirements and provided an opportunity to discuss communication, project integration, and effective management strategies for the projects and the programme as a whole.

Some outcomes/actions were:

- There is a need to improve the communication lines and information flow among the secretariat, projects, and core teams. A listserv email address for project managers was suggested.
- There was a recommendation to set up a file sharing drive, online portal or hub for PIs, core team leads, and support staff to access common versions of files and to share information and files.

22 January – Presentations from GWF Projects and Core Teams, and Discussion

The first day of the meeting included short overview presentations from all of the GWF projects, with time for questions and further discussion time at the end of each session. Later in the afternoon, there were longer presentations from the various GWF core teams, with time for questions and discussion. These helped to set the stage for the café discussions the next day, where specific issues were delved into more deeply.

The presentations addressed the following points:

a) What does the project address? (an overview of what the project is doing, science questions, societal questions)
b) Progress to date and how are things going
c) Foreseen collaborations with other projects and potential groupings
d) Core needs and contributions to the core
e) Reporting on key users and KM plan

Discussion After Pillar 3 Projects – What are the Gaps, What is Missing?

- Geographically, we have projects focused on different ecoregions, but how to do we deal with the interfaces between them, as ecoregions and their boundaries shift? Where will these zones be in the future? There are boarder questions such as these to resolve for the modellers to run models in the future. We may need some broad, cross-project activity to look at these shifts.
- The area of evolving landscapes is a critical issue. We are only able to do this now by using expert opinion and formulating snapshots, as our models are unable to handle/reproduce the dynamics. There is a need for a more holistic approach within our modelling framework to introduce these changes.
- There is a need for a more holistic approach to biogeochemistry across landscapes; it is an issue that comes across strongly in one or two projects, but does not in most others. As we move to more continuous monitoring of water quality, there is much work to be done to integrate the water quantity and quality to get more insights. This could be a thematic challenge.
- We should look at identifying opportunities that come with climate and environmental change. Much of the conversations focuses on mitigation, but there may be economic opportunities (e.g. possible links and solutions such as between forestry and wildfire). This is probably implicit in most projects but we should be sure to articulate these going forward, given the strong KM theme that runs through GWF.
- Another way to integrate research across projects would be to see how they identify, assess, and project changes in ecosystem services and functions, including drivers and impacts. A working group could be formed on this topic.
- Issues and conflicts associated with climate change across borders and transboundary aspects are an important area of focus. There is an international component of GWF that is still under development, but in terms of global conflicts there are aspects of governance that will come into play. GWF may be able to provide support to Global Affairs Canada in pursuing a *Water, Peace, and Security* agenda, and there will be expertise, and examples and solutions from the Canadian context we can draw on. Most of our basins are transboundary with the US, and part of the impetus for the IMPC project is to provide the tools to address these issues.
- Urban issues such as development and growth provide an opportunity for cross-cutting. This is being dealt with in some projects, but given the importance of this to some of the watersheds, this needs to be kept in mind and possibly reassessed down the line.
- We should map the Indigenous communities geographically across Canada to highlight the links with the various projects, not just as user groups but as contributors who have access to information and knowledge of the land and water. They can help guide the story of change. This can also help them search the information of relevance to them more readily. Members of these communities are an underutilized resource and may be help to provide further insights and observations. They are willing to partner with GWF.
- There may be a lack of awareness across many of the projects as to how their work fits within general governance (i.e. decision making). It is more than how the science gets used by decision makers and policy makers. It also involves the structures around how decisions are made and how the work fits in. Most of the ongoing and envisioned collaborations that were highlighted in the presentations were towards the science side, but there could be more towards the governance side. This also relates with the Indigenous aspects; a number of projects are working with First nations and they care greatly about the governance side and are routinely excluded from decision making. Better collaboration on the governance side might be a way to not overload the Indigenous partners of GWF.
- Such issues of governance are issues for the KM team to address strategically; for example, how do you frame decision tools to address governance challenges? How do you target appropriate

people and address their questions? This is at the heart of KM and is a role for the team to take on. We are not addressing this in any significant way generically in any of the projects.

Further Discussion after Pillar 1&2 Projects on Gaps:

- There is a need and opportunity for collaboration amongst projects developing decision support system and apps with the core computer science team. There is a need for integration of the systems. Apps need to be designed and tailored to the appropriate users. There does not seem to be a lot of activity here yet and should be addressed.

Discussion Points Following Core Modelling:

- There is a need to consider how we handle policy runs—experimental design, what driving models, how large are the ensembles, how will they be downscaled, requirements and protocols for preprocessing, etc. It was argued that a 15 year single realization WRF run is not sufficient for running hydrological models for policy runs, and something much more robust is necessary.
- Related to this, we need to consider the time lines (e.g. will policy runs be CMIP-5 driven, CMIP-6 driven?). What time lag will we allow between the availability of driving global climate change simulations and the resulting hydrological policy runs. The suggestion is to allow at least 3 years for clean-up and completion of CMIP-6. There are other issues of consideration such as the performance of the climate models in the mountain regions and the need to post-process and bias correct.
- This will be a big effort and needs to be tackled as a community. There will be a need to follow up at the June meeting in Hamilton.
- We need a strategy for the best way to train students (e.g. for CRHM) and perhaps develop a manual. We have not pushed this before but we should, and put resources into this. We should encourage people to put info up on a wiki page and to make info available to others.

Discussion Points Following Core KM:

- A point was made about the need to ensure that users don't get saturated with requests for consultation. The KM team can play a role in communicating with the SMC about how particular people and projects are engaging with particular groups. The team provides advice and support as to what is taking place and evaluating how successful it is.
- There is a need to compile lists of end users and cross-reference with the projects, and for the KM team to help streamline efforts.

There were no emergent points or issues to follow at the programme level from the other core team presentations.

<u>23 January – Café Topics and Rapporteur Reports</u>

On the second day of the workshop, a number of breakaway discussions took place in café style to address specific priority topics in GWF. These discussions focused on: 1) what is occurring on the topic? 2) What should be occurring and what are we planning? 3) What gaps are there to fill? 4) What is the nature of engagement with users and stakeholders?

1. Modelling and Computations

- Discussion Lead: Al Pietroniro
- Rapporteur: Saman Razavi

Rapporteur Report

The discussions started around the question of what should be occurring from both Core Modelling perspective and Projects perspective. And what are the gaps?

Policy Runs (Francis):

- The notion of policy runs should be defined clearly. What we plan to deliver on that? Timelines? What suite of models need to be considered?
- We need plausible future scenarios of change in climate, landcover/landuse, management and operation.
- Driving data for hydrological models? Statistically downscaled CMIP5 simulations or WRF runs? WRF runs only good for processes not as a scenario??? CMIP5 or CMIP6?

Consistency and Reproducibility of Research:

Need for Protocol?

- Develop courses/workshop for training HQP on how to use models and on what data.

Model Version Control (Bryan):

- There has been a lot of attention to do, but still work to do.
- Not easy to have researchers redo the runs with a newer version of a model

Data Inventories (Altaf)

- This may also need to include initialization data
- Need for protocol: courses for training HQP.

Indigenous and Treaty Lens (Merrel-Ann)

- Need for a new governance structure based on the treaties. Traditionally, we look at provincial boundaries and/or watershed boundaries for governance, but we might thinking having a treaty layer added to this and look at the issues relevant at the treaty level.
- Need to figure out what modelling variables in time and space are of importance to different governance units, for example what are treaty 8-wide relevant information?
- Another partnership level is needed at the treaty level (different from the reserves??)? Reserved-based approach is not adequate; Treaty-based approach is better.
- Treaty boundaries have a better harmony with watershed boundaries than provincial boundaries.
- Some in six nations in Ontario have dual citizenship in Canada and USA. Treaties don't align with western boundaries. Al: this is something to for SMC to consider.
- Need for lectures/workshops for researchers to learn more on how treaties work. We model to support decision making and we need to provide decision-relevant information.

Model Integration and Feedback

- We need to move beyond linearly running the models in sequence (from climate to hydrology, etc.). Climate is both a driver and a response (Lawrence).
- Impacts when famers change their cropping patterns (Chris).

Scaling Issues

- There are issues to address in hydrologic modelling, but not in a bad shape currently.
- Significant issues when it comes to hydro-geochemistry. It still needs a lot of work. Routing is very important hydro-geochemistry (Nandita)

Dynamics of vegetation

- Need to see that more explicitly in our modelling. CTEM is being used in Altaf's project.
- We have got some scenarios of land cover for certain points in time in future, but we don't have a mechanism to move from point A to point B with our current generation of models with statistic vegetation.

Environmental Flows:

- Environmental flows= critical flow for maintaining ecosystems services.
- Cultural flows (Lalita) – minimum flows needed for the livelihood of the communities
- Ecological flows – minimum flows for the ecosystem and fish

MyLake Model from WLU (1D small-lake model) and Gaps (Jason):

- Accessibility to powerful computing resources at WLU. The model is in MATLAB.
- Difficulty/impossibility to scale up and use on many lakes. One reason, lack of data.

Issues with Chemical Fate Models (Paul)

- The link between chemical fate models and hydrological models needs more work.
- GAP: Fate of chemicals from the atmospheres down to water bodies
- GAP: There has not been be a national chemical modelling strategy, unlike atmospheric and hydrologic modelling. That a kind of progression needing to happen.

Further Notes:

- Co-creation of knowledge with end-users can be exemplified by having Al P. here . (Kara)
- Al: Decisions are often political, and technical influence in limited.
- The contribution of the sensor group (Ravi) for water quality data can be very instrumental.
- Fragmentation of water quality data at the national level. Data collection and release by the provincial government takes a lot of time. Nandita is collecting a lot of data from conservation authorities and trying to have the unified. Models could be used for interpolation and gap filling.

What emerged here is that there is a great deal of work required to develop protocols for pan-Canadian modelling.

2. Observations, Sensors, and Remote Sensing

Discussion lead: Dave Rudolph
Rapporteur: Claude Duguay

<u>Rapporteur Report</u>

Observatories

- baseline datasets (can we leverage relationship with NRCAN for dem, land cover, etc. which could benefit the entire program)
- DEM for sites (what is the footprint of the site)
- access to common sites, coordinating field visits
- what is being measures at each site, what is planned for the coming field season?
- setting up easily accessible sites to start, one ag, forest, water quality "testbeds" (eastern and western)
- map of sites

Sensor needs/ deployments

- Doppler radar ($40,000) for falling snow measurements

- toxic algae – DNA or biologic type sensors in the field?
- facilitate sharing drones and sensors between sites
- soil moisture (wet/ moist / dry) C/L band
- Configure acquisitions from CSA (RADARSAT)

Data

- How much, how much storage do we need
- QA/QC (estimation of uncertainty, quality, and
- Format and metadata best practices (following LTER format)
- Field photos and citizen science data – is there an interest in this and who would use this and for what purpose? (eg light snow – volunteer reports / snow stake measurement pictures / agricultural information – drones, field measurements)
- Ownership of data

Integrating historical datasets/ other datasets

- Landsat
- Data from consultants, first nations groups
- Data access and ownership of data

Action Items

- Follow up with NRCAN
- Add to inception report – RS/ other data storage needs?
- Best practices for metadata (CCIN) and
- 'snapshot' year pulling together data at pan Canadian scale from observatories

Further actions and priorities as discussed by the group following the report:

- There was discussion among the group and a suggestion that we should pursue a year of special observations. This must be done within existing funding envelopes.
- We need to more fully engage NRCan (remote sensing, groundwater, glacier, forestry), as they have expressed interest in supporting our ground observations and providing data support.
- In the western sites, there have been protocols and we have worked on them as a community for many years. There is also a need to bring new sites and some of those operating in relative isolation into the fold with those in western Canada (operated under CCRN), it terms of operation standards and to pull info together in a coherent way. This is a matter of priority and may require a workshop (perhaps by WebEx). These sites are hotbeds for outreach, collaboration, training, etc.

3. Environment – Conservation, Ecological Flow Needs, Etc.

Discussion lead: Jennifer Baltzer
Rapporteur: Helen Baulch

<u>Rapporteur Report</u>

Environment – conservation; ecological flow needs ++.

- Discussion focused on:
    - What should be occurring (key opportunities and gaps).
    - How can we apply existing efforts in a pan-Canadian context (project bridging)
    - Tangible, useable outputs for various stakeholders
    - Development of conceptual frameworks to guide modelling scenarios

Cultural flows and ecological flows

- At the nexus of hydrology, ecology and human needs.
- In Canada, policy is underdeveloped, research is less advanced than other countries.
- Opportunities and Gaps:
    - plenary on eflows + cultural flows?
    - Opportunity to connect communities and broker conversations (e.g., Cumberland House, MB, Yukon, + sites in the south….)
    - More eflows work into ongoing program?
    - Large basin modelling may in some cases be too large for operational eflows – where are we working at the right scale? Workshop?
    - Opportunities for tools like decision theaters or discussion groups on decision making.
    - Cultural flows = having enough water in the system for traditional uses – navigation, hunting, fishing.
    - Integrative concept, lined to health and well being.

Temperature Effects

- The most important ecological parameter?
- What are thermal regimes going to be? (map to ecology –)
- What are the hotspots of thermal change – relate to bloom risk, higher trophic levels.
- Management issues –
    - thermal effluents and HAB issues.
    - Dam management for thermal regime.
- Temperature x flow effects.

Changing terrestrial to aquatic linkages.

- We are limited on health work – opportunity -- Mercury, methylation, bioaccumulation and risk.
- Need to develop region specific conceptual frameworks on what changes mean to ecology and water quality, and how they map to model based understanding.

Salinization

- Prairie salinity issues.
- NaCl – deleterious substance – what are the impacts? Potentially huge issue… science is growing, but… lags.

Source waters & effluents

- Changing DOC –
- Changing source waters – what do we know/need to know?
- Interactions between natural and engineered systems.
- Transboundary agreements re: water quality.
- Where are the nutrients coming from? Urban vs. Rural? What do we need to control? N? P? emerging contaminants?
- What are the toxicological impacts of exotic chemicals?
- *Human health and ecological risk assessment* – what do we need to build?

Further discussion after the report:

- An important question to be addressed is “environmental flows under what climate”? We should not aim to conserve a situation that will not exist in 20 years’ time, for example. There needs to be a serious conversation about this.

- We should put a regulatory lens around the water quality side and framing the science issues. There is an outstanding question, for example: what should a reasonable level of nutrient loads be in terms of transboundary waters in the prairies?

4. Agriculture and Forestry – Land Management

Discussion lead: Bruce MacVicar
Rapporteur: Merrin Macrae

Rapporteur Report

What is occurring, what projects address this?

- There are 8 projects directly linked at this time
    - AG: AWF, Lakes, Prairies, Extremes
    - Forestry: BWF, MWF, NWF, SFWF
- There are many synergies across these in the conceptual questions being tackled
- On the Ag side, looking at climate, landscape, management drivers on soil–plant–vegetation–water quality relationships; some process-based work, some modelling work, and at different scales. Mostly field-based, smaller scale.
- In forests it is more regional. Fundamentally looking at changing vegetation, and hydrological feedbacks, some water quality, fire, land use change, some ag. Focused around process, data mining, and data collection.

Opportunities for Synergies

- Transition zones between areas (e.g. ag moving north.
- Impacts on one another (i.e. watershed position)
- Replacing one with another (convert forest to ag, or reforestation in some areas; urban areas)
- Should we manage/model them together (e.g. treaty boundaries)
- Technology and modelling (sensors, land use change, harmonized datasets; include in dynamic models) – integration with big data and modelling proposals

Gaps to fill

- Forestry
    - There are few industrial or management linkages in forestry – they are using it as an adaptation, but no direct links to this sector
    - Not a close or direct link between forest proposals and extremes. Outputs (i.e. drought) from extremes can be used. *there may be a disconnect between what is needed for data and what is provided, so we need to keep in mind and consider how the projects are progressing in terms of phase (timing of deliverables).
    - Links to Indigenous communities. Traditional vs current management strategies
- Ag
    - For Ag, consider regions. do we need to pull in other regions (Okanagan, PEI)
    - Topics: Precision ag, sensors, GHG, livestock, irrigation (capacity? Where does GWF want to position itself?). Also human societal issues (effects of flooding and health)
- Ag–forest–urban continuum and land use change. Vegetation change (shrubbification) between critical zones
- Is climate the only driver? What about others (i.e. tech)?

Stakeholder Engagement

- What are we changing (policy?), who are we trying to reach

- Stakeholders. What info is needed? Some of what we generate may not be useable by specific communities or farmers
- In ag sector, interest in climate. How much moisture stress, what is prob for long term drought in future? Farmers want to know more immediate, shorter times scale. Need to be clear what info and what trying to share with whom.
- Ag and forestry need to develop synergies further to influence policy. Maybe manage together in more holistic manner.
- Provincial vs federal engagement. How to tackle some of this?

Things to plan

- Need for long-term observatories – observatories under GWF could lay the groundwork for some higher profile, long lasting networks. Could help w/ funding, data access, ID spatial gaps.

5. Governance

Discussion lead: Anna Frank
Rapporteur: Howard Wheater

Rapporteur Report

Governance: who decides and how?

- Most GWF projects aim to provide information that will be of use to decision makers, but the number of GWF projects studying who makes decisions, how they are made and the effectiveness of policy instruments is very limited.
- Rob De Loe is addressing the boundaries of decision making, including the international context. 2 projects are addressing decision making around land use management and wetland conservation in the prairies. There are also elements in the Ag and Boreal forest projects.
- There would be benefits in collaboration across these projects – social science components can be isolated in bigger projects, and it would be good to build critical mass.
- One suggestion was to take an issue such as flood plain risk management and study the governance challenges. Another suggestion was to invite international speakers from the Murray Darling and New Zealand to speak on governance to a GWF meeting.

Science to policy connection

- There is a need to understand how science can influence decision making and vice versa. Most projects have not formally considered this.
- Building relationships with policy makers and regulators can help to speed up the uptake of new science and tools.
- It was noted that GWF can play an important informal role as a power broker, for example in bringing indigenous communities to the decision making table. Access to information was seen as empowerment, and hence there was an important role for sensors and monitoring at a community level.
- It was noted that politicians respond to public opinion, so informing communities and the public is an important role for GWF.

Decision support systems

- Many projects aim to develop models as decision support systems, but it is important to develop models in collaboration with potential users, to engage users at the beginning of the process, and to frame models around user questions.

- An example was quoted where government policy makers did not accept the validity and utility of a model for policy making, but through engagement and training with the model, it was enthusiastically embraced. Other users may be prepared to trust the modeler and accept results, but building trust and understanding of model capabilities and limitations is important.
- Policy makers will use a model if it is available and easy to work with, despite limitations. So model complexity and usability should be tailored to the user community.
- There appears to be a danger that models are being developed without adequate end user engagement and consultation. This should not be left to the final stages of a project.

GWF governance

- The task of informing stakeholders and policy needs careful thought within the GWF governance structure.
- Users can be overwhelmed by the multiple projects of potential relevance to their interests, and some coordination across projects and themes is needed. New users may have difficulty in knowing how to engage.
- It would be helpful for GWF management to consider how to enable the science-to-policy interface. Does GWF need a policy and governance committee to address policymakers?
- The KM team was seen as playing a key role in facilitating the translation of science to policy. However, this was an issue that should not be siloed and could not be devolved to the KM team!
- Is it a role for the KM team to understand how science can be focused to inform policy and guide the science community?

Further Discussion after Report

- There are many other end points for the use of science as well. The analogue is the IPCC as an example of a UN based creation to provide independent advice – what is the analogue for GWF in terms of providing impartial advice to support policy?
- It is less clear for water what the IPCC equivalent is. There are various avenues for our work to influence international assessments.
- Popular science writing can be very powerful as well.

6. Urban and Rural Communities

Discussion lead: Kevin Boehmer
Rapporteur: Phillipe van Cappellen

<u>Rapporteur Report</u>

Rural and urban communities – water quality and groundwater

- Water quality & groundwater: recognition of importance by communities, but not necessarily well-defined (issues of perception of risk, values, cultural background)
- Water quality issues: complex and diverse, impacts local to regional
- General focus of GWF: nutrients, eutrophication potential for expanding to other WQ issues
- N-S gradient of stressors:
    - North: climate change driving changes in land/ice cover changes in water quality, DOC, expansion mining, impacts on livelihoods indigenous communities
    - South: (additional) human stressors and pressures (agriculture, urbanization, …)
    - N-S transition: area where GWF can develop stronger profile (agro-ecological changes, forestry-water, water-energy)

Gaps

- Full appreciation of the diversity of WQ issues, impacts, perception, decision-making
- Micropollutants – modeling
- Groundwater and groundwater-surface water interactions in large-scale hydrological modeling
- Urban water quality issues - beyond the urban black box (e.g., stormwater, nitrogen management, snowmelt, green infrastructure, road salt)
- Atmospheric contributions/exchanges

Strengths & Opportunities

- GWF offers ideal platform to validate and implement new WQ sensing technologies
- Many opportunities to closely integrate water quantity and quality (data, modeling, KM, …)
- Alpine-permafrost-large lakes/agriculture-forestry-fisheries
- Guidance for better inter-agency WQ data harmonization
- Development best practices for water quality data acquisition, treatment, visualisation, education
- Role of urban centers in GW and SW contamination (e.g., pilot study on nutrients in stormflow)
- Rural-urban interface
- Water and soil salinization
- Indigenous WQ issues and hybrid knowledge systems
- Delineate priority WQ metrics
- Composite WQ indicators for public information

Further Discussion after Report

- We require an integrated groundwater–surface water modelling effort; we may have the capacity within the core.
- We may look at specific linkages with other national and international programmes that deal with other water quality issues

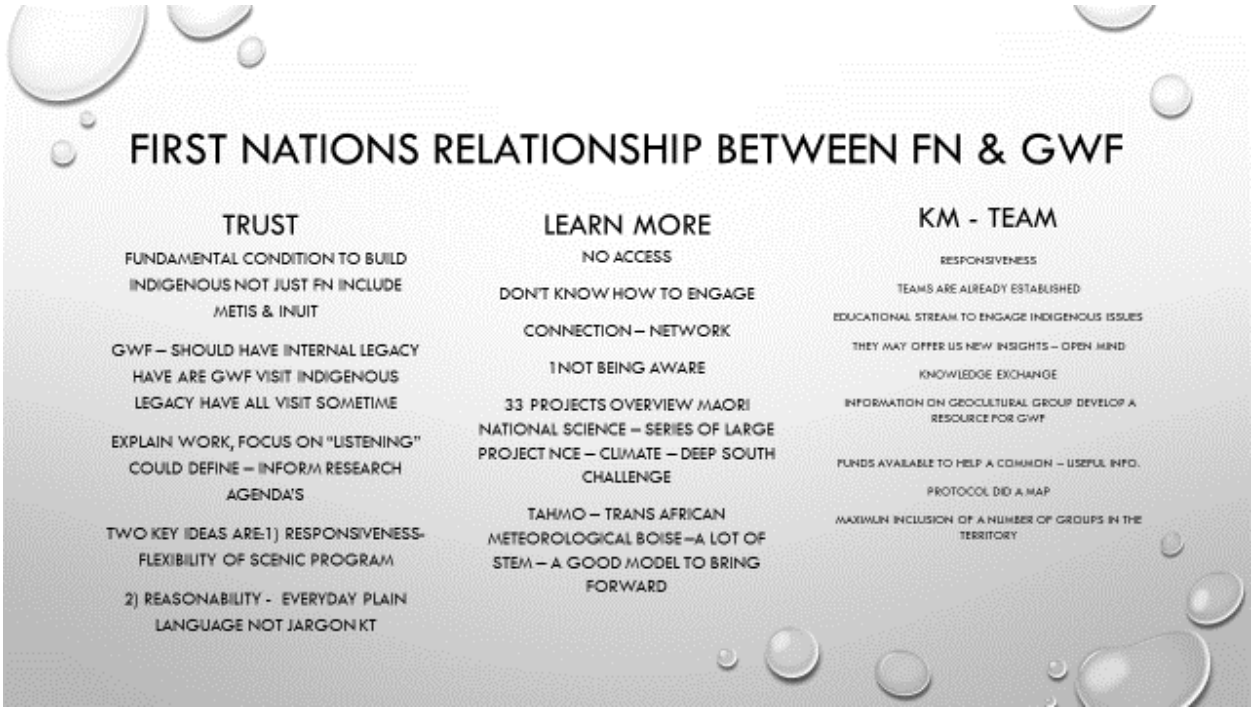
7. First Nations and Indigenous Communities

Discussion lead: Merrell-Anne Phare
Rapporteur: Dawn Martin-Hill

<u>Rapporteur Report</u>

The overarching theme was how to engage with First Nations and what role would GWF play to try to facilitate broader engagement and involvement of Indigenous people.

- There is a need for the GWF community to learn about protocols around engagement with First Nations and to work with the local Indigenous populations.
- There was a suggestion to develop a map or maps as a resource. For each region, a map of Canada might be made showing the geographic cultural regions of the area and the Indigenous communities.



8. Industry – Hydro Power, Insurance, Finance, Etc.

Discussion lead: Julie Thériault
Rapporteur: Ron Stewart

<u>Rapporteur Report</u>

Industry – occurring now

- Electrical utilities
- Insurance
- Oil
- Small forest company/biofuel
- NRC- building codes
- Consulting
- Sensor technology

What should we be doing/planning?

- Oil spills
- Insurance – ice jams
- Water treatment –Future climate/water temperature and quality
- Produce broad use of data products/information knowledge
- Help social license
- Several linkages - work together
- Other partners who wrote letters of support

Identify gaps

- Decommissioning dams in Canada – sediment build up
- Banks: TD, finance side and RBC, small businesses
- PwC
- Corporation environmentally friendly
- Emergency management and risk communication
- Opportunities for $$ (CRD, Engage, …)
- Data archive (ex: used by economic development)

Nature of engagement

- 1 on 1
- Some industries have several GWF linkages
- Worry about burn out
- Different messages?
- Timescale, from short to long term process
- …

Issues

- Mission drift?
- "Academic industry"
- Letters of support – involvement?
- Not overcommit

9. Natural Resources – Mining, Legacy Issues

Discussion lead: Mike Waddington
Rapporteur: Sean Carey

<u>Rapporteur Report</u>

Further Discussion after Report

- There was an idea/suggestion for a session at upcoming science meeting about reclamation and restoration and the ag and forestry sectors.

10. Knowledge Mobilization

Discussion lead: Kara Hearne
Rapporteur: Lawrence Martz

Rapporteur Report

Strengths

- Much KM ongoing and underway (sometimes unrecognized by those involved)
- Strong relationships and networks in many projects
- GWF project teams with substantial KM expertise/experience
- Core team maintains focus on KM

Challenges

- Clarify expectations for KM performance and impact assessment
- Communications across internal teams
- Time and resource requirements (need for PI's to be visible and engaged)
- Evolving user expectations
- Tailoring engagement practices to specific communities/stakeholders
- Getting stuck with the "same old" groups – failure to bring in new interests
- Tech projects and support teams

Opportunities

- Build a trans-disciplinary KM framework
- Identify a network of KM champions
- Develop shareable KM tools
    - White papers for policy makers
    - Maps for communities
    - Engagement protocols
- Bring value to researchers
    - Recognition for work
    - Enhance future funding and partnerships

Moving ahead

- Clarify expectations
    - Core team help develop KM metrics (team direction and reporting)
    - Evaluating impact (collect stories as well as numbers)
- Recognizing past and continuing KM activities
    - Document and talk about this work in KM terms
    - Sustaining "subconscious" KM throughout project
- Internal KM capacity building
    - Identifying KM champion for each team
    - Sharing stories, strategies and tools through workshops

Further Discussion after Report

- There was a point that we may need formal KM training. Workshops for best practice examples, for example. Bring together at least one person from every team to discuss and share what good KM looks like. We need to build capacity across the network.
- KM metrics. Given projects will be evaluated on this, they need advice as to what that would be and will look to the team to advise the SMC as to how that would be evaluated. And then communicate this to the projects. It will certainly be impact-based.
- There is a need for some literature and resources to be made available on best practices. A resources toolkit was proposed. CWN had done something and created a primer for KM; we can build from that. We should re-advertise and make sure everyone knows what the baseline is.

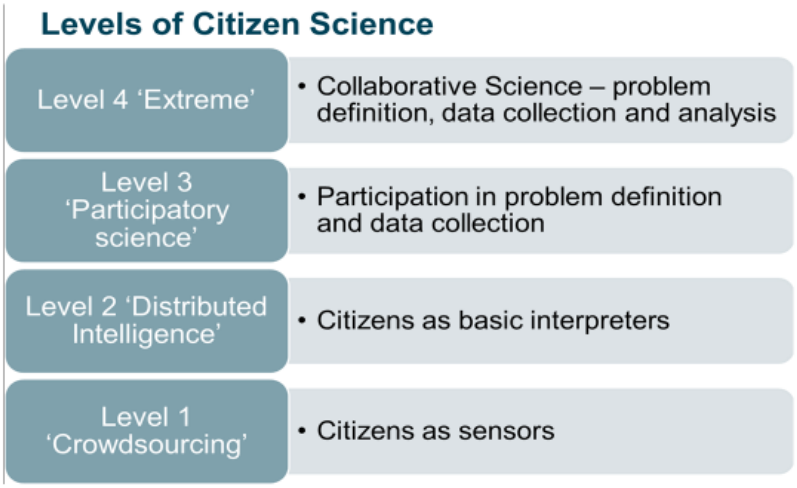
11. Crowdsourcing and Citizen Science

Discussion lead: Stephanie Merrill
Rapporteur: Graham Strickert

<u>Rapporteur Report</u>

Themes

- Different understandings crowd sourcing and citizen science?
- Examples galore
- Opportunities
- Challenges
- How to keep people engaged?
- Purpose
- What we didn't hear
- GWF Program Support



Opportunities

- Indigenous engagement Involving Youth AND Elders in collection – Connections between indigenous knowledge and scientific method
- Visualize various water futures (e.g. augmented reality)
- Real time data sharing vs processed data

- Integration with models
- Ping people on the landscape (to provide a data point)
- Building trust (co-design of tools not just apps)
- Integration with sensors (remote and ground based)
- Plug and play tools (e.g. electrical conductivity for water quality)
- People who support science support science – votes count!
- Decision support systems

Challenges

- Quality of data (confidence gaps – perceived confidences)
- The ability to process images (image processing) good problem
- Safety of citizen scientists
- Privacy
- Ownership, Control, Access and Possession
- Trust (data, science, models, etc)
- Willingness to share
- Multiple formats for data
- No need to re-invent the wheel (.e.g building what's already been done)
- Pros and cons of phones as data sources (geotagged photos are a good start)
- Liability of push/pings and information provided
- Decision support systems

How to keep people engaged??

- Co-design and creation
- Mid course corrections
- Be responsive
- Share results asap
- Use crowd sourcing to fund development (e.g. kick starter)
- Continuous clarity around how inputs are being used

GWF Projects That Include Apps

- Northern Water Futures
- Indigenous Health ABM Proof of Concept
- Global Water Citizenship
- Crowd Sourcing Water Science
- Integrated Modelling Program Canada
- Formbloom
- eDNA (Years 3-7)
- Others

Further Discussion after Report

- There was a suggestion for a page on the GWF website where all citizen science initiatives could be showcased and where we could encourage people to get involved. We will need to be strategic about how to direct people in.

Final Discussion and Closing Remarks

John put up GWF inception meeting statements, which were discussed and agreed upon/modified by the group. Overarching issues and needs were listed.

Following this, international linkages were briefly discussed. The Future Earth Sustainable Water Futures Project is well aligned with our own objectives and there is potential for linkages through various working groups: climate impacts, governance, and others that deal with agriculture, groundwater and others where we have expertise. We will propose some Canadian projects and realize a Canadian node to SWF. We could be a flagship regional programme for them and help them to set their agenda from what we do.

- There is a need to build the links, and a webinar should take place soon to facilitate this.

GWF will apply for status as a GEWEX Regional Hydroclimate Project, following on from CCRN. We will have to come up with an appropriate name for the project within the GEWEX framework. Other international links include the UN International Decade for Action: Water for Sustainable Development, and possibly Global Affairs Canada.

UNESCO has a water-related chairs programme and University of Waterloo has one. This is the only North American representative. There is interest in the Americas from UNESCO for Canada's leadership. The Andes, Great Lakes in Africa, and central Asia are other areas of interest where our unique expertise can contribute.

The meeting closed with remarks from John Thompson, Associate VPR of the University of Waterloo.