Hamlet of Tuktoyaktuk, Town of Inuvik
Government of Northwest Territories

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NOTES FROM MEETING IN TUKTOYAKTUK (SEPTEMBER 20, 2012) FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NWT MEMBERS OF HAMLET COUNCIL, COMMUNITY CORPORATIONS, AND PUBLIC

EIRB FILE NO. 02/10-05

September 20, 2012

The Developers of the proposed Inuvik to Tuktoyaktuk Highway are pleased to provide these notes from the meeting on September 20, 2012 in Tuktoyaktuk (Kitty Hall). The Hamlet Council invited the Developer to share information and answer questions about the Highway to members of the Hamlet Council, Community Corporations and the public.

Welcome

Mayor Gruben:

- Welcome, the reason we are here is because the Council had a number of questions that are better answered by the Department. We invited the Department to come and meet with us.

Opening Remarks

Russell Neudorf, Deputy Minister, Department of Transportation, GNWT

- Thank you for coming out.
- The new ATB (airport terminal building) looks very good and we are still trying to arrange an opening for it.
- We note the strong support we have received from Inuvik and Tuktoyaktuk on this highway project.
- The Mayors, Nellie and Russell Newmark, and others have all been a great support helping with the detailed technical information and for the lobbying for funding.
- Much credit to the communities to convince the governments for funding for the project.
- We have been in Inuvik with EIRB public hearings.
- Those hearings will continue next week on Monday/Tuesday. Please feel free to attend as they are public.
- They are pretty formal meetings, and limited opportunities to interact.
- This meeting today is much more informal and open to ask questions.
- We do need to be completed before noon, so we can catch our planes.
- We in the department are very excited about the project.
- It will be a new challenge for us.
- Constructing a new project over sensitive terrain.
- The team will introduce themselves.
- We will share where we are at in the project overall, engineering and environmental.
- We are talking to the ILA about land.
- We are talking to the feds about funding and final arrangements.
- We are talking to our own government, as our estimate is $250 to $300 million and we are looking for a little more money from our own GNWT.
- Next week I will be talking to our own Standing Committee about the programs in DOT, particularly this project.
- We have a presentation and please interrupt during so we can answer your questions.

Introductions

- Jim Stevens, Director, Inuvik to Tuktoyaktuk Highway, DOT
- Gurdev Jagpal, Superintendent, Inuvik Region, DOT
- Michael Fabijan, Traditional Knowledge Coordinator, Kavik-Stantec
- Robyn McGregor, Senior Transportation Engineer, Kiggiak-EBA
- Rick Hoos, Project Manager, Environmental Assessment, Kiggiak-EBA
- Walter Orr, Senior Civil Engineer, Kavik-Stantec
- Don Hayley, Senior Engineer and specialist in permafrost and geotechnical, Kiggiak-EBA

Presentation, Questions and Discussion

Jim Stevens shares an outline of the presentation as per the slides (see attached) and proceeds with the presentation.

Question/Comment: How was the Upland or Elders Route considered?

- R. McGregor: The Upland Route was considered with equal level of effort including preliminary design and estimate of construction quantities. The Upland Route has a greater number of curves and hills than the preferred alignment. Driving will be more difficult, dust and blowing snow on the curves will be greater and the potential for accidents will be greater.
- W. Orr: The Upland Route would be similar to the Tuk to Source 177 access road, and there will not be any opportunity to pass for that additional 40 km section along the Upland Route.

Question/Comment: Tuk to Source 177 road, not complete, needs gravel, soft spots. We will have a lot of problems, in the winter, summer and fall.

- J. Stevens: When the highway is constructed, the road will be complete.

Question/Comment: Some of the structures are peeling up. The skirting is peeling up.

- W. Orr: The skirting is erosion control and is put in only for construction, and is not intended to stay there when we finish the road, the black fencing material will be removed.

Question/Comment: When they were putting the material in the access road, when was it placed?

- W. Orr: It was placed in the winter, and the gravel, the surface will be placed in the summer.

Question/Comment: Two routes, controversy on the road being too close to Husky Lakes. I don't agree with it. The route closer to Husky Lakes is not a problem. It is 1km back. We don't see people going to Husky Lakes, it is really catch and release. It is still important, but we can manage it. Obviously, you know what you are doing in building roads, and the proper way to do it. There is so much arguing, all this small stuff, I'm worried about losing the funding, we shouldn't fight against each other.

- R. Hoos: Thank you for your comments; we moved the road away from that particular area, and the route that you are looking at, further away from the Husky Lakes.
- R. McGregor: (goes to alignment map on screen and identifies the preferred alignment)

Question/Comment: Biggest error the developer made is in the earlier meetings, they said that they are creating routes, bring them to the community, and go to a vote. The biggest error that the developer made is that they said it would go to a vote. That was an error to say that. The best shot is to go with the most economical route. I was surprised at the time, that there was this comment. In reality, it should have been planned way beyond this at the first. If we spend a lot of time and a lot of grief, it should have been presented as one route.

- R. Hoos: It is true, and when we came the very first time, we had a route that was closer to the lake, and it was suggested to us to look at the Elders or Upland Route. And we said we would do a more complete examination of this route. When we came back a second time to explain the results of the comparison, we explained why. And have continued to develop the preferred route.

Question/Comment: Could you explain and show the preferred route?

- J. Stevens: (goes to the alignment map on the screen and identifies the preferred alignment) That is what we are calling the preferred alignment. That is the next steps, for the terrain, environmental, engineering and other studies.

Question/Comment: For the Tuk highway, for years they have been trying to get money for this. Now they finally have the money for this. I respect other people's opinions on the traditions, but they have to respect our youth opinion, my generation, on getting the road in place. Even my generation, we don't live off the land fully. We have the money, it could very well lead to losing the funding, if we continue to argue about which route we go by. You have gone out of your way to keep it away from Husky lake.

- R. Neudorf: On timing, the community requested different alternatives, and we have looked at it. It didn't delay the project. We are in an environmental review and it has taken a lot of time to get through that. Alignment was something we had to look at it. On funding, the federal government has committed $150 million. We are still working with our own territorial government. Part of the big issue is to refine the cost estimate so we can present that information to the GNWT, to get the funding. It is important to know what the full number is and who is going to share costs, to make the final decisions about funding.

Question/Comment: How much was spent to this stage?

- R. Neudorf: We have spent $6 million to date. Large portion of that is geotechnical work to find the material to build the highway. Engineering and environmental studies as well. This is GNWT funding. Other agencies would also have been spending money, including the EIRB.

Question/Comment: We keep referring to the realignment far from Husky Lakes. And don't forget that the Husky Lakes is the big area. What Inuvialuit was involved in the realignment? There are still some people who use the area a lot.

- R. Hoos: We know that road does come slightly greater than 1 km away from Husky Lakes at the south area of Husky Lakes.
- R. McGregor confirmed that the realignment came from the ILA.

Question/Comment: Control of the future all-weather road when it is completed. There is nothing in place. The majority of the road is on Inuvialuit land, if the ILA doesn't work to control the activities and work with DOT. That concerns me. Where the government works in economics, it might be easier to get the dollars if you take the Upland Route, compared to the realignment. There is nothing wrong the realignment. I would be happy with it, because access to Husky Lakes could be regulated. I have had the opportunity to travel in the south where there is such control, but ILA has to do their part working with DOT. Let's pick this route (the realignment) and go by it, get the numbers together so the road can be built. The road will do greater good to the community than anything else. It is a publically funded road The government has the say as it is public funding.

- J. Stevens: Those comments you raised about access are in my next few slides, so I will move on.
- M. Fabijan: We had TK workshops in Tuk and Inuvik. Two days in each community. The goal was to find out how the land was used now and make recommendations on some of the mitigations. Make sure folks still got to do what they do now. Some recommendations – denning surveys prior to and during construction. Stream crossings, control access, identify what is there so people harvest accordingly. Report is in the communities now, and copies are available. We learned quite a bit from that.

Question/Comment: Many of the people who are sitting here are contractors and businessmen. You're only hearing from a portion of what the community consists of because everyone is working. To me, you should have scheduled in the evening when everyone is not working. Only the self employed can come to a meeting this morning. Reps from the Hamlet, HTC and TCC; those are a given, but I'm hoping that you folks will come back again and have another consultation in the evening. Catching the plane is beside the point. This is a very important topic, and only a few handful of people are here, and they are not being heard.

- J. Stevens: We are committed to coming back here at a more appropriate time. We will schedule an evening meeting for some time after the public hearings. There is much preparation for the public hearings.
- J. Stevens: Access management. We are aware of the concerns and it is very important going forward.

Question/Comment: The access is being used right now. There is a real land owner, beneficiaries, harvesters, we are starting to butt heads with the ILA because they are saying don't do this, and don't do that. But it is our land. You as developers need to leave it to the ILA and members of the community.

- J. Stevens: Access management continued. We have to talk to you and ILA, relative to number of information signs.

Question/Comment: It has been brought up in the council meetings, regards to who the developer is, (DOT, Inuvik, Tuk). What authority does the Hamlet have as a developer? All we have been hearing is that the Hamlet is one of the developers, but what kind of say does the Hamlet have if the road proceeds?

- J. Stevens: The Hamlet part of the development team. J. Stevens asks the Mayor to comment.
- Mayor Gruben: We were one of the proponents to get the project rolling and to get the funding. Once the road is done it will be a DOT highway. We are in it to get the project happening.

Question/Comment: Will the Hamlet have any authority to do anything while it is being developed? With the access road, Hamlet put in $1 million and got nothing out of it. We thought, it would be build the road and the gravel will be in town, but it is we built the road, and now go get the gravel. Do we have any authority to get gravel for the community or something out of this?

- Mayor Gruben: It is the access road to get the gravel, the new cemetery and other.

Question/Comment: What authority will the Hamlet have?

- J. Stevens: Without the support from the Hamlet (and Town), we would not have the funding today. The access road cost over $23.6 million (including royalties), and it was important to our legistlature to show the $1 million contribution to trigger more money from the GNWT. In terms of authority, the DOT has no involvement on the gravel taken from 177 into the Hamlet. As we go forward we are always talking with council to give updates on the project, concerns about activities during construction. In terms of authority, you are a full and equal partner in this project being a resident of Tuk.

Question/Comment: Interesting on the numbers for the access road. The road was built for a purpose, but the purpose has not been met. We're talking about the highway now but the access road isn't even finished. There is only a handful of people (the contractor) who has benefited from it. We can't even do any road work on it, minimum at most. Now it is tagging on to the all-weather road, and we have to spend more money on the access road. I don't know what were talking about for figures for the all-weather road. You're spending more and more money. Someone has to explain these things a little bit better.

Question/Comment: When they were doing the access road – it must have been done working 24 hours, hiring staff that doesn't have proper licence, and Hamlet stepped in and straightened it out. I think they were running short of gravel and had to get some from Inuvik, trucked in on the ice road to finish the access road. There is a lot of things you have to think about. Not just the road, but money involved behind every deal.

Question/Comment: At council, gravel issues always come up, the need for it. I have a concern about the cost. When the access road was being discussed, it was $16 plus million to build the road, and now you tell us $23.6 million. I have a concerned with the cost of negotiated contracts. If all of the roads that go ahead it has to be a public tender at least within the Inuvik Region. You get a better dollar amount for the road. Two or three contractors working on the road, instead of one big one.

- J. Stevens: Appreciate the comments. There has been no procurement process determined, cabinet is thinking about the same thing.

Question/Comment: A lot of this has to do with the way the access road was handled. Miscommunication. We have to wait for the all-weather highway to get the gravel to do the grave yard, the dump and the sewage lagoon, because we can't use the access road right now. What does the Hamlet have to do with this road, and how can we access the gravel for the Hamlet use?

- J. Stevens: If this Highway is approved, and funding in place, it is our intention to establish an office here and support the Hamlet, and our communications will improve.

Question/Comment: That will be the biggest difference, the community will know where to go to get the information and negotiate. The highway will be much bigger, so access to DOT will be great.

- Mayor Gruben: The SAO and the deputy mayor will be kept in the loop.

Question/Comment: Access road, Hamlet's responsibility to maintain, when they have a gravel haul. The community has not been told the quantity or quality of gravel that is left there.

- R. McGregor: Investigative work will be done on Source 177 to confirm the quantity and quality of the material.

Question/Comment: During the time they were doing the access road. Contractor hauling gravel, were going by load pay, not hourly pay, the more loads you get, the more money you get. That is a risky deal. It is unfair.

Question/Comment: R. Newmark comments - All the employees got paid by the hour. The subcontractors companies got paid by the load.

Question/Comment: How many people are here from the Hamlet working with you. You all have big education and good jobs. I wonder if someone local or from the community is in your group from the Inuvialuit region.

- J. Stevens: We are the developer team that is completing the planning, engineering and environmental work for the project. As the developer team goes forward, we will be working with the TIWG, WMAC, IGC, HTCs, FJMC, a lot of planning is required with those groups.

Question/Comment: That's good, if you could get them on your team.

- J. Stevens: Harvest Management – We are starting discussions with WMAC and FJMC on how we can work together. This is an important issue.
- R. Hoos: Environmental Considerations
    - A lot of studies done in the past. When we first started preparing the environmental assessment. We had help for the initial assessment and some of the environmental work that has continued to be done (the birds, wildlife, etc.) all of that information has been used to help with the mitigation, and the design of the highway and stream crossings.
    - The slide summarizes, some of the main things that have been done and what we will do.
    - Among other things, the developer's responsibility is the environmental management plan that is made up of 10 or more plans that need to be prepared (waste

management plan, sedimentation and erosion control plan, wildlife management plan, etc.)

- Contractors will be required to follow the overall plans, but they will have their own plans, for camps, and equipment, dealing with spills, etc.

- W. Orr: Stream Crossings
  - I'm a civil engineer, I'm leading the team of engineers and scientists working on the stream crossings.
  - 62 places that are crossings, most are small (1 – 3 m across and in many cases only flow right after the melt)
  - 10 of the crossings are big enough for permanent bridges; Zed Creek, Hans Creek and other places. They all have significant water flow at all times of the year.
  - Another 30 crossings in between. Some will have short bridges, some will have larger culverts.
  - All crossings will be designed for fish, even if we are not sure there is fish there.
  - We are finalizing the details on the bridges and the culverts to move ahead.

Question/Comment: As you are putting in details on this, it would be nice if you could put it on the map. We have a line of where the road is going to be, where is the creek that you are putting the crossing on? Some of us could say that this is a better route.

- W. Orr:
  - I have been in the field looking at this route three separate times. Looking at stream crossings is big part of evaluating those locations. There are times that we will put a crossing at a location that is good for the road, and it makes the crossing bigger. We're trying to choose the best of the two.
  - Hans Creek is the most unique crossing. It is wide and flat and will require the largest bridge. At least 30 m, maybe 50 m. It will be the largest crossing.
- J. Stevens: Summary of lessons learned:
  - We have learned from Source 177 access road. Winter construction is preferable. The entire route will have the geotextile. Fill only – in permafrost areas, you don't cut into the surface. You only put gravel on top. We have to maximum local and regional benefits. This is our primary objective – maximizing local employment.
  - We are coming back, the map with crossings is a good idea. Not at the public hearings on Monday/Tuesday, but when we return in October.

Question/Comment: I heard that the project will be completed in five years. It would be nice if it could be comleted in two or three seasons instead. Gurdev, I know the access road is not officially open. People have been using it, it would be nice of DOT could put a grader on it.

- G. Jagpal: We just completed blading and we will keep it in good shape.

Question/Comment: Bridges and Source 177. Where and how many bridges were supposed to be on that road? I heard that there was one location.

- W. Orr: At Crossing 6, initially there was a short bridge but, there is only one lane and you have to have a very flat road coming up to that, so traffic coming in different directions has an opportunity to stop or there might be a serious accident. The road coming up to the crossing is quite steep, and we would have had to raise it in the air.

Closure

Russell Neudorf thanks everyone for their questions and comments.

Attachments:

- September 20, 2012 Slide Presentation
- Sign In Sheet

Metric Graph Pads

INUVIK - TUKTOYAKTUK HIGHWAY

PUBLIC MEETING

SEPT 20, 2012

ATTENDING

(1) JIM STEVENS DOT
(2) ROBYN MCGREGOR EBA
(3) DON HAYLEY EBA
(4) WALTER ORR KAJIK-STANTEC
(5) MICHAEL FABIUTM " "
(6) GURDEV JAGPAL DOT
(7) RICK HOOS EBA
(8) Doug Saunders EGT
(9) Jim Elias T.H.T.C.
(10) SHAWNA WILSON ILA
(11) PATRICE STUART ILA
(12) Frank Umoak TUK
(13) PETER LOUIE - J&L TRANSPORT
(14) Peter Gruben J&L Trans
(15) ERNEST TAYLOR POKIAK JMG-GOLDER CORP

SPENCER MANGELANA (16)

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Project Number: ____ Page: ____ of ____

Date: MM/DD/YYYY By: ____ Checked: ____

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A TETRA TECH COMPANY

Billy Emaghok	Hamlet
Darrel Nasogaluak	Tuk Hunters + Trappers Chair
Erwin Elias	Hamlet of Tuk Council
JAMES PIKIAK	CONCERNED CITIZEN
Tina Steen	"
Donna Bernhardt	c/a to MLA Jackie Jacobson
Russell Newman	EGT
E. Pertschy	Tuktoyaktuk
Marjorie Ovayuak	Tuk.
John Mackintosh	ILA
Catherine Kalagakopuk	
Roy Cockney	Elder Tuk
Stan Felix	TUK
BENNET FELIX	TUK
MERVIN GRUBEN	TUK

INUVIK TUKTOYAKTUK HIGHWAY
STRENGTHENING OUR CONNECTIONS

Northwest Territories · Town of Inuvik

Inuvik to Tuktoyaktuk Highway

September 2012

INUVIK TUKTOYAKTUK HIGHWAY
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Northwest Territories · Town of Inuvik

Presentation Overview

- Purpose/ Benefits of Constructing the Highway
- Alignment
- Socio-economic Considerations
- Access Management
- Harvest Management
- Environmental Considerations
- Primary Protection and Management Measures
- Stream Crossings
- Lessons Learned: Tuktoyaktuk to Source 177 Access Road

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Purpose/ Benefits of Constructing the Highway

- Provides year-round overland access to Tuktoyaktuk and the Arctic Sea
- Decreases the cost of living in Tuk by enabling goods to be shipped year-round
- Provides Tuk residents with cheaper, easier and safer access to regional services including:
  - Health care
  - Educational opportunities
  - Recreational opportunities

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Purpose/Benefits of Constructing the Highway

- Enhances opportunities for family, social and sporting interactions by providing year-round access between communities
- Promotes the tourism and hospitality industry in Inuvik and Tuktoyaktuk

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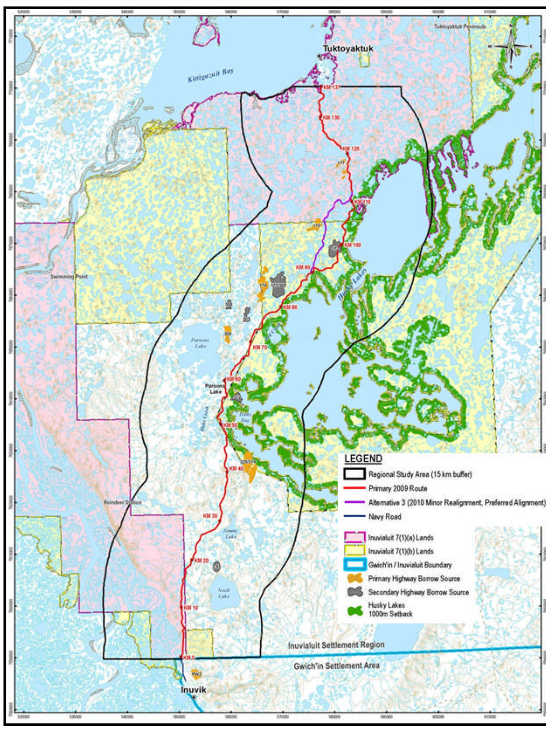
Purpose/Benefits of Constructing the Highway

- Strengthens Inuvik's role as the regional commercial hub
- Provides more opportunities for business expansion
- Reduces costs of onshore oil, gas and mineral exploration and development and encourages new activities
- Supports national security and northern sovereignty objectives



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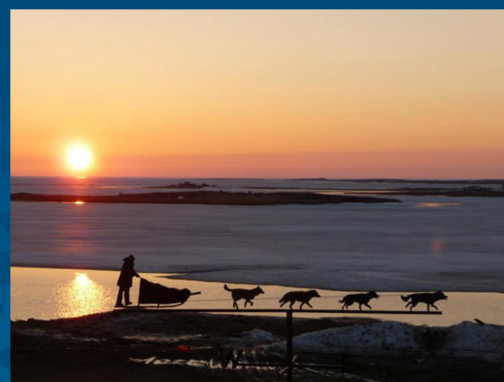
Alignment:

- Primary 2009 Route
- Alt. 3 – 2010 Minor Realignment

Socio-Economic Considerations

Several socio-economic aspects were considered:

- Culture
- Economy
- Housing
- Education
- Heritage resources
- Harvesting, and
- Land use



Access Management

- Increased access to the Husky Lakes and the area between Inuvik and Tuktoyaktuk was identified as a primary concern during consultation and the regulatory process
- Currently, access to these areas is primarily during winter months, using snow machines, or by air during summer months
- The ILA is responsible for administering and managing access to Inuvialuit lands
- The AANDC is responsible for administering and managing access to federal Crown lands in the ISR

Access Management

- The Developer encourages the responsible parties to work together to manage this issue
- During construction, the contractor(s) will ensure that construction vehicles stay on access roads and construction sites at all times
- During operations, the Developer will install signage advising Highway users to stay on the Highway

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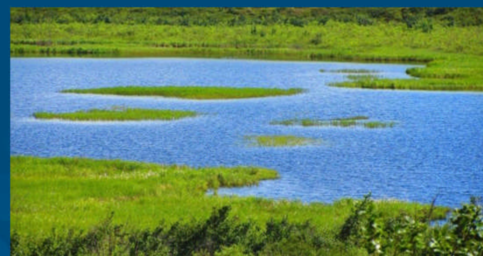
Harvest Management

- Additional harvest management planning may be necessary as a result of the Highway's development
- The potential for overharvesting was recognized and discussed during the 2009 and 2010 public consultations, and the responsible parties were identified at that time
- The role of resource and co-management agencies, and other parties is identified in the IFA and has been acknowledged throughout the EIRB review process

Environmental Considerations

The Highway alignment is located in an area with wildlife, bird and fish habitat considerations.

Baseline studies have been conducted to identify wildlife/birds/fish and their habitat along the proposed alignment.



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Primary Protection and Management Measures

- Avoidance and minimizing loss of habitat
- Primarily winter construction to minimize direct effects to birds
- No plans for pioneering construction work during summer
- Pre-construction surveys (e.g., den surveys) to avoid disturbance or mitigate potential effects
- Conformance with relevant guidelines, operational statements, and permit/ authorization conditions

Primary Protection and Management Measures

- Environmental Management Plan (including waste mgt)
- Species-specific wildlife management plans
- Environmental and wildlife monitors (construction), particularly regarding bear dens
- Wildlife effects monitoring program

Crossings Overview

There are approximately 62 crossings currently designated in the Highway corridor.

These include

- 25 minor crossings, designated as being approximately less than 2.5 m in width at the stream bed
- 27 medium crossing, from approximately 2.5 m to 5 m in width and
- 10 major crossings, larger than 5 m in width.

In addition to the currently designated crossings, the Project anticipates requiring up to 400 drainage culverts at various run off locations.

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Minor Crossings

Minor Crossings will be closed bottom culverts:

- Sized to accommodate 10 year spring runoff or rainfall event without overtopping of culvert
- Sized to accommodate 100 year spring runoff or rainfall event without failure of roadbed
- Sized to limit velocities to not exceed DFO guidelines for fish passage

Minor crossing installation details to consider 177 access road experience, GNWT DOT best practice and TAC Guidelines for Development and Management of Transportation Infrastructure in Permafrost Regions.

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Medium Crossings

Medium Sized Crossings could be one of a few different types of crossings:

- Closed bottom multiplate culvert
- Short span prefabricated bridge founded on adjustable surface foundation

Open bottom multiplate culverts have significant stability concerns in permafrost terrain which may not allow this type of structure to be used.

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Major Crossings

Major Crossings will be single lane bridges:

- All but the Hans Creek crossing are anticipated to be single span bridges, founded on piles
- Hans Creek may be a multi-span bridge
- Bridges structure will be either pre-cast concrete girders and deck, or steel girders with pre-cast concrete deck
- Availability of rock for rip rap will be problematic. Alternate solutions will be examined for erosion control around bridge abutments or piers

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Challenging Crossings

Most of the crossings in this project are straightforward, due to the open terrain, with limited elevation variation along the route. They present few problems with respect to channel location, abutment type and location.

Wide Low Flow Crossings

There are a number of locations, however, which present challenges with respect to balancing engineering and fisheries issues. These crossings, for which we use crossing 15 as a prototype, are similar in that they have the following characteristics:

- Wide vegetated area, with multiple flow paths active at high water
- Area too wide for an economic short span bridge
- Flows at high water can be dealt with hydraulically by a single closed bottom culvert
- Fills into the vegetated areas will cause some loss of fish habitat

Hans Creek

- Although Hans Creek is not the crossing with the highest calculated flow volumes at high water (Zed Creek is the highest flow crossing), it is the single crossing along the route that will require the longest and most expensive crossing structure.
- Hans Creek has a well defined channel, bordered with extensive floodplains in all locations near the route centreline. At the primary route location, the floodplain is 140 m bank to bank. The primary channel is some 17 m across at the primary route centerline.
- The floodplain is clearly active in freshet, with the June 2012 site trip showing evidence of recent flooding throughout the floodplain.

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Approaches to Crossing Hans Creek

The primary channel crossing can be crossed with a single span of 28m. That would require a road approach constructed in the floodplain itself.

Alternate approaches would try to bridge either a portion of the floodplain with a three span bridge, or the entire floodplain with a multi span bridge.

Any of these approaches will meet the hydraulic flow requirements of the crossing, but vary in fisheries impacts and construction costs.

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Summary of Lessons Learned: Tuk to Source 177 Access Road

- Winter construction is preferable
- Materials with lower moisture content are preferable
- Culvert design and installation needs improvement
- Use of "fill only" design is essential
- Cooperative approaches maximize local and regional benefits

Lessons Learned – Tuk to Source 177

1. Winter embankment construction is viable, even preferable in many circumstances. The use of a "side of embankment" winter road to allow return traffic from the working face allows high truck delivery rates to be maintained without interference with returning trucks, while preventing damage to the original ground cover.

Lessons Learned – Tuk to Source 177

2. Winter construction results in a smaller environmental footprint as gravel truck turnarounds and graveled access roads to borrow sources do not need to be constructed.
3. Winter construction results in less potential environmental risk and less potential permafrost damage as equipment or trucks which "slide" or "wander" slightly off the road course do not damage the permafrost.

Lessons Learned – Tuk to Source 177

4. Using drill / blast to excavate material from a source deposit in winter allows production rates sufficient to build the ITH project.
5. Placing relatively dry frozen material in winter with minimal compaction does result in a reasonably stable embankment base. The embankments with larger fills on Tuk to Source 177 show good stability in the near term years since completion of construction.

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Lessons Learned – Tuk to Source 177

6. Production from high moisture content sources in winter would be challenging, and is unlikely to be successful. Material from Source 177 with higher silt and moisture content came out as "nuggets", which were pushed aside and allowed to thaw in the summer. Sources with higher moisture contents may require summer stockpiling to allow moisture to drain before winter placement. This may be unsuccessful because, in the Arctic, minimal drying occurs and moisture may actually concentrate within the summer gravel piles making them more difficult to manage the following winter when refreezing occurs. Materials with lower moisture content are preferable.

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Lessons Learned – Tuk to Source 177

7. Shaping sideslopes and grading/compacting the thawed surface layers of the embankment in the summer can produce a finished product of reasonable quality.
8. Culvert design and installation needs improvement for ITH project. Issues such as end projection length, use of insulation, design elevations with or without subcut, design glaciation levels, all need greater analysis and planning than was undertaken during the design of the Tuk to Source 177 Access Road project. Such increased analysis at planning is currently underway.

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Lessons Learned – Tuk to Source 177

9. The use of a geotextile fabric between the embankment and the original ground is feasible with winter construction, and appears to achieve its intended purposes of maintaining roadbed stability and integrity.
10. Crossing polygonal terrain (unstable ice-rich terrain) remains a challenge, and it may require additional design features such as thicker or additional geotextiles, insulation, and increased embankment height.

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Lessons Learned – Tuk to Source 177

11. The Tuk 177 design, as a lower speed access road, was constructed to a design 0.9 m minimum embankment height, with the finishing gravel in place. The current as constructed roadway has a 0.7 m high minimum embankment height and has no road surfacing gravels in place. This structural height is much less than the 1.4 m minimum embankment height proposed for the ITH. The currently constructed roadway is; however, performing quite well in terms of stability in areas even though it was constructed at minimum embankment depths and without a surfacing gravel course other than where there is polygonal terrain.

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Lessons Learned – Tuk to Source 177

12. The use of a “fill only” design section is essential with no cuts in the traditional ditch areas adjacent to the embankment as it fully maintains the ground vegetation adjacent to the roadway. This intact vegetation cover provides excellent silt control for runoff from the roadway embankment, minimizing material transport into waterways.
13. The lack of available material for rip rap for erosion control at crossings will be a challenge with construction of the ITH. Manufactured products could be considered.

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Lessons Learned – Tuk to Source 177

14. The culvert erosion control end treatment of the Tuk to Source 177 road appears to be working well, and can be considered for use on the ITH.
15. A gravel road construction project can deliver extremely high levels of local and aboriginal employment, training and business participation. Due to the availability of a relatively skilled local workforce and experienced local contractors it is likely that this type of development Project provides more local economic benefits than any other type of development Project of a similar size.

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Lessons Learned – Tuk to Source 177

16. Cooperative approaches to development projects between the local communities, the local aboriginal organizations and corporations and the territorial and federal governments best achieves both a maximization of local and regional benefits as well as minimizes environmental impacts